GSI ITALIA
GRUPPO SOLIDARIETÀ INTERNAZIONALE

PRACTICAL TEACHINGS

FOR THE

REHABILITATION PHYSIOTHERAPIST

VOL. 1

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Bachelors Programme in Nursing

II Year

NURSING3REHABILITATION

A.Y. 2021/2022

Topics

- Rehabilitation models
- Rehabilitation modalities
- Rehabilitation setting
- Rehabilitation instruments
- Rehabilitation team

Mission of rehabilitation

Process of solving problems and education during which the patient with disabilities is brought to reach the best possible level of life on the physical, functional, social and emotional level with the least possible restriction of his operating choices even within the limits of his impairment and the quantity and quality of available resources

Physical and Medicine Rehabilitation

- Centrality of the patient
- Problem solving process in a biopsychosocial point of view of the patient
- Outcome-based rehabilitation
- Rehabilitation team

Objective of the rehabilitation

The objective of the rehabilitation intervention is to define the patient in order to carry out all the health interventions necessary to allow the patient to achieve the conditions of maximum possible level of functioning and participation, in relation to his own will and context, in the perspective of real empowerment.

Medical Model

The classical and traditional medical model of medicine bases its action on a concept of the disease that can be represented as follows:

Etiology → Pathology → Symptomatology

Medical Model

- Disability is understood as a problem of the person caused by the presence of diseases, traumas or other health conditions that require medical assistance as an individual treatment

- Disability management aims at treating diseases or adapting the individual and behavioral change

Medical Model

- Health is defined as the absence of disease.
- The central point of the International Classification of Diseases (ICD) is the pathology.
- On the pathology, books are written and knowing the pathology the clinicians know how to treat the disease (the physician bases his activity on this concept).

Medical Model

- There is a one-way relationship: there is a pathogenic cause that determines a pathology (it is a mechanistic approach).
- The behavior is standardized according to the pathology.
- It is based on the knowledge of anatomy, biology and the clinical manifestations of the pathology (I have that pathology, and so I take that specific drugs to treat it)
- In some way, the patient is classified and labeled according to the disease: therefore, the whole group with the same disase is treated according to that pathology (in this way the protocols work).

Medical Model

- The actions to be carried out follow this procedure, without taking into account the patient who undergoes this process.

- The features of this concept are:
  - An etiopathological model that determines activities essentially aimed at finding the cause
  - A primary focus on the disease that aims to treat
  - The patient as an object in an essentially passive role
  - A treatment, however, more mono-disciplinary, with a starting point of lost skills

Criticality of the medical model

- Disability is assimilated to the pathology and is seen as a the starting from the norm (it is a standardized vision of the person and of its functioning)
- Reduction of the person to his pathology and his deficit
- It excludes the relational dimension from the existential experience of the person in his interaction in his own life contexts

Criticality of the medical model

- The treatment is individual and standard
- One-dimensional vision of the person with disabilities and restriction of his social roles (the patient cannot / cannot do)
- The health is restricted to the absence of disease (medicalization of interventions and services)

The concept of "health"

- Health is "a complete state of physical, mental and social well-being and not just the absence of disease or infirmity”

- The health is “wellness that produces and expands thanks to the quality of relationships with others and with the environment”

International Classification of Impairment, Disabilities and Handicaps (ICIDH)

- Attempt by the World Health Organization (1980) to overcome the biomedical-diagnostic-rehabilitative model of the International Classification of Diseases (ICD) and its causal concept disease-cure

- It is not a guide to the classification of people with disabilities but attempts to define the circumstances that can lead to situations of disadvantage compared to other people on the basis of a presumed normality (social convention)

International Classification of Impairment, Disabilities and Handicaps (ICIDH)

- Introduces the consequence of a pathological or chronic state
- Illness → Impairment → Disability → Handicap
- The damage to the functions of an organ caused by an illness produces disabilities in the person

International Classification of Impairment, Disabilities and Handicaps (ICIDH)

- Disability is considered as an inability to perform normal activities

- Disability causes the handicap and therefore the disadvantage in having a social role and in carrying out daily activities

ICIDH - Impairment

- It represents any loss or anomaly of a structure or a function, on the anatomical, physiological and psychological level.

- The impairment is characterized by the existence or occurrence of anomaly, defect or loss (which may be temporary or permanent) of a limb, organ or tissue or other structure, of the body, or of a defect in a system, function or mechanism of the body , including the system of mental functions.

ICIDH - Impairment

- It is a deviation from the norm on the biomedical level of the individual and represents the externalization of a pathological condition

- For example: muscle weakness, motor control deficit, articular deficit

ICIDH - Disability

- Disability represents any reduction (consequent to impairment) partial or total capacity to perform an activity in the manner or within the limits considered normal for a human being.

- It is characterized by defects in the usual activities, performances and behaviors

- It can be temporary, permanent, reversible, irreversible, progressive or regressive

ICIDH - Disability

- Disabilities can arise as a direct consequence of impairments or as responses of the individual, particularly of a psychological nature, to a physical impairment, sensory or other.

- Disability represents the objectification of an impairment and as such reflects disturbances at the level of the person.

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ICIDH – Handicap

- Handicap constitutes the situation of social disadvantage, consequent to impairment and/or disability, which limits or prevents the fulfillment of a normal role for a given individual according to age, sex and cultural and social factors.

- It is characterized by a discrepancy between the performance and the condition of the individual and the expectations of the individual himself or of the particular group to which he belongs.

ICIDH – Handicap

- It is the result of discrepancy between individual expectations and the performance or condition of the individual

- It represents the socialization of a impairment or a disability and, as such, reflects the consequences for the individual - on a cultural, social, economic and environmental level - that arise from the presence of impairments and disabilities.

- It is the socialization of an impairment or disability

From the impairment to the handicap

- So, while the impairment and disability belong to the individual, the appearance of the Handicap is linked to the interface between subject and society that is not able to accept those who perform an activity differently from most subjects.

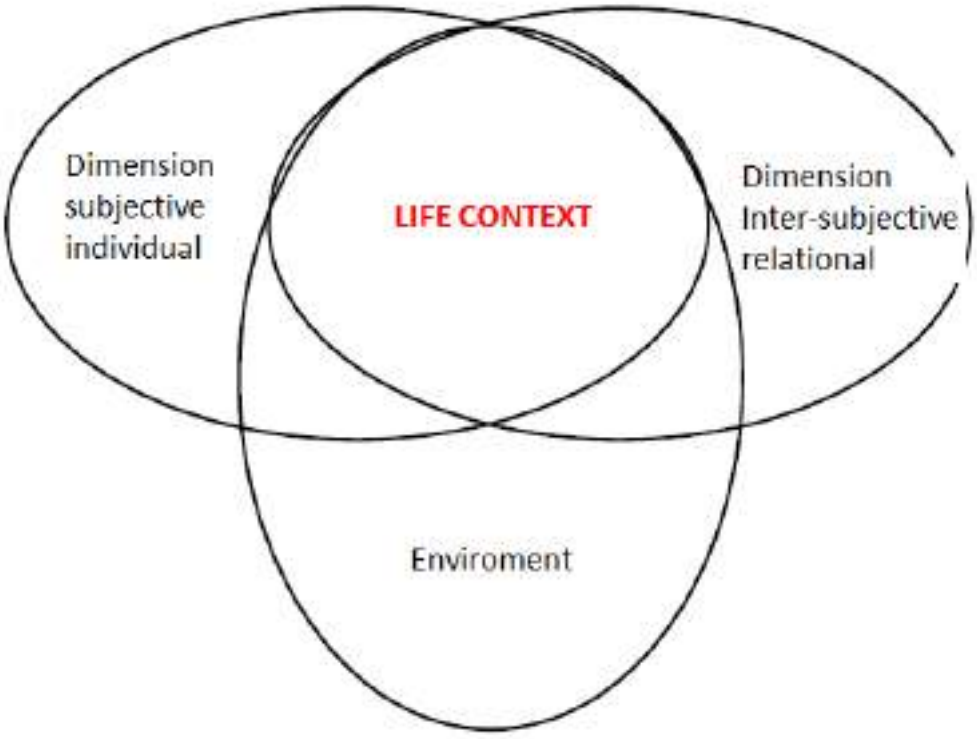
ICIDH example

Impairment Disability Handicap

Example: a person with amputation (impairment) who is not able to walk independently (disability) succeeds by using a wheelchair to make movements. The use of the aid has in fact reduced the disability (obviously not the impairment) but if the subject meets, in the path that leads him in social environments, barriers and limitations the same cannot relate and therefore this involves handicap.

Something is missing…

- **The context….**



The social model

- It develops in the United Kingdom in the 1960s and 1970s under the impulse of movements for the rights of people with disabilities and scholars

- It is a tool to capture the phenomenon of disability, providing new coordinates of meaning to understand a condition traditionally considered only in individual and medical terms

- It does not deny the individual problems that people with disabilities may encounter, but moves the domain from the individual sphere to the social sphere

The social model

- It is opposed to the identification of disability with the impairment of the person often seen in terms of personal tragedy
- Oppressive vision of society towards disability
- The social model of disability is not a real theory able to explain the multitude of phenomena related to disability but, rather, a holistic approach that explains which specific problems are experienced by people with disabilities, having regard to the totality of the environmental and cultural factors that make disabled

The social model

- It is society that "disables" the person by not allowing them to access education, communication and computer systems, work environments, transport, public buildings and housing

- Disability is not an individual characteristic but a complex interaction of conditions, mainly coming from the social environment

The social model

- Disability management requires social actions and is the collective responsibility of society

- There is a need to implement environmental changes for the full participation of people with disabilities in all existential areas of social life

The social model

- A health problem is described as a dynamic balance disorder in psychosocial interaction that gives the patient the feeling that they are unable to recover the well-being situation on their own.

- A health problem affects the psychological sphere of the patient

- This type of vision is strongly opposed to the biomedical model in that the person becomes the central element. Every health problem becomes that person's own.

The social model

- The problem in this case is multifactorial and multicausal where there are factors that influence the disease.
- Each person reacts to the same stimuli in different ways.
- The person is central, not the pathology.
  In this case the clinician, who intervenes on the problem, will play a role of advice.
- This type of approach is based on the knowledge of psychology, sociology and the sciences of communication.

Medical model VS Social model

- Medical model (individual adaptation)
  - Disability as a personal problem

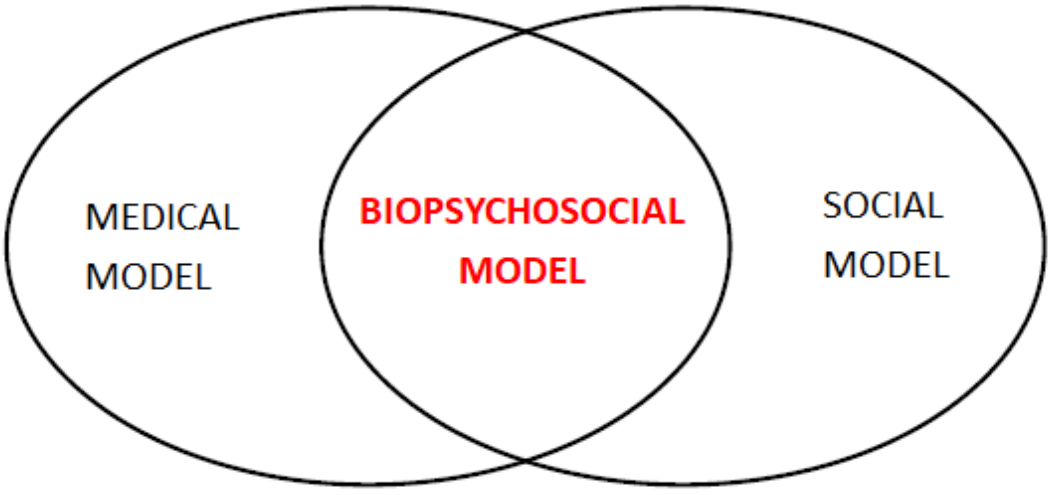
- Social model (transformation of contexts)
  - Disability as a social problem

Criticality of the social model

- It tends to exclude the biological dimension of disability and its subjective experience
- The pervasive nature of the social dimension tends to absorb the dimension of the body and its perception
- The oppressive nature of society cannot be generalized to the condition of all persons with disabilities

Bio-psycho-social model

- It is a summary that wants to provide a coherent perspective of the different dimensions of health at biological, individual and social level



Bio-psycho-social model

- At the center is the person with his health problem

- It is a multi-factorial model: it takes into account all the interactions that the person has in living his health problem

Bio-psycho-social model

- There are aspects of a mechanistic type, that is, a preface to the condition of pathology, and aspects of a communicative nature that integrate with each other

- The operator should pay attention to the uniqueness of the person in front of him and to general guidelines for that particular illness

International Classification of Functioning, Disability and Health

- It represents a classification of health and its related states

- It offers a conceptual framework for organizing information that is applicable to personal health care - including prevention and health promotion - and improving participation through the removal or reduction of social obstacles and the promotion of social support and facilitators

International Classification of Functioning, Disability and Health

- It refers to the broad context of health and does not cover circumstances that are not related to it, such as those caused by socio-economic factors

- It is not just about people with disabilities; in reality it concerns everyone

International Classification of Functioning, Disability and Health

- Health conditions and those related to it, associated with all health conditions can find their description in the ICF

- It has an universal application

ICF and Bio-psycho-social model

- The functioning and disability of a person are conceived as a dynamic interaction between health conditions (diseases, disorders, injuries, traumas, etc.) and contextual factors

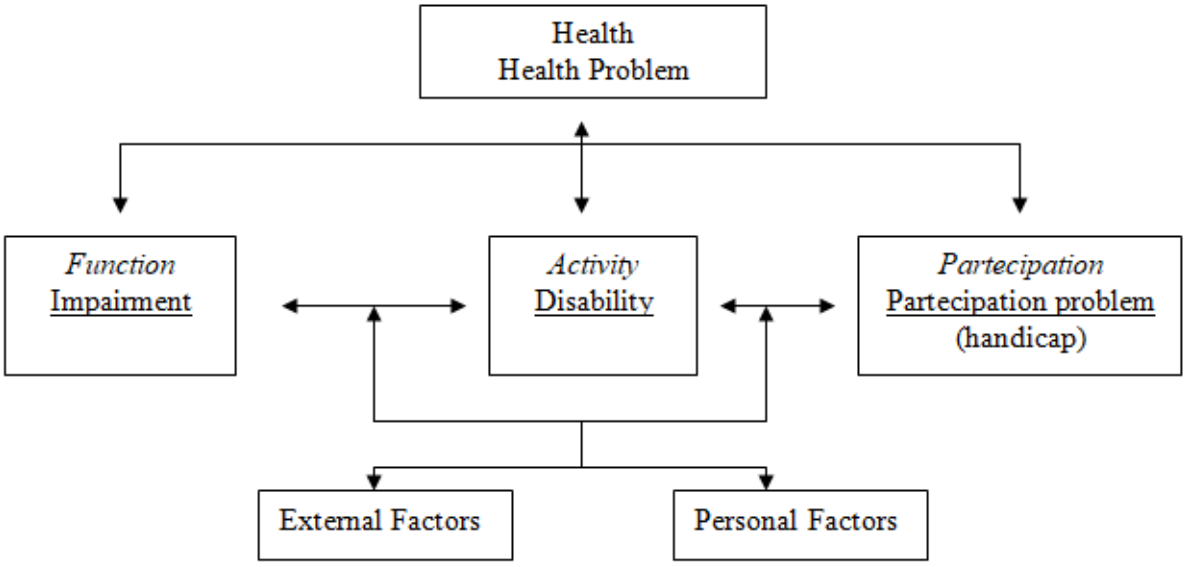
- ICF considers impairments as problems of body functions and structures associated with health conditions

ICF and Bio-psycho-social model

- ICF does not provide diagnostic information about diseases, traumas, etc. (as ICD) but information on the functioning of the person

- ICF responds to the need for a code shared internationally for the interpretation of the phenomenon of disability

International Classification of Functioning, Disability and Health



ICIDH VS ICF

- In ICIDH the vision of the state of health had a negative connotation whereby if there was a problem of function there was the impairment (= decrease of its capacity). The ICIDH talked about disability, and handicap

- With the ICF (that has a more positive vision, of the potential of the individual, although diminished by the state of health) talks about function, activity and participation.

ICIDH VS ICF

- External and internal factors have been added
- Internal or personal factors of each person reacts differently to the situation in which he lives
- External factors take into account the environment

ICIDH VS ICF

- With the ICF, consideration is given to how much the environment affects the patient so that while in ICIDH it was not considered, so it was not known how much the environment affected the patient

- With the ICF, the environment is taken into particular account, because it is different if the individual (inserted in prognostic terms in the sense of health) is inserted into a positive or negative environment.

The biological dimension in the ICF

- Body structures: these are the structural or anatomical parts of the body such as the organs, limbs and their components classified according to body systems.

- Body functions: physiological functions of body systems, including psychological ones.

- "Body" refers to the human organism in its entirety, thus including the brain. This is why mental (or psychological) functions are included in body functions.

The biological dimension in the ICF

- Impairment: it is a loss or an abnormality in the structure of the body or in the physiological function (including mental functions).

- The term "abnormality" is used only and exclusively to indicate a significant deviation from established norms and it should be used only in this sense.

Functioning VS disability in the ICF

- Function: umbrella term for bodily functions, body structures, activity and participation. It indicates the positive aspects of the interaction between an individual (with a health condition) and the contextual factors of that individual (environmental and personal factors).

- Disability: umbrella term for impairments, activity limitations and restrictions on participation. It indicates the negative aspects of the interaction between an individual (with a health condition) and the contextual factors of that individual (environmental and personal factors).

Activity in the ICF

- Activity: execution of a task or action by an individual. It represents the individual perspective of functioning.

- Activity limitationѕ: difficulties that an individual may encounter in carrying out activities. A limitation of the activity can be a slight to severe deviation, in quantitative or qualitative terms, in the performance of the activity with respect to the mode or measure expected by persons without a health condition.

Partecipation in the ICF

- Participation: involvement of a person in a life situation. It represents the social perspective of functioning.

- Restrictions of participation: problems that an individual can experience in involvement in life situations. The presence of a participation restriction is determined by comparing the individual's participation with what is expected of an individual without a disability in that same culture or society culture.

- It replace the handicap term

The person-context interaction in the ICF

- Environmental factors: all aspects of the external world that form the context of an individual's life with an impact on the functioning of the person For example the physical environment and its characteristics, the physical world created by man, other people in different relationships and roles , attitudes and values, social systems and services, and policies, rules and laws

- Personal factors: contextual factors related to the individual (age, sex, social class, life experiences, etc.), which are not currently classified in the ICF

Model of Rehabilitation

- Often patients, despite adequate treatment, cannot completely recover
- They become disabled as a result of illness or trauma and simultaneously lose their role in society.
- The consequences of the disease or the trauma and the disability they entail are the starting point in rehabilitation.

Rehabilitation process

- Rehabilitation takes place as a continuous process designed to avoid an imminent deficiency, and to maintain or develop or restore the person's ability to perform a normal activity.

- The goals of rehabilitation aim to ensure the disabled person, whatever the nature and cause of the disability, the widest independence and optimal participation in social and economic life.

Rehabilitation process

- Rehabilitation is therefore a continuous and global process that, starting from the phase of medical treatment, aims at the social integration of the disabled person at all level.

- To this objective, it incorporates all the measures designed to prevent or to reduce to the inevitable minimum the functional, physical, mental, social and economic consequences of invalidating diseases and traumas, from the beginning of the condition to the reintegration of the patient into his environment

Rehabilitation

- Its objectives are based on two principles:
  - The active participation of the person concerned in their rehabilitation
  - The duty for society to adapt to the specific needs of disabled people

Specific objective of rehabilitation

- Rehabilitation medicine goes beyond what characterizes the curative medicine, because the purpose of the treatment is not only anatomical and physiological healing, but above all the recovery of functions, the inclusion of the integration of the disabled in society.

Specific objective of rehabilitation

- The patient's remaining abilities, the prognosis of the illness or the trauma, the obligations that the society imposes on the patient, the consistency that the patient hopes to give to his existence and the efforts he is willing to do to get there, combined with the effectiveness of the aid offered, determine the choice of objectives and the method of treatment.

Specific objective of rehabilitation

- The rehabilitation, starting from the phase of medical treatment of functional recovery, in order to reduce the deficiency and disability as much as possible, continues its work aimed at optimizing the use of residual functional capacities and compensating for lost capacities, taking into account all aspects of life and person.

Specific objective

- The aspects of rehabilitation that should be implemented and coordinated are:
  - Prevention, identification, diagnosis and assessment of deficiencies, disabilities and handicaps
  - Recovery of personal autonomy through the implementation of functional re-education and the supply of orthoses, prostheses, wheelchairs and other technical aids
  - Socio-family, school and professional reintegration

Specific objective of rehabilitation

- But these invalidating aspects cannot be dissociated from the acts that the rehabilitation clinicians should perform in order to obtain from the society the means necessary to achieve these objectives:
  - Modalities of work of disabled people (work, sheltered work, adaptation of the workplace, activities aimed at professional integration)
  - Technical and social aids, abolition of architectural barriers, accessibility to buildings, adaptation of housing, facilities for communication and transport, leisure, sports, holidays.
  - Without forgetting the problems of health education and information

Methodology of rehabilitation

- Rehabilitation is methodologically implemented on the basis of an inventory (budgets of individual sectors) and on a detailed plan with priorities.

- The patient and his entourage ensure an active role while the multidisciplinary team and the coordination of the physiatrist offer the patient opportunities to change his behavior and his environment on his own and work towards his future in a learning situation.

Methodology of rehabilitation

- By method, rehabilitation means a set of measures and actions whose orderly, coordinated and conveniently programmed sequence should lead to a specific purpose.
- The methodology of rehabilitation is determined by the following factors:
  - The idea that medical and social purposes should be united in one coherent and uninterrupted unit
  - The principle that the disabled person has the right to an existence worth conducting in the social context to which he belongs

Methodology of rehabilitation

- The description of rehabilitation is a set of coherent and coordinated measures in the medical, social, professional, educational and economic fields

- The goal is to return the patient to the social role that belongs to him and to allow him to keep it

Systematic solution of the problems

- In rehabilitation , the activities are always "problem-oriented and patient-centered“
- Consequently, we need a systematic method of solving problems that have standard solutions.
- In general it is a three-step scheme:
  - Problem analysis and orientation
  - Synthesis of the formulation
  - Solution of the problem

Systematic solution of the problems

- The first phase of the problem analysis and orientation involves:
  - The history
  - The exam
  - The orientation
  - First diagnostic and prognostic conclusion
  - Evaluation of functional possibilities
  - Formulation of primary treatment and rehabilitation goals

Global exam

- In Rehabilitation, the balance should be assessed at the three levels of the handicap process:
  - Impairment (function)
  - Disability (activity)
  - Handicap (participation)

Impairment (function)

- On the physical plane, example of impairment (deficit) are:
  - Mobility
  - Muscle strength
  - Sensibility
  - Coordination
  - Control of posture and movement from analgesic reaction
  - Physical condition
  - Circulatory function
  - Respiratory function
  - Bladder function
  - Rectal function
  - Sexual function

Impairment (function)

- On the psychic level, example of deficit are the:
  - Conscience
  - Intelligence
  - Memory
  - Thought
  - Behavior

Disability (activity)

- At the level of disabilities, or functional limitations, problems can be grouped in areas or fields of attention.

- With this term, a set of related skills that present disabilities that disturb the patient in the path of rehabilitation is undertood.

Example of daily living activities

- Feeding
- Get up
- Sit
- Move
- Personal hygiene
- Toileting (WC)
- Moving into the home (including wheelchair conduct)
- Go up and down the stairs
- Manage auxiliary devices (for example, putting on and taking off a prosthesis)

Example of social activity

- Creative activity
- Home activities (including purchases, household activities, care for family members)
- Housing (including accessibility and practical use)
- The possibilities of moving (moving in a wheelchair outside, riding a bicycle, driving a car)
- Continuity of the family role (family problems)
- The availability of adequate financial resources
- The exercise of the profession (including workplace reports, the situation and the content of the work)

Handicap (participation)

- At the handicap level, these will be assessed considering the deficiencies and disabilities in the context of the inadequate situation in which the disabled person will be found.

Objectives of the rehabilitation

1. The recovery of a functional competence that, for pathological reasons, has been lost
2. The evocation of a competence that did not appear in the course of development
3. The need to put a barrier to functional regression trying to modify the natural history of chronic degenerative diseases, reducing their risk factors and dominating their progression
4. The possibility of finding alternative facilitating formulas

Need for immediate rehabilitation intervention

- The rehabilitative intervention begins at the same moment in which the damage is established.

- The term is defined by an accurate balance between the stabilization of the outcomes and the presence of potential for recovery.

Need for immediate rehabilitation intervention

- Rehabilitation, particularly in the case of an acute episode, starts from the moment of acute intervention in the therapeutic phase.

- This should be immediately set also through a careful balance sheet of the possible outcomes of the current illness, assuming, in the therapeutic process of the acute phase, the measures that can limit them and foreseeing the conditions that can facilitate the subsequent and immediate transition to the more properly rehabilitative phase.

Chronological phases of rehabilitation

- In a chronological sense, the first stage of rehabilitation takes place at the same time as the impairment occurs and, therefore, either in the acute phase of illness or in the ascertainment of a congenital or chronic pathology.

Chronological phases of rehabilitation

- The second stage of rehabilitation starts as soon as the acute phase of the illness has passed, as a result of the disabilities remaining

- It concerns the post-acute phase and concerns both hospital and non-hospital rehabilitation facilities, regardless of their legal status (public or private).

Chronological phases of rehabilitation

- The third stage of rehabilitation requires less systematic health interventions (as they pertain to a condition of stabilized disability and restriction of participation) and, therefore, also practicable in terms of outpatient treatment, aimed at maintaining functional autonomy achieved by the subject and prevention of possible further involutions.

Chronological phases of rehabilitation

- Rehabilitation is a process of problem solving and education during which a person is led to reach the best possible level of life on a physical, functional, social and emotional level, with the least possible restriction of his operational choices

Subjects and aspects involved

- The rehabilitation process also involves the subject's family and those close to him.

- Consequently, in addition to strictly clinical aspects, the rehabilitation process also involves psychological and social aspects.

Multiplicity, planning and purpose of the objectives

- To achieve a good level of effectiveness, any rehabilitation project, for any individual, shuld therefore be aimed at multiple objectives, planned in an orderly manner, so that the autonomy that can be reached in the various areas can be translated into the autonomy of the person as a whole and, in any case, in a better quality of life of the person.

Types of rehabilitation interventions and integrated service networks

- On the operational level, it is useful to distinguish between rehabilitative interventions mainly of a health nature (Rehabilitation Medicine) and rehabilitative interventions mainly of a social nature (Social Rehabilitation), belonging to specific integrated networks of services and rehabilitation facilities, which are in turn necessarily intimately connected, through the use of day or residential structures and / or at home, in order to guarantee qualified assistance.

Rehabilitation health activities

- "Rehabilitation health activities" are defined as evaluative, therapeutic diagnostic interventions and other procedures (for example, aids prescription) aimed at bringing the subject, affected by disabilities, to contain or minimize his disability, and the disabled subject to move, walk, talk, dress, eat, communicate and relate effectively in their family work, school and social environment.

Rehabilitation social activities

- "Social rehabilitation activities" are defined as the actions and interventions aimed at guaranteeing the maximum possible participation in social life for the disabled with the least possible restriction of his operational choices, regardless of the severity of irreversible impairments and disabilities in order to contain the condition of disability.

Integrated socio-medical pathway

- It is indispensable for a real and complete rehabilitation project to provide an integrated socio-medical pathway that contemplates the intimate connection of health intervention programs, aimed at developing all the potential resources of the individual in functional abilities, with social interventions aimed at developing and make resources and environmental potential available, to amplify and reinforce health intervention by allowing the disabled to be reintegrated into the various cycles of social life.

Integrated socio-medical pathway

- In this context, we should also place the answers for the "protection of life" of subjects who are not completely self-sufficient, in a chronic vegetative state or with minimal responsiveness, severe tetraplegics, etc.

- These types of disabilities and handicaps propose new problems and are progressively increasing, as emerges from the most recent epidemiological data concerning serious disabilities.

Rehabilitation phases

- Rehabilitation activities are divided into a network of hospital and extra-hospital services that require connection and synergy of the different services for the purpose of functional and social recovery.

Phases of the rehabilitation intervention and organizational levels

- Schematically, the intervention of rehabilitation can be divided into 4 phases
  1. Phase of prevention of secondary damage and consequent secondary impairments in high risk pathologies, development of disability (in acute care units)
  2. Phase of intensive rehabilitation: when the disability is more modifiable (or in the case of exacerbations of the pathology) (in the post-acute wards)

Phases of the rehabilitation intervention and organizational levels

- Schematically, the intervention of Rehabilitation Medicine can be divided into 4 phases
  3. Completion phase of the recovery process (sub-acute phase)
  4. Maintenance and / or prevention phase of disability progression, degradation of acquired motor and functional recovery (integrated with social rehabilitation)

1. Phase of prevention of secondary damage and consequent impairments

- This phase characterizes rehabilitative interventions in acute care wards, in particular in intensive care unit, neurosurgery, orthopedics, neurology, thoracic surgeries, etc., where it is necessary to include the preventive rehabilitation intervention within the therapeutic protocol.

- This intervention is closely integrated with nursing and requires particular attention to operational overlaps, improper interventions and skills conflicts.

2. Intensive rehabilitation phase

- It is characterized by intensive evaluation and therapeutic interventions and it is usually placed in the so-called immediate post-acute phase of the disease, when the rehabilitative intervention can positively influence the biological processes that underlie recovery, containing and reducing the extent of the impairment and when disability is more modifiable

- This phase may also be necessary in situations of exacerbation and recurrence of the pathological event.

3. Completion phase

- It is characterized by different modalities in relation to the nature and type of impairment and disability and it is however such as not to require intensive interventions

4. Phase of maintenance and / or prevention of disability progression

- It is characterized by different types of health rehabilitation interventions usually integrated with the activity of social rehabilitation

Rehabilitation phases

- These phases may not always coincide completely with the chronological stages of the rehabilitation intervention.

- In the chronological phase immediately post-acute, for example, the patient can be correctly addressed both to an extensive phase activity, and to an intensive phase, in relation to his general conditions, his recovery potential and the ability to face a more or less demanding treatment.

- The activation of an adequate network of health and social facilities intended for rehabilitation throughout the country finds strong motivations not only from a moral point of view, but also from an economic point of view.

- The efficiency of the hospital sector for acute NHS is subject to the activation of specific functional areas of rehabilitation, post-acute long-term care and Healthcare Residences designed to respond to different needs such as those of the disabled and elderly.

- If the growth of social services and support and reception facilities does not take place in parallel with that of prevention, treatment and rehabilitation facilities, the Rehabilitation services will inevitably end up becoming permanent temporary parking situations.

- This improper use of the rehabilitation facilities, which is widespread in our country, not only represents a useless and burdensome economic expenditure, but creates damage to patients by fueling vain hopes and delaying the achievement of a fundamental step.

Type of interventions in rehabilitation

- In relation to the intensity and complexity of rehabilitation health activities and to the quantity and quality of absorbed resources, they are divided into:
  - Intensive rehabilitation activities
  - Extensive or intermediate rehabilitation activities

Rehabilitation setting

- It should be established following a set of criteria
  - Clinical stability
  - Level of function and autonomy
  - Speed of modifiability of impairments and disability
  - Cognitive and behavioral state
  - Resistance to physical and re-educational activities in general
  - Adequacy of family and / or welfare support
  - Adequacy of the living environment
  - Entity of the network of principals and health and social services of the territory

Organizational levels

- First-level rehabilitation facilities (extensive rehabilitation)
  - Assisted Healthcare Facilities
  - Long-term hospital facilities
  - Residential structures
  - Outpatient facilities
- Second-level rehabilitation facilities (intensive rehabilitation)
  - Hospital facilities
  - Rehabilitation hospitals
  - Extra hospital units
- Third level rehabilitation facilities (intensive specialty rehabilitation)
  - Spinal unit
  - Unit for the rehabilitation of severe brain-injured patients
  - Unit for severe disability in the deveopmental age
  - Unit for acquired neuropsychological disordersl

First-level rehabilitation facilities

- They are characterized by a moderate-medium therapeutic commitment in the face of an adequate assistance supportive intervention towards the subjects in treatment.

- The clinical and therapeutic commitment is however such as to require a specific rehabilitation treatment and overall the rehabilitative therapeutic activities can be evaluated between one and three hours a day.

First-level rehabilitation facilities

- Extensive or intermediate rehabilitation interventions are aimed at the treatment of:

1. transient and / or minimal disabilities that require a simple and brief therapeutic - rehabilitative program that can be implemented
2. important disabilities with possible permanent, often multiple, outcomes that require long-term care and require more and more complex interventions.

First-level rehabilitation facilities

- Extensive rehabilitation interventions are provided at the following ad hoc accredited public and private, hospital and regional facilities:
  - long-term care facilities
  - outpatient facilities for territorial and hospital functional recovery and rehabilitation
  - non-hospital rehabilitation facilities at day and / or continuous cycle
  - outpatient rehabilitation center
  - Assisted Healthcare Residences
  - patient's home

Appropriateness in extensive rehabilitation

- Serious disabilities unable to participate and / or benefit from rehabilitation activities for three hours a day
- No need for complex multi-professional intervention despite the need for hospitalization for medical nursing care
- The expected and / or observed recovery process is too slow or too small to justify intensive rehabilitation
- It is foreseeable that, despite the continuous benefits received from rehabilitation, the subject's social destination is in a protected structure

Long-term hospital facilities

- In cases where nursing is of a particularly complex nature, with a particularly marked consumption of resources in relation to this element, these structures are called "long-term care with high intensity of care".

Long-term hospital facilities

- The long-term care facilities also assist, in a hospitalization regime, disabled people who are not self-sufficient, slow recovery, unable to participate in an intensive rehabilitation program or suffering from severe disability requiring high levels of care and nursing support and ongoing medical protection in the 24 hours, for which an individual rehabilitation project is to be envisaged.

Outpatient facilities

- The outpatient facilities for functional recovery and rehabilitation can be hospital or territorial. They carry out specialist outpatient activities towards external subjects, even at home.

- The services located within the hospital also assist individuals of all ages in the various unit of acute hospitals, in functional recovery, impairment and disability.

Outpatient facilities

- With regard to patients in charge of the various acute care units, they carry out activities to prevent secondary damage in disabling diseases or those at risk of developing disabilities.

Outpatient facilities

- The outpatient rehabilitation centers carry out functional rehabilitation and rehabilitation activities with a comprehensive treatment of the condition of disability, which, due to the developmental age, requires a simultaneous multidisciplinary medical, psychological and pedagogical contribution.

Assisted Healthcare Facilities

- The Assisted Healthcare Facilities are aids that offer to non-self-sufficient, elderly and non-dependent subjects, with stabilized outcomes of pathologies, physical, mental, sensorial or mixed, not taking care at home, a medium level of medical, nursing and rehabilitation assistance, accompanied by a "high" level of care and generic hotel protection based on the assistance models adopted by the Regions

Assisted Healthcare Facilities

- The extensive rehabilitation activities aimed at the guests of these structures concern in particular:
  - subjects with physical, mental, sensory or slow recovery, not assistable at home, requesting an individual rehabilitation project characterized by extensive rehabilitative health treatments;
  - non-self-sufficient subjects suffering from severe disability requiring a high level of care and nursing support in the face of a rehabilitation intervention of low complexity and intensity and without continuous medical coverage in the 24 hours, not assisted at home or in alternative forms to full hospitalization.

Assisted Healthcare Facilities

- Depending on the type of assisted subjects, the duration of the treatment can also be "permanent".

- This also includes "residential or semi-residential structures of a social-welfare nature"

Social and rehabilitation centers

- The rehabilitation health activities should integrate the rehabilitation and recovery moment with the assistance phase to guarantee on the one hand the maintenance of the potential reached however and, on the other hand, offer valid support to users and families to avoid institutionalization risks.

Social and rehabilitation centers

- The units offering integrated social and health services, which can be organized at home and / or through the use of day or residential facilities, should:
  - Guaranteeing qualified assistance that meets both primary psychological and emotional needs
  - Strengthen or maintain the level of autonomy acquired for the best possible preservation of psycho-physical well-being
  - Pursue the social integration of users by promoting constant links with the external environment

Second-level rehabilitation facilities

- The second level facilities provide intensive rehabilitation services aimed at recovering or compensating for important impairments and disabilities and can be organized at:
  - Hospital facilities
  - Non-hospital facilities

Hospital facilities

- Hospital facilities - multi-specialist or monospecialistic - where hospitalization and treatment functions with high diagnostic and care intensity are already present, in which a specific operating unit is set up to guarantee the multi-comprehensive management of individuals of all ages in functional recovery recoverable impairments and disabilities, which cannot be treated.

Hospital facilities

- These subjects require specialized medical rehabilitation protection and highly specific nursing interventions articulated over the entire 24 hours or during daylight hours, not available in extra hospital form, as well as intensive evaluation and therapeutic interventions (at least three hours of specific daily rehabilitation treatment)

Hospital facilities

- They are aimed at the recovery of important, modifiable disabilities, which require a high medical-specialist diagnostic commitment aimed at rehabilitation and therapy in terms of complexity and / or daily duration of the intervention, referable to a nursing articulated in the 24 hours

Hospital facilities

- Understanding such as those provided directly by the staff of the rehabilitation health professions. such as, for example, the physiotherapist, the speech therapist, the occupational therapist, the professional educator and the nurse for those acts aimed at improving the basic activities of daily life. The rehabilitation project and its implementation programs define the times of completely rehabilitative cycles, usually within 60 days.

Hospital facilities

- Objective: clinical stabilization and restoration of conditions of autonomy and / or manageability in the non-hospital setting

- Rehabilitation intervention: at least three hours a day provided by the rehabilitation specialist, by non-medical rehabilitation health professionals and by nursing staff. The social worker and the psychologist can contribute for the time required to reach the daily time required for the rehabilitation intervention

Hospital facilities

- Tools: individual rehabilitation project
- Duration of hospitalization or rehabilitation cycle: 60 days
- If there is no clinical or assistance need, it can be provided in a day –hospital regime
- Places of care: multi-specialist and single-specialist hospitals

Hospital facilities

- Intensive rehabilitation interventions are aimed at treatment:
  - of complex pathologies, which require the stay in a specialized rehabilitative environment dedicated and with a real possibility of interaction with other specialized disciplines
  - of the most serious impairments and the most complex disabilities
  - as well as those connected with rare forms of pathology for which treatment requires the acquisition of adequate experience or the use of particularly complex equipment, advanced technology and integration with other highly specialized branches.

Hospital facilities

- Structural requirements: area for hospitalization, area for assessment, area for the provision of specific rehabilitation activities

- Technological requirements

Hospital facilities

- Organizational requirement
  - Definition of appropriateness protocols for admissions in line with regional planning requirements
  - The interprofessional team should be at least made up of a physiatrist, nurse, physiotherapist and health and social worker
  - The social worker and the psychologist should be available
  - For the departments that take care of patients with disabilities and minor impairments of brain neurological diseases, the team should include the speech therapist
  - Occupational therapy activity should be guaranteed

Hospital facilities

- The provision of technical-assistance staff
  - To guarantee minimum safety levels, at least two nurses 24/24 h, 7 days a week should be present in the ward (considered an approximate number of 20 beds)
  - The presence of the physiatrist should be guaranteed during daylight hours on weekdays for at least 9 hours
  - For the remaining hours a prompt medical availability should be guaranteed, also shared with other departments.

Hospital facilities

- The episode of ordinary recovery in intensive rehabilitation is to be considered appropriate if:
  - the patient is judged susceptible to significant functional improvements during hospitalization, that is, he waits for the result to return the patient to the community (with or without support) or to make him progress to another level of rehabilitative care (outpatient, home care, etc.) .
  - The patient's clinical conditions are such as to allow a rehabilitative treatment to be administered with the most appropriate interdisciplinary approach

Hospital facilities

- The episode of ordinary recovery in intensive rehabilitation is to be considered appropriate if:
  - The patient's condition requires hospitalization with continuous availability within 24 hours of high-intensity diagnostic-therapeutic-rehabilitative services (by medical staff and other health professions) and a non-deferrable treatment that cannot be efficiently delivered in alternative regimes. The need for continuous medical protection is linked to a high risk of potential clinical instability, and provides for a regular individual direct contact between patient and specialist. The need for nursing care is linked to the need (or the risk of having to have) a multiple or complex rehabilitation nursing.

Hospital facilities

- Day Hospital in intensive rehabilitation
  - The patient is susceptible to significant functional improvements and quality of life if subjected to intensive rehabilitation treatment
  - The rehabilitation intervention is however high intensive due to the need for a multi-professional approach
  - The patient's clinical conditions are such as to tolerate such rehabilitative intervention
  - The patient does not need continuous assistance for 24 hours a day

Appropriateness in Day Hospital

- The Day Hospital admission episode in intensive rehabilitation is to be considered appropriate if the patient:
  - is susceptible to significant functional improvements and quality of life in a reasonable amount of time
  - has indication for a rehabilitative intervention of high intensity or, however, prolonged within the same day, to be administered with the most appropriate inter-professional approach, often also multi-specialist

Appropriateness in Day Hospital

- The Day Hospital admission episode in intensive rehabilitation is to be considered appropriate if the patient:
  - presents general clinical conditions that allow him to tolerate both this operation and the daily transfers to and from his home
  - is clinically stable to such an extent that it does not require continuous healthcare 24 hours a day
- A further and preferential criterion of appropriateness is to consider the condition of discharge from an intensive full-time facilities with indication to the continuation, in this form, of the treatment undertaken.

Non-hospital facilities

- The non-hospital rehabilitation units with day and / or continuous cycle of individuals with physical, mental and sensory disabilities provide day and / or continuous cycle services for the functional and social recovery of subjects with physical, mental, sensory or mixed disabilities from any cause.

Non-hospital facilities

- They are appropriate in the immediate post-acute phase (even after hospital discharge) through the provision of health protection aimed at recovering the outcomes deriving from acute episodes or injured or impaired functions through day or continuous residential services.

Non-hospital facilities

- The extra-hospital rehabilitation facilities are intended for the multi-comprehensive management of patients with disabilities of various nature and severity, such as to require intensive rehabilitation without continuous medical protection and highly specific nursing interventions articulated in the arch 24 hours.

Non-hospital facilities

- It is considered appropriate to entrust these units with the share of day or continuous hospitalization, where a considerable continuity of generic assistance and supervision over the autonomy and self-sufficiency of the persons entrusted to the institution is necessary.

Third-level rehabilitation facilities

- The third level structures are characterized by the provision of intensive rehabilitation that require particular qualification commitment, means, equipment and specifically trained personnel such as those aimed at the treatment of the most serious impairments and the most complex disabilities, as well as those connected with forms of rare pathology for which treatment requires experience or the use of particularly complex equipment, advanced technology and integration with other specialized disciplines.

Third-level rehabilitation facilities

- The third level structures or high-level facilities are intended for the treatment of serious disabilities secondary to neurolesions:
  - Spinal units
  - Unit for severe brain injury
  - Unit for serious disabilities in the developmental age
  - Unit for the rehabilitation of acquired neuropsychological disorders

Spinal unit

- The Spinal Unit represents a unipolar rehabilitation structure specifically intended for the assistance of subjects with spinal cord injuries of traumatic and non traumatic origin, such as to allow the myelolese to reach the best state of health and the highest level of functional capabilities compatible with the injury, guaranteeing the unity of rehabilitative intervention with respect to all the needs of the disabled subject in the physical, mental and existential globality of the person.

Spinal unit

- The Spinal Units are part of a carefully coordinated path that starts from the moment of the onset of the injury until the optimal outcome of the person with spinal cord injury is obtained.

Spinal unit

- The Spinal Unit is closely connected with the second level Emergency Urgency Services, and in particular with the "Trauma Centers", in order to provide their advice immediately after the trauma and during any phases of recovery in intensive care unit, neurosurgery, orthopedics, collaborating in the education and training of its staff, participating in common therapeutic protocols and ensuring timely acceptance of the myelogenous subject.

Spinal unit

- For the Spinal Unit, all the specialist consultations that may be necessary and useful in the rehabilitation process are available.

- The Spinal Unit is normally tightly integrated into the overall network of health services of first and second level rehabilitation and social rehabilitation, with which it is linked to the return of the disabled person in their own territory of life in adequate time, guaranteeing the completion of the rehabilitation path.

Unit for the rehabilitation of severe brain-injured patients

- The Unit for Serious Cerebral Injuries is expressly dedicated to addressing the complex and very serious problems of care and rehabilitation, such as the results of severe cranioencephalic trauma and other severe cerebral-injuries such as post-anoxic comas, severe secondary hemorrhages secondary to complex vascular malformations physical, cognitive and behavioral deficits (the outcomes of ischemic and degenerative cerebral lesions are therefore excluded).

Unit for the rehabilitation of severe brain-injured patients

- The Unit for the rehabilitation of severe brain-injured patients should be part of a carefully coordinated path that starts from the moment of the onset of the injury until the optimization of the outcome of the person with severe brain injury is obtained.
- They should be closely linked with the Emergency Services - second level Urgency and in particular with the Trauma Centers in order to provide their advice immediately after the trauma and during hospitalization in intensive care unit and neurosurgery.

Unit for severe disability in the developmental age

- The Unit for the rehabilitation of severe disabilities in the developmental age is expressly destined to face the complex and serious diagnostic, evaluation and rehabilitative problems of the outcomes of congenital or acquired neuromotor and cognitive pathologies of the developmental age.

Unit for severe disability in the developmental age

- The Unit is divided into subunits which, depending on the affecting pathologies, are activated within specialized centers, where the corresponding skills are guaranteed in the following areas: intensive care unit, neonatal pathology, orthopedics with a module specifically oriented to corrective interventions of child disabilities, neurosurgery, pediatrics, plastic surgery, neurology, otorhinolaryngology, ophthalmology, child neuropsychiatry.

Unit for acquired neuropsychological disorders

- The Unit for the rehabilitation of acquired neuropsychological disorders is expressly dedicated to addressing diagnostic, evaluation and rehabilitative problems related to cognitive impairments and disabilities and secondary cortical functions secondary to brain injury.

Unit for acquired neuropsychological disorders

- It should be activated in a hospital where the following specialist activities are present and available: neurology, physical and rehabilitation medicine, neuroradiology, otorhinolaryngology, ophthalmology, psychiatry and clinical psychology.

Taking charge of the patient

- Rehabilitation health activities, with the exception of those aimed at overcoming minimal, segmental and / or transient disabilities, necessarily require the overall clinical care of the person through the preparation of an individual rehabilitation project and its implementation through one or more rehabilitation programs

Taking charge of the patient

- General principles
  - Being focused on the insertion and integration of the person served within the community, the family, and support structures
  - To be periodically reviewed to continuously monitor the progressive approach to the final integration objective
  - To be designated a physiatrist responsible for the project that coordinates the various interventions towards the person
  - The provision of different types of personal services should be planned and organized

Taking charge of the patient

- Programs and projects should be written and communicated clearly to the patient and to all the people involved in the process

- The programs and projects should be regularly evaluated and modified in relation to the desired outcomes, to the expectations and needs of the person served and communicated to all

Taking charge of the patient

- To facilitate the implementation of the projects and programs relating to each patient, a logical process should be followed:
  - Identify the patient's problems and assess their extent and modifiability
  - Assign project responsibility to competent physician and identify the essential components of the inter-professional team
  - Identify the global outcome that is intended and can be reached with the patient
  - Choose the most suitable methods and tools for a more objective measure of its achievement
  - Identify the general functions to be developed (medium-term objectives) and establish how to measure them

Taking charge of the patient

- Identify the short-term objectives in compliance with the rules of biological recovery of the different systems and devices, the strengths of the patient and the resources of the structure

- Choose intervention methods and operational tools to use, identify and assign related responsibilities

Individual rehabilitation project

- It should be distinguished into:
  - Structural project: consisting of the provision and organization of the spaces, the organization of the work, the choice of operating methods, etc.
  - Project of the person: set of propositions elaborated by the rehabilitation team which, taking into account the needs of the patient, his impairment, disabilities and residual abilities, as well as the limits imposed by environmental situations and available resources, define what the desired outcomes are in defined times.

Structure rehabilitation project

- It is the basis of the work organization of a hospitalization rehabilitation facility
- The aim is to facilitate, accelerate and strengthen the processes of recovery of patients' functional autonomy
- The rehabilitation intervention is carried out within 24 hours of the day

Structure rehabilitation project

- It requires compliance with some general criteria and procedures
  - All rehabilitation services provided by qualified personnel should be consistent with the definition and verification of the individual rehabilitation project prepared in respect of the patient's global personality
  - The following are considered basic procedural standards:
  1. Service objectives consistent with therapeutic needs for potential users of the service
  2. Projects and programs that take into account the specificity of impairments and / or disabilities and personalization of the treatment in all its phases

Structure rehabilitation project

- The following are considered basic procedural standards:

3. Punctual registration of the entire route on nominative folder
4. Formal assessment of the acceptance and at the end of the program of the results achieved with a clear and verifiable methodology
5. Periodic meetings of the rehabilitation team to socialize and confront each other on the evolution of the program and propose possible modifications of the therapeutic strategies adopted
6. Scheduled follow-up with a frequency based on the type of disability
7. Timely coordination of medical and social rehabilitation interventions

Individual rehabilitation project

- It is a set of elaborate prepositions of the rehabilitation team that takes into account the needs, the patient's preferences (and / or his family members when necessary), his impairments, disabilities and above all the residual and recoverable abilities, in addition to the limits imposed by environmental situations and available resources

Individual rehabilitation project

- It defines the desired outcomes, the expectations and priorities of the patient, his family members, when necessary, and the rehabilitation team, identifying the general or global outcome and the functional outcome

Individual rehabilitation project

- Usually it does not provide for a quantification of the above aspects, but neither gives a description in general qualitative terms
- It establishes the role of the rehabilitation team with respect to the actions to be taken to achieve the desired results
- It determines the expected times, actions and conditions necessary to achieve the desired results

Individual rehabilitation project

- It should demonstrate awareness and understanding on the part of the entire rehabilitation team of all the patient's problems, including aspects that are not subject to intervention
- It is communicated in an understandable and appropriate way to the patient and his family when necessary

Individual rehabilitation project

- It is communicated to all the operators involved in the process itself
- It is the obligatory reference point for every intervention by the team
- It should be modified, adapted and re-communicated to the patient and the operators in the event of a substantial change in the basic elements on which it is processed, certain results are achieved or unexpected changes occur.

Individual rehabilitation project

- It indicates the specialist physician responsible for the project itself

- It takes into account the needs, the preferences of the patient (and / or his family members, when necessary), his impairments, disabilities and, above all, the residual and recoverable abilities, as well as the environmental, contextual and personal factors

Individual rehabilitation project

- It defines the desired outcomes, the expectations and priorities of the patient, his family members, when necessary, and the care team

- It should demonstrate the awareness and understanding, from the entire rehabilitation team, of all the patient's problems, including the aspects that are not the subject of specific interventions, and as a rule may not provide for a quantification of the aspects mentioned above, but gives a description, in qualitative and general terms

Individual rehabilitation project

- It should be modified, adapted and re-communicated to the patient and the operators, if there is a substantial change in the elements on the basis of which it was developed (needs, preferences, impairments, residual ability-disabilities, environmental limits and resources , expectations, priorities) also in relation to times, actions or previously defined conditions

Individual rehabilitation project

- The project scheme to refer to with all its essential elements is as follows:
  - Current situation
  - Overall results expected in the long term
  - Functional outcome or expected outcome at the end of admission and specific outcomes
  - Phases and modalities of the intervention of the rehabilitation team according to the expected results

Individual rehabilitation project

- The patient should be actively involved and have a greater role in the direction
- The assessment should be should provide elements necessary for the realization of the Individual Rehabilitation Project and of the Individual Rehabilitation Programs
- Individual Rehabilitation Project and Program should be carefully planned and coordinated

Individual rehabilitation project

- Planning should be individualized by establishing medium-term objectives on the strengths, needs and abilities and preferences of the person
- The personnel should be adequate in terms of professionalism and experience, but also quantitative and should be involved in the planning of interventions and in the longitudinal evaluation

Rehabilitation program

- Within the individual rehabilitation project, the rehabilitation program defines the specific areas of intervention, the short-term objectives, the timing and methods of delivering the interventions, the operators involved, the verification of the interventions.

Rehabilitation program

- In particular:
  - It defines the procedures for taking charge of a specific structure of the rehabilitation area;
  - It defines specific interventions during the take-in period
  - It identifies and includes immediate objectives (to be achieved in the space of a few days) and / or short-term objectives (to be achieved within a few weeks) and updates them over time

Rehabilitation program

- In particular:
  - It defines the methods and times for the provision of the individual services envisaged in the same interventions
  - It defines the appropriate outcome measures for the evaluation of the interventions, the expected outcome based on these measures and the time to verify the achievement of a given outcome
  - It identifies the individual operators involved in the interventions and defines their commitment, respecting the relative professional responsibilities

Rehabilitation program

- In particular:
  - It is regularly verified and updated periodically during the period of acceptance;
  - It constitutes an element of verification of the rehabilitation project
  - It is duly verified and updated periodically during the acceptance period
  - It constitutes an element of verification of the rehabilitation project

Rehabilitation program

- The general scheme of the program will contain, therefore, within it a sub-program for each specific area, for which a need for intervention has been identified by the team.

Rehabilitation program

- The professional identified by the team as competent for that area of intervention (physician, speech therapist, physiotherapist, nurse, occupational therapist, psychologist, social worker) prepares the area program, submits it to the team that discusses it and approves it , takes responsibility for it, carries it out, checks its results, according to the agreed outcome measures, and reports the whole to the team for the necessary checks.

Rehabilitation program

- Set of propositions elaborated by the team, coordinated by the physiatrist, foreseen by the individual rehabilitation project for a specific patient who:
  - define the appropriate outcome measures of the interventions, the expected outcome of these measures, the time to verify the achievement of this outcome
  - identify the individual operators involved in the specific interventions and define their role and commitment
  - are regularly verified and updated periodically during the period of taking in charge
  - constitute an element of verification of the rehabilitation project

Rehabilitation team

Characterized by the patient and by a variety of professionals who, sharing values and objectives, participate in the evaluation, planning and / or implementation of a rehabilitation project

Rehabilitation team

- Multi-professional team that is characterized by the variety of professionals coming from different sectors of rehabilitation who, sharing values and objectives, participate in the evaluation, planning and / or implementation of a rehabilitation project of the person in charge
- Moment of strong integration between the professions to reach complex goals identified by the team

Team operation

- There are some conditions necessary for its correct operation:
  - Low number of members
  - Possibility of interaction
  - Common language
  - Objective affinity
  - Integration
  - Facing difficult situations

Team composition

- Patient
- Personnel mainly and directly involved in individual rehabilitation projects
- Other significant people: family, friends, employer, people with similar disabilities

Rehabilitation team

- Physiatrist
- Patient
- Occupational therapist
- Physiotherapist
- Nurse
- Speech Therapist
- Orthopedic technician
- Social worker
- Bioengineer
- Psychologist
- Other physician

Team and family

- The objectives are identified by the team
- It is important to discuss the issues, desires and needs of the patient within the team
- Patient and family should be involved in all sectors and phases of the rehabilitation process in identifying the objectives, monitoring the progress and evaluating the final outcome

Role of the family

- As the patient, the family benefits from taking care of him so that he becomes an actor in the rehabilitation team, as well as a potential resource to be used at best to achieve the best possible result

- No rehabilitation project or program can be effectively pursued without full collaboration and sharing of the patient and the family

Role of the family

- This applies even more to situations of serious permanent disability in which the family is the only possible interlocutor of the team

- This assumes that team-family integration starts as soon as possible

Role of the family

- Early start of training for family members in the management of residual disability
- Management should be of all the professional components of the team which should be clear which are the strengths and weaknesses of the family to pay attention to and give support and support if necessary
- Often it requires an integration of the team with other figures (psychologist, social worker)

Role of the family

- The goal should be to create an effective therapeutic alliance between the team and the family. In what way?
  - By placing the family in the team: involving the family and collecting useful and complete information on family and patient, having the rehabilitation project reviewed
  - Training the family to manage the patient's disabilities
  - Obtaining that during the day they have behaviors appropriate to the physical, cognitive and behavioral condition of the patient so as not to frustrate the results obtained

Role of the family

- The goal should be to create an effective therapeutic alliance between the team and the family. In what way?
  - Training the family to manage the patient at home to facilitate his return (enteral feeding management, drug administration, sphincter management, hygiene, correct positioning, training in the use of verticalization aids, prevention of complications secondary to immobilization ...)

Rehabilitation nurse

- The activity of the nurse plays a fundamental role in the conduct of the process of rehabilitation of serious disabilities; the assistance modalities will be carried out with rehabilitative methods using the typical model of personalized assistance on individual patients based on their real needs and operating by objectives and not for individual services and tasks.

- The importance of nursing professionalism in the field of rehabilitation has led some countries like the United States to form a specific specialized figure ...

Rehabilitation nurse

- They assess the patient's care needs and collaborate in identifying the short, medium and long-term goals contained in the project and in rehabilitation programs and work within their specific tasks to achieve them.

- The rehabilitation nurse also has knowledge of physical, social and behavioral sciences and shows a specific attitude towards disabled people.

Rehabilitation nurse

- The rehabilitation nurse assesses and intervenes on the patient's following needs:
  - Hygienic care
  - Programs to achieve bladder, rectal and nutrition autonomy
  - Specific interventions to maintain skin integrity and treat any decubitus skin ulcers
  - Environmental factors such as temperature, noise, personal effects control, sanitation, infection control and environmental safety

Rehabilitation nurse

- The rehabilitation nurse assesses and intervenes on the patient's following needs:
  - The use of adaptive devices - compensators necessary for communication, feeding, mobility, evacuation, dressing and walking
  - Specific preventive measures to minimize the effect of immobility
  - Promote the spatio-temporal orientation and the control of behavioral disorders

Rehabilitation nurse

- The rehabilitation nurse assesses and intervenes on the patient's following needs:
  - Help patients with time management, including integration with various specific rehabilitation therapies in their daily activities
  - Pharmacological administration

Physiotherapist

- The physiotherapist assists the patient in the process of functional recovery and realizes, as far as it is concerned, the therapeutic program aimed at impairments and motor disabilities, according to the indications of the rehabilitation specialist, including the educational - information aspect towards the patient and his family, school, work environment, etc.

Physiotherapist

- The physiotherapist uses all the kinesitherapic and functional re-education techniques, as well as the massotherapic methodologies and the various equipment of physical instrumental therapy belonging to the therapeutic baggage of rehabilitation

Physiotherapist

- The physiotherapist has his own assessment competence for the purposes of treatment which enables him to adapt the therapeutic exercise independently to the specific needs of the moment.
- The physiotherapist can directly perform basic therapeutic interventions, on medical prescription, even in the absence of the specialist physician, according to the general indications previously defined.

Tasks of the physiotherapist

- Assists the patient in the rehabilitation process
- He collaborates in the drafting of the individual rehabilitation project
- As far as it is concerned, he carries out the therapeutic program aimed at impairments and motor disabilities
- He provides joint movement and gives therapeutic exercises to preserve or improve articulation
- He evaluates and quantifies muscle strength
- He evaluates the balance from sitting and standing, transfers and walking, including using the wheelchair

Tasks of the physiotherapist

- He trains on walking on uneven ground, on an inclined plane and climbing up and down stairs
- He administers exercises to increase strength, endurance and coordination for specific muscle groups or the entire body
- He uses various physical therapy modalities such as superficial and deep heat and cold, hydrotherapy techniques, electrotherapy, magnetic fields, tractions and massage

Tasks of the physiotherapist

- He collaborates in assessing the living environment of the disabled in order to make it free from architectural barriers and more accessible
- He analyzes the needs of the subject in a wheelchair and collaborate in identifying the necessary wheelchair and the related adaptations and aids, before the relative prescription.
- He performs educational and informative activity towards the patient's family by demonstrating techniques designed to maintain patient independence

Occupational therapist

- The occupational therapist exercises his specific skills within the therapeutic program according to the indications of the specialist physician including the educational and informative aspect towards his family, as well as the school, the working environment, etc.

Occupational therapist

- He operates in the functional translation of acquired motor skills, in the study and development of functional rewards for non-recoverable disabilities, with particular regard to training in self-care autonomy and more generally in ADL, in school, at work, in leisure time and in community.

Occupational therapist

- He is competent in the study, packaging and application of orthoses and various aids and in training for their use.

- He also provides its expertise in environmental changes (education, work, family life, etc.) in order to improve the patient's functional autonomy.

- He can directly perform basic therapeutic interventions, on medical prescription, even in the absence of the specialist physician, according to the general indications previously defined.

Occupational therapist

- He collaborates in the drafting of the individual rehabilitation project
- He assesses and trains the patient in self-care activities, such as dressing, eating, bathing and taking care of personal hygiene in order to maximize independence. When necessary, use orthoses and various aids
- He trains the acquisition of skills and abilities necessary for home management using simple methods aimed at minimizing fatigue and saving energy

Tasks of the occupational therapist

- He analyzes the work skills and occupational interests of the patient. He works together with the labor consultant when an occupational modification is planned following the acquired disabilit

- He collaborates in maintaining and improving articulation, muscular strength and resistance and coordination

Tasks of the occupational therapist

- He evaluates and trains patients to support compensation for sensory and perceptual deficits

- He evaluates home and suggests changes to overcome environmental barriers

Tasks of the occupational therapist

- He evaluates the driving skills of vehicles and carry out specific training, if necessary, also with the possible use of appropriate aids

- He carries out educational and informative activities for the patient's family by demonstrating techniques designed to maintain patient independence

Tasks of the occupational therapist

- He trains for the functional use of prostheses
- He evaluates and train patients in the use of environmental control systems (domotics)
- He trains the patient and / or his family to properly maintain the aids and equipment provided.

Speech therapist

- The speech therapist uses the specific therapeutic techniques with regard to central and peripheral disorders of language and, more generally, of communication, as well as of swallowing of any nature, according to the indications of the physician.

- He also works in the re-education of so-called upper cortical functions secondary to congenital or acquired cerebral injuries. It can directly perform basic therapeutic interventions, on medical prescription, even in the absence of the specialist physician, according to the general indications previously defined.

Tasks of the speech terapist

- He collaborates in the drafting of the individual rehabilitation project
- He evaluates and treats communication alterations secondary to neurological alterations
- He reeducates the verbal production
- He performs a pre-operative intervention in laryngectomies, glossectomies and in other therapeutic interventions that can affect communication skills

Tasks of the speech terapist

- He re-educates the linguistic function of laryngectomized patients
- He re-trains the linguistic function in patients with intraoral deficits (glossectomies, palatectomies, etc.)
- He evaluates the swallowing function and manages dysphagia

Tasks of the speech terapist

- He evaluates and train the patient in the use of non-verbal communication devices
- He re-trains the patient with cognitive disorders
- He educates the patient and his family about the problems of communication and swallowing

Orthopedic technician

- The orthopedic technician is responsible for the evaluation, design and manufacture of prostheses and orthoses.
- He ensures the functionality of the aid, the correct use and the real improvement of the patient's abilities with its use, according to the indications of the competent medical specialist for type of disability and disability.

Orthopedic technician

- He has the task of instructing the patient and the family on good maintenance and the correct use of prostheses and orthoses, perform periodic checks and carry out the necessary repairs and adaptations over time.

Tasks of the orthopedic technician

- He assesses the impairments in order to identify possible solutions through the prosthetic and orthotic provision
- He studies, builds and applies prosthetic and orthotic devices
- He evaluates motor disabilities in order to identify possible technological aids for the relative functional compensation

Tasks of the orthopedic technician

- Adapting prostheses, orthoses and technological aids to the patient's needs
- Train the patient and family to use what is provided

Aids/Orthosis/Prosthesis

- AIDS: tool that increases or improves an altered function of the subject (Modified cutlery, Canes, Wheelchair)
- ORTHESIS: tool that increase, improve or control the impaired function of body parts (Collars - busts, Knee pads - anklets)
- PROSTHESIS: tools that, when applied to the short, partially or totally replace missing parts, recovering the structure and the lost function.

Physiatrist

- He is an essential professional component in the rehabilitation team is the physiatrist.

- He is the physician of the disabled person, with the role of person in charge of the individual rehabilitation project.

Physiatrist

- He performs assessment, diagnosis, prognosis and treatment of impairments, disabilities and handicaps
- He directly manages internal issues
- He coordinates the rehabilitation team in the implementation of the project and the various programs
- He manages the necessary relationships with the patient and the family

The physiatrist establishes his clinical practice on six points

1. Evaluation and management of patients with physical disabilities are closely related and integrated aspects of medical care
2. Disability can often be prevented or reduced by an appropriate medical approach
3. The objectives of taking charge include the improvement of physical, social, psychological and work functional abilities, with or without obtaining modifications of the basic pathological processes. These objectives are of medical competence.

The physiatrist establishes his clinical practice on six points

4. The recovery or maintenance of a patient's functional skills frequently require the efforts of many specialized professionals, including non-healthcare personnel, and other medical specialists in addition to the physiatrist
5. Family and community resources are often essential elements of the rehabilitation process and the physiatrist should include them in his sphere of evaluative, diagnostic and therapeutic interventions
6. The planning of interventions to continue rehabilitation assistance represents a specific medical responsibility.

Physiatrist

- The physiatrist also has the task of forming a suitable team, of animating and guiding it.

- He should should also take care of all the necessary initiatives to ensure rapid, effective and continuous rehabilitation.

- The rehabilitation team is something more than a simple group of people and working in a group is something different from the sum of the work done by its individual members. The team is a united group of health professionals from different disciplines and with different professionals who share common values to achieve common goals.

Communication in the team

- Effective communication requires:
  - A continuous exchange of information
  - The exchange should be as clear and complete as possible
  - Information should have a meaning for those who receive it
  - Confirm that the message has been received

Communication tools of the team

- Unwritten communication: rehabilitation team meetings
- Written communication: the integrated medical record

Team meetings

- They represent an essential activity in the functioning of the group
- They represent a main communication and sharing tool
- They should be used correctly

Integrated medical record

- They represent the most important and characteristic communication tool of health activities
- It certainly represents a complex task due to various factors:
  - Wide range of issues
  - Complexity of the interventions
  - Number of actors involved
  - Need to define the outcome of the treatment process in a multidimensional way

Integrated medical record

- It contains:
  - Who, what, why, when and how to care for and care for the patient during hospitalization
  - Clear and precise documentation of the interventions during the period of patient care that is useful to all the operators involved

Structure of the integrated medical record

- At least the following points should be considered in the written documentation:
  - Resource identification
  - Evaluation of the dimensions of the disease (impairment, disability, handicap)
  - Forecast of the results
  - Definition of the treatment plan
  - Definition of the resignation plan
  - Service delivery methods
  - Possible modifications of the treatment plan
  - Modification of team members if a need is identified
  - Achievement of the expected outcomes for the patient

Structure of the integrated medical record

- It consists of three main sections

1. Admission assessment and rehabilitation project
2. Programs and goals
3. Communication, education and information for the patient and family members

- To these are added other sections in which are reported:
  - Biohumoral tests
  - Instrumental examinations
  - Consultations
  - Certifications
  - Resignation plan
  - Post-discharge assessments

GSI ITALIA
GRUPPISOLIDARIETÀINTERNAZIONALE

PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Bachelors Programme in Nursing

II Year

PATIENT POSITIONING, HANDLING AND TRANSFERT

A.Y. 2021/2022

Manual handling of loads

- Set of transport or support operations of a load by one or more operators, which involve risks of injury to the spine due to their characteristics or due to unfavorable ergonomic conditions

Manual handling of loads

We can essentially have three types of load handling activities:

1. Handling of inanimate loads such as packages, materials, or elements whose weight rests completely on the upper limbs: this is a situation that usually presents itself with low risk, due to the frequency with which it is performed

Loads handling

1. Activities characterized by prevailing operations of picking up, transporting and manually releasing a load of defined dimensions and weight, in which the other manual activities (static support, pulling, pushing) are negligible. For example:
   - unloading or manual loading of packages on pallets
   - placement of folders on a shelf
   - loaded with bricks on a wheelbarrow
   - unloading of bags from a vehicle

Manual handling of loads

We can essentially have three types of load handling activities:

2. Patient movement: a situation in which it is difficult to understand how much the operator is burdened with, since part of patient is discharged onto the handling surfaces. This is the most risky situation for the healthcare professionist, due to the frequency with which it can happen

Patient handling

2. This activity represents a risk when we have to deal with patients who are not self-sufficient, or when we have to partially or totally dependent patients
   - They require partial or total lifting by the healthcare professionist
   - I am unable to offer help - in part or completely - with the lower limbs

Manual handling of loads

We can essentially have three types of load handling activities:

3. Pulling and pushing actions, a frequent situation among health workers due to the need to transfer patients on stretcher, or in bed or in a wheelchair from one inpatient unit to the other

Pushing and pulling actions

2. Activities characterized by prevailing actions of pushing and/or pulling an object, with or without wheels, where the other activities involving muscular commitment (static support, lifting, lowering, transport on the flat and on stairs, repeated movements of the upper limbs) are negligible amount. For example:
   - Pushing of a trolley for the transport of manufactured things
   - Pulling bags on the floor
   - Pulling or pushing a stretcher
   - Pulling or pushing a wheelchair

The risk for the operator

- Why can patient handling activities be at risk?
  - There are several factors that make patient handling activities at risk and, therefore, increase the danger of trauma. An operator who performs positioning and transfers without adopting correct preventive strategies questions his health, sometimes seriously.
  - These risk factors are associated with different aspects of patient handling

Risk factors

- Weight: maximum weight of the object handled 30 Kg
- Horizontal distance: the horizontal distance between the point of grip (or release) of the object and the hips of the worker should be as small as possible
- Height: The height of grip (or release) of the object should be close to that of the hands when the arms are in resting position (75-80 cm from the ground)

Risk factors

- Activities. They can involve risk if:
  - Physical efforts are too frequent or prolonged
  - The breaks are insufficient
  - The lifting, lowering or transport distances are too large
  - The rhythm cannot be modulated

- Duration and break periods. A long duration of the task of manual handling of loads involves frequent and long recovery periods

Risk factors

- Strength concerns the amount of physical effort required to perform the task (for example, lifting heavy weights, pulling and pushing) or to maintain control of equipment and instruments

Risk factors

- Frequency: The frequency of handling actions should be as low as possible

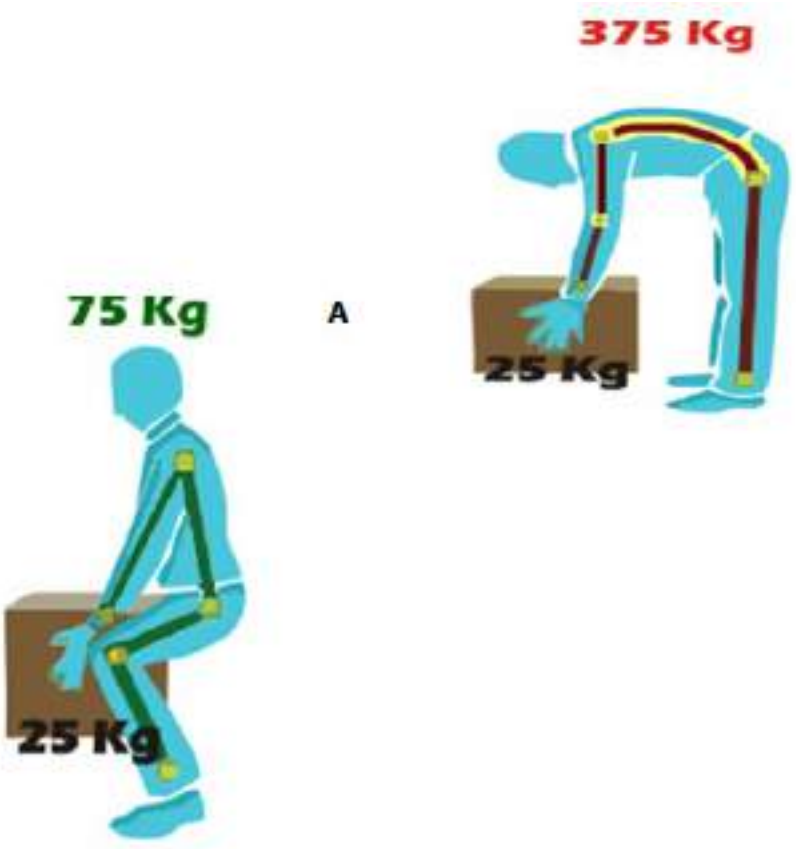
- Vertical shift
  - The vertical displacement of the object should be as small as possible.
  - The ideal condition corresponds to points of grip and release of the object located at the same height

Risk factors

- Trunk rotation: Trunk rotation should be avoided.
- With the same object weight, an asymmetrical lift is much more at risk than a symmetrical one
- It is not advisable to take uncomfortable positions, that put the body under stress, for example bend over on a bed, kneel or lift with the spine in rotation
- It is advisable to lift the weights using the knees flexion and not flexing the spine

To lift a weight

- Place yourself as close as possible to the patient or the load to be moved and if the weight to be lifted is placed near the ground, bend the knees (A) and not the spine (B)



Risk factors

- Load characteristics: may constitute a risk if the load:
  - It is cumbersome or difficult to grasp
  - It is in unstable balance or its content is likely to shift
  - It should be kept / handled at a certain distance from the trunk
  - Due to its structure or consistency, the load can cause injury to the worker, in particular in the event of a collision

Risk factors

- Physical effort. It can present risks if the load:
  - It is excessive
  - It is performed with the body in an unstable position
  - It can be done only with the rotation of the spine
  - Sudden movements are performed

Risk factors

- Taking the object
  - a good grip reduces the force required to grip the object and allows you to handle heavier objects
  - vice versa, an unfavorable grip makes it necessary to apply greater force to grasp the object and decreases the acceptable weight
  - good grip: when the hands adhere easily to the object (in case of regular and small objects)
  - unfavorable grip: when the hands do not adhere well to the object (in case of objects that are too large, with sharp or irregular edges)

Risk factors

- Individual risk factors. The operator can take a risk if:
  - Physically unfit to perform the task, taking into account gender and age differences
  - Wear inappropriate clothes, shoes and / or other personal effects
  - He does not have the knowledge, or training required for the task he performed

Risk factors

- Work environment characteristics. It can increase the risk if:
  - the free space, in particular vertical, is insufficient
  - the floor is uneven and presents a risk of tripping
  - the floor is slippery or unstable
  - the floor has unevenness that involves handling operations at different levels
  - the microclimatic conditions (temperature, humidity, or ventilation) are inadequate
  - If there are space limits (small rooms, lots of tools)
- All this increases the risk of slipping, tripping or falling

Risk factor associated with the patient

- Patients cannot be lifted like loads; therefore the "rules" for safe lifting are not always valid:
  - Patients cannot be kept close to the body
  - Patients have no handles
  - It is not possible to predict what will happen during the movement of a patient
  - Patients are voluminous

Risk factors – Pulling and pushing

- The posture adopted influences the ability to apply force
  - A unfavorable posture produces a reduction of pushing and pulling capacity and consequently a need to apply more force
  - A positive posture allows the body weight to be unloaded on the load, consequently the need to apply less force and consequently less compressions cutting efforts on the spine and shoulders

Risk factors - Pulling

- The stress on the spine and the anatomical districts of the upper limbs is influenced by the position of the hands on the object to be pushed or towed:
  - the position of the hands should not be too high or too low
  - the hands should not be too close or too far apart
  - the elbows should be bent and held down

Risk factors – Pulling and pushing

- High frequency of pushing and pulling actions, high number of maneuvers (not straight path), thrust and "jerky" drive imply that a high number of times the application of the initial force is required con consequently increased risk

Risk factors – Pulling and pulling

- The characteristics of the transport system should be such as to optimize maneuverability.
- Provide handles to optimize the applied force
  - The height and the distance between the handles should be adjustable according to the characteristics of the worker
  - If possible it is preferable to use long vertical handles
- The size of the system should not hinder the visibility
- If this occurs, pulling is preferable to pushing

The risk remains

- Overall, these factors merge and generate an insecure burden that staff cannot manage well. Even with the assistance of other staff members, it is essential to note that risk exposure persists.

Select the correct technique

- The choice of the correct patient handling technique involves the assessment of the needs and abilities of the specific patient.
- The evaluation of the patient should include the analysis of factors such as:
  - The level of assistance required by the patient: For example, a non-collaborating patient (a tetraparetic patient, an elderly bedridden patient, a patient in general or comatose anesthesia, a patient who is resistant to mobilization, etc.) needs a mechanical lifter, while a collaborating patient and willing to support his weight in part may be able to move from bed to chair using a stand-up aid

Select the correct technique

- The evaluation of the patient should include the analysis of factors such as:
  - The size and weight of the patient: For example, a patient may weigh too much for the operator to lift it without mechanical help
  - The capacity and availability of the assisted to understand and collaborate
  - Any medical conditions that may affect the choice of lifting or repositioning methods. For example, abdominal injuries, contractures, the presence of tubes, a pregnancy make transfer or repositioning operations more complicated.

Basic rules for correct handling

- Before illustrating all the patient mobilization procedures, it is good to know which are the less overloaded postures, to keep in mind whenever you approach a manual handling action:

1. Keep the balance. The balance is as stable as the support base is wider.
2. Flex the lower limbs. When lifting, it is good to use the muscles of the lower limbs and not that of the spine. Therefore you should never bend your spine forward but you should flex your legs.
3. Avoid flexion of the spine. The muscular effort should be reserved for the lower limbs, while the trunk should remain straight.

Basic rules for correct handling

4. Avoid the rotation the spine, but rather, turn around with the whole body.
5. Bring the weight to be lifted. The force needed to balance a weight increases with increasing weight distance from the body. Therefore it is necessary to reduce this distance as much as possible and therefore:
   - Reduce the distance between patient and operator,
   - When lifting or transporting an object, keep it as close as possible to the trunk.

Basic rules for correct handling

6. Share the load to be moved. When lifting a weight to one side of the body the trunk tilts on the opposite side to balance the effort (eg lifting and carrying a suitcase). In this case the spine should withstand both the overall load and the strain of the trunk muscles. It is therefore necessary to distribute the weight on both sides.
7. When the load is excessive, the effort should be either divided between several operators, or performed using aids or mechanical equipment (eg lifter).

Basic rules for correct handling

8. Place one knee on the bed. This is useful both to reduce the distance of the weight (patient), and to reduce the load on the spone in all the operations that require to be bent down.
9. Sit on the bed if necessary.
10. Before starting an activity, prepare and correctly position the material to be used for that particular task.

Basic principles for adequate patient handling techniques

- Rule 1 - Any type of handling operation, even if using handling aids, involves several basic principles:
  - If necessary, always request the help of the assistants
  - The handling operations involving immobilized patients should be carried out by more than one health worker (at least two) and, if necessary, by means of a sheet spread under the patient or, even better, using specific aids (eg sliding sheets).

Basic principles for adequate patient handling techniques

- Rule 2 - Before starting any type of handling activity, the operator should position himself as close as possible to the patient, if necessary also kneeling on the patient's bed

- This allows the operator to avoid to bend or stretch on the bed during the lifting and transfer of the patient, thus making the necessary physical efforts with the spine bent or in rotation.

Basic principles for adequate patient handling techniques

- Rule 3 - Before starting any type of handling operation, illustrate the procedure to the patient encouraging him, at the same time, to collaborate as much as possible during the handling activity
- This is to the benefit of both the patient and the healthcare provider because the patient, being able to move independently, albeit slightly, may then be able to perform some operations on his own: in this case the function of the professionist will simply be to lead this movement

Basic principles for adequate patient handling techniques

- Rule 4 - Keep correct posture during patient handling operations
- More specifically, before starting the lifting or transfer of the patient, the professionist should position himself with his legs slightly apart and a foot positioned slightly forward to ensure a wider support base. During the lifting of the patient, the muscles of the legs and hips should be used instead of the muscles of the upper body, bending first and then slowly straightening the knees while lifting the patient. The spine should be held in a position that follows its natural curve, making sure to avoid overloading it when stretching or bending over. Furthermore, the professionist should always try to shift his weight following the direction of the movement he is doing.

Basic principles for adequate patient handling techniques

- Rule 5 - Hold the patient well during handling operations

- Never grip a patient with just your fingers. Always use your whole hand and try to identify areas that allow for a firm grip. Grip the patient around the pelvic area, the shoulder blades and never by the arms or legs. To improve grip, some operators may need to move patients by gripping them by the pants or, even better, by using specific aids such as, for example, the belts with handles.

Basic principles for adequate patient handling techniques

- Rule 6 - Wear suitable footwear and clothing

- It is important to use firm shoes. They are, therefore, not recommended for shoes with high heels, clogs or slippers. Clothing should not restrict the operator's movements.

- The purpose of applying these principles is to preserve both the operator and the patient from risks and damages

- Naturally, in order to apply these principles we should also have suitable or at least adaptable environmental spaces

- Mobilizing and moving a patient involves effort: it is therefore important to develop skills rather than strength by not forgetting our limits
- Use a colleague's help whenever possible and necessary
- The principles listed above should become a nurse's professional baggage and properly combined make it possible to deal with more varied situations without running risks

Proper patient handling techniques

- In the following part, different techniques for moving patients (manual, large and small aids) for different transfers are illustrated.
- It is important to consider that:
  - Any type of handling operation, even if patient handling aids are used, includes the basic principles described above
  - The choice of the correct patient handling technique involves the assessment of the needs and abilities of the specific patient as indicated above.

Patient handling techniques

1. Manual transfer methods: these are performed by one or more operators who make use of their own muscular strength and, where possible, the possible residual movement capacity of the patient

Patient handling techniques

2. Transfer methods using minor patient handling aids: these are patient handling techniques carried out by means of specific aids, such as low-friction sheets, ergonomic belts, rotating platforms, the trapeze fixed above the bed etc.

Patient handling techniques

3. Transfer methods using major patient handling aids: these handling techniques are performed using electromechanical lifting devices

Patients who are not self-sufficient

- Based on the studies conducted, we have seen that normally the movement of
  - Partially uncooperative patient: involves an average load at the level of the spine
  - Patients totally uncooperative: it involves a high load in the spine

How to decrease the load on the spine

- Partially collaborating patients: use minor aids
- Non-collaborating patients: use major (eg. lifter) and minor aids

- The use of aids, if relevant with respect to the maneuver to be performed, is not optional but mandatory

- What is discretionary is the choice of which aid you use among those available

Aid

- Equipment that reduces the overload for the healthcare worker during the lifting and moving operations of the patient
  - Lifter
  - Ergonomic belt
  - Assistive products for walking (crutches, underarm walker, roller, etc.)

The minor aids

- Minor aids are equipment that make it easier to move the patient, reducing mechanical stress on the operator's spine. We distinguish between
  - Aids for patient handling: used above all for bed settling, they are based on the principle of removing friction between the patient's body and the bed on which it is placed, favoring its sliding for towing and pushing. The patient's body in particular, from supine unloads his weight in four main points, that is head, shoulders, hips and feet, positioning sliding sheets / surfaces favors the slipping of the patient's body over the mattress
  - Aids for transferring patients: used to transfer them from one location to another location

The minor aids

- High sliding sheets: these are sheets, of different sizes, made of low-friction material, which can help the patient move from floor to floor in the absence of height difference (eg bed-stretcher transfer) or move the patient to bed.

- Ergonomic belts. They are belts of different sizes coated with non-slip material and equipped with lateral and rear handles that can be applied to the partially collaborating patient's pelvis and allow the operator, in the passages from sitting to standing station to guide the movement without lifting it.

The minor aids

- Transfer table. It is an axis made of rigid material which, in the absence of differences in height between the two surfaces, makes it possible not to lift the patient during bed / wheelchair transfer.

- Rotating disk. It is a platform consisting of two superimposed disks that allow the patient to rotate in an upright position

- Wheelchair. It is good that:
  - The armrests can be removed to facilitate bed / wheelchair and wheelchair / toilet transfer
  - The footrests are removable or foldable to the outside
  - The wheels are fitted with easily operable brakes
  - The backrest is not too bulky

The minor aids

- Stretchers adjustable in height. Many hospitals are still equipped with old-fashioned fixed-height stretchers and this makes frequent bed-to-stretcher transfers to the ward and the stretcher-to-operating table transferts are extremely both demanding physically and logistically. The stretcher with variable height between 50 and 90 cm through an oleodynamic device that is operated by a pedal placed at the foot side, is an essential safeguard to make these operations less traumatic for operator and patient.

The minor aids

The major aids

- The major aids are characterized by being motorized: for example the lifter

Mobilization of the patient in bed: indications

- In all those clinical conditions in which it is temporarily or permanently compromised or impaired by the patient's ability to maintain his movement

Because it is important to mobilize the patient

- Risks of immobility or incorrect mobilization:
  - Skin: decubitus
  - Locomotor apparatus. Musculotendinous retractions - joint limitations, dislocations
  - Respiratory system: hypoventilation due to insufficient expansion of the rib cage
  - Nervous system: hypokinesia, balance disorders, neuropsychological disorders
  - Cardiovascular system: fatigue failure, thrombophlebitis
  - Psyche: depression, loss of autonomy

Definitions: positioning Vs transfers

- Positioning and handling: The patient remains on the same surface (for example, moving on the edge of the bed or upwards)

- Transfer: moving the patient from one support surface to another (for example, bed-wheelchair, wheelchair-toilet)

Fundamental factors

Before making any transfer / transfer it is necessary to evaluate:

1. Assistance level:
   - Maximum assistance
   - Medium assistance
   - Minimum assistance

2. Degree of collaboration of the patient

3. Mass and weight of the patient

Conditions that influence the choice and application of the techniques

- Positioning characteristics
- Clinical conditions of the patient
- Residual psychophysical capacity of the patient
- Collaboration of the patient
- Operator

Positioning

- In the bedridden patient, the positioning of a patient is intended to prevent pressure sores
- The purpose is to change the contact areas of the body with the surface, paying particular attention to the bony protrusions
- In these patients, it is necessary to change position every 2-3 hours

Objectives of the positioning

- Preventing the complications of immobility
  - Bedsores
  - Urinary stasis
  - Venous and lymphatic stasis
  - Prevent pain syndromes

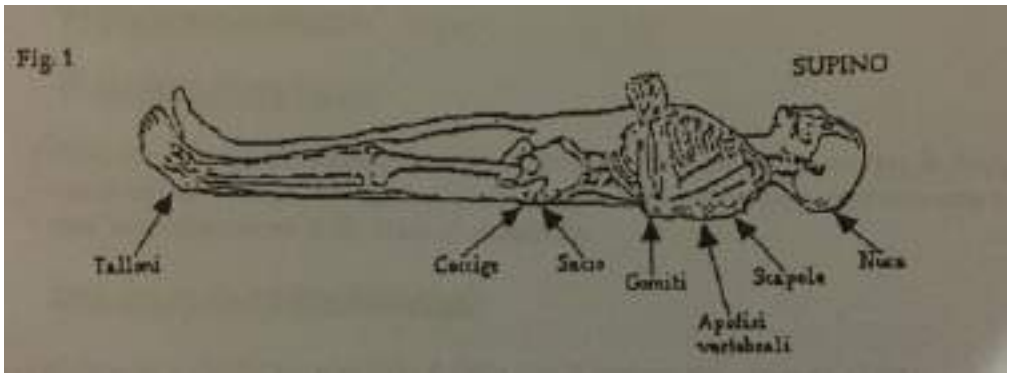
- Prevent vices of posture, contractures, and muscle-tendon retractions
- Prevent the onset of muscle tone disorders
- In the stroke patients, to facilitate awareness of the patient with an affected side

Anatomical parts at risk

- The areas most at risk for pressure sores are those where the soft parts corresponding to the bone surfaces are relatively little thick and where pressure is exerted

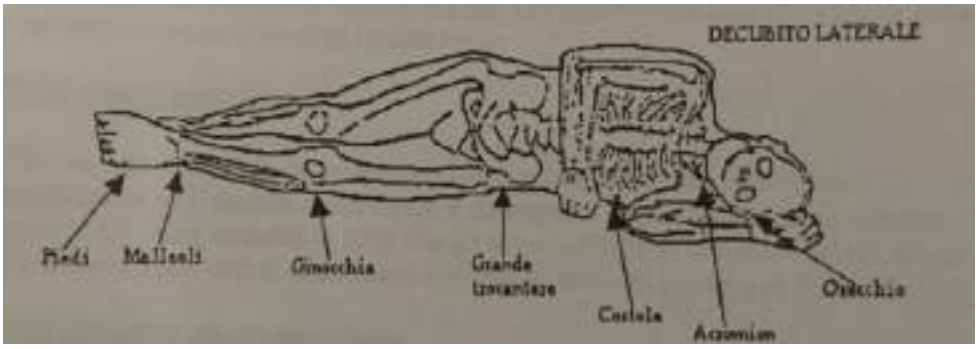
Anatomical parts at risk

- Supine position
  - Occipital area
  - Coccyges
  - Ischial tuberosities
  - Heels
  - Vertebral spinous processes
  - Spine of the scapul



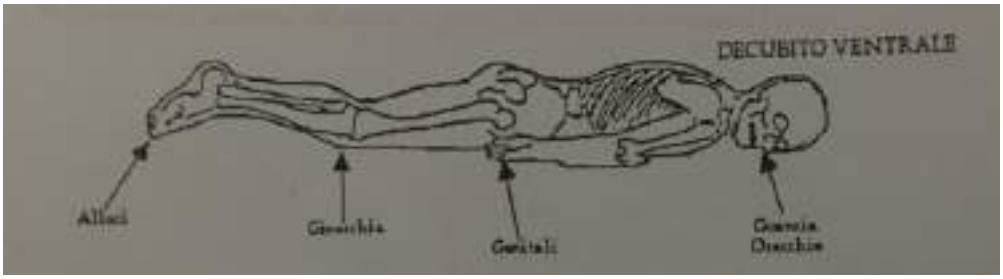
Anatomical parts at risk

- Position on the side
  - Acromion
  - Great trochanter
  - Head of the fibula
  - External malleolus
  - Earlobe



Anatomical parts at risk

- Prone position
  - Temporal zone and ear lobe
  - Clavicle
  - Sternum
  - Anterior area of the humeral head
  - Upper anterior iliac spine
  - Forefoot
  - Patella



Suggestions for correct positioning

In general:

- In the supine positioning:
  - Pillow between the legs or under the calves
  - Pillows under the arms.

- Positioning on the side:
  - Pillow behind the back to support
  - Pillow under the leg and the arm that are above

Suggestions for correct positioning

- Depending on the pathology the placements have different purposes:
  - Hip replacement: a pillow between the legs when it goes on the healthy side avoids dislocation of the replacement
  - Stroke patient: a pillow under the arm in a wheelchair avoids subluxation of the shoulder
  - Upper limbs for the prevention of edema to maintain hand higher than the shoulder

General criteria for moving the patient to bed

- Know the patient's residual motor skills
- Equip the bed with the necessary aids: trapeze, smart bed sheet, sliding sheet etc.
- Inform the patient of the procedure to be made
- Adjust the height of the bed, brake it and remove the sides, place yourself on the patient's affected side
- Verify the patient's collaboration verbally

Procedure

- If necessary, always request the help of another operator
- Before starting any type of handling activity, the operator should position himself as close as possible to the patient, if necessary also kneeling on the bed
- Before starting, explain the procedure to the patient, encouraging him or her to collaborate as much as possible during the handling activity
- Apply ergonomic principles

Moving the patient to bed

- Aims:
  - Means to prevent decubitus ulcers
  - It allows the weight of the body to be weighed alternately in different areas, favoring blood circulation and the trophism of the tissues corresponding to the areas subjected to greater pressure
  - It prevents contractures and promotes the well-being of the patient as it avoids the constant commitment of the same muscles involved in maintaining posture.

Patient moving

- In the bed:
  - Towards the headboard
  - Lateral
  - On the side
  - From supine to sitting
- In a wheelchair:
  - 2 operators (1 front and 1 back)
  - 2 operators on the side
  - 1 operator

Moving the patient up in the bed

- Maneuver with a single operator, and collaborating patient
  - The patient helps himself by pushing with his legs
  - The operator helps by moving his pelvis.

Moving the patient up in the bed

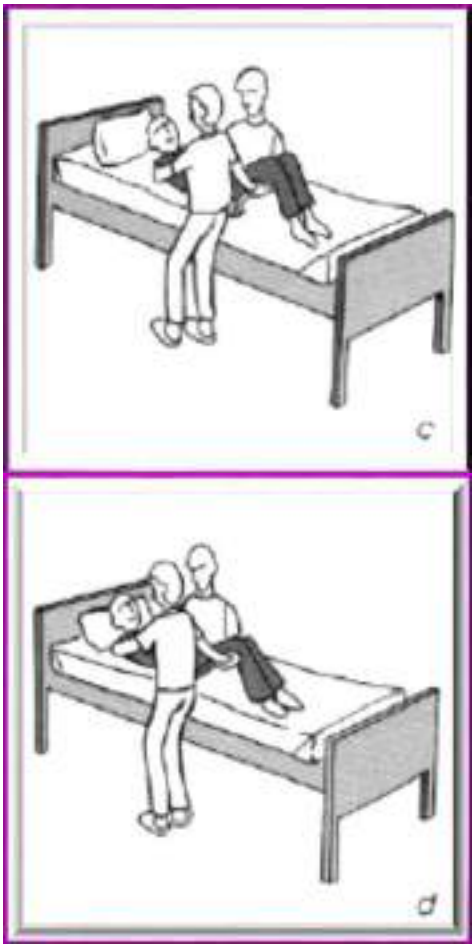
- Maneuver with a single operator, collaborating patient – Variant
  - invite the person to hold on to the headboard or the trapeze if present help him bend his knees and rest his feet on the bed
  - put one arm under the shoulders and the other under the pelvis / thigh of the patient
  - Ask him to lift his head from the pillow, to point his feet on the bed, to raise his pelvis and inform him of the importance of his collaboration during the movement maneuver
  - Push it towards the head of the bed, shifting the weight of your body from the leg behind the one placed forward

Moving the patient up in the bed

- Points to remember
  - Adjust the bed height correctly according to your height
  - Ask the patient to flex his knee, look at his feet and then pivot on his foot. This will increase the patient's collaboration
  - During the transfer, shift your weight from side to side, keeping your back straight.

Moving the patient up in the bed

- Maximum assistance with two operators: collaboranting patient
  - Stand at the sides of the bed and help the patient flex their knees
  - Place one arm under the shoulders (grabbing the patient's shoulder) and the other under the pelvis ot the thighs
  - Take with your hand, your arm with that of the other operator
  - Lift the patient from the bed surface, and move him towards the headboard, bringing the weight of his body, from the leg behind to the one placed forward



Moving the patient up in the bed

- Maneuver with two operators
  - If possible, ask the patient to get their hands on the top of the bed and get hold of them during the transfer.
  - If possible, ask the patient to flex his knees, look at his feet and then pivot on his feet.

Moving the patient up in the bed

- Maneuver with two operators: crossed grip
  - place the back of one hand behind the patient's shoulder; lift the patient by forcing on the lower limbs and on the left arm
  - they place the patient with folded arms
  - carry out the crossed grip by gripping both upper limbs firmly with one hand
  - with the other hand they gip the lower limb behind the knee; lift and move the patient towards the pillow.

Moving the patient up in the bed

- Maximum assistance with one / two operators: non-collaborating patient - Variant, use of the smart bed sheet
  - In the presence of 2 operators the smart bed sheet is taken at the level of the pelvis and shoulder and the patient is moved towards the head.
  - An operator placed at the head of the bed can take the smart bed sheet at shoulder level and pull the patient towards him.

Moving the patient up in the bed

- Points to remember:
  - Ask the patient to put his hands on the top of the bed and hold yourself during the transfer by pivoting on the feet
  - When lifting the patient, use the muscles of the legs and hips instead of those of the upper body, first bend over and then slowly straighten the knees while lifting the patient
  - The movements of the two operators should be synchronized while transferring the patient. Communication is very important.
  - To reposition a patient who has slipped into the bed, do not pull him from his arms.

Moving the patient from one side to the other of the bed

- Maneuver with a single operator
  - The operators first moves the trunk by gripping the patient under the shoulder blades and then the pelvis and then the legs.

1- SPOSTAMENTO DEGLI ARTI INFERIORI 2 - SPOSTAMENTO DEL BACINO 3 - SPOSTAMENTO DELLE SPALLE

Moving the patient from one side to the other of the bed

- Maneuver with two operators
  - The first operator moves the trunk by gripping the patient under the shoulder blades and the second operator moves the pelvis and then the legs.

Moving the patient from one side to the other of the bed

- Maneuver with an operator:
  Variant with the smart bed sheet
  - Take the smart bed sheet as close to your legs as possible and bring them close to the edge of the bed.
  - Take the smart bed sheet as close to the pelvis as possible and bring it close to the edge of the bed.
  - Take the sheet as close to your shoulders as possible and bring them close to the edge of the bed.
  - Align the head by lifting it gently

Moving the patient from one side to the other of the bed

- Points to remember:
  - Adjust the bed height correctly according to your height
  - Divide the transfer into three parts: legs , pelvis and shoulder
  - Pull and pull the patient together using his own weight.
  - Use the muscles of the legs and hips instead of those of the upper body
  - Ask the patient to watch his feet. This will increase the tension of the abdominal muscles and improve collaboration.
  - Balance the patient's weight with your own weight
  - The movements of the two operators should be synchronized while transferring the patient. Communication between the two operators is very important

Assistive aids for patient handling

High sliding sheet

Sheet to be positioned between the shoulder blades and the pelvis can be used depending on the direction of insertion to move the patient on the bed

Correct use of high sliding sheets or smart bed sheet

- The sheets should not be lifted by the handles.
- Take the upper sheet near the patient's scapular and pelvic girdles.
- The operator should spread the legs and slide it gently towards the headboard.

Moving the patient from supine to lateral decubitus

- Independent patient
  - Bend the knee opposite to the side position you want to move
  - Help hiself with your arms pushing against the edge of the bed to turn around.
  - If he cannot, it could help him by gripping the hands and, letting the arms fall, stretched, towards the edge of the bed, turning at the same time the head and pushing with the flexed leg.

Moving the patient from supine to lateral decubitus

- Maneuver with an operator
  - Position yourself to the side of the bed towards which you intend to turn the patient, so as to avoid possible falls.
  - Bend the knee of the leg that is further away from you and hold it with one hand.
  - Make him bend the arm that is along the side towards which he will have to turn, and if possible, place it near his head
  - With the other hand take the patient to the height of the humerus, behind the back
  - Patient rotation: the operator holds one foot forward and one back; flexes the knees; and rotates the patient

Moving the patient from supine to lateral decubitus

- Maneuver with an operator: variant with the smart bed sheet
  - Take the smart bed sheet near the shoulders and the pelvis and rotate the patient on the side.
  - Put a pillow behind your back by fixing the pelvis.
  - Bring the lower shoulder forward.
  - Place a pillow between his knees.

90 ° lateral decubitus

- When the patient is left on the side, one or two pillows should be placed behind the spine, a pillow between the legs and one under the arm

Side decubitus at 30 °

- To prevent the formation of pressure sores at the level of the great trochanter,
  the patient should be turned on his side, leaning against a single pillow behind his spine.

How to put a smart bed sheet

- From the supine, the patient's legs are flexed and he turns on his side.
- Position a pillow rolled (or the smart bed sheet half stretched and half rolled) under the patient.
- The patient is turned on the opposite side and the smart bed sheet is unrolled and stretched well.

Positioning from one side to prone

- Independent patient
  - Make sure you have enough space to turn around.
  - Bend the trunk slightly with the help of the arms and then turn the legs.

Positioning from one side to prone

- Dependent patient:
  - spread the patient's arm, that of the side towards which he will turn it
  - with a coordinated movement of the hands, turn the person towards us until it is prone
  - once placed in the prone position, place the head.

Moving the patient from supine to sitting

- Independent patient
  - Position him on the side
  - Put his legs out of the bed
  - Lift his by pushing your arms against the bed with all your body weight

Moving the patient from supine to sitting

- Cradle grip of the lower limbs: the professionist firstly brings the patient's legs out of the bed, then places one arm under his shoulders, the other arm wraps his legs at the knees, from above. A rotation is performed.

- Taken below the scapula: the professionist positions with the hand on the scapula of the patient and carry out a load shift backwards.

Moving the patients from supine to sitting

- Partially collaborating patient
  - The subject helps himself by pivoting on his elbow and moving his legs off the bed. The legs can be kept crossed. This trick is used if there is a leg much weaker than the other, in this case the one crossed below helps the other. Perform the postural transition in a single gesture: while the legs are lowered the trunk rises.
  - Use the muscles of the legs and hips when lifting the patient instead of the muscles of the upper body. First of all, bend over and then slowly straighten your knees while lifting the patient.
    Guide the patient's trunk from behind the shoulder blades, not from the cervical spine

Moving the patients from supine to sitting

- Dependent patient:
  - Place the patient on the side with the legs flexed.
  - Surround his legs with one arm, passing behind his knees
  - With the other arm surround the spine (never the neck) so that its head rests on our forearm.
  - With a coordinated movement, seat the patient by raising the trunk and simultaneously lowering the legs
  - Important: never pull his legs and arms

Moving the patients from supine to sitting

- Maneuver with two operators: non-collaborating patient
  - The two operators stand on the different sides of the bed. An operator takes care of moving the legs, one of lifting the trunk .
  - Use the muscles of the legs and hips when lifting the patient instead of the muscles of the upper body.
  - The movements of the two operators should be synchronized while transferring the patient. Communication between the two operators is very important!

Moving the patient in the wheelchair

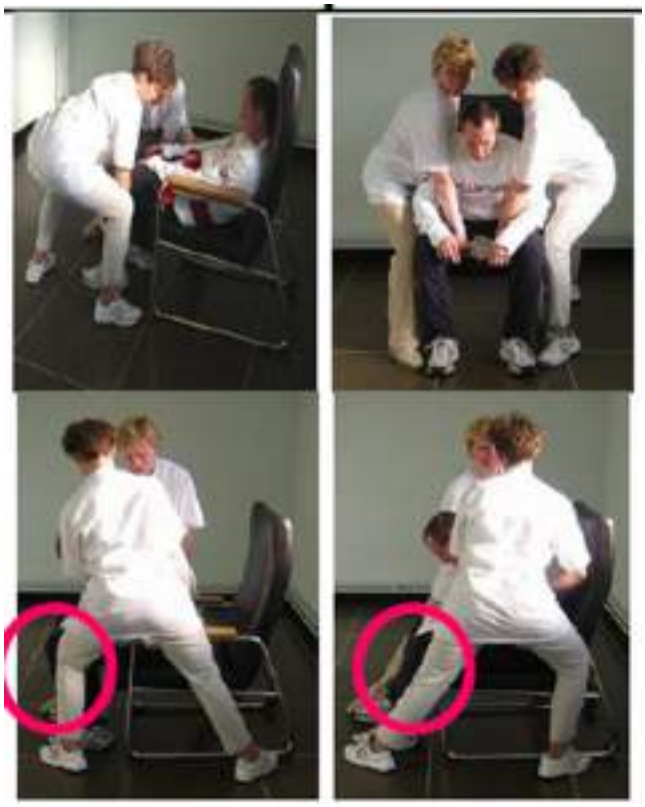
- 1 operator
  - Before starting, make sure that the patient's feet are as close to the chair as possible. Ask the patient to lean forward as much as possible, helping him by putting his arms around his pelvis.
  - Ask the patient to lean forward and pivot on the legs during the transfer. This will make lifting easier.
  - Guide the patient with his hands over his pelvis and push him back with his knees.
  - Use the muscles of the legs and hips instead of those of the upper body.

Moving the patient in the wheelchair

- 2 operators (1 front and 1 back):
  - The operator standing in front fixes the knees and tilts the trunk forward. The operator behind brings the pelvis back.
  - Variant: the operator behind performs a cross hold, the front one supports the patient's legs.

Moving the patient in the wheelchair

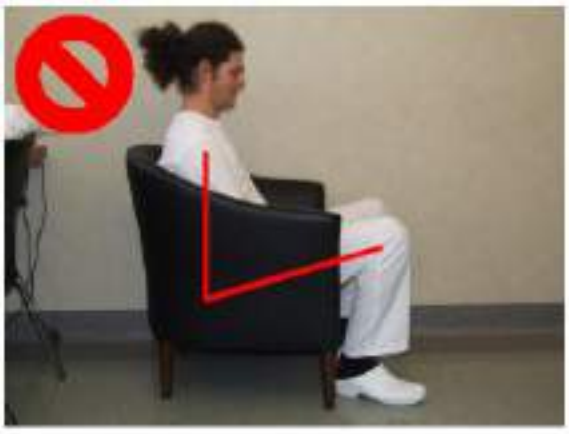
- 2 operators on the side:
  - the operators carry out a cross-grip and below the patient's knee



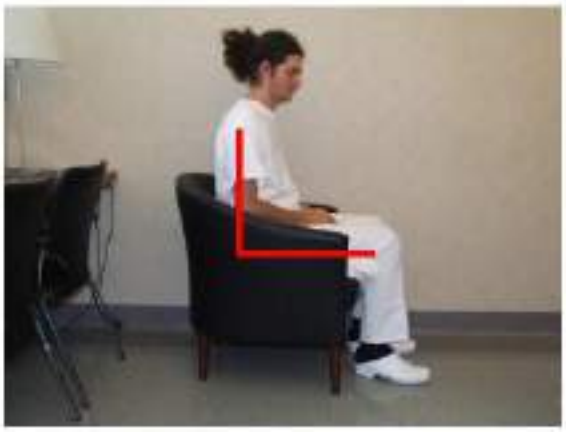
Moving the patient up in the wheelchair

- Points to remember:
  - When lifting the patient, use the muscles of the legs and hips instead of those of the upper body, first bend over and then slowly straighten the knees while lifting the patient
  - During the moving, shift your weight from side to side, keeping your back straight
  - The movements of the two operators should be synchronized while transferring the patient. Communication between the two operators is very important.

How the patient should sit



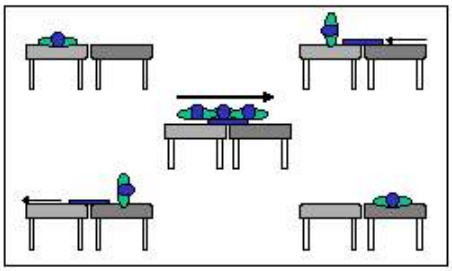
- The patient is sitting too low; the pelvis is lower than the knees



- The patient is seated with the pelvis at the same level as the knees

Transfer of the patient from one surface to another

- Approach the two surfaces between which the transfer is to be made
- Lock the bed and stretcher brakes
- Place the high sliding sheet on the free surface
- Place the patient on the side and roll the high sliding sheet under the body and bring the patient back to the supine position
- Transfer the patient by pushing only slightly with both hands on the shoulder and hip
- Reposition the patient on the side and remove the high sliding sheet
- The high sliding sheet should never be used to lift the patient



Transfers from sitting to upright

- Maneuver with an operator, collaborating patient
  - The operator stands in front of the patient and helps him to recede his feet stabilizing them with his own
  - leaning slightly on the legs, he then puts his knees in contact with those of the patient, "hugging them" and asks him to lean forward with the trunk (he can ask him to put his forehead on his body)
  - grips the patient at the pelvis level using his body as a counterweight
  - pulls him towards himself.

Bed-wheelchair transfers

- Collaborating patient with minimum / average assistance
  - Position the wheelchair beside the bed, brake it and remove the armrest from the side closest to the bed;
  - Stand in front of the person and stop their feet with their own;
    "Hug" the knees of the patient by fixing them with his own and grasping it from the pelvis;
  - Using your body as a counterweight, pull the person towards you;
    Once you have reached the upright position, have the person rotate

Transfer from wheelchair to bed - Collaborating patient

Points to remember:

- Position the bed and (wheel)chair close together
- Check that the wheels of the (wheel)chair are locked
- Eliminate any obstacles (armrests, footrests, platforms)
- Adjust the bed height correctly according to your height
- Ask the patient to watch his feet. This will increase the tension of the abdominal muscles and improve collaboration
- Ask the patient to lean forward and pivot on the legs during the transfer. This will facilitate the lifting of the patient from the sitting position to the standing position
- Use the muscles of the legs and hips when lifting the patient instead of the muscles of the upper body. First of all, bend over and then slowly straighten your knees while lifting the patient
- Balance the patient's weight with his own weight
- If necessary, hold the patient’s knee between his legs/knees to guide the movement

To stand up

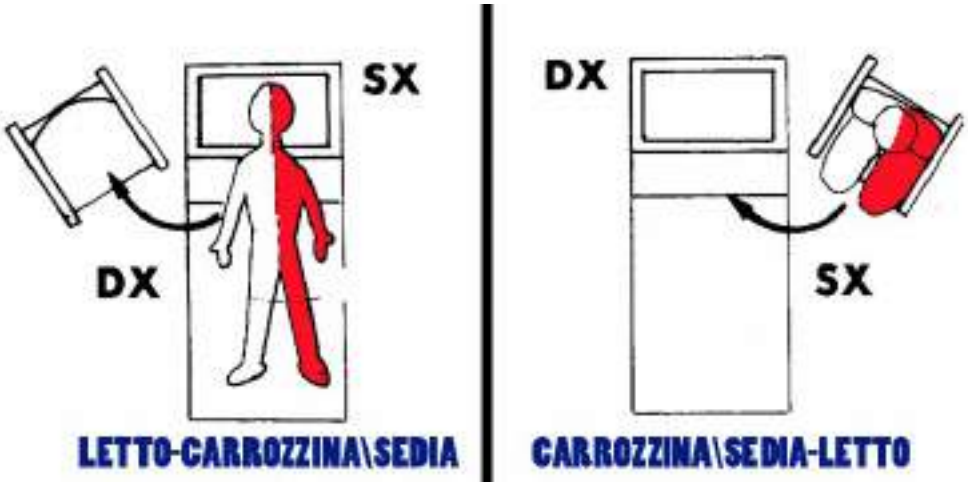
- Do not stand up a patient without shoes
- Before setting up a patient, the feet should be placed on the ground.
- The feet and knees should always be fixed before each maneuver.

Where you put your hands

- The patient should not put his hands behind the operator's neck to avoid stretching his shoulders.
- The operator should not lift the patient by taking him under the armpits.
- The operator puts his hands at chest level and brings the patient forward.

How to position the wheelchair

- Evaluate which side is weakest
  In the example the patient is weaker on the left



How to position the wheelchair

- The wheelchair should not be placed in front of the bed but next to it.

How to position the wheelchair

- The front wheels of the wheelchair must be oriented forward to increase stability.

- The rear wheels should be braked.

Assistive aid for patient transfer Ergonomic belt with handles

- Used for partially collaborating patients, to help them get up from a chair or from the edge of the bed, to sit or lie on the bed or to change their position.

- It is composed externally of a low-friction material and internally of a non-slip material that guarantees a better grip.

Use of the belt with handles

- The belt with handles can be worn either by the patient or by the operator.
- It should not be used to lift the patient.
- It should not be used in patients with recent wounds, drainages, ascites, bone metastases, ostomy.

Assistive aids for patient transfer Rotating platform

Disco girevole "TurnTable"
(Demarta)

Disco girevole "TurnTable"
(Demarta)

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Aids for patient transfer – Transfer table

Bed-wheelchair transfers

- Non-collaborating patient:
  - Use of major aids for handling the patient

The lifter

- The lifter is a major mechanical aid used for the movement of totally non-collaborating patients, particularly heavy patients or in particularly difficult situations.
- It eliminates the need to perform manual movements in actually more dangerous situations such as:
  - Lifting on the bed.
  - Lifting from bed to wheelchair.
  - Lifting in and out of the tank.
  - Lifting off the ground.
  - Lifting of polytraumatized and / or obese patients.

The lifter

- There are different types of lifts: mobile or fixed, foldable, column-mounted, electric or manually operated.

- The one most frequently used is a mobile aid, equipped with wheels and therefore transportable from one environment to another.

- They are generally equipped with tilting handlebars so as to allow the position of the patient to be varied from lying down to sitting particularly suitable for transferring from the bed to the wheelchair.

The lifter

- The base is adjustable in width: by enlarging the two arms that constitute it, it is possible to get close enough with the wheelchair (in this position, among other things, the lift is more stable), by tightening them the dimensions of the lift are reduced in order to pass even in close environments.

- The harness, that is the part that wraps and supports the person, can be chosen according to the characteristics and possibilities of the patient (with separate straps, underarm, with support for the head etc.)

- The drive can be manual or electric.

The lifter - Limits

- It is rather cumbersome;
- It is not possible to use it to immerse and lift the person from the bathtub (most of the bathtubs are walled to the floor, while the base of the lift should be able to pass underneath);
  the bed should also be raised from the ground by 8-10 cm.
- An alternative can be models to be fixed to the wall or ceiling: they avoid the encumbrance on the ground, but they are much more expensive.

Lifter: how to use it

Transfer from wheelchair to bed

- Maneuver with an operator, collaborating patient
  - Invite the seated patient to approach the edge of the seat and bring the feet to the ground
  - Fix the patient's feet with their feet, then support the knees with their own and with their arms the pelvis
  - The professionist, with flexed knees and straight trunk, without changing the grip, accompanies the patient in the first phase of detachment from the seat using his weight
  - Help the patient to rotate the trunk and the pelvis thus reaching the edge of the bed
  - Accompany and restrain the descent on the bed

Transfer from wheelchair to bed

- Non-collaborating patient, two operators
  - Position the bed and the chair (or braked wheelchair) close together, with an inclination of about 30°.
  - Remove any obstacles if possible (armrests, footrests, footrests).
  - Seat the subject with the legs stretched out on the bed.
  - An operator, placed behind the subject, grips his arms with a crossed grip. The other operator places one hand under the knees and one under the feet.
  - The operators lift the subject together and place it in the chair.
  - Use the muscles of the legs and hips when lifting the patient instead of the muscles of the upper body.
  - The movements of the two operators should be synchronized while transferring the patient. Communication between the two operators is very important.

Transfer from wheelchair to bed

- Non-collaborating patient, two operators
  - Cross grip

Transfer from wheelchair to bed

- Non-collaborating patient, two operators: variant
  - The operator standing in front fixes the patient's feet and knees, carries the patient's trunk forward, taking it at chest level.
  - The operator who stands laterally / behind moves the patient's pelvis by taking it at the level of the pants or under the pelvis

Transfer from wheelchair to bed

- Non-collaborating patient, two operators: variant
  - The maneuver is the same as the previous one.
  - Note that the wheelchair is inclined at 30 ° to the bed.
  - The armrest on the bed side is removed.
  - The operator behind puts one knee on the bed.

Suggestions for transfers

- In the case of subjects with hemiplegic upper limbs:
  - It is important that during handling the limb is not pulled, to avoid shoulder subluxations that would produce permanent pain
  - It is important that the arm is kept in a controlled position during handling, if necessary kept by the same with the healthy limb.

Suggestions for transfers

- In the case of elderly subjects:
  - Older people often suffer from arthrosic problems on their shoulders or neck.
  - It is important to remember not to tug these areas during handling, because it could create severe pain

- In the case of subjects with balance problems:
  - Often those who have had brain injuries (for example a stroke) have balance problems. In this case, patients are sometimes able to make moving and transfers independently, but it is always necessary for an operator to be near, with one hand under the armpit to take the scapula, to intervene in case of need.

Suggestions for transfers

- In case of difficulty in finding a firm grip:
  To improve the grip, some operators may need to move patients by grabbing them by the pants or, even better, by using specific aids such as, for example, the belts with handles.

- The grip for the paints turns out to be very annoying for the patients, especially if men, and should be used only in case of extreme necessity

Move a patient who has fallen to the floor in the chair

- The presence of two operators is always required for this type of handling technique
- Bring the patient to a sitting position. Use the muscles of the legs and hips instead of those of the upper body.
- If possible, ask the patient to bend his knees.
- Place a hand under the shoulder blade of the subject, one below the knee.
- When moving from the floor to the chair, shift your weight from side to side while keeping your back straight.
- Variant with the cross-grip: An operator, placed behind the subject, grabs his arms with a crossed grip. The other operator places one hand under the knees and one under the feet.

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

REHABILITATIONƎNƎTALY

Prospectves for Actvites in Ethiopia

360/3677

Road Map

- **Rehabilitation: General Concepts**
- **Rehabilitation setting in Italy**
- **Rehabilitation: Critical Point in Ethiopian Model**

Rehabilitation: General Concepts

Mission of rehabilitation

Process of solving problems and education during which the patient with disabilities is brought to reach the best possible level of life on the physical, functional, social and emotional level with the least possible restriction of his operating choices even within the limits of his impairment and the quantity and quality of available resources

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REHABILITATION PHYSIOTHERAPIST

Physical and Medicine Rehabilitation

Centrality of the patient

Medical Model

The classical and traditional medical model of medicine bases its action on a concept of the disease that can be represented as follows:

Etiology → Pathology → Symptomatology

Criticality of the medical model

- **Reduction of the person to his pathology and his deficit**
- **It excludes the relational dimension from the existential experience of the person in his interaction in his own life contexts**

International Classification of Impairment, Disabilities and Handicaps (ICIDH)

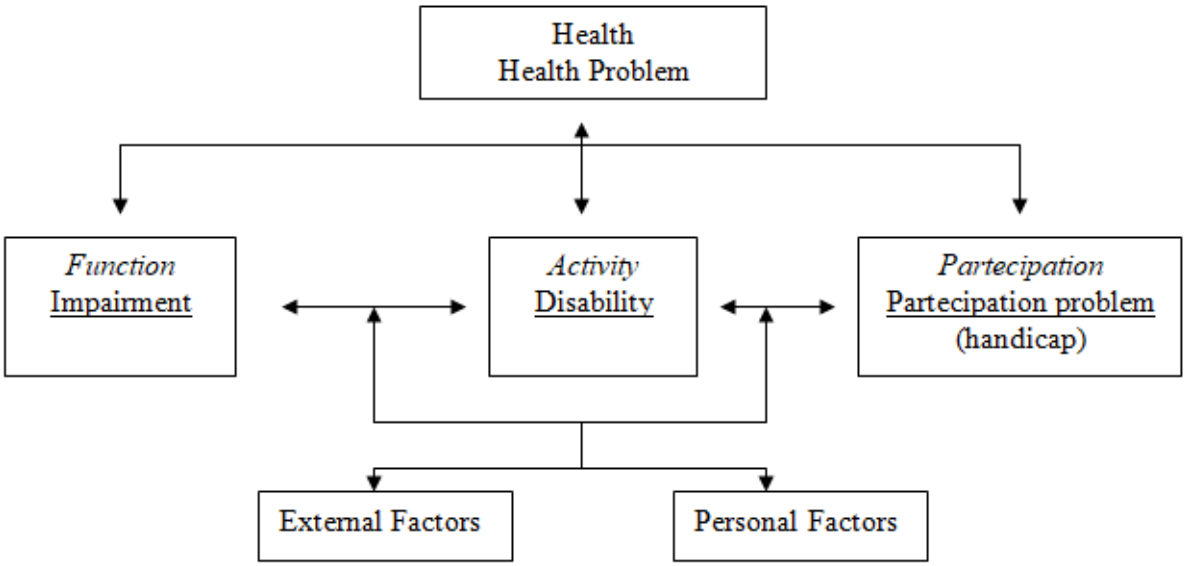
- **Introduces the consequence of a pathological or chronic state**
- **Illness → Impairment → Disability → Handicap**
- **The damage to the functions of an organ caused by an illness produces disabilities in the person**

ICIDH example

Impairment Disability Handicap

Example: a person with amputation (impairment) who is not able to walk independently (disability) succeeds by using a wheelchair to make movements. The use of the aid has in fact reduced the disability (obviously not the impairment) but if the subject meets, in the path that leads him in social environments, barriers and limitations the same cannot relate and therefore this involves handicap.

International Classification of Functioning, Disability and Health



Rehabilitation Process

- **Rehabilitation takes place as a continuous and global process from acute phase to return to home:**
  - **develop or restore the person's ability to perform a normal activity and the widest independence and optimal participation in social and economic life.**
- **It include two principles:**
  - **The active participation of the person concerned in their rehabilitation**
  - **The duty for society to adapt to the specific needs of disabled people**

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Rehabilitation setting in Italy

Chronological phases of rehabilitation

- **In a chronological sense, the first stage of rehabilitation takes place at the same time as the impairment occurs and, therefore, either in the acute phase of illness or in the ascertainment of a congenital or chronic pathology.**
- **The second stage of rehabilitation starts as soon as the acute phase of the illness has passed, as a result of the disabilities remaining. It concerns the post-acute phase and concerns both hospital and non-hospital rehabilitation facilities, regardless of their legal status (public or private)**
- **The third stage of rehabilitation requires less systematic health interventions and, therefore, also practicable in terms of outpatient treatment, aimed at maintaining functional autonomy achieved by the subject and prevention of possible further involutions.**

Organizational Levels

- **First-level rehabilitation facilities (extensive rehabilitation)**
  - **Assisted Healthcare Facilities**
  - **Long-term hospital facilities**
  - **Residential structures**
  - **Outpatient facilities**
- **Second-level rehabilitation facilities (intensive rehabilitation)**
  - **Hospital facilities**
  - **Rehabilitation hospitals**
  - **Extra hospital units**
- **Third level rehabilitation facilities (intensive specialty rehabilitation)**
  - **Spinal Cord Unit**
  - **Unit for the rehabilitation of severe brain-injured patients**

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Emergency Department: early rehabilitative presence

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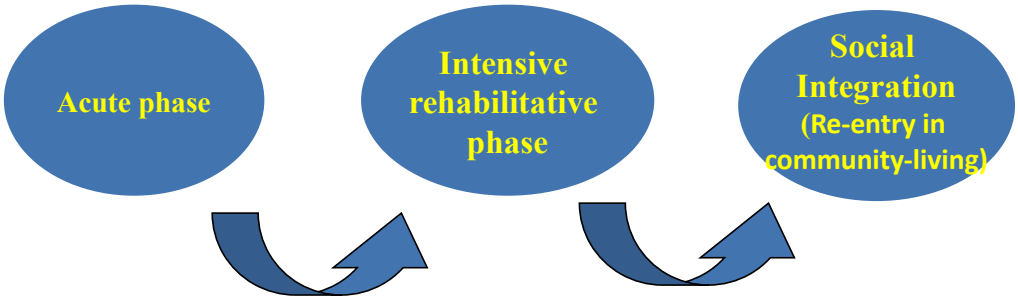
Intensive and early Rehabilitative assessment and treatment

Early process – Continuity - Globality



Multidisciplinar Team

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Overlapping Neuro-Surgery/Orthopedic/Intesive-Care Cultur with Rehabilitative Phylosophy

Team

- Neuro-Surgeon
- Orthopedic
- Intensive Care Specialist
- Neurologist
- Head Nurses
- Nurses
- …….

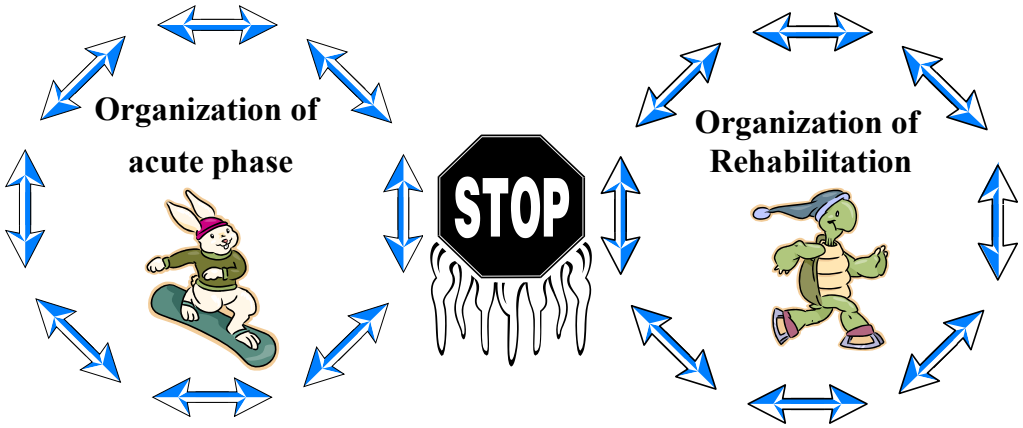
- Physiatrist
- Physiotherapist
- Speech Therapist
- Occupational Therapist
- Social Worker
- Psychologist
- Caregiver
- ……..

Critical Aspects

Criticism

- **Early rehabilitative presence by the Rehabilitative Team as soon as possible after the admission in hospital (max 48h./96h.)**
- **Treatment beginning at the bed of the patient**
- **In the case where it is not strict rehabilitative indication it needs to activate a rehabilitative nursing**
- **Early transfer to specialist rehabilitation facilities when necessary**
- **Differently the treatment in some patients could be activated as outpatients**

Risks


Organization of
acute phase
STOP
Organization of
Rehabilitation

Fundamental aspect

- **Correct and homogeneous assessment of the patient**
  - **Needs the right rehabilitative diagnosis and prognosis**
    - **The best choice for the clinical aspect of each patient**
- **Precise system of control for the organization in all phases**

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Central role of the Rehabilitative Team:

Early Management of Patients

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Critical Point in the System of Ethiopian Model

What do we mean by early management of patients?

- To evaluate patient early after the admission in Hospital
  - Maximum 48/96 h. from admission
  - Daily presence in the next few days
- To include the participation of the eventual different components of the rehabilitative team.
  - Constant interaction with the team during acute phase

New model

- To coordinate all the steps in acute phase
- To conduct the rehabilitative process in every phase

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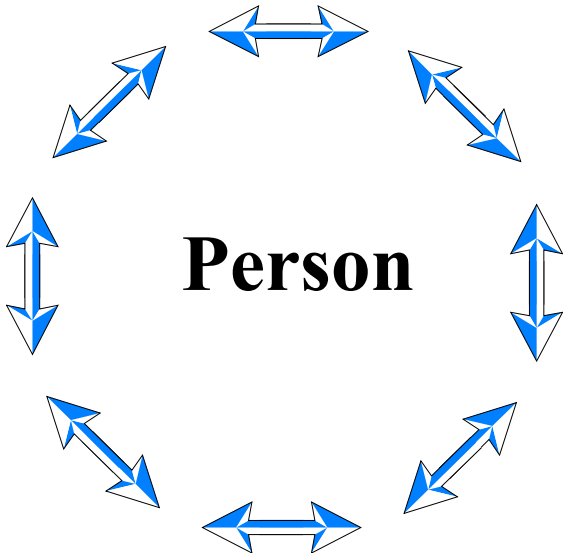
PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST



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Objectives

- **Prevention of motor and joint complications (Secondary Impairment)**
- **Prevention of pressure sores**
- **…….**
- **As same time the treatment for the recovery of primary impairment (strictly connected to the pathological event) must begin**

An essential aspect to guarantee this would be the presence within the Acute Hospital of an area, even a small one, with dedicated beds for Rehabilitation (Rehabilitation Unit)

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Conclusions and Future Developments

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Amputation and Rehabilitation: Preparation of a Prosthesis

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

PRODUCTION PROCESS

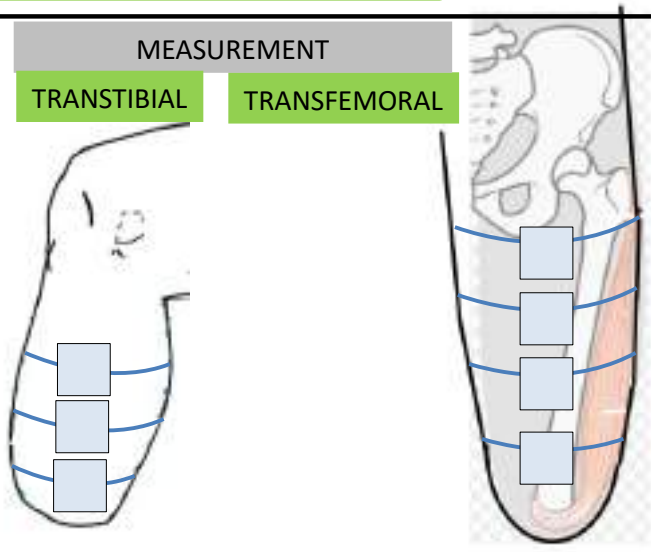
PRODUCTION PROCESS

PATIENT INFO

Age
Weight (Kg)
Gender M F
Amputation Level TF TT
Amputation Side R L
Foot lenght (cm)
Ischio– floor (cm)
Knee – floor (cm)
Stump lenght (cm)
(from ischio TF/form kneeTT)

MEASUREMENT

TRANSTIBIAL TRANSFEMORAL



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TRANSTIBIAL

Thermoplastic Socket

Articulated Foot
- Flexion/ extension movement

TRANSFEMORAL

Thermoplastic Socket

Monocentric **Locking knee**

Articulated Foot
- Flexion/ extension movement

Thermoplastic Socket

Monocentric **knee with a brake function** and a locking lever.

Sach foot
- Solid Ankle cushion heel

Continuous training for teachers of the degree Course in Addis Ababa (Lions Hospital)

- **Intensive training by a high level centre in Italy**
- **Presence of an expert physiotherapist at the Lions Hospital for at least 3 months to support the physiotherapists teaching the course during the practical lessons**

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REHABILITATION NURSING

General Concepts and Indications

Tissue/cell damage

- **State of "Illness"**

PATHOLOGY

molecular

cellular
tissue

atherosclerosis
stroke
les. cerebral

State of "Illness"

- **Primary objective**
  - **The treatment of the disease**
  - **Save life**
- **"Parallel" primary objective**
  - **Prevention of all damages that can limit the person's global functions and their quality of life**

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The Care Process Includes Rehabilitation Nursing

Rehabilitative Vision of the Healthcare Approach in its Globality

- **Person at the Center**
- **Best possible QUALITY OF LIFE**
- **Global approach to the patient understood as a biopsycho-social unit**
- **Areas of intervention: physical, functional, emotional, social**
- **Identification of achievable goals**
- **Interprofessional team**
- **Fundamental role of the person with his morbid event and his family members**

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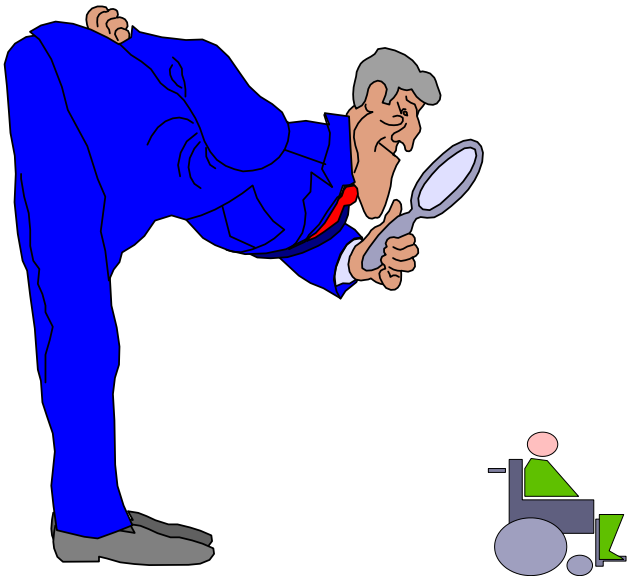

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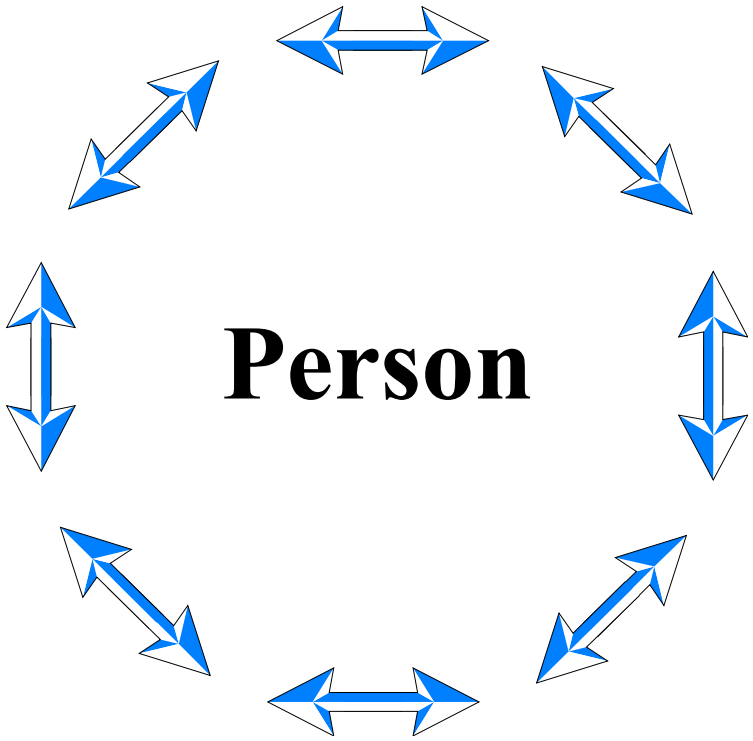

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What does it mean “person at the center”?

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The “person at the centre”

The "**person at the center**" means that they are not only at the center of the system of performances and responses, but also the subject who **collaborates, participates and chooses the process of social inclusion**, even where the severity of the impairment of the dynamic or behavioral framework is of considerable importance.

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What is the difference between “cure” e "to take care of"?

"Cure" vs "Take Care"

Cure

- A disease is cured
- A service is provided

To take care of

- The person is taken care of as a bio-psycho-social unit
- **A global individual care project** is carried out aimed at:
  - Resolution of the disease
  - Achieving the least limitation/restriction possible

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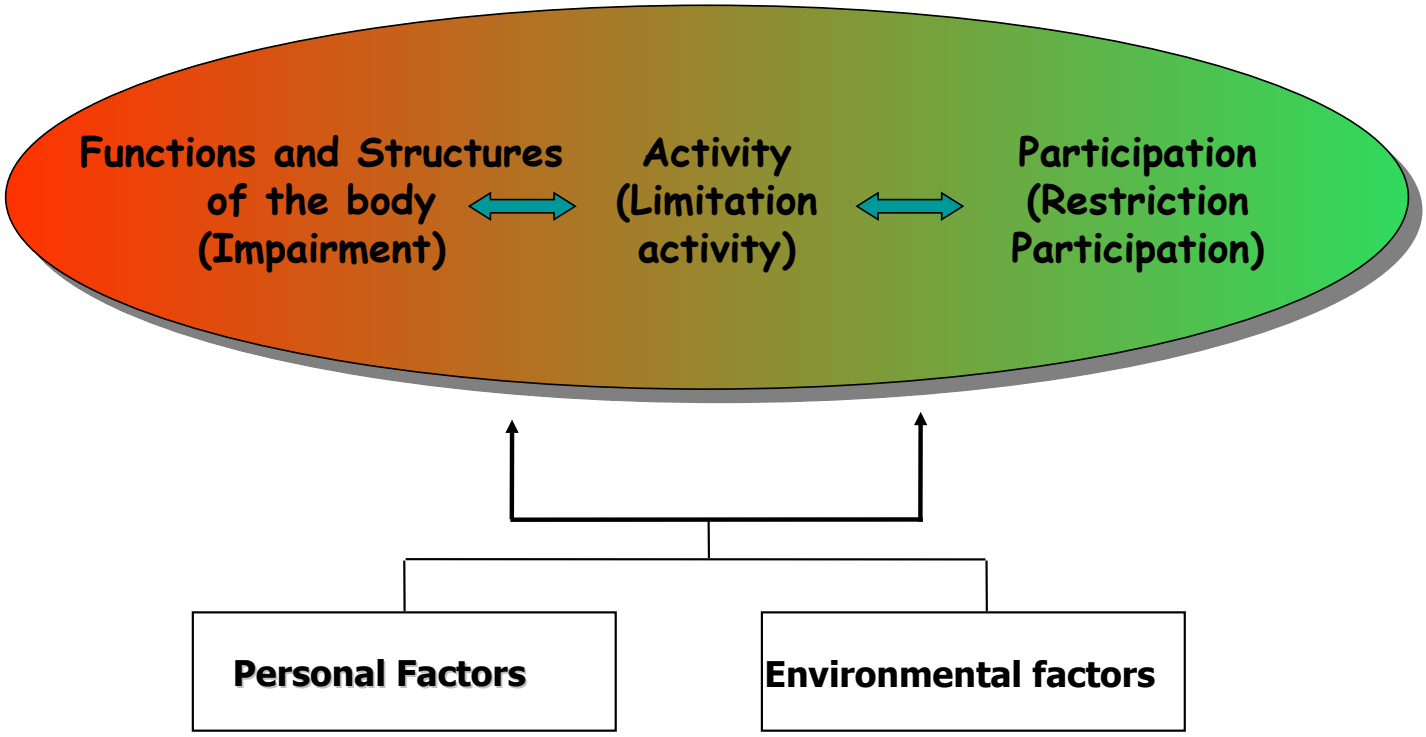
Which “Model” Follow the process Assistance with a Rehabilitative Vision?

HEALTH STATUS (ICF 2001)
(disorders/diseases)



Disability

Body Function		Activity and Participation		Factors Environmental	
Structures	**Functions**	**Capacity**	**Performance**	**Barriers**	**Facilitators**

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Rehabilitation Nursing Requires an Overlap of Nursing Culture with Rehabilitation Culture

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Prevention of secondary damage not dependent on the "underlying disease" but on all the "negative aspects" dependent on hospitalization"

Nurse and OSS role

Key team member:

- Acute and sub-acute patient
  - Importance of classic care management
- Present 24 hours a day. on 24h. with the patient
- Rehabilitation nursing manager
  - Placements
  - Mobilization
    - to and from the bed
    - bathroom etc.
  - Psychological relationships
  - Relationships with the caregiver

CONTINUUM

The nurse helps the person to recover their position in the continuum of life and to proceed towards the greatest possible independence

Definition of nursing:

- **In the context of care aimed at maintaining health, Rehabilitation Nursing has the aim of helping a person to proceed towards the maximum independence allowed to the individual himself in each daily activity, of helping him maintain this autonomy, helping him deal with any regression, helping him to die with dignity**

Peculiarities of the Nurse with Rehabilitation skills

- **It helps patients with chronic diseases or physical disabilities to enhance their residual capabilities to achieve independent living**
- **Identify the objectives to be achieved**
- **He works towards this goal not only with patients but also with their families**
- **Educate the patient and family members (or caregivers)**
- **Collaborates in managing the patient's medical complexity**
- **Collaborate with other healthcare professionals**

Peculiarities of the Nurse with Rehabilitation skills

- **Hygiene care**
- **Programs to achieve bladder, rectal and nutritional autonomy**
- **Specific interventions to maintain skin integrity and treat any skin pressure ulcers**
- **Environmental factors such as temperature, noise, control of personal effects, sanitization, infection control and environmental safety**

Peculiarities of the Nurse with Rehabilitation skills

- **The use of adaptive devices – compensators necessary for communication, nutrition, mobility, toileting, dressing and walking**
- **Specific preventive measures to minimize the effect of immobility**
- **Promote space-time orientation and control of behavioral disorders**
- **Help patients with time management**
- **Pharmacological administration**

Nursing/Rehabilitation Activities

REHABILITATION: aimed at both young and old people who modify their abilities by learning new ways of doing things.

REACTIVATION: aimed at people of any age aimed at restoring functional abilities temporarily lost due to an acute event.

Nursing/Rehabilitation Activities

INTELLECTUAL COMPETENCE

- Identify real and potential problems relating to the satisfaction of life needs/activities in the person with a disability and/or chronic illness
- Collaborate with the rehabilitation team to develop the individual rehabilitation project
- Plan specific nursing care by providing criteria and indicators for evaluating the plan

Nursing/Rehabilitation Activities

INTELLECTUAL COMPETENCE

- **Identify the educational needs related to the disability and chronic pathology of the person, their family/resource people**
- **Design an educational and/or training plan aimed at the person, the family, aimed at maintaining residual abilities and promoting the greatest possible autonomy in carrying out daily life activities**

Nursing/Rehabilitation Activities

INTELLECTUAL COMPETENCE

- **Evaluate the ability that the person, family and/or resource persons have to follow the instructions given in the educational and/or training program at home**

Nursing/Rehabilitation Activities

MANUAL SKILL

Implement nursing care independently and/or in collaboration with the team, in order to reintegrate, maintain or promote the greatest possible autonomy

RELATIONAL COMPETENCE

Use specific relational strategies according to the different disabilities, aimed at establishing a helping relationship aimed at supporting the person, the family and people understood as resources

Nursing/Rehabilitation Activities

MANUAL SKILL

Implement nursing interventions aimed at encouraging the person and their family to learn the knowledge and skills necessary to promote the greatest possible autonomy

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Welfare Interventions

Educational Interventions

Educational Interventions

1. The family is part of the team
2. Team-family communication
3. Information, acceptance and adaptation to the person's global situation
4. Educate the family and the patient on the management of various problems
5. Educate the family on how to manage the patient at home
6. Domiciliation support

Family is a resource!!!

COMMUNICATION

- **Inside the Team**
- **With the Patient**
  - **his Family/Caregiver**

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What does it mean teamwork?

Team

- **Specialized doctor:**
  - **Internist/ Geriatrician/ Physiatrist/ Neurologist/..**
- **Physiotherapist**
- **Speech therapist**
- **Neuropsychologist**
- **Occupational Therapist**
- **Nurse**
- **OTA/OSS**
- **Social worker**
- **Psychologist**
- **……..**

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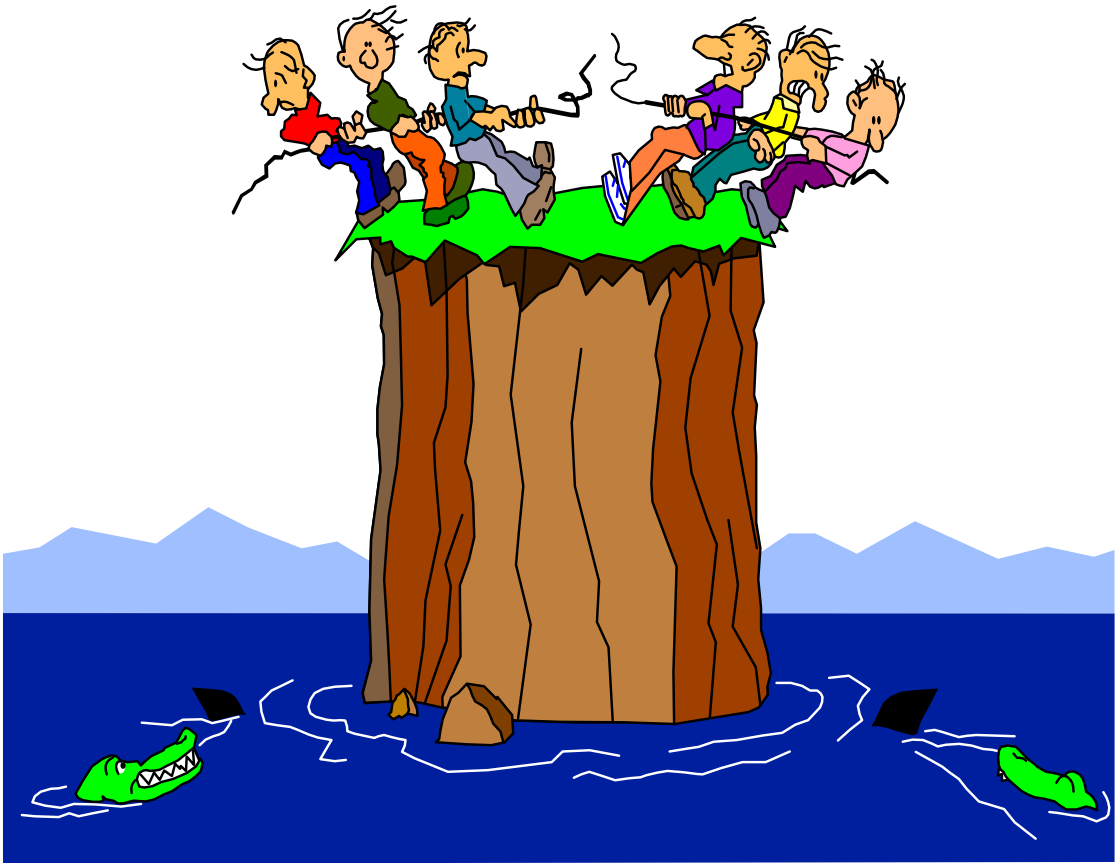

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“Disabled” Team

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Skilled team

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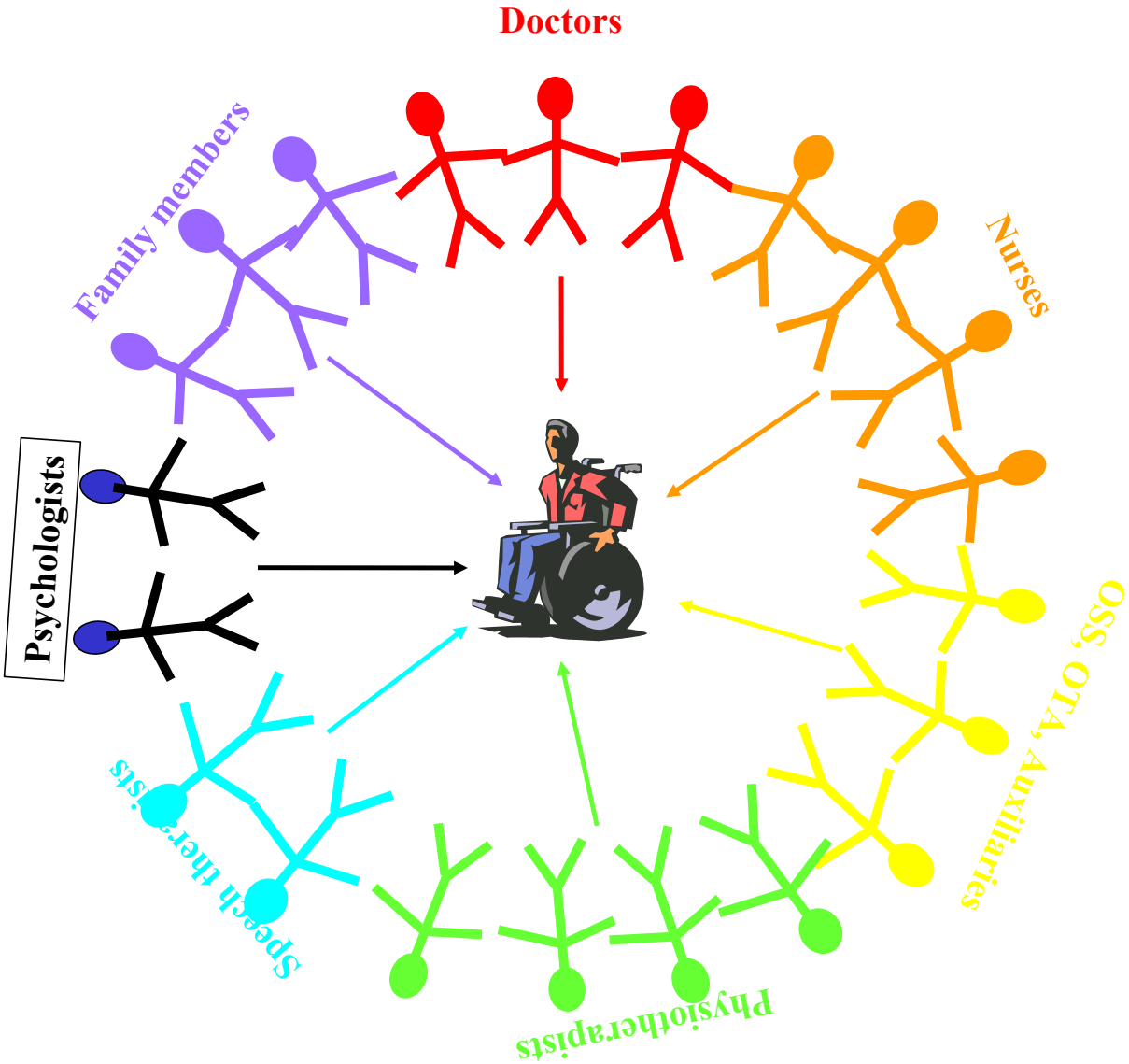
Team work

"Disabled" Team

- Centered on the disease and any impairments present
- Areas of intervention and independent objectives
- Each professionalism pursues its own objectives
- Defined professional boundaries
- Final result as the sum of the results of the individual interventions

"Skilled" Team

- Focused on activity and participation
- Oriented to the person and the overall outcome
- Strong integration and interaction
- More flexible professional boundaries
- Result as a product of intervention synergies


Doctors
Family members
Nurses
Psychologists
OSS, OTA, Auxiliaries
Speech therapists
Physiotherapists

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PRACTICAL TEACHINGS FOR THE
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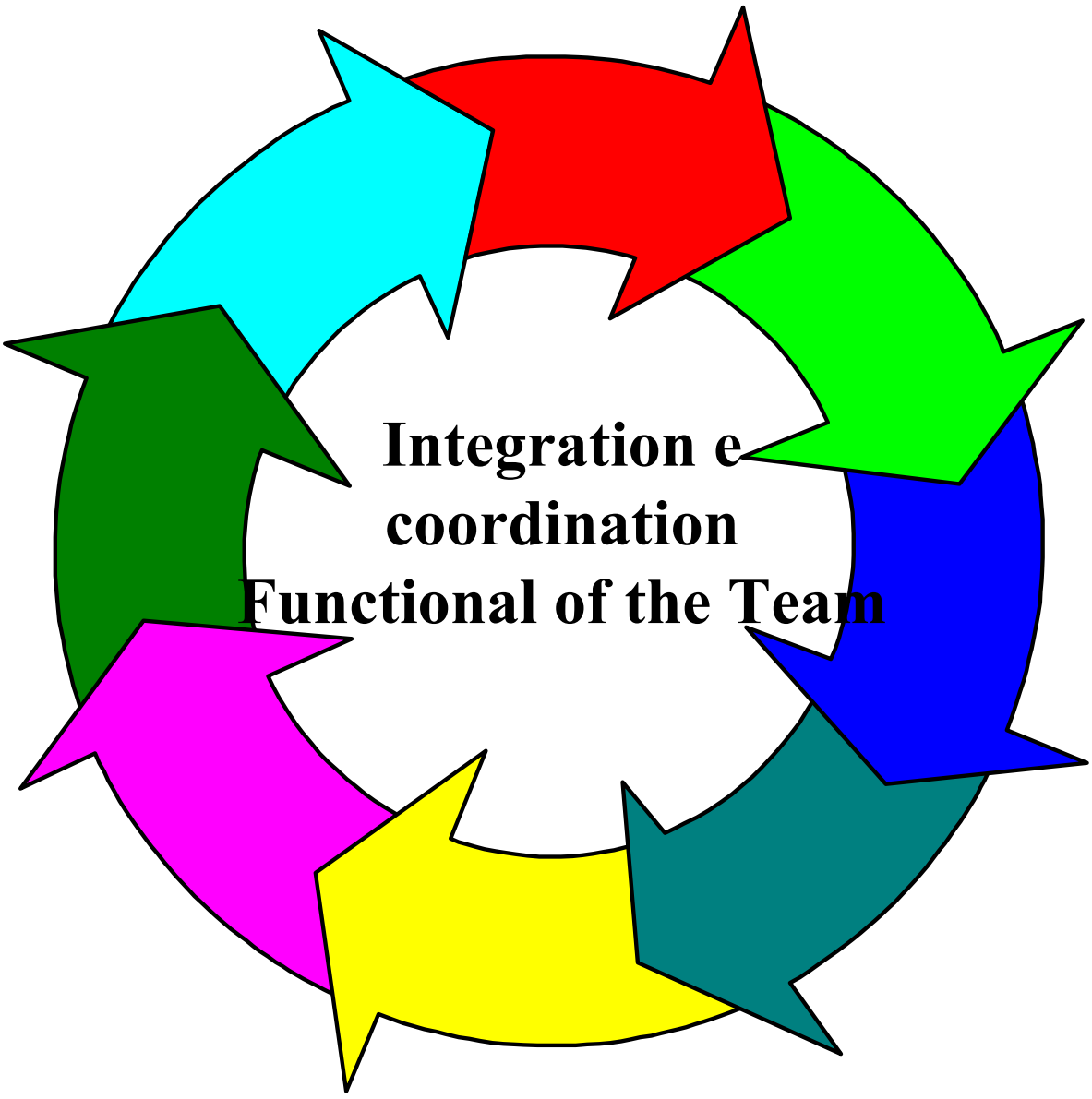
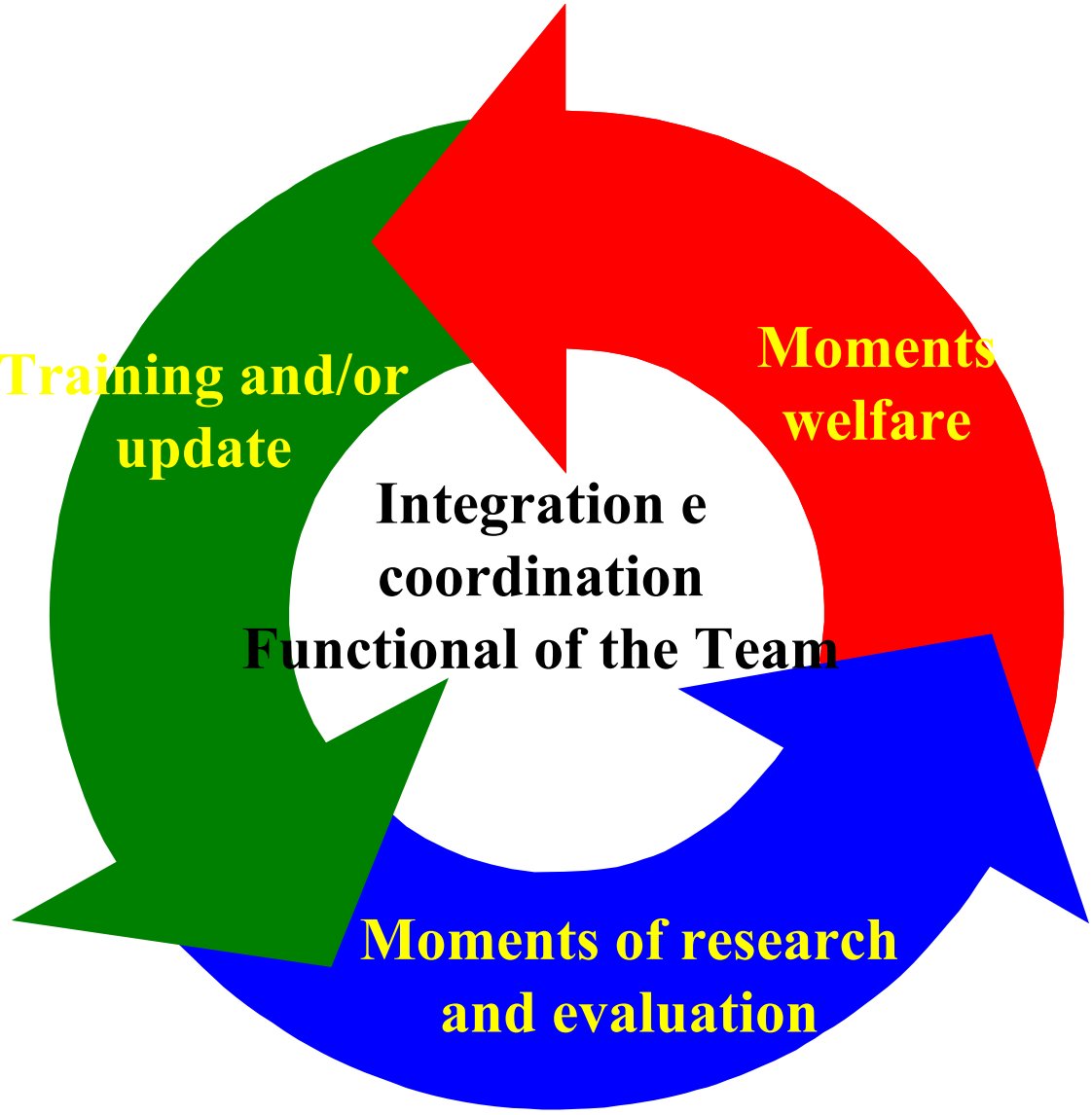
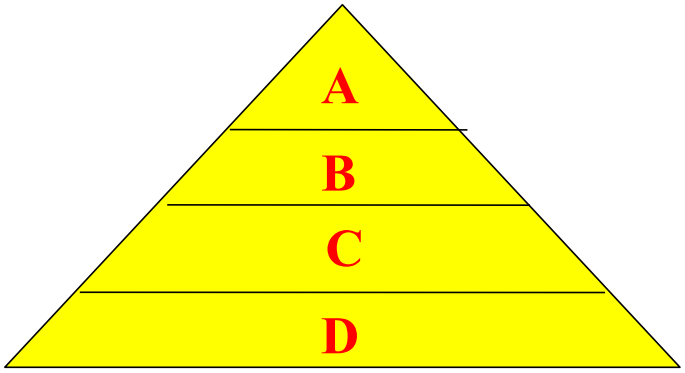
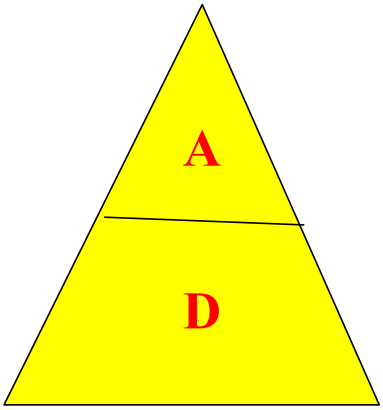


Integration e coordination Functional of the Team


Training and/or update
Moments welfare
Integration e coordination Functional of the Team
Moments of research and evaluation


A
B
C
D


A
D

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PRACTICAL TEACHINGS FOR THE
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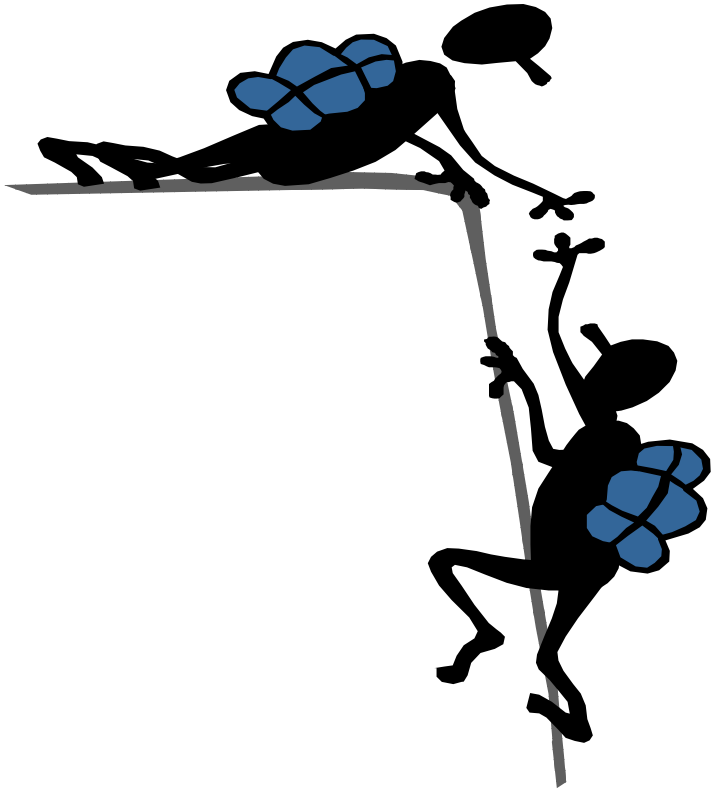
Organizational Models



Comparison Cultural

↓

Increase in experiences

↓

New models organizational

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PRACTICAL TEACHINGS FOR THE
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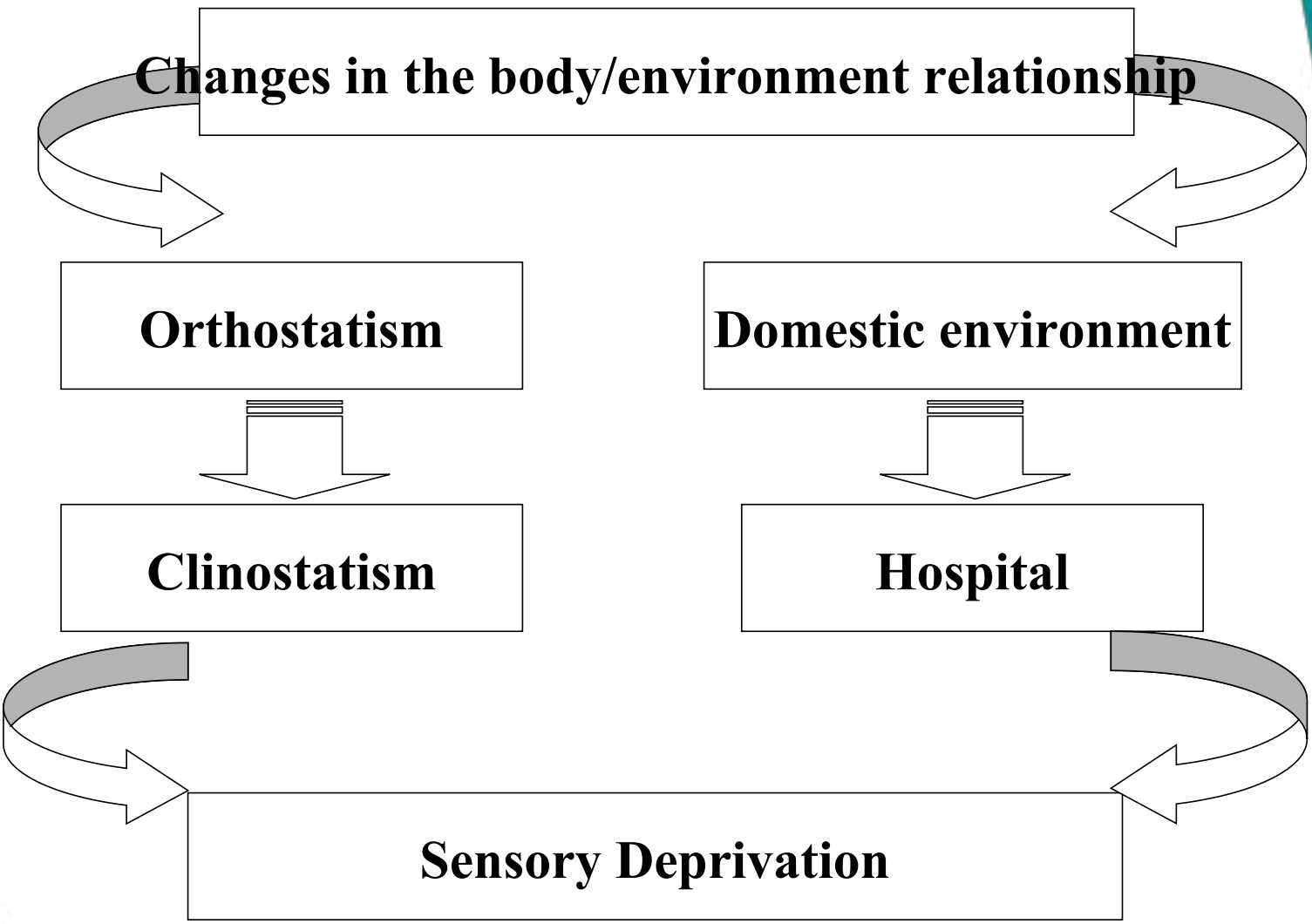
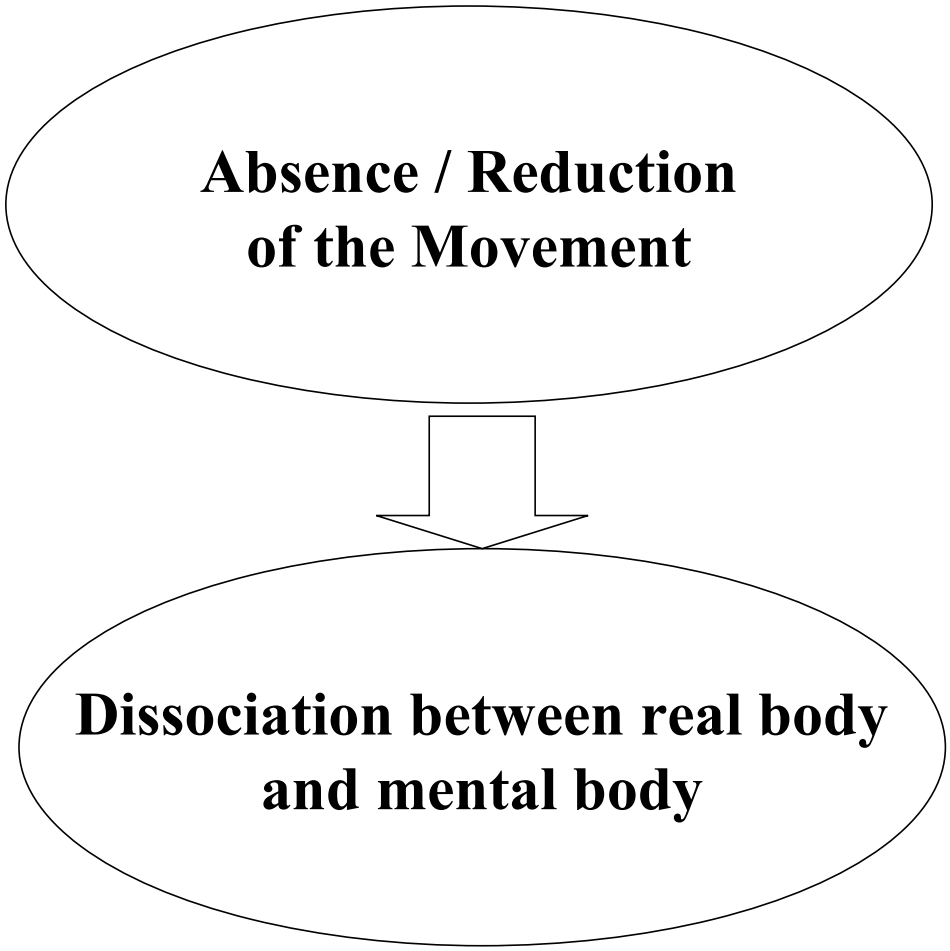
Clinical aspects
Bedrest Syndrome

Bedrest Syndrome

- **It is a syndrome that arises in a previously independent subject, following prolonged inactivity and/or hospitalization in bed, regardless of the underlying disease, determined by a complex of secondary signs, almost always "iatrogenic", for at least in terms of omissions**


Changes in the body/environment relationship
Orthostatism
Domestic environment
Clinostatism
Hospital
Sensory Deprivation

Prolonged immobilization determines, at the level of the entire organism, morpho-functional modifications which add to and aggravate the subject's conditions, with a picture which frequently results in a disability much greater than that of the disease for which he would have been rendered. bed rest is necessary


Absence / Reduction
of the Movement
Dissociation between real body
and mental body

Consequences of immobilization

- **on a somatic level**
- **on a psychic level**

Somatic level

- **Locomotor system**
- **Cardiovascular and Respiratory System**
- **Integumentary system**
- **Digestive system**
- **Urogenital system**
- **Metabolism**

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PRACTICAL TEACHINGS FOR THE
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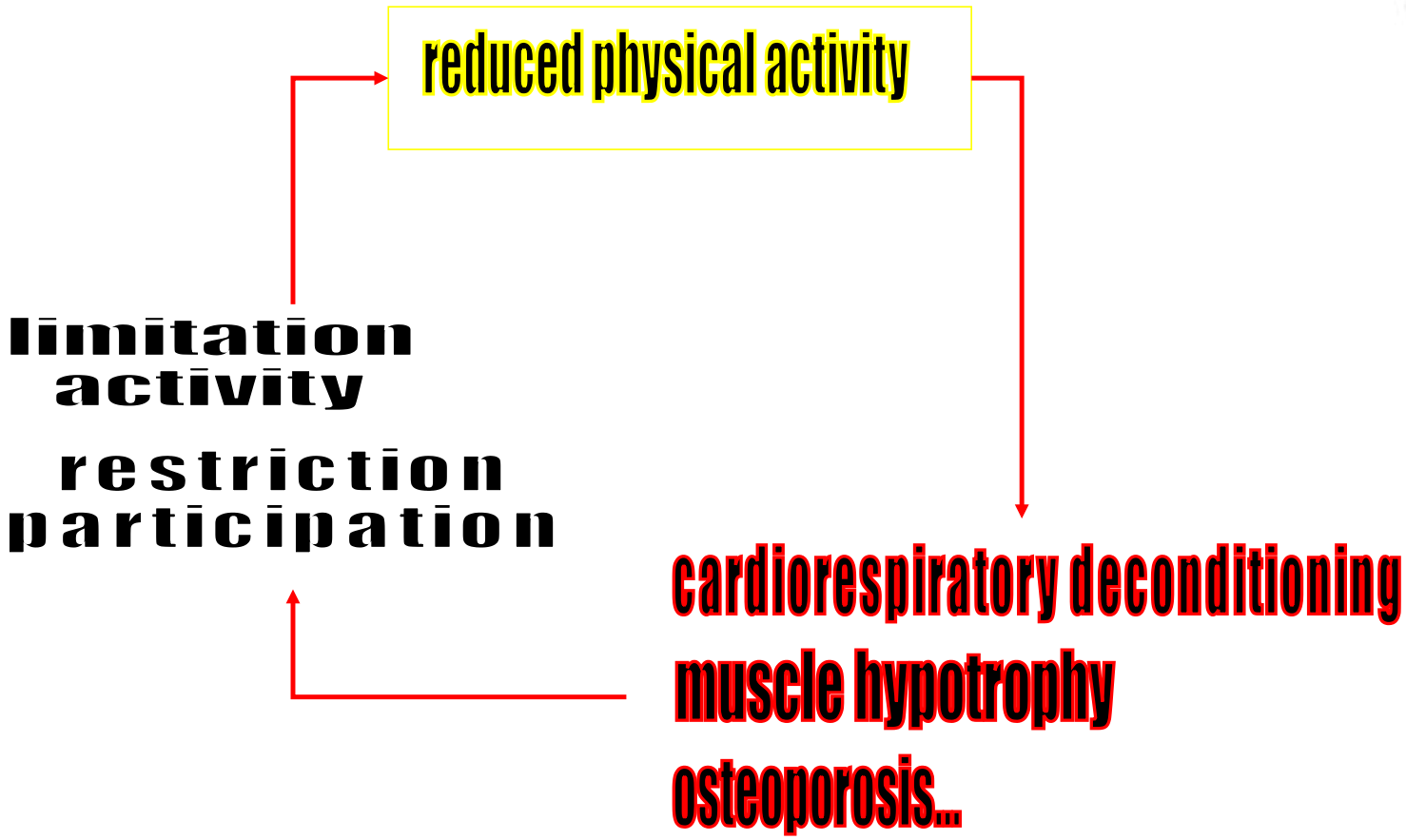
Cardiovascular and Respiratory System

- **Bed Rest and Previous Sedentary Life**
  - **Cardiorespiratory deconditioning**

Deconditioning as Aging

- **Three weeks of bed-rest in the same people at age 20 (1966) has a greater impact on physical work abilities than three decades of aging**
- **Longitudinal study on 6 healthy people studied at 20 and 50 years of age**
  - **(McGuire-2001)**


reduced physical activity
limitation
activity
restriction
participation
cardiorespiratory deconditioning
muscle hypotrophy
osteoporosis...

Psychic Level

- **Space-time disorientation**
- **Abulia**
- **Psycho-motor agitation**
- **Mental confusion**
- **Apathy**

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Overcoming fragmentary vision of the injured organ

but

overall vision

PERSON

THE APPROACH TO THE PATIENT

- **Correct postures**
- **Frequent change of position**
- **Achieve "the habitability of the sitting position" as soon as possible**
- **Functionally involve the person in all nursing activities**
- **Encourage people to take the initiative as much as possible: eating, shaving, combing their hair...**

THE APPROACH TO THE PATIENT

- **Remove the catheter early**
- **Eliminate other invasive means (venous catheters, etc.) as soon as possible**
- **Correct nutrition with good caloric intake**

THE APPROACH TO THE PATIENT

- **Functionally integrate with all the other members of the Team, with particular reference to the T.O.**
- **Involve the family where possible**

The damage due to the original damaging event could sometimes even be overcome well

Secondary damage due to incorrect patient management (absence of Rehabilitation Nursing) could lead to irreversible or not easily reducible limitations

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PRACTICAL TEACHINGS FOR THE
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Clinical aspects
Person with Cerebral Stroke

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Objectives of Nursing Care

- **Infection prevention**
- **Stabilization of vital parameters**
- **Prevention of secondary brain damage**
- **Careful neurological evaluation**
- **Correct management of devices, monitors..**
- **Continuous monitoring**
- **…**
- **Accompaniment to death**

Objectives of Nursing Care

- **Assess consciousness /unconsciousness/coma**
- **Evaluate the evolution of brain lesions**
- **Identify complications early**

Objectives of Nursing Care

- **Respiratory Aspects**
  - **Airway patency**
  - **Pulmonary stasis due to bed rest**

Objectives of Nursing Care

- **Nutrition and Hydration**
  - **Altered functionality of the mouth**
  - **Difficulty bringing food to the mouth**
  - **Risk of dehydration and malnutrition**
  - **Careful management of devices such as SNG and PE**

Objectives of Nursing Care

- **Diet**
  - **Dysphagia**
  - **Ab ingestis**
  - **Pneumonia**
  - **Death**

Objectives of Nursing Care

- **Dysphagia**
  - **Dysphagia refers to any difficulty in swallowing, or in the passage of food and drinks from the mouth to the stomach**
  - **EVENTS:**
    - **Difficulty managing saliva and secretions**
    - **Decreased movements of the mouth and tongue**
    - **Frequent throat clearing and hoarseness**
    - **Slow to start swallowing**
    - **Uncoordinated chewing**

Objectives of Nursing Care

- **Avoid the risk of thromboembolism by using elastic stockings and pneumatic leggings**

Objectives of Nursing Care

- **Rehabilitation Nursing !!!!!!**

STATE OF COMA??

TOTALLY DEPENDENT PERSON??

**FULL ANSWER (SUBSTITUTE)
BY THE NURSE**

(evaluate the possible involvement of relatives..)

Hygiene

- Mouth
- Perineal hygiene for incontinence
- Water temperature (not felt)
- Privacy
- Sedation
- Eyes (conjunctivitis prevention)
- Macerated skin of hemiplegic limb
- Beard/nails
- Pleasure/Pain

Mobilization

- **Supine posture with head raised 20°-30°, aligned with the rest of the body**
- **If plegic/paretic**
  - **Prevention and management of shoulder pain (risk of subluxation of the glenohumeral joint)**
  - **A pillow should be placed under the hip to avoid extra rotation, while the feet should be supported with another pillow to prevent equinus. For this purpose it will also be useful to place a blanket lifting arch**

Mobilization

- When the person is on his hips, a pillow will be placed behind his back to support the spine and another to support the lower limb
- Mobilization allows you to keep muscle and joint functions intact, prevents the formation of deformities and keeps circulation efficient.

Mobilization

- **PREVENTION OF SHOULDER ADDUCTION**
  - **In the hemiplegic patient, control of the voluntary muscles is lacking and consequently there is a tendency to the adduction position and to rotate inwards**

Advice

- **Place a pillow under your armpit to keep your arm away from your chest**
- **Place a pillow under the slightly flexed arm, with the distal joints higher than the proximal ones**
- **Use the appropriate harness for walking to avoid dangling of the upper limb**

Mobilization

- **POSITIONING OF THE HAND AND FINGERS**
  - **Avoid edema of the hemiplegic hand**

Advice

- **Place your hand slightly supine**
- **Use the anti-decline position of the carpus**
- **Occasionally bend the wrist and move all the joints of the fingers of the hemiplegic hand**
- **Avoid exaggerated hand and arm movements**

There are splints on the market functional pre-shaped hand

Recommendations

- **Do not exert traction on the hemiplegic limb;**
- **When the person is sitting in a wheelchair, ensure a support surface for the upper limbs (table);**
- **When walking, stand on the hemiplegic side, because it is on this side that the person with hemiplegia can fall more easily;**
- **Aids, such as the tripod and the stick, must be gripped by the healthy upper limb, to increase the support surface and facilitate walking,**
- **Suggest changing the furnishings and layout of the house, in order to avoid obstacles to travel (e.g.: removing carpets)**
- **During bed-chair-toilet transfers, teach the caregiver that they must keep their spine erect, bend their knees and not their back, keep their feet slightly spread and the assisted person close to their body, holding them at belt level.**

Recommendations

- **Dressing:**
  - **Use loose, easily wearable clothing.**
  - **Use Velcro closures instead of buttons, laces and zippers;**
  - **Dressing/undressing is a particularly tiring activity for those with hemiplegia; breaks will therefore be foreseen;**
  - **The activity will be easier if the person does it sitting down or lying down in bed;**
  - **Prevent the risk of falls.**
-

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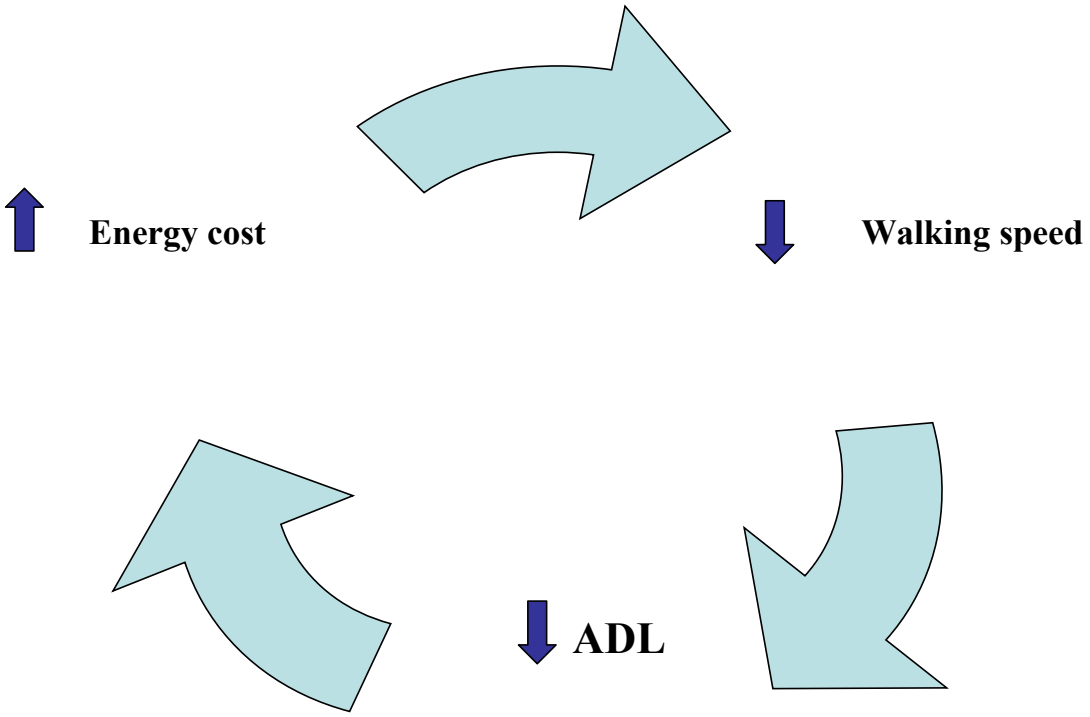
PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Deconditioning and Cerebral Stroke

Deconditioning in stroke may cause:

- Fatigue in common ADLs
- Limitations in resistance to effort
- Orthostatic hypotension
- Lack of motivation
- Depression
- Progressive impoverishment of motor performance

Physical inactivity in people with stroke outcomes creates cardiovascular deconditioning



The aging process causes a reduction in exercise capacity (Skelton DA, 1995)

The person with Stroke outcomes has further reduced capabilities (Potempa K et Al, 1996)

- **Mobilize the person with Cerebral Stroke early:**
  - **Place in a seated position**
  - **Place in an orthostatic position**
  - **Walk**

Multivariable binary logistic regression summarizing the characteristics of the predictive model using the Barthel Index (≥75) 6 months after stroke (n=310).

	Coefficients	OR (95% CI)	p-value
Intercept	5.974		<.0001
Age (for one year increase)	-.055	.946 (.922-.971)	<.0001
Premorbid Rankin score (for one point increase)	-.637	.529 (.345-.810)	.0034
NIHSS score (for one point increase)	-.070	.932 (.892-.974)	.0018
TACI syndrome	-1.226	.293 (.137-.628)	.0016
Presence of Incontinence	-1.475	.229 (.126-.414)	<.0001
Early mobilization (≤48h)	.834	2.303 (1.212-4.379)	.0109
Early rehabilitation (≤ 72 h)	-.709	.492 (.267-.907)	.0230

Nagelkerke R^2=.445 **Tjur R^2**=.350

Area under the ROC curve=.841, **95% CI**=.796-.880

Multivariable binary logistic regression summarizing the characteristics of the predictive model using the modified Rankin Scale (0-2) 6 months after stroke(n=310).

	Coefficients	OR (95% CI)	p-value
Intercept	2.300		.0133
Age (for one year increase)	-.050	.951 (.928 - .975)	.0001
Barthel Index score (for one point increase)	.031	1.032 (1.018 - 1.046)	<.0001
Ischemic Clinical syndrome (TACI)	-1.290	.275 (.108 - .703)	.0070
Affected Side, (Left)	.954	2.60 (1.405 - 4.794)	.0023
Presence of Incontinence	-.837	.433 (.225 - .833)	.0122
Risk factors (Hypertension)	-.949	.387 (.196 - .765)	.0064
Early mobilization (≤48 h)	.836	2.306 (1.126 - 4.723)	.0223

Nagelkerke R^2 = .478 **Tjur R^2** = .384

Area under the ROC curve = .863, **95% CI** = .820 - .899

INTERACTION IN COMMUNICATION

- **Explain to relatives how to relate to the patient and what to expect as "responses"**
- **If necessary, it is possible to use aids (blackboard, music, TV..)**

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

After the hospitalization phase?

Return to the Territory

- **It must be prepared as soon as you enter the hospital**
- **Fundamental active role of both the patient and the family**
- **Connection with the General Practitioner and Specialists who operate in the area bilaterally**
- **Fundamental involvement of the various functions present in the Districts**
- **Involvement of patient associations and volunteers**

Return to the Territory

- **Ensure therapeutic continuity**
- **Shared communication system (pre-built board? IT system?…)**
- **Home care guarantee**
- **Rehabilitation therapy**
  - **Occupational therapy at home or in a social structure (optimization of functional recovery achieved, choice of aids,...)**
  - **Teaching of activities that can be self-managed by the patient or family**
  - **District or local social rehabilitation therapy if improvements are foreseeable**

Return to the Territory

- **Guarantee of care for those who do not have an indication for rehabilitation in the acute phase as a functional change cannot be foreseen or have a serious cognitive impairment**
- **Guarantee of care for those who, after hospital rehabilitation treatment, do not show functional improvements such that their social situation allows them or their family members to return to their home**

Complex Care Networks

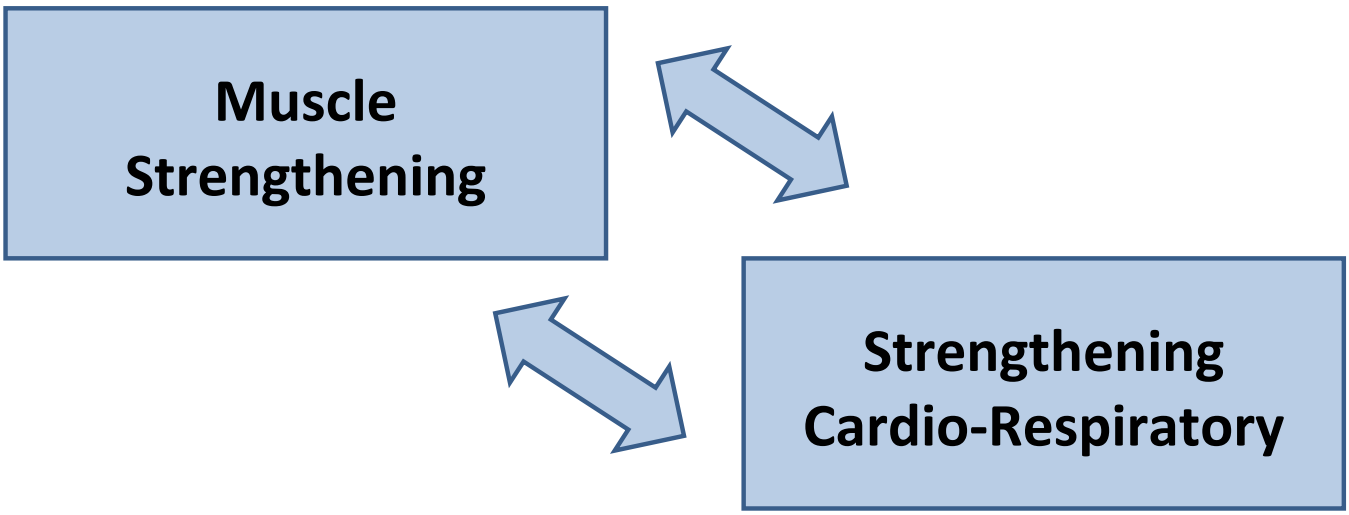
- They are centered on the needs of the person (patient, family, caregiver, social services, ..)
- To guarantee continuity of care on the organizational side
- To guarantee professional behavior consistent with the principles of effectiveness, appropriateness, efficiency and safety

PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

TRAUMATOLOGY AND REHABILITATION OF THE LOCOMOTOR SYSTEM

Physical Exercise: Muscle Strenghthening

Physical Exercise



Physical Exercise: Muscle Strengthening

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

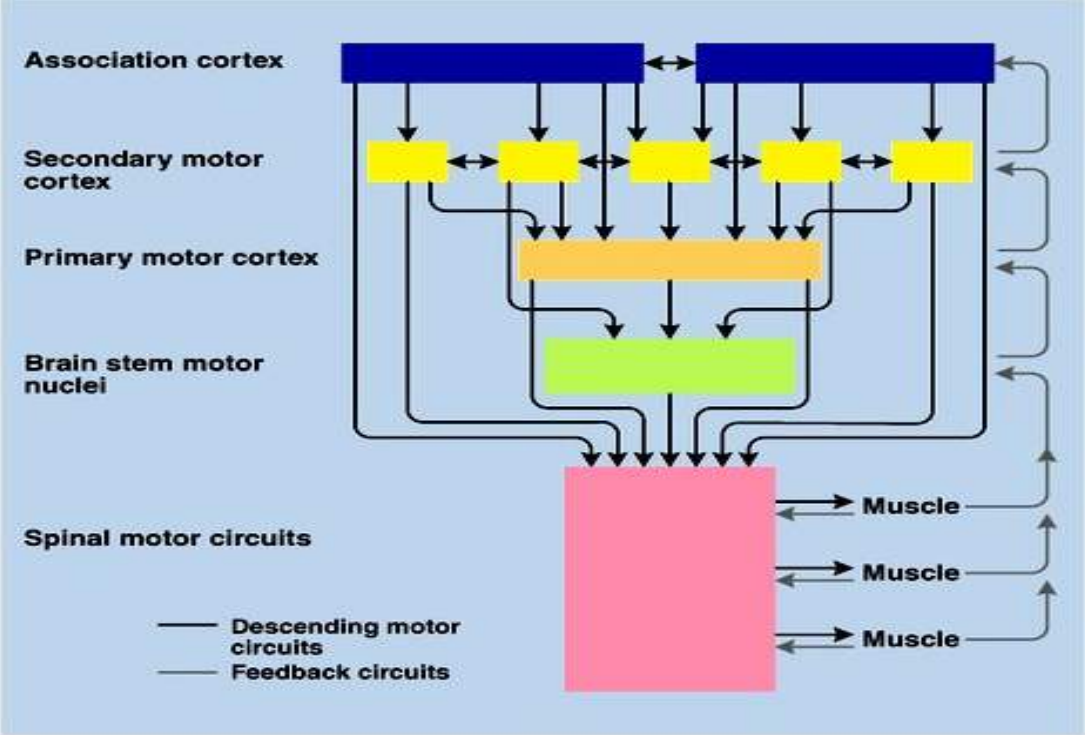
Neuro-physiological premises

Physical Exercise: Muscle Strengthening

Neuro-physiological premises

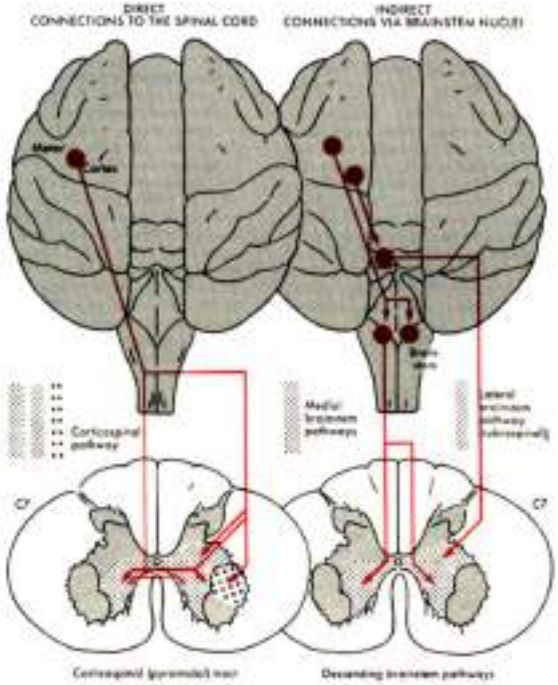
- Central control
- Descending control
- Sensory Feedback
  - Somatosensory system
  - Visual System
  - Vestibular System
- Bottom-up information

Physical Exercise: Muscle Strengthening



Physical Exercise: Muscle Strengthening

Descending Pathways from the Cortex to the Spinal Cord



Physical Exercise: Muscle Strengthening

Common Final Arrival Point

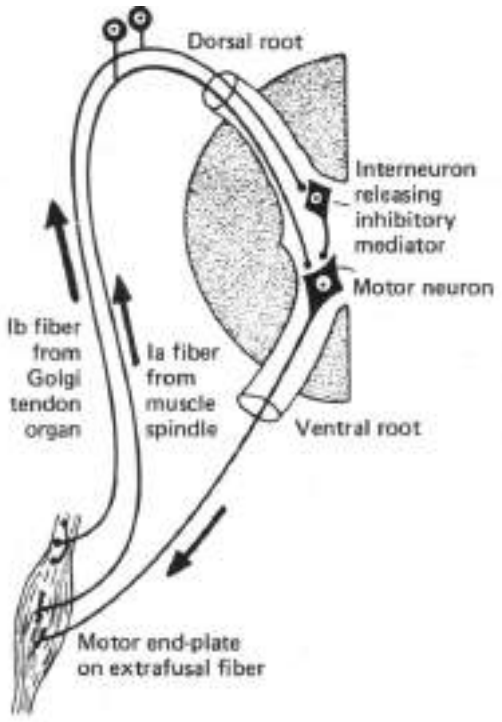
- The α–motoneurons in the anterior horns of the spinal cord are the final point of arrival of the descending pathwaysMidollo Spinale sono il punto finale di arrivo delle vie discendenti

Physical Exercise: Muscle Strengthening

Spinal cord

- **The main function is the integration of descending commands with peripheral inputs and sending peripheral information to the brain centers**
- **Spinal interneurons are able to modulate the output signal of motor neurons**

Spinal Reflex Pathway



Physical Exercise: Muscle Strengthening

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

Motor Unit (M.U.)

Physical Exercise: Muscle Strengthening

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Muscles are innervated by pools (families) of motor neurons

Physical Exercise: Muscle Strengthening

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Motor Unit

the association between the nervous and muscular components constitutes the MOTOR UNIT

(Sherrington)

Physical Exercise: Muscle Strengthening

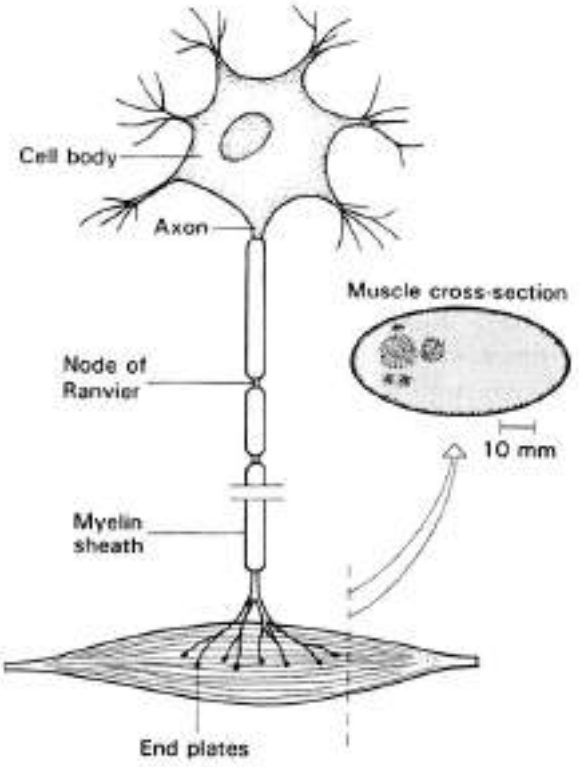
Motor Unit

Skeletal muscle fibers associate with each other into Motor Units.

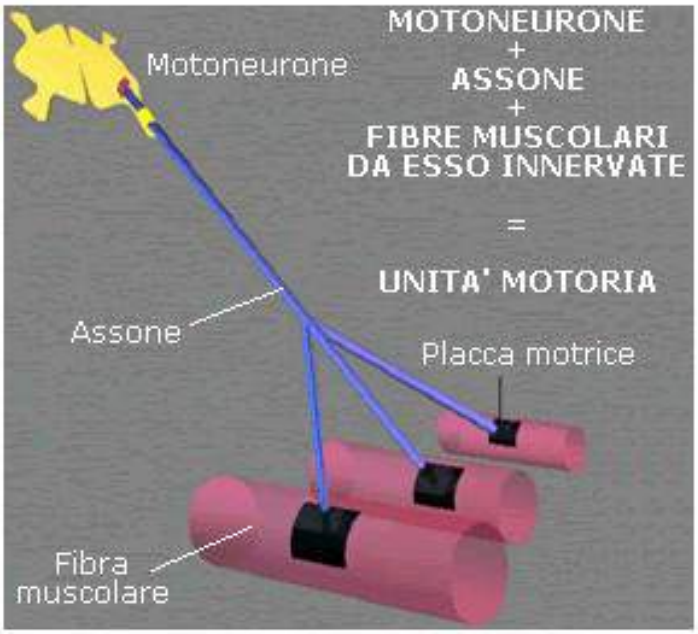
This structuring is fundamental to increase the "control" of muscle shortening otherwise limited to the level of individual fibrocells

Physical Exercise: Muscle Strengthening

Main characteristics



Physical Exercise: Muscle Strengthening



Physical Exercise: Muscle Strengthening

Each fibro-cell of the motor unit is equipped with only one motor plate (neuro-muscular union between the nerve and the fiber), which excludes the mutual interaction of the motor units.

Therefore it is possible to state that:

the motor unit is the minimum amount of muscle tissue that the nervous system can control:

<u>motor unit = functional unit of movement.</u>

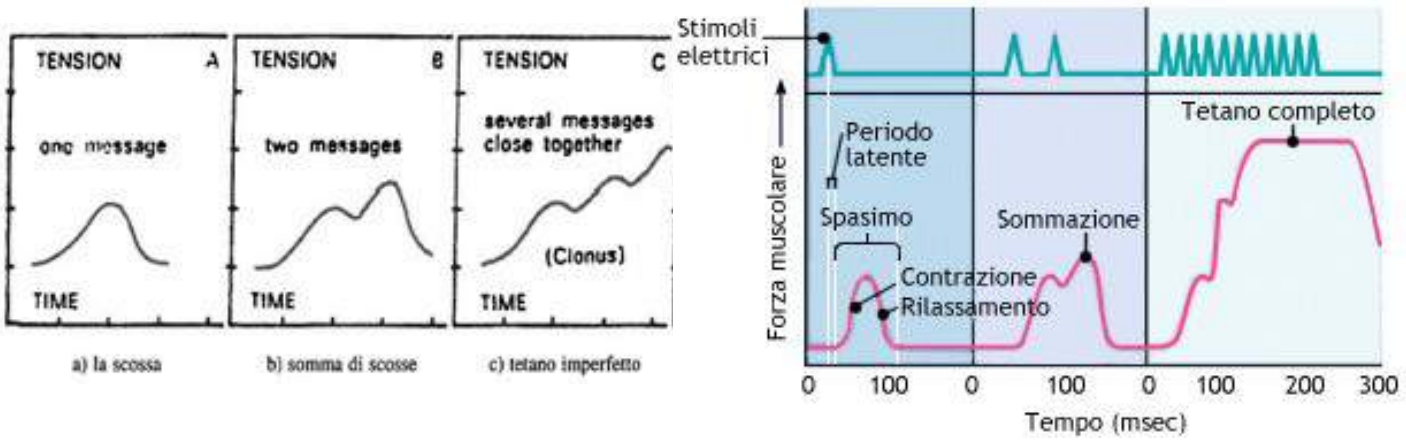
- **The composition of the motor units varies significantly both within the same muscle and between different tissues; the number of muscle fibers present in each single motor unit also differs significantly and is much lower in the muscles responsible for "fine or precision" movements (eye, hand, etc.).**
- **In practice, the smaller the number of fibers innervated by the single motor unit, the greater the central control by increasing or decreasing the number of motor units solicited.**

Physical Exercise: Muscle Strengthening

Differences between the various U.M.

- Contraction time (period necessary to develop maximum strength)
- Force developed at the peak of the simple shock
- Maximum force developed during tetanus (tetanus corresponds to numerous action potentials delivered in a very short time)
- Fall in contraction strength following tetanus

Simple and “Tetanic” Activity



Physical Exercise: Muscle Strengthening

Classification of U.M.

- **Lens (red fibers, type I):**
  - **little force following a single shock or tetanic shock and slow contraction times (>50 milliseconds)**
- **Rapid and Fatiguable (white fibers – type IIB):**
  - **they boast maximum speed and strength but with little resistance (after 2' the strength is reduced by 75%)**
- **Fast and resistant (white fibers – type IIA):**
  - **they have intermediate characteristics between the two mentioned above, the contraction times are short and the force is high; at 2' they maintain more than 75% of the force delivered at the start**

Physical Exercise: Muscle Strengthening

It has been demonstrated that each motor unit ONLY innervates fibers belonging to the same category.

The motor units determine the athletic characteristics of each subject

Physical Exercise: Muscle Strengthening

- **The composition of the muscles in terms of fast and slow fibers also varies in the same individual, in relation to the muscle considered:**
  - **Antigravity ones have, for example, a higher percentage of slow fibers (toned muscles)**
  - **Those in the arms are richer in fast-twitch fibers (phasic muscles)**

Training

- **Training the various types of fibers requires different methodologies:**
  - **Fast-twitch fibers should be trained with explosive cadences, high loads, short tension times and high recovery pauses**
  - **Slow twitch fibers should be trained with slow rhythmic cadences, medium-low loads, long tension times and short recovery pauses**
  - **In the intermediate courses a mixed methodology is used**

Training

- **The white muscle fibers need 5-6 repetitions, with a 4 minute rest between one set and the next and 6 days of recovery.**

Training

- **Slow twitch fibers can involve repetitions greater than 12-15**
- **Rest between sets of 60 seconds and 2-3 days of recovery**

Evaluation of the state of the fibres

- **A targeted evaluation of the different fiber components can be made, for example:**
  - **Slow twitch fibers can be assessed by performing as many repetitions as possible, above 12-15, in that given muscle tested. This highlights its resistance capacity, a typical characteristic of red fibres**
  - **By analyzing all the main districts it is possible to create a good program that is as subjective as possible**
  - **To quantify the strengthening exercise (number of repetitions) there are some specific more or less complex formulas**

Physical Exercise: Muscle Strengthening

Evaluation of the state of the fibres

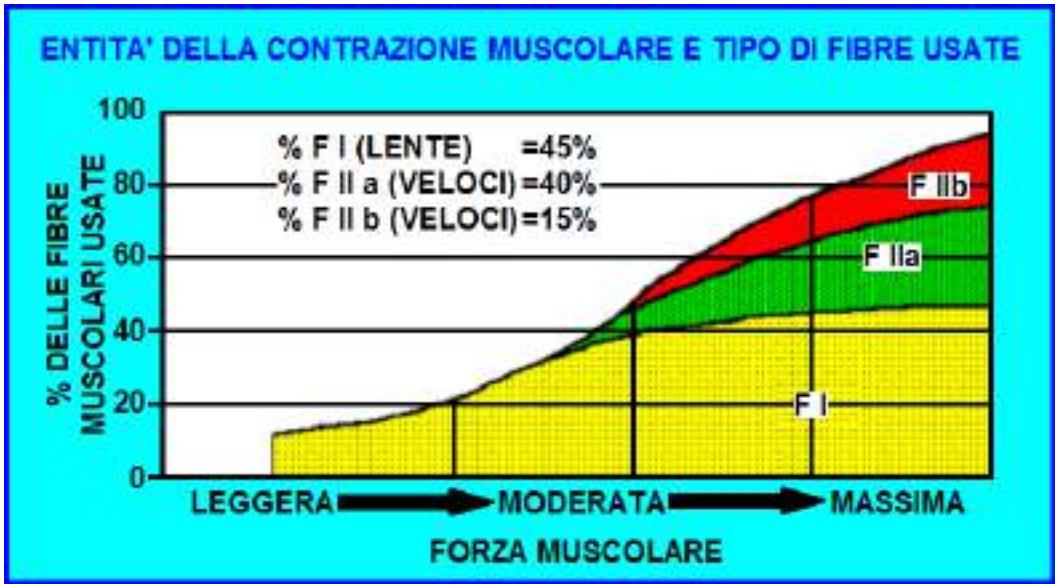
- **An empirical but effective system can also be used:**
  - **"the burning sensation" in the muscle during training**
    - **The burning is an indication of lactate accumulation and this characteristic is typical of fast-intermediate twitch fibres, which have an anaerobic metabolism with possible production of lactic acid**

Work Program

- **A specific exercise for each type of muscle**
- **Each muscle in our body is made up of different types of fibres, each of which is present in a different percentage. Depending on the prevailing type of fibre, muscle training will vary based on:**
  – Serial number
  – Pauses between one series and another
  – Recovery between workouts

Physical Exercise: Muscle Strengthening

Fiber Activation

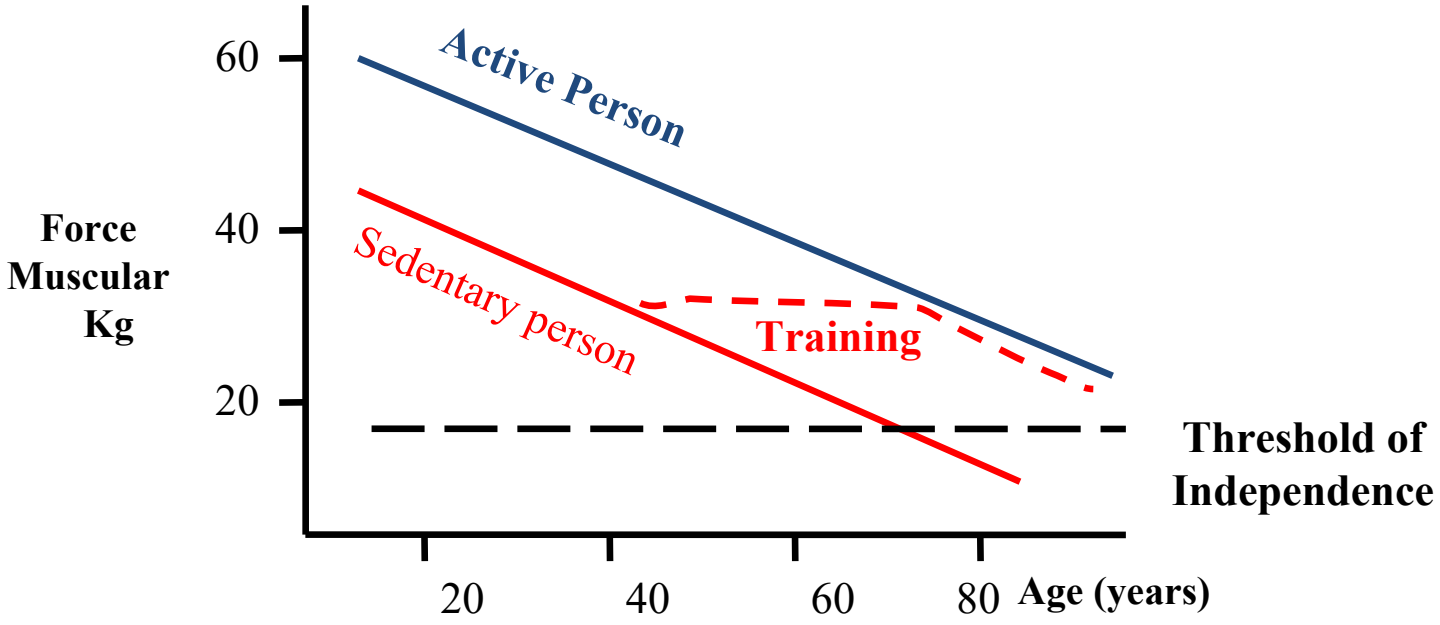


Physical Exercise: Muscle Strengthening

Work Program

- **Initial phase:**
  - **Work with single-joint exercises, that is, those exercises with which you work on only one joint at a time**
- **Subsequently**
  - **We move on to exercises that involve more joints**

Results



Physical Exercise: Muscle Strengthening

Main Indications

- **Strengthening muscle groups at a segmental level**
  - **Shoulder and Upper Limb proximally or distally**
  - **Lower limb proximally or distally**
  - **Trunk front and back**

Lower limbs

Physical Exercise: Muscle Strengthening

Lower limbs

Physical Exercise: Muscle Strengthening

Lower limbs

Physical Exercise: Muscle Strengthening

PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Lower limbs

Physical Exercise: Muscle Strengthening

Upper limbs

Physical Exercise: Muscle Strengthening

Upper limbs and pectorals

Physical Exercise: Muscle Strengthening

Upper limbs

Physical Exercise: Muscle Strengthening

Trunk

Physical Exercise: Muscle Strengthening

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Muscle strengthening can be useful in situations of "fragility"

Physical Exercise: Muscle Strengthening

Fragility

- **A physical situation in which "physiological reserves" are reduced with therefore an increased risk of acquiring a disability**
- **It is characterized by generalized weakness, limited mobility and balance with low level of endurance**

- **Buchner and Wagner**

Physical Exercise: Muscle Strengthening

Can the negative evolution of Frailty be prevented by Physical Exercise?

- **Low intensity, long duration exercise?**
- **High intensity and short duration exercises?**

Physical Exercise: Muscle Strengthening

Can the negative evolution of Frailty be prevented by Physical Exercise?

- **Low intensity muscle strengthening training has repeatedly proven to be a safe and effective intervention to reduce weakness, postural control and fall risks.**
  - **Tracy et al. 1994**

Physical Exercise: Muscle Strengthening

High intensity, short duration exercises

- **Significant improvements in muscle strength and mobility in older people in a social structure aged around 90 years**

– **Jama 1990**

Physical Exercise: Muscle Strengthening

What adaptations occur in the elderly after strengthening exercise

- Structural Adaptations
- Adaptations of the Contractile Function
- Neural Adaptations
- Performance adaptations

Physical Exercise: Muscle Strengthening

What adaptations occur in the elderly after strengthening exercise

- **Structural adaptations**
  - **Muscle Hypertrophy**
  - **Fiber hypertrophy**
  - **Fiber Distribution**

Physical Exercise: Muscle Strengthening

What adaptations occur in the elderly after strengt

- **Contractile Activity**
  - **Increased ability to lift weights**
  - **Increased isometric activity**
  - **Maximum power increase**
  - **Increase in sustainable work**

Physical Exercise: Muscle Strengthening

What adaptations occur in the elderly after strengthening exercise

- **Neural Adaptations**
  - Ability to activate muscles
  - Co-activation of antagonist muscles

Overall result

- **Reduced risk of falls**
- **Improved Performance**
  - **Participation increased**

Physical Exercise: Muscle Strengthening

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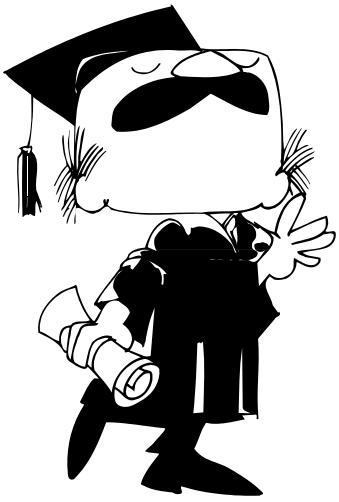
PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

Correct Physical Conditioning

Adapted Physical Activity (AFA) 1



Adapted Physical Activity (AFA) 1

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

DECONDITIONING

Adapted Physical Activity (AFA) 1

Immobilization & Deconditioning

- **Immobilization – physical restriction of movement of the body or a segment of it**
- **Deconditioning – reduction of the functional capacity of many organs and systems**
  - **Its severity depends on the degree and duration of immobilization**
- **Causes of disuse:**
  - **Impairments: organ system level**
  - **Disability: decline in function**
  - **Elderly age and/or low motivation to move**

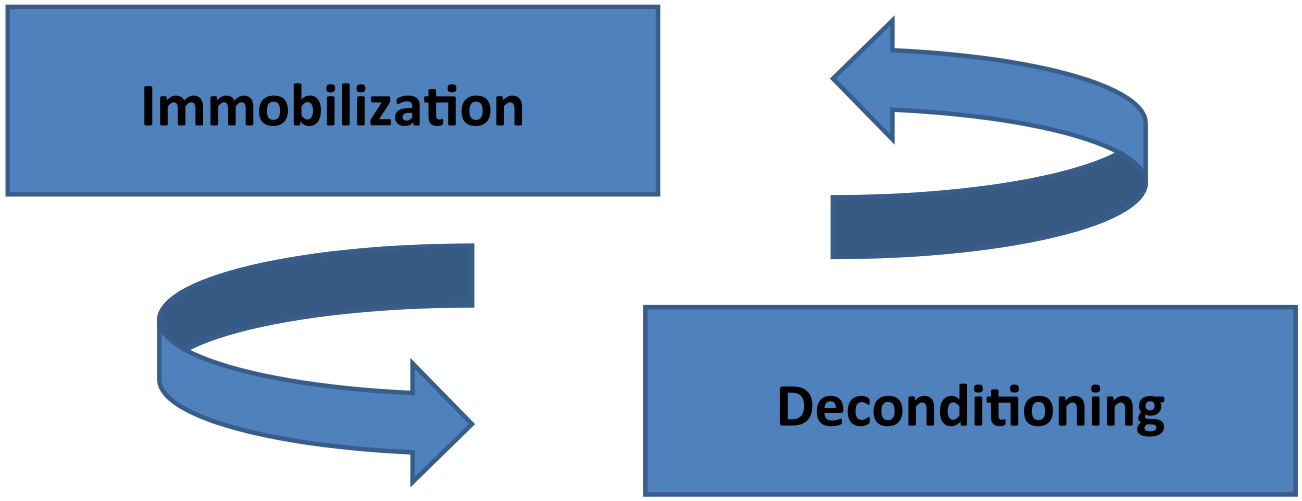
Adapted Physical Activity (AFA) 1

Immobilization & Deconditioning

- **The goal of rehabilitation is recovery and maximization of function**
- **The objective of Physical Activity is the maintenance of a "Normal" Physical Capacity**

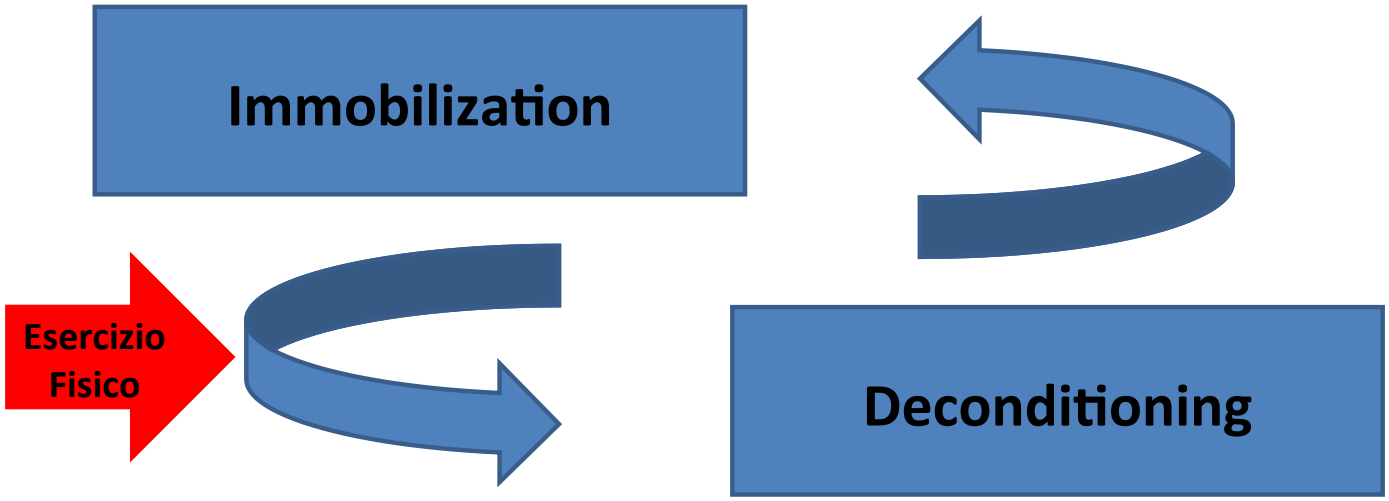
Adapted Physical Activity (AFA) 1

Immobilization & Deconditioning



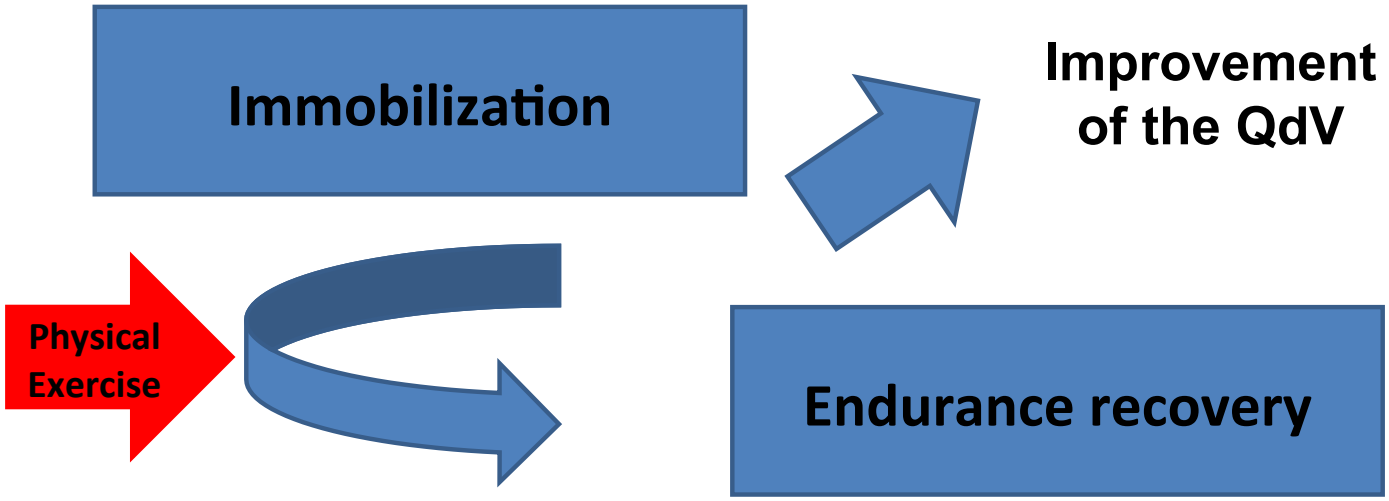
Adapted Physical Activity (AFA) 1

Immobilization & Deconditioning



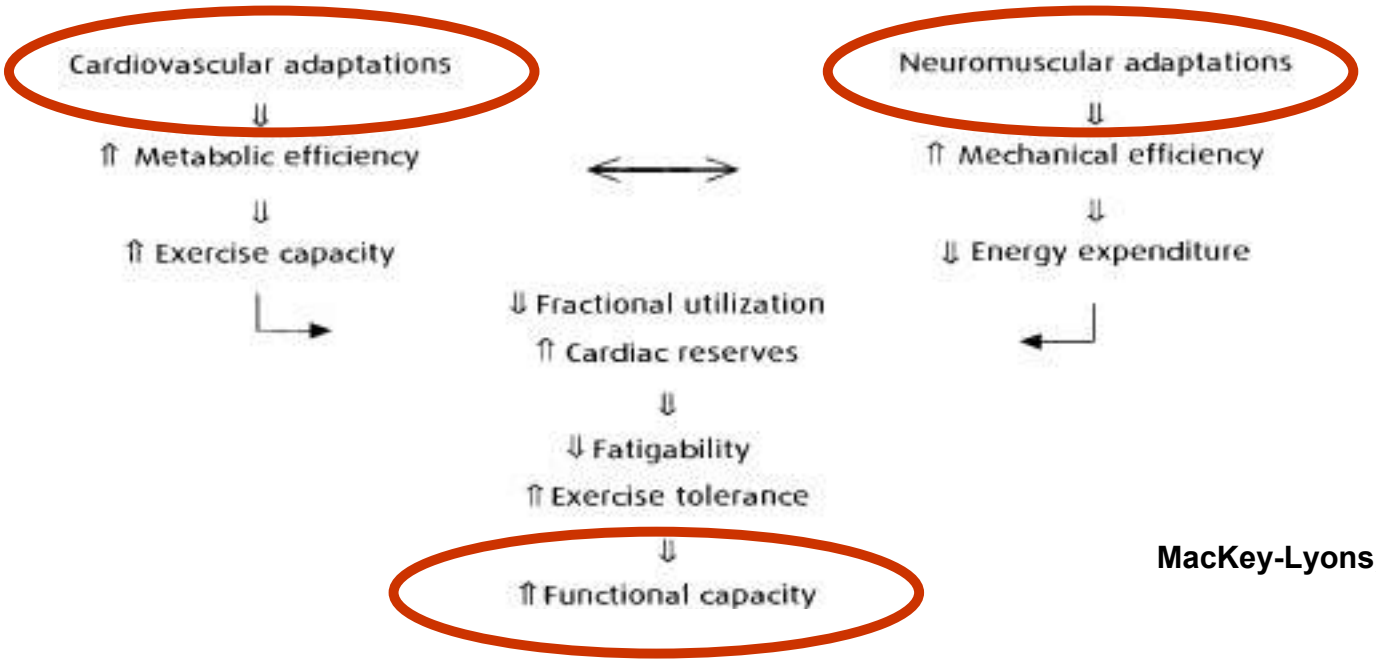
Adapted Physical Activity (AFA) 1

Immobilization & Deconditioning



Adapted Physical Activity (AFA) 1

DECONDITIONING



MacKey-Lyons, 2006

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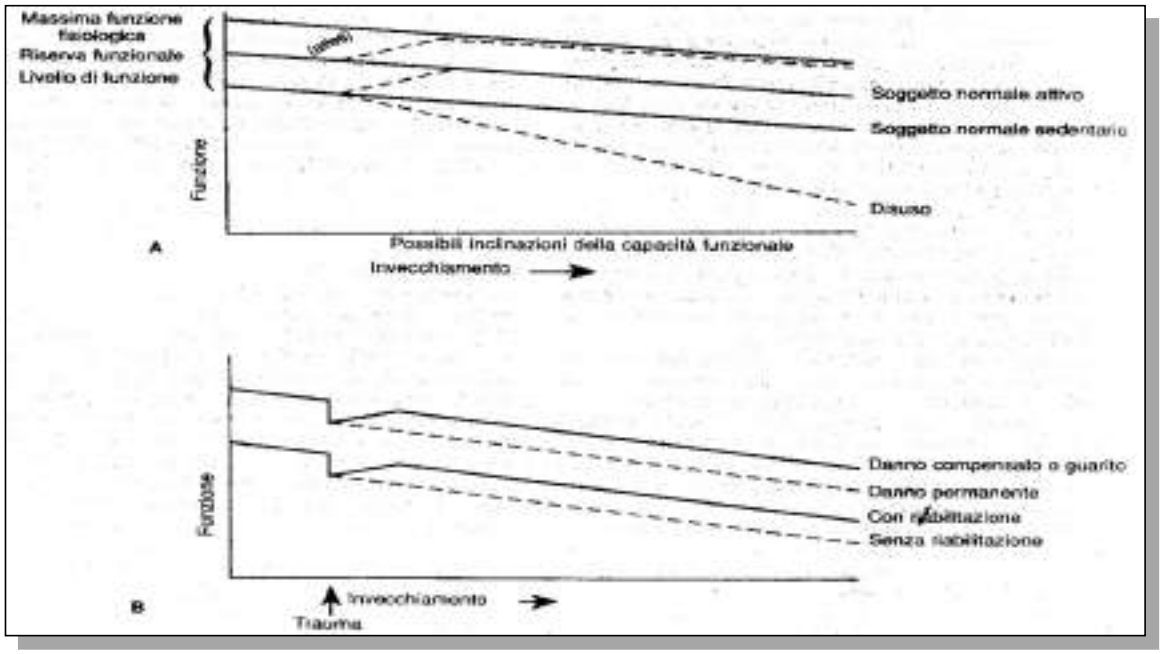
PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

Immobilization & Deconditioning

Without maintaining adequate physical activity, the result of rehabilitation is lost over time!

Adapted Physical Activity (AFA) 1

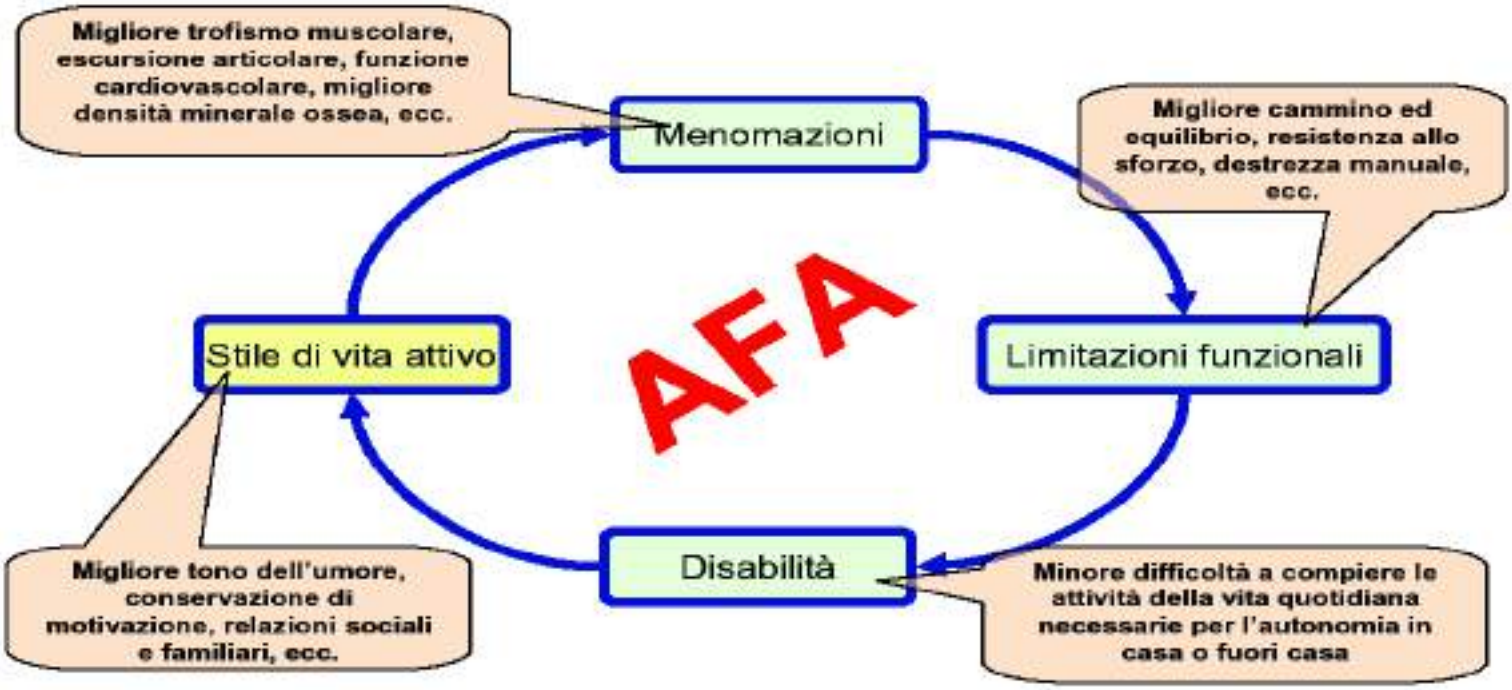
Consequences of non-use



Adapted Physical Activity (AFA) 1

i danni da immobilità

Adapted Physical Activity (AFA) 1



Adapted Physical Activity (AFA) 1

ADAPTED PHYSICAL ACTIVITY (AFA)

- **1973: according to the I.F.A.P.A. (International Federation of Adapted Physical Activity) the A.P.A. "refers to movement, physical activity and sports in which particular emphasis is given to the interests and abilities of individuals characterized by disadvantageous physical conditions, which may be present in disabled, sick or elderly people".**
- **Today: AFA is a non-healthcare activity created to promote healthy behaviors and lifestyles and to promote the secondary and tertiary prevention of disability.**

AFA is not classic rehabilitation

Adapted Physical Activity (AFA) 1

SCIENTIFIC EVIDENCE

The main evidence on the effectiveness of physical exercise:

- **Aerobic physical activity improves walking and resistance in using the upper limbs (Romberg et al. 2004**
- **Aerobic exercise improves fatigue in physical activity (Oken et al. 2004)**
- **Long-term physical exercise improves life activities, especially walking, but not disability (Romberg et al. 2005)**
- **Aerobic activity improves the physical condition of patients with mild disabilities (Bjarnadottir et al. 2007)**
- **Aerobic physical exercise improves walking ability in patients with MS and mild disabilities (Franceschini et al. 2007)**
- **Physical exercise in patients with mild disabilities improves the quality of exercise, quality of life and fatigue (McCullagh 2008)**

Adapted Physical Activity (AFA) 1

Aerobic Physical Activity

- **This is a <u>low-intensity, long-duration activity</u>. If done well, both at an amateur and competitive level, it can have many beneficial effects on the body. In fact, it allows you to:**
  - **Improve cardiovascular, respiratory and metabolic function and mood**
  - **With constant training the heart rate gradually decreases and breathing capacity increases (greater tissue oxygenation**
  - **This also means greater resistance and less sense of fatigue**
  - **The most practiced aerobic activities and sports are for example: walking, running (or jogging), cycling, low-intensity swimming, cross-country skiing, exercise bike and treadmill.**

Adapted Physical Activity (AFA) 1

Aerobic Physical Activity

- **In Sports Sciences, an aerobic exercise is a gymnastic-conditional activity in which oxygen becomes a determining part of the ATP re-synthesis process. Physiologically, aerobic exercise becomes such when muscle glycogen stores are no longer sufficient to allow the re-transformation of pyruvic acid into ATP. For this reason, an exercise begins to be aerobic only when the effort is prolonged for more than 3-4 minutes; fully aerobic exercise is sustained effort for more than about twenty minutes.**
- **In terms of energy consumption, aerobic exercise is certainly less efficient but certainly more effective than anaerobic exercise; the energy output is lower than anaerobic, but it is possible to carry out a greater total amount of work.**

Adapted Physical Activity (AFA) 1

Anaerobic Physical Activity

- **By Anaerobic Activity we mean a power activity: in a short period of time you undergo an intense effort, technically called maximal, which cannot be prolonged over time because it could cause the presence of lactic acid (natural waste from contraction muscular), very unpleasant. Lactic acid causes a worsening of performance because its accumulation quickly leads to a sense of fatigue, muscle pain and interruption of effort.**
- **Anaerobic Activity takes place in the absence of oxygen and uses the sugars present in the muscles and blood as "fuel". Sugars, however, do not burn completely and after a short time produce a waste, lactic acid, which is toxic to the body.**

Adapted Physical Activity (AFA) 1

PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

“Fragile People”

The elderly and people with different abilities fall within the definition of "Fragile People"

The national welfare system must be organized to allow maximum inclusion and participation, eliminating all conditions of restriction and obstacle

Adapted Physical Activity (AFA) 1

Several scientific studies have shown that introducing or rather reintroducing physical activity in these subjects reduces the quantity and extent of health problems they may incur, while improving their overall state of health, also from the point of view of socialization and mood tone.

Adapted Physical Activity (AFA) 1

The benefits of regular physical activity affect both individuals and individuals directly indirectly the community; in fact, a sedentary lifestyle has a notable importance in the reduction of people's autonomy and in the onset and/or worsening of numerous chronic pathologies with consequent impact on costs for both social and health care.

Adapted Physical Activity (AFA) 1

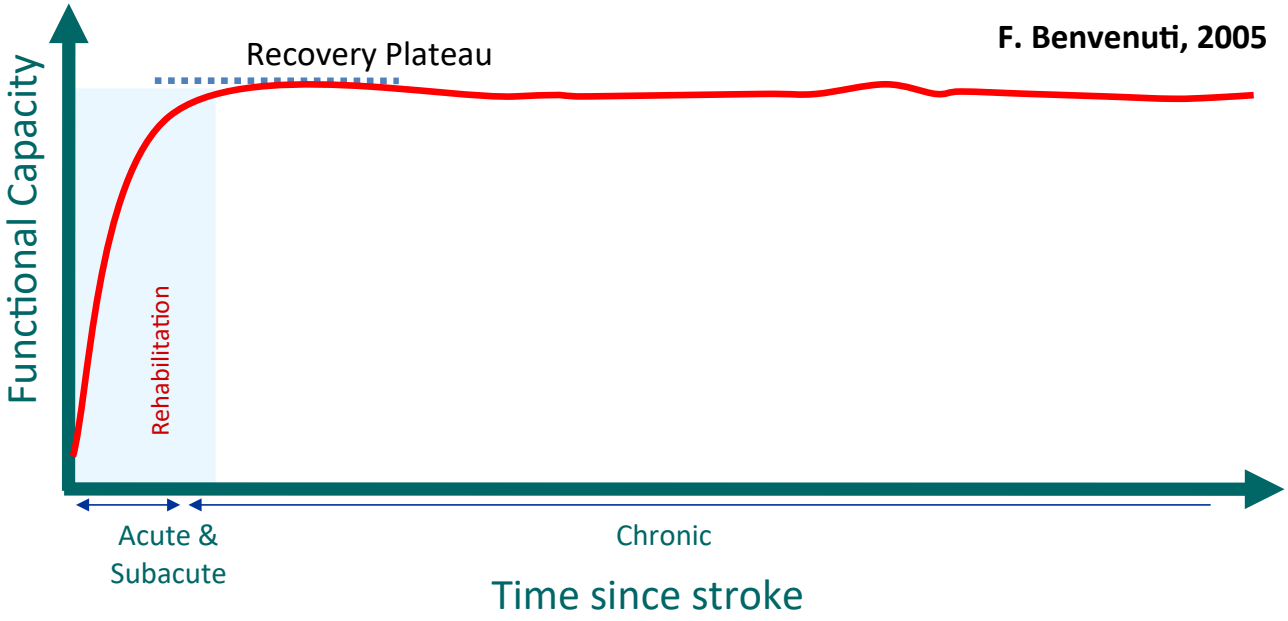
- **Among the positive effects we remember:**
  - **Substantial and long-lasting improvements in cardiac function, blood pressure, lipid and carbohydrate metabolism,**
  - **Positive changes in the ratio between muscle mass and fat mass, muscle tone and balance ability,**
  - **Important beneficial effects on a psychological level, with improvement in particular in mood and self-esteem.**

Rehabilitation in the so-called "Chronic" phase

- **Most rehabilitation interventions in the chronic phase produce some type of improvement**
- **The improvement is usually temporary**
- **The inactive central nervous system undergoes “learned non-use”**
- **Plastic functions can be "reactivated" even in chronic conditions**

Adapted Physical Activity (AFA) 1

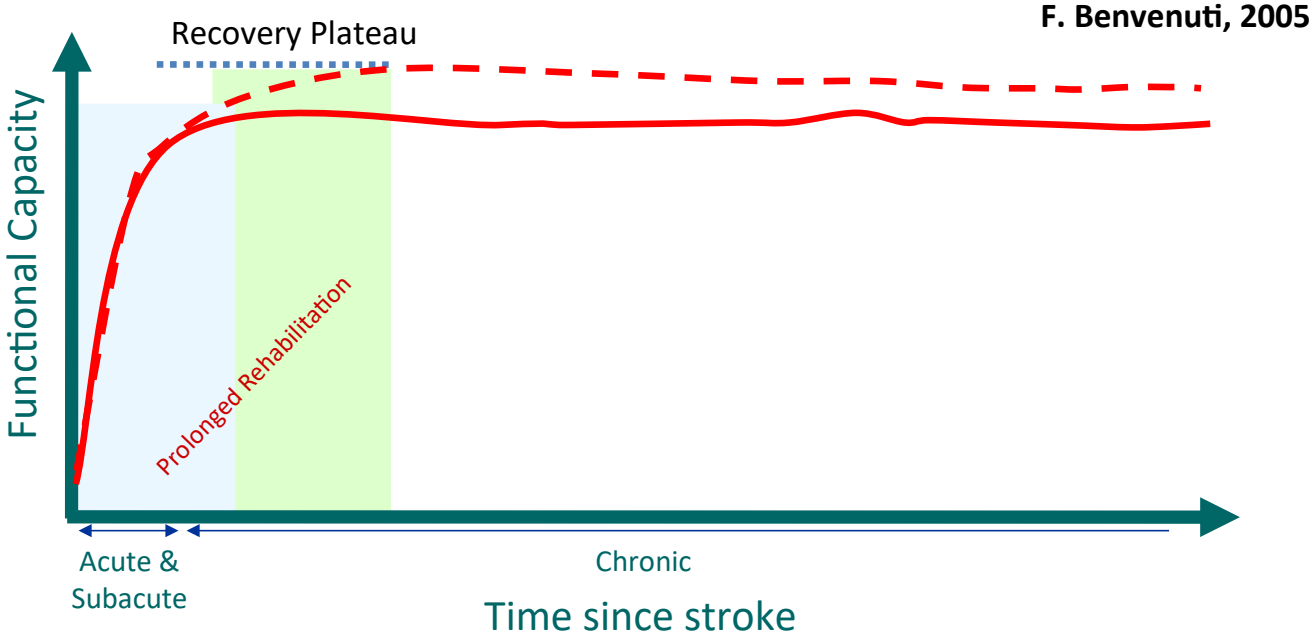
Recovery after stroke



Adapted Physical Activity (AFA) 1

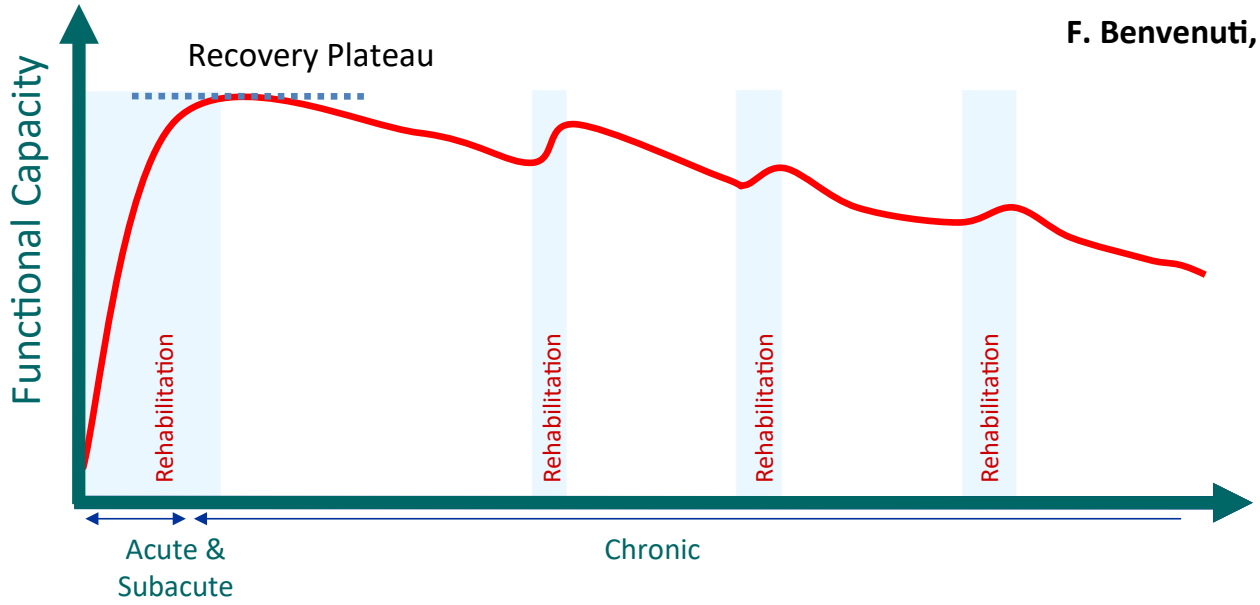
Prolonged rehabilitation after stroke

F. Benvenuti, 2005

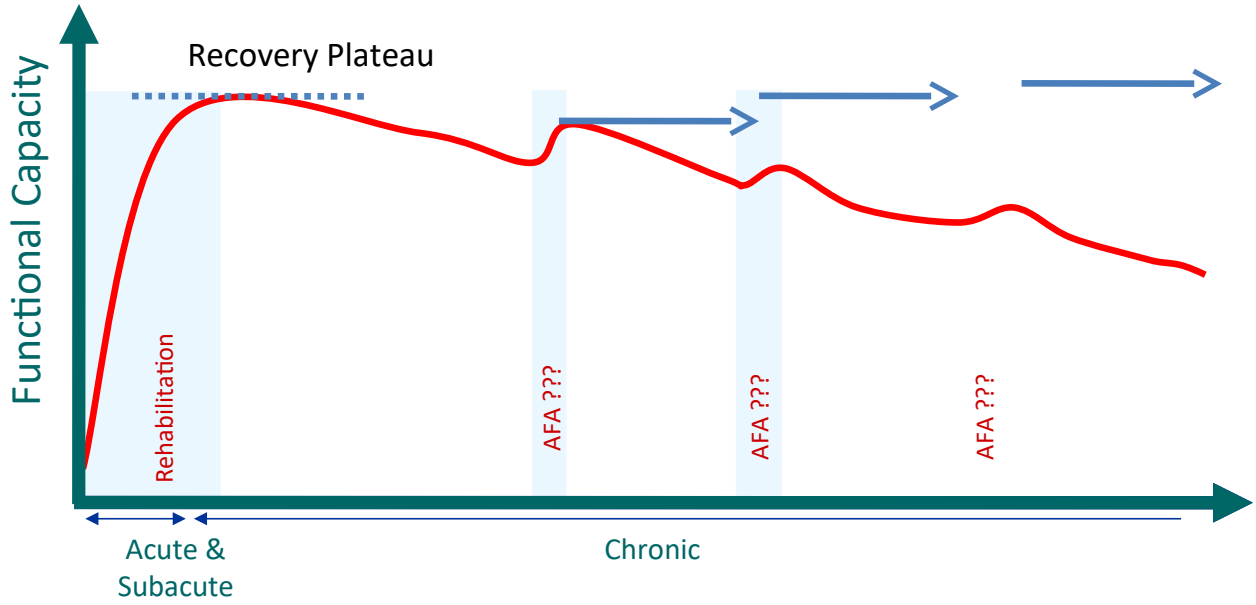


Adapted Physical Activity (AFA) 1

The chronic condition



The chronic condition



Adapted Physical Activity (AFA) 1

Adapted Physical Activity

- **Fundamental role in maintenance**
  - **Maintain residual capacities**
  - **Move to a higher level of performance compared to the abilities shown during rehabilitation in a specialist centre**

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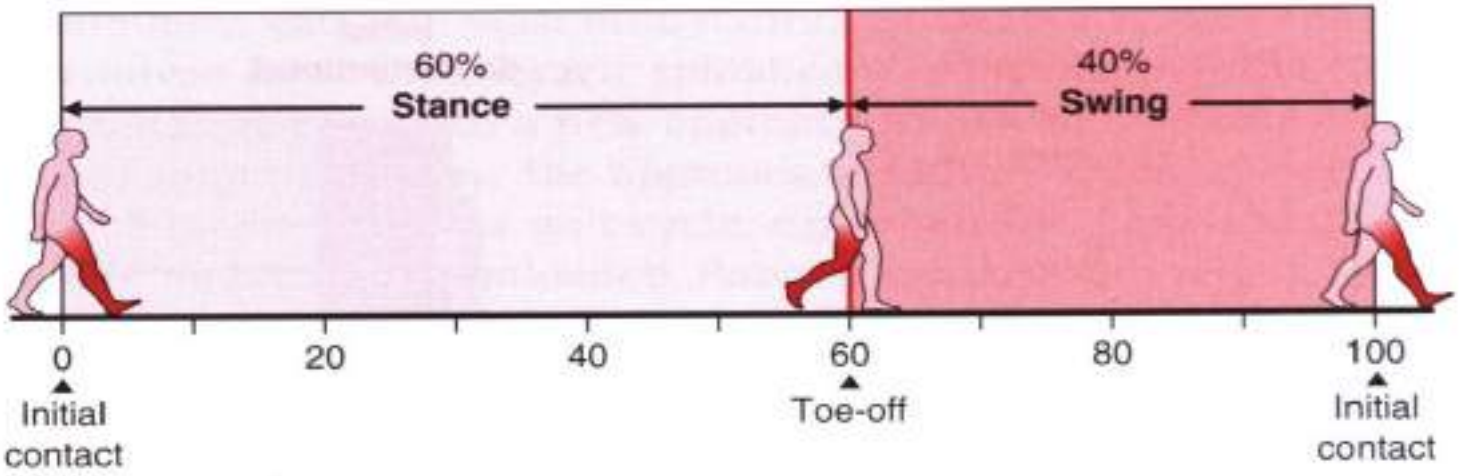
PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

Premises of Biomechanics of Walking

The Path: Biomechanics and Energetic Aspects



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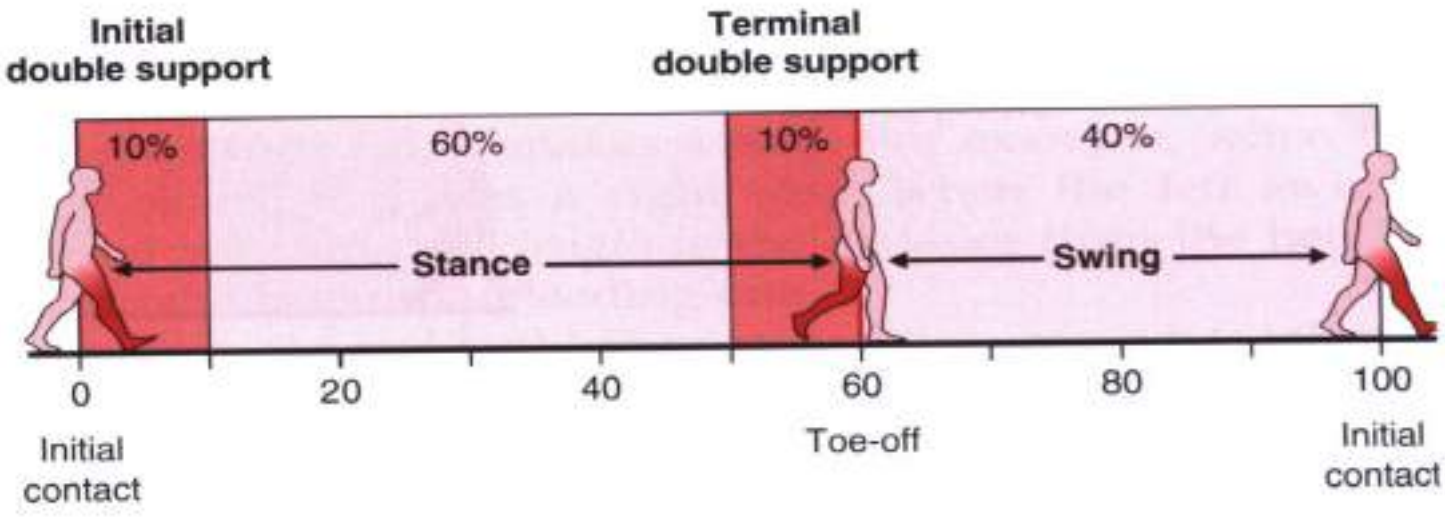

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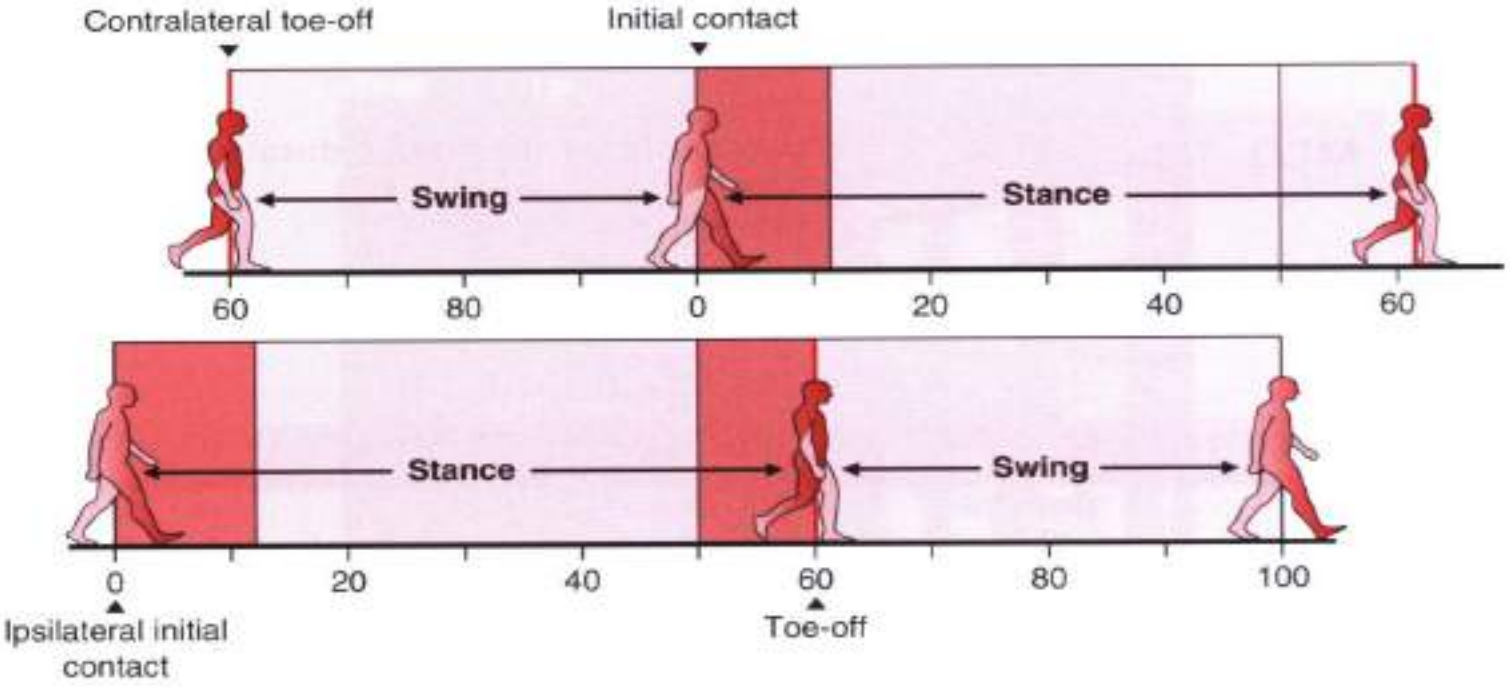

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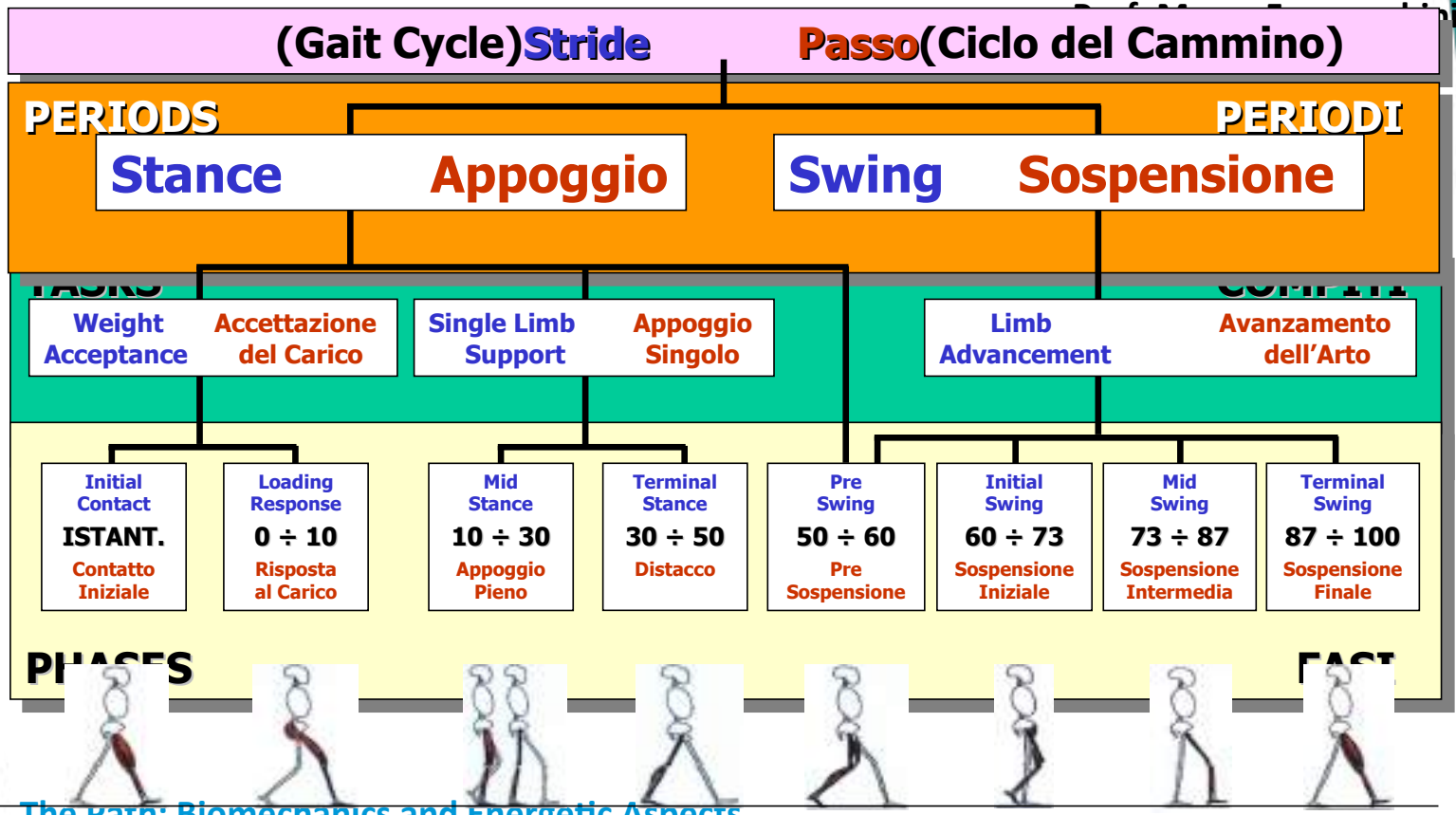
The Path: Biomechanics and Energetic Aspects



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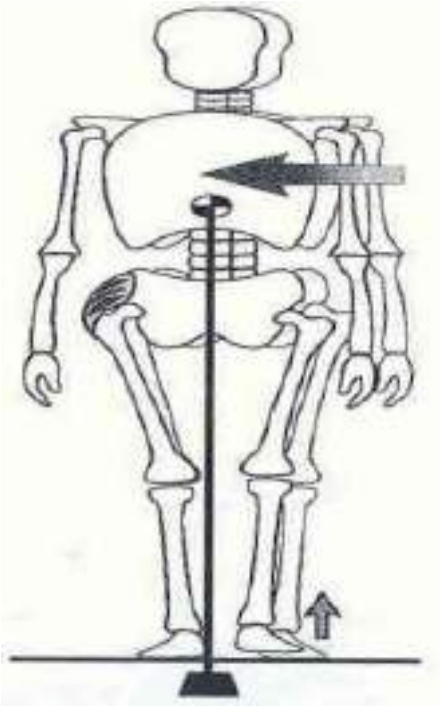

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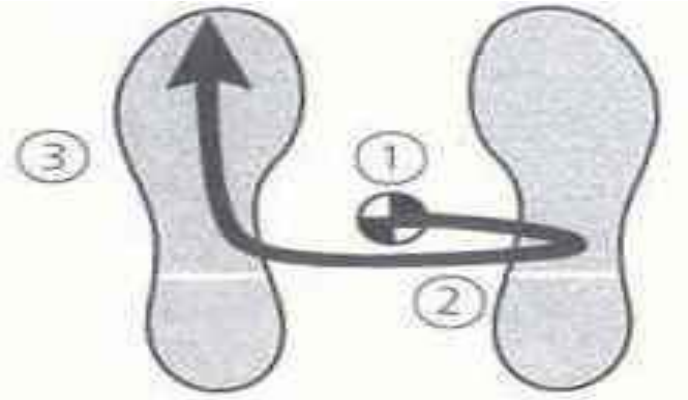
Start of step

1. Brief weight shift (6%) towards the limb that will be lifted
2. All weight towards the supported limb
3. Weight moves onto supported limb, body falls forward and swing foot is lifted

Start of step



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Rolling of the heel

- The heel acts as a fulcrum
- The foot rotates into plantar flexion
- The pretibial muscles
  - They decelerate the fall of the foot
  - They bring the tibia forward

Limb progression

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The action of the quadriceps continues the progression of the tibia begun with the rolling of the heel to advance the thigh

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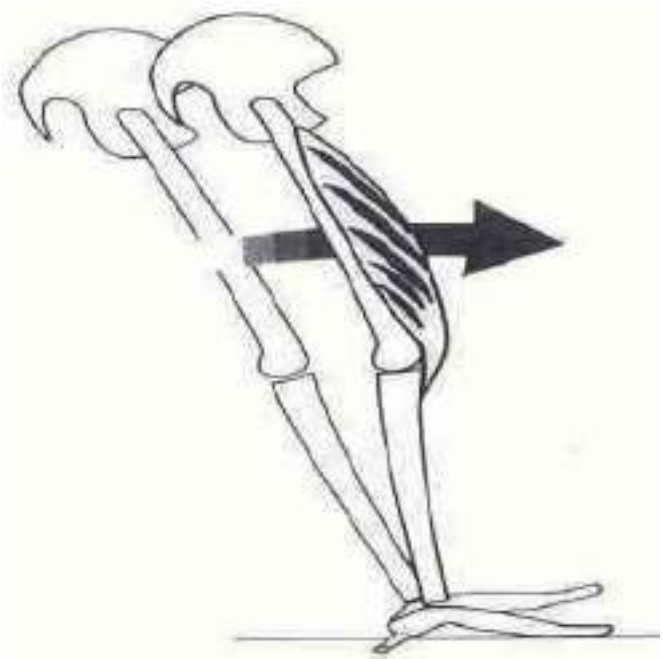

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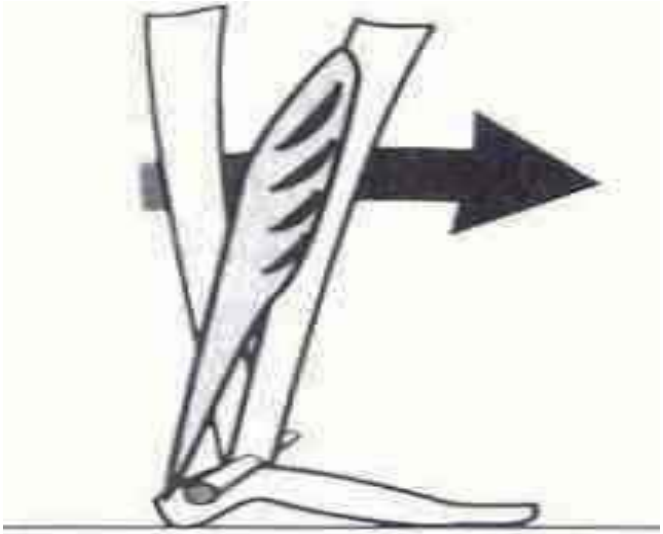
Rotation of the ankle

- **The ankle joint acts as a fulcrum:**
  - **The tibia and the entire limb rotate forward in response to movement**
  - **The rate of progression of the tibia is decelerated by m. soleus and gastrocnemius**



Rotazione della tibiotarsica

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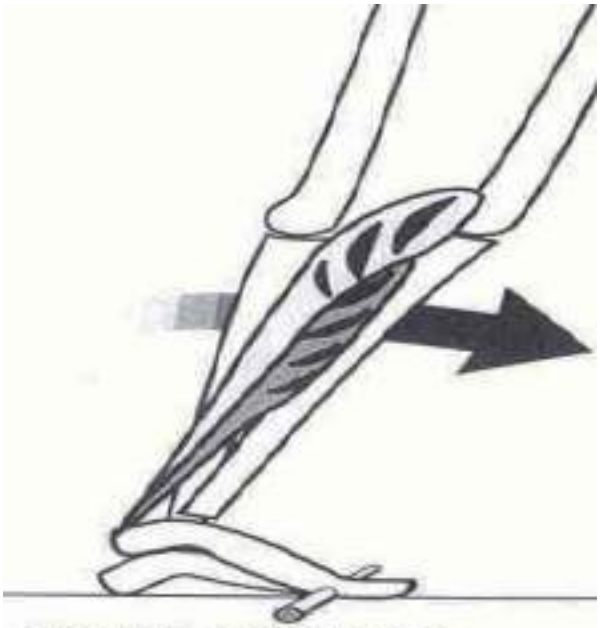
Forefoot rotation

- The progression of the tibia continues with rotation on the toes of the forefoot
- Both the gastrocnemius and soleus activate vigorously to reduce the rate of advancement of the tibia



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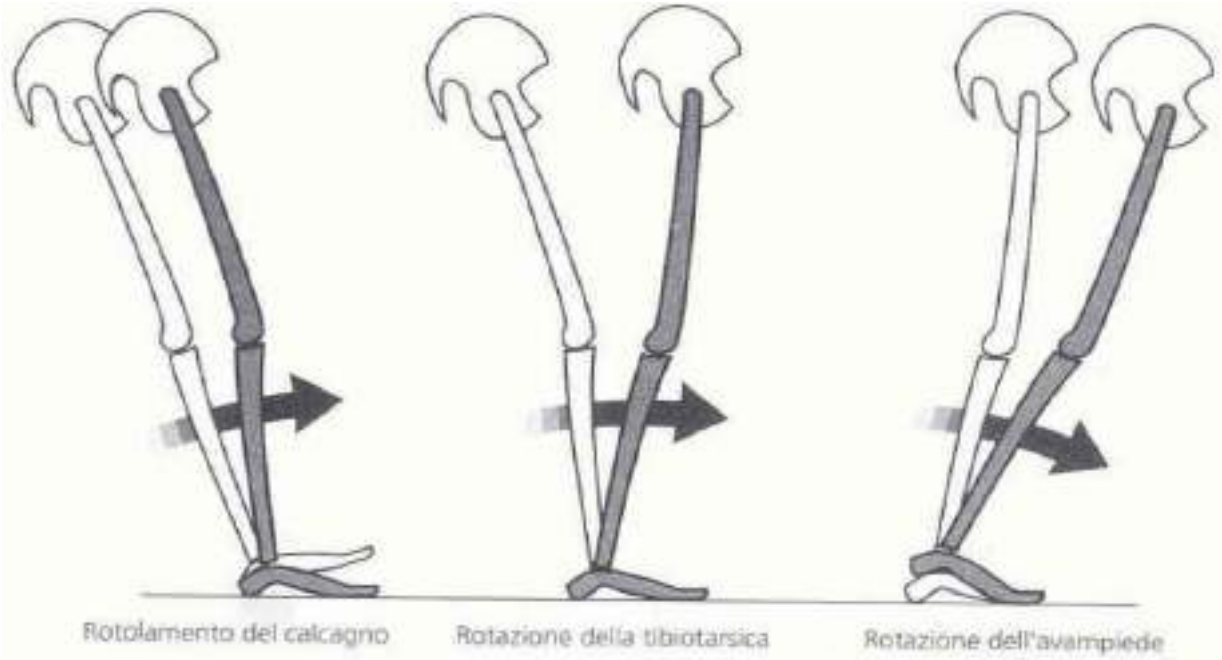

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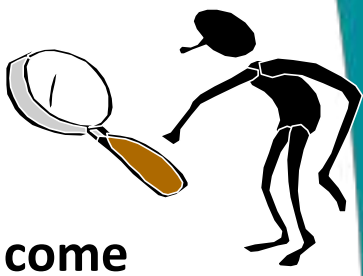
Energy saving in the gait cycle

- Cyclic variations in potential energy are produced which are determined by the sequence of elevations (mid-stance) and lowerings (initial contact) of the center of gravity.
- At the end of the swing phase the head, arm and trunk (TBT) complex is located posterior to the position of the leg that extends forward.
- During the initial-contact phase, the TBT complex begins to rise above the stance leg.



Some questions

- Where does the energy for muscle contraction come from?
- How do the cardiovascular and respiratory systems adapt to effort?
- How is muscle energy spent in human locomotion?
- How is the energy expenditure of walking evaluated in practice and what is its usefulness in rehabilitation medicine?

Muscle Contraction: Energy

1. **The energy necessary to carry out work (muscle, electrical, etc.) comes from the splitting of high-energy phosphorus (P) bonds (ATP and Phospho-Creatine, CP)**
2. **The resynthesis of ATP starting from substrates (sugars, fats and proteins) occurs predominantly in the mitochondria through the Krebs circle**
3. **The resynthesis of ATP is closely related to gaseous exchange (O2 and CO2)**

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The Anerobic Threshold (At) - 1

1. It is the maximum level of work, at which aerobic processes cannot satisfy the ATP demands of skeletal muscles for any longer (AT = 50% VO2 max).
2. Beyond AT, progressive increases in anaerobic glycolysis accompany aerobic metabolism resulting in AC production. lactic acid (metabolic acidosis).

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THE ANEROBIC THRESHOLD (AT) - 2

1. **Any type of physical activity that requires a VO2 lower than that of AT can theoretically be performed indefinitely, depending only on the availability of substrates.**
2. **Free walking (80 m/min): 38% VO2 max**

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Definition of Vo2

1. **Maximum aerobic power is equivalent to the maximum quantity of oxygen that can be used in a unit of time by an individual, during a physical activity involving large muscle groups, of progressively increasing intensity and lasting until exhaustion.**
2. **It is generally expressed as VO2Max: the maximum volume of oxygen consumed per minute.**

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GASEOUS EXCHANGE

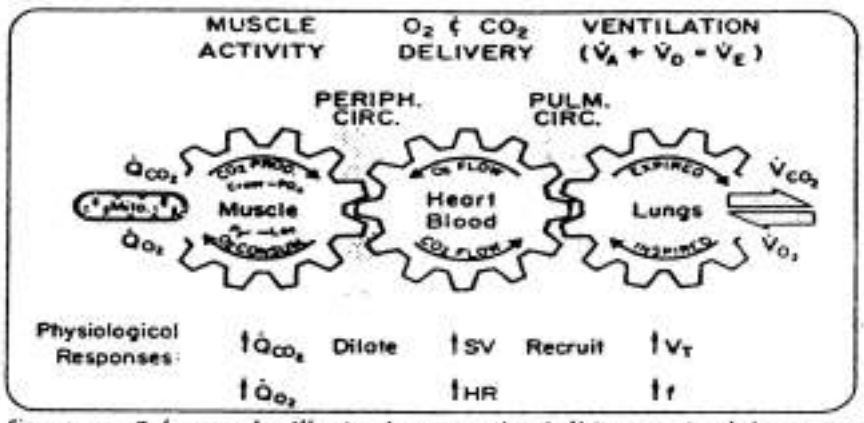

Figura 10 - Schema che illustra i meccanismi di trasporto dei gas per l'accoppiamento della respirazione cellulare (interna) con quella polmonare (esterna). (Exercise testing and interpretation: an overview. In: Principles of exercise testing and interpretation. Second Ed. C. Wasserman, J.E. Hansen, D.Y. Sue. B.J. Whipp. R. Casaburi. Ed Lea e Febiger).

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LIMITING FACTORS
EXCHANGES OF O_2 AND CO_2

- Environmental factors
- Respiratory Factors (Lung Diseases)
- Blood Factors (O_2 AND CO_2 Transport)
- Cardiocirculatory Factors (cardiac output, muscle circulation)
- Tissue Factors (O_2 utilization capacity)

RESPIRATORY ADAPTATIONS

- **Increased pulmonary ventilation (VE)**
- **Increased Respiratory Rate (RR)**

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Cardiocirculatory adaptations

- Increased cardiac output
  - Increased HR
  - Increased pulsatory output
- Increase in P.A. mean (systolic)
- Reduction of peripheral resistance
  - Increased capillary bed
  - Diversion of flow to the muscles

Instrumental Evaluation

RESPIRATORY PARAMETERS	CARDIOCIRCULAR PARAMETERS
• VO_2 • VCO_2 • VE • VO_2 MAX • FR • BLOOD ANALYSIS • LACTATES	• FC • WRIST O_2 (VO_2/FC) • PA

1 liter O2 = 4.830 kcal

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

LOCOMOTOR FUNCTION

Conservation of energy

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Conservation of energy

1. Modulation of the alignment of the center of gravity
2. Selective muscle control

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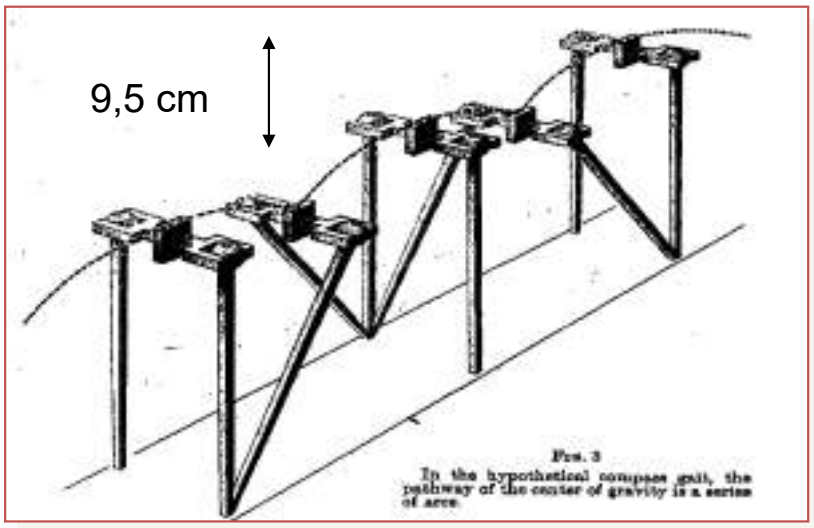
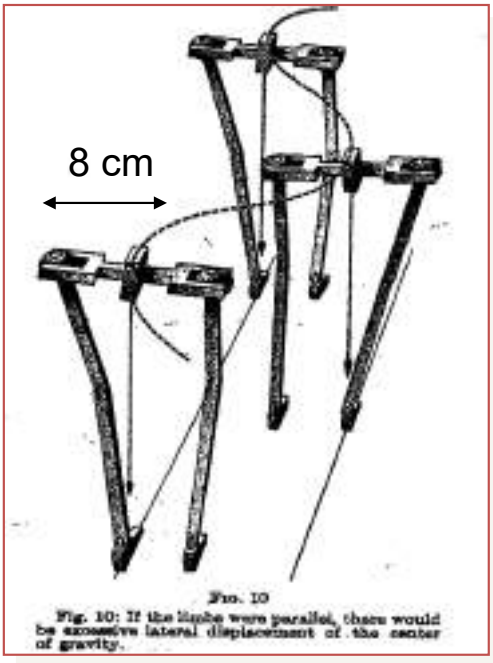
Theoretical shifts of the center of gravity





Saunders M, J Bone Joint Surgery, 1952

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The normal gait pattern

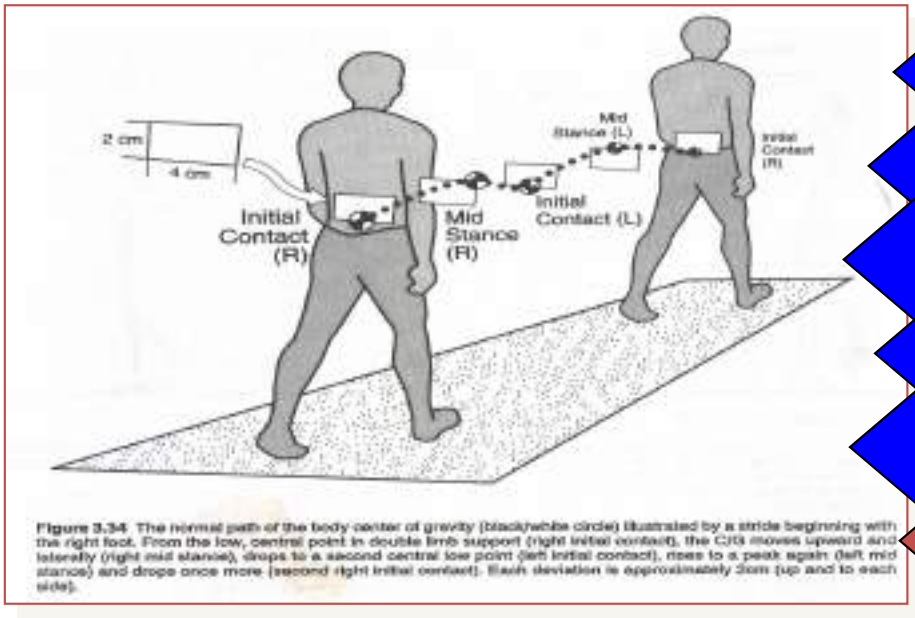

Figure 3.34 The normal path of the body center of gravity (black/white circle) illustrated by a stride beginning with the right foot. From the low, central point in double limb support (right initial contact), the COG moves upward and laterally (right mid stance), drops to a second central low point (left initial contact), rises to a peak again (left mid stance) and drops once more (second right initial contact). Each deviation is approximately 2cm (up and to each side).

- Pelvic rotation
- Pelvic tilt
- Knee Flexion in Stance Phase
- Mechanisms of Foot and knee
- Lateral displacement of the pelvis
- inertia

Perry J, Gait analysis, SLAC inc. 1992

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Conservation of energy

- **Modulation of the alignment of the center of gravity**
- **Selective muscle control**

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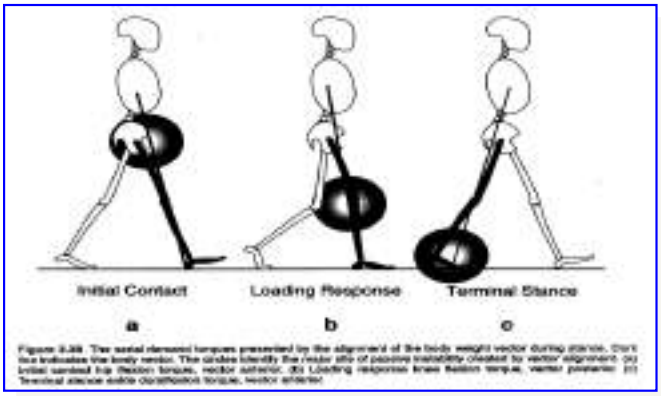
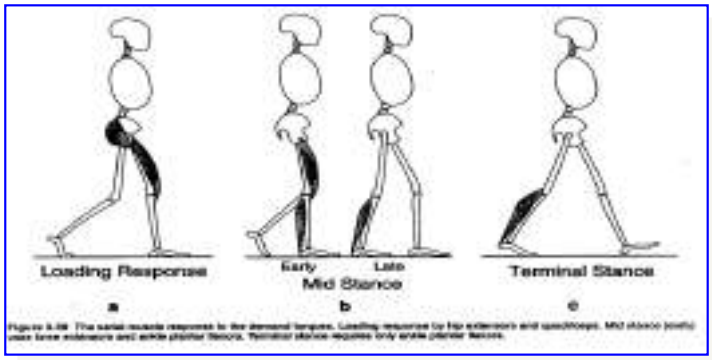
Selective muscle control





Muscle contraction opposes potential conditions of instability for the limb and trunk caused by the alignment of the body. It responds to precise temporal and intensity criteria. These mechanisms contribute to energy saving.

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CONSERVATION OF ENERGY ON THE WALK

- Carrying out work always requires an expenditure of energy
- In the gait cycle, variations in kinetic energy and potential energy are produced which are largely in phase opposition: one converts into the other and vice versa
- This minimizes energy expenditure and produces a saving in the mechanical work necessary to support the movement

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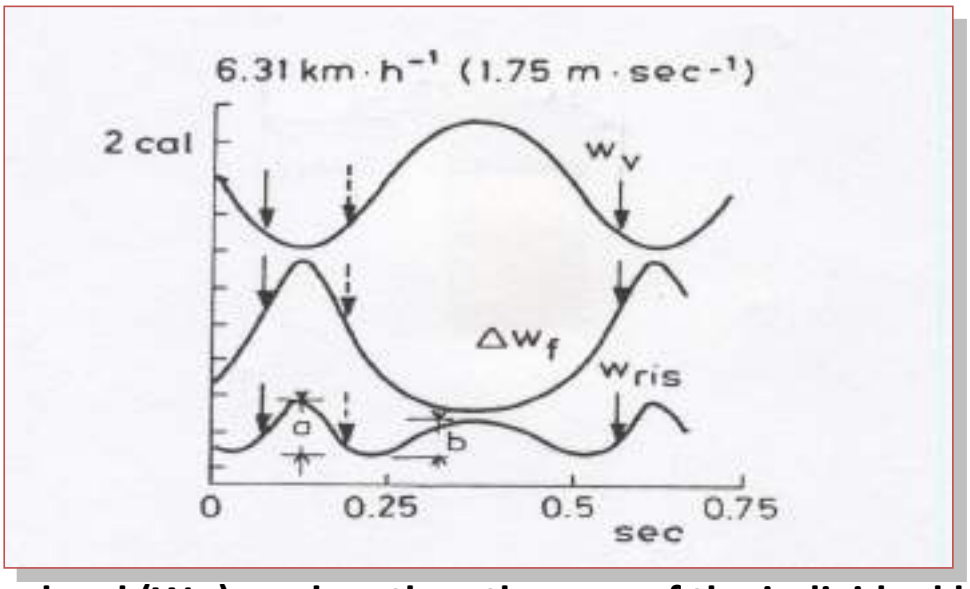
PITCH WORK



Changes in energy level (W_{ris}) are less than the sum of the individual kinetic energy components (ΔW_f) e (potential W_v). (Cerretelli 1990)

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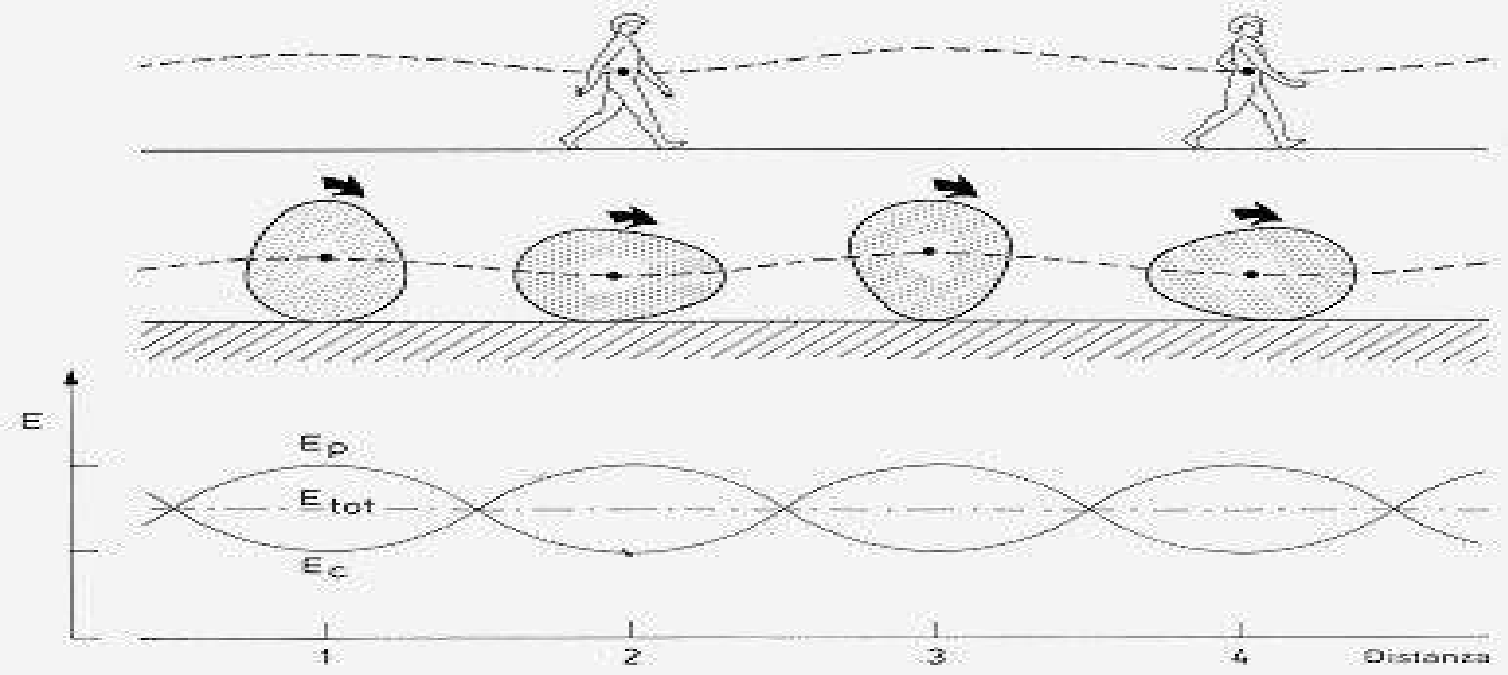

EN. KINETICS ➡ EN. POTENTIAL

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

TRAUMATOLOGY AND REHABILITATION OF THE LOCOMOTOR SYSTEM

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PATH EVALUATION

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EVALUATION SETTING ON THE WAY:

Measure O2 and CO2 concentrations and volumes of breathed air

Quantifying the work imposed on the locomotor system: speed

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DEFINITIONS

Energy consumption:

Amount of O2 consumed per unit of body weight per unit of time (ml/kg/min)

Energy cost:

O2 consumption per unit body mass per unit distance traveled (ml/kg/m)

Energy expenditure: the equipment

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

ENERGY OF PATH IN THE NORMAL SUBJECT

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ENERGY CONSUMPTION

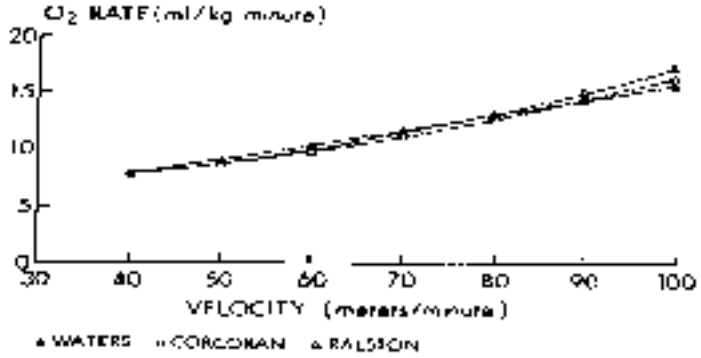

Fig. 4-1. Rate of O_2 consumption-speed relationship in three different studies. This relationship is approximately linear in the range of functional walking speeds between 40 and 100 m/min. (From Waters and Yakura[4], with permission.)

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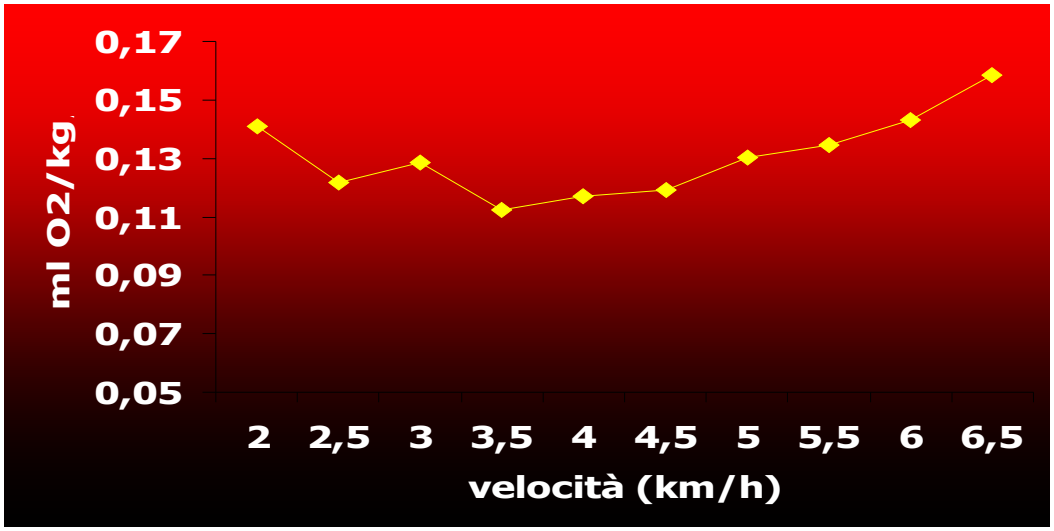
Energy Cost



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6 MINUTE WALKING TEST
Six-Minute Walk Test- 6MWT

The test measures the distance travelled, in a period of 6 minutes, by a subject walking on a surface flat at a brisk pace

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6 MINUTE WALKING TEST
Six-Minute Walk Test- 6MWT

Simple and practical test evaluates submaximal physical exercise capacity reflects the level of exercise in activities of daily living

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6 MINUTE WALKING TEST
Six-Minute Walk Test- 6MWT

1. Technical Aspects

1. Use a flat, straight surface, possibly a little-used corridor
2. The length of the corridor must be at least 30 meters
3. The starting and turning points must be clearly visible
4. The healthy patient/subject is encouraged during the test

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What happens from a biomechanical point of view in the path of the neuron-injured?

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Impairment in the walking of the subject with central neurolesion - 1

- **Elevation of the center of mass to facilitate the release of the contralateral limb**
- **Instability of the pelvis on the horizontal plane**
- **Transition from an economic and plastic system typical of human beings towards a rigid system.**

Impairment in walking of the subject with central neurolesion -2

1. Increased bipedal stance phase
2. Reduction of walking speed
3. Problems with standing balance

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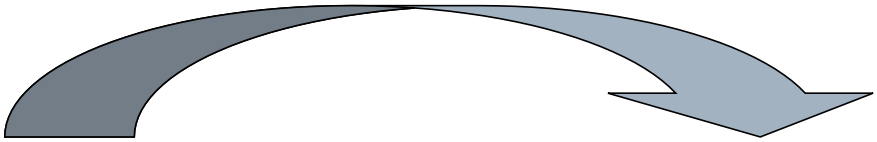

Motor impairment lower limb(s).

Increase of energy cost on the way

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I walk in the neurologically disabled person

- Limitation of abilities
- Reduction in the possibility of participation, especially outside the home
- Depression

What to do ?

- **Rehabilitation programs aimed at aspects of alteration of body function on which a modification in neuro-motor control is still possible**
- **Adapted Physical Activity**

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The journey in the elderly person: changes compared to the path of the young man

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Biomechanical Modifications - 1

- Increase in load transfer times
- Asymmetry in load distribution in relation to the difficulty of the proposed task

Jonsson E et Al. 2007 »

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Biomechanical Modifications - 1

- speed
- stride length
- commuting of the AA.SS.
- rotation of the hips and knees
- of the double support phases

Elble RJ et Al 1991»

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Biomechanical Modifications - 2

- production of propulsive force of the t-t
- **Possible causes:**
  - **Hip flexor contracture**
  - **Plantar flexor weakness**

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Role of a cognitive task during the walk

- The cognitive task in the elderly person who walks could influence, increasing the chances of falling

High criticality in arrest and change of direction

- The phase of the walk in which the person stops and turns to go back:
  - High incidence in causing fracture following a fall

- **Kinematic alterations:**
  1. **staggers as they turn**
  2. **the absence of a pin during rotation**
  3. **the rotation is accompanied by at least 5 or more steps or weight shifts on the center of gravity**
  4. **use 3'' or more to make the turn**

1. Thigpen MT et Al nel 2000

What to do?

- **Prevention is fundamental**
- **Reconstitute a situation as close as possible to the physiological one**
  - **Muscle lengthening at the AAII level in order to avoid shortening especially at the hamstring and ileo-psoas level**
  - **Strengthening of fundamental muscles during walking**
  - **Strengthen postural control in orthostatism**
  - **Strengthening of cardio-respiratory capabilities**
    - **Increased Endurance**
    - **Reduction of fatigue**

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Ergometers as walking training systems

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Treadmill or Tapis Roulant

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Ergometer for walking

- **Definition**
  - **It is a device for measuring the mechanical work performed by certain forces. The same name refers to the equipment used to simulate physical exercise. They are machines that reproduce, more or less faithfully, the bio-mechanics of the sporting gesture."**

Devoto Oli

Ergometer for walking

- **Definition**
  - **Consisting of a tape that runs at a known speed on which the subject under examination walks or runs with the same speed and direction opposite to that of the tape.**

Applications - 1

- Path Analysis
- Precise fatigue assessments
- Performance analysis in order to enhance performance
- Research in sports traumatology

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Applications - 2

- **Pathology and Rehabilitation** *(Hesse and all. 1995)*
  - **Increase in walking speed after re-education with a treadmill and partial relief of body weight**

Applications - 3

- **Recreational-Sports Activities**
  - Increased walking speed
  - Aerobic training
  - Cardio-Respiratory training
  - ……

Advantages in using the Treadmill

1. **Known and fixed internal resistances**
2. **Constant speed with possible precise and known changes**
3. **Possibility of simultaneously monitoring other parameters (cardio-respiratory and metabolic)**
4. **Direct monitoring during performance**
5. **Data stored directly and immediately available**

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Critical Aspects in the use of the Treadmill

- **Artificial path is not the one we implement in reality**
- **Use is not immediate and requires learning for correct and effective use**
- **Predetermined and constant speed**

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Different types of Treadmills

- **Simple**
- **With built-in Evaluation Systems**
- **With the possibility of partially lifting the person performing the exercise, making walking easier as the body weight is reduced during the activity**

Treadmill

- **Components**
  - **Conveyor belt**
  - **Tilting system**
  - **Control unit for regulation**
  - **Display with data**
- **Direct data**
  - **Speed**
  - **Time**
  - **Inclination**
  - **Distance travelled**
  - **Power**

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Treadmill

- **Indirect data**
  - **Calorie Consumption**
- **Usage**
  - **Sporty**
  - **Rehabilitative**
  - **Evaluative**

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Results

The Path: Clinical Aspects

Clinical Research

- **Temporo-spatial parameters**
  - **Increased cadence (Corresponds to the number of steps per unit of time)**
  - **Reduction of support times**
- **Joint kinematics**
  - **Increased maximum hip flexion**
  - **Increased maximum knee flexion**
  - **Increased hip ROM**

Increased degree of maximum hip flexion•

The Path: Clinical Aspects

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  - **Increased maximum knee flexion**
  - **Increased hip ROM**
  - **Increased degree of maximum hip flexion**

PROBLEM OF POST STROKE DECONDITIONING

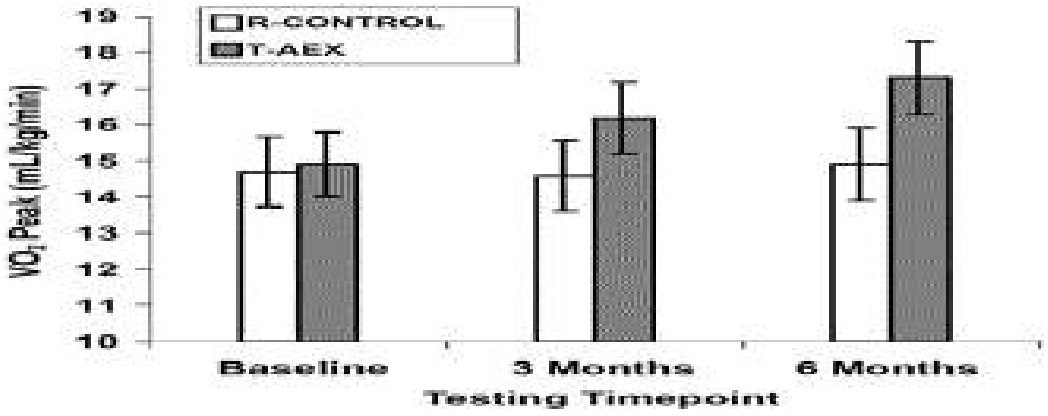


Figure 2.
Effects of 6-month treadmill exercise intervention on peak oxygen consumption (VO_2) after stroke. R-CONTROL = control group, T-AEX = treadmill aerobic exercise group. *Source:* Reprinted with permission from Macko RF, Ivey FM, Forrester LW, Hanley D, Sorkin JD, Katzel LI, Silver KH, Goldberg AP. Treadmill exercise rehabilitation improves ambulatory function and cardiovascular fitness in patients with chronic stroke: A randomized, controlled trial. Stroke. 2005;36(10):2206–11. [PMID: 16151035]

The Path: Clinical Aspects

Physical Activity and Exercise Recommendations for Stroke Survivors

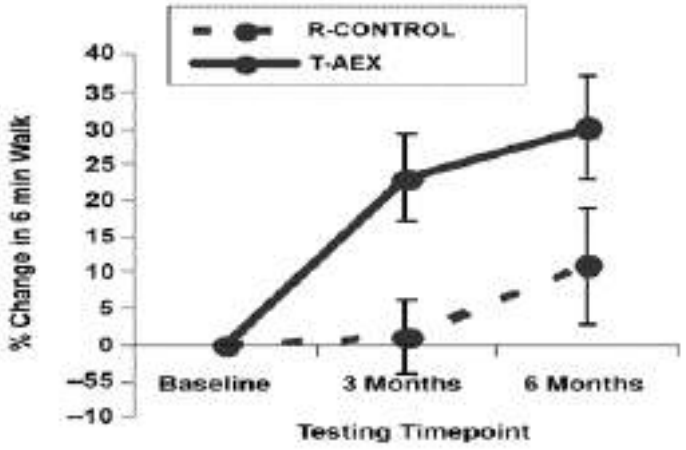


Figure 3.
Effects of 6-month treadmill exercise intervention on 6-minute walk distance after stroke. R-CONTROL = control group, T-AEX = treadmill aerobic exercise group. *Source:* Reprinted with permission from Macko RF, Ivey FM, Forrester LW, Hanley D, Sorkin JD, Katzel LI, Silver KH, Goldberg AP. Treadmill exercise rehabilitation improves ambulatory function and cardiovascular fitness in patients with chronic stroke: A randomized, controlled trial. Stroke. 2005; 36(10): 2206–11. [PMID: 16151035]

The Path: Clinical Aspects

PRACTICAL TEACHINGS

FOR THE

REHABILITATION PHYSIOTHERAPIST

VOL. 2

654/3677

GSI ITALIA
GRUPPISOLIDARIETÀINTERNAZIONALE

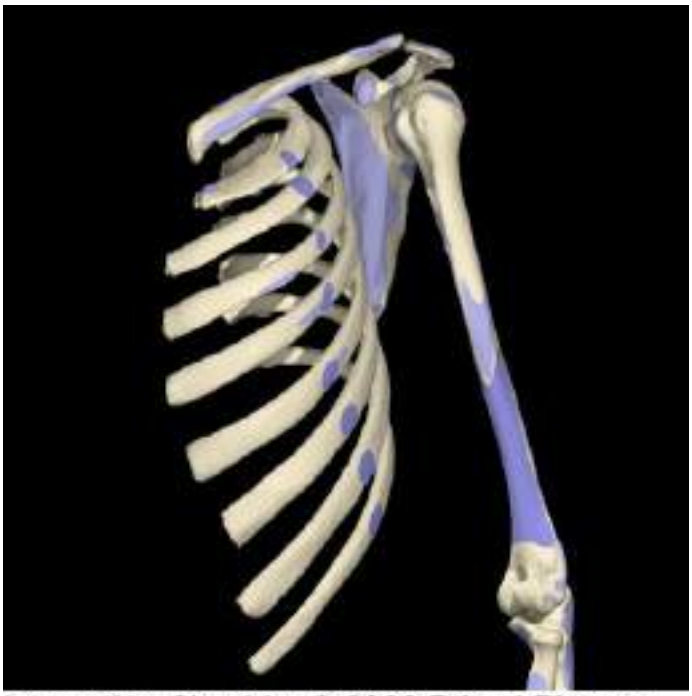
PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

REHABILITATION OF THE TRAUMATIZED SHOULDER 1

SHOULDER

Made up of 4 joints:

- ❑ **Scapular-thoracic**
- ❑ **Sterno-costo-clavicular**
- ❑ **Acromioclavicular**
- ❑ **Glenohumeral**



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GLEN HUMERAL JOINT

- **It is an enarthrosis where a large surface (humeral head) articulates with a small surface (glenoid cavity)**

- **Glenoid labrum: fibrocartilaginous ring inserted around the glenoid cavity, supports the rotation of the humeral head and protects the margin of the glenoid. It provides attachments to the glenohumeral ligaments**

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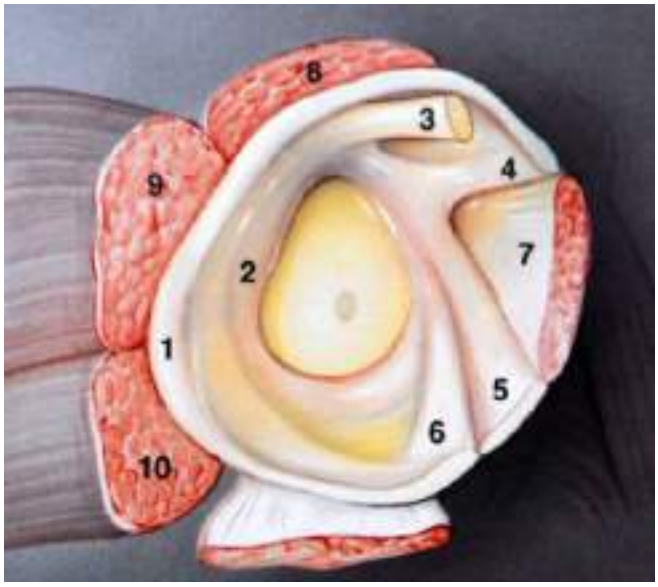
GLEN HUMERAL JOINT

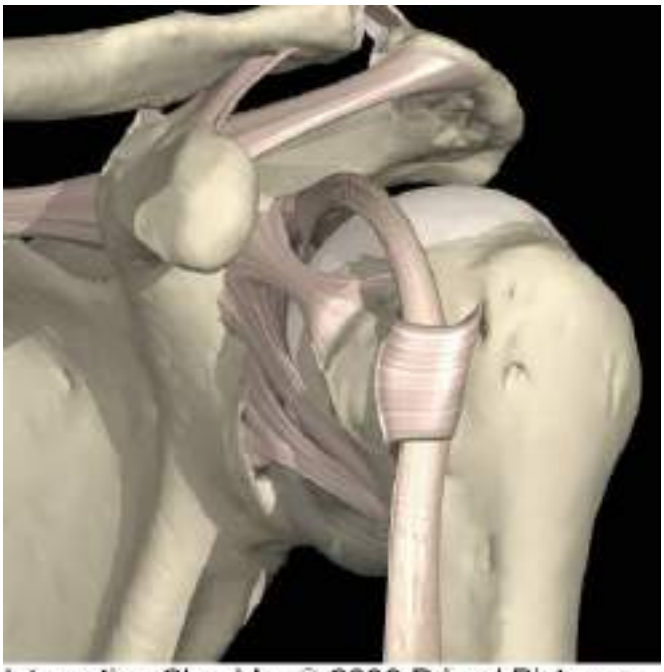
1. Joint capsule
2. Glenoid labrum
3. Tendon of the C. L. of the Biceps
4. Leg. superior glenohumeral
5. Leg. middle glenohumeral
6. Leg. inferior glenohumeral
7. Subscapularis tendon
8. Supraspinatus tendon
9. Subspinatus tendon
10. Tendon of the teres minor



Puddu G. e Cerullo G. – Roma 1988

GLEN HUMERAL JOINT

- Leg. superior glenohumeral
- Leg. middle glenohumeral
- Leg. inferior glenohumeral



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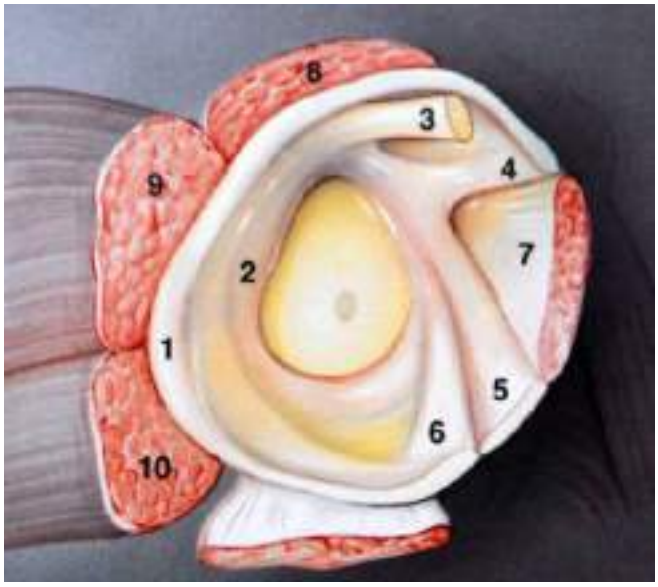
GLEN HUMERAL JOINT

- **Rotator Cuff**
  - **7 - Subscapularis tendon**
  - **8 - Supraspinatus tendon**
  - **9 - Subspinatus tendon**
  - **10 -Tendon of the teres minor**



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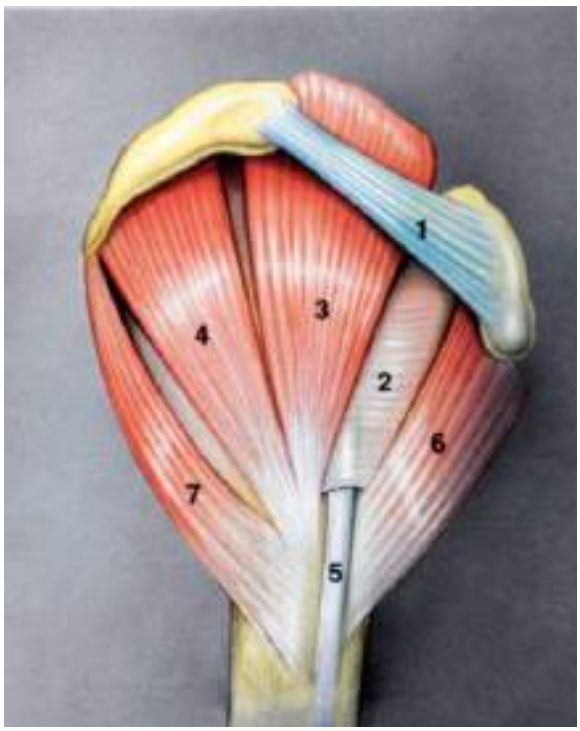
GLEN HUMERAL JOINT

❑ Rotator Cuff

1 Coraco-Acromial Ligament
2 Transverse Humeral Ligament
3 T. Supraspinatus (abd.)
4 T. Infraspinatus (ext. rot. + abductor component)
5 T. Long Head Biceps
6 T. Subscapularis (int. rot. + abductor component with extrarotated humerus)
7 T. Teres minor (rot.est.)



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GLEN HUMERAL JOINT

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Coraco-Acromial Arch:

1 - Coracoid apophysis

2 - Leg. Coracus Acromialis

3 - Acromial process

The sub-acromial space is approximately 10 mm.

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GLEN HUMERAL JOINT

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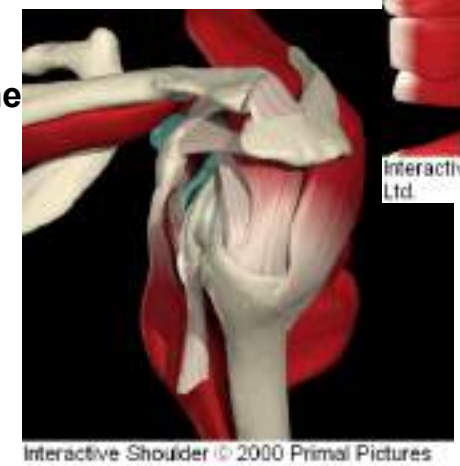

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- **Coraco-Acromial Arch:**
  - **The Supraspinatus passes under the arch and is separated from it by the sub-acromial bursa.**

CLAVARIAN ACROMION JOINT

- Leg. Acromioclavicular
- Leg. Clavicular Coraco
  - Leg. Trapezoid
  - Leg. Conoid

GLEN HUMERAL JOINT

Supraspinatus lesion

- ❑ Degenerative nature
- ❑ Traumatic nature

CLAVARIAN ACROMION JOINT

- **Leg. Acromioclavicular**
  (responsible for horizontal stability)

- **Leg. Clavicular Coraco**
  - **Leg. Trapezoid**
  - **Leg. Conoid**

  (responsible for vertical stability)

VASCULAR-NERVOUS BUNDLE
Brachial plexus

- **Nerves:**
  (dorsal, suprascapular, thoracic, musculocutaneous, axillary, subscapular, thoracodorsal, median, ulnar, cutaneous of the arm)

- **Arteries:**
  (subclavian, circumflex, axillary, thoracoacromial, thoracodorsal, thoracic)

- **Veins:**
  (axillary, subclavian)

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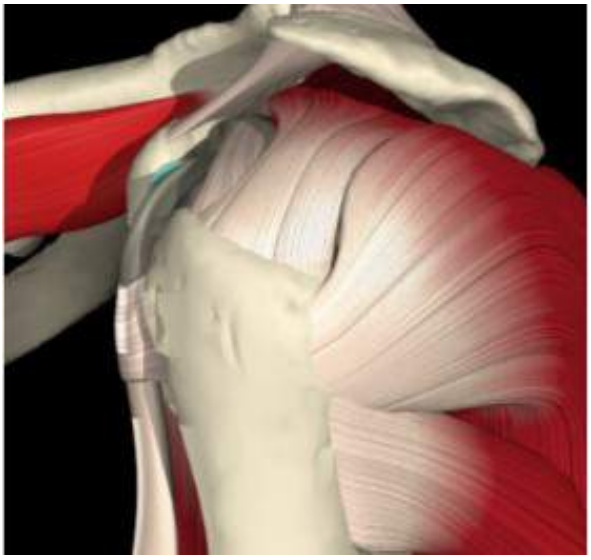
Biomechanics

- Deltoid-Supraspinatus
  - (abducent action with upward translation of the humeral head)
- Subscapularis, Infraspinatus, Teres minor
  - (rotating, compressive and forcing action vs. low)
- Lattiti dorsi, Pectoralis major, Deltoid
  - (primary motors and accelerators)
- Subspinatus and Teres minor
  - (decelerators)



Biomechanics

Force couple:

- **Subscapularis (3) counterbalanced by the Subspinatus (9) and the Teres Minor (10)**

- **Deltoid (2) opposite the Subspinatus (9) and Teres Minor (10)**

BIOMECHANICS

- The cuff is synergistic with other muscles in movements of the head of the humerus
- Stabilizes the head of the humerus in the glenoid

BIOMECHANICS

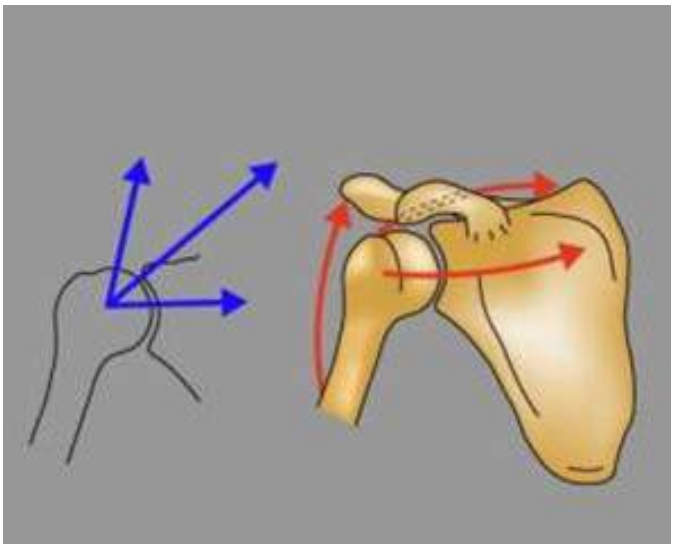
(Supraspinatus: starter of abduction)

- With arm adducted:
  - Supraspinatus has a lever of 25 mm. and the deltoid of 14 mm.
- With the arm abducted at 60°, the deltoid has a lever arm of 32 mm, so as the deltoid is abducted, the lever arm increases and that of the supraspinatus decreases

Biomechanics
Compression and Concavity

- **Functional stability: given by the compression force of the cuff**

- **Passive stability: given by the glenoid**



Biomechanics
Compression and Concavity

The success of functional recovery depends on:
by the right compromise between mobility and stability:
"the shoulder must be loose enough to allow excessive external rotation, but must be stable enough to prevent dislocation of the humeral head"

(pitcher's paradox
Andrews e Wilk)

GLEN HUMERAL JOINT

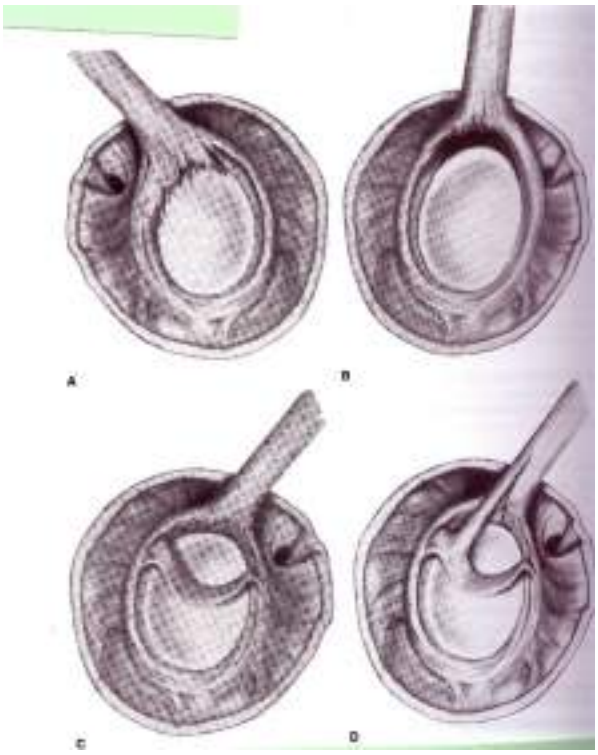
(labrum injury)

4degrees of injury (S.L.A.P.) Superior Labrum Anterior and Posterior:

A SLAP lesion means an injury to the shoulder labrum, which is the ring of cartilage that surrounds and protects the shoulder joint by resting on its scapular portion (glena).

GLEN HUMERAL JOINT

(labrum injury)

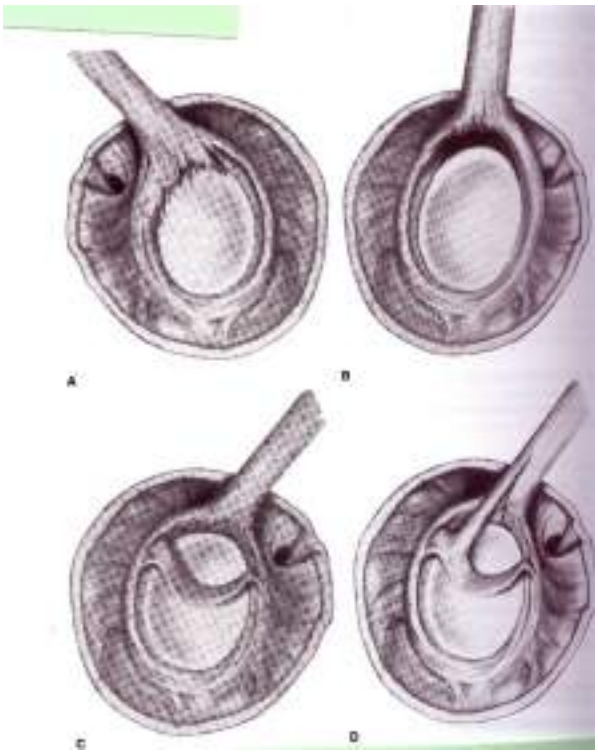


Caused by:

- ❑ **compression trauma**
- ❑ **traction injuries**
- ❑ **degenerative phenomena**

GLEN HUMERAL JOINT

(labrum injury)



Injuries to the superior glenoid labrum (SLAP) can be caused by acute trauma or repetitive movements of the shoulder. An acute SLAP injury can result from:

A car accident.

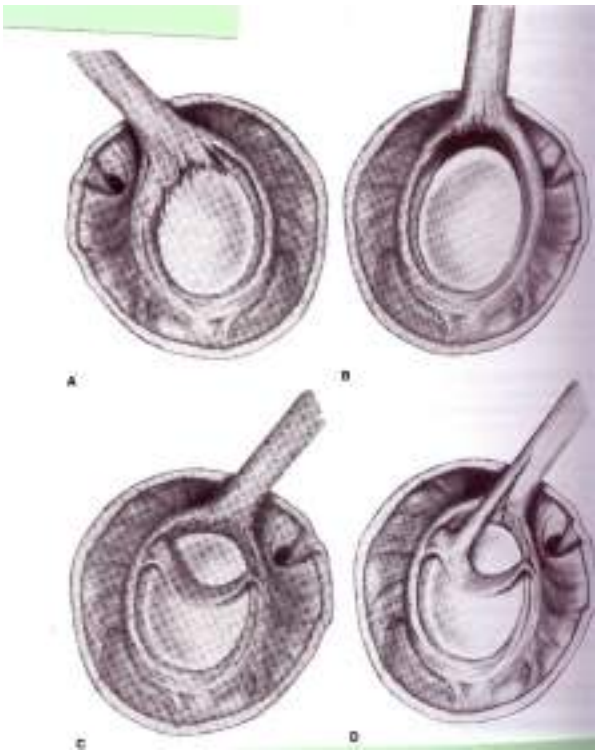
A fall onto an outstretched arm.

A strong pull on the arm, as when trying to pick up a heavy object.

GLEN HUMERAL JOINT

(labrum injury)

People who play overhead sports (i.e. sports that involve throwing in which the arm is brought above and behind the head), such as throwing sports (baseball, tennis, volleyball) or weight lifting, can injure the glenoid labrum due to repetitive movement of the shoulder



Etiopathology of Cuff Lesions

A lesion of the rotator cuff leads to an ascent of the humeral head which can cause an acromial modification thus creating impinchement

Etiopathology of Cuff Lesions

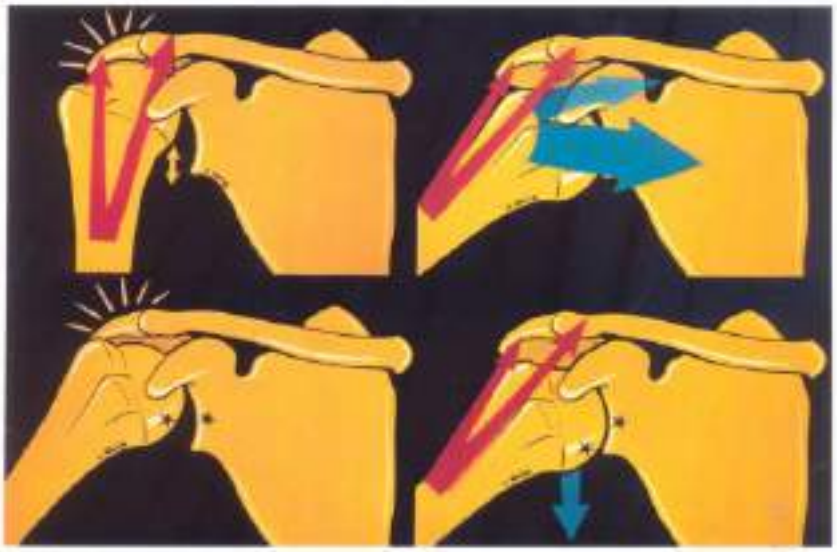


Fig. 2A - La contrazione isolata del deltoide non può che produrre una risalita della testa dell'omero.
B - La cuffia dei rotatori stabilizza la testa omerale nella cavità glenoidea.
C - Lo scivolamento della testa sulla glena produrrebbe un conflitto tra cuffia e acromion.
D - Il centraggio attivo della testa dell'omero.

The Stages of Headphone Conflict

- **Stage 1 (fig 4A):**
  - **Reaction with edema and microhemorrhages in the sub-acromio-deltoid bursa**
    - **It manifests itself with pain after intense activity with the arm in anterior elevation and internal rotation**

The Stages of Headphone Conflict

- **Stage 2 (fig 4B):**
  - **Fibrosis in the sub-acromio-deltoid bursa with tendonitis of the supraspinatus and/or the long head of the biceps**
    - **Pain during prolonged arm elevation (recedes with rest)**
    - **Stage not always completely regressive**

The Stages of Headphone Conflict

- **Stage 3 (fig 4C):**
  - **More serious tendon injuries or degenerative rupture of the cuff or long head of the biceps**
    - **Permanent pain even at night**

The Stages of Headphone Conflict

- **From a theoretical point of view, the three stages manifest themselves at different ages:**
  - **Stage 1 around age 20**
  - **Stage 2 between 30 and 40 years old**
  - **Stage 3 after age 40**

Breakages at the headphone level

(classification on a topographical basis)

- **High or intracapsular tears**
- **Low or extracapsular tears**
  - **Violent pain in anterior position**
  - **Consequent to trauma but, sometimes, also in its absence**
  - **Severe functional impotence**

Breakages at the headphone level

(classification on a topographical basis)

Fig. 5 - Il tendine del capo lungo del bicipite (1) passando al di sotto del legamento omerale trasverso (2), si porta in articolazione. (La freccia indica il confine tra porzione intra ed extrasinoviale del tendine).

Structure of the Tendons

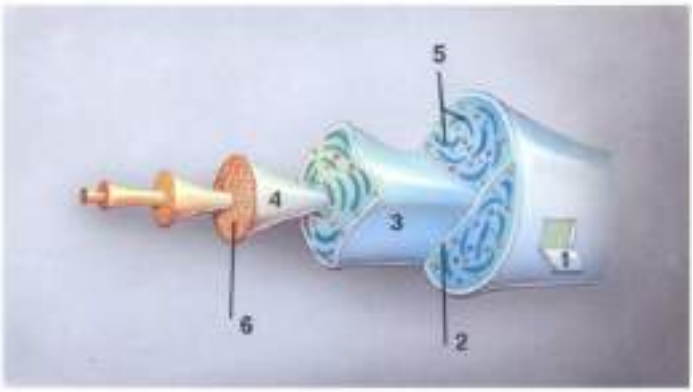


Fig. 1 - Struttura del tendine:
1 Peritenonio
2 Setti endotenonici
3 Fascio di II° ordine
4 Fascio di I° ordine
5 Tenocita
6 Fibre collagene

Structure of the Tendons

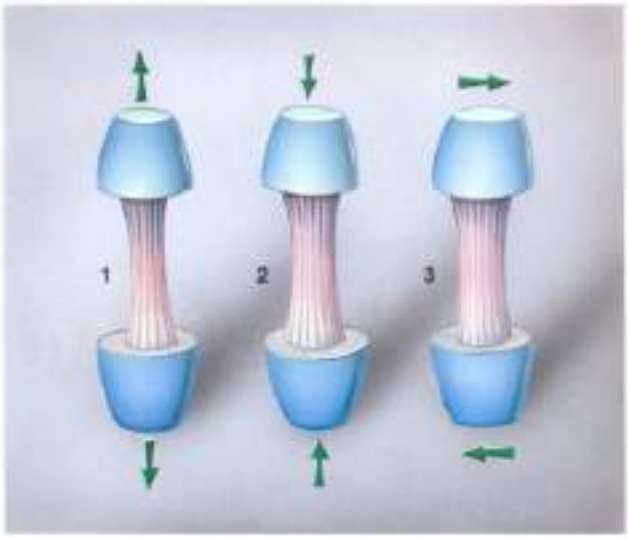


Fig. 2 - I tendini durante l'attività sportiva subiscono forze di 1) stiramento, 2) compressione, 3)torsione, il cui ripetersi continuamente può determinare l'instaurarsi di fenomeni infiammatori.

Pathogenesis of Cuff Lesions

Edema

Fibrosis

Partial lesion

Complete lesion

Types of Cuff Lesions

- 54% of injuries are over 60 years old
- Only 4% are under 40 years old
- 70 to 90% of cuff repairs recur
- 80% positive results only
- with rehabilitation in subjects over 60 years of age

Classification

1st degree (small): < 1 cm.❑

2nd degree (average): < 3 cm.❑

3rd degree (large): 3-5 cm.❑

4th degree (massive): >5 cm.❑

BIOLOGICAL PHASES OF TENDON REPAIR

- First phase: inflammatory
  (first week, presence of inflammatory cells and lymphocytes)
- Second phase: proliferative (2-5 weeks, presence of granulation tissue, fibroblasts and immature type III collagen tissue proliferate)
- Third phase: maturation (5-8 week, collagen transforms from III to I, dense connective tissue is formed, fibroblasts increase and resistance increases)
- Fourth phase: remodeling (up to 26 weeks, with bone tendon integration

TENDON HEALING

- After an injury there is a modification of the collagen tissue:
  - the fibers from type 1 and 3 become type 2 (cartilage collagen, subjected to compression)

CUFF SURGERY

Difficult indication

- ❑ tissue degeneration
- ❑ fatty infiltrations
- ❑ ascent of the humeral head
- ❑ long rehabilitation
- ❑ uncertain results

CUFF SURGERY

Objective:

- ❑ **Pain reduction**
- ❑ **Improved range of motion and functionality (never increased strength)**
- ❑ **Prevention of joint stiffness**

through:

- ❑ **Closure of the defect (injured area)**
- ❑ **Remove the impichement (mechanical friction of the coraco-acromial arch, with acromion-plasty)**

SURGERY FAILURES

Caused by:

- ❑ Operative technique
- ❑ Extent of the lesion
- ❑ Chronic lesion with fatty infiltrations
- ❑ Poor rehabilitation

SURGERY FAILURES

Chronic injury:

it is necessary to operate early because there is a modification of the tendon structure after an injury, with collagen degeneration

SURGERY FAILURES

Apoptosis: (death of degenerated tendon cells) with:

- ❑ **Fatty infiltrations**
- ❑ **Hypotrophism**
- ❑ **Loss of the protein synthesis capacity of the tenocyte**
- ❑ **Fibro-cartilaginous metaplasia with biological inability to heal**

CONSERVATIVE TREATMENT

Objectives:

- ❑ Pain control
- ❑ ROM recovery
- ❑ Muscle strengthening
- ❑ Maintenance of recovery

CONSERVATIVE TREATMENT

Influenced by biological factors:

- ❑ Lifestyles (smoking)
- ❑ Use of NSAIDs and/or anabolics
- ❑ Systemic diseases
- ❑ Activity

SMOKE

- ❑ Reduces collagen maturation, delaying tendon healing
- ❑ Inhibits vascularization after a suture

ANABOLICS AND STEROIDS

- Direct action: weakening of the mechanical properties of the tendon
- Indirect action: increase in strength in a hypertrophic muscle in a weakened tendon

METABOLIC DISEASES

- ❑ **Diabetes**
- ❑ **Rheumatoid arthritis**

n.b.: cortisone infiltrations act as disintegrants of collagen fibres

Conclusions

- **Cuff injuries, whether traumatic or degenerative, can cause pain and functional limitations**
- **Conservative treatment where possible is preferable**
- **In the presence of obvious and important ruptures that prevent the tendon parts from sliding correctly, surgical treatment is mostly inevitable**

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

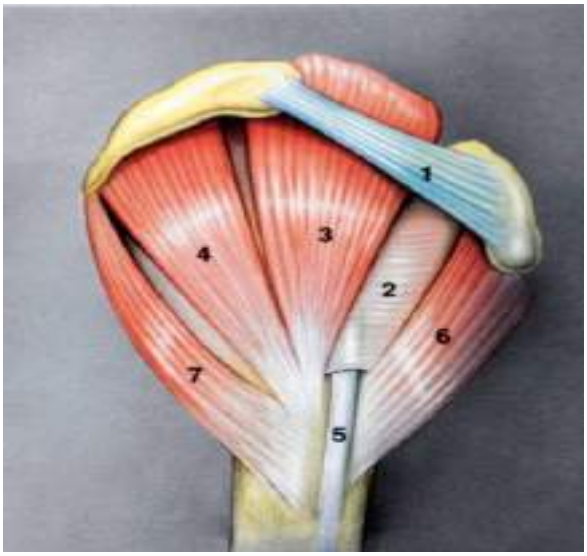
REHABILITATION OF THE TRAUMATIZED SHOULDER 2

AT A PRACTICAL LEVEL ROTATOR CUFF REHABILITATION IS:

It is a problematic rehabilitation and inextricably linked to surgery but above all to surgical indications which must be very rigid and selective. (tissue degeneration, adipose infiltration, rising humeral head, systemic diseases, etc.)

It is a pathology in young people often linked to sporting or traumatic activity, while in the over 60s it is often of a chronic nature, so rehabilitation takes on the characteristics of a true conservative aid where the patient's expectations must however be realistically scaled down.

RESIZING EXPECTATIONS



Results:

- **Conservative treatment:**
  - **Only approximately 60%-70% of cuff tears treated conservatively give good results**
- **Surgical treatment:**
  - **In approximately 45% - 55% of cuff repairs recur**

GUIDELINES AFTER SURGERY

- **PHASE 1: immediate post-op: reduction of edema and inflammation, and cautious passive joint mobilization**
- **PHASE 2: neuro-muscular control and joint mobilization at the limits of ROM, active "muscle awakening"**
- **PHASE 3: advanced muscle strengthening**
- **PHASE 4: return to pre-trauma sporting and work activities**

GUIDELINES IN CASE OF CONSERVATIVE TREATMENT

- **PHASE 1: functional saving. Passive recovery and maintenance of R.O.M. with maximum respect for the pain threshold**
- **PHASE 2: muscle awakening through active/passive recovery**
- **PHASE 3: intensification of work and maintenance of the results obtained through a fair compromise between strength, stability and mobility**
- **PHASE 4: return to daily activities**

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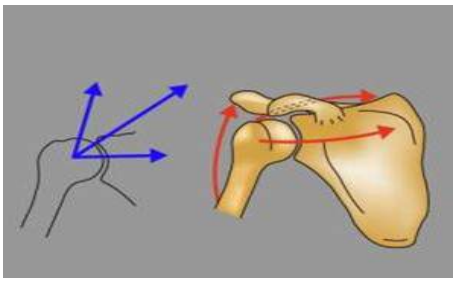
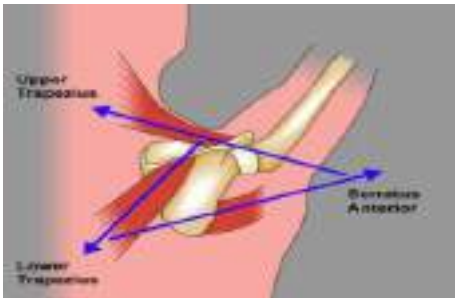
FUNCTIONAL RECOVERY OF THE SHOULDER (IN 4 STEPS)



1. Rotator cuff recovery

- for the functional stability of the glenohumeral given by the compressive forces



2. Scapula recovery

- stable component of the shoulder that provides retraction-protraction

FUNCTIONAL RECOVERY OF THE SHOULDER (IN 4 STEPS)

3. Recovery of the humeral head depressors

- lowering of the head of the humerus creates an increase in the sub-acromial space with a decrease in impinchement

4. Neuro-muscular control (proprioceptivity)

- response of the efferent motor neuron to afferent sensory information

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PRACTICAL TEACHINGS FOR THE
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ROTATOR CUFF RECOVERY

It is necessary to talk about global recovery in internal and external rotation as some muscles can make up for injured others, through synergistic adaptations

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

ROTATOR CUFF RECOVERY

In the event of a lesion of the infraspinatus, the teres minor can replace it as they have a different innervation

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

ROTATOR CUFF RECOVERY

By preserving the pair of forces of the infraspinatus and subscapularis it is possible to have good stabilization of the humeral head even in the presence of a lesion of the supraspinatus.

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

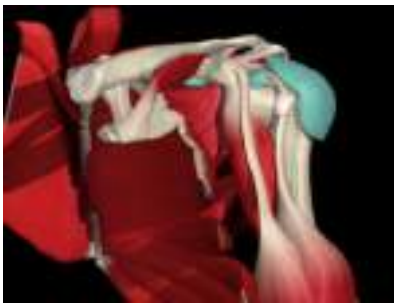
ROTATOR CUFF RECOVERY

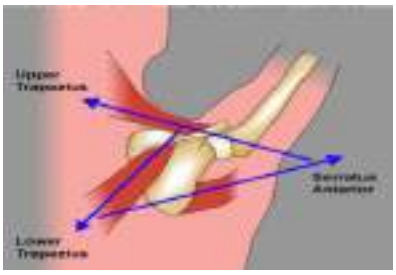
Re-educational activity on all possible compensations

Always paying maximum attention to negative compensation

(e.g. shoulder elevation)

RECOVERY OF THE STABILIZERS OF THE SCAPULA





Scapula activators:

- **Serrated Anterior:**

  - pushes the scapula anteriorly on the rib cage (anteposition or protraction) and stabilizes it in elevation

  - pairs with the trapezius and the levator scapulae for rotation-elevation vs. top of the scapula

RECOVERY OF THE STABILIZERS OF THE SCAPULA

Scapula activators:

- **Rhomboid:**
  - **stabilizes the scapula during abduction and elevation of the humerus and allows posterior rotation of the scapula towards the spine (retraction)**

RECOVERY OF HUMERUS DEPRESSORS

- Great Pectoral
- Grand Dorsal
- Large Round

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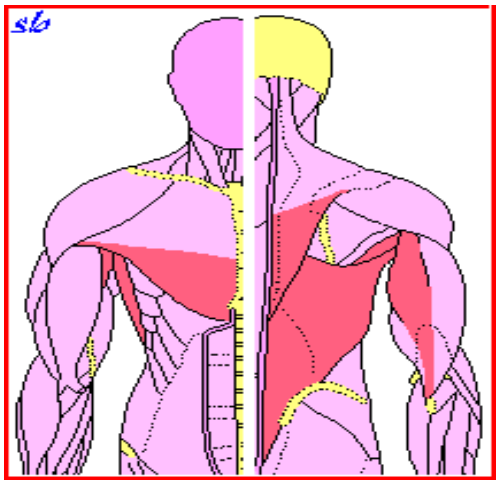
RECOVERY OF HUMERUS DEPRESSORS



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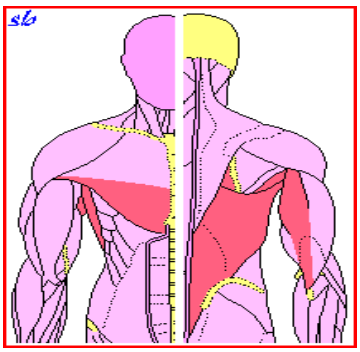
RECOVERY OF HUMERUS DEPRESSORS



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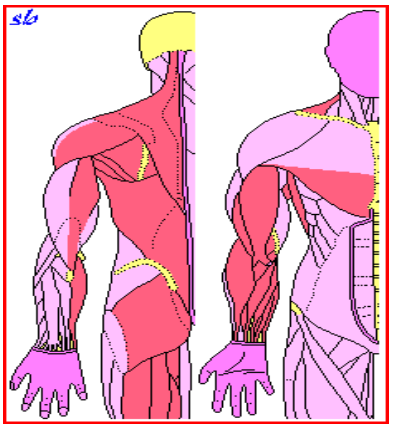
PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

RECOVERY OF HUMERUS DEPRESSORS



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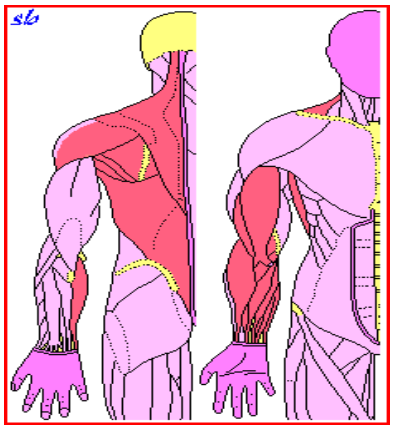
RECOVERY OF HUMERUS DEPRESSORS



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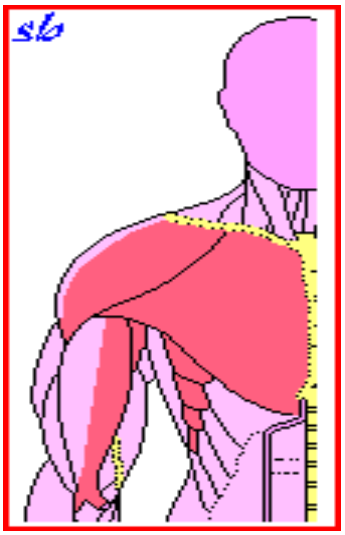
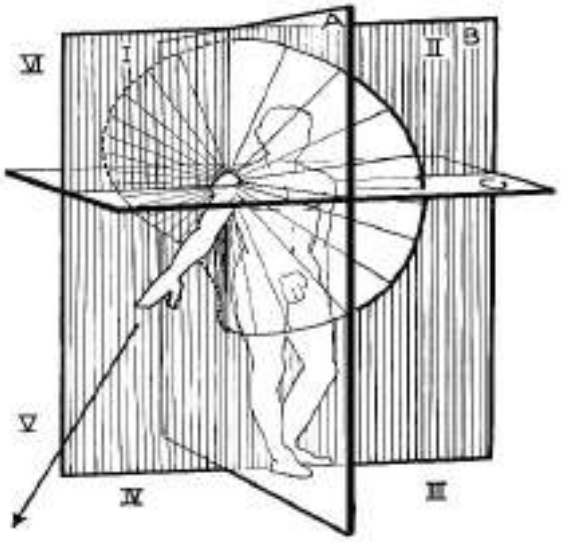
RECOVERY OF HUMERUS DEPRESSORS



PROPRIOCEPTIVE RECOVERY

- **There are mechanoreceptors in the capsule, in the glenoid labrum and in the tendons: after a trauma or surgery the receptor apparatus undergoes alterations in neuromuscular control (disorganization of the response). Through exercises that physiologically reproduce the movements of the shoulder in the 3 planes (frontal, sagittal and transverse) we try to restore the arthrokinetic sense**



Some examples of exercises

- Stretching
- Passive Activity
- Isometric activity
- Strengthening with weights

Some examples of exercises

- **Stretching**
  - **Set of exercises aimed at gently stretching and relaxing the muscles**
  - **Muscles, tendons, bones and joints are involved and largely consist of muscle lengthening movements**

Some examples of exercises

- **Passive activity**
  - **It consists of a mobilization of one or more joints without the active participation of the person and therefore without muscle recruitment actions**

Some examples of exercises

- **Isometric Activity**
  - **it is a type of muscle contraction that creates tension in the muscle without causing it to shorten (concentric work) or lengthen (eccentric work)**
- **Concentric contraction**
  - **Muscle tension is developed to accelerate a lever arm. As the muscle contracts concentrically, its fibers shorten and the origin and insertion are tensed simultaneously.**
- **Eccentric contraction**
  - **Muscle tension is developed to decelerate a lever arm. As the muscle contracts eccentrically its fibers lengthen and the origin and insertion are stretched separately.**

Some examples of exercises

- **Strengthening with Weights**
  - **It is a progressive restoration of the muscular strength and power of the shoulder district in the terminal phase of recovery**

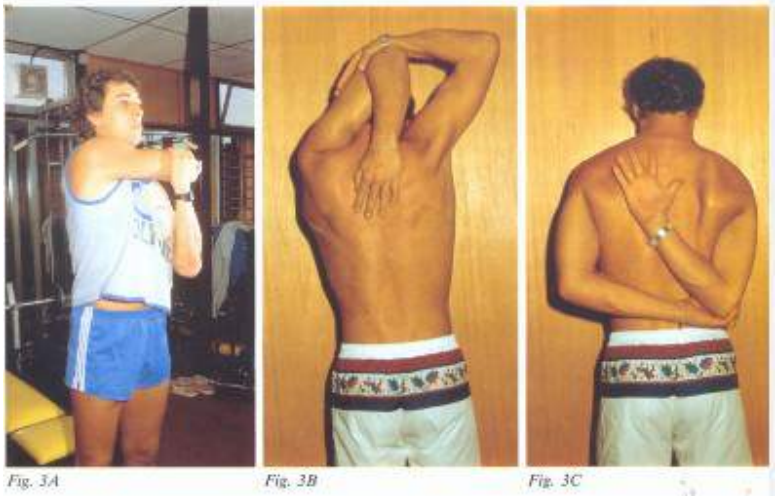


Fig. 3A Fig. 3B Fig. 3C

Stretching

A: Post distension. of the headset
B: Lower distension of the headset
C: Upper distension of the headset

Fig. 3D

Fig. 3E

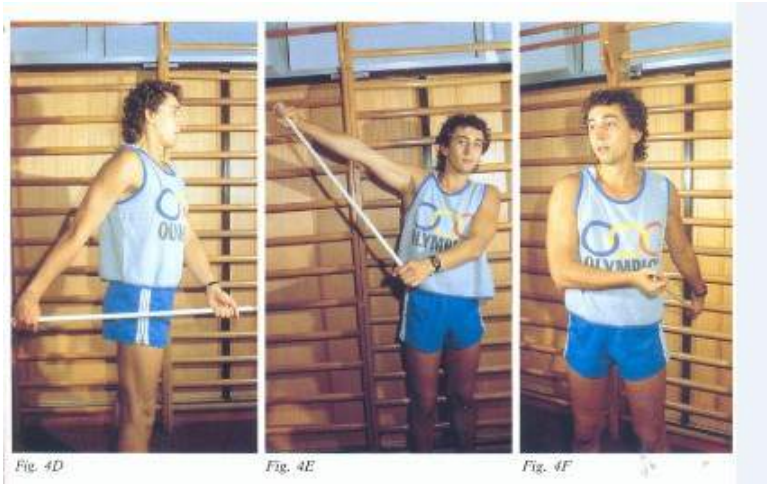
Stretching

D: anterior distention of the cuff
E: 90° distention of the cuff

Fig. 4A Fig. 4B Fig. 4C

Passive Activity

A: pendulum exercises
B: ventral climbing
C: lateral climbing



Passive Activity

D: flexion-extension exercises
E: abduction
F: intra-extra rotation

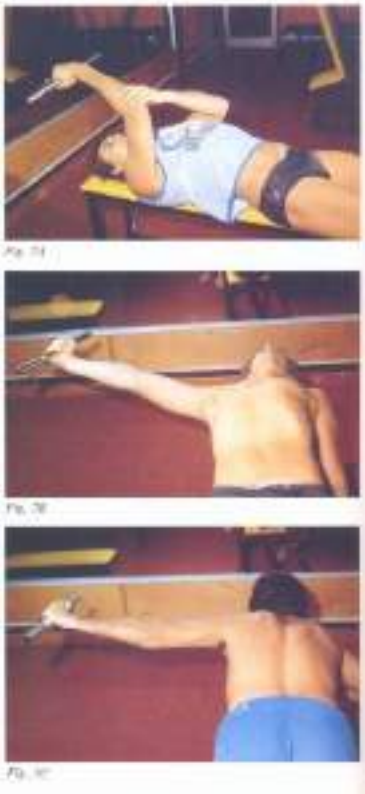
Fig. 4G Fig. 4H

Passive Activity

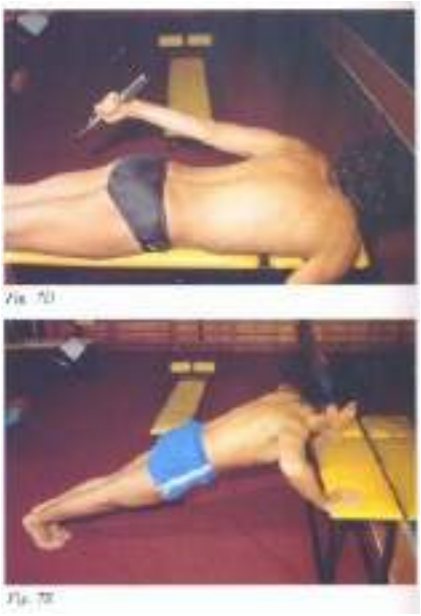
G: horizontal ab-adduction exercises in the supine position
H: flexion-extension in the supine position

Fig. 5A Fig. 5B Fig. 5C

Strengthening with isometric activity
A: Deltoid
B: Flexors
C: Extenders



Strengthening with weights:
A: Triceps
B: Great Pectoral
C: Rhomboid



Strengthening with weights:
D: Trapeze
E: Grand Dorsal

Fig. 6A

Fig. 6B

Strengthening with weights:
A: Deltoid
B: Flexors

Fig. 6D

Fig. 6E

Strengthening with weights:
D:Trapeze
E: Grand Dorsal

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Strengthening with weights:
C: Extenders
F: Intrawheelers

Puddu G. e Cerullo G. – Roma 1988

CONCLUSIONS

- **It is a long and complex recovery**
- **Great patient motivation is needed**
- **Importance of constant personalization of treatment**
- **A continuous exchange of information between Doctor and Rehabilitator is also necessary to optimize results**

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REHABILITATION PHYSIOTHERAPIST

The rehabilitation approach to osteoporosisosteoporosis

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Osteoporosis is a skeletal disease characterized by a decrease in bone mass and a structural reorganization of the bone tissue.

Quantitative and qualitative abnormalities of bone tissue compromise resistance and increase the risk of fracture.

The reduction of bone mass has a multifactorial genesis

Primary osteoporosis:

- **Type 1 osteoporosis Post-menopausal osteoporosis**
- **Type 2 osteoporosis Senile osteoporosis**

District secondary osteoporosis:

- **Posttraumatic**
- **Not to be used**
- **Algoneurodystrophies**

Systemic secondary osteoporosis

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CIDH-2

International Classification of Impairments, Activities, and Participation

Introductory Slide Set with Notes

© WHO, Geneve 1997

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Sequence of Concepts
ICIDH 1980

Disease or disorder → **Impairments** ▸ **Disabilities** ▸ **Handicaps**

Interaction of Concepts
19971997

Health Condition
(disorder/disease)

Impairment ◄ ► **Activities** ◄ ► **Participation**
(function/structure) **(Activity Limitation)** **(Participation Restriction)**

Contextual Factors

A Environmental

B Personal

Impairments

- **Ache**
- **Joint limitation**
- **Osteo-articular deformities**
- **Muscle hypotrophy-weakness**

Skill Reductions

- **Difficulty performing postural steps**
- **Balance disorders**
- **Gait alterations•**

Participation Restriction

- **Reduction of autonomy both in the domestic and social spheres**

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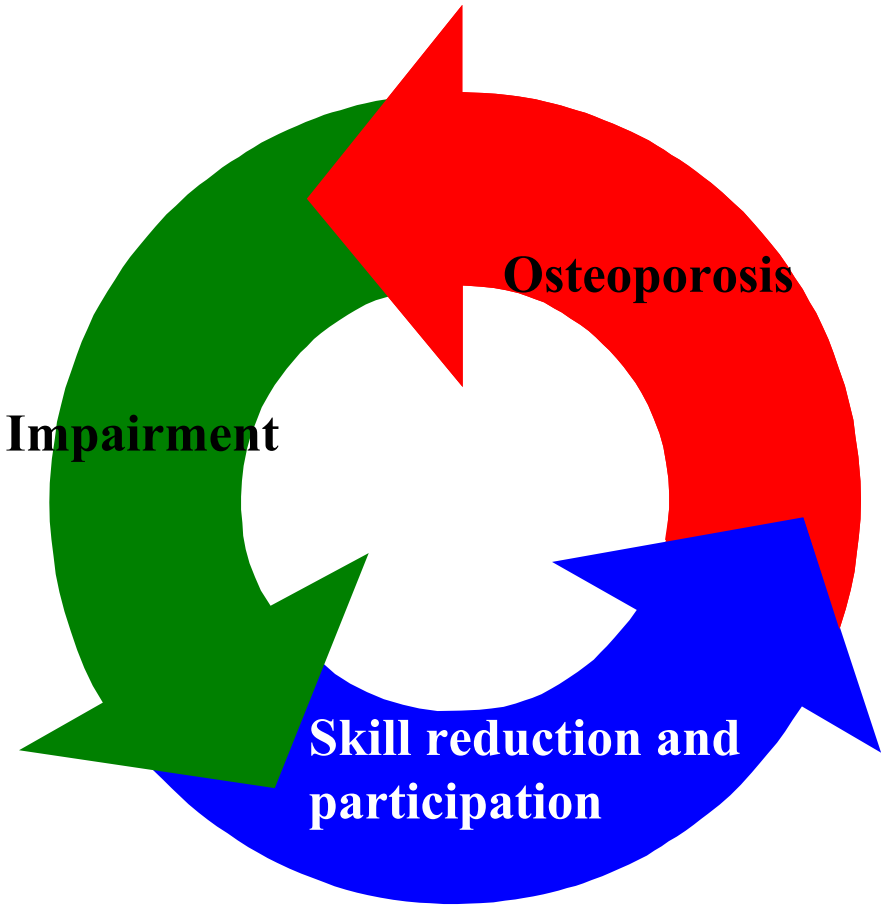
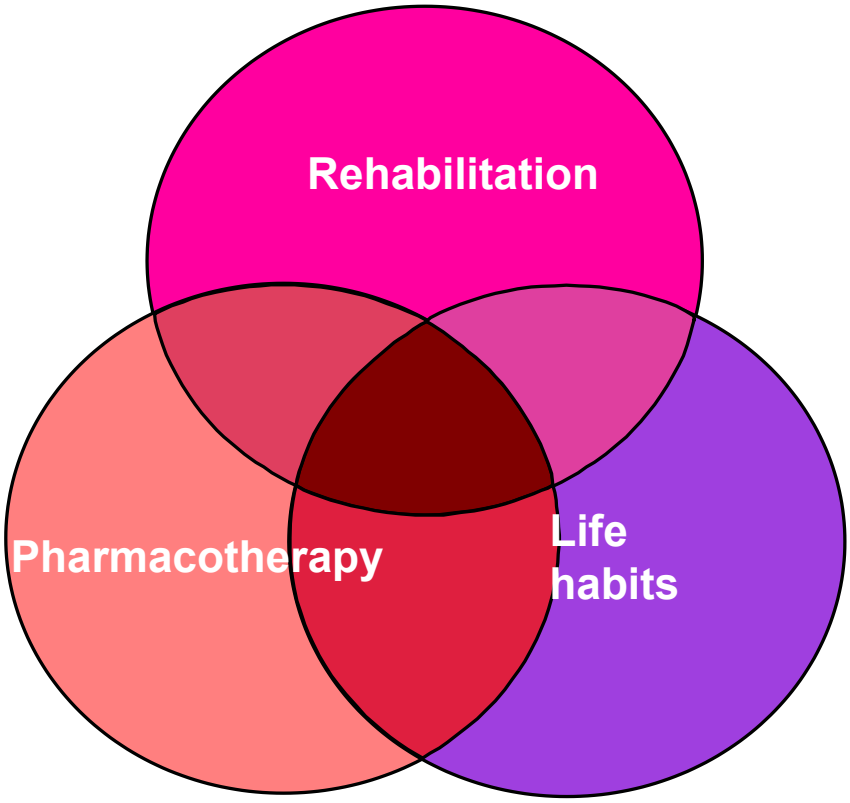


Therapeutic Synergy



Rehabilitation objectives in osteoporosis

- **Primary objective:**
  Increase in bone mass

- **Secondary objective:**
  Prevention of fractures

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INCREASE IN BONE MASS

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Bone tissue adapts to variations in mechanical stress

The reduction of stresses causes osteopenia:

- **therapeutic district immobilization (Braun 1985)**

- **bed rest in both patients and healthy volunteers (Le Blanc 1990)**

- **spaceflight components (Rambaut 1985)**

The adaptation of the bone to mechanical stress is local (site-specific) and affects only the bones subjected to load.

- **The bone mass of the upper limb. of athletes who practice asymmetric sports is greater on the dominant side (Haapsalo 1994)**

- **Unilateral training of the radius and femur in menopausal women resulted in a unilateral bone mass gain of these bones (Kerr 1996)**

- **The bone density of the skull is not affected by hypogravity or by weight lifting or gymnastics (Bass 1998; Karlsson 1995)**

The compressive stresses due to the force of gravity and the tensile stresses produced by the muscular force are powerful osteogenic stimuli.

Athletes who practice weight-bearing sports such as weightlifting and gymnasts have higher bone density than swimmers who exercise in an antigravity environment (Taaffe 1995)

Intense muscle activity compensates for hypogravity in water.

Water polo players have greater bone density in the spine and femur (Block 1994)

The compressive and tensile stresses add their osteogenic action

The bone density of the upper end of the femur is high in both the neck and the greater trochanter in athletes who practice high-impact weight-bearing sports (Mayoux-Benhamou 1998)

The bone response depends on the characteristics of physical activity

Loads applied intermittently are more osteogenic than continuous loads (Rubin 1985)

In humans, endurance sports appear to be less osteogenic than those that require short-term intense efforts (weight lifters vs. marathon runners) (Heinonen 1993)

The bone gain obtained with regular sporting activity is reduced after its cessation.

Gymnasts maintain a bone gain of 0.5-1.5 s.d. on average 8 years after finishing gymnastics . at the level of the load-bearing bones when compared to a sample population (Bass 1998)

The lumbar bone gain obtained with a 2-year weight-bearing activity program disappears 13 months after completion (Dalsky 1988)

The bone benefit of several years of running is canceled out in two years of sedentary lifestyle (Fries 1998)

Mechanisms of action of aerobic activity on increasing bone mass

- **The increase in perfusion improves the capillary microcirculation at the bone level (White 1984)**

- **The better oxygenation guarantees greater cellular functionality (White 1984)**

- **District venous hyperpressure favored by muscle contraction can have an effect favoring osteogenesis (Tayon 1980)**

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FRACTURE PREVENTION

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Factors favoring falls

Intrinsic factors	Extrinsic factors
Auditory	Architectural barriers
Visual	Clothing
Neurological	
Musculoskeletal	
Iatrogenic	
From abuse of alcoholic substances	

(Aloia 1993)

Practical operational conclusions

- **Muscle strength and gravity are determining elements**

- **A district action and direct mechanical stimulation on the bone segments of both the force of gravity and the force of muscle are indicated**

- **Maintaining muscle trophism is important**

- **It is important to alternate moments of intense anaerobic work and aerobic activities**

- **Neuromuscular potential must be developed globally by increasing motor strategies**

Rehabilitation care

- **Remote and immediate pathological history**
- **Drug history**
- **Muscle and joint balance**
- **Balance assessment**

•Romberg test
•Tinetti scale
•Walking in tandem
•Single-legged standing position

Gait evaluation

- Tinetti scale
- Garrett scale
- Instrumental gait analysis

Evaluation of cognitive functions

Disability assessment

- Barthel Index
- FIM

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Proposed therapeutic exercises

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Body awareness while supine and standing

- **The subject is invited with his eyes closed to perceive his own body with the help of small contractions and relaxation of the muscles of the various parts of the body**

- **Supine relaxation exercises with awareness of breathing acts**

Muscle strengthening exercises for the abdominal muscles

- Flexion of the trunk with the lower limbs flexed, lifting only the upper back section

- Flexion of the thighs on the pelvis

Exercises to strengthen the paravertebral muscles

- The subject is prone with a pillow under his abdomen and must raise his trunk while keeping his hands behind his head

- In a quadrupedal position, extend the upper right limb and the lower left limb and repeat on the other side

- "Bridges" with and without hand support

Bridge with support

Bridge without support

Strengthening exercises for the upper limb muscles

- **In pairs, holding a stick and trying to rotate it in the opposite direction**

- **Individually with the use of 1-2 kg dumbbells by pronating the wrist, flexing or extending it**

- **Strengthening exercises for the biceps, triceps and pectorals using dumbbells**

Compression exercise for the upper limbs

❖ **In front of a wall at a distance of about 50 cm. lean forward, letting yourself fall and slowing down the run with your hands and then push yourself backwards, extending your arms up to the starting position**

❖ **The same exercise is proposed on the mat starting from the kneeling position**

Traction exercises for the upper limbs

❖ **At the back, the subject must hold the rung and allow himself to be supported by his hands, trying to move his buttocks closer to the ground.**

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Compression exercises for the lower limbs

- **Flexion of the hips and knees initially with support of the upper limbs and then free (can also be performed with the back leaning against the wall)**

- **Jump on the spot**

- **Ascent and descent of a step (step)**

Balance and motor coordination exercises

- **Exercises on oscillating boards in various postures, with and without support on the upper limbs, with eyes open and then closed**

- **Balance and trunk control exercises on the Bobath ball**

- **Walking in tandem (eyes open and closed)**

- **Walk or run in slalom**

- **Use of the medicine ball while walking or on the swinging boards**

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Stretching

Suitable for the warm-up and cool-down phases and alternated with strengthening exercises

- **Triceps**
- **Quadriceps**
- **Hamstrings**
- **Ileo-psoas**
- **Paravertebrals**

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Stretching

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Stretching

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Aerobic motor activities

Exercise involving large muscle groups in dynamic movements for periods of 20 minutes or more, 3 or more times per week, at an intensity of 60-80% of HR. max (American College of Sports Medicine 1990)

Walk at a brisk pace or run on a treadmill

Step

Step machine

Fall prevention

- **Correction of sensory deficits**
- **Reduction or abolition of the intake of sedatives and alcohol**
- **Use of aids (sticks, rollators)**
- **Use of appropriate clothing and footwear**
- **Modification of the home environment**
- **Maintenance of adequate motor strategies with age-appropriate balance and motor coordination exercises**

(Aloia 1993)

Program

- **Taking charge of evaluation, treatment setting and monitoring**
- **Personalized treatments when necessary**
- **Involvement of local structures**
  - **Gyms (gymnastics for the elderly)**
  - **Social centers (gymnastics, play activities, dance, etc.)**
- **Motor activity at home**

CONCLUSIONS

Osteoporosis is a morbid condition that has both clinical and social consequences and must therefore be addressed with a multidisciplinary approach.

An integrated team of specialists is needed (internist, orthopaedist, physiatrist, physiotherapist, physical educators, etc.) committed to reducing painful symptoms, improving mobility, thus avoiding the establishment of the vicious cycle osteoporosis-reduction of mobility-osteoporosis.

The team has the task of promoting the inclusion of the person with osteoporosis in a social context capable of stimulating motor activity, improving socialization and consequently the quality of life.

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REHABILITATION PHYSIOTHERAPIST

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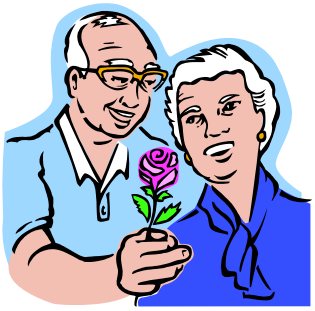
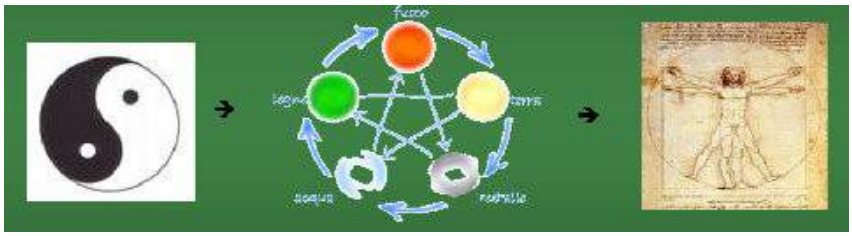
&
PARKINSON





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Falls and related injuries in the elderly are considered among the **most problems of public health** and often the **risk of falling** is strongly associated **with previous falls**.

Fall survivors experience a **reduction** in activities of daily living (**ADL**) compared with non-fallers.

Fear of falls might be a **protective response** preventing people from undertaking activities with a **high risk of potential injury**

Parkinson disease (PD) **is a progressive neurodegenerative movement disorders** that affects more than **1 million people in the United States** causing **falling and hip fractures** so costing approximately **192 Million US dollars**.

Parkinson disease (PD) is an **important intrinsec factor risk** of falls and is characterized by a **progressive neurodegenerative movement disorder** that induce a **worsening** of Quality of Life (**QOL**).

Clinical and neurobiological aspects of Parkinson's
Stacy and coll.
Parkinson's disease: Neurobehavioural aspects 1992 (pp. 10-13)

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I) Intellective level

Decline
Thought disturbs
Depression
Motivation

II) Daly Life

Speech
Salivation
Deglution
Writing
Cutting the food
Dressing
Hygiene
Turning in the bed
Falls
Freezing
Gait
Tremor Sensitivity disturbs

III) Exam of motion

Speech
mimic
Tremor at rest
Tremor in action
Rigidity
Fingers movement
Movement of the hand
Alternate queeck movements
Agility of the legs
Get up from the chair Posture
Gait
Postural stability
BradyKinesia and hypoKinesia

UPDRS

IV) Later Complications

***A**. Diskinesias*
***B.** Fluctuations*
***C**. Other complications*

UPDRS

La scala consente una **valutazione di tipo numerico** e di seguire **l'evolversi della malattia pre e post trattamento**;
4 sezioni

147 grave compromissione

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Modified stadiation of HOEN E YAHR (1987)

0	anyone sign of disease
1	Monolateral disease
1.5	Monolateral disease with axial involvement
2.	Bilateral diisease without deambulation impairment
2.5	Bilateral disease with "pull test" recovery
3	**Low-moderate bilateral disease; low postural instability physical indipendence**
4	Severe disability; available deambulation and standing byself
5	Constrant at weelchair or bed without help

La MdP viene classificata in **5 stadi secondo (Hoehn Yahr) 1967 modificata nel 1987**

lo **stadio 3** identifica: **iniziali disturbi posturali e dell'equilibrio**, **instabilità** del paziente quando si **gira o quando viene spinto dalla posizione di equilibrio in ortostatismo** e il paziente conserva una certa **autonomia ed una vita indipendente**

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Terapia farmacologica 1° intervento

Although **pharmacological intervention can slow the progression of this disease,** medication tend to **become ineffective** over a period of time and appropriate **Physical exercise intervention** may be necessary **troughout the stages of this disease**

Abbinamento di un appropriato intervento di altro tipo

On-Off effect

Fluctuations on perfomances
Weakness and impairment of movement during **period Off**
Wearing off
successive progressive benefit shortening

Multidimensional exercise for people with Parkinson's disease: A case report.
Kluding and coll.
Physiotherapy Theory and Practice, 22 (3): 153-162, 2006

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Postural instabilty is an **Hallmark sign** of Parkinson Disease due to
-**Rigidity**
-**Bradykinesia**

Instabilità posturale
Paura di cadere
L'esercizio ↓ mortalità
Migliora la velocità del passo

Postural instabiliy → **↑ Fear of Falls and relative injuries**

Physical activity may slow the progression of secondary impairments and **functional limitations** as well as **reduce mortality rates**.
PwPD (early-middle) who **regularly exercises** were **found to induce an gait velocity improvement**

Tai Chi based exercise for the older adults with Parkinson disease: a pilot program evaluation
Li P. Harmer et al.
Journal of aging and physical activity" 2007; 13; 23-27

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L'esercizio aerobico

Combinare es. propriocettivo con Es. carico

Aerobic exercise training may not only **improve cardiovascular fitness** but also may **increase movement time** in people with PD. **Combination** of **balance training** with **resistance training** is effective at **increasing both muscle strength and balance** and is **better than balance training alone**.
Combined exercise decreases **sway during destabilizating conditions on the Equitest**

Aerobic exercise intervention improves aerobic capacity and movement initiation in Parkinson's disease patients.
Bergen at al.
NeuroRehabilitation 17; 161-168; 2002

1) **Vision** remains **important** in maintaining **postural control** while **conduction and central integration become less efficient with age**

2) Exercise would be accompanied **by visual cue** (observation of movements by means of **2 mirrors**).

Among the strategies based on **motor programs** needed and **useful to prevent a phenomenon, with devastating clinical and social consequences in terms of individual and collective costs** such as **falls in the elderly people**, there is an **old and innovative technique** (so called Tai Chi Chuan (TCC)) whose support, as **additional and complementary tools to counteract the amount of falls**, is nowdays **object of widespread debate in the scientific world**

Visual control of balance in cerebellar and parkinsonian syndromes.-
A.M. Bronstein et all
Brain 1990, Vol.113, No 3, pp 767-779

TAI CHI CHUAN e PARKINSON

Tai Chi Chuan (TCC), **early known and commonly described as a traditional chinese martial art**, useful to increase in **healthy people** speed of **movement, strength, coordination, balance**, it over time developed in a **body mind exercise a**ble to reduce **anxiety, improve mood, quality of sleep and self confidence**.

Arte Marziale
Arte psicomotoria
Trasferimenti carichi
Soggetti sani anziani

Tai Chi for stroke rehabilitation: a focused review
Au-Yeung SS
Am J Phys Med Rehabil. 2012 Dec;91(12):1091

Graceful technique
Weight shifting foot to foot
Weight bearing
Breathing control
1970-2000
Healty people
(73-93 Years)
O
Physical effects
Psychical effects
Social effects

BENEFITS

TAI CHI CHUAN e PARKINSON

Physical

Arch Phys Med Rehabil. 2004 Jan;85(1):129-37.

Tai Chi improves standing balance control under reduced or conflicting sensory conditions.

Tsang WW, Wong VS, Fu SN, Hui-Chan CW.
Department of Rehabilitation Sciences, The Hong Kong Polytechnic University, Kowloon.

Abstract

OBJECTIVE: To investigate the effects of long-term Tai Chi practice on balance control when healthy elderly Tai Chi practitioners stood under reduced or conflicting somatosensory, visual, and vestibular conditions, as compared with healthy elderly non-Tai Chi practitioners and young subjects.

DESIGN: Cross-sectional study.

SETTING: University-based rehabilitation center in Hong Kong.

PARTICIPANTS: Twenty elderly Tai Chi practitioners (mean experience +/- standard deviation, 7.2+/-7.2 y) were compared with 20 elderly non-Tai Chi practitioners and 20 young, healthy university students.

INTERVENTIONS: Not applicable.

MAIN OUTCOME MEASURES: The amplitude of anteroposterior body sway under different somatosensory, visual, and vestibular conditions was measured using computerized dynamic posturography, whereby subjects underwent 6 combinations of visual and support surface conditions.

RESULTS: The Tai Chi practitioners had significantly better balance control than the non-Tai Chi subjects in the visual and vestibular ratios, but not in the somatosensory ratio. Furthermore, there were no significant differences in any of these 3 sensory ratios when the Tai Chi practitioners were compared with those of the young, healthy subjects.

CONCLUSIONS: Long-term Tai Chi practice improved balance control in the elderly population when there was an increased reliance on the visual and vestibular systems during stance. Of particular interest is that our elderly Tai Chi practitioners attained the same level of balance control performance as did young, healthy subjects when standing under reduced or conflicting somatosensory, visual, and vestibular conditions.

Short-form Tai Chi improves standing balance of people with chronic stroke.

Au-Yeung SS , Hui-Chan CW, Tang JC.

Neurorehabil Neural Repair. 2009 Jun;23(5):515-22

TAI CHI CHUAN e PARKINSON

Physical

knee joint proprioception commonly believed very **important in the control of dynamic than static balance** so required in **some daily activities involving weight shifting**
is **improved** by TCC.

The **mechanism for its improvement** by TCC could be due to the **plastic changes i**nduced in the **cortex by repeated positioning of limb joints in specific spatial positions.**

Propriocezione del ginocchio
Ipotesi

Tai chi improves standing balance control under reduced or conflicting sensory conditions
Tsang e coll.
Arch. Phys. Med.Rehabil. Vol 85, Jan. 2004

TAI CHI CHUAN e PARKINSON

Physical

TCC training is a **method of improving plantar sensation** and **balance in diabetic patients** with a **large plantar sensation loss.**

It has been known that **vestibular rehabilitation VR** has become one of the **most widely used treatments** for **balance disorders** and fits patients with deficits affecting either the **peripheral or central vestibular system** improving **balance, safety of the gait and reducing the disability due to dizziness**.
A **specific exercise of TCC (*like clouds*)** reproduces **some movements like VR .**

Sensibilità plantare nel diabete

ES. «Le nuvole»
Sistema vestibolare

Does Tai Chi Improve Plantar Sensory Ability? A Pilot Study
SAMANTHA RICHERSON and KYLE ROSENDALE
DIABETES TECHNOLOGY & THERAPEUTICS Volume 9, Number 3, 2007

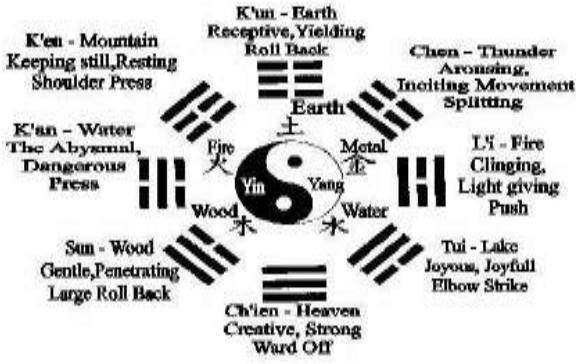
TAI CHI CHUAN e PARKINSON

Psycho-social effects

Sintomi depressivi
Autostima
Capacità relazionale

TCC, has a **positive effect in reducing depressive symptoms** compared **no treatment in older patients with depression** and is **equally effective in reducing all categories of depressive symptoms**, included **somatic**, other symptoms related to **interpersonal relationship, and others again associated with well-being.**

It has been shown that a **long term TCC is helpful to achieve a major self-confidence**, reduce **anxiety** and ameliorate the **ability to establish valid interpersonal relationships**



BMC Neurol. 2014; 14; 165
Mindfulness-based interventions in multiple sclerosis: beneficial effects of Tai Chi on balance, coordination, fatigue and depression
Janina M Burschka, Philipp M Keune, Ulrich Hofstadt-van[2] Oy–, Patrick Oschmann[2] and Peter Kuhn

TAI CHI CHUAN e PARKINSON

How?

The **term mindfulness**, rooted in Buddhist philosophy, is featured by the **attempt to focus on the present moment experience** while **maintaining and open, non-judgemental attitude**
In this context, mindfulness training was show to **yield beneficial effects in a variety of conditions including chronic pain, Multiple Sclerosis fibromyalgia, psoriasis, as well as depressive and eating disorders.**
Mindfulness training may yield **adaptive neurophysiologic effects, including altered immune functioning.**

BMC Neurol. 2014; 14; 165
Mindfulness-based interventions in multiple sclerosis: beneficial effects of Tai Chi on balance, coordination, fatigue and depression

Janina MBurschka, Philipp MKeune, Ulrich Hofstadt-van Oy,[2] Patrick Oschmann and Peter Kuhn[2]

Here and now

No-giudizio
Qui e ora
Attenzione
Responsabilità
Consapevolezza
Lascia andare
Dolore cronico
Fibromialgia
Psoriasi
Sclerosi multipla
ADHD

According to the authors, **self-regulated attention involves focusing on experience in the here and now**. The resulting ability to **sustain attention and switch its focus intentionally** is assumed **to enable non elaborative awareness**.
The latter is characterized by **observing, acknowledging and releasing arising thoughts, sensations and emotions without further, secondary cognitive elaboration**

Journal of Bodywork and Movement Therapies (2005) 9, 120–133
The role of Tai Chi Chuan in reducing state anxiety and enhancing mood of children with special needs
Lois J. Baron, Christine Faubert

TAI CHI CHUAN e PARKINSON

NCBI Resources

Arch Phys Med Rehabil. 2004 Jan;85(1):129-37.

Tai Chi improves standing balance control under reduced or conflicting sensory conditions.

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CONCLUSIONS: Long-term Tai Chi practice improved balance control in the elderly population when there was an increased reliance on the visual and vestibular systems during stance. Of particular interest is that our elderly Tai Chi practitioners attained the same level of balance control performance as did young, healthy subjects when standing under reduced or conflicting somatosensory, visual, and vestibular conditions.

J Am Geriatr Soc. 2002 Apr;50(4):746-54.

Evaluation of the effectiveness of Tai Chi for improving balance and preventing falls in the older population--a review.

Wu G
Department of Physical Therapy, University of Vermont, Burlington, Vermont 05405, USA. gwu@zoo.uvm.edu

Abstract

One of the challenges faced by people with advancing age is decreased postural stability and increased risks for falls. There has been an increased interest over the last decade in using Tai Chi as an intervention exercise for improving postural balance and preventing falls in older people. Despite the increased number of studies in recent years relating Tai Chi to balance and fall prevention, results are scattered and inconsistent. There is wide variation in the use of balance measures, subject population, type and duration of Tai Chi exercise, and type of study. This paper provides a systematic review/analysis of currently available study reports. The goal of the review is to address the following concerns: how the effect of Tai Chi on balance or fall prevention has been evaluated to date, what level of evidence exists supporting Tai Chi as an effective exercise for improving balance or preventing falls, and what factors could possibly affect the benefit of Tai Chi on balance or falls. This review also helps identify directions for future research.

TAI CHI CHUAN e PARKINSON

NCBI Resources

Physiother Theory Pract. 2006 Jun;22(3):163-82.

Multidimensional exercise for people with Parkinson's disease: a case report.

Kluding P, McGinnis PQ.
MPT Program, Rutgers University, USA. pkluding@kumc.edu

Abstract

The primary impairments associated with Parkinson's disease occur in combination with the secondary, preventable effects of immobility. A community-based fitness program may help increase activity and maintain function in people in the early or middle stages of the disease. This article describes a unique program designed to reduce fall risk and promote independent exercise for people with Parkinson's disease. Two 66-year-old males, both community ambulators and in early or middle stages of Parkinson's disease, participated in 3 months of various physical activities. Group balance classes were held twice weekly during the first month, participants joined a fitness center and self-directed their exercise program during the second month, and group Tai Chi classes were held twice weekly during the third month. At conclusion of the program, participants were given suggestions for continued physical fitness activities. After the 3-month program, improvements were noted for both individuals in functional reach, Timed Up and Go, and Berg Balance scores. Both participants continued to exercise regularly for at least 5 months following the program. Two individuals with Parkinson's disease demonstrated improvement in their balance test performance over a 3-month period. Perhaps most importantly, these participants independently continued exercising after completing this program.

J Aging Phys Act. 2007 Apr;15(2):139-51.

Tai Chi-based exercise for older adults with Parkinson's disease: a pilot-program evaluation.

Li F, Harmer P, Fisher KJ, Xu J, Fitzgerald K, Vongjaturapat N.
Oregon Research Institute, Eugene, OR 97403, USA.

Abstract

The primary objective of this study was to provide preliminary evaluation of the feasibility, safety, and efficacy of a newly developed Tai Chi -based exercise program for older adults with Parkinson's disease (PD). Using a one-group pretest-posttest design, 17 community-dwelling adults (mean age 71.51 years) with mild to moderate idiopathic PD (Stage I, II, or III on the Hoehn and Yahr scale) and stable medication use completed a 6-day, 60-min/day Tai Chi exercise-evaluation program. Outcome measures included face-to-face exit interviews on appropriateness and safety and physical performance (i.e., 50-ft speed walk, up-and-go, functional reach). At the end of this brief intervention, exercise adherence was 100% and the program was shown to be safe. Exit interviews indicated that the program was well received by all participants with respect to program appropriateness, participant satisfaction and enjoyment, and intentions to continue. Furthermore, a significant pretest-to-posttest change was observed at the end of the 6-day program in all three physical-performance measures ($p < .05$). The results of this pilot evaluation suggest that Tai Chi is an appropriate physical activity for older adults with PD and might also be useful as a therapeutic exercise modality for improving and maintaining physical function. These preliminary findings warrant further investigation.

TAI CHI CHUAN e PARKINSON

Forme standardizzate eccesivi rischi

Postural instability is one the cardinal features of Parkinson disease and there are some characteristics of TCC that make it amenable to PD patients with posture related instability problems.

The multisegmental movements features of standardized forms of TCC could create excessive physical and mental challenges for people with PD (PwPD)

TAI CHI CHUAN e PARKINSON

Not every TCC dynamic posture is physically appropriate for PwPD (i.e "*Sweep down*" that involves a squatting down movie with a forward inclination of the upper body while stretching one leg sideways, posture difficult for healthy people too, increases the risk of knee injuries or falling in PwPD

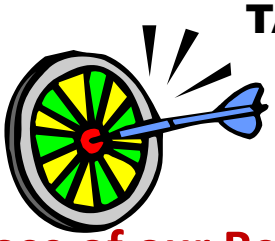
Discesa del serpente NO

Forma specifica Hoen Yahr 1-3

For this reason it has been developed a Parkinson's specific (4 forms)TCC-based exercise programs for older people with early-middle (1-3 stages Hoen and Yahr PD scale), choicing a program which emphasizing ripetitions and bilateral stepping with body-weight transfer, inner concentration.
drawn from the basis of the traditional TCC Yang short Style

TAI CHI CHUAN e PARKINSON

Aim



The purpose of our Research project study was to evaluate the effects on postural control and mobility of some exercises of Yang Style TCC designed for early-middle PwPD in a multiple approach intervention for falls prevention

Progetto di ricerca
Equilibrio statico e dinamico
Qualità di vita

Tai Chi Chuan in Parkinson disease: a preliminary study

S. A. Cassarino MD*, C. Damiani MD**, S. D'Ottavio MS •, G. Della Bella MD*, M. Sallì MD*, A. Lucaselli MD *, I. Sbardella MD*, V.Di Giuseppe **, A. Laurini MD*, C. Foti MD-PRM-FP*

**San Raffaele Portuense Tosinvest, Rehabilitation Hospital, Rome, Italy
*Physical and Rehabilition Medicine Tor Vergata University Rome Italy
• Motor Science Tor Vergata University Rome Italy

Introduction: Parkinson disease (PD) determines the loss of balance inducing people with PD (PwPD) to falls because of difficulty responding to abrupt perturbations.
It has been known that depressive symptoms and fear of falling can be used as outcome measures in fall prevention trials, but little is known about underlying mechanisms, including the role of cognitive and physical elements.
Fear of falling might be a protective response preventing people from undertaking activities with a high risk of potential injury, although fear of falling resulting in a restriction of activities that one could safely perform may lead to unnecessary adverse consequences regarding social, mental, and physical health
Tai Chi Chuan (TCC) is overtime developed in an exercise useful to reduce anxiety, improve mood, quality of sleep, and self-esteem. It has been known that TCC practitioners swayed less and achieved significant higher visual and vestibular ratios than sedentary people so decreasing fear of falling. Because standardadized forms of TCC could be not available to PwPD, it has developed a specific TCC-based exercise programs useful to people with *early-middle* PD containing 4 exercises.

Methods: We have examined 18 people with PD (1-3 stages Hoen and Yahr) without severe cognitive impairments (MMSE≥14), severe comorbidities or recent lower extremity joint replacements. We used a single arm trial with a pre and a post-test (Tinetti balance, Fear of Falling Scale), once weekly lasting 2 months (60 minutes each one session weekly PwPD). Were evaluated FOF (Fear of Falling Scale) assessed by a single-item question "at the present time you are often, always, sometimes, or never fearful that you might fall (or fall again) during ADL".

Results: 9 patiens treated by a specific based TCC exercise has shown an improvement:

- 16% in balance on standing position (with open eyes).
- 16% in balance on standing position (with closed eyes).
- 18% in starting the walk
- 33% in standing up from chair
- 66% in FOF during ADL.

Conclusion: The results seems to demonstrate the efficacy in PwPD of a specific Tai Chi Chuan Training exercise on postural changes, balance in standing position, and partcularly on FOF during DLA.
This study needs to be continued.

Keywords: Parkinson's disease, Taj Chi Chuan, Rehabilitation

TAI CHI CHUAN e PARKINSON

Methods

14 PwPD

Inclusion criteria

(Hoen Yahr 1.5-3) **MMSE> 20**, **no severe co-morbidity** ;

Walk **independently for at least 3 m** without assistive devices

Experimental protocol

ON phase

4 exercises Yang Style TCC **60 min/weekly/12 sessions**

(**visual cue by means of two mirrors**)

+ **Neurorehabilitation (Therapeutical Exercise, OT, Speech therapy (3 hr/daily, 5 times/weekly) +Psychological Counseling** (group sessions 1 time/weekly)

Outcome measures

UPDRS, Tinetti balance, Barthel, FES, Hammilton (**admission/dimissions**)

Wilcoxon test

MdP in fase iniziale
intermedia
Cognitività
no comorbidità
neuroriabilitazione

PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

TAI CHI CHUAN e PARKINSON

8th Mediterranean Congress of Physical and Rehabilitation Medicine

Mediterranean Forum of PRM

Rehabilitation without frontiers

Tai Chi effects on balance, mobility and gait in Parkinson disease: preliminary study

C. Damiani, S.A Cassarino, S. Ippolito, L. Bestavashvili, I.Clemenzi, C. Foti

TAI CHI CHUAN e PARKINSON

Materials and Methods

Postural control and movement

To evaluate the **contribute offered by proprioceptive, visual, vestibular pathways** on postural control and movement in **static and dynamic single leg stance with both open and closed eyes conditions,** we used an advanced computerized system (**Delos System**) to evaluate the **choice of strategy used by patients to maintain a static and dynamic postural control.**

Indications DELOS SYSTEM

1) The **level of indipendence in postural instability management**
2)The **prevalent strategy used** (precautional, proprioceptive, visual, vestibular)
3) The **level of intervention of each one strategy**

Riva 2000

Valutazione del contributo dai singoli sistemi all'equilibrio statico-dinamico monopodalico
Strategia prevalente
Delos System
Sport

TAI CHI CHUAN e PARKINSON

Results

8th Mediterranean Congress of Physical and Rehabilitation Medicine

PATIENT	UPDRS	UPDRS	Barthel index	Barthel index	Timed	Timed	fall fear scale	fall fear scale	Hamnilton	Hamnilton
D.	35	22	71	90	25	38	39	25	6	5
D.	41	37	68	82	12	15	62	18	8	7
R.	40	26	63	80	16	26	38	35	55	30
M.	42	31	73	95	14	19	36	23	8	7
S.	44	37	71	90	22	25	12	11	8	5
A.	45	33	66	81	18	15	35	18	13	9
C.	18	14	81	95	26	28	10	10		
P.	14	4	86	100	27	28	10	10		
S.	29	18	68	88	23	25	26	28		
S.	21	16	73	88	25	28	13	11		
S.	35	28	72	95	24	26	10	10		
T.	22	16	84	94	23	27	15	13		
G.	37	15	71	95	17	26	18	13		
D.	50	38	57	78	9	29	34	26		
	32.428857143	23.214285571	71.642857114	89.357142886	19.857142886	24.071428557	25	17.928571143	13	10.5
	11.435561641	9.861959307	7.899436619	6.934338816	6.514665263	4.961507612	15.397780046	8.748310239	11.027238	9.668638883
	P<0.02		P<0.02		P<0.02		P<0.05		P<0.062	

Pat	UPDRS II adm	UPDRS II dim	UPDRS III adm	UPD RS III dim
D	4	4	10	7
D	4	1	8	3
R	12	7	15	13
M	8	7	12	9
S	13	9	13	11
A	6	5	5	5
C	13	6	13	8
P	20	16	24	17
D	9	8	12	8
D	18	11	19	13
R	12	8	19	12
M	15	11	18	15
S	16	13	19	17
		P< 0.02		P<0. 02

Results

TAI CHI CHUAN e PARKINSON

8th Mediterranean Congress of Physical and Rehabilitation Medicine

Postural control and movement

Precautional	3	**ADMISSION**
Visual	3	
Proprioceptive	0	
Precautional	4	**DIMISSION**
Visual	0	
Proprioceptive	not evaluabile 4 lower 3 normal 2	
Visual dipendece	4 high 0 low 1 absent 1	
Vestibular strategy	maxi.activation indequate 5 present 1	

The high use of precautional strategy do not permit to quantify visual and propriceptive strategies

-

Conclusions 1

Balance
Coordination
Strenght
Self exteem
Mood
Insight awareness
Relationship skills
Sleep
Body expression
Body schema
improvement
Quality of life

TAI CHI CHUAN e PARKINSON

Conclusioni
Equilibrio
Forza
Autostima
Tono umore
Consapevolezza
Capacità relazionali
Disturbi del sonno
Espressione corporea
Schema corporeo
Qualità di vita

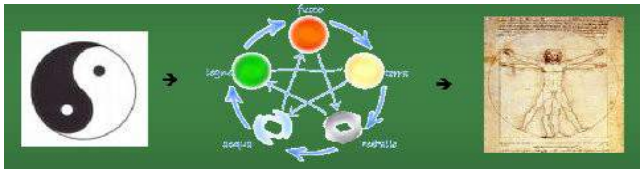
Implementazioni
Controllo placebo
Gait Analysis
fRMN
Altri esercizi

TANGO??????

Conclusions
Only the **beginning of long term study** that will **need of some implementations** to insert **TCC as adjuntive method** in a **multiapproach intervention** for falls prevention in PwPd
Developement
A **Control randomized group** (Shame TCC)
B) **Other method of analysis (Gait analysis)**
C) Neuroimaging **fRMN**
C) **Choice of dfferent exercises**
New challengies
Argentinian tango Why?
-**Dual task method**
-**pivot on leg stance**
-**Rhytm and melody**
-**walking management skills** (corrida)
Directions changes (useful **to crossing narrow doors)**

More enjoyment than TCC

TAI CHI CHUAN e PARKINSON



GSI ITALIA
GRUPPISOLIDARIETÀINTERNAZIONALE

PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Ancient but innovative proposals in Disabilty management

811/3677

Multiple Sclerosis

- **Multiple Sclerosis (MS), the most common neurological disease of young adults is a disabling demyelinating inflammatory, tought probably to be an autoimmune disorder, disease of the Central Nervous System (CNS) with subsequent destruction of myelin, oligodendrocytes and axons and functional impairments**

J.M Burscha et al.

Mindfulness-based intervention in Multiple Sclerosis: beneficial effects on balance, coordination, fatigue and depression

BMC Neurol. 2014; 14, 165

Functional impairments

- **Functional impairments in MS such as normal walking,**
- **poor balance,**
- **muscle weakness**
- **fatigue**
- **All result from axonal degeneration and conduction block but the exact aetiology of MS remain unknown.**

Following

- **Balance and coordination are comproimised when deyelination occurs; furthermore is affected the proprioceptive, visual and vestibular pathways with following vertigo, imbalance, incoordination, gait disturbances and spastic movements whom lead to mobility problems.**

MS fatigue

- **MS fatigue (a common symptom in MS observed since the initial description of this disease) is experienced in different forms interfering significantly with daily activity life (DAL) at work and at home while cognitive fatigue (reduced attention, memory and information processing) have also been reported.**

Depression
Suicides

- **Over 50%** of MS patients experience **depression,**
- **high risk of suicides**, sometimes developed from **the initial MS diagnosis** and the **realization that the disease may progress to permanent disability**.

EDSS

- **Several studies utilized the Expanded Disability Status Scale (EDSS) widely applied classification of neurological impairment in MS.**
- **EDSS scores ranging from 1-4.5 indicate patients who are fully ambulatory.**

Exercise training in MS

For many years patients with MS had been advised not to participate in physical training but during the last decade it has been shown that worsening of the number and/or intensity of sensory symptoms wich is experienced by more than 40% of MS patients after exercise is temporal and will be normalized within an hour after exercise cessation.

Exercise training in MS

Additionally, physical exercise may yield potentially adaptive immune-modulating effects.

Recent findings also suggest that repeated physical exercise may foster neuroplasticity, affecting neurotrophic and neuroprotective mechanisms.

However, most MS patients remain physically inactive

information regarding choice, dose and effects of specific exercise programs is

sparse

Outcomes

Individualized exercise in MS can promote many important outcomes, such as

improved cardiorespiratory

muscle function

decreasing depression

fatigue

promotion of health and quality of life.

comorbidities

- **Exercise is considered helpful in managing common symptoms and promoting wellness, for reducing the risk of comorbidities such as**
- **obesity**
- **heart disease**
- **diabetes**
- **Osteoporosis**

Quality of life

- **Exercise training seems to positively influence quality of life as assessed by SF 36, Multiple Sclerosis Quality of Life (MSQOL), Hamburg Quality of Life questionnaire for MS (HAQUAMS).**

Becks Depression Inventory

- **Improvements** have been found in **items regarding:**
- **Vitality**
- **social functioning**
- **Mood**
- **energy,**
- **fatigue,**
- **Anger**
- **sexual function**
- **and depression** monitored by **Becks Depression Inventory**.

Fatigue

- Prescribing exercise on an **intermittent basis** helps to
- **avoid excessive build-up of fatigue** and **heat stress**, which **worsen MS symptoms**

Mindufulness based intervention
focus on present moment experience
non-judgemental attitude

- **Recently, such programs have successfully been implemented in combination**
- **with**
- **mindfulness based interventions.**
- **The term mindfulness is rooted in Buddhist philosophy.**
- **Its key element is the attempt to focus on the present moment experience while maintaining and open, non-judgemental attitude**

J.M Burscha et al.

Mindfulness-based intervention in Multiple Sclerosis: beneficial effects on balance, coordination, fatigue and depression

BMC Neurol. 2014; 14, 165

benefits

mindfulness training intervention (MTI) was shown to yield beneficial effects in a variety of conditions including

chronic pain

Fibromyalgia

psoriasis, as well as

depressive and eating disorders, and to attenuate maladaptive cognitive patterns.

Further studies indicate that mindfulness training may yield adaptive neurophysiologic effects, including altered immune functioning.

Attention motivation

- Bishop et al. defined in MTI an attentional and a motivational component.
- First component
- Attention and motivation
- According to the authors, self-regulated attention involves
- focusing on experience in the here and now.
- The resulting ability to sustain attention and switch its focus intentionally is assumed to enable non-elaborative awareness.

Breath

2 rd component

- **Since attentional resources are limited, non-elaborative awareness increases access to information on current experience, as attentional capacity is not allocated to further elaborative processing**
- **In mindfulness exercises, commonly the • breath is used as an**
- **object of orientation to return back to the present moment experience**

curious and accepting attitude
non-judging perspective and the open receptivity
body awareness and emotional awareness

The Third component is the orientation to experience, with a curious and accepting attitude towards the stream of consciousness.

This observant, non-judging perspective and the open receptivity to new experience are assumed to

reduce avoidant behaviour patterns

Tai Chi Chuan

- **Tai Qj Quan (TCC) is an ancient chinese martial art over a period of time is evolved into a slow and gentle form of low-to-moderate impact and velocity exercise.**

Practice

The basic of TCC consists in a continuous series of graceful movements so that the body is constantly shifting from foot to foot with a lower centre of gravity (CG) with knees and hips held in soft flexion.

Body and Mind

During the TCC performance, deep breathing and internal concentration are constantly required to achieve the harmony between body and mind.

depression

TCC, has a positive effect in reducing depressive symptoms compared no treatment in older patients with depression and is equally effective in reducing all categories of depressive symptoms, included somatic, psychological, other symptoms related to interpersonal relation, and others again associated with well-being.

PSYCHOSOCIAL

- **It has been shown that a long term TCC (almost 3 years) is helpful to achieve a major self-confiance, reduce anxiety and ameliorate his ability to establish valid interpersonal relationships.**

Both mindfulness and exercise

- To date, there are only few structur interventions which incorporate bot physical and mindfulness exercises for people with MS.
- Tai Chi may be particularly suited to integrate physical and mindfulness training in MS.

Form

Tai Chi involves purposeful direction of attention.

Attention needs to be directed during the process of imitating a choreography (called *form*) as demonstrated by the instructor.

Switch attention

it is necessary to constantly switch attention between

exteroception (observing the instructor and the own body) and interoception (bodily involving proprioception, balance, sensations breathing). During exercises, attention is also directed at the Tai Chi principles

Respect
Non-elaborative awareness

The second component of mindfulness is addressed as Tai Chi training implies the maintenance of a curious and open attitude.

The perpetual aim in Tai Chi practice is a friendly attitude towards oneself and others, respecting the own person and the own abilities, without judgement or competition.

Non-elaborative awareness is a prerequisite to stay on track while playing the form.

arising emotions

- **Awareness is developed by consciously observing and accepting arising emotions during Tai Chi practice (e.g. fear of embarrassment, fear of falling, self-criticism, motivational issues).**
- **Tai Chi has been shown to yield health benefits in various neurological and orthopaedic groups, including Parkinson's Disease, Fibromyalgia, chronic stroke**

J.M Burscha et al.

Mindfulness-based intervention in Multiple Sclerosis: beneficial effects on balance, coordination, fatigue and depression

BMC Neurol. 2014; 14, 165

M-Care Project 4 rd Meeting Rome, March 23 th 2015

Stroke, new proposals

Annually, 15 million people have a stroke worldwide.

Of these, **5 million die**

5 million are left with permanent disability,

placing a burden on the family and the community.

In the **United States, approximately 759,000** people have a **new or recurrent stroke each year**.

Stroke remains the **third leading cause of death in China**, with total stroke incidence (3) increasing 6.7% **annually from 1984 to 2004**

Incidence

Stroke leaves **many survivors with mental and/or physical disabilities**.

The **incidence** of strokes in **industrialized nations** is **on the rise**, particularly **in the older population**.

The risk of **stroke doubles every ten years after age 55**

Prognosis

The **prognosis of functional recovery** following a stroke **depends**

on several factors,

including **initial severity of the injury, spontaneous recovery**

In older individuals, **stroke sequelae** can include **sensorimotor,**

cognitive

perceptual impairments, which **directly affect mobility and balance** and thus **drastically increase the risk of falls and the impact of rehabilitation**

Falls

In fact, **balance and ambulation problems** are the **most important fall risk factors following a stroke**.

It has been shown that **75% of individuals who have had a stroke fall within the first six months** following **their discharge from hospital**.

Services

Consequently, **balance** is considered to be **one of the most promising reversible risk factors** to reduce falls.

Thus, there is a **large number of individuals at home** who need rehabilitation following their stroke but who **do not have access to services**

Variety

Consequently, **their mobility and balance declines**, creating a **significant risk for falls** in this population.

Regardless of the **rehabilitation delivery mode**, the **choice and type of exercise** program **varies** from **one study to the next**.

Exercise health insurance

Physical activity is an **important aspect** of a comprehensive stroke rehabilitation program to **reduce disabilities** associated with **poor physical functioning and quality of life,** and can be **costly** when **not covered by health insurance**

Diabetes
low-cost, low-tech, low impact

A study conducted **with older individuals** with **diabetes** found that a **simple sequence of Tai Chi** movements improved **their balance and attention capacity.**

Furthermore, the Tai Chi intervention appeared to **delay the onset of the first fall** in older individuals. Tai Chi may **is a low-cost, low-tech, low impact, moderate -intensity exercise** that appeals to older adults

Benefits

Tai Chi offers **additional benefits** to traditional stroke rehabilitation programs by **combining physical movements**

with

mental concentration

and

relaxation.

During Tai Chi, the **slow, rhythmic movements** are **linked together in a continuous sequence**, while **body weight is shifted from leg to leg**

DAL

- This challenges the balance control system to **maintain its center within a changing base of support** and enhances better balance, which is a **vital aspect of physical functioning** affecting **safe performance of activities of daily living and fall prevention** among stroke survivors.

Sociocultural and meditative components

In addition, individuals are taught to be **mindfull of what their bodies are doing** and how **it feels while performing Tai Chi.**

Tai Chi also has **sociocultural and meditative** components that are **believed to contribute to overall well-being**

Qi gong
Breath

Furthermore, **specialized breathing** that accompanies motion of the extremities, such as in ***Qigong*** exercise, is **helpful for reducing stress and anxiety.**

Most of the studies of a review reported that **Tai Chi has positive effects with respect to quality-of-life**, **sleep, depression and anxiety** among patients who have had a stroke.

Increased sway of COG

It is well known that the effects of Tai Chi **vary** based on the **type** of Tai Chi, exercise **dose** and **population**.

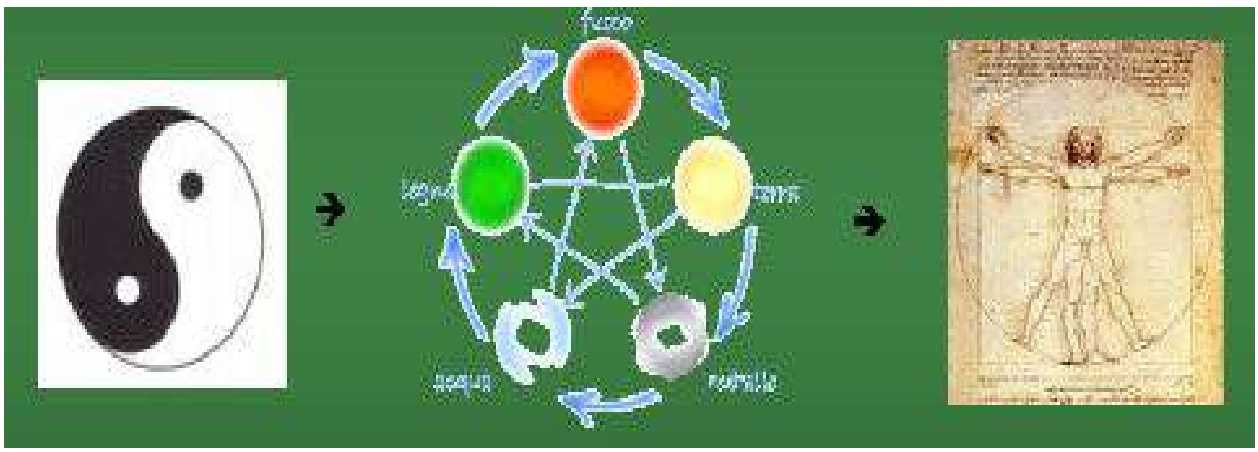
In **standing**, people with chronic stroke typically demonstrate **postural control problems**, including **increased sway** of their center of gravity (**COG**)

Mindfulness

Recently, such programs have successfully been implemented **in combination with mindfulness based interventions**.

Integration

- Tai Chi may be particularly suited **to integrate physical and mindfulness training in MS.**
- Tai Chi involves purposeful direction of attention.



friendly attitude

without judgement or competition.

The perpetual aim in Tai Chi practice is a **friendly attitude towards oneself and others**, **respecting the own person and the own abilities**, **without judgement or competition**.

Non-elaborative awareness is a prerequisite to stay on track while playing the form.

Diseases and disabilities management

Tai Chi has been shown to yield health **benefits** in various **neurological groups, including Parkinson's Disease, Fibromyalgia, chronic stroke, and peripheral neuropathy**

Referehces

Short-form Tai Chi improves standing balance of people with chronic stroke.

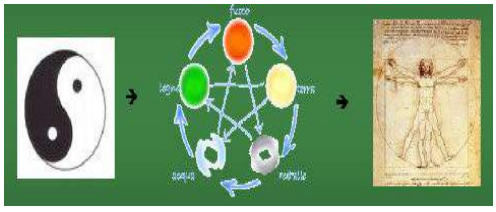
Au-Yeung SS, Hui-Chan CW and Tang JC.

Neurorehabil Neural Repair 2009; 23(5): 515–522.

Mindfulness-based interventions in multiple sclerosis: beneficial effects of Tai Chi on balance, coordination, fatigue and depression

Janina M Burschka, Philipp M Keune, Ulrich Hofstadt-van Oy[1], Patrick Oschmann[2] and Peter Kuhn[1]

BMC Neurol. 2014; 14; 165



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GRUPPISOLIDARIETÀINTERNAZIONALE

PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

Physiotherapy Sciences – Second year of the course

D3. Methodology and Techniques of Neurological Rehabilitation

MED/34 – Physical Medicine and Rehabilitation

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Intervention in the acutephase

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REHABILITATION TREATMENT

Early

- Hemiplegia therapy
  - Early phase
  - Development of motor control
  - Upper limb therapy
  - Mobility therapy
- Communication therapy
- Cognitive and behavioral disorders
  - Cognitive/behavioral
  - Neglect
  - Depression
  - Sexuality
  - Psychosocial aspects

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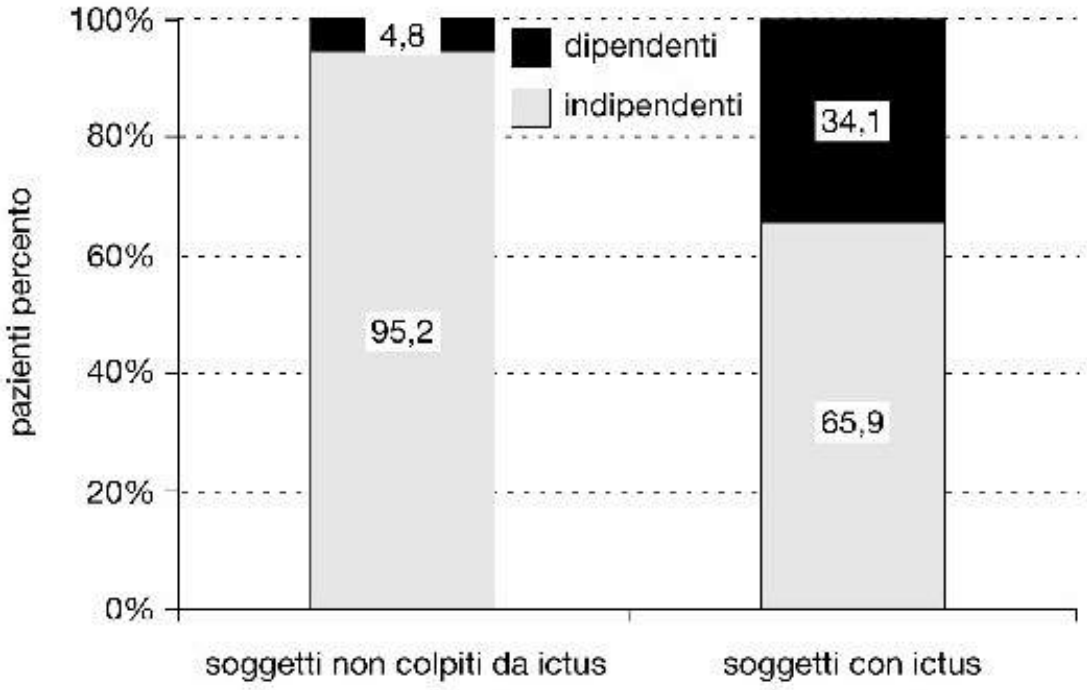
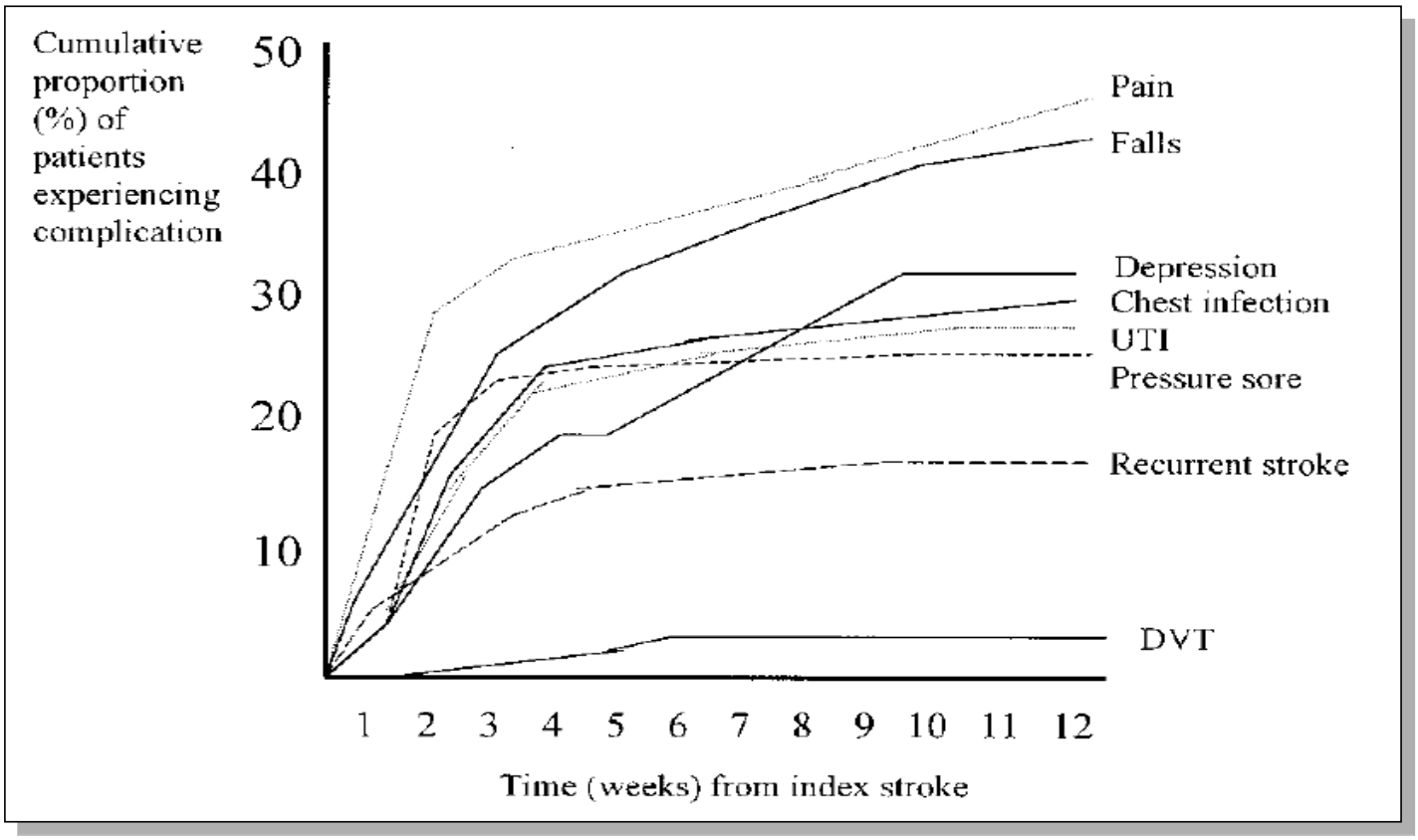
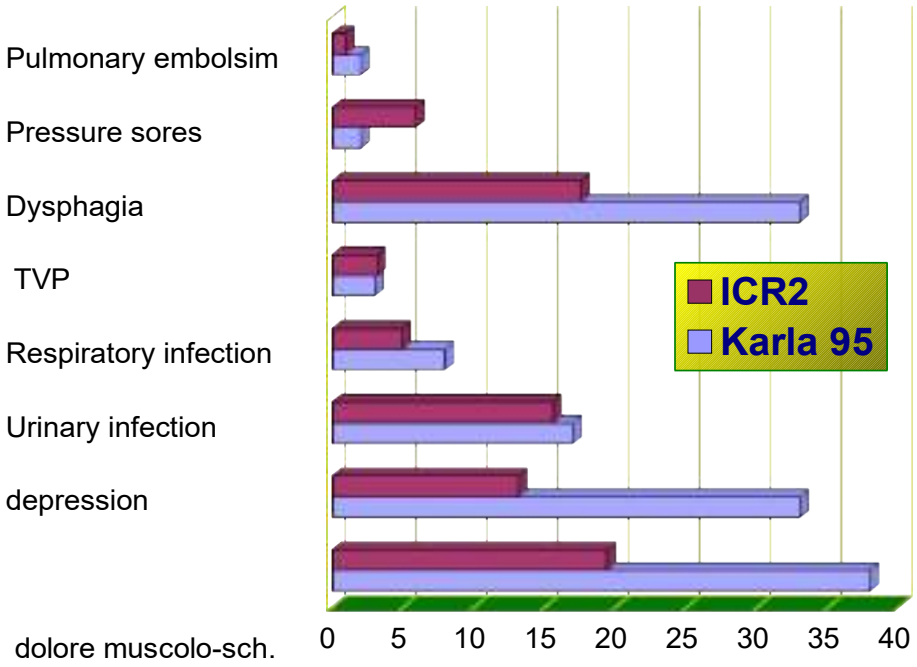

100%
80%
60%
40%
20%
0%
pazienti percento
4,8
95,2
34,1
65,9
dipendenti
indipendenti
soggetti non colpiti da ictus
soggetti con ictus

Complications post-ictus

Langhorne 2000



THE COMPLICATIONS
The Italian study ICR2

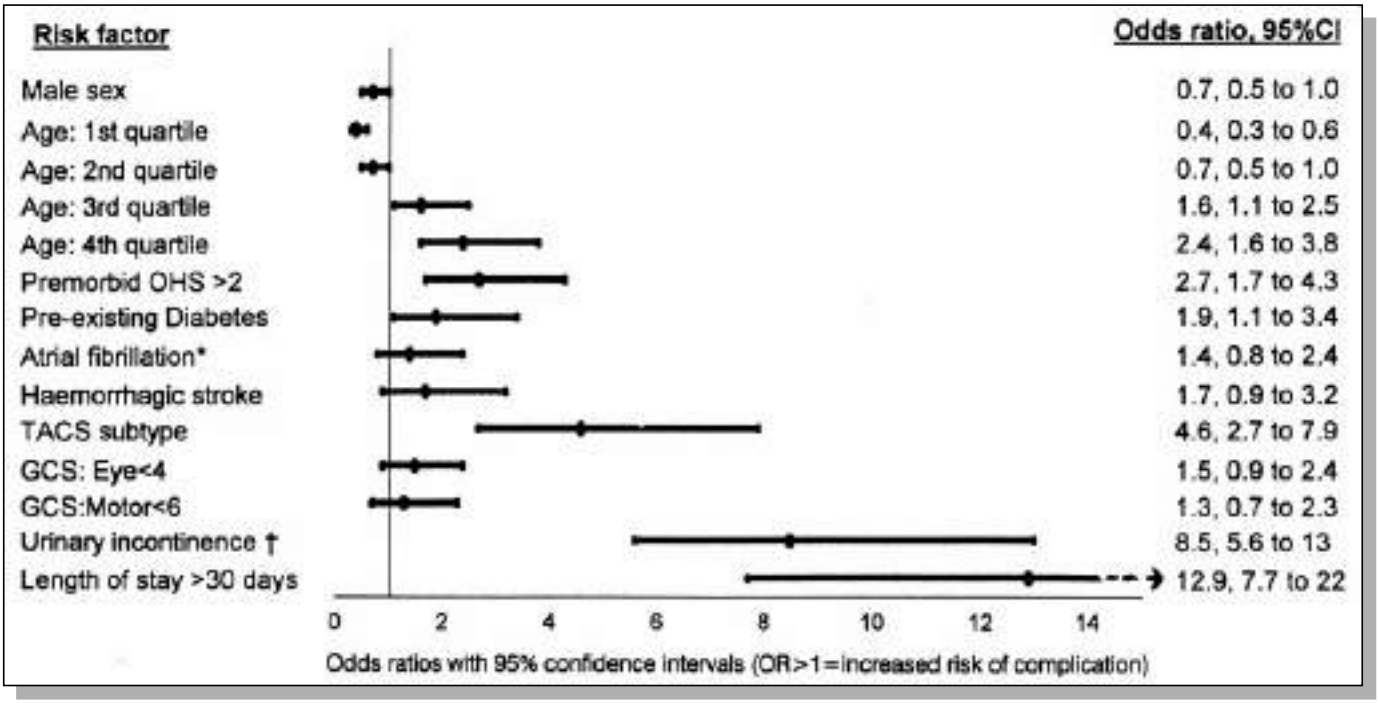


Complications related to the severity of the stroke

Langhorne 2000

Complication	Initial Level of Dependency (FIM Score)			Significance (χ^2 Test)
	FIM >100	FIM 50–100	FIM <50	
Recurrent stroke	21 (1–42)	12 (1–22)	14 (6–20)	NS
Seizure	0	2 (0–4)	4 (0–8)	NS
Infection	14 (0–32)	35 (19–51)	54 (43–65)	$P<0.05$
Falls	21 (0–42)	31 (23–40)	39 (28–50)	NS
Pressure sore	7 (0–20)	12 (2–22)	36 (25–47)	$P<0.01$
Thromboembolism	0	5 (0–11)	5 (0–10)	NS
Pain	14 (0–35)	43 (28–58)	38 (27–49)	NS
Depression	14 (0–32)	17 (6–28)	30 (19–41)	NS
Anxiety	0	12 (2–22)	42 (31–53)	$P<0.01$

Risk of developing complications



Outcome measures and presence of invasive devices

Outcome Measures	No Medical Tubes (n=985)	Foley Catheter Only (n=193)	Feeding Tube Only (n=117)	Foley and Feeding Tube (n=147)	Feeding Tube and Tracheostomy (n=44)	All 3 Medical Tubes (n=67)	Significance, F(5)	Total (n=1553)
Admission NIHSS score	7.27±4.21	10.80±4.72	11.07±5.29	13.71±5.12	11.13±5.88	13.66±4.68	86.8*	9.01±5.13
Admission FIM score	68.0±19.7	51.4±16.6	44.7±17.7	35.8±13.9	31.4±11.8	31.4±11.8	146.0*	58.9±22.5
Discharge FIM score	91.4±20.1	79.4±19.4	70.1±22.7	62.2±24.6	75.5±28.1	59.4±23.7	84.8*	83.8±23.9
FIM efficiency	1.16±0.99	0.94±0.67	0.80±0.57	0.76±0.63	0.91±0.66	0.66±0.53	8.5*	1.04±0.89
Rehabilitation medical complications, n	1.6±1.8	2.7±2.0	2.4±2.0	2.9±2.2	2.2±2.1	3.4±2.8	30.1*	2.0±2.0
Rehabilitation length of stay, d	24.4±12.5	33.1±13.3	34.5±13.1	34.4±13.4	35.6±18.3	43.8±16.3	58.0*	28.4±14.3
Charge, $/d†	1246.07±560.65	1312.49±248.73	1385.4±344.91	1551.91±815.18	1741.98±523.55	1709.93±357.23	20.0*	1326.45±558.89

Prognostic factors of disability

- Age,
- right and left arm paresis at admission,
- NIH-Stroke Scale at admission,
- Rankin Scale 48-72 hours later,
- gender,
- prior stroke,
- diabetes,
- fever,
- lenticulostriate infarction,
- neurological complications

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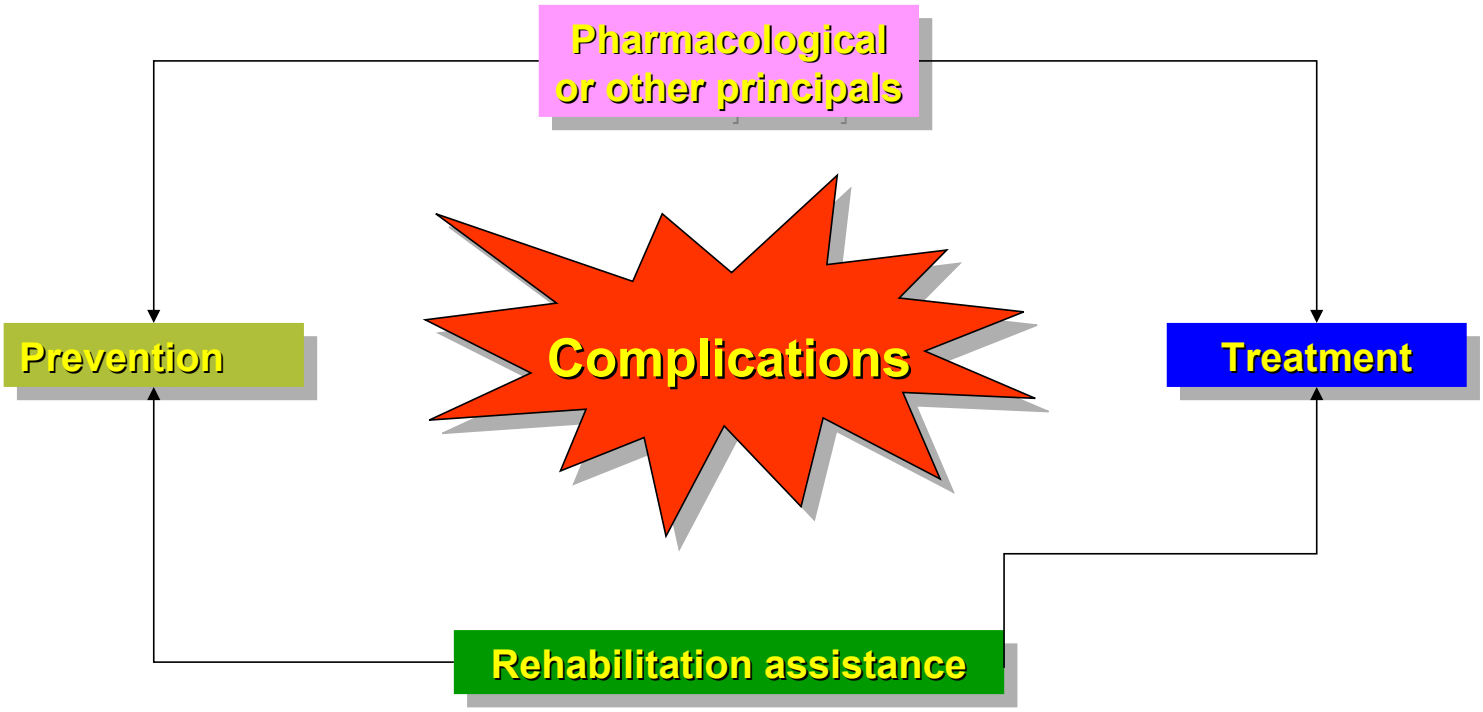
Intervention on complications



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Factors influencing some complications

- Poor mobility
- Incorrect mobility
- Inadequate management of sphincter functions
- Inadequate evaluation and treatment of dysphagia

Poor Mobility

- Bedsores
- Lung Infections
- Deep vein thrombosis
- Muscle-tendon shortening
- Ache
- Cognitive deficit

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Intervention strategies

- passive mobilization of the muros or hemiplegic limbs and of the person in general as early mobilization and training of the patient reduces complications and facilitates recovery;
- adequate positioning in bed and in a wheelchair;
- use of anti-decubitus devices and maintenance of hygiene to minimize the risk of bedsores.
- prevention of bronchopulmonary infectious complications through accurate clinical evaluation and encouragement of autonomous ventilation;
- prevention of deep vein thrombosis it is advisable to actively mobilize and adequately position the lower limbs;

Incorrect mobility

- Painful shoulder and/or algodystrophic syndrome
- Falls
- Joint injuries
- Pulmonary embolism

Intervention strategies

- Prevention of painful shoulder through adequate movements and positioning
- Prevention of falls through adequate risk identification and identification of specific preventive strategies.

Inadequate management of sphincter functions

- Decompensated neurological bladder
- Urethral injury from catheter
- Urinary tract infections
- Bedsores
- Intestinal obstructions

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Intervention strategies

- Treatment of the neurological bladder to prevent chronicity and urinary infections.
  - Early weaning from the bladder catheter
  - Bladder re-education not through periodic closure but by placing the patient in the bathroom periodically
  - Facilitate the baby

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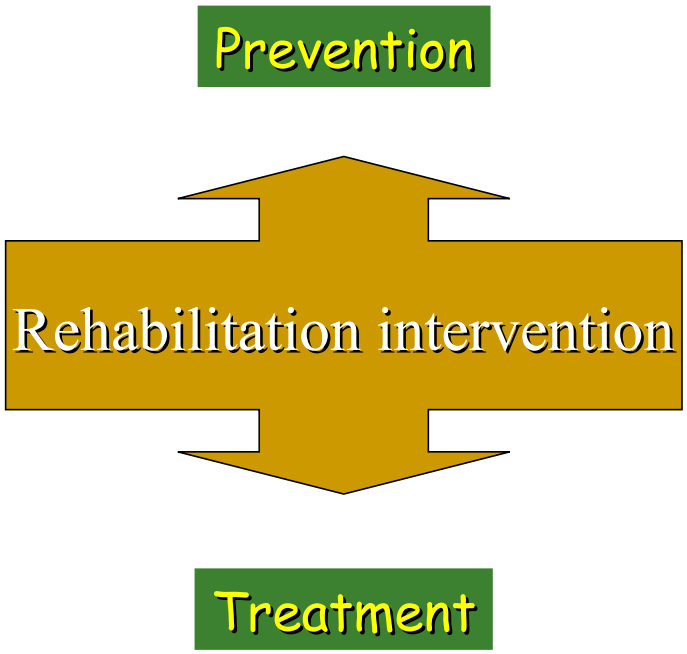
PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

The painful shoulder in the person with hemiplegia



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Size of the problem

Shoulder subluxation occurs in 15% to 81% of stroke patients

Bohannon RW. Clinical Rehabilitation 1988

During the first year after a stroke, three-quarters of patients with hemiplegia suffer from shoulder pain

Wanklyn, Forster et al 1996

This complication negatively interferes with the rehabilitation program and in general with the chances of recovery

Wyller at al 1997

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Painful shoulder of the hemiplegic

Several pathogenetic conditions have been recognized that can cause this syndrome which is most likely multifactorial.

- **Glenohumeral subluxation**
- **Decreased joint range**
- **Shoulder-hand syndrome**
- **Periarticular soft tissue trauma**
  - **irritation (tendinitis) of the long head of the biceps**
  - **involvement of the rotator cuff tendon**
  - **suffering of peripheral nervous structures**
  - **adhesive capsulitis**

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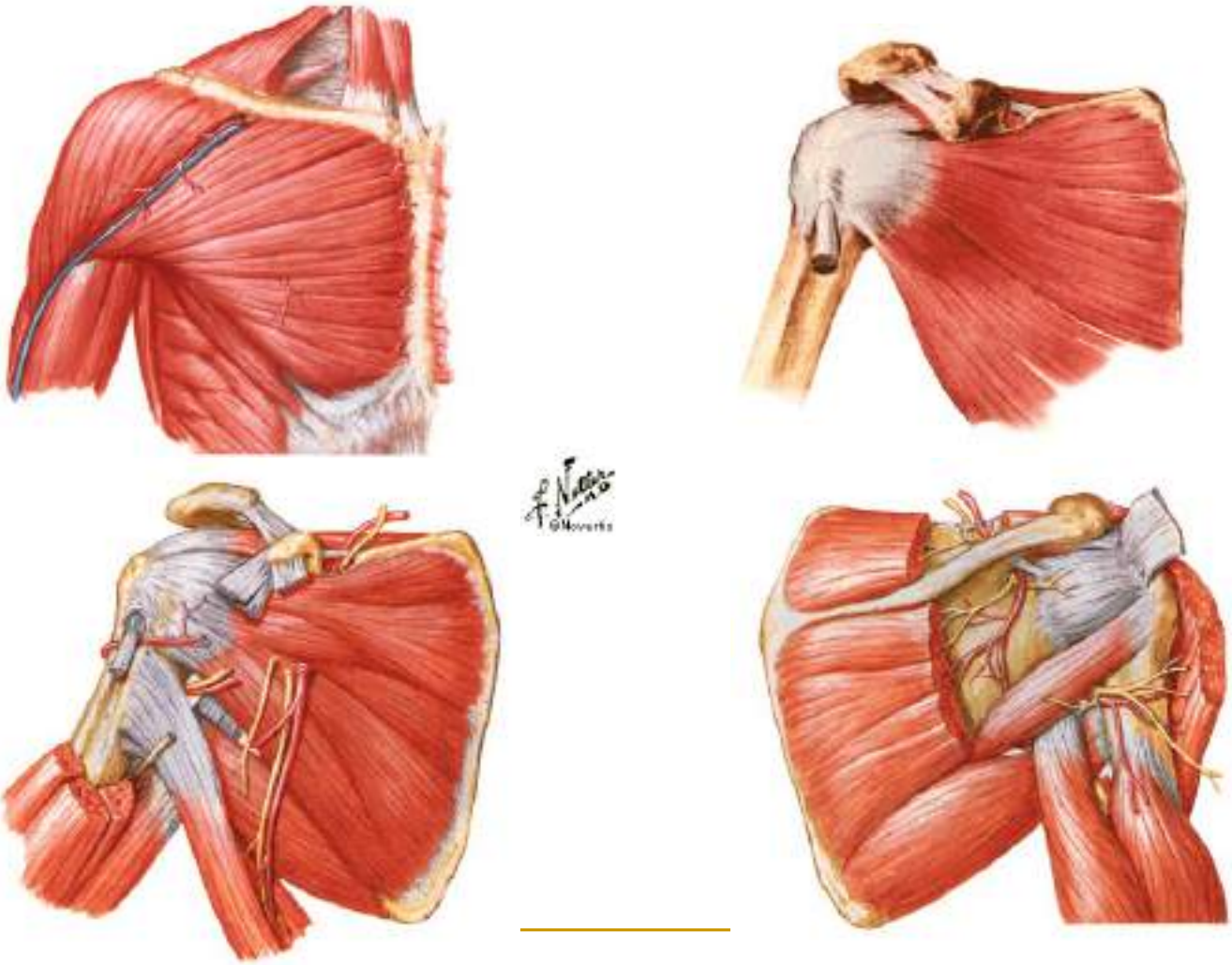
PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST



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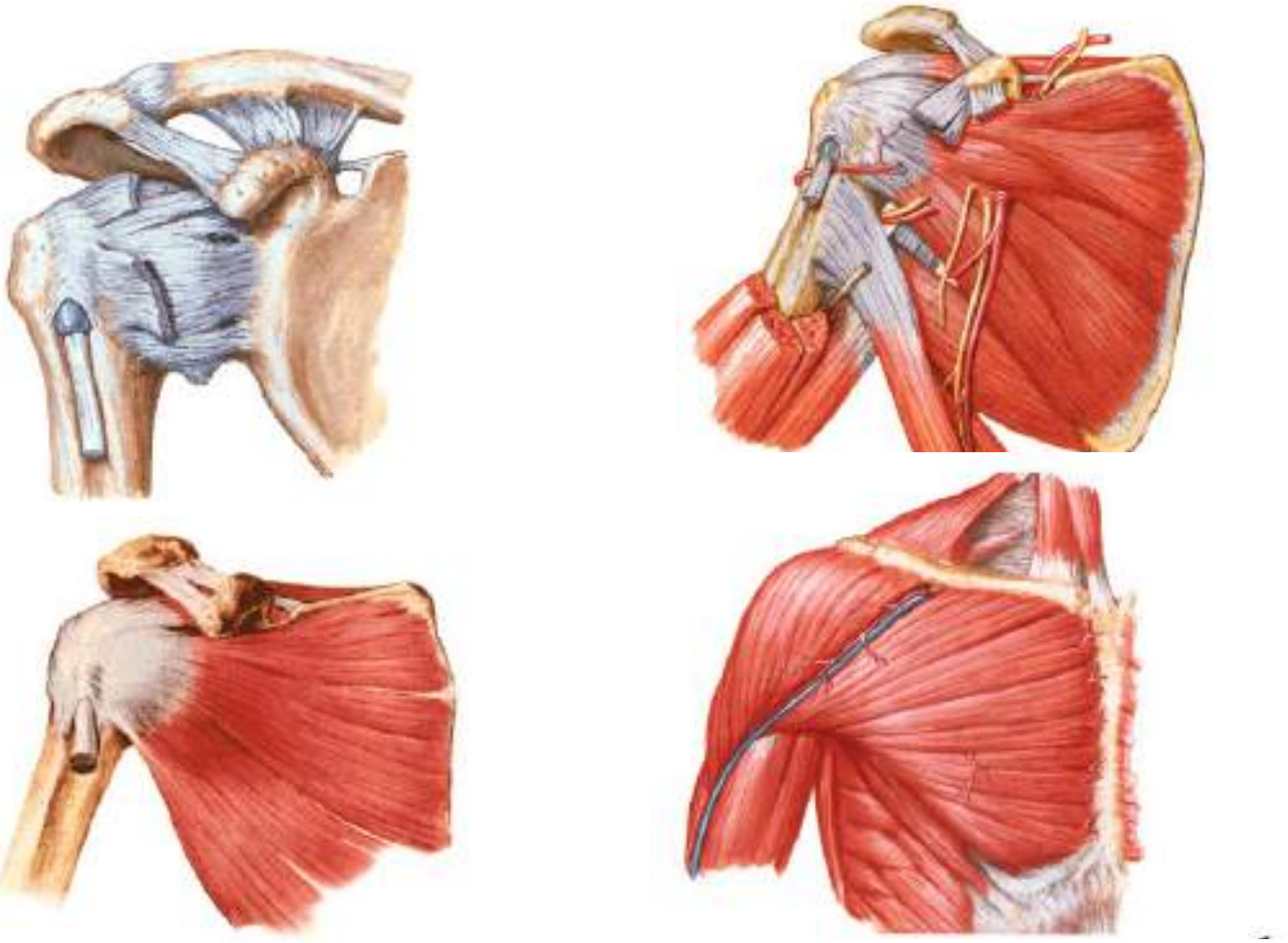

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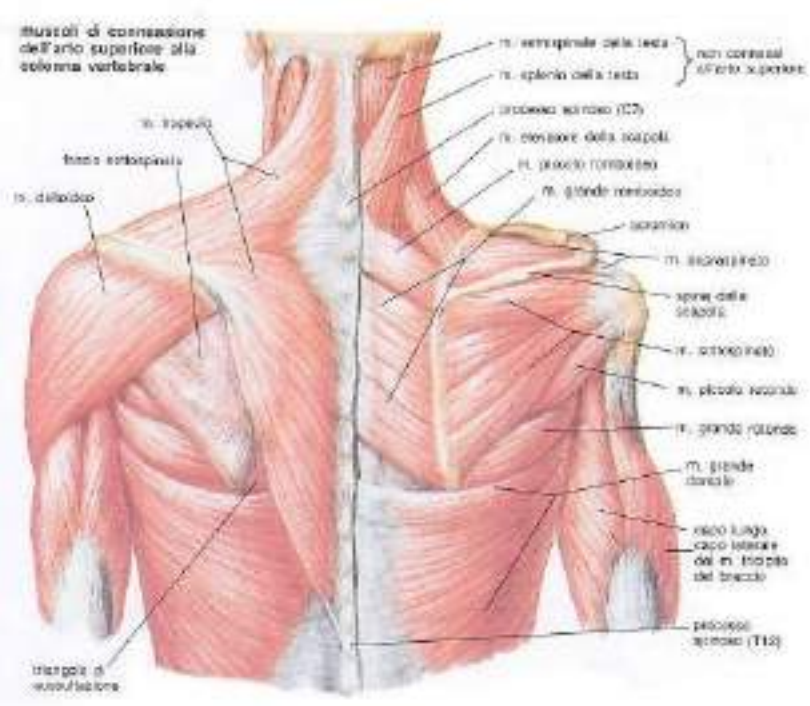
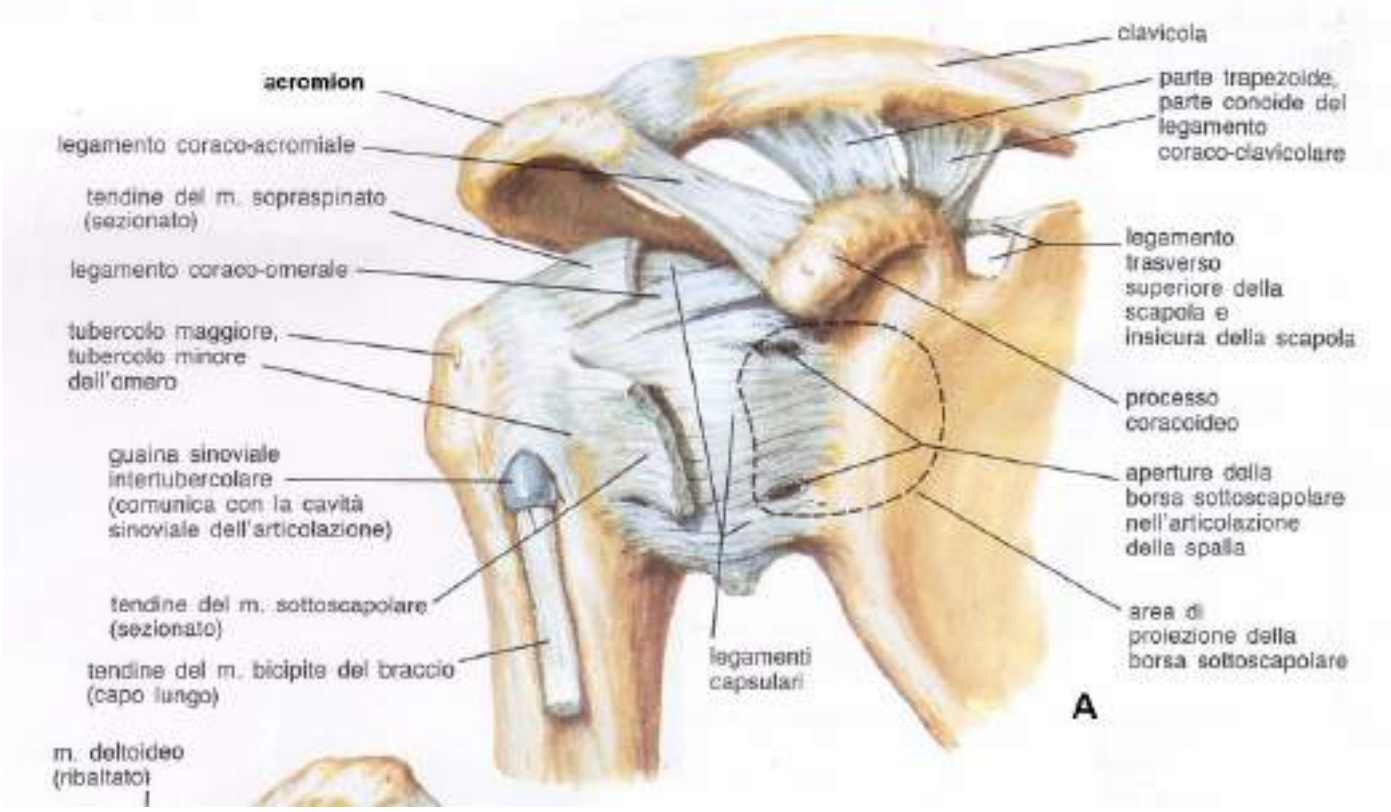
The shoulder muscles



Shoulder musculature

- ***Longitudinal stabilizers:***
  m. deltoid
  m. triceps
- ***Transverse stabilizers***
  m. rotator cuff
- ***Azione sinergica***:
  m. deltoid
  m. supraspinatus
- ***Azione fissatrice*** :
  m. rotator cuff

Static stabilizers

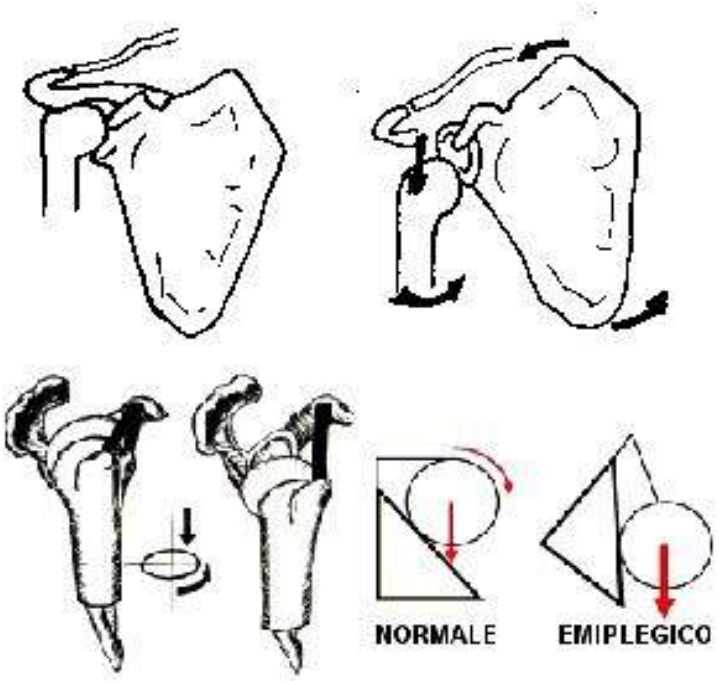


Etiology

Several pathogenetic conditions have been recognized that can cause this syndrome which is most likely multifactorial (Wanklyn, Forster et al. 1996):

- acromiohumeral subluxation (Zorowitz, Hughes et al. 1996),
- rotator cuff injury,
- frozen shoulder,
- impingement syndrome of the shoulder joint structures with biceps tendinitis,
- supraspinatus tendinitis and hypertonicity in internal rotation,
- acromioclavicular arthritis,
- glenohumeral arthritis.

La sublussazione gleno-omerale



Pathogenesis
"BASMAJIAN THEOREM".

Hypotonia of the trapezius muscle

↓

Internal rotation of the scapula

↓

verticalization with "loosening" of the coracohumeral ligament

↓

fall of the humeral head

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Associated Terms

- hypotonia of the shoulder muscles which favors glenohumeral subluxation,
- spasticity,
- loss of profound proprioceptive sensitivity,
- neglect,
- visual field deficit.

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Interventions

- Prevention
  - Movements and positioning
  - Supports
  - Physiotherapy

- **Treatment**
  - Pharmacological therapy
  - Physiotherapy
  - Tens
  - FES
  - Botulinum toxin
  - Surgery

Shoulder supports

- It has not been proven that supporting the limb with shoulder/arm orthoses in the acute phase prevents pain even if they can prevent subluxation.
- There is no evidence of the effectiveness of one type of support over another.

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Functional electrical stimulation

- **Functional electrical stimulation** in the hypothesis of facilitating the recovery of muscle strength by causing a contraction in an organized manner, facilitating the reduction of joint subluxation and reducing spasticity
- It is applied to the arm and forearm in an attempt to reduce edema, contractures and lost functionality
- There is no evidence to recommend or discourage this technique for the prevention of painful shoulder. Only the subluxation reduction effect appears significant, which does not affect the quality of life.

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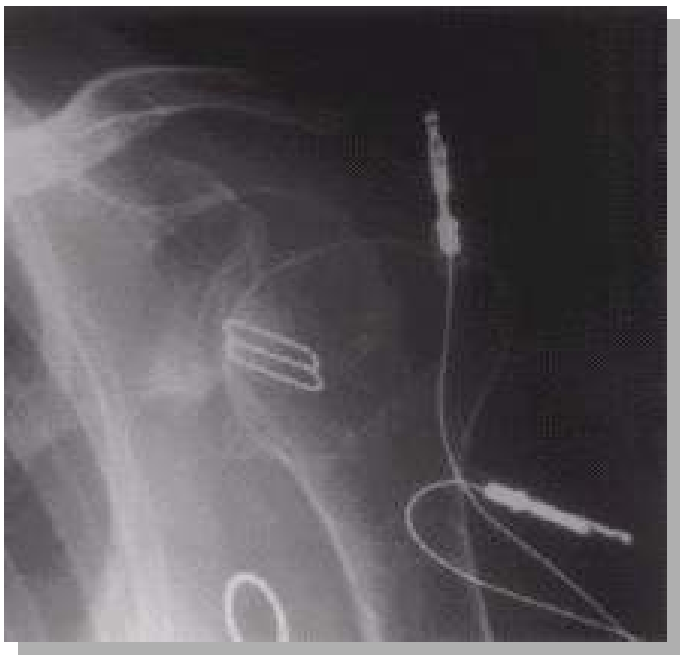
PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Radiographic examination

Alteration of joint relationships
in a shoulder
sub-luxated



Recovery of the joint relationship
during electrostimulation

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Painful shoulder medical treatment

- *Start with oral anti-inflammatories (C);*
- *In case of ineffectiveness, 3 intra-articular injections of triamcinolone 40 mg (C);*
- *In case of further ineffectiveness, use electrostimulation*

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Recommended Procedures

- *Support the flaccid limb to reduce the possibility of subluxation;*
- *Teach the patient not to keep the limb dangling when sitting or standing;*
- *Involve the patient and relatives in prevention techniques*
- *When sitting, support the limb with supports that are more stable than cushions;*
- *Avoid exerting traction on the limb when moving the patient;*
- *The method of travel must be defined by the therapist, communicated to all staff and patient care;*

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Dysphagia

45% of acute strokes persist for an average of a week, at 14 days it is present in 14% of cases and at 30 in 3%. In 40% of patients aspiration occurs silently.

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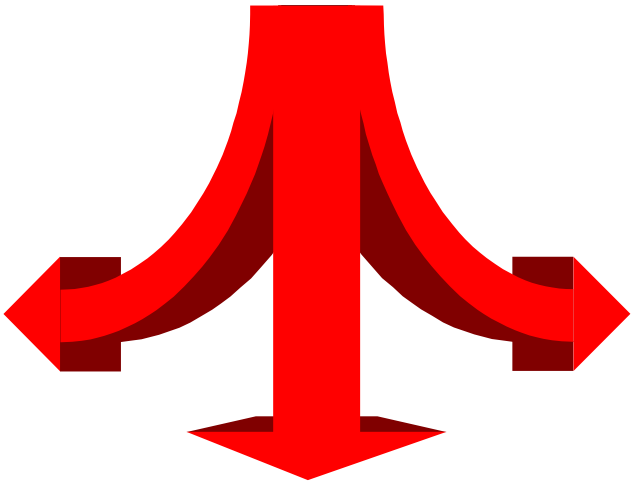
PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

Dysphagia

Inadequate evaluation and treatment of dysphagia



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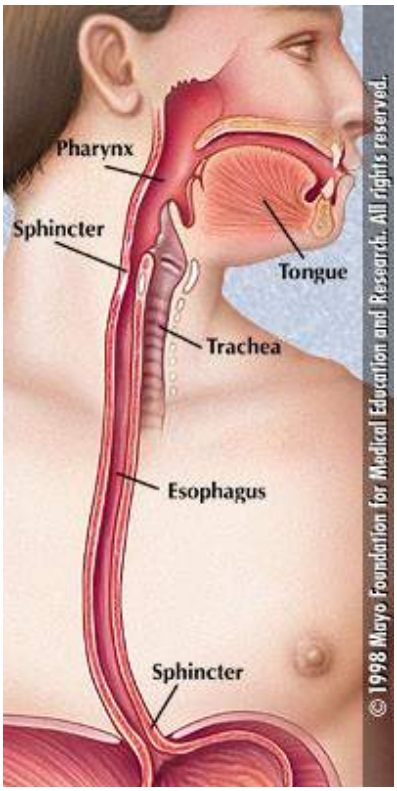
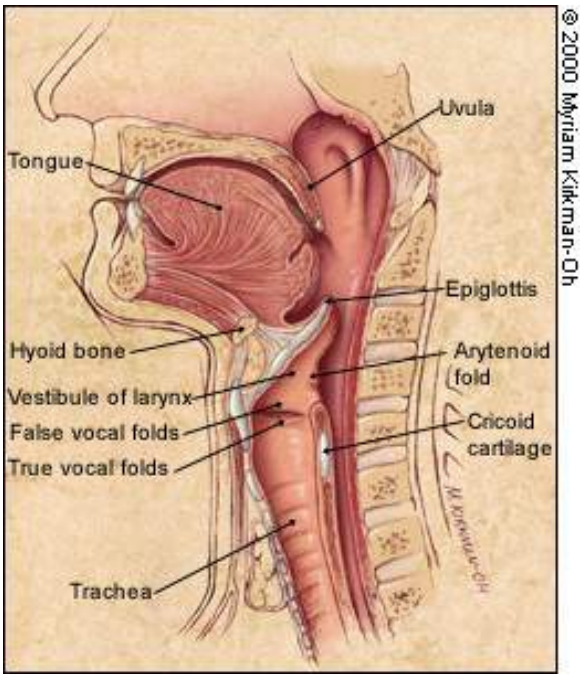
PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

Anatomy of the structures involved in the swallowing function





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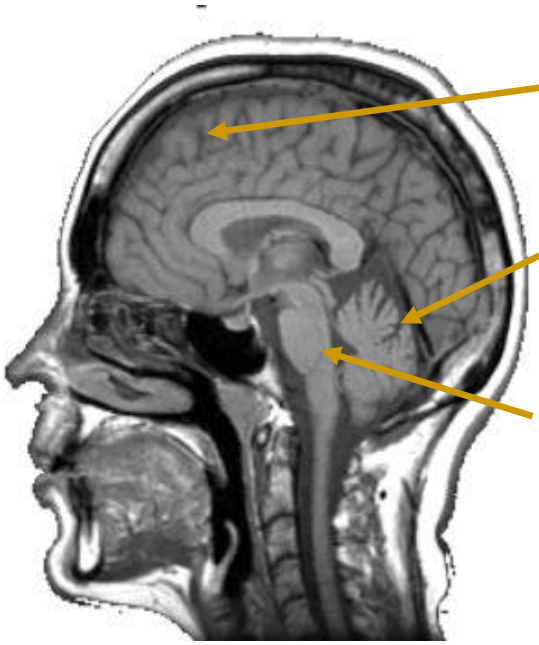


Tavola 2: Organizzazione circuito deglutizione

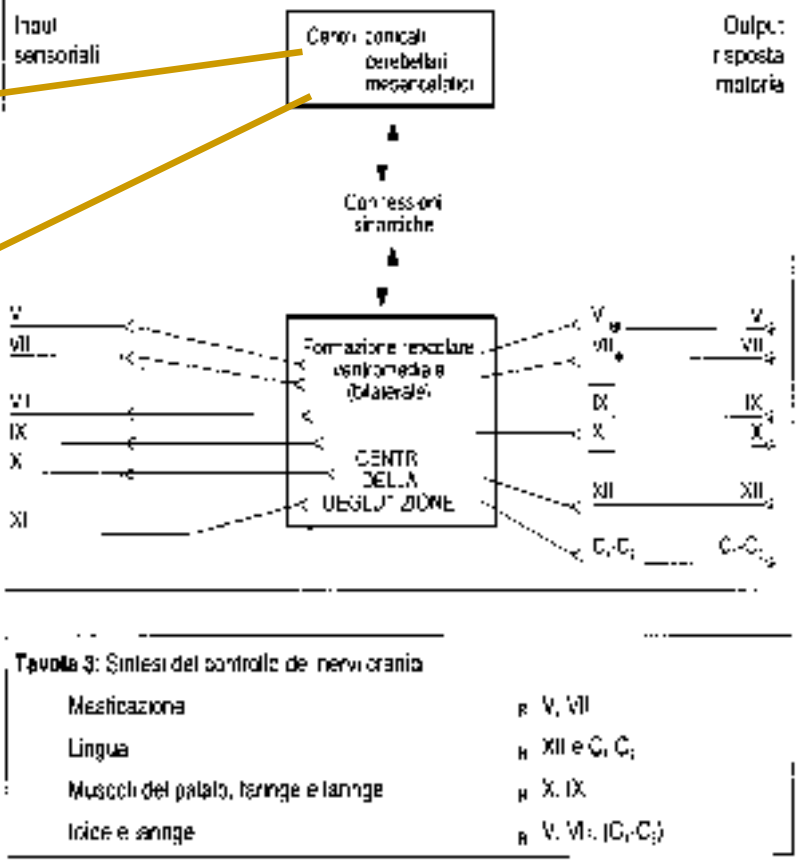
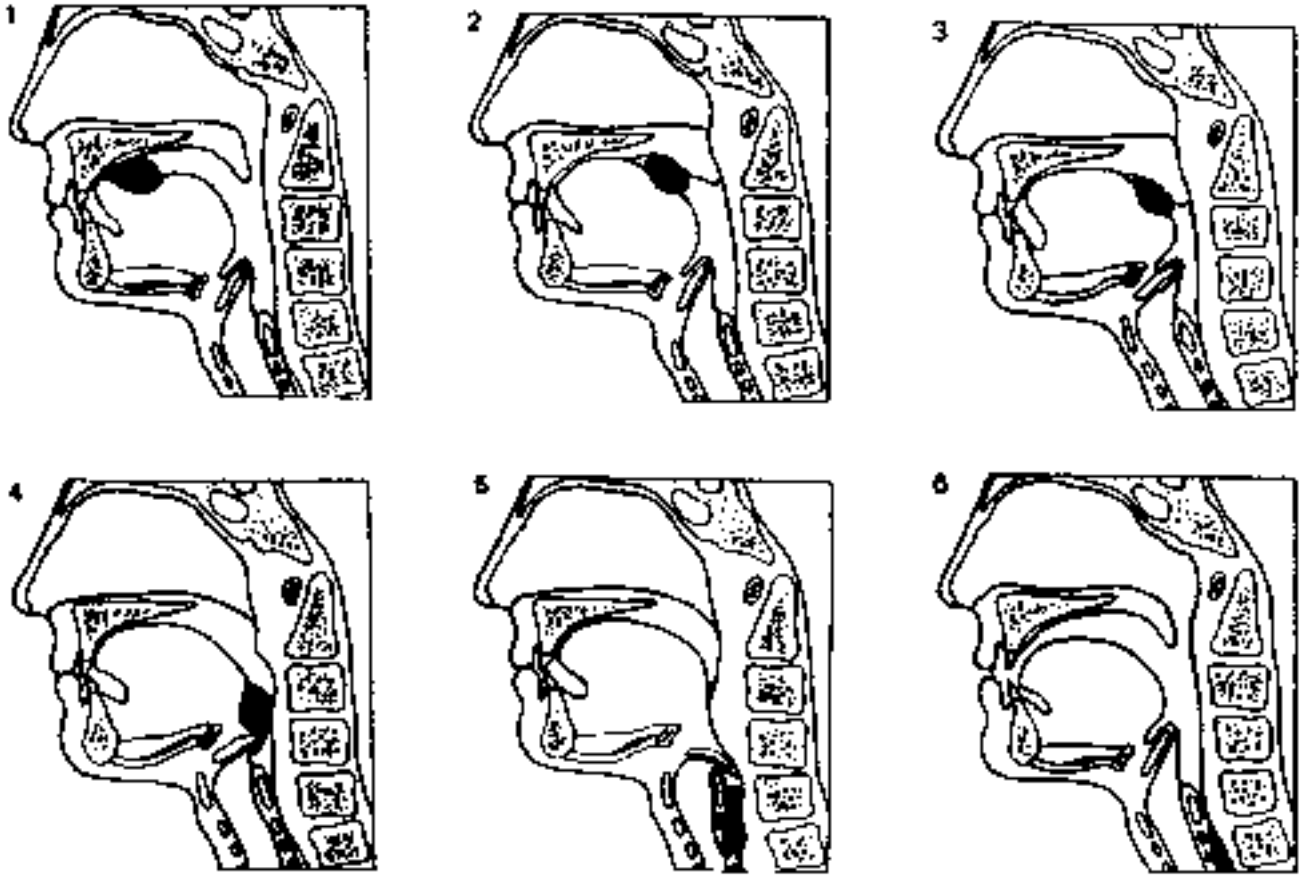


Tavola 3: Sintesi del controllo dei nervi cranici

Masticazione	V, VII
Lingua	XII e C_1, C_2
Muscoli del palato, faringe e laringe	X, IX
Laringe e faringe	V, VII, (C_1-C_2)



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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

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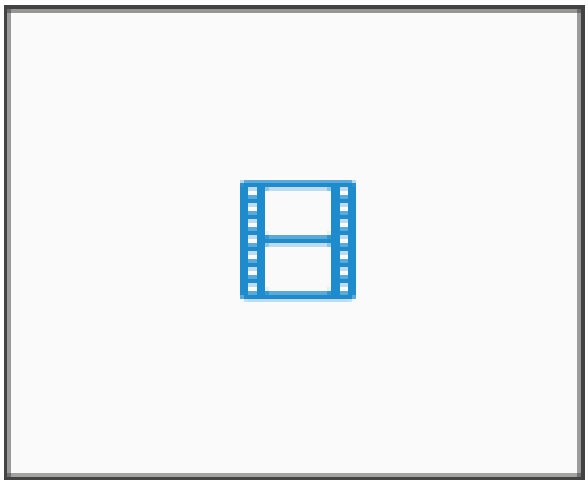
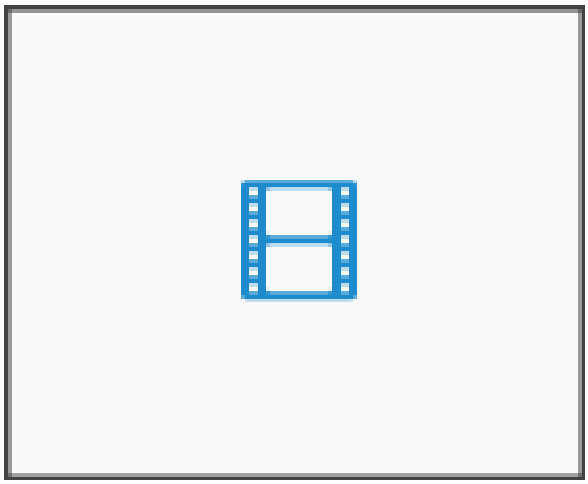
Dysphagia studied with videofluoroscopy

Normal



Stroke



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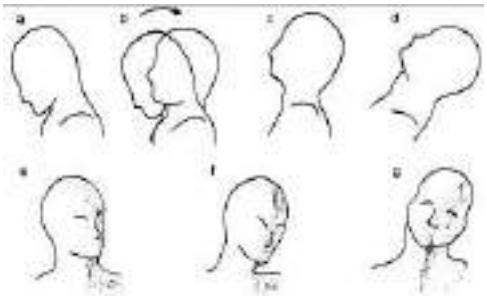
Intervention strategies



- **Compensatory techniques**
  - research of the position of the head and body to be able to control the passage of food and liquids;
  - changing the consistency and volume of food;
  - change in the frequency at which food is normally given.
  - thermal stimulations with food or special equipment.

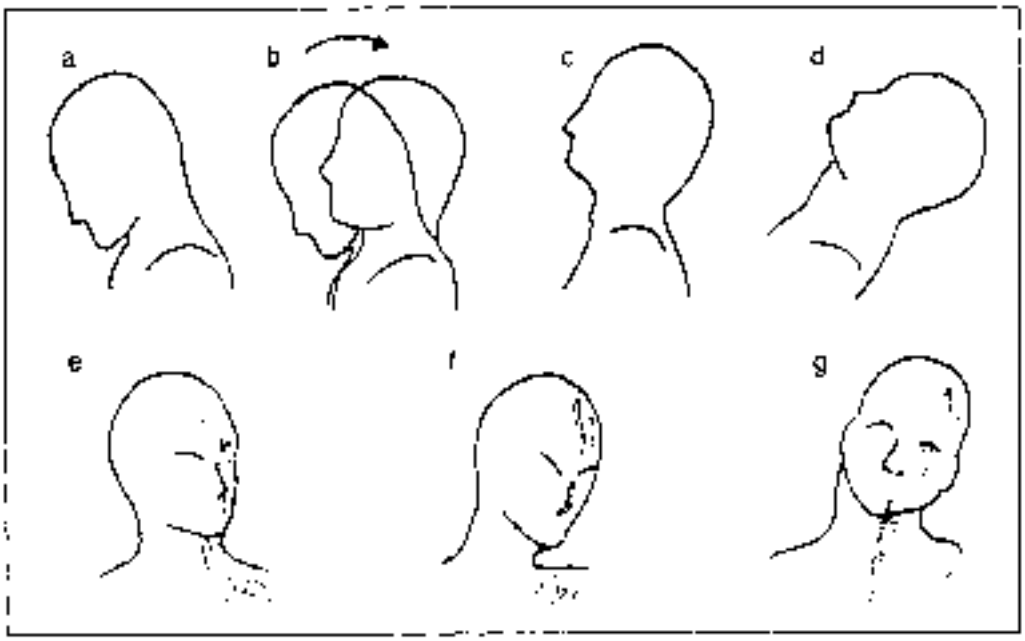


Figura 25.2 - (da Cancialosi et al. 1993 modificato) [291]

Indirect rehabilitation techniques

- lateralization of the tongue during chewing
- elevation of the tongue towards the hard palate
- arching of the tongue under the bolus
- elevation of the tongue against the palate to retain the bolus;
- voluntary mobilization of the tongue in an antero-posterior direction;
- coordination of movements in an antero-posterior direction

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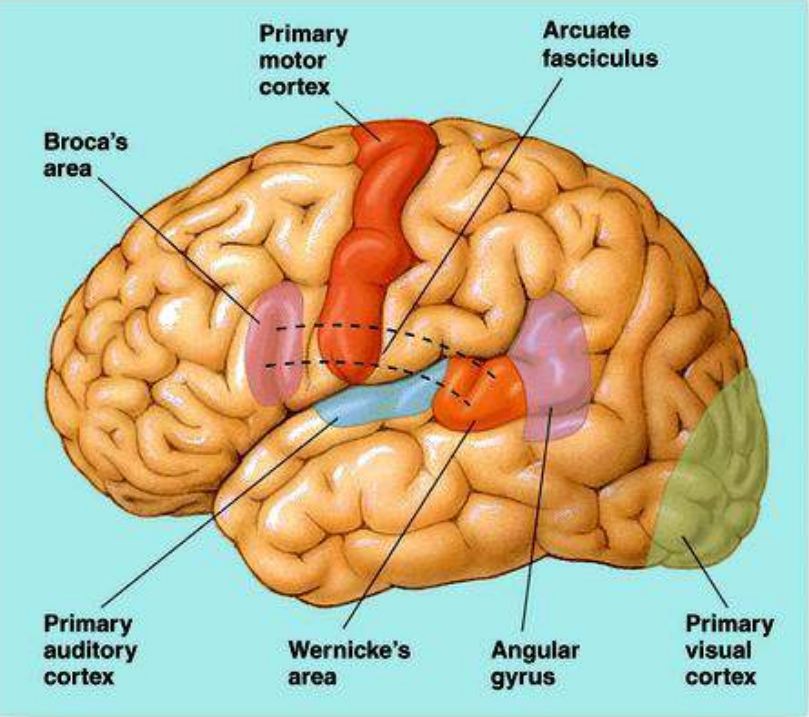
Direct rehabilitation techniques

- Mendelson maneuver: Patients are trained to feel their larynx elevated during swallowing and to prolong the period of maximum elevation as much as possible.
- supraglottic swallow: patients voluntarily hold their breath before and during swallowing, thus requesting laryngeal access. After swallowing, the patient coughs to clear the pharynx of food residues.

The comunication

► **Seven Components of the Wernicke-Geshwind Model**



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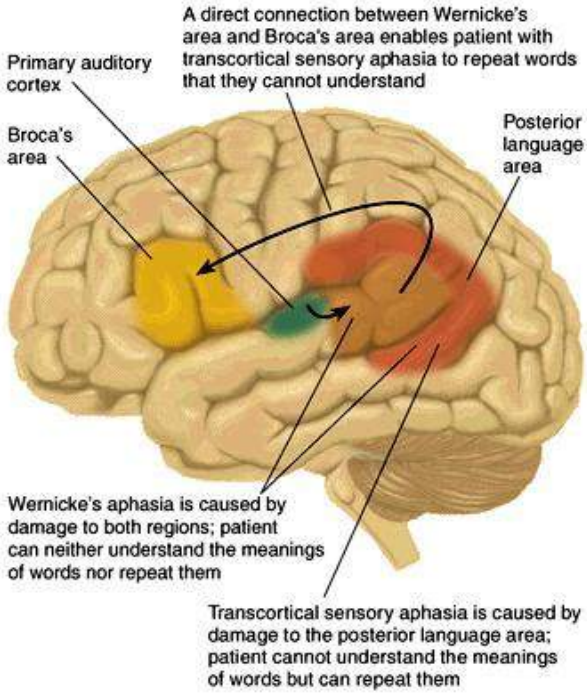
Aphasia

► **Location and Interconnections of the Posterior Language Area**



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Dysarthria

- work to normalize muscle tone and/or improve the strength and precision of movement and coordination of the muscles involved
- compensation through behavioral changes by reducing speech production in order to increase comprehension
- training in the elimination of hasty responses which lead to an increase in language production which would subsequently be perceived as slow and difficult to understand
- training to carry out auxiliary strategies such as lifting the palate to reduce the nasality of the words produced
- suggestion and training in the use of alternative tools which can range from simple writing with pen and paper, the use of a slate with magnetic letters to refined computerized tools
- handicap reduction by modifying the environment through the use of people with the ability to understand dysarthric patients

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What to do ?

- All patients suffering from aphasia or communication problems must be evaluated within the first few days by the speech therapist or neuropsychologist, who together with a competent rehabilitation doctor must set up the treatment plan, with the sharing of the multidisciplinary group, and define the behavioral strategies individual, both for the members of the group and for any other person who is in contact with the patient.

Neglect

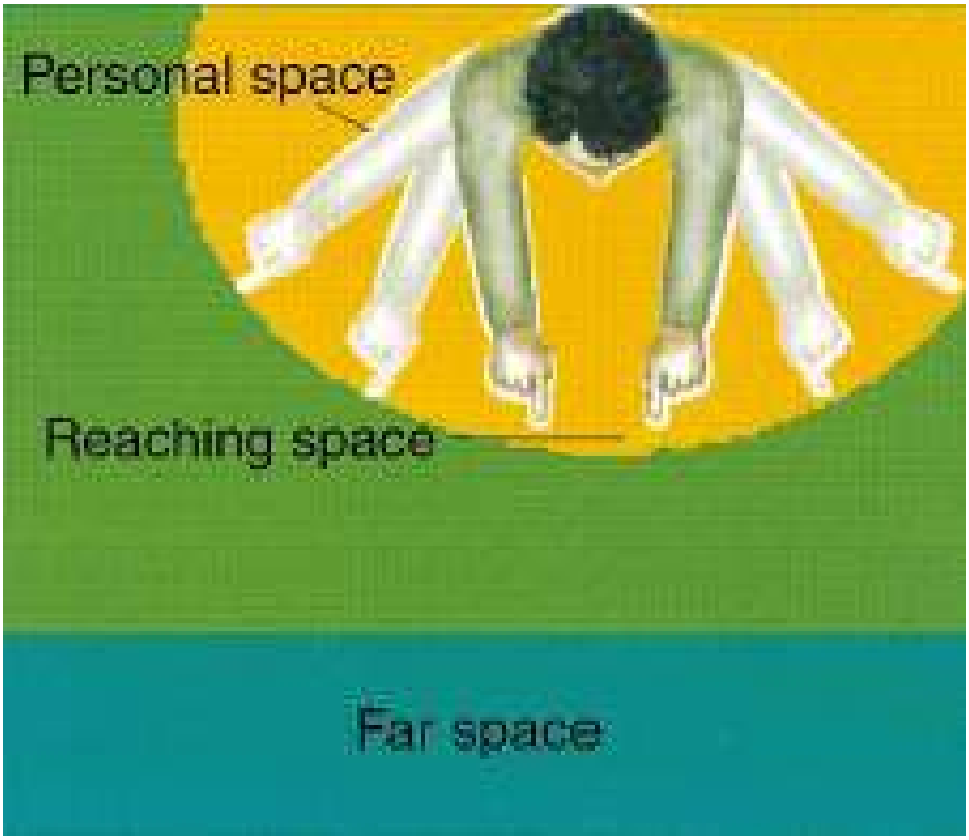

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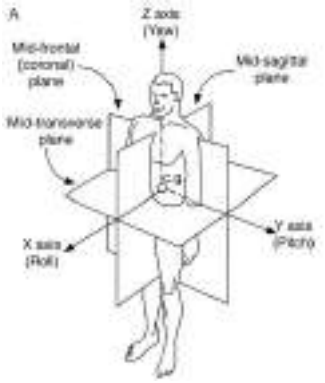
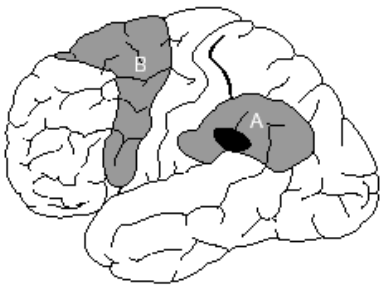
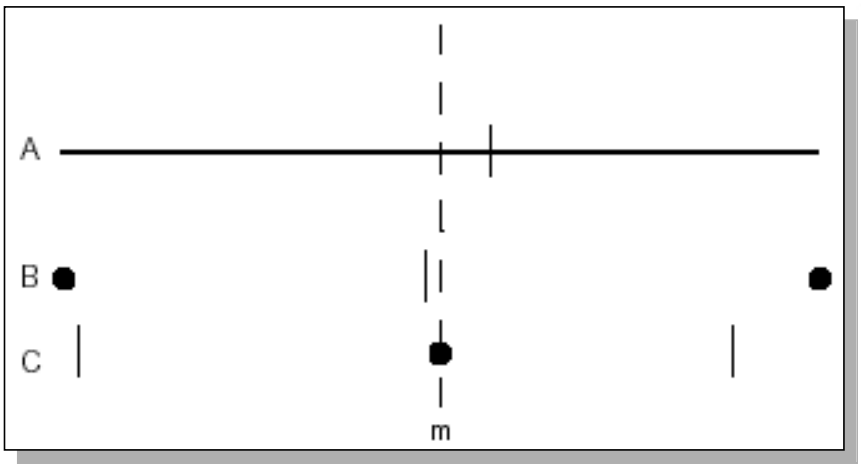
Table. Manifestations of spatial hemineglect

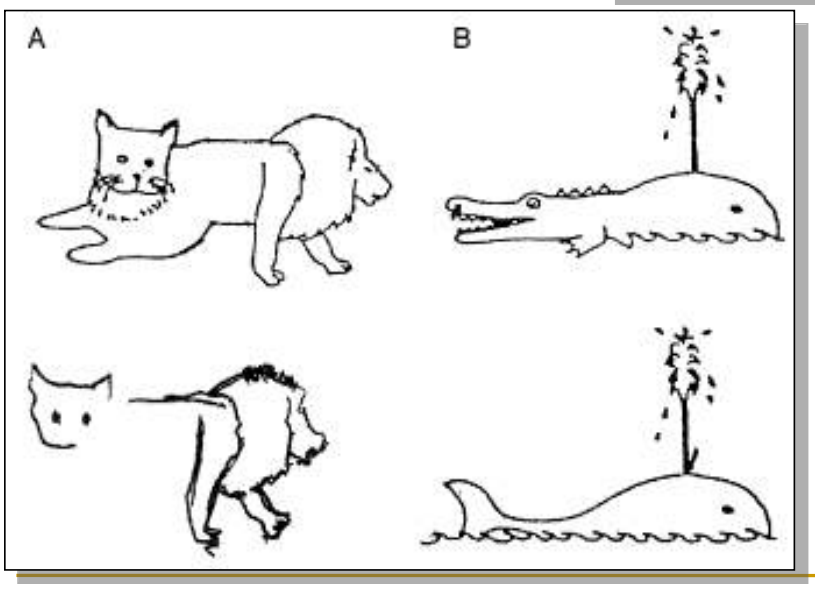
	Defective manifestations	
	Extra-personal space	**Personal (bodily) space**
Dimension **Input/output**	**Variety** **Perceptual HN**[a]	**Hemiasomatognosia**[b] **Anosognosia**[c]
	Premotor/intentional HN, directional hypokinesia[d]	**Motor neglect**[e]
Sectors of space (with reference to the body, as in Fig. 3A)	**External HN Lateral** (along a left-right axis) near, far **Altitudinal** (along a vertical axis) upper, lower **Internal (imaginal) HN Lateral**	
Frames of reference	**Egocentric hn** head, trunk, arm, etc. **Allocentric/object-centred HN**	
Sensory modality[a]	**Visual HN** (pseudo-hemianopia) **Auditory HN**	**Somatosensory HN**[f]
Processing domain (material-specific forms of neglect)	**Facial neglect** **Neglect dyslexia**	



	Productive manifestations	
	Extra-personal space	**Personal (bodily) space**
Avoidance (active withdrawal from contralesional targets)		**Somatoparaphrenia**[g]
Hyperattention (magnetic attraction towards ipsilesional targets)		







Trends in Cognitive Sciences –
Vol. 2, No. 3, March 1998

Academic Year 2003-2004 MED/34 - Physical and Rehabilitation Medicine

Fig. 1. Unilateral neglect shown by the artist Tom Greenshields before (left) and after (right) a stroke. (Reproduced with permission from Ref. 19.)

Trends in Cognitive Sciences – Vol. 3, No. 1 0, October 1999

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

Team intervention on the person with stroke

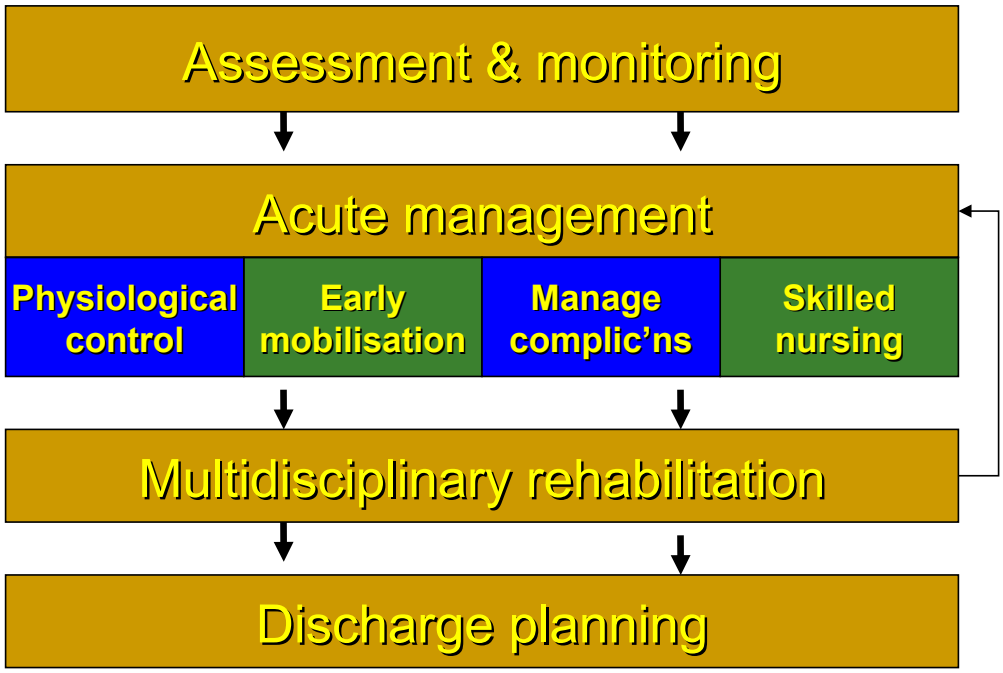
- Importance of the multidisciplinary and multi-professional team
- Rehabilitation as a fundamental element of effectiveness in reducing mortality and disability

Academic Year 2003-2004 MED/34 - Physical and Rehabilitation Medicine

What are the components of effective stroke unit care?

- **assessment procedures**
  - (medical, nursing and therapy assessments),
- **early management policies**
  - (e.g. early mobilization; avoidance of urinary catheterization; treatment of hypoxia, hyperglycaemia and suspected infection),
- **ongoing rehabilitation policies**
  - (e.g. co-ordinated multidisciplinary team care, early assessment for discharge).

Comprehensive stroke unit



(SUTC 2002)

Trained staff e specialized structures

SPREAD 2003
Racc. 14.1

- After the acute phase of the stroke, it is recommended that the care plan be implemented in specialized facilities by trained personnel, taking into account the long-term needs of the subject affected by the acute cerebrovascular event. D grade

The multi-professional team

SPREAD 2003

Racc. 14.13

- **It is recommended that the rehabilitation project is the product of the interaction between the patient and his family and an interprofessional *team*, coordinated by an expert in stroke rehabilitation. Grade C**
- **The *team* must meet periodically to identify active problems, define the most appropriate rehabilitation goals, monitor progress and plan for discharge. Grade C**

Early assessment

SPREAD 2003

Racc. 14.9/8

- Within the first days of admission to rehabilitation facilities, it is advisable to take stock of the clinical and functional conditions of the person affected by a stroke and of the socio-health context in which he lives. Grade D
- The assessment must include both measures of autonomy and parameters relating to motor and cognitive abilities. D grade
- It is advisable to evaluate the patient's disability before and after the rehabilitation treatment, using validated and commonly used scales, such as the *Barthel Index and the Functional Independence Measure* (FIM). Grade D

Early intervention

SPREAD 2003

Racc. 14.23/24

- In the first days after the ictal event it is indicated that the operators of the structure intended for the phase of acute cases implement an intervention protocol which takes into account: state of consciousness and cognitive abilities, ability to swallow, nutritional status, risk of bedsores, patient needs related to motor limitations. Grade C
- Within the first week of hospitalization it is advisable to activate the staff responsible for providing assistance
- for rehabilitation purposes. Grade A

Positioning e Mobilization

SPREAD 2003

Racc. 14.30

- Positioning (postural hygiene) are indicated and segmental limb mobilization of the patient with stroke, in order to minimize the individual risk of complications more frequent, such as contractures and infections of the respiratory tract, the painful shoulder and decubitus. Grade B
- It is advisable to stimulate and encourage patients with stroke to participate in daily activities and promote early leaving of bed (early verticalization), through the acquisition of alignment in a sitting position by the third day, if there are no contraindications to the program. Grade B

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

APA
Italian experience
users and facilities

919/3677

Premise

Centre of lot of study
Importance to maintain achieve and improve well being
Nobody bust to be exclused

Thinking to altenative solutions
To involve wide possible spectrum of people
Chronic fraility
temporary or definitive conditions

outside reeducational programs
clinical functional stability
not there is the need of intervention in the hospital or under medical doctor supervision

We can not to refer to patients but to persons

Can must participate and contribute to own well being

Carry out programs of phsyical activity become foundamental

They can and must to do Physical activity

Premise

concept of health all aspects of life
not only merely physical but psychological and social
WHO health is a unanaleniable right but is duty too?????
Not merely absence of disease
Complete psycho physical and social well being

APA programs of physical activity within in gymns and equipped centres
Complete well being
function of multiplier of resources internal and anyone has
only in relationship well being
psysical and psychical

Limit for the developement of the person and the whole society
To forget and to not consider realationship part of the life

Foundamantal to achieve individual
well being
social participation

Definition

Definition
International Federation of Adapted Activity
Adapted Physical Activity
Multidisciplinary theoric and practical knowdlegment oriented to

Profession
Social Service
Academic enviroment of study
Acceptation of individual differences
Promotion of active life style
Sport

Disability
Constraints
Participation to physical activity

Concretely
APA is a specific motor program oriented to person with diseases or particular conditions
Clinical condition of functional stability assessed by MD
Promote health
Reduce sedentary behaviour
Modify lifestyle

Prevention

A real program of secondary and tertiary prevention
To achieve all persons
Reduced costs management

It is a not and can/must to be carried out outside of the hospital
Equipped gymns

MD supervision
evaluates indication and controindication
assessing clinical conditions
MD monitor execution by middle evaluation in more complex cases

APA

APA program
Qualified professional figure

Master 2 years degree in Science and techniques of preventive and adapted motor activities
Foundamental multipdsciplinary and multiapproach team to realize the project and its body expression considering firstly the safety of of the persons

Ameliorate QOL despite all diffcuties due to the changes
The intervention based on active style improve the life of the person on three istinct planes
Physical
Psychological
Social

Physical

- Criticities due muscle trophism
- Joint problems
- Cardiovascular problems

Psychosocial

Psychological

- Mood
- Maintaining selfconfiance and selfexteem,
- Depression

Social,

- capability to create a good network of realtionschips

- facilitating exchanges of opinions dialogues comparisons with other persons

APA in Italy Regional Models

- The first step in realizing a structured route journey alternative to medical course
- Some pathologies
- Toscan region
- by resolution of the regional council
- defined an assitance path devoted to painful condition due hypomobility

group

- Characterized by chronicizing trend
- Need to to determine an adjustments of own lifestyle

- IT are believed adequate motor programs modified and exerted in group (difference with therapeutic exercise and PT)
- Not necessarly medical

Education to Health

- Entering within education to Health and Promotion of correct lifestyle (motor and postural hygiene, adapted fitness)

- Since 2007 were considered more complex diseases with clinical function stability consequences of neural motor disesases (Stroke, Parkinson Disease)
- Procedures slightly different
- To guarantee the best safety possible to patient

Other regions

- Following the example of Toscan region
- Other italian regions designed and realized own directives and procedures to activate APA motor program plans on the territory to achive more wider spectrum of persons
- Courses for elderly people so preventing mutiple falls

theme

- Foundamental theme or issue
- Fractures
- Immobilization/istituzionalization
- Psichical and behavioural changes

themes

- Fear of falling and of new falls
- Anxiety
- Depression
- Worsening of health of person

Regional Projects

- Regional Projects evidenced between them little and sometimes necessary changes due to specific features of the territory it is possible to indentify the highlits organizzative features of APA Motor Program

- It is described
- The path to access the service
- Inclusion criteria
- Exclusion criteria
- Maximum number of participant (10-15 persons)

Equiped facilities

- Its foundamental to guarantee a list of faclities and equiped and certified structures (gimns, associations, swimming roooms, places for socialization, recreational clubs)

Meeting

- APA 2 tmes weekly (1 hour)
- Meeting for health education useful to modify lifestyle according to the action of promoter of APA
- APA must to be regular continuous during the whole year

costs

- The cost of the service varies depending on
- the structures managed by profit and no profit agencies
- needed resources
- level of complexity of the intervention
- services avaliable

- And the user?
- Little participation to cover the costs because an social intervention not contained within essential assistance levels (EAL) used in Hospital insured by the National Health Service

to whom it is addressed

- Programs of APA are addressed to anyone at any age feel the need to carry out an active lifestyle feeling the need of more specified adapted approach to execute this activity without occurrence in an increase of the amount of the risk for the person

not

- The programs were calibrated depending on omogenous functional level and not mandatory depending on basical pathology

Container

- The programs can contain
- osteoarticular mobilization exercises
- muscle strenghtening
- stretching
- respiratory exercises
- training to physical effort
- increase of aerobic capacities
- exercises to increase coordination
- Motor control
- Balance
- Deambulation

How?

customizing the type of intervention based on residual capacities of the person participating to APA program

positive

- This behavior exert positive ripercussions on the whole improvement of the perfomance in all activities daily life and on recovery and mantaining of indipendence and autonomy

professional

- Qualified and well trained professional figure
- The specificity of APA programms needs of qualified profesional figures such as Master degre 2 years in STPAMA and MS

Work table

- We can refer to final document of the work table instituted at the Ministry of Health on 2013 among graduates in Physiotherapy and and graduates in Motor Sciences so defining roles and competencies

firstly

- Firstly to guarantee a formation and to give informations about the benefit induced by an active lifestyle and concretive benefits of anyone program
- Furtehermore to accompaign the person in a process of learning aimed to making him able to execute exercises in autonomic way but always costantly monitored

mandatory

- For this reason it is mandatory to give continuity to activity
- Not only
- The exercises must to be conceived by using repetitions and estabilished timing
- The exercise must to be calibrated
- The exercise must to be adapted

Must to be clear to user

- The description of exercise and eventual its variants
- The number and duration of repetitions expressed in minutes
- The material to give per its execution
- The main aim that we would like to achieve
- The user have to understand utility so hardly engaging himself in the correct realization

Benefits of APA

- Regular exercise hollow to brack this vicious circle occurring in the person with disability
- Patology, impairment and disability can conduct inexorably
- to a condition of difficulty, hypomobility sedentary style, physical deconditioning
- removal from an active lifestyle

Benefits of APA

- further reduction of the skills of the person dragging him in a situation of dependence and unadequacy to execute the more easy ADL

- The continuous gradual and monitored activity can contain the chronicities

International scientific studies

- International scientific studies demonstrated that regular physical exercise can be able to reduce morbidity and mortality in the person with chronic diseases as CV diseases Stroke, Hypertension, Diabetes II, obesity, Osteoporosis, Psychiatric disorders, an some types of cancers.

Regular APA

- Regular exercise modify insulin sensitivity and the expression of lipoproteins

- Prevent and counteract degenerative diseases of Muscle skeletal apparatus
- Improve muscle tone
- Counteract Osteoporosis
- Reduce painful sensation

- In the elderly Physical activity
- reduces the risks of falling
- Cognitive decline

Infact

- Physical activity exert favourable effects on
- Attention
- Executive functions
- Memory
- Learning
- Cognitive processes
- Preventing Dementia

changes of lifesyle

- It is referred to a changes of lifesyle and a reduction of sedentary behaviour

- Only recently sedentary lifestyle as a indipendent determinant of the health

Some international studies

- Some international studies demonstrated that the are three important reasons to consider sedentary style distinguished from lack of physical activity

differences

- Firstly because the approaches aimed to increase physical activity may differ from these carried out to reduce sedentary behavioural
- These two behaviorals can quietly coexist and compete with each other at the same time

To spend the time

- To explain this concept we can ust think of how a person can divide his time

- Infact
- Can to spend two hours of the day o some day weekly to perform a physical activity and and the rest of the time adopt sedentary behaviors

- secondly, the physiological responses of the organism at the molecular level to sedentary behavior are distinguished from responses to physical activity

Mets

- Finally, assessment and measurement of sedentary behavior may require different units of measurement and distinct indicators

- It is correct to underly that for sedentary we to not refer only to these behaviors prefering sitting or lying down, but all activities able to generate less of 1.5 metabolic equivalents (METs)

SO

- It’s well known that regular exercise is also therapeutic and protective towards of depression, ameliorate mood, relationship capabilities an socialization so increasing psychophysical well being facilitating the higher perceiption of efficency of the own body regenerating the strength needed to recover and exert an active role in the society.

Conclusions I

- In this lecture we focused our attention on the importance of physical activity and on the benefits achieved in terms physical psichical and social.
- Adapted Physical Acitivity, particularly, permit to all persons do carry out an active lifestyle and to establish a valid relatonships with other persons in any age feeling part of a group.

Conclusion II

- If APA is by now accredited at scientific level it is important the spread the knowdlege of it in the most possible capillary manner in the society.

- The spread must to be a a task of final users but of qualified professional figures trained, medical and not by awareness campaignes and formation courses

Conclusion III

- It is important that could be more possible widespread a new point of view of physical activity open to all, of health and opportunities to live in peace, wellness and harmony with each other.

conclusion IV

- So permitting to invest on new programs and on research, on building of new facilities (devoted Gymns to APA) and on formation of always more qualified professional figures with benefits for the whole society

Role of Physical Activities and Health Prevention Lectures and exams

Prof. Salvatore A. Cassarino, MD

PRM aggregate Professor

Coordinator of an integrated course comprising Physical and rehabilitation Medicine Internal Medicne and Endocrinology CFU 14

13 lectures Hours 26 last lecture Nov 28 2018

Attendance in class On time please

Exams

This is an inhgrated course. sSingle exam not fragmented in three exams is impossible

Data

I exam appea 2019 Feb 15 9.30 2 exam appeal 2019 feb 21 9.30 Where? A t 1b1 computer classroom Admission Test to oral exam by multiple choices q uestions concerning the three disciplines in computer 1b1 classroom The

admission test foundamental to access to the oral exam

If you do not pass the admission test you cannot substain any exams with no professor of integrate Course

1° introductive lecture
2018 October 19

- Benefits of active life style on health and prevention of disases and disconfort
- WHO indications (official document pubblished 2002)
- Who indications for
- Youth
- Women
- Elderly

Physical Activity

- Physical activity has many health (physical/ mental) social and economic benefits.
- Chronic, noncommunicable diseases (NCDs) cause 60% of global deaths and 47% of burden of disease (World Health Report 2002).
- These estimates expected to rise to 73% and 60 % respectively by 2020.
- 66% of NCD deaths occur in developing countries
- Physical inactivity a major risk factor.
- Physical inactivity causes 2 million deaths/year.
- At least 60% of global population fails to achieve 30 minutes moderate intensity physical activity daily

Benefits of Physical Activity (I/II)

- reduces the risk of dying prematurely; reduces the risk of dying from heart disease or stroke, which are responsible for one- third of all deaths
- reduces the risk of developing heart disease or colon cancer by up to 50%
- reduces the risk of developing type II diabetes 50%
- helps to prevent / reduce hypertension, which affects one-fifth of the world's adult population
- helps to prevent / reduce osteoporosis, reducing the risk of hip fracture by up to 50% in women

Benefits of Physical Activity (II/II)

- reduces the risk of developing lower back pain
- promotes psychological well-being, reduces stress, anxiety and feelings of depression and loneliness
- helps prevent or control risky behaviours, especially among children and young people, like tobacco, alcohol or other substance use, unhealthy diet or violence
- helps control weight and lower the risk of becoming obese by 50% compared to people with sedentary lifestyles
- helps build and maintain healthy bones, muscles, and joints and makes people with chronic, disabling conditions improve their stamina
- can help in the management of painful conditions, like back pain or knee pain

Benefits of Physical Activity

We all know that **physical activity** — taking a walk, riding a bike, dancing or playing — **simply makes you feel better**. But regular physical activity brings about many other benefits. It not only has the potential to improve and maintain good health, but it can also bring with it important social and economic benefits.

Benefits of Physical Activity

Regular physical activity benefits communities and economies in terms of reduced health care costs, increased productivity, better performing schools, lower worker absenteeism and turnove, increased productivity and increased participation in sports and recreational activities.

Benefits of Physical Activity

In many countries, a significant proportion of health spending is due to costs related to lack of physical activity and obesity. **Promoting physical activity can be a highly cost-effective** and sustainable public health intervention**.**

Policy related to physical activity

One of the major challenges in the prevention of noncommunicable diseases and in the promotion of physical activity and other healthy lifestyle choices is communicating **the importance of action now in return for future benefits**.

Despite the fact that prevention has been the major contributor to health gains, including 30 added years of life expectancy, in the past century, most studies of health expenditures indicate that less than five percent of resources are devoted to prevention.

Policy related to physical activity

Prevention and health promotion activities are seldom a priority for policy-makers. However, it is at the **policy level, rather than in the realm of medical care**, where most decisions about prevention are made. Thus, it is important that advocacy move beyond individuals to reach policy-makers as well.

Policy related to physical activity

Physical inactivity is not merely about individual behaviour. Crowding, crime, traffic, poor air quality, a lack of parks, sports and recreational facilities and sidewalks make physical activity a difficult choice for many people. The challenge of prevention is therefore as much the responsibility of governments as it is for people.

Sedentary lifestyle: a global public health problem

Sedentary lifestyle is a major underlying cause of death, disease, and disability. Approximately 2 million deaths every year are attributable to physical inactivity; and preliminary findings from a WHO study on risk factors suggest that sedentary lifestyle is one of the ten leading causes of death and disability in the world. **Physical inactivity increases all causes mortality**, doubles the risk of cardiovascular disease, type II diabetes, and obesity. It also increases the risks of colon and breast cancer, high blood pressure, lipid disorders, osteoporosis, depression and anxiety.

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

Sedentary lifestyle: a global public health problem

Levels of inactivity are high in virtually all developed and developing countries.

MEDICINA FISICA RIABILITAZIONE

Sedentary lifestyle: a global public health problem

WHO is currently assessing the global burden of disease from **22 health risk factors, including physical inactivity.** The results of this research are published in the World Health Report 2002. It is clear that physical inactivity is a major public health problem that effects huge numbers of people in all regions of the world. Effective public health measures are urgently needed to promote physical activity and improve public health around the world.

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

Physical activity and youth

Youth

Regular physical activity provides young people with **important physical, mental and social health benefits**

978/3677

Physical activity and youth

Regular practice of physical activity helps children and young people to build and maintain **healthy bones, muscles and joints**, helps control body weight, helps reduce fat and develop efficient function of the **heart and lungs**. It contributes to the development of movement and co-ordination and helps prevent and control feelings of **anxiety and depression**. Some studies show that among adolescents, the more often they participate in physical activity, the less likely they are to use tobacco. It has also been found that children who are more physically active showed **higher academic performance**. Team games and play promote positive social integration and facilitate the development of social skills in young children.

Physical activity and youth

Patterns of physical activity acquired during childhood and adolescence are more likely to be maintained throughout the life span, thus providing the basis for active and healthy life. On the other hand, unhealthy lifestyles — including sedentary lifestyle, poor diet and substance abuse, adopted at a **young age are likely to persist in adulthood.**

Physical activity and youth

Physical activity levels are **decreasing among young people** in countries around the world, especially in poor urban areas. It is estimated that less than one-third of young people are sufficiently active to benefit their present and future health and well-being.

Physical activity and youth

Physical education and other school-based physical **activities are also decreasing**. Only a few countries offer at least two hours per week of physical education in both primary and secondary schools. These negative trends are likely to continue, even worsen and spread to an increasing number of countries.

Physical activity and youth

This decline is largely due to increasingly common sedentary ways of life. For example fewer children **walk or cycle to school** and excessive time is devoted to **watching television, playing computer games**, and using computers - very often at the expense of time and opportunities for physical activity and sports.

Physical activity and youth

Many factors prevent young people from being regularly physically active: lack of time and motivation, insufficient support and guidance from adults, feelings of embarrassment or incompetence, **lack of safe facilities and locales** for physical activity, and **simple ignorance of the benefits of physical activity**.

Women and physical activity

Women

Regular physical activity and good eating habits can improve women's health and help prevent many of the diseases and conditions that are major causes of death and disability for women around the world.

Women and physical activity

Regular physical activity helps prevent **cardiovascular diseases (CVDs)**. These diseases, which include **heart disease, high blood pressure and stroke**, account for one-third of deaths among women around the world. CVDs cause half of all deaths in women over 50 in developing countries.

Women and physical activity

Regular physical activity, combined with adequate diet has shown to be one of the most effective means of controlling **mild to moderate obesity** and maintaining an ideal body weight in women.

Women and physical activity

Diabetes affects more than 70 million women in the world. This figure is projected to double by 2025. Diabetes can lead – in addition to CVDs - to **blindness, nerve damage, kidney failure, foot ulceration and amputation**. A recent study shows that even modest regular physical activity and dietary changes can prevent more than half of the cases of non-insulin dependent diabetes.

Women and physical activity

Physical activity can also greatly help prevent and manage osteoporosis. **Osteoporosis** is a disease in which bones become fragile and more likely to break. Women, particularly post- menopausal, have a higher risk of developing osteoporosis than men.

Women and physical activity

Weight-bearing activities such as walking, dancing and jogging, is essential for normal skeletal development in the childhood and adolescence, and may help in decreasing bone loss. It also improves muscle strength and balance and reduces the risk of falling, thereby helping to prevent fractures.

Women and physical activity

Regular physical activity helps reduce **stress, anxiety, depression and loneliness**—this is particularly important for women as rates of depression for women are almost double those of men in both developed and developing countries. Physical activity also helps build **self-esteem, confidence and promote psychological well-being and social integration**.

Women and physical activity

Arthritis is an important cause of activity limitation among adult and elderly people. Physical activity is a means to control joint swelling and joint pain in arthritis, thus reducing the consequences of the disease for everyday well-being.

Physical activity and older people

Elderly

Active lifestyles provide older persons with regular occasions to make new **friendships, maintain social networks**, and interact with other people of all ages. Improved flexibility, balance, and muscle tone can help **prevent falls** — a major cause of disability among older people. It has been found that the prevalence of **mental illness is lower** among people who are physically active.

Physical activity and older people

The benefits of physical activity can be enjoyed even if regular practice starts late in life. Common diseases among older people are **cardiovascular disease, arthritis, osteoporosis, and hypertension**. While being active from an early age can help prevent many diseases, regular movement and activity can also help relieve **the disability and pain** associated with these conditions.

Physical activity and older people

Physical activity can also contribute greatly to the **management** of some mental disorders such as depression and Alzheimer's disease. Organized exercise sessions, appropriately suited to an individual's fitness level, or simply casual walks can provide the opportunity for making new friends and maintaining ties with the community, reducing feelings of loneliness and social exclusion. Physical activity improves self-confidence and self-sufficiency — qualities that are the foundation of psychological well-being.

Physical activity and older people

As for people of all ages, older persons should take part in physical activities they enjoy the most. Anyone with a specific condition or disability that could affect their ability to be physically active **should seek the advice of a doctor before participating in physical activity**. Walking, swimming, stretching, dance, gardening, hiking and cycling are all excellent activities for older persons.

Physical activity and older people

The number of people over 60 years old is projected to double in the next 20 years. Most of these older persons will be living in developing countries. Reducing and postponing age-related disability is an essential public health measure and physical activity can play an important role in creating and sustaining well-being at all ages.

Degree in Motor Sciences

Three-year basic degree awarded by Italian University Institutes , which has replaced for some years the diploma of the Higher Institute of Physical Education (ISEF), once issued by autonomous institutes or regional courses

Specialist Degree in Motor Sciences

Specialist degree to complement the basic one.

It is also awarded by Italian University Institutes.

It has three addresses:

- of a sports-performance type
- preventive-adapted type
- managerial type

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REHABILITATION PHYSIOTHERAPIST

Rehabilitation Clinic in the person with outcomes of Brain stroke

2nd year – 2nd semester

Degree in Physiotherapy

1000/3677

Stroke definition

Sudden, nonconvulsive, focal neurological deficit that persists more than 24 hours

(Stroke Data Bank - 1988)

Stroke definition

Sudden appearance of signs and/or symptoms attributable to focal and/or global deficit (coma) of cerebral functions, lasting more than 24 hours or to a fatal outcome, not attributable to any other apparent cause other than cerebral vasculopathy

(WHO - 1989)

Stroke

(International data)

1.26 - 3.71 per 1000 inhabitants

(Europe)

4.79 per 1000 inhabitants

(Japan)

Incidence

- **200 new cases per 100,000 inhabitants**
- **400 new cases per 100,000 (age 45-84 years)**

Incidence

	Authors	Year	Incidence	Correct incidence	Mortality at 30 days
Umbria	Ricci et al	1991	2.54 ‰	1.55 ‰	20.3%
Val D'Aosta	D'Alessandro	1992	2.23 ‰	2.15 ‰	31%
Veneto	Lauria et al.[9]	1995	2.24 ‰	1.70 ‰	33%
Abruzzo	Carolei	1997	2.75 ‰	2.37 ‰	25.6%
Calabria	Di Carlo	2003	1.79 ‰	1.99‰	23.7

Stroke

- 75% 1st episode
- 25% relapse

Mortality

- 3rd cause of death in industrialized countries
  - 10-12% of deaths
  - 90% deaths over 65 years

- 17-34 mortality at 30 days
- 25-40 " at 1 year
- 32-60 " at 3 years

Intervention	Primary prevention Risk reduction
Smoking abolition	50% (after 1 year)
Anticoagulants and antiaggregants in non-valvular atrial fibrillation	68% (warfarin) 21% (ASA)
Correction of hyperlipidemia	20-30%*
Correction of arterial hypertension	38%

*** with statins in patients with known coronary artery disease**

Intervention	Secondary prevention Relative risk (95% CI)
Antiaggregants	0.78 (0.73-0.85)
ATE in patients with symptomatic stenosis ≥70%*	0.52 (0.40-0.64)
Smoking abolition	
Anticoagulants and antiaggregants in non-valvular atrial fibrillation	0.14** (0.07-0.21)
Correction of hyperlipidemia	0.81 (0.75-0.87)
Correction of arterial hypertension	0.72 (0.61 - 0.85)

* excluding quasi-occlusions
** Absolute risk reduction

Autonomy (immediate)

- **12% self-sufficient**
- **38% severely dependent**

Six months autonomy

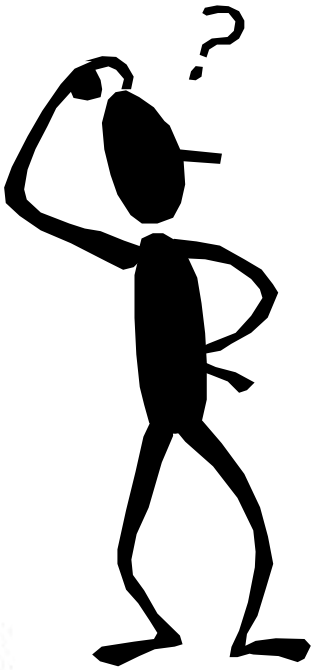
- **33-50% of survivors dependent on ADL**
- **20% total dependency**

Skill limitations

	Authors	Year	Disabled patients at 30 days
Valle D'Aosta	D'Alessandro	1992	62%
Veneto	Lauria	1995	54%
Abruzzo	Carolei	1997	38.9% (at 1 year)
ILSA	Di Carlo	2002	67.6%

Stroke

ITALY: population 57,500,000.



Approximately 130,000 first strokes in a year

Approximately 50% of survivors with disabilities residual at six months

walk

- **23-37% after 1 week**
- **58% within 6 months**
- **78-80% of survivors walk independently in the long term**

Recovery of the path

- **50-80% within 3 weeks or at Dim.**
- **85% after six months**

Upper Limb Recovery

- **85% significant deficits at onset**
- **55-75% deficit at 3-6 months**
- **56% significant deficits at 5 years**

Upper Limb Recovery (Nakayama on 100 pcs.)

- **Complete damage**
  - **16% recover functional use**
- **Partial conservation**
  - **57% recover functional use**

Upper Limb Recovery (Broeks 54 pcs. with FU 4 years)

- **1/3 of cases improvement compared to the picture 4 months after the stroke**

Motivations - 1

- **In 75% of strokes the middle cerebral artery is involved, therefore the upper limb is affected**
- **The upper limb involves much more complex motor strategies than the lower limb, in which partial recovery is sufficient to allow standing and walking;**

Motivations - 2

- **The deficit of the upper limb, unlike the lower limb, can generate a process of less stimulation and activation in favor of the contralateral limb (functional exclusion of the limb)**
- **The onset of secondary complications such as glenohumeral subluxation, shoulder pain, shoulder-hand**

Recovery in ADL

- **67/80% partial or total dependence in the first three weeks**
- **24/53% of survivors between six months and 5 years**

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Neuronal and functional recovery occurs between three and six months

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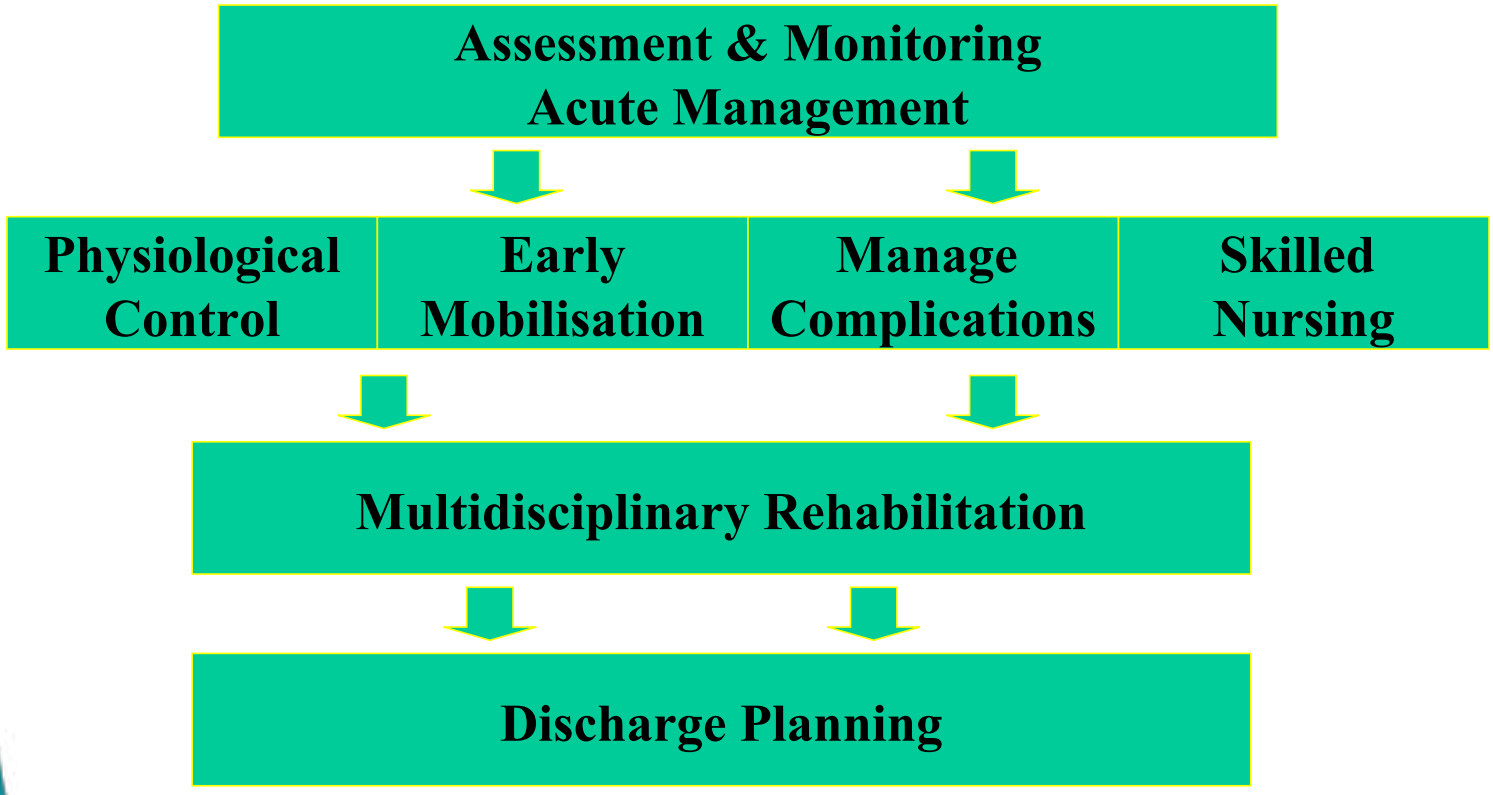
High incidence of stroke

High number of people with disabilities

High rehabilitation need

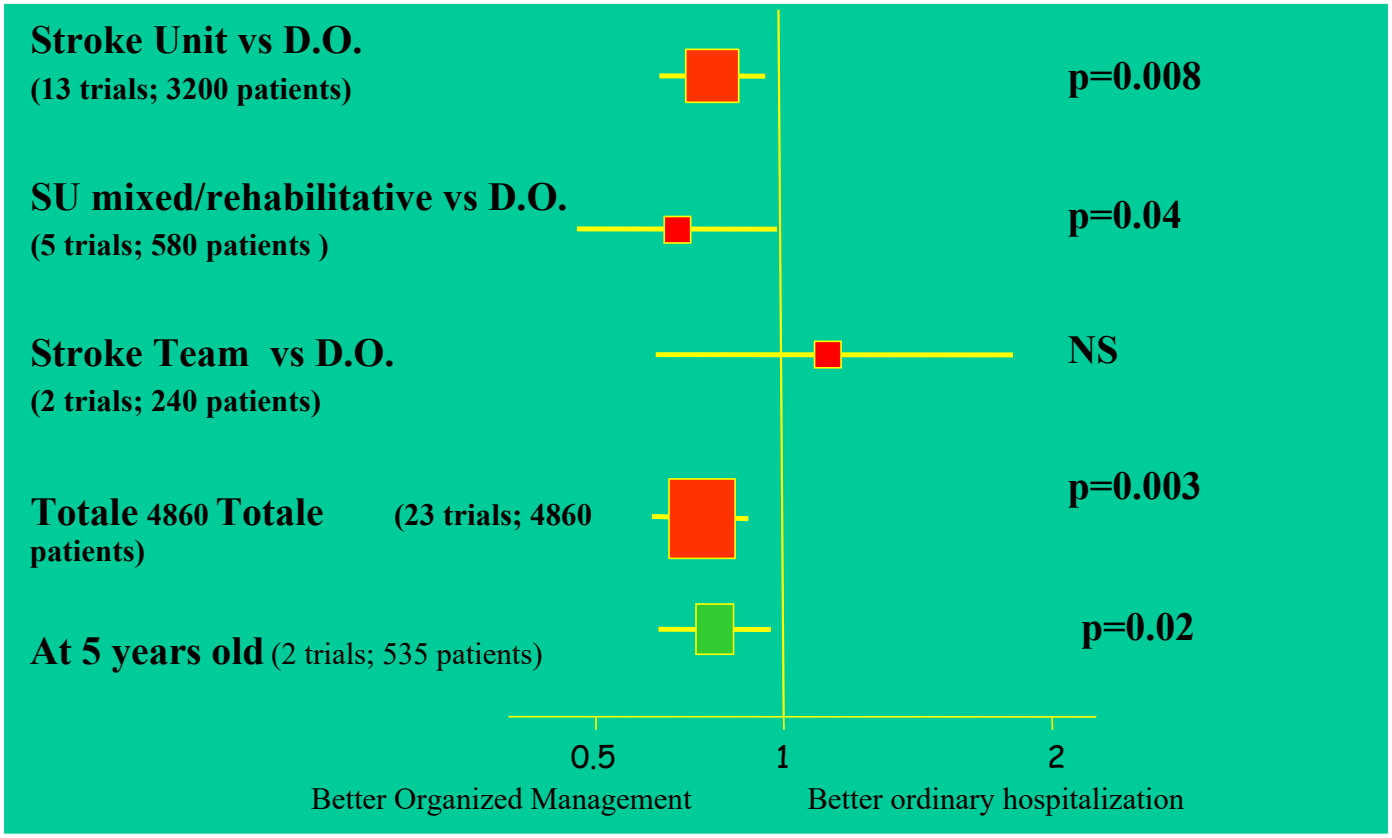
Evidence: Comprehensive Management

(Langhorne - 2002)

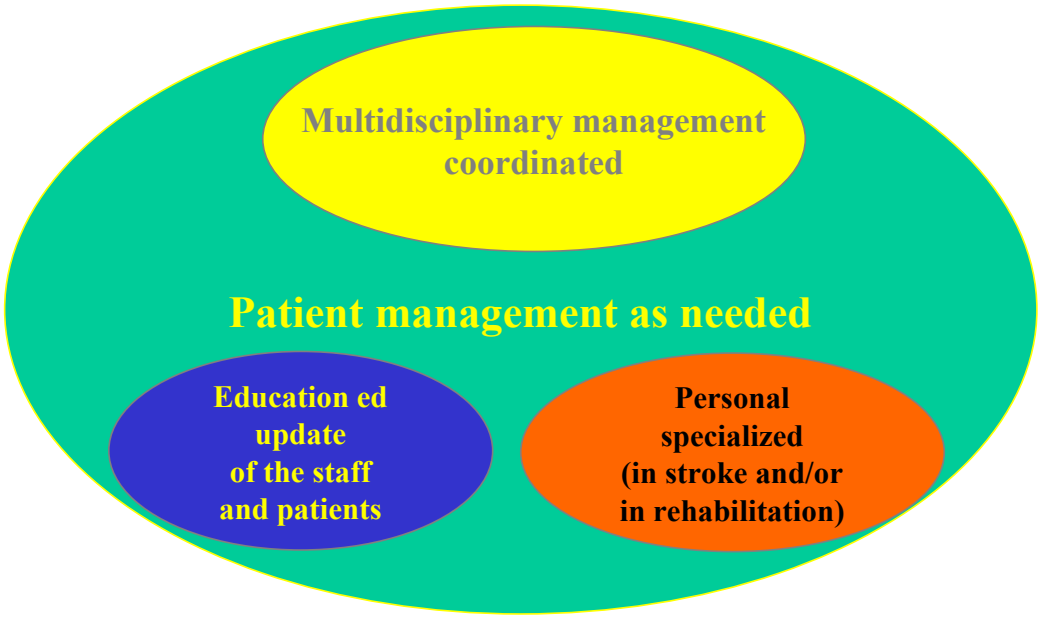


Organized Management vs Ordinary Hospitalization (D.O.)

Odds of death or institutionalization



Characteristics of “organized” management (Stroke Unit)



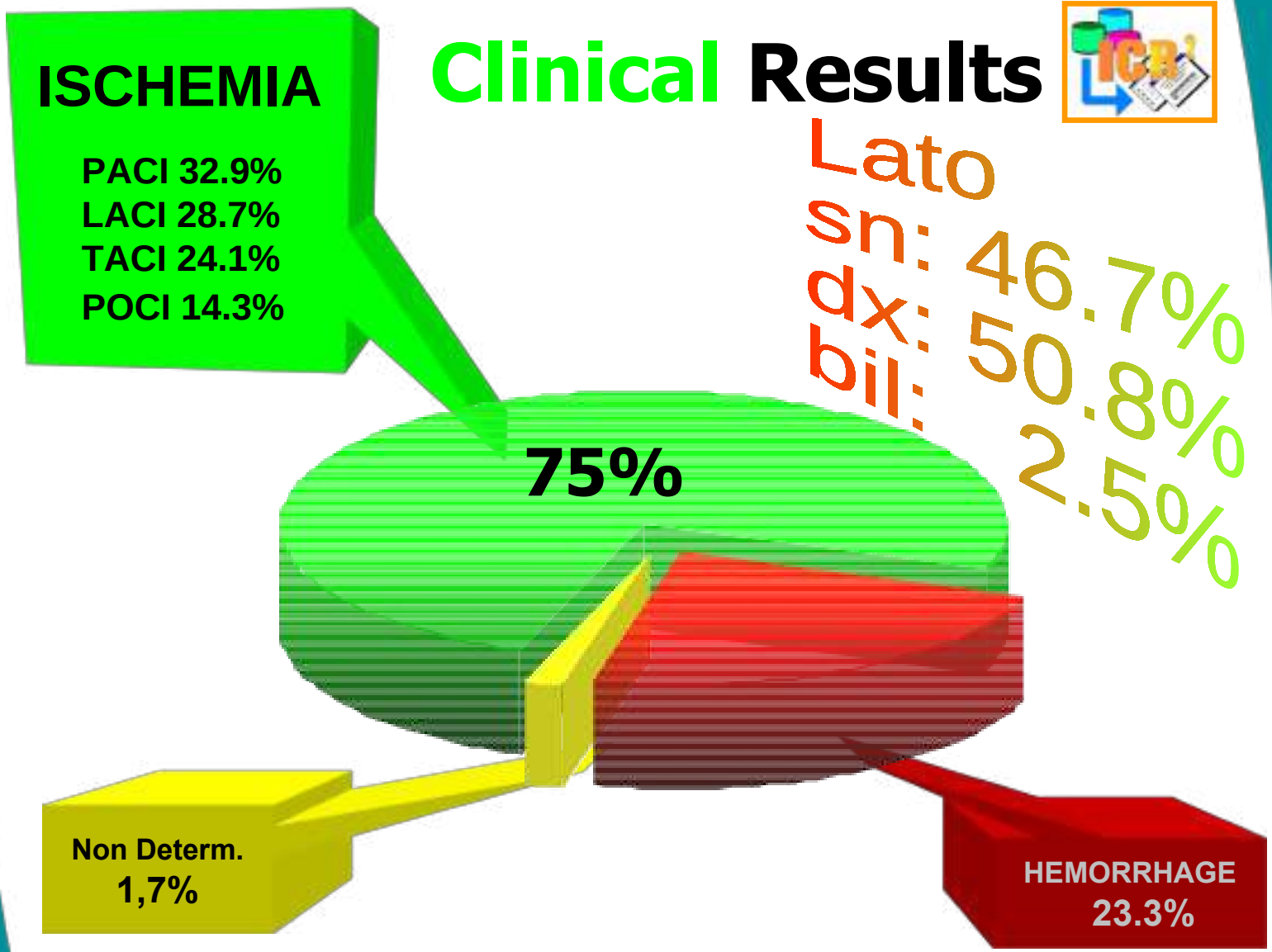
Cochrane Library (2002)

Etiology of Stroke

- **Approximately 80% ischemic infarction**
- **Approximately 15%-20% intraparenchymal cerebral hemorrhage**
- **Approximately 3% subarachnoid hemorrhage**

(Oxforshire Community Stroke Project)

Clinical Results

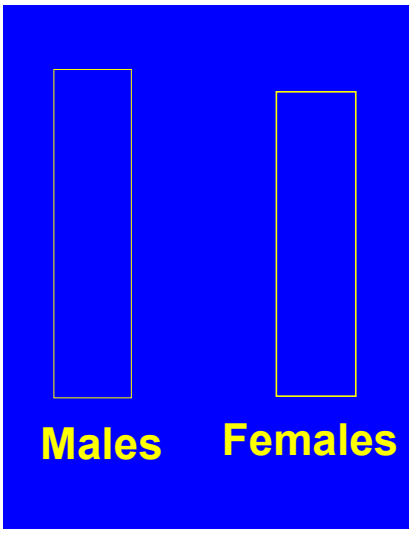


Demographic Results

Average age: 69.8±12.0 years

51.5%

middle age
67.1±11.2



48.5%

middle age
72.1±12.4

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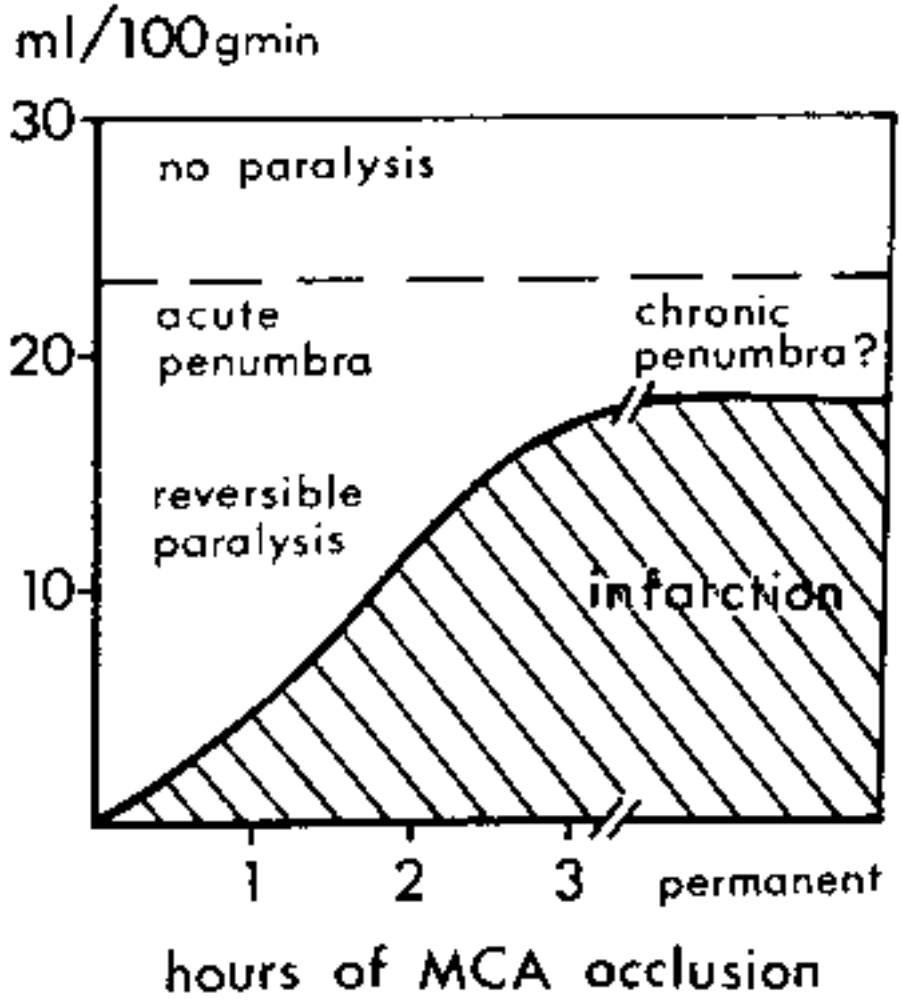
NEURO-PHYSIOPATHOLOGICAL ASPECTS

Evolution of ischemia

- **Hemodynamic compensation**
  - **from 90 to 60 mm Hg self-regulation flow**
  - **< 60 mm Hg oligoemia**
- **> O2 extraction (60 to 30 mm Hg)**
- **Moderate Ischemia (Penumbra) (30 to 10 mm Hg)**
- **Severe (fatal) ischemia (< 10 mm Hg)**
- **Severe (fatal) ischemia (< 10 mm Hg)**


ml/100gmin
30
20
10
no paralysis
acute
penumbra
chronic
penumbra?
reversible
paralysis
infarction
1
2
3
permanent
hours of MCA occlusion

The infarction is of little clinical interest

Irreversible

The penumbra is of great clinical interest

Potential recovery

Third aspect

- **PHENOMENON OF DIASKHISIS**

Von Monakow (early 20th century)

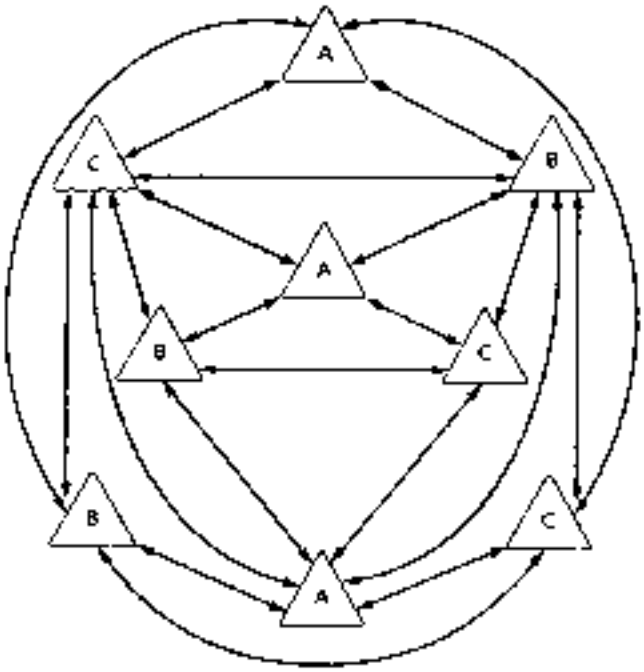
Diaschisis

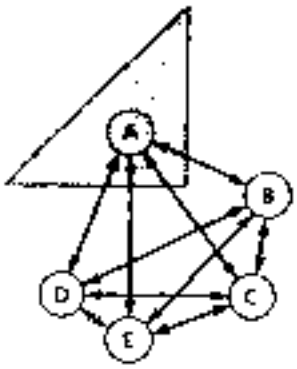
- **Diffuse inhibition phenomenon**
- **It affects remote areas of the lesion due to a paralyzing radiation along the connection routes of the damaged systems with the other systems**

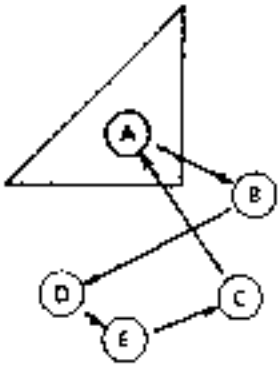
Diaschisis

- **Cascade effect through the connections between the necrotic and ischemic penumbra zone and the network of which they are part**

- **The intimate mechanism is at the level of the synapse**


A
C
B
A
B
C
B
C
A


A
B
D
C
E


A
B
D
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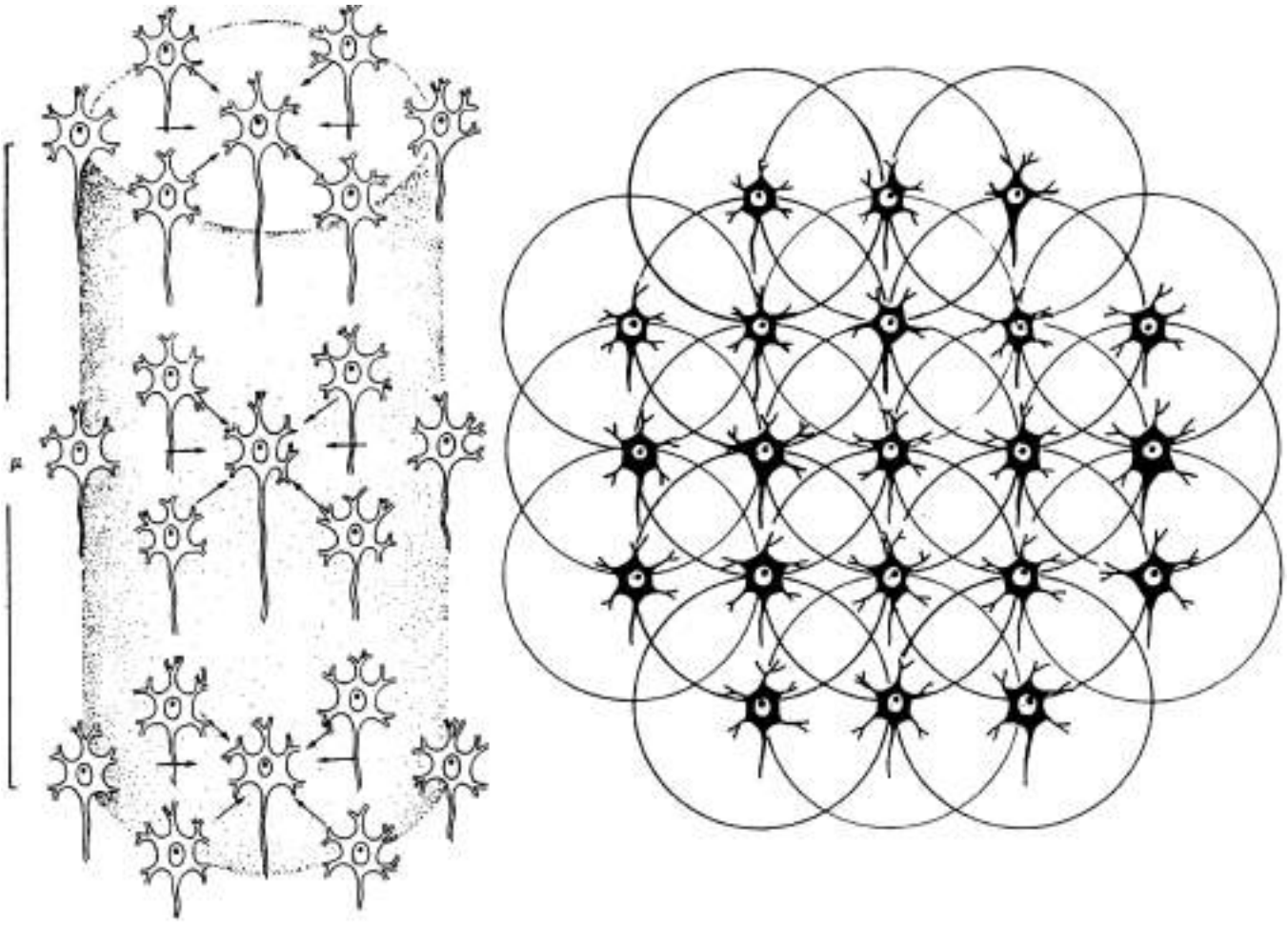
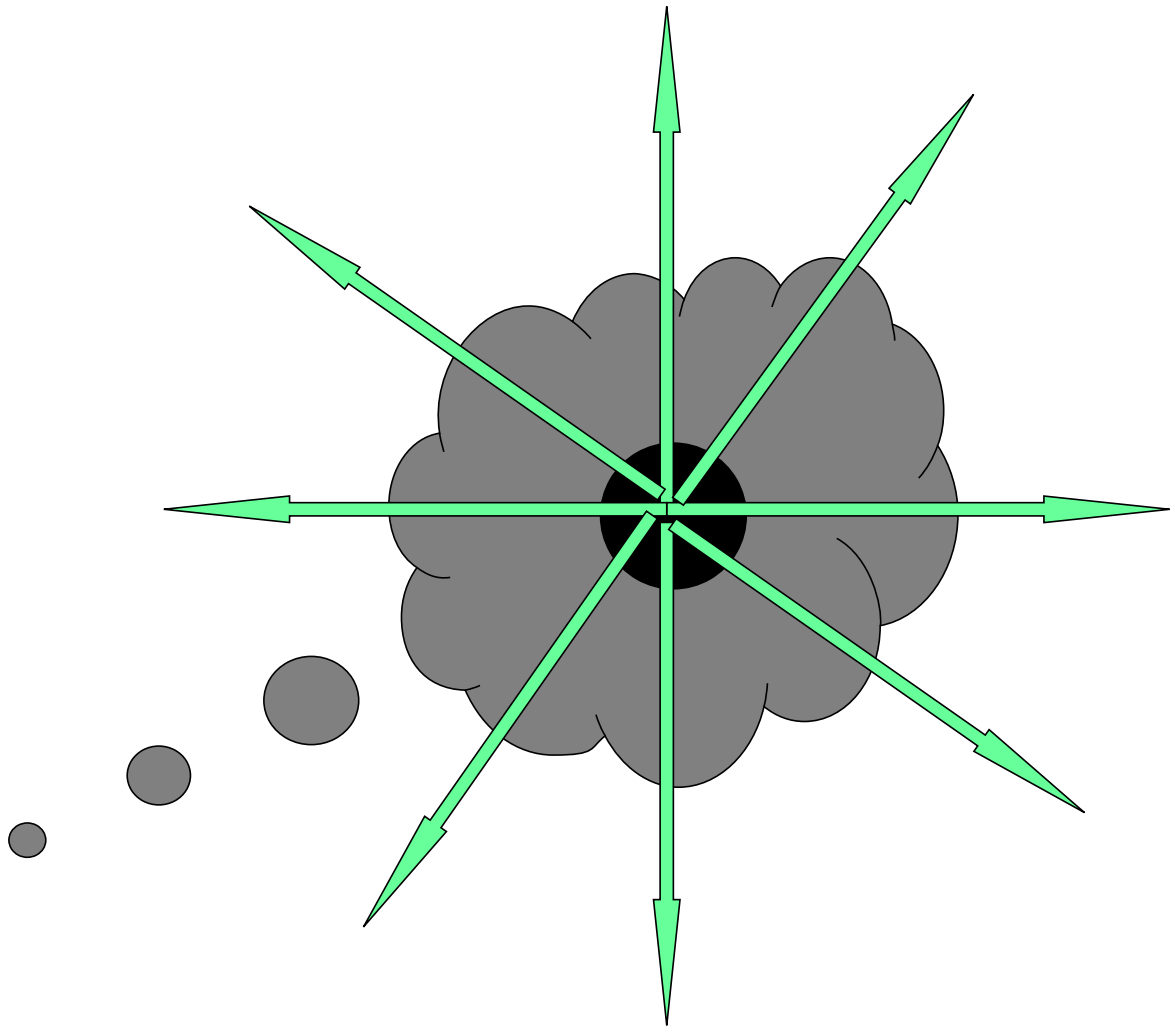
E


100-1000
Module
Cortical

Diaschisis

- **Its prolongation determines a process of transsynaptic degeneration**

(neuronal degeneration due to lack of exchanges)



CNS plasticity

- **Sprouting**
- **Unmasking**
- **Vicariance**

Sprouting

- **Formation of new connections by the fibers that remain intact**

- **New collaterals are formed that are able to establish new synaptic connections in sites left free by degenerated synaptic terminals (synaptogenesis)**

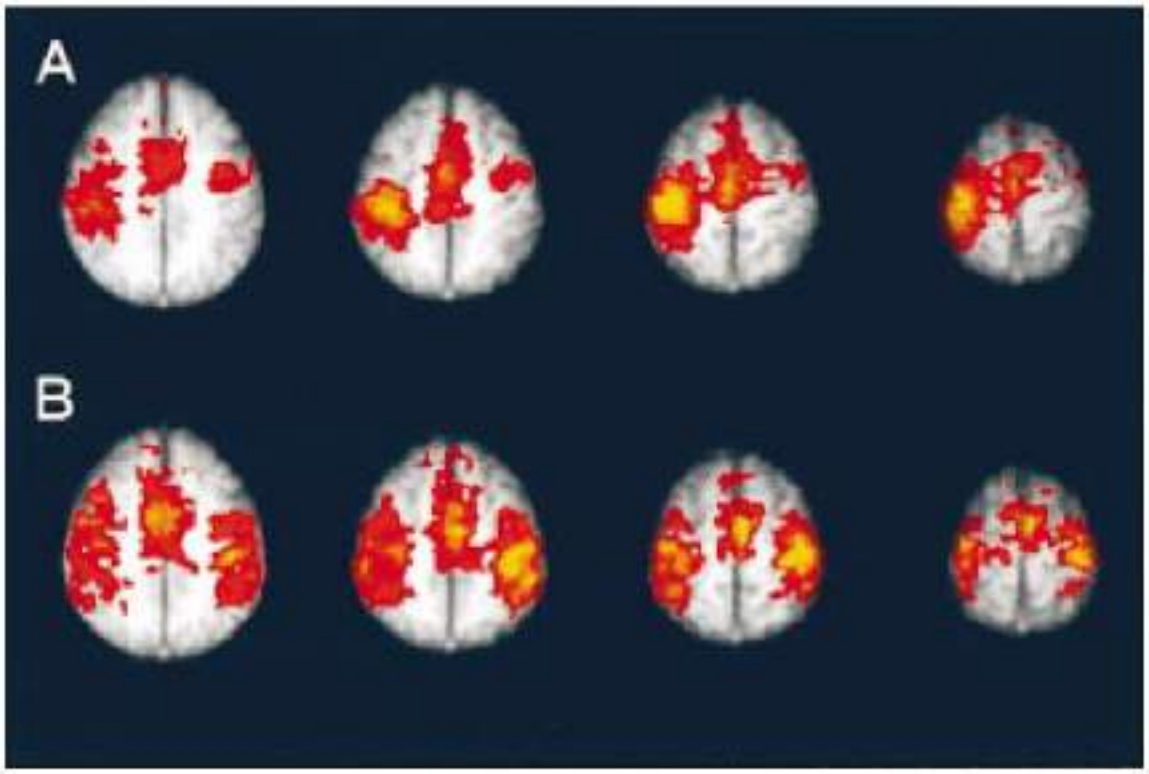
Sprouting

- **Is it an advantageous mechanism?**
  - **Various interpretations**

- **Possible disadvantage:**
  - **Mass movements are activated outside the perfection of functional synergies**

Unmasking

- **Strengthening of existing, but silent, synaptic connections that are normally not active**
- **Faced with an injury they begin to work**



Cortical activation patterns studied using fMRI.
Movement of the injured hand (B) produces an activation pattern
more bilateral than the movement of the healthy hand (A). (from Johansen-Berg)

Vicariance

- Change of strategies by some neurogenic pathways
- Possibility of varying the specificity of a system to the advantage of other non-functioning ones (for example ipsilateral non-pyramidal cortical pathways)
- Changes in the long-term efficiency of synapses in perilesional areas (long term potentiation or long term inhibition)

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Cortico-Spinal Pathways

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Evidences of ipsilateral pathways

- Anatomic

Intracellular Recordings

Motor evoked potentials

Functional imaging

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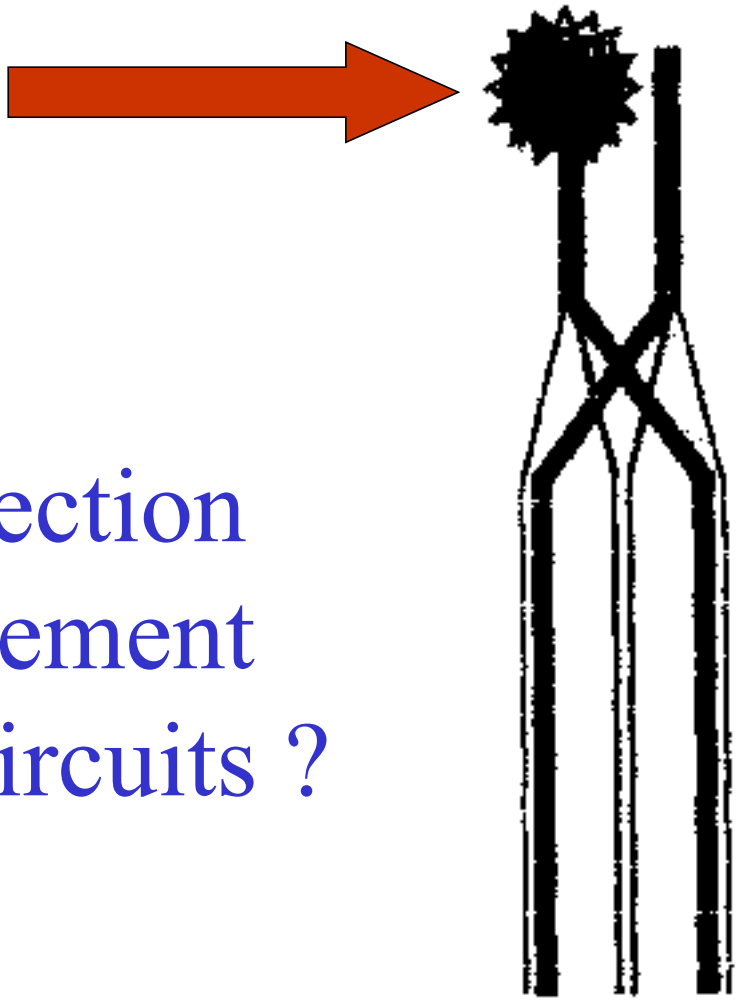
STROKE



New connection
or reinforcement
of existing circuits ?

Post-injury recovery

- Ischemic penumbra
- Diaschisis
  - Drive to the highest level of integration
- Sprouting
- Unmasking
  - favor them, encourage them
- Vicariance
- Spontaneous recovery
- Guided recovery
  - Functional re-educ
  - Ter. pharmacological

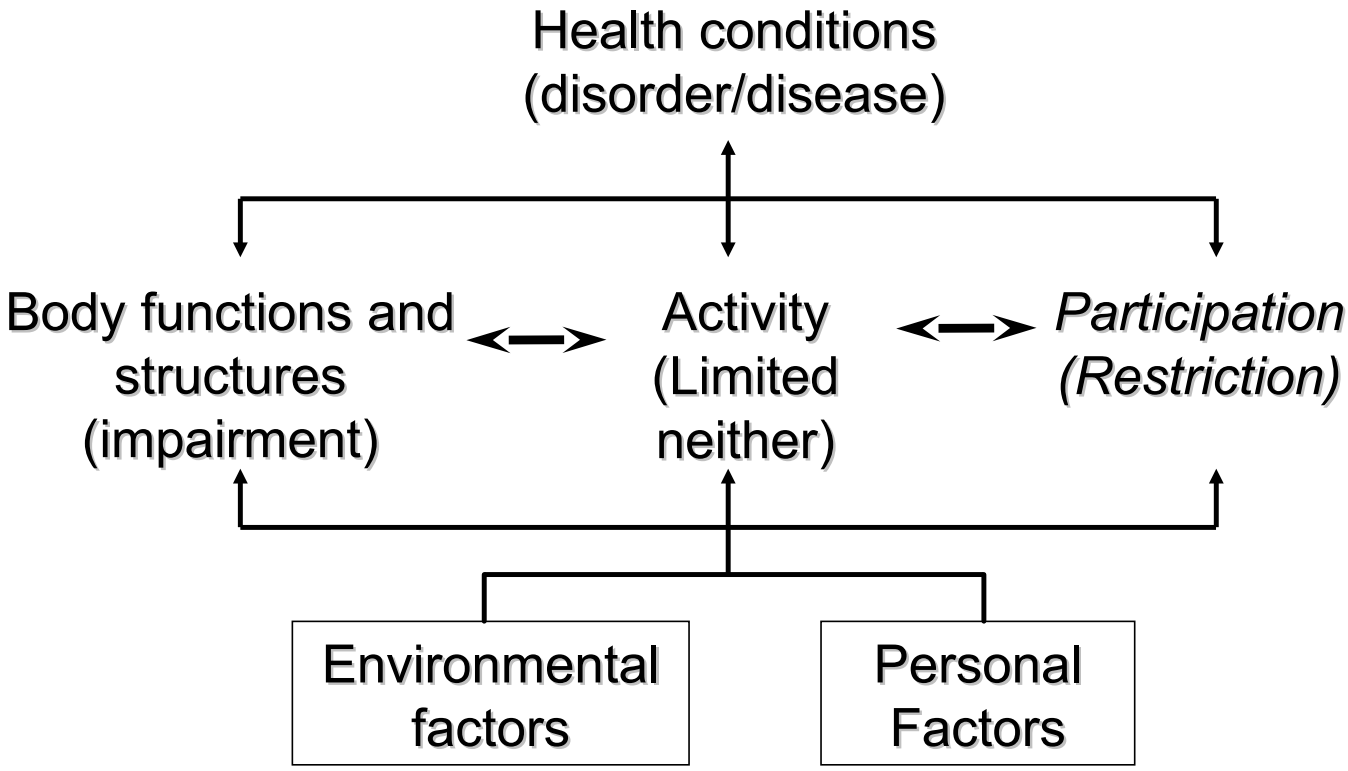
Evidenze

- **Various neuro-bio-physiological studies have demonstrated the presence of these phenomena**
- **Correlation between therapeutic exercise proposal and plasticity**
- **Importance of the functional significance of the re-educational proposal**

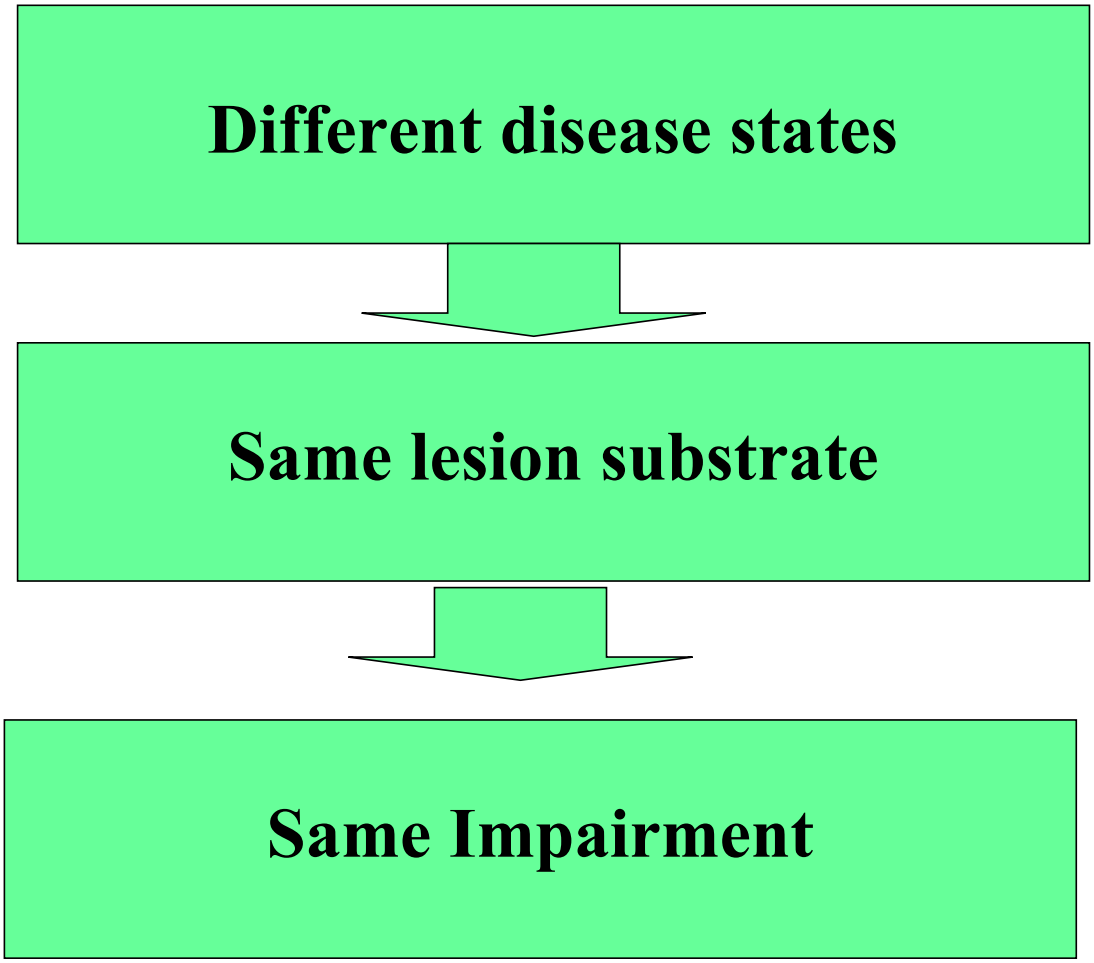
Aspetti da tenere presenti

- **Functional exclusion of body segments not functionally used**
- **Importance of functional synergies**
- **Importance of the postural preactivation component**
- **Evolution of movement in the recovery phase towards the pathological components**

Interaction of Concepts
ICF 2001



- **Level 0:**
  - **lesional substrate (it is the real lesion)**
  - **Breakdown of a homeostasis**
- **Different causes:**
  - **Vascular**
    - **Ischemic, Hemorrhagic**
  - **Traumatic**
  - **Neoplastic**
  - **Degenerative**
  - **Inflammatory**


Different disease states
Same lesion substrate
Same Impairment

Lesion substrate, extent of damage and consequent impairments

- Site
- Extension
- Tempo di istaurazione
- Etiology

Site

- **Affected area**
  - **Corticale**
    - **Fronto-parietale**
    - **Parieto-temporal**
    - **Occipital**
  - **Subcortical**
    - **Inner capsule**
    - **Basal nuclei**
    - **Trunk**

Extension and speed

- **Width of the affected area**
  - **Silent areas and areas strongly influencing behavioral control**
- **Speed of initiation of the lesion**
  - **Possibility or otherwise of the establishment of collateral circles**
    - **Front circle**
    - **Back circle**
    - **Circle of Willis**

Residual impairments and recovery

- Different lesion widths on CT do not necessarily determine the same severity of impairments
- Importance for the recovery of the integrity of the remaining unaffected cortical areas
- Importance of the "motivation" factor

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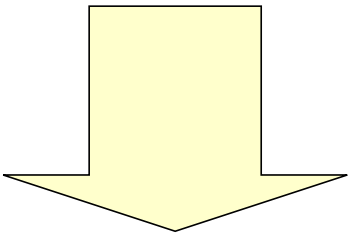
IMPAIRMENTS

Stroke



Family of Impairments

Impairments

- **Dependent directly on the harmful event**
  - **Primitives**
- **Dependent on immobilization or incorrect approach**
  - **Secondary**

Primary impairments

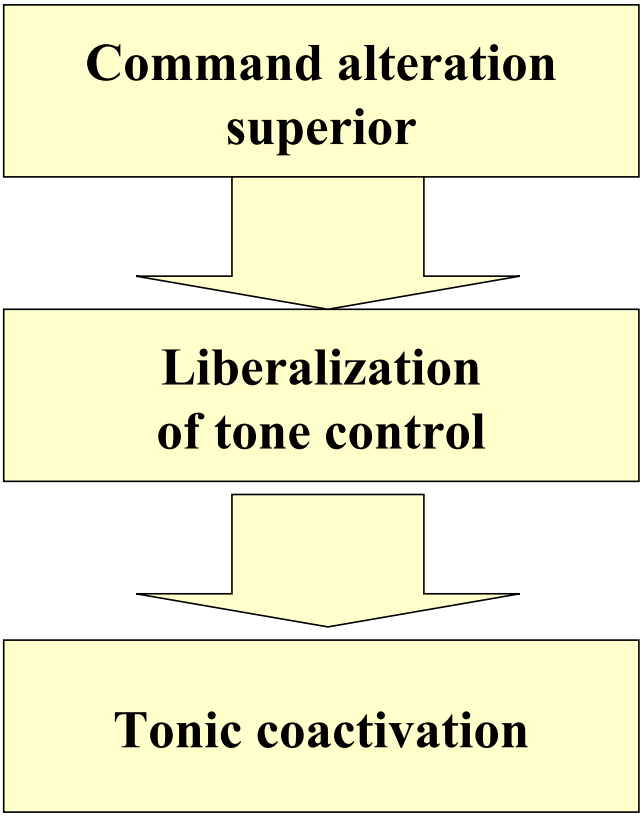
- Disorders of levels of vigilance and contents of consciousness
- Motor disorders
  - tone
  - postural
  - segmental
  - disintegration of symmetries
- Neuropsychological disorders
- Sensitivity disorders
- Visual disturbances
- No deficit disorders. cranial

Alterations in the level of vigilance

- **Interruption between various brain areas**
  - **frontal area / other cortical and subcortical areas**
- **Lowering of the activation level of the reticular system**

The patient is confused, disoriented, confabulating, in a coma

Tone changes



Postural alterations

- Loss of motor automatisms
  - Change your posture
    - In the bed
    - While sitting
    - ….
  - Sitting unaided
  - Standing
  - Walking
  - Pre-activation of segmental motor acts

Segmental motor alterations

- **Complete (hemiplegia) and incomplete (hemiparesis) pyramidal hemisyndromes**
  - **Loss of the richness of functional synergies**
  - **Loss of fine movements**

Alteration of symmetries

- **Body halved**

Neuropsychological impairments

- **Aphasias**
  - **Non-fluent globals, fluent globals, expressive...**
- **Negligence**
  - **Personal, peripersonal, extrapersonal**
- **Apraxia**
  - **Ideomotor, of use…**
- **Attention, orientation, memory**
- **Awareness disorders**
- **Anosognosia, hemisomatoagnosia**

Sensory impairments

- **Painful and thermal anesthesia or dysesthesia or paresthesia**
- **Attenuation or lack of proprioceptive sensitivity (position of the limbs)**

Visual impairments

- **Hemianopsia**
- **Partial or complete blindness**

Deficit impairments n. cranial

- Dysphagia
- Dysarthria
- Oculomotor disorders
  - Diplopias
  - Lack of eyelid elevation
- Lack of eyelid elevation

Secondary impairments

- DVT due to venous stasis
  - Pulmonary embolisms
- Capsulo-ligament contractures
- S. shoulder-hand
- Hypotonic shoulder
- Pressure ulcers
- Neurovegetative alterations
  - Orthostatic hypotension, sphincter disorders..
- Bedrest syndrome
  - Lung problems, disorientation….

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

Evolution in the first weeks

State of consciousness

- Improved vigilance
- Recovery of consciousness
- At least partial memory restoration
- Recovery of life relationships with people and the environment

  - Rare cases of dementia and post-ictal coma

Motor recovery

- **Possibility of losing the ability to control the motor command, which thus becomes free (completely or partially)**
- **Loss of the richness of synergies**
- **Loss of richness of movement**

Pathological motor activities

- **Synkinesis**
  - **involuntary movements of the affected hemisome associated with remotely provoked motor activities**
- **Synergies**
  - **irradiation of motor activity along stereotyped kinematic chains**

Pathological synergies of the upper limb

- **Flexor**
  - **Shoulder elevation**
  - **Elbow flexion**
  - **Abduction of the limb**
- **Extensor**
  - **Shoulder depression and extension (not always)**
  - **Elbow extension**
  - **Adduction of the limb**

Pathological synergies of the lower limb

- **Flexor**
  - **Hip flexion**
  - **Knee flexion**
  - **External rotation of the limb**
  - **Ankle dorsiflexion (not always)**
- **Extensor**
  - **Hip extension**
  - **Knee extension**
  - **Adduction of the limb**
  - **Plantar flexion of the ankle (not always)**

Possibility

- **Stereotypical voluntary motor activity "prisoner of synergies"**
- **Voluntary motor activity partially capable of controlling synergies and partially expressing "evolved" movements**
- **Voluntary motor activity completely capable of controlling the pathological components**

Motor recovery

- Generally proximo-distal recovery
- Recovery first of the postural S. then of the focal ones (functional acts)
- Tendency to recreate an axial structure
  - Activation of damaged hemisome components
  - Reduction of control intervention of behaviors by the healthy hemisome

Other recoveries

- Complete restoration of sphincter controls
- Often recovery of a fair sensitivity
- Difficult recovery of serious neuropsychological disorders

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The evaluation

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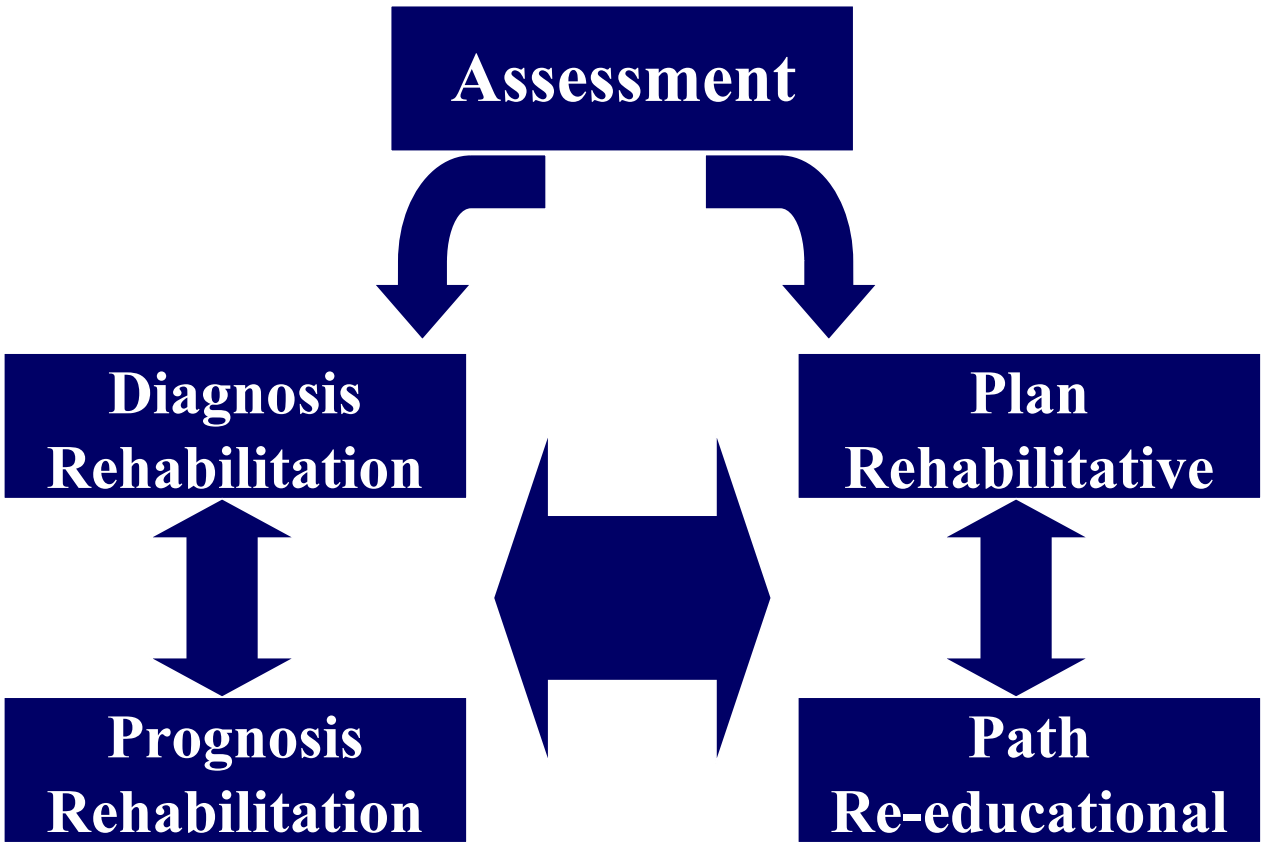
PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST


Assessment
Diagnosis Rehabilitation
Plan Rehabilitative
Prognosis Rehabilitation
Path Re-educational

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Evaluation is a fundamental moment of the rehabilitation program in any area

Evaluation of the acute rehabilitation phase

- **“Attitude” observation**
- **State of consciousness**
- **Neuropsychological situation**
- **Motor activity**
- **Tertiary damage**

Assessment

- **Medical history**
- **Observation**
- **Ispezione**
- **Examination of segmental motor components (passive and active)**
- **Examination of global motor components**

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Medical history

“Rehabilitation”

Knowledge of previous aspects with possible connection to the treatment

- Physiatrist Doctor
- Other Medical Specialists
- Family members
- Patient himself

Useful information

- **Previous impairments**
  - **Motor**
  - **Psychic**
- **Family situation**
- **Socio-economic status**
- **Housing situation**

Presence of "potential barriers"

- of a psychological nature
- architectural in nature

Observation

Observation

- **Attitude of head and gaze**
- **Body position**
  - **Alignment or not**
  - **Pathological attitudes**
- **Relationship with the environment and surrounding people**
- **Absent or present voluntary motor activity and its type**

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Inspection

Inspection / interview

- **Skin situation**
- **Vascular situation**
- **Sphincter situation**
- **Orientation**
- **Level of potential collaboration**

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Motor component examination

Passive segmental motility exam

- **Articular freedom**
  - **Functional limitations**
  - **Mechanical limitations**
- **Joint pain**

Examination of segmental motor components

- **Basal muscle tone and after mobilization**
- **Reflex motor activity**
  - **Synkinesis**
  - **After skin stimulus (nociception)**
- **Voluntary motor activity**
  - **Within pathological synergies**
  - **Out of pathological synergies**

Component examination global motors

- **Static posture**
  - **Clinostatism**
  - **Sitting**
  - **Orthostatism**

Component examination global motors

- **Skill in posture modifications**
  - **Rotations at the hips**
  - **Transitions from reclining to sitting and vice versa**
  - **Transitions from sitting to standing and vice versa**
- **“Habitability” of the various postures**
  - **With call for global voluntary movements**
  - **With external disturbances**

Component examination global motors

- **Assisted walking**
- **Free walk**
  - **Between the parallels**
  - **With aids (rolletor, tripod or cane)**
  - **Without aids**

Component examination global motors

- **the walk**
  - **Safety**
  - **Speed**
  - **Endurance**
  - **Harmony**

Tertiary damage assessment

- **Retractions**
  - **mechanical**
  - **functional**
- **Spoiled attitudes**
  - **fixed**
  - **reversible**
- **S. shoulder hand**
- **Hypotonic shoulder**

Differentiated evaluation

- **Different phases of the same pathology**

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Behavioral activities of human beings: functions of the various body segments for movement management

1106/3677

Trunk

- **Role in the anticipation of movement for both the upper and lower limbs**
- **Role of the pelvis**
  - Stabilize the lower segments allowing correct oscillation

Lower limb

- **Body weight management**
- **Movements (walking)**
  - Safety
  - Speed
  - Harmony

Upper limb

- Power
- Prehension
- Exploration
- Role of the arm
  - Bring your hand into working position when approachingwhen approaching
  - Move the limb away and bring the hand where it needs to actwhere it needs to act

- **We can find all the variables:**
  - Complete absence of movement (plegia)
  - Partial deficiency (paresis)
  - Presence of only an annoyed movement

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Muscle problems

- **Hypotrophy**
- **Shortenings**
- **Loss of elasticity**

Type of Hemiplegia
(according to A.Albert)

- **Deep hemiplegia**
  - –It does not escape the pathological patterns
- **Intermediate hemiplegia**
  - – Combine two strong components of two schemes
- **Mild hemiplegia**
  - – More or less complete liberation from radiation patterns

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THE TREATMENT

The treatment

- **Recovery of impairments**
- **Containment of disabilities**
- **Cancellation of any limitations on participation**

The treatment

- **Acute Phase (Acute Internal Medicine)**
- **Post Acute Phase (Acute Rehabilitation)**
- **State phase**

Acute Phase

- **"Cultural" role in the Team**
  - Rehabilitation Nursing:
    - » Correct bed positioning
    - » Movements in correct ways
  - Early sitting position in wheelchair
  - I do not use indwelling catheterization
  - Early and correct evaluation of any dysphagic disorders
- **Family training**

Acute Phase

- **Recovery of cognitive and motivational aspects**
  - Collaboration
  - Orientation
  - Participation in the environment
- **Passive and active mobilizations**
- **Sitting trunk control**

Postacute phase

- Global recovery (postural)
- Segmental recovery (functional synergies)
- Prevention of secondary damage (especially at shoulder level)

Global recovery (postural)

- **Recovery of body symmetry**
- **Postural transitions to bed and from bed to sitting**
- **Sitting trunk control**
  - With help (support of the feet or hands)
  - Whitout help
  - With disturbances

Global recovery (postural)

- **Sitting trunk control**
  - "Maximum “habitability"
- **Transitions from sitting to standing and vice versa**
  - Symmetry care
  - Stabilization of the pelvis
- **Corthostatism**
  - Static
  - Dynamic (load transfers)

Global recovery (postural)

- **Preparation for walking**
  - **"Static" phase**
    - » Fixed base and ant-post movements of the center of gravity only
  - **Dynamic phase**
    - » With FT facilitation and/or orthoses and/or aids
    - » Using parallel bars
    - » Free phase with or without aids and orthoses
    - » Independence in walking
    - » Treadmill with load suspension

Segmental recovery (Functional synergies)

- **Voluntary motor recovery goals**

  - **Within pathological synergies?**
  - **Out of pathological synergies?**

Segmental recovery (Functional synergies)

- **Always remember the importance of the "significance" of the proposed therapeutic exercise for the cortical areas of the person with stroke outcomes**

Segmental recovery
(within pathological synergies)

- **Make the most of the "positive" components**

  – Extensor synergy in the lower limb
  – Flexor synergy in the upper limb

Segmental recovery
(outside of pathological synergies)

- **Complete dominion over pathological synergies in the lower limb.**
  - **Possible objective:**
    - » The restoration of a functional gait with a "physiological" pattern
  - **Possible residual problems:**
    - » Fluidity of movement (robotization)
    - » Lack of harmony

Segmental recovery
(outside of pathological synergies)

- **Complete dominion over pathological synergies in the upper limb.**
  - **Possible objective:**
    - » Functional recovery in A.D.L.
    - » Recovery of even complex work activities
  - **Possible residual problems:**
    - » Functional exclusion in the body schema
    - » Lack of harmonyLack of harmony

Segmental recovery
(partially out of pathological synergies)

- **Compromise between the pathological and functional components of the lower limb.**
  - **Possible objective:**
    - » The restoration of a functional gait that manages to partially combine a proximal extensor (hip) activity with a knee flexor and vice versa
  - **Possible residual problems:**
    - » Reduced speed
    - » Acquisition over time of a prevalence of pathological components (extensor)

Segmental recovery
(partially outside of pathological synergies)

- **Partial dominion over pathological synergies in the upper limb.the upper limb.**
  - **Possible objective:**
    - » Recovery also limited both proximal and distal
    - » Transport of the main effector of the activity (hand) where it can carry out its function (opening/closing)
    - » Recovery of partial capacity in A.D.L.
  - **Possible residual problems:Possible residual problems:**
    - » Functional exclusion in the body schema
    - » Progressive increase in tone and reduction of "extensor" possibilities

Prevention of secondary damage

- Correct postures in bed and in a wheelchair
- Use of splints and positioning orthoses
- Passive mobilizations repeated several times during the day at articles. "at risk"

Prevention of secondary damage

(especially at shoulder level)

- Accurate mobilization of the scapula, attempt to reposition it in the correct position
- Scapulohumeral mobilizations
- If possible, muscle strengthening proximally

State phase

Is there a real state or clinical stabilization phase in the subject with hemiplegia?

State phase

- Careful distinction between the possible negative presence of health components and social ones:
  - Reduced motor skills
    - » Real worsening of impairments
    - » Non-functional use of motor "potential" due to socio-family or psychological problems

State phase

- Taking charge to try to positively modify the present deficits
- Careful choice of aids
- Involvement of local structures, especially social ones, to achieve better integration and home reintegration
  - Occupational therapy at home
  - Removal of architectural barriers
  - Free time management

State phase

- Careful evaluation for indications for any " external " interventions that could modify " the present motor deficit
  - Functional surgery
  - Personalized containment orthoses
  - Drastic reduction in muscle tone
    - » Botulinum toxin
    - » Baclofen pump
  - .....

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Prognostic indicators of recovery

Comment on analysis univariate statistics

- **Indicators associated with an unfavorable outcome:**

  – Have a Rankin anamn. ≥ of 1
  – Elderly age and living alone
  – Presence of a total anterior lesion
  – Presence of catheter, dysphagia and complications
  – MMSE < 24–
  – Severe global and segmental motor impairment

Comment on multivariate statistical analysis

- **Common factors:**
  - Age is an important but relative factor
  - Motor impairment appears to be the most important factor
- **Independence:**
  - Cognitive state
  - Early hospitalization
- **“Home” destination:**
  - Live alone
  - Bladder and swallowing problems

Literature data

- Early rehabilitation integrated with the acute phase is a positive factor for autonomy
- Female sex unfavorable predictor for independence
- Age factor discussed
  - According to A.A. not a positive factor as such but as it is more often associated with comorbidities and the risks of hospitalization

Literature data

- **Impairment**
  - MMSE is not always an unfavorable predictorMo
  - Motor deficit and poor trunk control (TCT) often predict poor ADL performance

Literature data

- Presence of a bladder catheter is a very influential factor, especially for returning home, although urinary incontinence is much more cited
- Dysphagia presents the same trend

Conclusions

- The presence of a family probably plays an important role in the success of the rehabilitation project
- The absence of factors that complicate the management of the family at home facilitates successful reintegration
  - No catheter (severe incontinence)
  - No dysphagia
  - Good trunk control = easier handling

Conclusions

(For the Acute Phase doctor)

– Do not insert the bladder catheter unless absolutely necessary, but remove it as soon as possible
– Diagnose dysphagia early and treat it if severe or persistent (SNG/PEG)
– Early verification of the availability of the family or caregiver
– Early identification of severe cognitive impairments
– Send the patient to Rehabilitation as soon as possible

Particular attention should be paid if the patient is elderly

Pressure ulcers

- Definition:

- A pressure ulcer is a localized damage of the skin and subcutaneous tissues
- it is caused by pressure, traction, friction or a combination of these

Classification

- stage 1= redness on normal skin
- stage 2= superficial ulcer that involves epidermidis and/or derma
- stage 3= deep ulcer; necrosis of subcutaneous tissue (not the muscle)
- stage 4= very deep ulcer involving muscles, bone...

1.Treatment: risk of ulcer (stage 1)

- Objective: ulcer prevention
- wash with saline solution
- apply hydrating creams

- medication every 5-7 days

2.Treatment : necrotic ulcer
(skin color= black)

- Objective = remove dead tissue
- wash with saline
- apply hydrogel on necrosis then cover with transparent film
- medication every 24/48 hours•

3.Treatment: ulcer after necrosis removal (stages 2-3)

- Wash with saline, apply **hydrogel** then film
- if very deep, use **polyuretan** then film (always keep humid, never dry)
- if too damp: **algynate** then film
- if infection: no local disinfectants, no iodoformic gauze (cell damage). Hydrogen peroxyde can be used then washed away. Treat with sistemic antibiotics
- MEDICATION EVERY 24 HOURS

Pressure ulcers: different causes

- 1) Fixed postures:
- continuous tissue compression diminishes local blood supply. Skin damage can appear after 2 hours of immobile bed rest, after 1 hour of immobile sitting posture

Pressure ulcers: different causes

- 2) sphynteric deficits (incontinence):

- faeces and urine have irritant effects and cause skin maceration

Pressure ulcers: different causes

- Inadequate nutrition
- if nutrition is hypocaloric and/or unbalanced, skin can be easily damaged

Pressure ulcers: different causes

- Sensory deficit:

- if pain sense is weakened or lost, compression can be unperceived and body position isn't adequately changed

Pressure ulcers: localizations

- On bony prominences
- if supine : heels, sacrum, scapula, head
- if lying on the side: hips, ears, ankles
- if prone: iliac crest, tibial crest, knees
- if sitting: pelvic bones

Pressure ulcers: prevention

- Change posture

- if patient lying in bed: change posture every 2 hours
- if sitting : change every hour.

Pressure ulcers: prevention

- Skin hygiene

- carefully watch skin appearance at least every day. Keep clean and dry.
- Use absorbent pads if incontinence.
- Use hydrating lotions if skin is too dry

Pressure ulcers: prevention

- Balanced diet

- supply adequate intake of calories, proteins and vitamines.
- If pressure ulcer occurred, caloric intake must be increased

Pressure ulcers: not to do

- NO Skin Alcohol frictions: dehydrate skin
- NO Massages on reddened skin
- NO Fleece
- NO disinfectant creams or lotions

PRACTICAL TEACHINGS

FOR THE

REHABILITATION PHYSIOTHERAPIST

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Rehabilitation in spinal cord injuries Lesson: Introduction

A bit of history

- ... . in an Egyptian papyrus from 3000 BC, spinal cord injury was defined "a disease not to be treated“
- 1823, 1st Lancet, Sir Astley Cooper wrote: “In these cases there is no remedy if the extravasation is considerable. I do not know what could be attempted, in addition to bleeding immediately, in order to prevent further extravasation ..... The patient will survive five or six weeks "

A bit of history

- During World War I, neurosurgeon Harvey Cushing reported that 80% of soldiers died within two weeks of spinal cord injury
- 1934: with a daily protocol of good nursing care the complications of spinal cord injuries (e.g. pressure ulcers and urinary tract infections could be alleviated with a daily protocol of good nursing care)

A bit of history

- The actual beginning of healthcare for spinal cord injury dates back to the work of the American neurosurgeon Donald Munro at Boston City Hospital in the 1930s.
- His approach was followed by Sir Ludwig Guttmann who founded the SCI ward at Stoke Mandeville Hospital in the UK in 1944 which became the National Spinal Cord Injury Center in 1952.

A bit of history

- The mortality rate for SCI was then at 80% and subsequently started to decline, thanks to the postural change every two hours and the prevention of pressure ulcers, together with the better management of the bladder.
- With physiotherapy and occupational therapy, better results were achieved in the recovery of functions and a more holistic assistance intervened, attentive to the socio-economic needs of the patients

A bit of history

- 1944: first European center specialized for the treatment and rehabilitation of paraplegic subjects (Spinal Unit of Stoke Mandeville - GB, Dir. Dr. Ludwig Guttman)
- Global approach to the treatment and rehabilitation of patients with spinal cord injury for their reintegration into the family, society and the working world
- "Independence in a wheelchair"

A bit of history

- Guttmann emphasized sport as a method of therapy and was the founder of the Stoke Mandeville Games, which developed into the Paralympic Games in 1960.
- These early centers became the model for SCI healthcare in the UK, US and other countries

1948: the first Games for disabled athletes in Stoke Mandeville

1960: the games took place in the context of the Rome Olympics

Some history…

- 1978: birth of the first spinal unit in Italy, in Florence
- 1988: Ministerial Decree Determination of hospital staff standards, establishment of spinal units in high-level hospitals
- 1998: Guidelines for the rehabilitation activities of the Ministry of Health; the USU is included among the services that provide highly specialized intensive rehabilitation activities
- 2004: publication of Guidelines for Unipolar Spinal Units

Patient opinions

- “Before my spinal cord injury, I was a very independent person, had a very intense social life with many friends, worked a lot, traveled a lot and was finishing my studies in law, had romantic encounters…my life was identical to that of any other young woman, with a great desire to live. After the injury, everything changed and many of my dreams were interrupted – that of going to live alone, of finishing university, of having a family.”(Claudia, Brazil)

Patient opinions

- “While my father was riding his motorcycle and my mother, sitting next to me, was holding me in her arms, a car hit us. My parents were killed. I survived but became a paraplegic at age 2. My grandfather, who lived in a slum in Bangkok, took care of me. Later, I was sent to a school for disabled children. Now I'm 11 and I dropped out of school. My brain is not good. I don't have a good memory but I can maneuver the wheelchair without difficulty. Fortunately Mr. B, a quadriplegic businessman and his wife met me and decided to take care of me. Now I live with them. They gave me a sports wheelchair and they plan to make me a wheelchair athlete in the future, and I think I can do that.”(Anonymous, Thailand)

Patient opinions

- “When I returned from rehab, I was greeted at the airport by the community and entered a new phase in my wheelchair life. I thought I couldn't live my life like before. I was ashamed and didn't want to see my friends – now I was different – I had changed. I couldn't play ball, run, or go camping or cycling to the river where I live. The only thing I wanted to do was stay home and hide. It took my first Occupational Therapy team about six months to get me out of the house. Before returning to the company, the team had already built ramps in the school and made the toilets accessible for me. Very slowly I regained my confidence. Basketball was my favorite pastime before my accident, and while I was in rehab I learned to play wheelchair basketball. I taught some friends how to do some chair shots. Teachers have begun to encourage participation in school and in the social community by going on local field trips, visiting various places and learning about various plants, as well as going to Cairns for a school trip. The support from teachers, friends and family has been encouraging.”(Alfred, Australia)

Patient opinions

- “One day I woke up and I was staring at the ceiling. I wanted to turn my head and raise my arm, but I couldn't. I couldn't move anything. I heard a lot of noise, but saw nothing. A nurse appeared next to me and I wanted to tell her something, but I couldn't make myself heard; I wanted to scream, but I couldn't make a sound. So I closed my eyes and opened them again when I heard my name called, I looked up and saw my parents. Although it seemed to me that only an instant passed between closing my eyes and reopening them again, in reality it had been a whole day. My parents told me I had quadriplegia and was in a hospital in Brussels following an accident at work. My neck was broken, I was totally paralyzed and couldn't breathe on my own. I was thirsty and asked for some water; I couldn't even drink from the straw they gave me, because I couldn't swallow. I was working on a house when I lost my balance and fell off a ladder, I'm not really sure anymore. I fell from a height of 6 meters and ended up on the concrete.”(Gunther, Belgium)

Patient opinions

- “I suffered a cervical injury (C5-C6) in a road accident at the age of 19 and now I have been in a wheelchair for 30 years. I live in the northernmost city in the world, Hammerfest, and face great physical challenges; with the roads covered in snow for about five months of the year and with the low temperatures, it is difficult for me to get out in the wheelchair. I have always needed a lot of assistance since the injury and then my community had just started organizing home care. From that moment, I had the opportunity to participate in the organization of the services necessary for my needs and requirements and to have as normal a life as possible, as a citizen."(Kjell, Norway)

What is spinal cord injury

- Spinal Cord Injury (SCI) is a complex medical and life condition.
- Historically, it was associated with high mortality rates.
- Today, however, in high-income countries, SCI is no longer seen as the end of a useful or productive life but more as a personal and social challenge that can be overcome.
- This change reflects improvements in medicine, whereby people are able to survive, live and thrive after injury.

What is spinal cord injury

- In low-income countries the situation is very different.
- Traumatic SCI often remains a terminal condition.
- Most women with SCI in countries such as Sierra Leone die within a few years after the injury.
- In low-income, and many middle-income, countries, the availability of quality assistive technologies such as wheelchairs is very limited; health and rehabilitation services are minimal and the possibilities of participating in the various situations of personal and social life are limited.

What is spinal cord injury

- The situation today in many developing countries is comparable to that of Europe and North America in the 1940s.

- Poverty makes life even more difficult for people with SCI.

- Yet the fact that considerable progress in survival and participation has been achieved in high-income countries in a relatively short period of time should lead to optimism in other parts of the world. With the right policy arrangements, it should be possible to live with SCI, thrive and participate anywhere in the world

What is spinal cord injury

- Quality of life with SCI depends, for the most part, on the presence or absence of environmental facilitations – the availability of appropriate resources and services, the presence of supportive relationships and inclusive communities – or whether their environment acts as a barrier that is, when people are confronted with discriminatory attitudes and other obstacles, including the lack of provision of services, facilitators and suitable aids.

What is spinal cord injury

- The global effects of SCI on the individual, and also on society as a whole, therefore depend on a wide range of factors, including:

■ the age at which the injury occurs (whether early or late in a person's productive life);

■ the level and degree of injury;

■ the availability and timing of resources and services;

■ the environment in which the person lives – physical, social, economic and attitudinal.

What is spinal cord injury

- Policy reforms that ensure prompt and effective medical intervention along with sustained rehabilitation on the path to full reintegration into community life are cost-effective and socially beneficial.

- The cost of immediate rescue and medical care is offset by the fact that this assistance directly saves lives.

- Since SCI disproportionately affects young people with many years of productive life, the failure to allocate resources to their rehabilitation is a major social waste that can be avoided through measures that are cost-effective.

- The cost of medical intervention and rehabilitation for SCI is money well spent. Above all, saving lives, improving quality of life and sustaining productivity are social and humanitarian imperatives

What is spinal cord injury

- Spinal cord injuries can be traumatic or non-traumatic.

- Traumatic SCI can result from many different causes – including falls, traffic accidents, occupational and sports injuries, acts of violence.

- Nontraumatic SCI, on the other hand, usually results from other conditions – such as infectious diseases, cancers, musculoskeletal diseases such as osteoarthritis, and congenital problems such as spina bifida, which is a neural tube defect at the embryonic development.

What is spinal cord injury

- Symptoms of spinal cord injury depend on the extent of the traumatic injury or the nontraumatic cause, and may include sensory or motor loss of the lower extremities, trunk, and upper extremities, as well as loss of autonomous (involuntary) body regulation.

- This can cause changes in breathing, heart rate, blood pressure, temperature control, bowel and bladder control, and sexual function.

What is spinal cord injury

- In general, the further up the spinal cord the lesion is, the more extensive the impairment will be.

- Cervical SCI usually causes sensory and motor loss (paralysis) in the arms, body, and legs, called tetraplegia (the alternative term quadriplegia is now obsolete). A person with C4 or higher lesions may need assisted ventilation to breathe because the lesions directly interfere with autonomous control of breathing.

- Thoracic SCI usually causes sensory and/or motor loss in the trunk and legs, referred to as paraplegia. Lumbar SCI typically causes sensory and motor loss in the lower abdomen and legs. All forms of SCI can also involve chronic pain.

What is spinal cord injury

- The degree and severity of sensory, motor and autonomy loss caused by SCI depends not only on the level of the spinal cord injury, but also on the "completeness" or "incompleteness" of the same.

- According to the International Standards for Neurological Classification of SCI and the American Spinal Injury Association (ASIA) (severity scale of impairment), a SCI is considered complete if motor and sensory functions are absent at S4-S5, while in the lesion there is no complete some motor and sensory functions are present below the level of the lesion, including the lower sacral segments S4-S5, however this situation is a serious condition and can cause severe impairment.

Organizational levels

- First-level rehabilitation facilities (extensive rehabilitation)
  - Assisted Healthcare Facilities
  - Long-term hospital facilities
  - Residential structures
  - Outpatient facilities
- Second-level rehabilitation facilities (intensive rehabilitation)
  - Hospital facilities
  - Rehabilitation hospitals
  - Extra hospital units
- Third level rehabilitation facilities (intensive specialty rehabilitation)
  - Spinal unit
  - Unit for the rehabilitation of severe brain-injured patients
  - Unit for severe disability in the deveopmental age
  - Unit for acquired neuropsychological disordersl

First-level rehabilitation facilities

- They are characterized by a moderate-medium therapeutic commitment in the face of an adequate assistance supportive intervention towards the subjects in treatment.

- The clinical and therapeutic commitment is however such as to require a specific rehabilitation treatment and overall the rehabilitative therapeutic activities can be evaluated between one and three hours a day.

First-level rehabilitation facilities

- Extensive or intermediate rehabilitation interventions are aimed at the treatment of:

1. transient and / or minimal disabilities that require a simple and brief therapeutic - rehabilitative program that can be implemented
2. important disabilities with possible permanent, often multiple, outcomes that require long-term care and require more and more complex interventions.

First-level rehabilitation facilities

- Extensive rehabilitation interventions are provided at the following ad hoc accredited public and private, hospital and regional facilities:
  - long-term care facilities
  - outpatient facilities for territorial and hospital functional recovery and rehabilitation
  - non-hospital rehabilitation facilities at day and / or continuous cycle
  - outpatient rehabilitation center
  - Assisted Healthcare Residences
  - patient's home

Appropriateness in extensive rehabilitation

- Serious disabilities unable to participate and / or benefit from rehabilitation activities for three hours a day
- No need for complex multi-professional intervention despite the need for hospitalization for medical nursing care
- The expected and / or observed recovery process is too slow or too small to justify intensive rehabilitation
- It is foreseeable that, despite the continuous benefits received from rehabilitation, the subject's social destination is in a protected structure

Long-term hospital facilities

- In cases where nursing is of a particularly complex nature, with a particularly marked consumption of resources in relation to this element, these structures are called "long-term care with high intensity of care".

Long-term hospital facilities

- The long-term care facilities also assist, in a hospitalization regime, disabled people who are not self-sufficient, slow recovery, unable to participate in an intensive rehabilitation program or suffering from severe disability requiring high levels of care and nursing support and ongoing medical protection in the 24 hours, for which an individual rehabilitation project is to be envisaged.

Outpatient facilities

- The outpatient facilities for functional recovery and rehabilitation can be hospital or territorial. They carry out specialist outpatient activities towards external subjects, even at home.

- The services located within the hospital also assist individuals of all ages in the various unit of acute hospitals, in functional recovery, impairment and disability.

Outpatient facilities

- With regard to patients in charge of the various acute care units, they carry out activities to prevent secondary damage in disabling diseases or those at risk of developing disabilities.

Outpatient facilities

- The outpatient rehabilitation centers carry out functional rehabilitation and rehabilitation activities with a comprehensive treatment of the condition of disability, which, due to the developmental age, requires a simultaneous multidisciplinary medical, psychological and pedagogical contribution.

Assisted Healthcare Facilities

- The Assisted Healthcare Facilities are aids that offer to non-self-sufficient, elderly and non-dependent subjects, with stabilized outcomes of pathologies, physical, mental, sensorial or mixed, not taking care at home, a medium level of medical, nursing and rehabilitation assistance, accompanied by a "high" level of care and generic hotel protection based on the assistance models adopted by the Regions

Assisted Healthcare Facilities

- The extensive rehabilitation activities aimed at the guests of these structures concern in particular:
  - subjects with physical, mental, sensory or slow recovery, not assistable at home, requesting an individual rehabilitation project characterized by extensive rehabilitative health treatments;
  - non-self-sufficient subjects suffering from severe disability requiring a high level of care and nursing support in the face of a rehabilitation intervention of low complexity and intensity and without continuous medical coverage in the 24 hours, not assisted at home or in alternative forms to full hospitalization.

Assisted Healthcare Facilities

- Depending on the type of assisted subjects, the duration of the treatment can also be "permanent".

- This also includes "residential or semi-residential structures of a social-welfare nature"

Social and rehabilitation centers

- The rehabilitation health activities should integrate the rehabilitation and recovery moment with the assistance phase to guarantee on the one hand the maintenance of the potential reached however and, on the other hand, offer valid support to users and families to avoid institutionalization risks.

Social and rehabilitation centers

- The units offering integrated social and health services, which can be organized at home and / or through the use of day or residential facilities, should:
  - Guaranteeing qualified assistance that meets both primary psychological and emotional needs
  - Strengthen or maintain the level of autonomy acquired for the best possible preservation of psycho-physical well-being
  - Pursue the social integration of users by promoting constant links with the external environment

Second-level rehabilitation facilities

- The second level facilities provide intensive rehabilitation services aimed at recovering or compensating for important impairments and disabilities and can be organized at:
  - Hospital facilities
  - Non-hospital facilities

Hospital facilities

- Hospital facilities - multi-specialist or monospecialistic - where hospitalization and treatment functions with high diagnostic and care intensity are already present, in which a specific operating unit is set up to guarantee the multi-comprehensive management of individuals of all ages in functional recovery recoverable impairments and disabilities, which cannot be treated.

Hospital facilities

- These subjects require specialized medical rehabilitation protection and highly specific nursing interventions articulated over the entire 24 hours or during daylight hours, not available in extra hospital form, as well as intensive evaluation and therapeutic interventions (at least three hours of specific daily rehabilitation treatment)

Hospital facilities

- They are aimed at the recovery of important, modifiable disabilities, which require a high medical-specialist diagnostic commitment aimed at rehabilitation and therapy in terms of complexity and / or daily duration of the intervention, referable to a nursing articulated in the 24 hours

Hospital facilities

- Understanding such as those provided directly by the staff of the rehabilitation health professions. such as, for example, the physiotherapist, the speech therapist, the occupational therapist, the professional educator and the nurse for those acts aimed at improving the basic activities of daily life. The rehabilitation project and its implementation programs define the times of completely rehabilitative cycles, usually within 60 days.

Hospital facilities

- Objective: clinical stabilization and restoration of conditions of autonomy and / or manageability in the non-hospital setting

- Rehabilitation intervention: at least three hours a day provided by the rehabilitation specialist, by non-medical rehabilitation health professionals and by nursing staff. The social worker and the psychologist can contribute for the time required to reach the daily time required for the rehabilitation intervention

Hospital facilities

- Tools: individual rehabilitation project
- Duration of hospitalization or rehabilitation cycle: 60 days
- If there is no clinical or assistance need, it can be provided in a day –hospital regime
- Places of care: multi-specialist and single-specialist hospitals

Hospital facilities

- Intensive rehabilitation interventions are aimed at treatment:
  - of complex pathologies, which require the stay in a specialized rehabilitative environment dedicated and with a real possibility of interaction with other specialized disciplines
  - of the most serious impairments and the most complex disabilities
  - as well as those connected with rare forms of pathology for which treatment requires the acquisition of adequate experience or the use of particularly complex equipment, advanced technology and integration with other highly specialized branches.

Hospital facilities

- Structural requirements: area for hospitalization, area for assessment, area for the provision of specific rehabilitation activities

- Technological requirements

Hospital facilities

- Organizational requirement
  - Definition of appropriateness protocols for admissions in line with regional planning requirements
  - The interprofessional team should be at least made up of a physiatrist, nurse, physiotherapist and health and social worker
  - The social worker and the psychologist should be available
  - For the departments that take care of patients with disabilities and minor impairments of brain neurological diseases, the team should include the speech therapist
  - Occupational therapy activity should be guaranteed

Hospital facilities

- The provision of technical-assistance staff
  - To guarantee minimum safety levels, at least two nurses 24/24 h, 7 days a week should be present in the ward (considered an approximate number of 20 beds)
  - The presence of the physiatrist should be guaranteed during daylight hours on weekdays for at least 9 hours
  - For the remaining hours a prompt medical availability should be guaranteed, also shared with other departments.

Hospital facilities

- The episode of ordinary recovery in intensive rehabilitation is to be considered appropriate if:
  - the patient is judged susceptible to significant functional improvements during hospitalization, that is, he waits for the result to return the patient to the community (with or without support) or to make him progress to another level of rehabilitative care (outpatient, home care, etc.) .
  - The patient's clinical conditions are such as to allow a rehabilitative treatment to be administered with the most appropriate interdisciplinary approach

Hospital facilities

- The episode of ordinary recovery in intensive rehabilitation is to be considered appropriate if:
  - The patient's condition requires hospitalization with continuous availability within 24 hours of high-intensity diagnostic-therapeutic-rehabilitative services (by medical staff and other health professions) and a non-deferrable treatment that cannot be efficiently delivered in alternative regimes. The need for continuous medical protection is linked to a high risk of potential clinical instability, and provides for a regular individual direct contact between patient and specialist. The need for nursing care is linked to the need (or the risk of having to have) a multiple or complex rehabilitation nursing.

Hospital facilities

- Day Hospital in intensive rehabilitation
  - The patient is susceptible to significant functional improvements and quality of life if subjected to intensive rehabilitation treatment
  - The rehabilitation intervention is however high intensive due to the need for a multi-professional approach
  - The patient's clinical conditions are such as to tolerate such rehabilitative intervention
  - The patient does not need continuous assistance for 24 hours a day

Appropriateness in Day Hospital

- The Day Hospital admission episode in intensive rehabilitation is to be considered appropriate if the patient:
  - is susceptible to significant functional improvements and quality of life in a reasonable amount of time
  - has indication for a rehabilitative intervention of high intensity or, however, prolonged within the same day, to be administered with the most appropriate inter-professional approach, often also multi-specialist

Appropriateness in Day Hospital

- The Day Hospital admission episode in intensive rehabilitation is to be considered appropriate if the patient:
  - presents general clinical conditions that allow him to tolerate both this operation and the daily transfers to and from his home
  - is clinically stable to such an extent that it does not require continuous healthcare 24 hours a day
- A further and preferential criterion of appropriateness is to consider the condition of discharge from an intensive full-time facilities with indication to the continuation, in this form, of the treatment undertaken.

Non-hospital facilities

- The non-hospital rehabilitation units with day and / or continuous cycle of individuals with physical, mental and sensory disabilities provide day and / or continuous cycle services for the functional and social recovery of subjects with physical, mental, sensory or mixed disabilities from any cause.

Non-hospital facilities

- They are appropriate in the immediate post-acute phase (even after hospital discharge) through the provision of health protection aimed at recovering the outcomes deriving from acute episodes or injured or impaired functions through day or continuous residential services.

Non-hospital facilities

- The extra-hospital rehabilitation facilities are intended for the multi-comprehensive management of patients with disabilities of various nature and severity, such as to require intensive rehabilitation without continuous medical protection and highly specific nursing interventions articulated in the arch 24 hours.

Non-hospital facilities

- It is considered appropriate to entrust these units with the share of day or continuous hospitalization, where a considerable continuity of generic assistance and supervision over the autonomy and self-sufficiency of the persons entrusted to the institution is necessary.

Third-level rehabilitation facilities

- The third level structures are characterized by the provision of intensive rehabilitation that require particular qualification commitment, means, equipment and specifically trained personnel such as those aimed at the treatment of the most serious impairments and the most complex disabilities, as well as those connected with forms of rare pathology for which treatment requires experience or the use of particularly complex equipment, advanced technology and integration with other specialized disciplines.

Third-level rehabilitation facilities

- The third level structures or high-level facilities are intended for the treatment of serious disabilities secondary to neurolesions:
  - Spinal units
  - Unit for severe brain injury
  - Unit for serious disabilities in the developmental age
  - Unit for the rehabilitation of acquired neuropsychological disorders

Unit for the rehabilitation of severe brain-injured patients

- The Unit for Serious Cerebral Injuries is expressly dedicated to addressing the complex and very serious problems of care and rehabilitation, such as the results of severe cranioencephalic trauma and other severe cerebral-injuries such as post-anoxic comas, severe secondary hemorrhages secondary to complex vascular malformations physical, cognitive and behavioral deficits (the outcomes of ischemic and degenerative cerebral lesions are therefore excluded).

Unit for the rehabilitation of severe brain-injured patients

- The Unit for the rehabilitation of severe brain-injured patients should be part of a carefully coordinated path that starts from the moment of the onset of the injury until the optimization of the outcome of the person with severe brain injury is obtained.
- They should be closely linked with the Emergency Services - second level Urgency and in particular with the Trauma Centers in order to provide their advice immediately after the trauma and during hospitalization in intensive care unit and neurosurgery.

Unit for severe disability in the developmental age

- The Unit for the rehabilitation of severe disabilities in the developmental age is expressly destined to face the complex and serious diagnostic, evaluation and rehabilitative problems of the outcomes of congenital or acquired neuromotor and cognitive pathologies of the developmental age.

Unit for severe disability in the developmental age

- The Unit is divided into subunits which, depending on the affecting pathologies, are activated within specialized centers, where the corresponding skills are guaranteed in the following areas: intensive care unit, neonatal pathology, orthopedics with a module specifically oriented to corrective interventions of child disabilities, neurosurgery, pediatrics, plastic surgery, neurology, otorhinolaryngology, ophthalmology, child neuropsychiatry.

Unit for acquired neuropsychological disorders

- The Unit for the rehabilitation of acquired neuropsychological disorders is expressly dedicated to addressing diagnostic, evaluation and rehabilitative problems related to cognitive impairments and disabilities and secondary cortical functions secondary to brain injury.

Unit for acquired neuropsychological disorders

- It should be activated in a hospital where the following specialist activities are present and available: neurology, physical and rehabilitation medicine, neuroradiology, otorhinolaryngology, ophthalmology, psychiatry and clinical psychology.

Spinal unit

- The Spinal Unit represents a unipolar rehabilitation structure specifically intended for the assistance of subjects with spinal cord injuries of traumatic and non traumatic origin, such as to allow the myelolese to reach the best state of health and the highest level of functional capabilities compatible with the injury, guaranteeing the unity of rehabilitative intervention with respect to all the needs of the disabled subject in the physical, mental and existential globality of the person.

Spinal unit

- The Spinal Units are part of a carefully coordinated path that starts from the moment of the onset of the injury until the optimal outcome of the person with spinal cord injury is obtained.

Spinal unit

- The Spinal Unit is closely connected with the second level Emergency Urgency Services, and in particular with the "Trauma Centers", in order to provide their advice immediately after the trauma and during any phases of recovery in intensive care unit, neurosurgery, orthopedics, collaborating in the education and training of its staff, participating in common therapeutic protocols and ensuring timely acceptance of the myelogenous subject.

Spinal unit

- For the Spinal Unit, all the specialist consultations that may be necessary and useful in the rehabilitation process are available.

- The Spinal Unit is normally tightly integrated into the overall network of health services of first and second level rehabilitation and social rehabilitation, with which it is linked to the return of the disabled person in their own territory of life in adequate time, guaranteeing the completion of the rehabilitation path.

Spinal unit

- The Unipolar Spinal Unit (USU) is the structure intended for the assistance of individuals with spinal cord injuries of traumatic and non-traumatic origin, from the moment immediately following the injurious event, in order to allow myelolysis to reach the best state of health and the highest level of functional capabilities compatible with the injury.

Spinal unit

- The complexity of bone marrow pathology requires a close integration of health-social-assistance interventions, implemented by a multidisciplinary team (doctors, nurses, physiotherapists, occupational therapists, socio-health workers, professional educators, psychologists, social workers) with the predisposition of an individual rehabilitation project and the implementation of one or more rehabilitation programs. Obviously, the latter must be shared by the patient and his family, they need to be periodically checked and, when necessary, must be modified in relation to the specifics of the case.

30-05-1998

GAZZETTA UFFICIALE DELLA REPUBBLICA ITALIANA

Serie generale - n. 124

DECRETI E DELIBERE DI ALTRE AUTORITA

CONFERENZA PERMANENTE PER I RAPPORTI TRA LO STATO LE REGIONI E LE PROVINCE AUTONOME DI TRENTO E BOLZANO

PROVVEDIMENTO 7 maggio 1998

Linee-guida del Ministro della sanità per le attività di riabilitazione.

2.3.4,1 Unipolar Spinal Unit

As defined in law ng between the State and the Regions approving the Guidelines on the health emergency system, the Unipolar Spinal Unit (USU) is intended for the assistance of subjects with spinal cord injuries of traumatic and non-traumatic origin, from the moment of the injurious event and has the purpose of allowing people with spinal cord injuries to reach the best state of health and the highest level of functional capacity compatible with the injury .....

Unipolar Spinal Unit
Law 1998

What does UNIPOLAR mean?

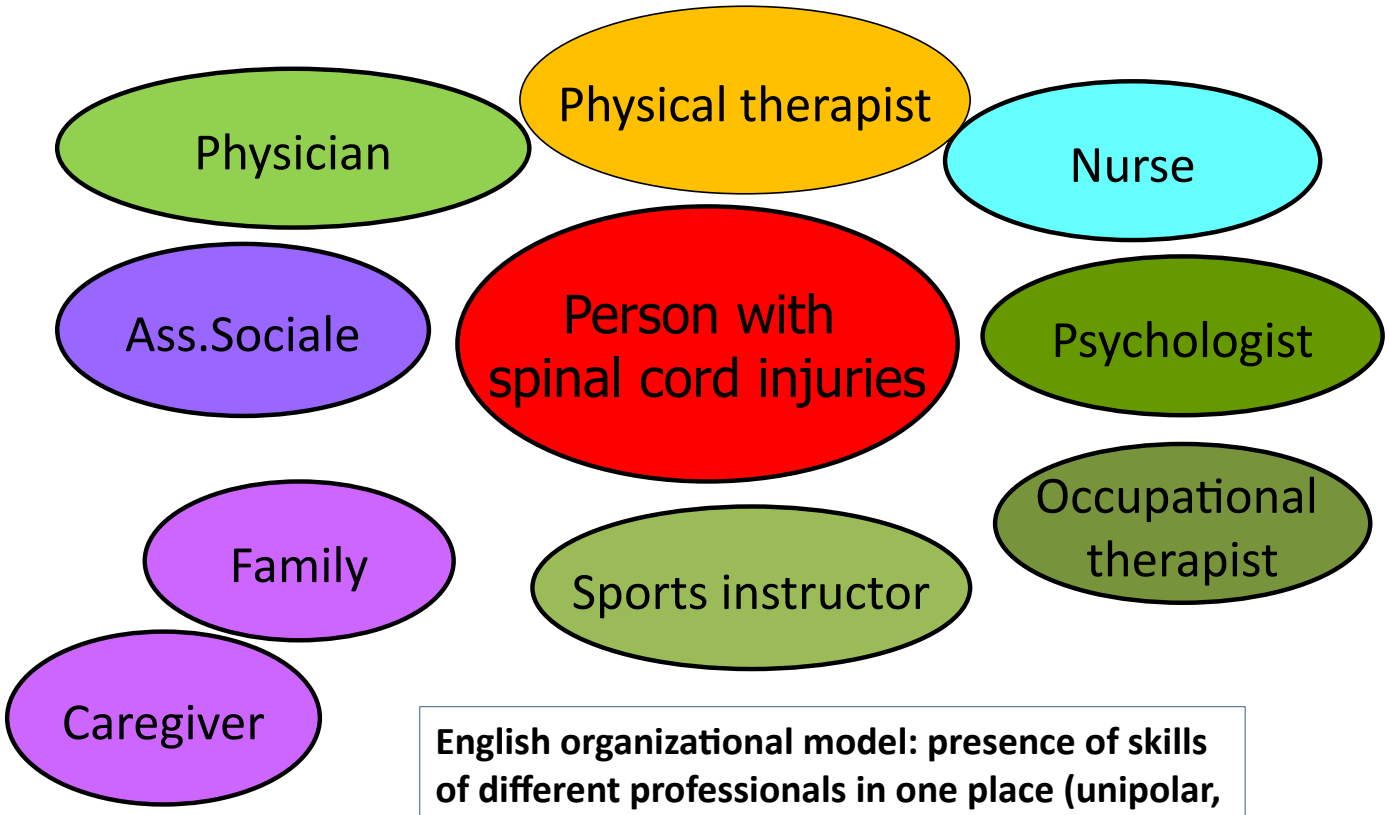
- The overall rehabilitation process of the person with spinal cord injury must be unitary both in terms of space and time
- Rehabilitation project with contemporary and progressive characteristics
- Starting from the appearance of the spinal cord injury up to complete social and occupational reintegration

What does Global Rehabilitation mean?

- Return efficiency and functionality by addressing the person in his or her physical, mental, emotional, communicative and relational entirety, involving the family, social and environmental context

- The rehabilitation project is aimed at achieving the maximum possible autonomy and at defining a new life project

Multidisciplinary approach



English organizational model: presence of skills of different professionals in one place (unipolar, multidisciplinary)

Spinal Cord Unit = Specialized Rehabilitation Unit

- Specialized physicians
- Specialized nurses
- Physical therapists
- Occupational therapists
- Psychologists
- Social workers

- Their purposes are delivering continuous, comprehensive and specialized care to cover the broad spectrum of medical, physical, psychological and social issues that arise from Spinal Cord Injury

FUNCTIONAL REHABILITATION

- Even the recent WHO guidelines define rehabilitation as “a global intervention aimed at preventing or eliminating disability (ICIDH), at preserving or expanding the area of participation (ICF)” through direct and indirect actions.

FUNCTIONAL REHABILITATION

Within the rehabilitation process, physiotherapy is basically carried out in two areas:

- re-education aimed at recovering maximum functional capacity through:
  - neurological recovery if it occurs;
  - strengthening of the muscles that have remained intact;
  - the search for compensation and motor strategies that allow the re-learning and reacquisition of functional skills in daily activities, work, play, etc .;
  - identification and training of aids;
  - the activation of coping strategies that promote "readaptation" to the disability event;
- educational aimed at the knowledge and correct management of problems related to spinal cord injury (health education).

FUNCTIONAL REHABILITATION

- Where residual potentials are severely reduced, it is essential that the subject with spinal cord injury be "educated" in the knowledge of their needs and also acquire the ability to know how to "guide" third parties in assisting their person (verbal independence program).

FUNCTIONAL REHABILITATION

- The first type of strategy allows the person to relieve the emotional tension associated with the stressful event but does not change the situation: it is a behavior.
- The second type of strategy sees the person focused on a problem in an attempt to change the situation: it implies a change in the modus vivendi.
- The ability to activate coping strategies is influenced by the number, duration and intensity of stressors, by previous illness experiences, by the social support system, by the personality of the individual.

Rehabilitation team

- Teamwork means inter-professional comparison of common and shared objectives based on the global clinical-functional evaluation

- Rehabilitation project

Final objective of the rehabilitation project in the Spinal Unit:

- Achievement of the maximum level of autonomy based on the level of injury, age, associated complications and patient motivation
  - Physical and functional sphere
  - Psychic and social sphere

Rehabilitation Project

- Based on clinical-functional evaluation defines:
  - the short, medium and long term objectives
  - the expected times
  - the actions and conditions necessary to achieve the desired outcomes
- Keeping in mind:
  - of global needs
  - patient preferences
  - of impairments and disabilities
  - of residual or recoverable capacities
  - environmental, contextual factors

Rehabilitation program

- The document in which the specific areas of intervention, the times and methods of delivery of the interventions, and their purposes, the levels of responsibility of the operators involved, the verification of the interventions themselves are explained in a general way.
- The physician is responsible for coordinating the entire rehabilitation project, the physiotherapist is responsible for the therapeutic act and the activities directly connected to it

GSI ITALIA
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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Rehabilitation in spinal cord injuries
Lesson: Anatomy of Spinal Cord

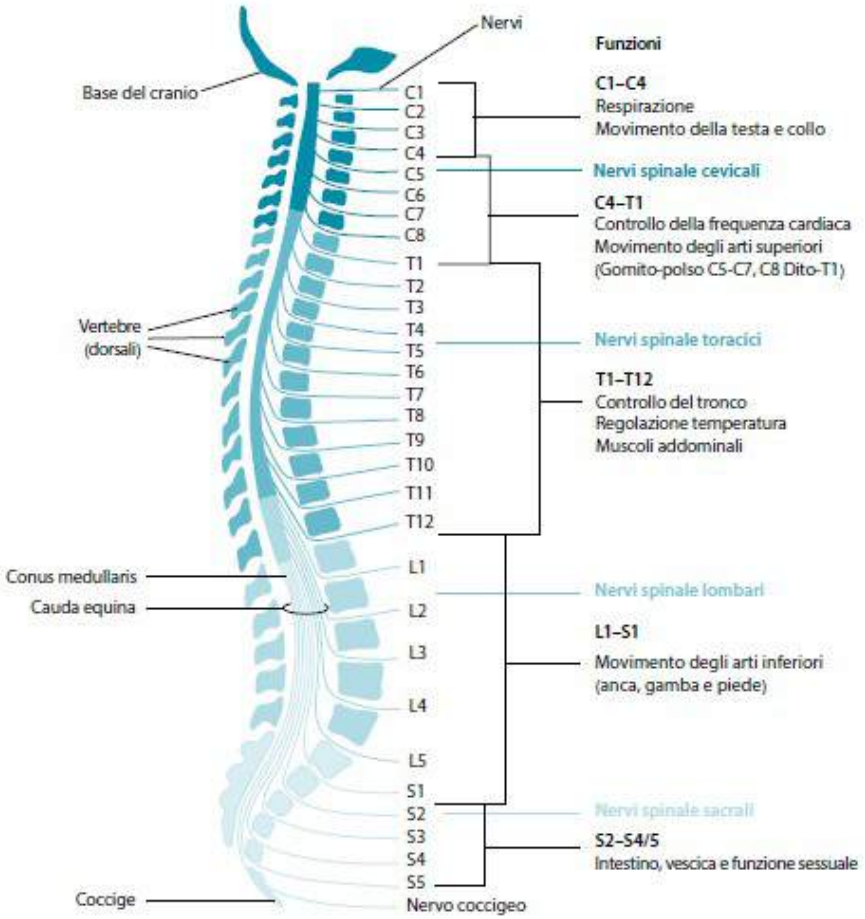
NOTES OF ANATOMY OF THE SPINAL CORD

- The limit between the bulb and the spinal cord is conventionally represented by a transverse plane passing between the emergence of the last pair of cranial nerves and the first pair of spinal nerves. The first spinal nerve, exiting the vertebral canal, passes between the occiput and the atlas, while all the other spinal nerves pass through the conjugation foramen between the vertebra of the corresponding number and that of the previous number.

NOTES OF ANATOMY OF THE SPINAL CORD

There are 31 or 32 pairs of spinal nerves arranged symmetrically:

- 8 cervical;
- 12 thoracic;
- 5 lumbar;
- 5 sacral;
- 1-2 coccygeal (as a pair may sometimes be missing)


Nervi
Funzioni
Base del cranio
C1
C2
C3
C4
C5
C6
C7
C8
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
L1
L2
L3
L4
L5
S1
S2
S3
S4
S5
Nervo coccigeo
C1–C4
Respirazione
Movimento della testa e collo
Nervi spinale cevicali
C4–T1
Controllo della frequenza cardiaca
Movimento degli arti superiori
(Gomito-polso C5-C7, C8 Dito-T1)
Vertebre
(dorsali)
Nervi spinale toracici
T1–T12
Controllo del tronco
Regolazione temperatura
Muscoli addominali
Conus medullaris
Cauda equina
Nervi spinale lombari
L1–S1
Movimento degli arti inferiori
(anca, gamba e piede)
Nervi spinale sacrali
S2–S4/5
Intestino, vescica e funzione sessuale
Coccige

NOTES OF ANATOMY OF THE SPINAL CORD

- The spinal cord is enlarged at the cervical and lumbar level, that is, in correspondence with the roots intended for the innervation of the limbs; the so-called cervical and lumbar swellings extend from segment C4 to T1 and from segment T12 -L1 to S3 respectively.

NOTES OF ANATOMY OF THE SPINAL CORD

- The segments L5-S1-S2 constitute the so-called epicone

- The last three sacral segments plus 1 or 2 coccygeal segments constitute the terminal cone which continues with a fibrous filament, the final filum, up to the posterior surface of the coccyx.

- Below the terminal cone, therefore, the vertebral space contains a series of nerve roots which run longitudinally and which together are defined as cauda equina.

NOTES OF ANATOMY OF THE SPINAL CORD

- The spinal cord and the initial portion of the roots are enveloped by the 3 meningeal envelopes (pia mater, arachnoid and dura mater) which continue with the corresponding encephalic meninges at the level of the foramen magnum. These meninges terminate in a cul de sac at the level of the upper margin of L2.

NOTES OF ANATOMY OF THE SPINAL CORD

- Between the dura mater and the vertebral canal there is a space called the epidural space containing areolar adipose tissue and a venous plexus

- Between the dura and arachnoid there is a subdural space which usually contains a layer of clear liquid similar to lymph.

- The space between the arachnoid and the external surface of the spinal cord, enveloped by the pia mater, is the subarachnoid space and contains the cerebrospinal fluid.

NOTES OF ANATOMY OF THE SPINAL CORD

- The pia mater completely envelops the spinal cord and sends to the dura mater, on each side, 22 triangular processes, the denticulate ligaments which, together with the roots of the spinal nerves that emerge, hold the spinal cord in place.

Internal deformation of the spinal cord

- In transverse section, the spinal cord is divided into a central gray matter and a peripheral white matter.

- The first is constituted by the cell bodies, by the dendrites of the spinal neurons and by fibers that arrive or originate there, while the second is constituted only by bundles of fibers that run longitudinally.

Organization of the gray matter

- The gray matter of the medulla resembles that of a butterfly or a H in shape; on both sides of the median line, each half can be divided into a dorsal (or posterior) and a ventral (or anterior) horn.

- The two halves are joined by a transverse septum called the gray commissure, at the center of which runs the central canal or ependimal.

Organization of the gray matter

- In the anterior horn, squat, quadrangular or rounded in shape, we find the motor neurons for the skeletal muscles and for the neuromuscular spindles that will form the anterior roots

- In the dorsal horn, thinner and elongated, we find sensory neurons, second-order sensory neurons, which receive the lateral contingent of the fibers of the posterior roots that will form the spinobulbar bundles.

Organization of the gray matter

We can roughly divide the gray matter into four areas:

- in the head of the anterior horn we have represented the somatomotor area,
- while the visceromotor area is located at the base of this horn;
- in the head of the posterior horn we find the area for exteroceptive stimuli (pain, temperature, touch and pressure)
- and in its base we have the enteroceptive area that receives stimuli from the enteroreceptors of the vessels and viscera;

between the base and the head of the posterior horn we find the so-called neck, which constitutes an area for proprioceptive stimuli (muscle, tendon, joint and bone).

Organization of the gray matter

- Dorsal horn and ventral horn are connected to each other by a portion of gray matter called the intermediate zone, which has the typical aspect of the reticular substance in which fibers and cells are mixed, it actually contains neurons whose axons terminate in the horn ventral, in the brain stem or cerebellum.

- In the tract of the medulla extending from C8 to L3, the intermediate zone also contains the sympathetic preganglionic neurons of the autonomic effector system, thus forming a lateral horn called the intermediate-lateral-thoraco-lumbar nucleus

.

- At the level of the first three sacral segments, between the posterior and anterior horn, there is a cell grouping which constitutes the sacral parasympathetic

Organization of the gray matter

- From the anterior horn originates the anterior root in which we find the axons of the muscular and visceral effector motor neurons

- From the posterior horn, however with a centripetal direction, the posterior root originates, conveying the entero and exteroceptive sensitivity.

- On the posterior root, before the junction with the anterior root to form the spinal nerve, we find a ganglion that contains the pyrenophores of the sensory nerves.

Organization of the gray matter

- The spinal nerves have an initially horizontal course, while descending into the metamers they increasingly take an oblique course downwards, so much so that at the height of the body of L1-L2 we find only nerve roots joined to form the cauda equina, which ends at coccygeal with the filum terminus.

Organization of the white matter

- The white matter is divided into three pairs of columns or funicles.
  - The dorsal columns are located between the posterior sulcus and the posterior roots penetrating the posterolateral sulcus, arranged medially to the posterior horn, consist mainly of fibers that transmit somatosensory information to the bulb.
  - The lateral columns are located between the anterolateral and posterolateral sulcus, arranged laterally to the gray matter, contain both somatosensory ascending bundles and fibers from the sensory, motor and autonomic brain centers.
  - The ventral columns are located between the anterior median fissure and the anterior roots emerging from the anterolateral sulcus, are located medially to the anterior horn, contain mainly descending tracts intended for the axial musculature.

Organization of the white matter

- In the white matter, three types of pathways are distinguished:
  - ascending ways
  - descending ways
  - own spinal muscles

Ascending ways

- The ascending pathways are made up of afferent fibers that mediate different types of sensitivity.

- The so-called exteroceptive sensitivity informs the Central Nervous System about everything that can change the internal environment from the outside; it consists of both protopathic and epicritic information, and from the part of conscious proprioceptive sensitivity (that is, in which the impulses linked to the sense of position and movement arrive at the cortical level).
  - The epicritic system is necessary for mediating touch, pressure, slight differences in temperature and for discrimination between two points.
  - The protopathic system provides the basis for recognizing pain and extreme thermal differences; this system is able to give diffuse sensory impressions of an all or nothing type, thus providing coarser sensory information than that provided by the epicritic system.

Ascending ways

- Introceptive or visceral sensitivity informs about internal changes in the organism, that is, about vegetative parameters of acidity, tension of the various viscera, changes in cardiac contractility and so on.

- The ascending pathways include the gracilis fasciculus and the cuneate fascicle that carry fine discriminative sensitivity, i.e. epicritic, from the lower and upper parts of the body, respectively.

Ascending ways

- A coarser, ie protopathic, sensitivity is carried by the anterior and lateral spino-thalamic bundles; in particular, the lateral spino-thalamic bundle is especially important for the transport of pain and thermal sensitivity.

- Other ascending pathways, more closely connected with reflex activity and motor control, include the anterior and posterior spino-cerebellar bundles and the spino-olive, spino-tectal and spino-reticular bundles.

Descending ways

- The descending routes have been divided into two groups for convenience.

- The first group includes the cortico-spinal bundles and the rubro-spinal bundle. It ends mainly in the dorsal-lateral areas of the spinal cord, which contain the neurons responsible for controlling the distal muscles of the limbs. Damage at this level causes a loss of control of the fine movements of the extremities.

Descending ways

- The second group includes the lateral and anterior spinal reticulum bundles, the roof-spinal bundle, the lateral and medial spinal vestibule bundles and the interstitium-spinal bundle which runs inside the medial longitudinal fascicle and ends at the level of the ventro-medial zones. spinal cord.

- These areas contain the neurons responsible for controlling the axial and proximal muscles of the limbs.

- Damage to these pathways causes posture and standing disorders. Both groups of descending bundles, in addition to carrying out a motor action, also have fibers that modulate sensory impulses in the spinal pathways

Own spinal muscles

- Part of the proper spinal tracts consist of afferent fibers that penetrate the spinal cord with the posterior roots and then rise or fall, passing through the oval bundle, the comma bundle, the dorsolateral fascicle (Lissauer), the gracilis fascicle and the fascicle cuneate to terminate in relation to neurons of other levels of the spinal cord.

- Other spinal fibers of their own originate from the interneurons of the gray matter itself of the spinal cord. Overall, the own spinal fibers are important in mediating spinal reflexes and coordinating activity in the different levels of the spinal cord.

Vascular anatomy of the spinal cord

- The main source of blood supply to the cervical cord is the posterior lateral spinal arteries and the anterior median artery consisting in part of the segmental branches of the vertebral arteries.

- The thoracic and lumbar spinal cord are supplied through segmental arteries that branch off from the aorta and internal iliacs; the segmental branches of the lateral sacral arteries provide for the supply of the sacral cord.

Vascular anatomy of the spinal cord

- Typically, each segmental artery is divided into an anterior and a posterior branch: a spinal artery starts from each posterior branch which, passing through the intervertebral foramina, penetrates the dura mater and nourishes the ganglia and spinal roots.

Vascular anatomy of the spinal cord

- Lazorthes divides the medullary radicle arteries into three groups:
  - Upper or cervico-thoracic arteries
  - Intermediate or mid-thoracic arteries,
  - Lower thoracic or lumbar arteries.

Vascular anatomy of the spinal cord

- The anterior median spinal artery, consisting of the anterior medullary arteries, develops along the entire medulla in the anterior sulcus and gives rise to the central arteries, which provide the vascularization of most of the anterior horns and the ventral portion of the gray matter of the medulla.

- Also from the anterior spinal artery originates an anterior pial reticulum which supplies the anterior two thirds of the medulla with its bundles of white matter.

- The anterior medullary arteries form the paired posterior spinal arteries that supply the remaining dorsal third of the medulla with both direct penetrating vessels and a plexus of pial vessels.

Vascular anatomy of the spinal cord

- The anterior medullary veins are generally eight to twelve in number, while the posterior ones are in greater number, arranged rather closely together at the level of each medullary segment.

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Rehabilitation in spinal cord injuries
Lesson: Epidemiological data

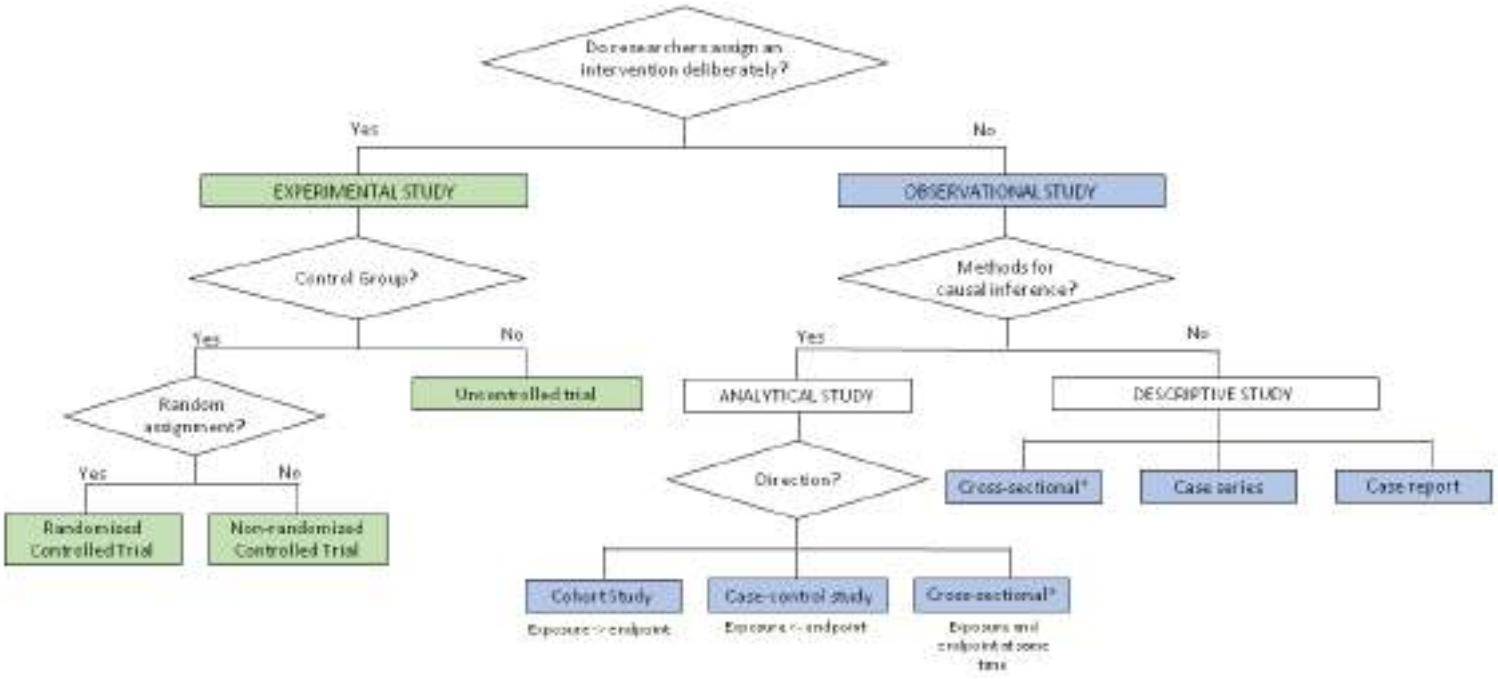
Prevalence VS Incidence

Incidence	Prevalence
Probability of developing a disease	Probability of having a disease
The numerator includes only new cases	The numerator includes all cases
Requires two surveys spaced out over time (follow-up)	It is ascertained with a single investigation
It does not depend on the duration of the disease	It depends on the duration of the disease
It is preferred when studying the causes of the disease	It is preferred for evaluating the impact of a disease (usually of long duration) in a population

$$\text{Incidence} = \frac{\text{Number of new diagnoses of the disease in the population in a given period of time}}{\text{Number of subjects in the population}}$$

$$\text{Prevalence} = \frac{\text{Number of cases of disease in the population}}{\text{Number of subjects in the population}}$$

PRIMARY RESEARCH



CROSS SECTIONAL STUDY

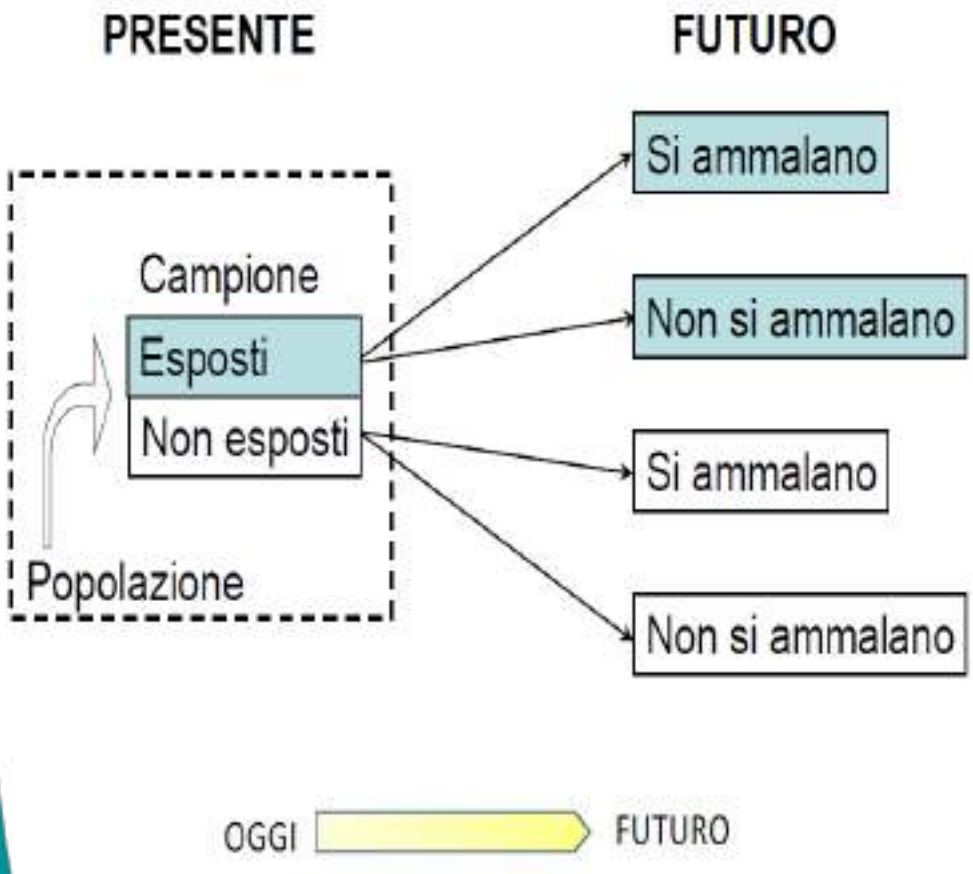
- Collect information about the condition of interest at the same time and in the same patient(s)
- They are a kind of photography.
- They detect the presence or absence of a disease/problem or the presence or absence of an exposure at a given time
- They do not allow to establish a cause-effect relationship between risk factor and pathology (Exposure and Outcome detected simultaneously in the population)
- The enrollment can be longitudinal, what is transversal is the analysis
- Studies of prevalence, diagnosis, validation of measuring instruments

CROSS SECTIONAL STUDY

Advantages
- Information on the frequency and characteristics of a disease (prevalence)
- Relatively fast and low cost
- It allows you to analyze associations and generate hypotheses

Disadvantages: Cannot clarify whether or not the hypothetical Risk Factor precedes the disease

Cohort prospectic study



Useful for etiology (risk factors) and prognosis (prognostic factors) questions

Subjects without the outcome of interest in relation to their exposure to the possible risk factor are enrolled and prospectively followed up

They may have a control cohort (parallel cohort) not exposed to the factor

Cohort prospectic study

Advantages:

- It can measure the incidence and therefore the risk

- Useful for prognostic and etiological questions

- Exposure detected before the outcome (exposure certainly precedes the outcome) → clear temporal relationship between exposure and outcome

- It can study many diseases

- It can study many exposures

- Very efficient for rare exposures

Cohort prospectic study

Disadvantages:

- It requires many participants
- It requires a long follow-up
- Inefficient for rare diseases
- Exposure status may vary throughout the study
- Diagnostic criteria may change over time
- Very expensive
- Complex to evaluate multiple exposures
- Ethical aspects

INCIDENCE

- Incidence data show how many people have suffered a spinal cord injury (SCI) in a given population and in a specific time period. The number of new cases of SCI, per million population, per year, is usually reported.

- Incidence is a direct measure of SCI risk. Incidence rates are affected by etiology, and further by demographics (gender, age), occupation and geographic location (urban, rural) variables that can differentiate/identify groups at risk, thereby informing policies and effectiveness of programs of prevention.

INCIDENCE

- There are variations according to several factors:

– Definition of the population at risk (ie the population of origin of the SCI cases).
– Precise definition of SCI case
– Completeness of the assessment of SCI incident cases according to the case definition. For example, the incidence of traumatic SCI may not include those people with SCI who died at the scene of the injury.

Incidence of non-traumatic SCI may not include people who develop SCI during end-of-life care (e.g. spinal metastases)

Prevalence

- The number of people in the population living with SCI at a given time.
- It is measured as the number per million inhabitants. Prevalence is influenced by the risk and duration of a disease, and the latter is determined by recovery or death.
- Regular data collection, broken down by age, gender, and socioeconomic categories, such as occupation and balance sheet, can uncover patterns and trends that are important for understanding the lived experience of SCI.
- Prevalence is an indicator of the effectiveness of secondary prevention and the need for health care and social support.

Etiology

- Factor indicating the number of people with SCI by cause of injury, location and activity.
- Useful for local planning of primary prevention, trauma care and rehabilitation services.
- Useful for calculating health care costs.

Standardized Mortality Rate (SMR)

- The SMR provides a standardized estimate of mortality in people with SCI compared to the general population.

- When the SMR is equal to 1 there is no increase in the mortality risk for SCI; if greater than 1 then the increased risk is present.

- The requirements necessary to calculate the SMR for a group are:

– the number of people with SCI broken down by age group and gender;
– deaths detected in SCI;
– the age- and gender
-specific mortality rates of the general population.

Standardized Mortality Rate (SMR)

- Determine whether the death rate of SCI is higher or lower than in the general population.

- Limitation: Variations in SMR estimates among different populations may reflect in part variations in the death rate of the general population and in part the completeness of the death rate findings.

Lethality rates

- Absolute number of numbers of people who died from SCI.I
- f broken down by etiology, appropriate measures can be identified and implemented.
- Show the relationship between SCI and lethality.
- To make the information comparable, standardize it into the following groups: number of people with SCI, including those with TSCI who die at the scene of the accident; lethality in hospital; and lethality after hospital discharge: 30 days, 1 year, 5 years, etc.

Lethality rates

- To estimate its socio-economic impact, it is necessary to have a complete epidemiological picture of SCI, in terms of the global number of people living with SCI (prevalence), the number of new cases (incidence) and the causes of SCI

- This data must be collected at regular intervals to make predictions about future needs. Nationally based policy and planning also require information about the environmental factors that influence living with SCI, the socioeconomic status of people with SCI, their met and unmet needs, and the costs associated with SCI.

What do we know about spinal cord injury?

- Data regarding the extent and costs of SCI are limited. Only some of the high-income countries are able to provide national statistics. Other sources of data are so few and so methodologically varied that it is not possible to make reliable estimates of worldwide prevalence or incidence.

- It is not known how many people in the world live with SCI, but international incidence data indicate that 250,000 to 500,000 people suffer a spinal cord injury each year. Most of these cases are traumatic SCI, primarily caused by traffic accidents, falls and violence. Recent studies show an increase in the age of onset of SCI and a gradual increase in the percentage of NTSCI cases – partly attributable to the aging of the world population

- Current data show that SCI is associated with a high risk of mortality.

What do we know about spinal cord injury?

- People with SCI are at greater risk of dying, especially in the first year after SCI onset, and even in high-income countries where health progress has favored increased survival, they still have a high mortality risk and are more likely to die earlier than the rest of the population.

What do we know about spinal cord injury?

- People with SCI in low-income countries continue to die of preventable secondary complications, which are no longer a leading cause of death in high-income countries.

What do we know about spinal cord injury?

- SCI costs vary widely depending on context, and some comparable data is available.

- From the existing data, it is clear that SCI involves considerable direct and indirect costs and that many of these costs are borne by SCIs. The level and severity of a SCI have a significant influence on costs. Direct costs appear to be highest in the first year after SCI onset, but indirect costs often exceed direct costs over the course of a lifetime.

Prevalence of spinal cord injury

- Data on SCI prevalence are important for quantifying health care and social support needs and for evaluating the effects of secondary prevention measures; unfortunately data on the prevalence of SCI are scarce. There are currently no global or regional estimates of the prevalence of all causes of SCI.

Tabella 2.2 Prevalenza di TLM

Paese	Località	Anno della stima	Tipo di studio e popolazione di referenza	LM pediatrico/ adulto	Prevalenza per milione di abitanti
Repubblica Islamica dell'Iran	Teheran	2008	Prospettico, trasversale, registro nazionale	Adulto, pediatrico	440
Finlandia	Centro Riabilitazione Käpylä, Helsinki; Ospedale Universitario Centrale di Helsinki, Helsinki	1999	Retrospettivo, registro dati dell'ospedale	Adulto, pediatrico	280
Norvegia	Province di Hordaland e Sogn og Fjordane	2002	Retrospettivo, longitudinale/ di gruppo usando dati ospedalieri	Adulto, pediatrico	365
Islanda	Landspitali Ospedale Universitario, Reykjavík	2009	Retrospettivo, longitudinale/ di gruppo usando dati ospedalieri	Adulto, pediatrico	526
Canada	Tutta la Nazione	2010	Retrospettivo, trasversale, Registro Nazionale, studio di modellazione	Adulto, pediatrico	1298
Australia	Tutta la Nazione	1997	Retrospettivo, Registro Nazionale, studio di modellazione	Adulto	681

Tabella 2.3 Prevalenza di NTLM

Paese	Località	Anno della stima	Tipo di studio e popolazione di referenza	LM pediatrico/adulto	Prevalenza per milione di abitanti
Canada	Tutta la Nazione	2010	Retrospettivo, trasversale; Registro Nazionale	Adulto, pediatrico	1227
Australia	Stato di Victoria	2010	Retrospettivo, trasversale; Registro Nazionale	Adulto, pediatrico	367 (455 per adulti di età maggiore o uguale a 16 anni)

EPIDEMIOLOGY

- At the national level there are still no systems and uniforms of epidemiological investigation and surveillance, nor sources of official statistics that can allow a standardized study of this phenomenon.

EPIDEMIOLOGY

- This is due to the scarce presence, especially in Italy, of reception and treatment centers for spinal injuries, the Spinal Units, which could also carry out an epidemiological observatory function. Therefore, there is a lack of data on which the economic impact can also be assessed and a comparison at a regional and geographical level is lacking.

EPIDEMIOLOGY

- This condition does not only concern Italy but is a phenomenon more or less extended to the entire international scientific community; in any case, albeit with different investigation procedures, there is an incidence of new cases per year that varies between a minimum of 9.7 cases per million inhabitants, in Denmark, and a maximum of 38/40 cases per million of inhabitants, in Japan and the USA

EPIDEMIOLOGY

- According to the Ministry of Health, from a collection of data and regional estimates, in Italy an average of about 20/25 cases per year per million inhabitants would appear, i.e. on European levels, which indicates a total of about 1200/1500 people per year. year.

Incidence and prevalence in Italy (GISEM, 2005)

- INCIDENCE: 20-25 NEW CASES / 1,000,000 INHABITANTS / YEAR
- PREVALENCE: 60,000 / 70,000 people with spinal cord injury in Italy
- 1578 new cases of spinal cord injury in 2010 (ISTUD Foundation data, 2010)

Characteristics of the population with spinal cord injury

- Traumatic origin 67.5%
- 57% paraplegia- 43% tetra
- Average age 38 years
- Rep. 4: 1 male female

- Non-traumatic origin 32.5%
- 74% paraplegia - 26% tetra
- Average age 55
- Rep. 1.6: 1 male female

- Road accidents 54%
- Accidental falls 22%
- Work accidents 10%
- Sports accidents 8%

- Vascular 26%
- Neoplasms 25%
- Degenerative 19%
- Inflammatory 18%

Spinal injuries

- Trauma: main cause (80%)
- 43% quadriplegia, 57% paraplegia
- 55% road accidents (38% car, 14% motorbike, 3% cycle or pedestrian)
- 22% falls
- 8% sport
- 4% suicide
- 2% firearm

Spinal injuries

- 25-40 new cases / year / million inhabitants
- 1500 new cases / year
- Age: 16-30 years, 50-55 years
- 4: 1 male / female ratio
- Life expectancy → like healthy subjects
- Non-traumatic:
  - 25% neoplastic,
  - 25% vascular
  - 19% degenerative
  - 18% infectious

EPIDEMIOLOGY

- The fact that the Spinal Units are rather scarce on our national territory and distributed above all in the center north, and that among these only some constitute a unipolar center, means that a good number of these thousand patients are hospitalized in other wards making the less specific treatment and the most dispersed and difficult to evaluate statistical sample.

EPIDEMIOLOGY

- On 3/6/99, for a Ministerial Decree, a Commission of Unipolar Spinal Units is installed which in April 2001 draws up a Concluding Document which constitutes the most up-to-date source of epidemiological aspects concerning Italy.

EPIDEMIOLOGY

This slide shows the result of the survey carried out in the period 1997 - 1999 by the G.I.S.E.M. (Italian group for the epidemiological study on myelolesions), consisting of 7 spinal units, 25 rehabilitation centers and 5 rehabilitation services in support of emergency departments, which highlighted the following:

- the most frequent etiology (65%) is of the traumatic type;
- vertebro-medullary trauma caused tetraplegia in 43% of cases and paraplegia in 57%;
- the age of the traumatized was between 11 months and 96 years, but the highest incidence range is between 20 and 40 years, with two frequency peaks around 20 and 59 years;
- the average age is 35-38 years;
- males are definitely more affected than females with a 4: 1 ratio;
- cervical lesions were less frequent than back-lumbar lesions (21.8% vs 76.1%);road accidents (car, motorcycle, cyclist / pedestrian) constitute 54% of the total traumatic causes; then there are accidents at work (17%), the most frequent of which are related to falls from a height, road accidents orsportsman; finally, domestic accidents represent about 12% of the total and are the result of accidental falls and suicide attempts;

Causes of the traumatic event by age and sex. - G.I.S.E.M. (Italian group for the epidemiological study on myelolesions 1997 - 1999)

CAUSA	FREQUENZA	MASCHI	FEMMINE	ETA' MEDIA (mediana)
Auto	37,2%	77,1%	22,9%	34,8 (29,2)
Moto	13,9%	87,9%	12,1%	28,1 (24,8)
Ciclista/pedone	3,4%	70,8%	29,2%	51,3 (53,9)
Sport	8%	96,5%	3,5%	32,2 (30,3)
Arma/violenza	2,1%	100%		31,9 (26,7)
Caduta dall'alto	21,8%	85,9%	14,1%	49,1 (50,5)
Precipitazione	4,2%	26,7%	73,3%	33,1 (32,7)
Altro	9,4%	77,6%	22,4%	47 (48)

The remaining 35% of spinal cord injuries identified by the G.I.S.E.M. non-traumatic type is due to the following causes:

vascular (27%)
neoplastic (28%)
degenerative (14%)
inflammatory / infectious (16%)
unidentified causes (13%)

Another interesting information detectable by the Document is the demonstration that the severity of myelolesions of traumatic origin is greater than non-traumatic ones and therefore have a greater number of complete lesions.

PREVALENCE

- In any case, the relationship between incomplete and complete injuries is in a positive trend and this is mainly due to a higher quality of the roadside assistance or first aid service, which can often make use of more qualified health workers who are therefore able to use methodologies and means technologically more sophisticated.
- In particular, the improvement in assistance at the accident site has had a positive effect on the increase in incomplete spinal cord injuries.
- The movements are carried out with extreme caution, avoiding or limiting as much as possible the flexion-extension and rotation movements of both the spine and the head; the patient is kept stretched out and placed on a rigid padded stretcher to protect the points of greatest pressure

PREVALENCE

- Incomplete injuries can be caused by bone fractures, severe subluxations, intervertebral disc protrusions, and congenital or degenerative cervical spondylosis. The development of an incomplete spinal cord injury in patients with pre-existing cervical spondylosis, after minor trauma, without evidence of fracture, is common as well as among those who have sustained gunshot wounds but in whom the bullet has not penetrated the internal spinal canal. The possibility of having an incomplete type injury increases in the case of a fracture with dislocation of only one facet joint and not of both; as is the case with wounds caused by a blade.

PREVALENCE

- Spondylosis, or stenosis of the medullary canal, is quite frequently detected in elderly patients with cervical lesions, while the possibility that they have fractures associated with spinal cord injury is much lower, as frequently occurs in younger patients.

PREVALENCE

- The data obtained from this study, in particular those concerning the distribution of lesion types (neurological level and completeness of the lesion), are similar to those found in other European studies.
- Road accidents are the main cause of spinal cord injury; in particular, accidents on two wheels lower the average age of patients at the time of the injury and are mostly borne by the male sex.
- Falls from above are mainly borne by an older population (46-65 years).
- In recent years, shallow water diving accidents have increased significantly.

Incidence of spinal cord injury

- The global estimate of the incidence of SCI is 40–80 new cases per million population per year, based on quality studies of the incidence of all causes of spinal cord injury, conducted at the national level. This means that 250,000 to 500,000 people suffer a spinal cord injury each year.

- Historical data reported that up to 90% of cases of SCI had a traumatic origin, but more recent studies indicate, in recent years, a slight trend towards an increase in the percentage of NTSCI (12).The population with NTSCI is generally older, with chronic diseases that require more expensive treatments, but for shorter periods.

Traumatic spinal cord injury

- Incidence rates of TSCI tend to be higher in North America than in Europe, possibly due to a higher number of cases of violence in the USA.

- In adult TSCI, there is a considerably higher incidence in men

- 3. TSCI is more likely to occur in young adults and the elderly.

Traumatic injury etiology

- the three most common causes are transport (particularly road accidents), falls and violenceTraffic accidents are the main cause of TSCI.

- A study conducted in Mississippi, USA, shows that, in at least 75% of car accidents resulting LM, seat belts were not available or were not used (31).

- Similarly, a study on SCI in Nigeria reports that none of the 63 patients who suffered road accidents were wearing seat belts(38), demonstrating the importance of seat belt use in reducing SCI in people in cars

Traumatic injury etiology

- Falls are the second leading cause of TSCI. Falls account for just over 40% of cases in the Eastern Mediterranean and Southeast Asian regions.

- For example, a study in Nepal reports that 40% of spinal cord injuries result from falls from trees while pruning and 28% result from falls from buildings. The African Region reports the lowest percentage (14%) of falls, while the other WHO countries show percentages between 27% and 36%.

Traumatic injury etiology

- Violence, including self-harm, is the third most common cause of Traumatic SCI. Rates of acts of violence causing Traumatic SCI vary considerably between the Americas, Africa and Eastern Mediterranean Areas, which report the highest rates at 14%, 12%, and 11%, respectively.

- Some data, specific to some countries – particularly those in a state of war – show much higher rates, such as Afghanistan which reports 60% of all Traumatic SCI cases attributable to violence.

Traumatic injury etiology

- In all regions, sports and recreational activities contribute less than 10% of all Traumatic SCI cases, with the Americas reporting the highest proportion of Traumatic SCI caused by sports
- Causes of Traumatic SCI can also be attributed to activities, places and circumstances. Work-related injuries contribute to at least 15% of all Traumatic SCI cases
- Alcohol or drug use was identified as a determinant of TSCI in 34% of all cases in British Columbia, Canada and in 34% of transport-related trauma cases in Mississippi, USA.

Non-traumatic spinal cord injury - Incidence

- Studies conducted on non-traumatic SCI are much fewer in number than those on the incidence of Traumatic SCI, with the exception of specific studies on spina bifida

- The incidence of Non-Traumatic SCI varies with both age and gender. As in Traumatic SCI, the incidence rate of Non-traumatic SCI is higher in men than in women. In contrast to Traumatic SCI, the incidence of non-traumatic SCI increases steadily with age, with the risk likely being influenced by the increase in disease with advancing age. Given that non-traumetic SCI is more common in older age groups, and given general ageing, the incidence of non-traumatic SCI will continue to increase and could exceed that of Traumatic SCI in the coming decades

Non-traumatic spinal cord injury - Etiology

- There are few reliable national data regarding the aetiology of non-traumatic SCI, but some studies suggest that the main causes are tumors and degenerative spinal diseases followed by vascular disorders andautoimmune

Mortality and life expectancy

- People with SCI continue to have a greater chance of dying – and dying younger – than people without SCI.

- They are also more likely to die from certain health problems than the general population. In most cases, the first year after the injury is the one in which the mortality risk is higher for SCI, and many SCI in low-income countries continue to die of preventable secondary complications.

Mortality and life expectancy

- People with SCI die earlier than people without SCI. Overall, studies have indicated that people with SCI are 2 to 5 times more likely to die prematurely than people without SCI

- Another way to evaluate the effects of SCI is to consider its impact on life expectancy, i.e. how long a person can expect to live. Few studies compare SCI to the general population.

Mortality and life expectancy

- Among SCI, the risk of mortality depends on the level and severity of the injury.

- Quadriplegics die before paraplegics. A Finnish study showed that the Standardized Mortality Rate (TMS) for paraplegia is 2.3, versus 3 for tetraplegia, while in Australia the TMS for paraplegia is 1.27, versus 2. 2 for tetraplegia. The Finnish study also showed that mortality is higher in complete SCI than in those with incomplete lesion; in the event of a complete injury, the mortality rate doubles for people with paraplegia and almost triples for those with tetraplegia.

Mortality and life expectancy

- In developed countries, life expectancy has been increasing since the 1950s. Longitudinal studies in high-income settings have shown a steady increase in life expectancy for people with SCI. A study in the United States on TSCI observed, in the years between 1973 and 2004, a reduction in mortality in the first two years after injury, while mortality in the years following the first two remained rather stable.

- Similarly a study showed, between 1981 and 1998, an annual decline in the mortality rate of 3%, in TSCI; in particular, the mortality rate decreased in males, in whites and in victims of road accidents.This change reflects improvements in healthcare and rehabilitation medicine for SCI over the past 60 years

Mortality and life expectancy

- Secondary diseases associated with SCI are no longer the leading cause of death in people with SCI in high-income countries. In high-resource countries, there was a shift in leading causes of death, from urological complications, such as urosepsis or renal failure, to similar causes of death as in the general population, such as respiratory problems, especially pneumonia and the flu.

- Some studies have found high death rates from heart disease, suicide, and neurological problems.

- However, people with SCI die from these diseases more frequently than people in the general population.

Mortality and life expectancy

- In low-income countries, people with SCI continue to die from preventable secondary complications, e.g. urological complications and pressure injuries. In countries with few resources, though

- While there is little data due to the very high patient follow-up non-adherence rate, anecdotal evidence indicates that urological complications remain a common cause of death. In low-income countries, due to the lack of adequate healthcare, fatal sepsis caused by untreated pressure ulcers is a common cause of death.

Mortality and life expectancy

- Mortality rates for SCI are strongly influenced by the quality of the healthcare system, especially the emergency room.T

- ransportation and the timing of hospitalization following the injury are important factors for survival. The first 24 hours after SCI are the most critical for survival. A study in Nigeria found that predictors of mortality after 6 weeks included being in a crouched position during transfer (odds ratio of 23.52) and presenting 24 hours or more after injury (odds ratio of 23.52). probability/odds ratio of 5.48). Although the overall mortality in hospitals in high-resource settings, such as Canada and the United States, is 11.6% and 6.1% respectively , Sierra Leone has an average mortality rate of 29%. and in Nigeria almost 35%.This underscores the importance of timely recognition, initial evaluation and appropriate management of suspected SCI.

Mortality and life expectancy

- In a large retrospective study of the outcomes of 324 patients in Australia who were transported by ambulance and admitted to the ward for SCI, it was only thanks to well-trained ambulance crews in identifying the physiological vital signs of SCI that these patients were referred to the SCI ward, where about 88% of them were diagnosed with SCI.

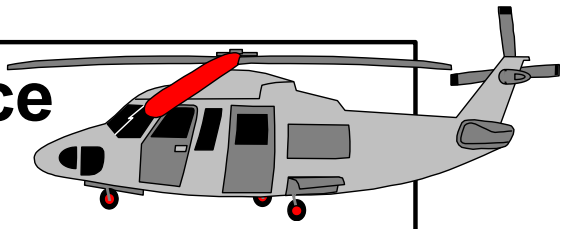
- Generally, hospital mortality rates confirm the importance of quality health care for the survival of people with SCI, and these rates may be related to the level of general resources in a country.

GSI ITALIA
GRUPPISOLIDARIETÀINTERNAZIONALE

PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Rehabilitation in spinal cord injuries
Lesson: Concepts of Traumatology

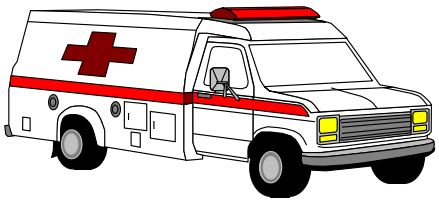
Ambulance



Hospital of second level

Neurosurgical intensive care

Spinal unit



hospitalization in the emergency areait must be limited solely to timenecessary for the recovery of vital functions!

CONCEPTS OF VERTEBRO-MEDOLLAR TRAUMATOLOGY

- Immediately after the trauma, the patient is immobilized and transported in the shortest possible time to the emergency room capable of accommodating major trauma, "so-called centralization", that is, to a hospital facility equipped both from the point of view of diagnostic equipment and as a medical-nursing team (emergency room equipped with trauma center).

CONCEPTS OF VERTEBRO-MEDOLLAR TRAUMATOLOGY

- The best is the emergency room belonging to the DEA (emergency acceptance department) where the USU (unipolar spinal unit) is based, but this type of department is not yet present in all Italian regions.
- Patients who have suffered spinal trauma are considered to be at risk for any type of traumatic injury.

CONCEPTS OF VERTEBRO-MEDOLLAR TRAUMATOLOGY

- The main associated traumatic injuries are reported below.
- In cervical injuries (falls from a height, dives, motorcycle accidents):
  - head trauma
  - fractures of the upper limbs, collarbone, shoulder blades
  - chest trauma
- In back injuries (motorcycle accidents, frontal collisions):
  - thoracic trauma, sternal and rib fractures
  - haemo-pneumo-thorax
  - upper limb fractures
  - heart injuries
- In lumbar injuries (road accidents, pedestrian hit, fall from above, etc.):
  - abdominal trauma
  - pelvic and lower limb fractures

CONCEPTS OF VERTEBRO-MEDOLLAR TRAUMATOLOGY

- Consequently, total body investigations must be carried out and constant monitoring (state of consciousness, respiratory function, vital parameters, blood chemistry values, neurological signs, autonomic disorders, pain, etc.) as well as correct mobilization of the patient to avoid further neurological deterioration (therefore use of the spine board, cervical immobilizer to avoid flexion and rotation movements of the spine).

CONCEPTS OF VERTEBRO-MEDOLLAR TRAUMATOLOGY

- Medical diagnostic procedures depend on several factors: extent of trauma, patient's state of consciousness, collaboration, presence or absence of neurological alterations, neurological level, pain, associated trauma, etc.
- Even if x-ray is always the most frequently used diagnostic tool (available in all centers), MRI has now become the examination of choice in case of vertebral trauma because it allows to study in addition to bone structures also nerve ones and tissues soft

CONCEPTS OF VERTEBRO-MEDOLLAR TRAUMATOLOGY

- As regards the indication for surgery, today there are precise protocols accepted worldwide that vary according to the severity of the vertebral fracture, the extent to one or more levels, the age of the patient.
- In recent years, however, the conservative approach has been almost completely abandoned, based on bloodless reduction by traction for cervical and postural injuries (immobilization for 2-3 months) on special beds for back and lumbar injuries.

CONCEPTS OF VERTEBRO-MEDOLLAR TRAUMATOLOGY

- The "centralization" of the patient who has suffered a vertebro-medullary trauma in an emergency room-trauma center guarantees appropriateness and timeliness not only for the diagnostic framework but also for the treatments that can be provided in terms of the possibility of performing general surgical interventions in urgency (rupture of the liver and / or spleen, cerebral hematoma, ruptures of vessels, etc.) and the possibility of carrying out complex surgical interventions for severe vertebral fractures in an emergency.

CONCEPTS OF VERTEBRO-MEDOLLAR TRAUMATOLOGY

In cases of myelic patients (partial or complete) for whom surgery is indicated and who do not have life-threatening systemic lesions (brain lesions, haemorrhagic lesions, etc.), it is preferable that this is performed in the regimen of urgency. There are many objectives of emergency treatment:

- early decompression
- rapid re-vascularization and action on the so-called "secondary damage“
- early stabilization
- avoid suffering later after surgery
- shorten the lodging
- early onset of rehabilitation

CONCEPTS OF VERTEBRO-MEDOLLAR TRAUMATOLOGY

- In some cases, such as in the case of cervical dislocations, emergency treatment is limited to transcranial traction which allows decompressing and at the same time aligning the cervical metamers to facilitate surgery once the bloodless re-alignment of the vertebrae has been achieved.

CONCEPTS OF VERTEBRO-MEDOLLAR TRAUMATOLOGY

- While in the past traumatic vertebral injuries were divided into
  - Fractures
  - Dislocations
  - sprains (damage to the capsule-ligament component with progressive vertebral sliding)
- Today there are classifications that divide vertebral lesions in order of severity (classification "AO-spine") distinguishing lesions of type A (flexion-compression), type B (distraction-extension) or type C, more complex (in rotation) which are based on the finding visible in Rx, Tc and above all MRI.

CONCEPTS OF VERTEBRO-MEDOLLAR TRAUMATOLOGY

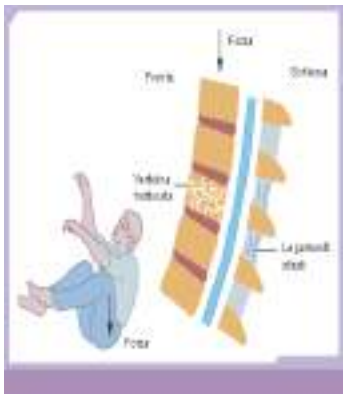
- Vertebral lesions can be stable or unstable, myelic or amyelic.
- According to White and Panjabi's (1990) definition, the stability of the spine is: "the ability of the supporting elements of the spine to support the physiological load, preventing neurological injuries, deformities and pain".

CONCEPTS OF VERTEBRO-MEDOLLAR TRAUMATOLOGY

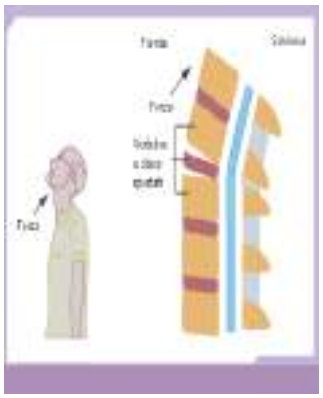
- The stability of the vertebral fracture pattern is also based on this type of classification and on these diagnostic means. The use of MRI has in fact made it possible to identify many fractures, including myelic or unstable, without the presence of significant bone damage.
- The extent of neurological damage is not always proportional to skeletal damage: apparently modest vertebral injuries can cause irreversible paralysis, while anatomically serious injuries can leave the spinal cord unscathed.

Mechanical insult

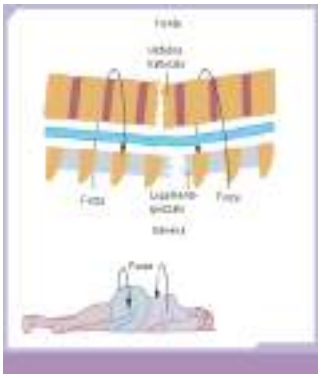
- Type A injury (flexion-compression)
- Type B injury (distraction-hyperextension)
- Type C injury (rotation)



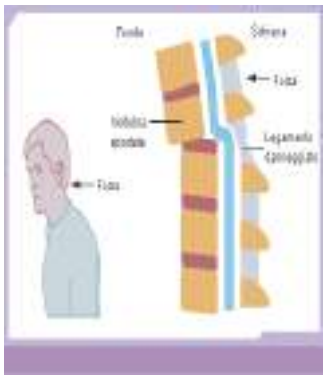
Compression



Hyper-extension



Flexion + rotation



Hyper-flexion

Tipo A: FLESSIONE – COMPRESSIONE
I. Cuneiforme (muro posteriore integro)
1. Muro superiore
2. Cuneiforme
3. Schiacciamento
II. Split (muro posteriore integro)
1. Sagittale
2. Coronale
3. Assiale
III. Scoppio (muro posteriore interessato)
1. Cuneo
2. Split (sagittale/ coronale/assiale)
3. Scoppio
Tipo B: DISTRAZIONE – ESTENSIONE - SHEAR
I. Distrazione con interessamento del disco
1. Senza frattura
2. Con frattura di tipo A
II. Distrazione attraverso il soma
1. Senza spondilolisi
2. Con spondilolisi
3. Con frattura di tipo A
III: Estensione o Dislocazione posteriore
1. Estensione con sublussazione
2. Estensione con spondilolisi
3. Dislocazione posteriore
Tipo C: ROTAZIONE
I. Con Flessione
1. Fr cuneiforme muro sup., cuneo,schiac.
2. Con split: sagitt., coron., assiale
3. Con scoppio completo, split, cuneo
II. Con Distrazione, estensione o dislocazione posteriore
1. Con distrazione e con interess. del disco
2. Con distrazione attraverso il soma
3. Con estensione o dislocaz. post.
III. Frattura orizzontale con dislocazione
1. Con dislocazione anteriore
2. Con dislocazione laterale
TC
RM
S
C
3D

CONCEPTS OF VERTEBRO-MEDOLLAR TRAUMATOLOGY

- Aims of the surgical treatment of vertebral fractures:
  - nerve decompression (by surgically removing the causes of compression: bone fragments, soft tissue such as disc or ligaments, hematoma, etc.)
  - re-alignment (reduce dislocations, correct kyphosis, distraction, lateral deviation and rotation)
  - stabilization (according to the concept of White and Panjabi). Different means of synthesis are used which replace the 3 support columns of the vertebral column (1/2 body, 1/2 body, articular + spinous-ligaments).

CONCEPTS OF VERTEBRO-MEDOLLAR TRAUMATOLOGY

Surgical interventions are chosen according to the type of fracture, the extent of compression, the neurological conditions and the support "column" to be repaired. Posterior, anterior, lateral approaches can be performed. In some cases, transcutaneous stabilization is performed with screws and / or cement injection into the vertebral body. It is not always necessary to perform decompression (stabilization without laminectomy). In some cases, circumferential decompression / stabilization of the dural sac with or without double approach (anterior and posterior) is required in one or more surgical sessions.

GSI ITALIA
GRUPPISOLIDARIETÀINTERNAZIONALE

PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Rehabilitation in spinal cord injuries
Lesson: Clinical Features

Spinal injury

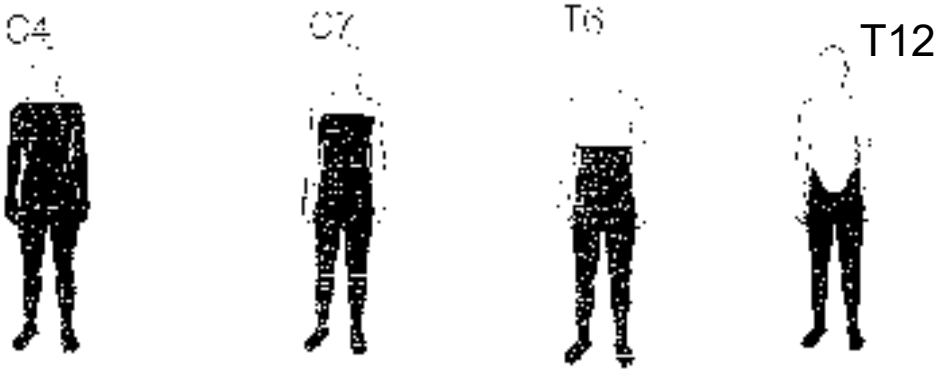
- Loss of control of sensory, motor, visceral, autonomic functions below the level of spinal cord injury
- NEUROLOGICAL INJURY LEVEL: NEUROLOGICAL LEVEL: last metameric segment with normal sensitivity and motor skills
- COMPLETENESS OF THE INJURY

SCI can be divided into two types on the basis of severity, namely:

- Complete lesion – individuals with complete injury have no sensory or motor function below the LM level and specifically at the S4-S5 level.
- Incomplete lesion – people who are incompletely injured retain some function (ie sensory and muscular) below the neurological level of the lesion, including the lower sacral segments S4-S5. There are several types of incomplete SCI, such as anterior, central and posterior spinal syndrome, and Brown-Sequard syndrome, which can affect residual function.

SENSITIVE-MOTOR PARALYSIS

- TETRAPLEGIA: loss of sensitivity and / or motor skills in the upper, lower limbs, trunk and viscera, due to damage to the cervical segments
- PARAPLEGY: loss of sensitivity and / or motility in the lower limbs, trunk and viscera, due to damage to the dorsal, lumbar and sacral segments



Paraplegia

- Paraplegia – refers to a lesion of the thoracic (T2-T12), lumbar (L1-L5), or sacral (S1-S5) segments of the spinal cord, including the conus medullaris (bulbous distal part of the spinal cord) and the cauda equina (collection of nerve roots emerging from the spinal cord at L1-L2).

- The result is a loss of variable degree of lower extremity and trunk control without upper extremity involvement. For example, people with complete injuries between T2 and T8 will have poor trunk control, due to insufficient control of the abdominal muscles, with total loss of lower extremity function; people with lower complete lesions, between T9 and T12, will have good control of the trunk and abdomen and total loss of lower limb functions; while people with lumbar and sacral injuries will retain partial control of their lower limbs.

Tetraplegia

- Tetraplegia– refers to a lesion of the cervical segment of the spinal cord, i.e. between C1 and T1. Depending on the severity and level of the injury, tetraplegia results in varying degrees of functional loss in the neck, trunk, and upper and lower extremities. For example, people with complete C1-C3 lesions will need the assistance of a ventilator to breathe; persons with complete C5 injuries will have control of the shoulders and arms, but no control of the wrists and hands; persons with complete C6 injuries will have wrist extension but no hand or finger function; people with complete C7-C8 injuries will be able to control their upper limbs, but will have dexterity issueswith hands and fingers.

Consequences of neurological injury

- Voluntary motor paralysis
- Loss of deep and superficial sensation
- Alterations in muscle tone
- Alteration of respiratory function
- Cardio-vascular alterations
- Alteration of thermoregulation
- Alteration of the urinary and intestinal system
- Disorders of the sexual sphere and reproductive system
- Alterations in the emotional-behavioral sphere, body image, and self-esteem.

SENSITIVE INJURY

- Absent or reduced superficial and deep sub-injury sensitivity. Cause of:
  - Pressure ulcers
  - Burns from heat sources
  - Bad placements
  - Motor difficulties
- Sensory disturbances or lesional and sub-lesional neuropathic pain (burning, tingling, stinging, shooting pains). Cause of:
  - Limitation of functional activities
  - Worsening quality of life

Emotional - behavioral sphere

- Feeling of disorientation, fear and helplessness
- Alteration of body image and loss of self-esteem
- Anxiety, rejection, denial, anger, depression
- Mourning processing
- Conscious acceptance of physical loss and disability
- Reconstruction of one's identity and a new life project

PHYSIOPATHOLOGY OF SPINAL INJURIES

- A spinal cord injury causes the onset of motor and sensory symptoms in relation to a particular motor and sensory segmental level of the spinal cord.
- According to the extent of the lesion on the transverse plane we will talk about complete disruption syndromes of the spinal cord, constituting the so-called complete transverse syndrome, with a prevalent traumatic (vertebral fracture or dislocation) or inflammatory genesis, and incomplete syndromes, with a prevalent vascular or compressive genesis. Lesions in the cervical and lumbo-sacral areas are often incomplete due to the larger space of the vertebral canal in those sites and the improved vascularity in those regions.

PHYSIOPATHOLOGY OF SPINAL INJURIES

Immediately after the trauma, external deformities of the vertebral column are almost never visible, while, in the medulla, small petechial-type hemorrhages form. This is followed by central hemorrhagic necrosis and local chromatolysis with acute edema of the nerve cells affected by the lesion. In a subsequent phase, we see the resolution of the bleeding through a process of phagocytosis and therefore, small cavities are formed in the injured marrow that will form a glial scar.

PHYSIOPATHOLOGY OF SPINAL INJURIES

- Primary damage is caused by mechanical trauma to the spinal cord and vascular structures as a result of the displacement of the vertebrae and soft tissues surrounding the spinal cord, or by the presence of foreign bodies, such as bullets and laminae, which penetrate the vertebral theca.
- The so-called secondary damage, on the other hand, comes from that series of biochemical events that are positioned in a cascade following the trauma and therefore aggravate the situation.
- We speak of bone marrow concussion when the damage is slight and therefore the loss of transient neurological functions.

PHYSIOPATHOLOGY OF SPINAL INJURIES

- Immediately after the trauma, due to the total isolation of the spinal cord from the higher centers, we witness what is called spinal shock.
- The spinal shock phase is characterized by flaccid paralysis with marked hypotonia of all muscles below the level of injury, abolition of both tendon and skin reflexes, recent studies speak of disruption of reflexes rather than abolition, anesthesia in the underlying regions lesion, retention of urine and faeces, impossibility of erection and ejaculation, appearance of trophic disorders of the skin and muscle masses, disappearance of sweating, vasoparalysis with consequent drop in blood pressure and skin hypothermia.

PHYSIOPATHOLOGY OF SPINAL INJURIES

- The duration of the spinal shock is highly variable in humans; the return of reflexes that marks the end of this phase can occur in 3-4 days (especially in children) as well as in 6 weeks. Reflexes are usually increased, unless peripheral motor neuron damage is prevalent.
- Once this phase is over or in any case after at least 24-48 hours, it can be better defined whether it is an incomplete or complete syndrome.

PHYSIOPATHOLOGY OF SPINAL INJURIES

- Establishing the exact type and severity of the lesion is of fundamental importance in order to indicate a prognosis for the future, since, while it is often possible to see a recovery of one or two levels below the level of the lesion, more rarely it is It is possible to witness a recovery of motor and sensory functions, and, when this happens, it certainly occurs more frequently in incomplete lesions (1-2% of cases of complete lesions, in the literature).

PHYSIOPATHOLOGY OF SPINAL INJURIES

- As a consequence of a spinal cord injury, sudden and radical changes occur in a person's life; the interruption between spinal and encephalic functions with loss of control of the latter over the peripheral components determines, below the level of injury, impaired motor skills, sensory perception and neurovegetative functions.

PHYSIOPATHOLOGY OF SPINAL INJURIES

- The sudden and often unpredictable loss of one's autonomy has important repercussions in the psychological sphere: psycho-physical harmony is broken with the inevitable reduction of self-esteem; learning to "live" with a body that is no longer able to perceive stimuli and move as it was before the injury involves being able to recompose the unity of the person on a physical, psychic, social and relational level.

The general clinical picture of spinal cord injury is characterized by:

- voluntary motor paralysis below the level of injury; the lesion of the descending central motor pathways, at the level of the anterior horns of the spinal cord, interrupts the motor circuit between the upper motor neuron and the lower motor neuron; the severity of the lesion and consequently the degree of autonomy that can be reached is in relation to the neurological level preserved and the type of neurological damage (complete and incomplete);

Pain

- Most people with SCI are affected by chronic pain, which can have a significant impact on their quality of life.
- In recent years, the International Spinal Cord Injury Pain Classification has been developed to assist clinicians and researchers in classifying spinal cord pain.
- A significant percentage of people with SCI experience neuropathic pain as a result of spinal cord damage, usually characterized by burning sensations, stabbing pains, dull pain, electric shocks.

Pain

- Persons with SCI are also prone to developing musculoskeletal pain, resulting from functional overload, for such as shoulder pain caused by pushing the manual wheelchair, muscle spasms, mechanical instability or altered posture.

- Pain is experienced differently by each individual and therefore various biomedical, cultural and psychosocial factors must be considered.

- A multidisciplinary approach is necessary to set up a correct pain management program, which may include drugs, physiotherapy, massage, acupuncture, psychotherapy, meditation and relaxation techniques, use of assistive devices, review and modification of seating systems, and training in alternative methods of carrying out activities such as transfers.

The general clinical picture of spinal cord injury is characterized by:

- muscle tone disorders: after the first phase of flaccidity typical of spinal shock, the lesion of the upper motor neuron, being the reflex arc intact, manifests itself with hyperreflexia and spasticity of "spinal" origin, characterized by a slow and progressive increase in the state excitatory with spasms (involuntary contractions) in flexion and extension and clones; spasticity mainly affects the flexor muscles of the upper limbs and the extensors of the lower limbs.

The general clinical picture of spinal cord injury is characterized by:

- Hypertonicity can favor the maintenance of a certain muscular trophism, stimulate the blood pump at the extremities, can sometimes be functional to the patient for transfers but can also cause contractures, skin lesions from rubbing, falls with consequent trauma, interfere with mobility and autonomy in the LDAs; if the injury also involves the lower motor neuron, with consequent interruption of the reflex arc, hypotonia and areflexia persist at the level of the districts that correspond to the level of interruption of the 2nd motor neuron.

Spasticity/spasms:

- Spasticity is a common complication among people with SCI. It can cause involuntary movements and develop muscle contractions, which limit the range of motion and thus hinder function.

- Management methods include: passive movement or stretching, which can be applied manually by a physiotherapist, managed independently or carried out through positioning, the use of braces and/or serial casts; active movement and exercise; electrical, mechanical or thermal techniques to stimulate muscles or nerves; antispasmodic drugs.

Sublesional osteoporosis

- Immediate bone loss occurs following SCI, increasing the risk of osteoporosis below the level of the lesion. Inadequate dietary calcium intake, vitamin D insufficiency, aging, and inactivity can also contribute to changes in bone density.

- If osteoporosis is present, people with SCI are at increased risk of bone fractures, which can occur easily during activities of daily living, such as transfers.

Sublesional osteoporosis

- Given the immediate loss of bone mass following SCI, early management of bone health is particularly important.

- Examples of treatment are: administration of bisphosphonates (drugs that prevent or treat bone loss), together with vitamin D and/or calcium; activity under load; electrical stimulations.

- However, the evidence on their effectiveness is limited.

Heterotopic ossification

- it is a condition that consists of abnormal bone formation in the soft tissues around the joints below the level of the SCI. Joints commonly affected are: hips, knees and, in neck injuries, shoulders and elbows.

- Heterotopic ossification limits the range of joint motion and can therefore have a significant impact on functional outcome for people with SCI. It is important to have an early radiological diagnosis.

- Since the cause of heterotopic ossifications is not clear, its treatment is often difficult.

Heterotopic ossification

- The limited evidence available suggests that early administration of anti-inflammatory drugs may be effective in reducing the risk of developing heterotopic ossification.

- Treatments such as drug administration and radiation therapy can help stop the progression of heterotopic ossification, while surgical treatment can be helpful in improving the range of motion of the affected joints.

The general clinical picture of spinal cord injury is characterized by:

- loss of superficial and deep sensitivity below the lesion level as the sensory pathways, running in the posterior horns of the spinal cord, are interrupted by the lesion; sub-injury anesthesia is frequently accompanied by subjective disturbances of sensitivity that are characterized as burning, tingling, shooting pains or stinging pains (neuropathic pain);

Pressure ulcers

- People with SCI are at high risk of developing pressure ulcers as a result of sensory and motor impairment.

- The presence of other behavioural, socio-demographic and clinical factors – smoking, nutritional deficiencies (malnutrition, underweight, anemia), infections, skin maceration from sweat or incontinence, or comorbid conditions such as diabetes and respiratory disorders – can increase the risk of pressure injuries.

- Pressure sores can developa t any time and can have a significant impact on the health of the individual, his activities and quality of life, also affecting the costs of the health system due to the increase in the hospitalization rate and the increase in hospitalization times

Pressure ulcers

- Preventing the development of pressure sores is one of the most important aspects of health in the person with SCI and is more cost-effective than treatment.

- Consequently, people with SCI and their families need adequate education and training in proper skin management techniques as an integral part of long-term care.

- Prevention includes simple measures such as regular skin checks, pressure relief techniques, proper bladder and bowel management, provision of adequate aids, and proper nutrition. Treatment methods include appropriate wound dressings, pressure relief measures, antibiotic therapy for infections, and surgical treatment.

The general clinical picture of spinal cord injury is characterized by:

- respiratory disorders (cervical and back injuries above D6); if the diaphragmatic activity is normal (lesions from C4 spared onwards) the total or partial paralysis of intercostal and / or abdominal muscles leads to restrictive ventilatory insufficiency of an entity correlated to the neurological level preserved; in lesions above C3, paralysis of the diaphragm requires mechanical ventilation; in C3-C4 lesions the diaphragmatic activity is partially preserved and spontaneous respiratory activity may be sufficient, even if the vital capacity is greatly reduced (20-40% residual) resulting in severe respiratory failure;

Respiratory Insufficiency of the Restrictive Type

- Lesion above C3 essential mechanical fan
- Lesion C3-C4 mechanical ventilation alteration (easy diaphragm fatigue)
- Lesion below C4 preserved diaphragmatic activity (up to T8, alteration of ventilatory function remains due to abdominal and intercostal paralysis)
- T8-T12 lesion progressively preserved ventilatory function

Respiratory function

- Lung capacity, ease of breathing, and the ability to cough and expel secretions are often impaired following SCI as a result of paralysis of the respiratory muscles.

- People who have high levels of quadriplegia are particularly vulnerable.

Respiratory function

- Persons with SCI at or above a level of C3 often require the use of continuous mechanical ventilation or the implantation of a phrenic or diaphragmatic nerve pacemaker to maintain adequate respiratory function.

- In some people, tracheostomy is required during the acute phase of treatment to maintain an adequate airway as well as to facilitate suction of secretions and ventilation

Respiratory complications

- pneumonia, atelectasis (“collapsed lung”), aspiration, and respiratory failure remain the leading causes of morbidity and mortality in people with SCI. However, with careful management, these complications are preventable.

- Recommended measures include annual influenza vaccination, pneumococcal vaccination every 5 years, timely treatment of upper respiratory tract infections with antibiotic therapy, early implementation of cough assistance in persons with high level of SCI.

Respiratory complications

- Long-term management requires:
  - Regular re-evaluations withinstrumental analyzes of respiratory and pulmonary functions;
  - aids for short- or long-term mechanical ventilation;
  - training of respiratory muscles;
  - aerobic exercise;
  - psychological support to develop new coping skills, especially for those who depend on a ventilator;
  - education of the person with SCI and his family members.

The general clinical picture of spinal cord injury is characterized by:

- cardio-vascular disorders especially in cervical and dorsal lesions above D6 due to loss of sympathetic vasomotor tone and consequent tendential arterial hypotension and basic and reflex bradycardia; characteristic symptoms are symptomatic orthostatic hypotension, especially in the initial phase, and venous stasis in the lower limbs (high risk of deep vein thrombosis and pulmonary embolism); paroxysmal hypertension is also possible as a sympathetic response to a noxious stimulus both somatic and visceral (see then autonomous dysreflexia);

Cardio-vascular alteration

- Arterial hypotension (cervical level and above D6)
- Bradycardia (cervical level and above D6)
- Vasoparalysis
- Paroxysmal hypertension

Immobility
Reduced muscle activity
Reduced venous return

→ **venous stasis** →

Thrombosis
Venous
Deep

Autonomic dysreflexia:

- This condition is characterized by a sudden increase in blood pressure and usually occurs in people with SCI at level T6 or higher.
- Other signs and symptoms include severe migraine, profuse sweating, flushing or redness of the skin, blurred vision, horripilation and cardiac arrhythmias.
- The cause can be any noxious stimulus, most commonly bladder or bowel distention or blockage.
- Autonomic dysreflexia is a medical emergency which, if left untreated, can have serious consequences such as stroke, seizures and death.

Deep Vein Thrombosis (DVT)

- people with SCI are at high risk of DVT, especially in the acute and post-acute phases of the lesion when alterations in neurological control of blood vessels and immobility can lead to circulatory stasis.

- Other risk factors include age, obesity, presence of leg fractures, pregnancy, and a history of DVT.

- Signs and symptoms include pain, edema, fragility, discoloration, and temperature changes in the affected limb.

Deep Vein Thrombosis (DVT)

- DVT can cause a pulmonary embolism and potentially death, and therefore requires prompt treatment with anticoagulant drugs.
- Preventive measures such as anticoagulant medications or the use of support stockings are extremely important and should be part of general hospital procedures

Hypotension

- Orthostatic hypotension is a significant drop in a person's blood pressure when they stand up.

- It affects people with both paraplegia and tetraplegia and is commonly seen during the acute phase of the injury, although some symptoms may continue to occur afterwards.

Hypotension

- Symptoms typically include fatigue, lightheadedness, dizziness, blurred vision, muscle weakness, and even temporary loss of consciousness.

- Management involves close monitoring, gradual changes in posture, and, when appropriate, the administration of medications and salt tablets.

The general clinical picture of spinal cord injury is characterized by:

- disorders of thermoregulation due to the interruption of the neurovegetative thermoregulatory mechanisms at the sub-injury level; they are particularly frequent in complete high cervical lesions where poikilothermia occurs with the risk of hypo or hyperthermia from both environmental and endogenous causes; alteration of the mechanism of sweating, horripilation and chills often remain in the supralesional areas;

The general clinical picture of spinal cord injury is characterized by:

- neurogenic bladder: the loss of the normal neurological mechanism that coordinates urination means that the bladder fills up but is unable to send information about its condition to the brain and, above all, it is no longer able to empty itself adequately; in particular in supracral lesions after the initial phase of spinal shock, a picture of bladder hyperactivity occurs, which determines an increase in intravesical pressure during filling with the appearance of involuntary detrusor contractions.

The general clinical picture of spinal cord injury is characterized by:

- During bladder contraction, the emptying mechanism is altered due to difficulty in relaxing the external sphincter; this dissynergy between the external sphincter and the detrusor characterizes 75-90% of supracral lesions and can be divided into various degrees of severity. Sacral lesions, on the other hand, determine an acontractile and areflexic bladder which can be associated with a decrease in bladder compliance; the external sphincter is not altered to the same extent as the detrusor;

The general clinical picture of spinal cord injury is characterized by:

- neurogenic intestine: intestinal dysfunction (small and colon) leads to digestive, absorption and emptying problems; during spinal shock there is paralysis of intestinal peristalsis (paralytic ileus) and blockage of defecation; this causes accumulation of liquids and gases inside the intestinal loops, abdominal distension, vomiting, breathing difficulties resulting from a consequent diaphragmatic elevation.

The general clinical picture of spinal cord injury is characterized by:

- After the shock phase in supracral lesions, the reflex coordination of fecal propulsion, even if altered, is restored but the external sphincter is no longer voluntarily controlled; in sacral lesions there is the absence of the fecal propulsion reflex, the anal sphincter is hypotonic with a marked risk of incontinence;

Urinary tract infections (UTIs):

- UTIs are common in people with SCI and are a leading cause of re-hospitalization in high-income countries and of premature death in developing countries.

- SCI impairs vesicosphincteric function and many people use catheterization to manage this function (see below).

Urinary tract infections (UTIs):

- There is some evidence that the type of bladder management and also the type of catheter used may affect the risk of UTI.

- Other factors associated with an increased risk of UTI are fluid intake, personal hygiene, pregnancy, social support systems and access to health services.

The general clinical picture of spinal cord injury is characterized by:

- disorders of the sexual and reproductive sphere: sexuality understood in the most global sense of the term, that is, as a condition of physical and psychological pleasure, is altered by the organic and functional consequences of the spinal injury; the aspect properly linked to the genito-sexual function must be addressed separately in the two sexes. In humans, suprasacral, sacral and infrasacral lesions are distinguished (below the back-lumbar metamers and above the sacral ones).

The general clinical picture of spinal cord injury is characterized by:

- In the first, there are reflex erections, mediated by the parasympathetic, often of short duration because there is no higher level processing for maintenance; in the sacral lesion, the reflex arc is interrupted so that only the psychogenic erection, mediated by the orthosympathetic, is possible on visual, auditory stimuli or thoughts of an erotic type, it is usually of little entity and does not allow intercourse; the infrasacral lesion finally involves a mixed erection, usually caused by a psychogenic stimulus and maintained by genital stimulation or vice versa. Erectile dysfunction, associated with qualitative and quantitative alterations of the spermatic fluid (oligoasthenospermia) frequently leads to infertility problems in men.

The general clinical picture of spinal cord injury is characterized by:

- Orgasm is mostly absent; when it is present (incomplete lesions) it is often altered with respect to prelesional experiences.
- In women, the reproductive function is usually not compromised, while as regards the sexual disorder, lesions above D12 occur in reflex events (congestion of the external genitalia and clitoral swelling) similar to the reflex male erection; orgasm is absent in complete lesions but in the case of a back or lumbar lesion, pleasant sensations can be induced by the stimulation of supralesional erogenous zones.

The general clinical picture of spinal cord injury is characterized by:

- emotional-behavioral disorders: in the initial phase of the traumatic event, a state of shock is predictable; the first reactions range from a feeling of disorientation in an attenuated form to an excessive psychotic-like state, similar to that which frequently follows a coma. The sensation can be similar to that of waking up from a bad dream ("it can't be true"; "it can't have happened to me!") With difficulty in defining one's present condition: what is the reality and what is the nightmare .

The general clinical picture of spinal cord injury is characterized by:

- Mechanisms that are triggered later are anxiety, rejection, denial, anger, reactive depression, which represent the most common physiological reactions. The elaboration of the "mourning" takes place not in a linear way but, precisely because of the deep emotional resonance it entails, alternating with reactions in which the subject turns in on himself, risking to get stuck in a pathological depression or in an attitude of passive opposition , or it resorts to methods of negation, which take the form of an attitude of "flight forward". Only when the myeloleso manages to continuously take note of the changed existential condition, thus giving value to the moments of depressive processing, does it lay the foundations for a new life project.

The general clinical picture of spinal cord injury is characterized by:

- Through the conscious acceptance of physical loss and the consequent disability, the subject can try to reconstruct the link between past and present, between body and mind, between internal fantasies and external events, thus re-establishing a link in their experiences. The psychological reactions that allow to channel the internal resources of the person affected by the spinal cord trauma towards an intentional change are represented by hope and trust, collaboration, sublimation.

The general clinical picture of spinal cord injury is characterized by:

- However, hope can help a psychologically disturbed patient but may not be realistic and therefore ultimately not always positive. Pathological reactions are very rare and may require psychiatric intervention. The sadness that comes from the loss suffered can sometimes be a manifestation of pain so intense that it gives way to depression: disinterest grows, while motivation and internal resources decrease, sometimes inducing extreme desires such as suicide;

The general clinical picture of spinal cord injury is characterized by:

- Body image disorders: sensory, motor control and sphincter loss profoundly alter the mental image of physicality, that is, the way in which existence is perceived as a body unit; the paralyzed part of the body is often perceived as foreign or even "bad"; this disorder can lead to states of discomfort and dissociation (paralyzed legs and visceral functions are considered detached from the person); Body image disturbance can be even more devastating for those subjects, especially women, who for culture attach great importance to physical appearance and social acceptability;

The general clinical picture of spinal cord injury is characterized by:

- loss of self-esteem and personal consideration: the distortion of body image involves loss of personal self-esteem which can result in feelings of inferiority, weakness and helplessness.

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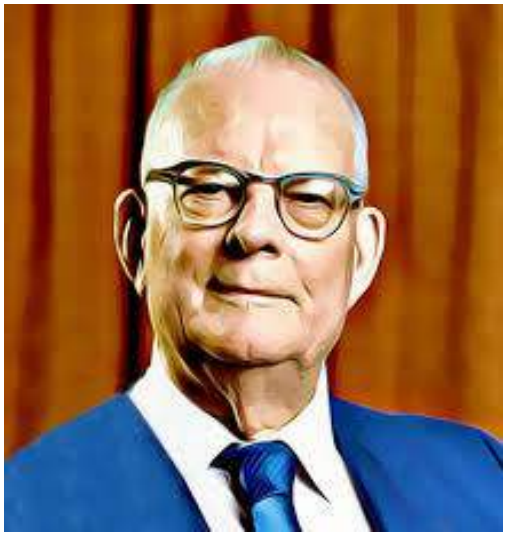
PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

Selecting an appropriate outcome measure in physiotherapy

1406/3677

In God we trust

All others must provide data



William Edwards Deming
(1900 – 1993)

TO MEASURE

Process of assigning a numerical value to a variable representing an amount of a certain characteristic, defined according to certain rules (Stevens, 1946)

Only when they prove to be reliable and valid, the measurements contain information, while otherwise they are intended to provide only numbers or categories that lead to a false impression of credibility

Rothstein, 1985

ARISTOTELIAN METHOD

Deductive method

Natural phenomenon

↓

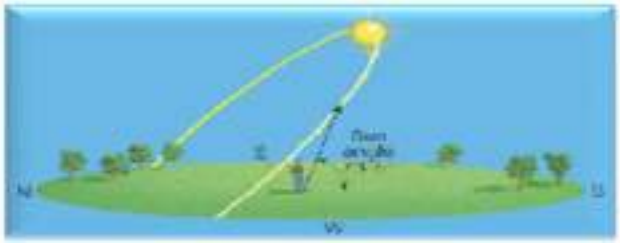
Observation

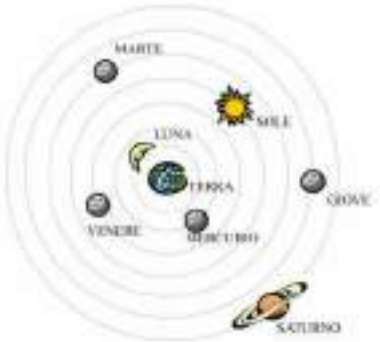
↓

Theory

↓

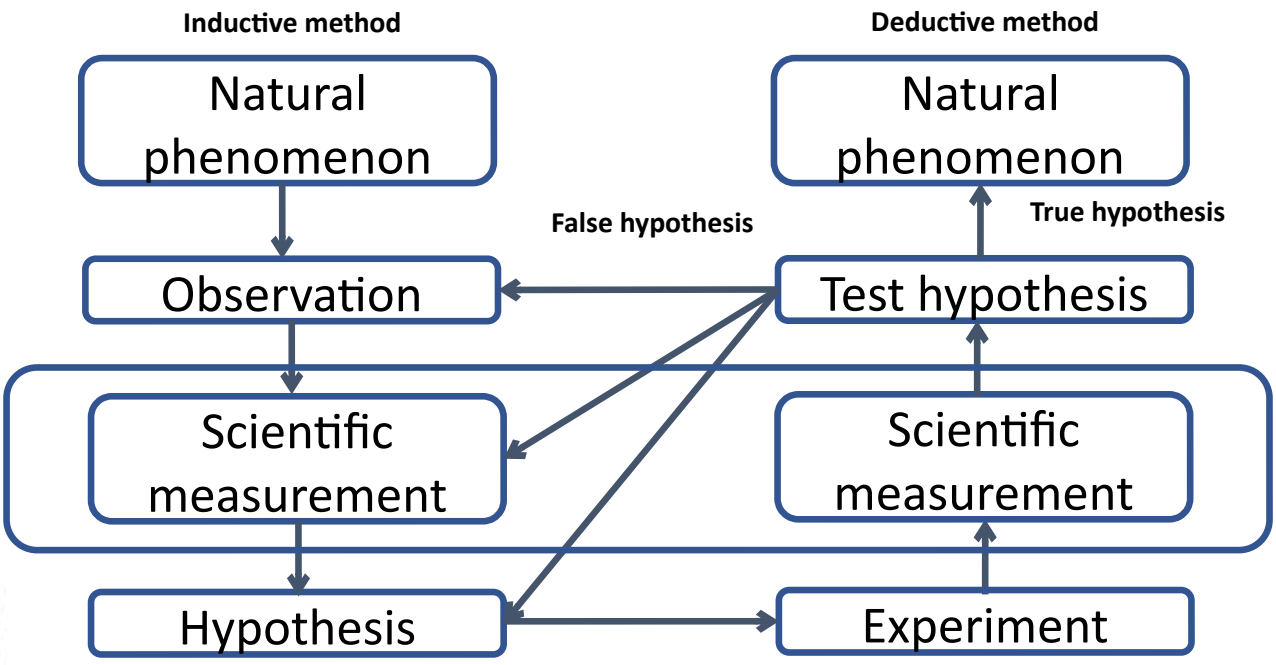
Logical reasoning





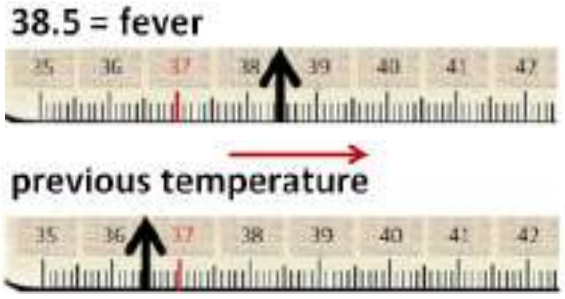
Aristotele
(384 a.C. – 383 a.C.)

GALILEAN SCIENTIFIC METHOD



Galileo Galilei (1564 – 1642)

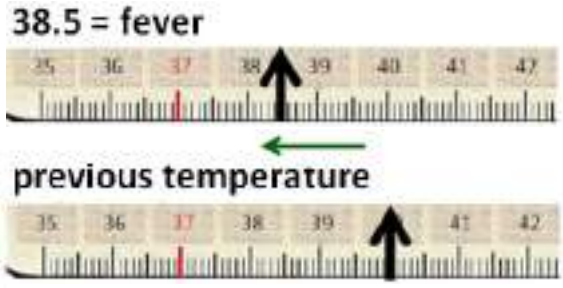
MEASURE VS ASSSESS



MEASURE = QUANTIFY

Quantifying an observation relating to objects or events in relation to a predetermined frame of reference

ASSESS = INTERPRET



Attributing meaning to a measurement in a specific context

Measurement is a means but not an end!

WHO TO MEASURE?

- Define the target population
  - Age
  - Sex
  - Features of the pathology

Prinsen et al., 2016

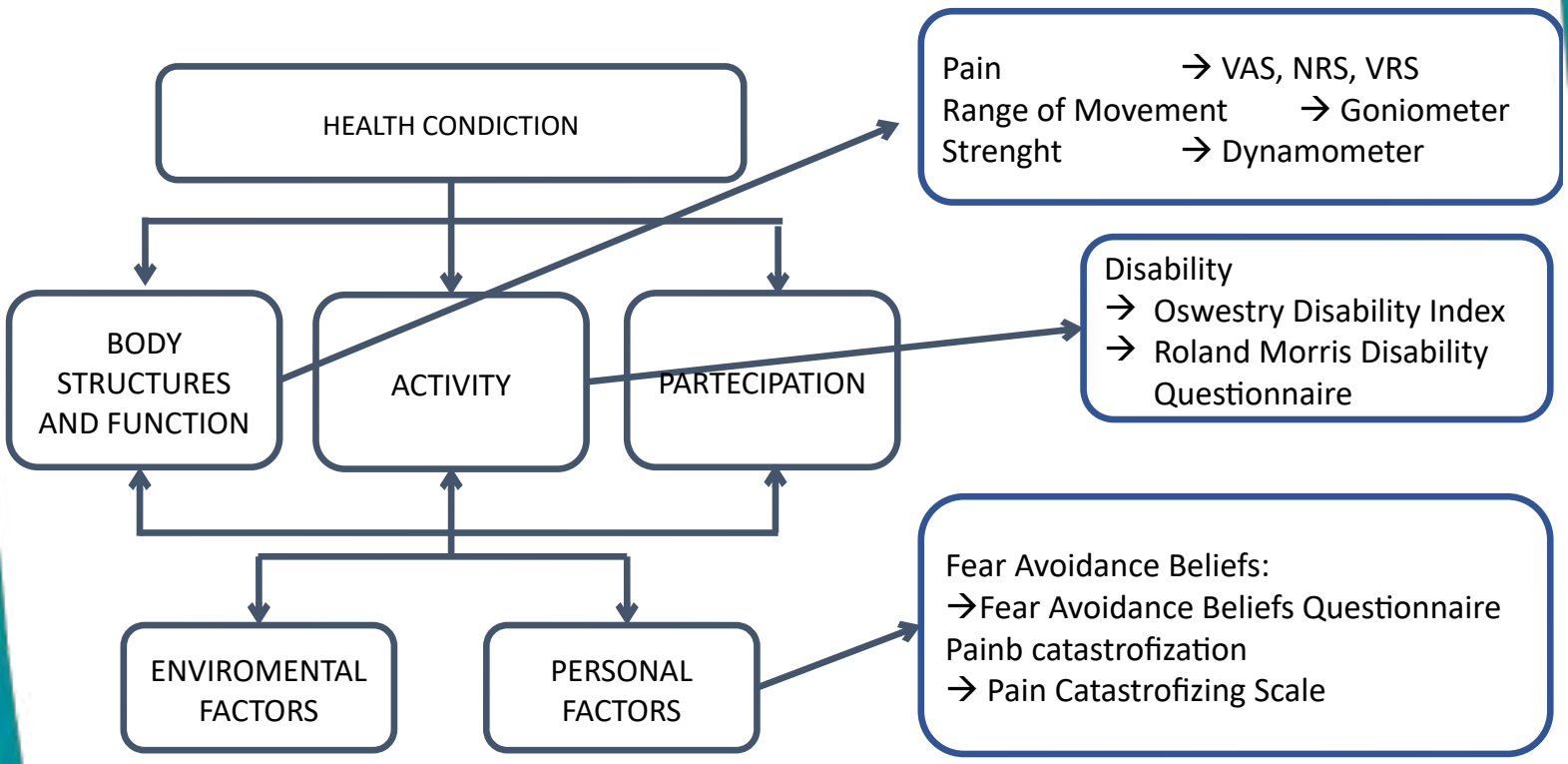
WHAT TO MEASURE

- Define the construct to be measured
  - What is the relevance for clinical practice?

- Refer to existing conceptual models
  - For example: ICF, OMERACT framework, PROMIS

Prinsen et al., 2016

WHAT TO MEASURE: ICF EXAMPLE



WHAT TO MEASURE

- Define the construct to be measured
  - What is the relevance for clinical practice?

- Refer to what is reported by:
  - Patients
  - Clinical experience
  - Scientific literature

Prinsen et al., 2016

WHAT TO MEASURE – PATIENTS

Arthritis & Rheumatism (Arthritis Care & Research)
Vol. 61, No. 1, January 15, 2009, pp 124–131
DOI 10.1002/art.24162
© 2009, American College of Rheumatology

ORIGINAL ARTICLE

Recovery: What Does This Mean to Patients With Low Back Pain?

JULIA M. HUSH,[1] KATHRYN REFSHAUGE,[2] GERARD SULLIVAN,[2] LORRAINE DE SOUZA,[3] CHRISTOPHER G. MAHER,[4] AND JAMES H. McAULEY[4]

In this study, we have identified the scope of recovery domains relevant to a broad sociodemographic spectrum of typical back pain patients seeking primary care. We found that the domains of recovery relevant to patients in this cultural context were symptom attenuation, improved function, and achievement of an acceptable quality of life.

Relief of symptoms
Functionality improvement
Improvement of quality of life

WHAT TO MEASURE – SCIENTIFIC LITERATURE

Eur Spine J
DOI 10.1007/s00586-015-3892-3

ORIGINAL ARTICLE

Core outcome domains for clinical trials in non-specific low back pain

Alessandro Chiarotto[1] · Richard A. Deyo[2] · Caroline B. Terwee[3] · Maarten Boers[3] · Rachelle Buchbinder[4] · Terry P. Corbin[5] · Leonardo O. P. Costa[6,7] · Nadine E. Foster[8] · Margreth Grotle[9] · Bart W. Koes[10] · Francisco M. Kovacs[11] · Chung-Wei Christine Lin[7] · Chris G. Maher[7] · Adam M. Pearson[12] · Wilco C. Peul[13] · Mark L. Schoene[14] · Dennis C. Turk[15] · Maurits W. van Tulder[1] · Raymond W. Ostelo[1,3]

Conclusions The following outcome domains were included in this updated COS: 'physical functioning', 'pain intensity', 'health-related quality of life' and 'number of deaths'. The next step for the development of this COS will be to determine which measurement instruments best measure these domains.

CORE OUTCOME SET

set of outcomes that should be measured and reported, at a minimum, in all clinical trials for specific health conditions

HOW TO MEASURE

1) Type of instrument and administration
Theoretical/conceptual considerations

2) Identify the tools available
Systematic literature review
Comprehensive literature search
Database for measuring instruments (e.g. PROQOLID)

3) Evaluate the quality of the measuring instruments available
Psychometric properties
Feasibility

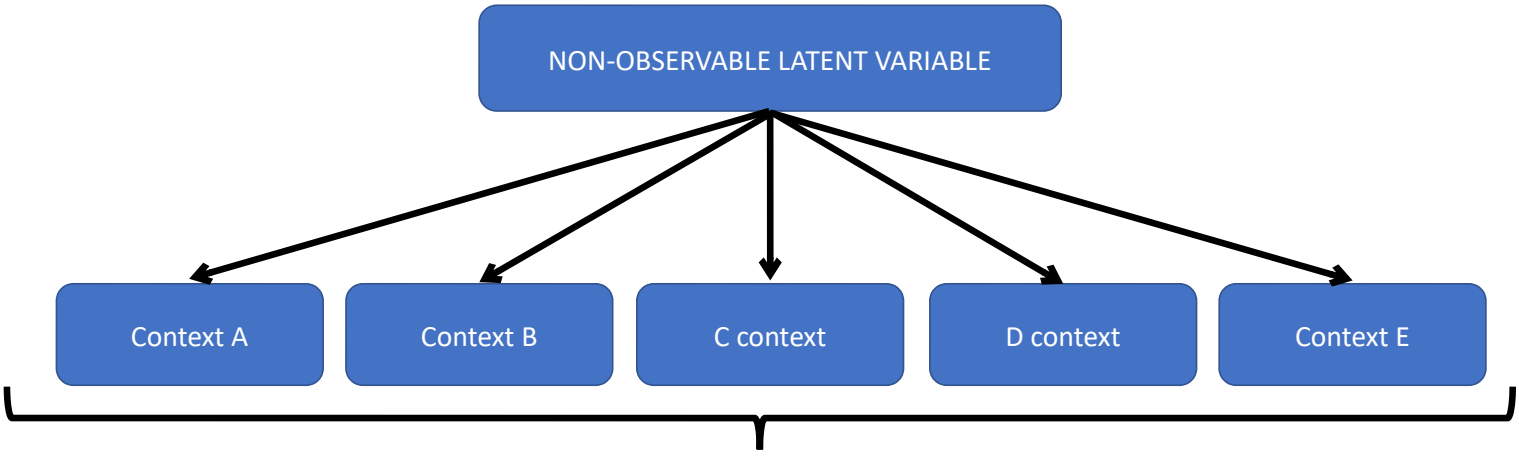
Prinsen et al., 2016

MEASUREMENT INSTRUMENTS

- OUTCOME MEASURE
  - Biomarkers survival
  - Clinical outcome assessment
    - Functional performance testing
    - Patient-Reported Outcome
    - Clinician-Reported Outcomes
    - Observer-Reported Outcome

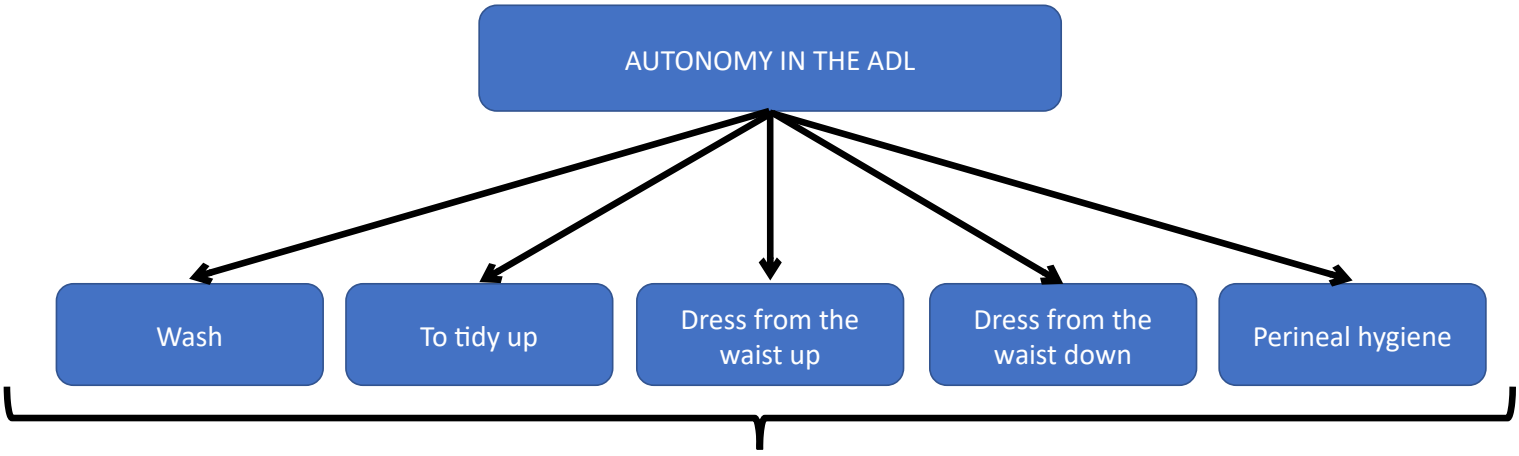
Streiner & Norman, 2008

LATENT VARIABLE AND MANIFEST BEHAVIOR



Tesio, 2006

EXAMPLE



Tesio, 2006

TYPES OF QUESTIONNAIRES

GENERAL HEALTH MEASURES

- They quantify the general state of health of a patient
- Applied to patients with many different health-related conditions
- Benefit: They allow you to compare health status across different diseases, severities, and interventions
- Disadvantage: lack of sensitivity for small, but important changes in the variable

SPECIFIC MEASURE

- They investigate the specific physical, mental and social aspects of the health of the pathology or the joint or region of interest
- Pathology, joint or region specific tools
- Benefit: Potential ability to detect small changes in patient function.

HOW TO MEASURE

1) Type of instrument and administration

Theoretical/conceptual considerations

2) Identify the tools available

Systematic literature review

Comprehensive literature search

Database for measuring instruments (e.g. PROQOLID)

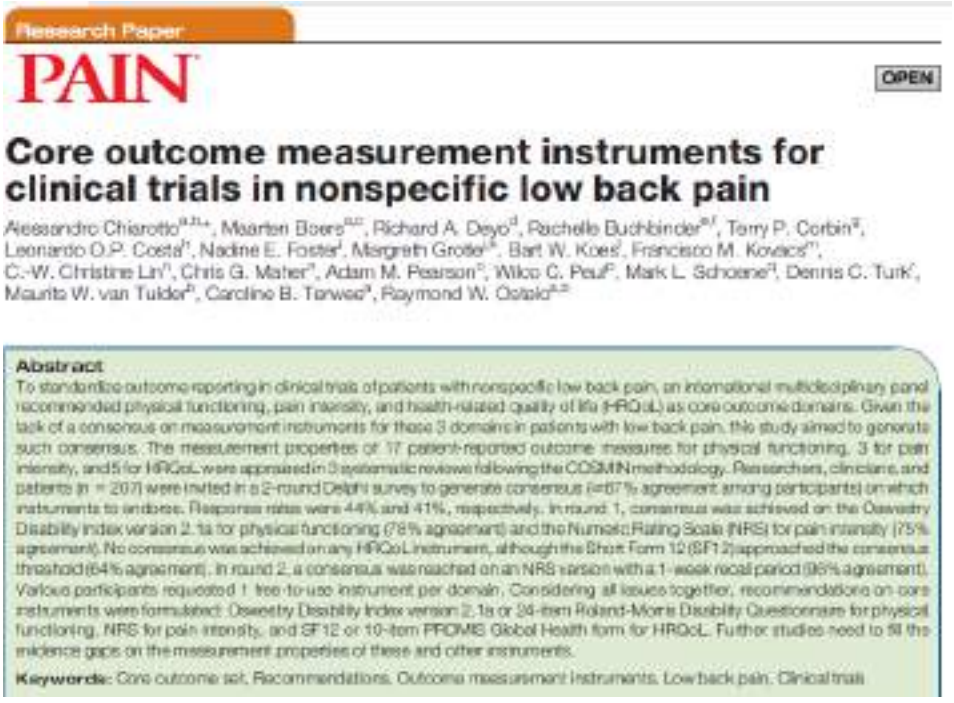
3) Evaluate the quality of the measuring instruments available

Psychometric properties

Feasibility

Prinsen et al., 2016

SYSTEMATIC LITERATURE REVIEW



Research Paper

PAIN

OPEN

Core outcome measurement instruments for clinical trials in nonspecific low back pain

Alessandro Chiarotto[a,b,c,*], Maarten Boers[d,e], Richard A. Deyo[f], Rachelle Buchbinder[g,h], Terry P. Corbin[i], Leonardo O.P. Costa[j], Nadine E. Foster[k], Margreth Grotle[l,m], Bart W. Koes[n], Francisco M. Kovacs[o], C.-W. Christine Lin[p], Chris G. Maher[q], Adam M. Pearson[r], Wilco C. Peul[s], Mark L. Schoene[q], Dennis C. Turk[t], Maurits W. van Tulder[n], Caroline B. Terwee[a], Raymond W. Ostelo[a,n]

Abstract

To standardize outcome reporting in clinical trials of patients with nonspecific low back pain, an international multidisciplinary panel recommended physical functioning, pain intensity, and health-related quality of life (HRQoL) as core outcome domains. Given the lack of a consensus on measurement instruments for these 3 domains in patients with low back pain, this study aimed to generate such consensus. The measurement properties of 17 patient-reported outcome measures for physical functioning, 3 for pain intensity, and 5 for HRQoL were appraised in 3 systematic reviews following the COSMIN methodology. Researchers, clinicians, and patients (n = 207) were invited in a 2-round Delphi survey to generate consensus (≥67% agreement among participants) on which instruments to endorse. Response rates were 44% and 41%, respectively. In round 1, consensus was achieved on the Oswestry Disability Index version 2.1a for physical functioning (78% agreement) and the Numeric Rating Scale (NRS) for pain intensity (75% agreement). No consensus was achieved on any HRQoL instrument, although the Short Form 12 (SF12) approached the consensus threshold (64% agreement). In round 2, a consensus was reached on an NRS version with a 1-week recall period (96% agreement). Various participants requested 1 free-to-use instrument per domain. Considering all issues together, recommendations on core instruments were formulated: Oswestry Disability Index version 2.1a or 24-item Roland-Morris Disability Questionnaire for physical functioning, NRS for pain intensity, and SF12 or 10-item PROMIS Global Health form for HRQoL. Further studies need to fill the evidence gaps on the measurement properties of these and other instruments.

Keywords: Core outcome set, Recommendations, Outcome measurement instruments, Low back pain, Clinical trials

PHYSICAL FUNCTION

OSWESTRY DISABILITY INDEX
ROLAND MORRIS DISABILITY QUESTIONNAIRE

PAIN INTENSITY

NUMERICAL RATING SCALE

HEALTH RELATED QUALITY OF LIFE

SHORT FORM 12
PROMIS GLOBAL HEALTH

COMPREHENSIVE LITERATURE RESEARCH

Qual Life Res (2009) 18:1115–1123
DOI 10.1007/s11136-009-9528-5

Development of a methodological PubMed search filter for finding studies on measurement properties of measurement instruments

Caroline B. Terwee · Elise P. Jansma · Ingrid I. Riphagen · Henrica C. W. de Vet

Results We identified 116 studies on measurement properties in the gold standard. The sensitive search filter was able to retrieve 113 of these 116 studies (sensitivity 97.4%, precision 4.4%). The precise search filter had a sensitivity of 93.1% and a precision of 9.4%. Both filters performed very well in the validation sets.

Conclusion The use of these search filters will contribute to evidence-based selection of measurement instruments in all medical fields.

SENSITIVE STRING

(instrumentation[sh] OR methods[sh] OR Validation Studies[pt] OR Comparative Study[pt] OR ''psychometrics'' [MeSH] OR psychometr*[tiab] OR clinimetr*[tw] OR clinometr*[tw] OR ''outcome assessment (health care)''[MeSH] OR outcome assessment[tiab] OR outcome measure*[tw] OR''observer variation''[MeSH] OR observer variation[tiab] OR ''Health Status Indicators''[Mesh] OR ''reproducibility of results''[MeSH] OR reproducib*[tiab] OR ''discriminant analysis''[MeSH] OR reliab*[tiab] OR unreliab*[tiab] OR valid*[tiab] OR coefficient[tiab] OR homogeneity[tiab] OR homogeneous[tiab] OR ''internal consistency''[tiab] OR (cronbach*[tiab] AND (alpha[tiab] OR alphas[tiab])) OR (item[tiab] AND (correlation*[tiab] OR selection*[tiab] OR reduction*[tiab])) OR agreement[tiab] OR precision[tiab] OR imprecision[tiab] OR ''precise values''[tiab] OR test–retest[tiab] OR (test[tiab] AND retest[tiab]) OR (reliab*[tiab] AND (test[tiab] OR retest[tiab])) OR stability[tiab] OR interrater[tiab] OR inter-rater[tiab] OR intrarater[tiab] OR intra-rater[tiab] OR intertester[tiab] OR inter-tester[tiab] OR intratester[tiab] OR intra-tester[tiab] OR interobserver[tiab] OR inter-observer[tiab] OR intraobserver[tiab] OR intraobserver [tiab] OR intertechnician[tiab] OR inter-technician[tiab] OR intratechnician[tiab] OR intra-technician[tiab] OR interexaminer[tiab] OR inter-examiner[tiab] OR intraexaminer[tiab] OR intra-examiner[tiab] OR interassay[tiab] OR inter-assay[tiab] OR intraassay[tiab] OR intra-assay[tiab] OR interindividual[tiab] OR inter-individual[tiab] OR intraindividual[tiab] OR intra-individual[tiab] OR interparticipant [tiab] OR inter-participant[tiab] OR intraparticipant[tiab] OR intra-participant[tiab] OR kappa[tiab] OR kappa's[tiab] OR kappas[tiab] OR repeatab*[tiab] OR ((replicab*[tiab] OR repeated[tiab]) AND (measure[tiab] OR measures[tiab] OR findings[tiab] OR result[tiab] OR results[tiab] OR test[-tiab] OR tests[tiab])) OR generaliza*[tiab] OR generalisa*[tiab] OR concordance[tiab] OR (intraclass[tiab] AND correlation*[tiab]) OR discriminative[tiab] OR ''known group''[tiab] OR factor analysis[tiab] OR factor analyses[tiab] OR dimension*[tiab] OR subscale*[tiab] OR (multitrait[tiab] AND scaling[tiab] AND (analysis[tiab] OR analyses[tiab])) OR item discriminant[tiab] OR interscale correlation*[tiab] OR error[tiab] OR errors[tiab] OR ''individual variability''[tiab] OR (variability[tiab] AND (analysis[tiab] OR values[tiab])) OR (uncertainty[tiab] AND (measurement[tiab] OR measuring[tiab])) OR ''standard error of measurement''[tiab] OR sensitiv*[tiab] OR responsive*[tiab] OR ((minimal[tiab] OR minimally[tiab] OR clinical[tiab] OR clinically[tiab]) AND (important[tiab] OR significant[tiab] OR detectable[tiab]) AND (change[tiab] OR difference[tiab])) OR (small*[tiab] AND (real[tiab] OR detectable[tiab]) AND (change[tiab] OR difference[tiab])) OR meaningful change [tiab] OR ''ceiling effect''[tiab] OR ''floor effect''[tiab] OR ''Item response model''[tiab] OR IRT[tiab] OR Rasch[tiab] OR ''Differential item functioning''[tiab] OR DIF[tiab] OR ''computer adaptive testing''[tiab] OR ''item bank''[tiab] OR ''cross-cultural equivalence''[tiab])

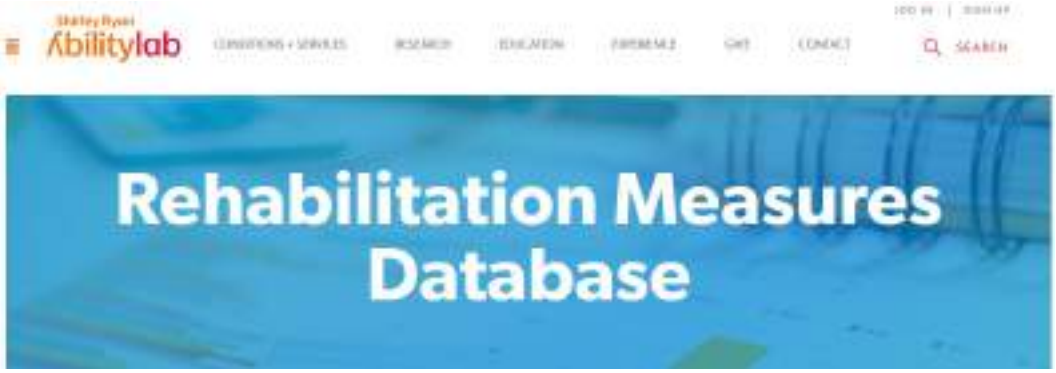
DATABASE FOR MEASURING INSTRUMENTS

https://eprovide.mapi-trust.org/about/about-proqolid

- Partly free (general information), partly paid (information about measurement properties
-)Contains information on 1600 instruments

DATABASE FOR MEASURING INSTRUMENTS

https://www.sralab.org/rehabilitation-measures



- Developed by the Rehabilitation Institute of Chicago
- Staffed by physiotherapists, occupational therapists, speech and language therapists, and psychologists and nurses with rehabilitation experience
- Contains information on over 400 rehabilitation-related tools

HOW TO MEASURE

1) Type of instrument and administration

Theoretical/conceptual considerations

2) Identify the tools available

Systematic literature review

Comprehensive literature search

Database for measuring instruments (e.g. PROQOLID)

3) Evaluate the quality of the measuring instruments available

Psychometric properties

Feasibility

Prinsen et al., 2016

COSMIN INIZIATIVE

ELSEVIER

Journal of Clinical Epidemiology 63 (2010) 737–745

Journal of Clinical Epidemiology

The COSMIN study reached international consensus on taxonomy, terminology, and definitions of measurement properties for health-related patient-reported outcomes

Lidwine B. Mokkink[a,*], Caroline B. Terwee[a], Donald L. Patrick[b], Jordi Alonso[c,d], Paul W. Stratford[e,f], Dirk L. Knol[a], Lex M. Bouter[a,g], Henrica C.W. de Vet[a]

- Purpose: To clarify and standardize the terminology and definitions of measurement properties and to develop a taxonomy of measurement properties relevant to the assessment of health tools.

FEASIBILITY

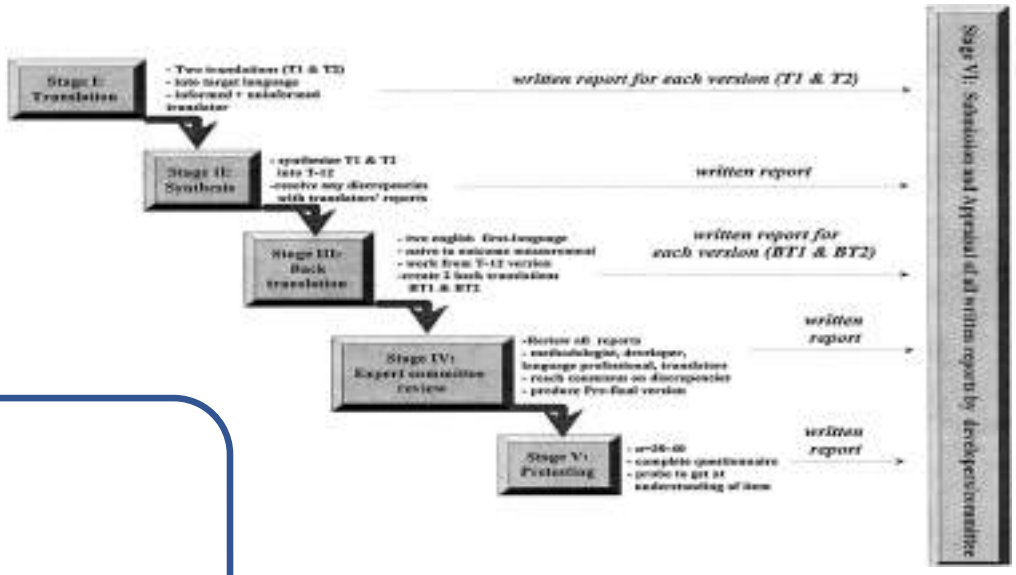
- Comprehensibility for patient
- Availability in different languages
- Interpretability (e.g. MIC)
- Copyright
- Ease of administration
- Patient physical ability level
- Length of the tool
- Type of administration
- Completion time
- Ease of scoring
- Patient mental ability level
- Required equipment
- Ease of standardization
- Tool costs
- Availability in different settings

Prinsen et al., 2016

TRANS-CULTURAL VALIDITY

Degree to which the items of a translated or adapted tool are an adequate reflection of the items of the original version of the tool

Mokkink et al., 2010



1. Translation
2. Synthesis of translations
3. Reverse translation
4. Expert review
5. Test on the pre-final version
6. Evaluation of all reports from the developer

Beaton et al., 2000

THE LANGUAGE PROBLEM

- Item FEEDING

THE LANGUAGE PROBLEMS

DISABILITY AND REHABILITATION, 2017
Taylor & Francis

ORIGINAL ARTICLE

The cross-cultural adaptation and psychometric validation of the MSSS-88 for use in Italian patients with multiple sclerosis

Marcell[illegible]nello[a,b], Leon[illegible]Bellicciari[a], Diego Centonze[c,d], Calogero Foti[a,d], Caterina Pistarini[b], Cate[illegible]i[a] and Andr[illegible][e]

54. Fee[illegible]ugh

54. Feeling like you're walking through honey?

CONTENT VALIDITY

Degree to which the content of a measuring instrument adequately represents the construct it is intended to measure

- It is mostly about relevance and all-inclusiveness of the content

1. Do all items refer to relevant aspects of the construct being measured?
2. Are all items relevant to the study population in terms of age, gender, disease characteristics, language, country and setting?
3. Are all items relevant to the scope of application of the measuring tool?

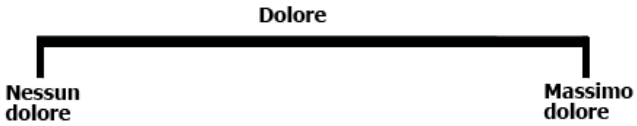
Mokkink et al., 2010

CONTENT VALIDITY: EXAMPLE

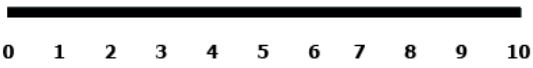
Patient	Stay seated	Standing	Speak chinese	Total score
Patient A	1	1	0	2
Patient B	1	0	1	2

INTENSITY OF PAIN

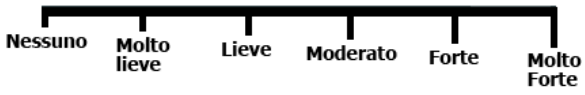
- [x] Visual Analog Scale (VAS)



- [x] Numerical Rating Scale (NRS)



- [x] Verbal Rating Scale (VRS)



J Rehabil Med 2012; 44: 798–799

DEBATE

HOW SHOULD WE USE THE VISUAL ANALOGUE SCALE (VAS) IN REHABILITATION OUTCOMES? I: HOW MUCH OF WHAT? THE SEDUCTIVE VAS NUMBERS ARE NOT TRUE MEASURES

Franco Franchignoni, MD[1], Fausto Salaffi, MD[2] and Luigi Tesio, MD[3]

- Ordinal measure and not interval
- Patients divide the score into no more than 7 categories
- It requires **an abstraction** of **pain** and a careful explanation of meaning
- Ontological problem: **what really measure** ?

ORIGINAL ARTICLE

Measuring Pain Intensity in Patients with Neck Pain: Does It Matter How You Do It?

Steven J. Kamper, PhD[*,†]; Sanneke J.M. Grootjans, MSc[*]; Zoe A. Michaleff, PhD[*]; Christopher G. Maher, PhD[*]; James H. McAuley, PhD[‡]; Michele Sterling, PhD[§]

ORIGINAL ARTICLE

Measuring the Intensity of Chronic Pain: Are the Visual Analogue Scale and the Verbal Rating Scale Interchangeable?

Mark Kliger, PhD[*,†]; Shy Stahl, MD[‡]; May Haddad, MSc[§]; Erica Suzan, MSc[§,¶]; Rivka Adler, BA[§]; Elon Eisenberg, MD[§,¶]

- Patients judge **differently** the **intensity of your pain if VAS** , **NRS** , **VRS** is administered
- **recall bias :** the **score** it tends to **grow** in relation to how **far back** over **time** we refer

CONSTRUCT VALIDITY

Degree to which scores on one instrument correlate with scores on other instruments

Mokkink et al., 2010

CONVERGENT → **The extent to which the scores correlate with instruments that intend to measure the same latent variable**

DVVERGENT → **The extent to which scores correlate with instruments that intend to measure a different latent variable**

Statistical indexes: Correlation Coefficient (Spearman orPearson)

$\rho > 0.70$ = strong correlation
$0.50 < \rho < 0.70$ = moderate correlation
$\rho < 0.50$ = weak correlation

Munro, 2000

CONSTRUCT VALIDITY: ATRS EXAMPLE

Knee Surg Sports Traumatol Arthrosc (2018) 26:854–860
https://doi.org/10.1007/s00167-016-4152-8

ANKLE

Cross-cultural adaptation and multi-centric validation of the Italian version of the Achilles tendon Total Rupture Score (ATRS)

Alberto Vascellari[1] · Pietro Spennacchio[2] · Alberto Combi[3] · Alberto Grassi[4] · Silvio Patella[5] · Salvatore Bisicchia[6] · Gian Luigi Canata[7] · Stefano Zaffagnini[4] · SIGASCOT Sport Committee

Table 3 Validity as measured by correlation between the ATRS and the VISA-A, the 17-FFI, the LEFS, and different SF-36 subscales

Score	Correlation with ATRS	*p*
VISA-A	0.72	<0.0001
17-FFI	−0.30	0.007
LEFS	0.70	<0.0001
SF-36		
Physical functioning	0.75	<0.0001
Pain	0.61	<0.0001
Vitality	0.34	0.0023
Role emotional	0.40	0.0002
Role physical	0.52	<0.0001
Social functioning	0.49	<0.0001
Mental health	0.20	n.s.
General health	0.18	n.s.

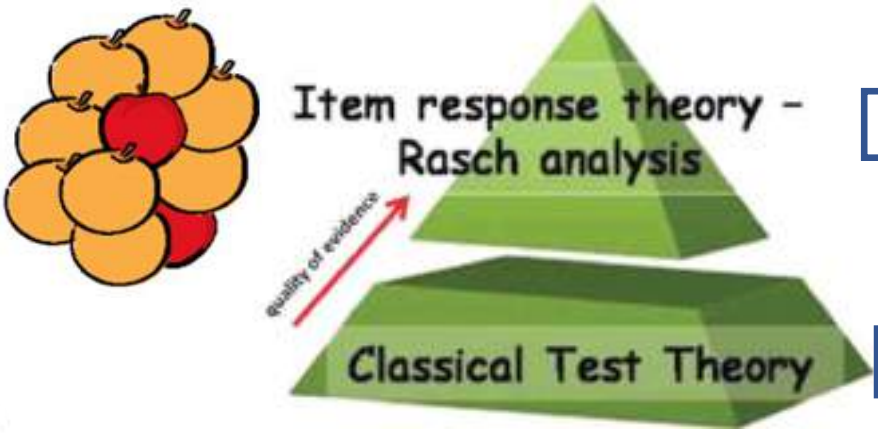
r > 0.70 **Strong** correlation
0.50 < r < 0.70 **Moderate** correlation
r < 0.50 **Weak** correlation

Munro, 2000

STRUCTURAL VALIDITY

The degree to which an instrument's scores are an adequate reflection of the dimensionality of the construct being measured

Mokkink et al., 2010



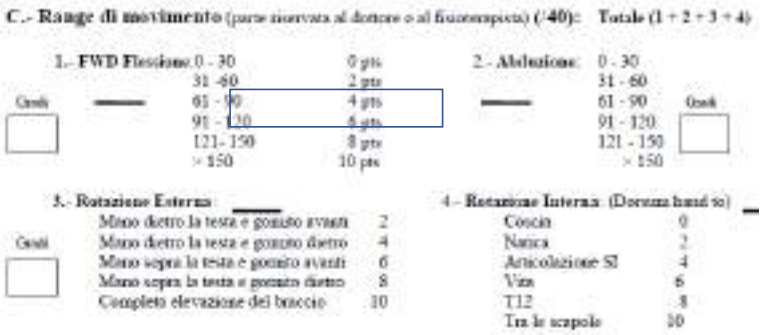
- Functioning of the thresholds
- Unidimensionality
- Item Local dependence
- Differential item functioning
- Targeting

- Factorial analysis

CONSTANT MURLEY SCORE

A Clinical Method of Functional Assessment of the Shoulder

C. R. CONSTANT, M.B., B.CH., B.A.O., F.R.C.S.I.,* AND
A. H. G. MURLEY, M.B., F.R.C.S.**


C.- Range di movimento (parte riservata al dottore o al fisioterapista) (/40): Totale (1 + 2 + 3 + 4)

1.- FWD Flessione: 0 - 30 (0 pts); 31 - 60 (2 pts); 61 - 90 (4 pts); 91 - 120 (6 pts); 121 - 150 (8 pts); > 150 (10 pts)

2.- Abduzione: 0 - 30; 31 - 60; 61 - 90; 91 - 120; 121 - 150; > 150

3.- Rotazione Esterna: Mano dietro la testa e gomito avanti (2); Mano dietro la testa e gomito dietro (4); Mano sopra la testa e gomito avanti (6); Mano sopra la testa e gomito dietro (8); Completo elevazione del braccio (10)

4.- Rotazione Interna: (Dorso mano a) Coccix (0); Natica (2); Articolazione SI (4); Vita (6); T12 (8); Tra le scapole (10)

• Pain	⇨	15%
• ADL	⇨	20%
• ROM	⇨	40%
• Strenght	⇨	25%

No rationale provided for weighing individual domains (*Wright et al., 2010; Kirkley et al., 2003*)

RELIABILITY

Expresses the degree to which the measurement is free from measurement error (*Mokkink et al., 2010*)

TRUE SCORE

+

MEASUREMENT ERROR

=

OBSERVED SCORE OF THE TEST

Statistical indexes: Intraclass Correlation Coefficient, Cohen's k

ICC > **0.70** → GROUP MEASUREMENT
ICC > **0.90** → SINGLE PERSON MEASUREMENT

Portney & Watkins, 2000

RELIABILITY

TEST-RETEST RELIABILITY	The proportion of the total variance in the measurements that causes "true" differences between patients
MEASUREMENT ERROR	The systematic and random error of a patient's score that is not attributed to true changes in the construct
INTERNAL CONSISTENCY	Expresses the degree of interrelation between items

ICC VS SEM & MDC

RELIABILITY	MEASUREMENT ERROR	MEASUREMENT ERROR
ICC: interval/ordinal variables K di Cohen: dichotomous variables	STANDARD ERROR OF THE MEASUREMENT(SEM)	MINIMAL DETECTABLE CHANGE (MDC)
They evaluate correlation based on estimates of variance	The variation in scores due to the unreliability of the measure used	The smallest detectable change in score beyond the measurement error.
ICC > **0.70** → group measurement ICC > **0.90** → single person measurement	SD x √(1–R) SD: standard deviation R: correlation coefficient	Z-score x SEM x √ 2 MDC_{95} Z-score = 1.96 MDC_{90} Z-score = 1.64

RELIABILITY: EXAMPLE OAFQ FOR CHILDREN

Qual Life Res (2016) 25:117–123
DOI 10.1007/s11136-015-1064-x

BRIEF COMMUNICATION

Validation of the Italian version of the Oxford Ankle Foot Questionnaire for children

Nicolò Martinelli[1] · Giovanni Romeo[1] · Carlo Bonifacini[1] · Marco Viganò[1] · Alberto Bianchi[1] · Francesco Malerba[1]

TOTAL SCORE OF EACH SUBSCALE
0-100 POINTS

	Test rest (ICC)		Child–parent (ICC)	Minimal Detectable Change	
	Child	Parent		Child	Parent
Physical	0.88	0.97	0.99	17.0	3.3
School and play	0.89	0.82	0.93	7.7	12.9
Emotional	0.90	0.88	0.87	7.0	7.8
Footwear	0.97	0.96	0.96	-	-

INTERPRETABILITY

The degree to which qualitative, that is, clinical, significance can be assigned to quantitative scores of an instrument or to a change in scores.

Mokkink et al., 2010

MINIMAL CLINICAL IMPORTANT DIFFERENCE

The smallest change in score that can be perceived by the patient as a significant improvement in their clinical condition.

Terwee et al., 2007

DASH & QuickDASH

[RESEARCH REPORT]

FRANCO FRANCHIGNONI, MD[1] • STEFANO VERCELLI, PT, MSc[1] • ANDREA GIORDANO, PhD[2]
FRANCESCO SARTORIO, PT[1] • ELISABETTA BRAVINI, PT[1] • GIORGIO FERRIERO, MD[1]

Minimal Clinically Important Difference of the Disabilities of the Arm, Shoulder and Hand Outcome Measure (DASH) and Its Shortened Version (QuickDASH)

DASH

- **MCID = 10.83 points**
- SEM = 4.63 points
- MDC_{90} = 10.81 points
- AUC = 0.87 (95% CI 0.84-0.91)

QuickDASH

- **MCID = 15.89 points**
- SEM = 5.51 points
- MDC_{90} = 12.85 points
- AUC = 0.86 (95% CI 0.82-0.89)

The **MCID** is influenced by:

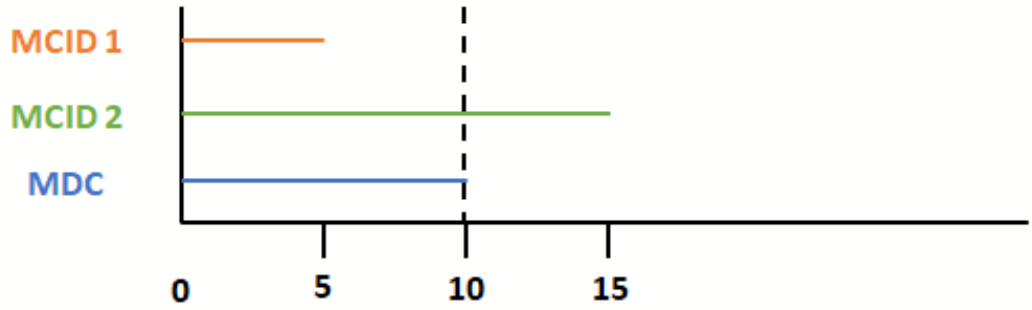
- Age & Sex (Wang et al., 2011)
- Initial functional status (de Vet et al., 2007; de Vet et al., 2015)
- Duration of pain (Lauridsen et al., 2006, Wang et al., 2011)
- GRCS threshold defining change (Demoulin et al., 2010)
- Statistical analysis (Terluin et al., 2015)
- Treatment
- Interval between evaluations

GLOBAL RATING OF CHANGE SCALE

- **GRCS threshold that categorizes patients into improved and non/improved7-point GRCS?**
- **At 11 points? At 15 points?**
- **Retrospective subjective judgment of change**

MCID VS MDC

- The MCID must always be greater than the MDC (Terwee et al., 2007)
- Least potentially detectable change < MDC < MCID
- Otherwise the measurement error would be too high to detect clinically significant changes



MDC VS MCID: FAAM EXAMPLE

FOOT & ANKLE INTERNATIONAL
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Evidence of Validity for the Foot and Ankle Ability Measure (FAAM)

RobRoy L. Martin, P.T., Ph.D., C.S.C.S.[1]; James J. Irrgang, Ph.D., P.T., A.T.C.[2]; Ray G. Burdett, Ph.D., P.T., C.Ped.[2]; Stephen F. Conti, M.D.[3]; Jessie M. Van Swearingen, Ph.D., P.T.[2]
Pittsburgh, PA

ADL SUBSCALE

SEM = 6.9 POINTS
MDC = **5.7** POINTS
MCID = **10** POINTS

SPORT SUBSCALE

SEM = 10 POINTS
MDC = 12.3 POINTS
MCID = 9 POINTS

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

Measure what is measurable and make measurable what is not (Galileo Galilei)

To measure is to know. If you can't measure it, you can't improve it (Lord Kelvin)

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Rehabilitation in spinal cord injuries
Lesson: International Classification of Functioning, Disability & Health

Medical Model

The classical and traditional medical model of medicine bases its action on a concept of the disease that can be represented as follows:

Etiology → Pathology → Symptomatology

Medical Model

- Disability is understood as a problem of the person caused by the presence of diseases, traumas or other health conditions that require medical assistance as an individual treatment

- Disability management aims at treating diseases or adapting the individual and behavioral change

Medical Model

- Health is defined as the absence of disease.
- The central point of the International Classification of Diseases (ICD) is the pathology.
- On the pathology, books are written and knowing the pathology the clinicians know how to treat the disease (the physician bases his activity on this concept).

Medical Model

- There is a one-way relationship: there is a pathogenic cause that determines a pathology (it is a mechanistic approach).
- The behavior is standardized according to the pathology.
- It is based on the knowledge of anatomy, biology and the clinical manifestations of the pathology (I have that pathology, and so I take that specific drugs to treat it)
- In some way, the patient is classified and labeled according to the disease: therefore, the whole group with the same disase is treated according to that pathology (in this way the protocols work).

Medical Model

- The actions to be carried out follow this procedure, without taking into account the patient who undergoes this process.

- The features of this concept are:
  - An etiopathological model that determines activities essentially aimed at finding the cause
  - A primary focus on the disease that aims to treat
  - The patient as an object in an essentially passive role
  - A treatment, however, more mono-disciplinary, with a starting point of lost skills

Criticality of the medical model

- Disability is assimilated to the pathology and is seen as a the starting from the norm (it is a standardized vision of the person and of its functioning)
- Reduction of the person to his pathology and his deficit
- It excludes the relational dimension from the existential experience of the person in his interaction in his own life contexts

Criticality of the medical model

- The treatment is individual and standard
- One-dimensional vision of the person with disabilities and restriction of his social roles (the patient cannot / cannot do)
- The health is restricted to the absence of disease (medicalization of interventions and services)

The concept of "health"

- Health is "a complete state of physical, mental and social well-being and not just the absence of disease or infirmity”

- The health is “wellness that produces and expands thanks to the quality of relationships with others and with the environment”

International Classification of Impairment, Disabilities and Handicaps (ICIDH)

- Attempt by the World Health Organization (1980) to overcome the biomedical-diagnostic-rehabilitative model of the International Classification of Diseases (ICD) and its causal concept disease-cure

- It is not a guide to the classification of people with disabilities but attempts to define the circumstances that can lead to situations of disadvantage compared to other people on the basis of a presumed normality (social convention)

International Classification of Impairment, Disabilities and Handicaps (ICIDH)

- Introduces the consequence of a pathological or chronic state
- Illness → Impairment → Disability → Handicap
- The damage to the functions of an organ caused by an illness produces disabilities in the person

International Classification of Impairment, Disabilities and Handicaps (ICIDH)

- Disability is considered as an inability to perform normal activities

- Disability causes the handicap and therefore the disadvantage in having a social role and in carrying out daily activities

ICIDH - Impairment

- It represents any loss or anomaly of a structure or a function, on the anatomical, physiological and psychological level.

- The impairment is characterized by the existence or occurrence of anomaly, defect or loss (which may be temporary or permanent) of a limb, organ or tissue or other structure, of the body, or of a defect in a system, function or mechanism of the body , including the system of mental functions.

ICIDH - Impairment

- It is a deviation from the norm on the biomedical level of the individual and represents the externalization of a pathological condition

- For example: muscle weakness, motor control deficit, articular deficit

ICIDH - Disability

- Disability represents any reduction (consequent to impairment) partial or total capacity to perform an activity in the manner or within the limits considered normal for a human being.

- It is characterized by defects in the usual activities, performances and behaviors

- It can be temporary, permanent, reversible, irreversible, progressive or regressive

ICIDH - Disability

- Disabilities can arise as a direct consequence of impairments or as responses of the individual, particularly of a psychological nature, to a physical impairment, sensory or other.

- Disability represents the objectification of an impairment and as such reflects disturbances at the level of the person.

ICIDH - Disability

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- Disability represents the objectification of an impairment and as such reflects disturbances at the level of the person.

ICIDH – Handicap

- Handicap constitutes the situation of social disadvantage, consequent to impairment and/or disability, which limits or prevents the fulfillment of a normal role for a given individual according to age, sex and cultural and social factors.

- It is characterized by a discrepancy between the performance and the condition of the individual and the expectations of the individual himself or of the particular group to which he belongs.

ICIDH – Handicap

- It is the result of discrepancy between individual expectations and the performance or condition of the individual

- It represents the socialization of a impairment or a disability and, as such, reflects the consequences for the individual - on a cultural, social, economic and environmental level - that arise from the presence of impairments and disabilities.

- It is the socialization of an impairment or disability

From the impairment to the handicap

- So, while the impairment and disability belong to the individual, the appearance of the Handicap is linked to the interface between subject and society that is not able to accept those who perform an activity differently from most subjects.

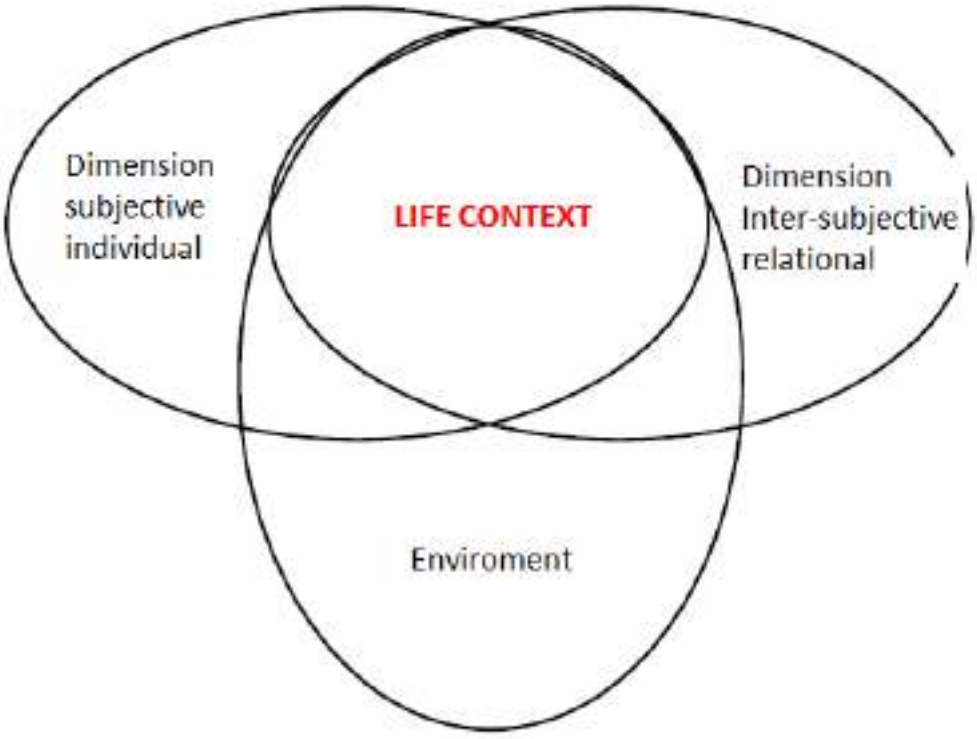
ICIDH example

Impairment Disability Handicap

Example: a person with amputation (impairment) who is not able to walk independently (disability) succeeds by using a wheelchair to make movements. The use of the aid has in fact reduced the disability (obviously not the impairment) but if the subject meets, in the path that leads him in social environments, barriers and limitations the same cannot relate and therefore this involves handicap.

Something is missing…

- **The context….**



The social model

- It develops in the United Kingdom in the 1960s and 1970s under the impulse of movements for the rights of people with disabilities and scholars

- It is a tool to capture the phenomenon of disability, providing new coordinates of meaning to understand a condition traditionally considered only in individual and medical terms

- It does not deny the individual problems that people with disabilities may encounter, but moves the domain from the individual sphere to the social sphere

The social model

- It is opposed to the identification of disability with the impairment of the person often seen in terms of personal tragedy
- Oppressive vision of society towards disability
- The social model of disability is not a real theory able to explain the multitude of phenomena related to disability but, rather, a holistic approach that explains which specific problems are experienced by people with disabilities, having regard to the totality of the environmental and cultural factors that make disabled

The social model

- It is society that "disables" the person by not allowing them to access education, communication and computer systems, work environments, transport, public buildings and housing

- Disability is not an individual characteristic but a complex interaction of conditions, mainly coming from the social environment

The social model

- Disability management requires social actions and is the collective responsibility of society

- There is a need to implement environmental changes for the full participation of people with disabilities in all existential areas of social life

The social model

- A health problem is described as a dynamic balance disorder in psychosocial interaction that gives the patient the feeling that they are unable to recover the well-being situation on their own.

- A health problem affects the psychological sphere of the patient

- This type of vision is strongly opposed to the biomedical model in that the person becomes the central element. Every health problem becomes that person's own.

The social model

- The problem in this case is multifactorial and multicausal where there are factors that influence the disease.
- Each person reacts to the same stimuli in different ways.
- The person is central, not the pathology.
  In this case the clinician, who intervenes on the problem, will play a role of advice.
- This type of approach is based on the knowledge of psychology, sociology and the sciences of communication.

Medical model VS Social model

- Medical model (individual adaptation)
  - Disability as a personal problem

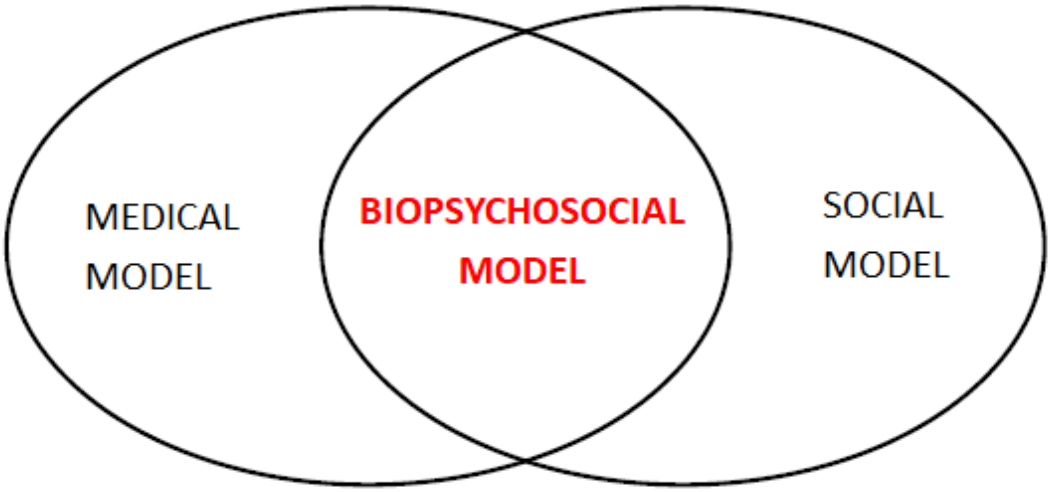
- Social model (transformation of contexts)
  - Disability as a social problem

Criticality of the social model

- It tends to exclude the biological dimension of disability and its subjective experience
- The pervasive nature of the social dimension tends to absorb the dimension of the body and its perception
- The oppressive nature of society cannot be generalized to the condition of all persons with disabilities

Bio-psycho-social model

- It is a summary that wants to provide a coherent perspective of the different dimensions of health at biological, individual and social level



Bio-psycho-social model

- At the center is the person with his health problem
- It is a multi-factorial model: it takes into account all the interactions that the person has in living his health problem

Bio-psycho-social model

- There are aspects of a mechanistic type, that is, a preface to the condition of pathology, and aspects of a communicative nature that integrate with each other

- The operator should pay attention to the uniqueness of the person in front of him and to general guidelines for that particular illness

International Classification of Functioning, Disability and Health

- It represents a classification of health and its related states

- It offers a conceptual framework for organizing information that is applicable to personal health care - including prevention and health promotion - and improving participation through the removal or reduction of social obstacles and the promotion of social support and facilitators

International Classification of Functioning, Disability and Health

- It refers to the broad context of health and does not cover circumstances that are not related to it, such as those caused by socio-economic factors

- It is not just about people with disabilities; in reality it concerns everyone

International Classification of Functioning, Disability and Health

- Health conditions and those related to it, associated with all health conditions can find their description in the ICF

- It has an universal application

ICF and Bio-psycho-social model

- The functioning and disability of a person are conceived as a dynamic interaction between health conditions (diseases, disorders, injuries, traumas, etc.) and contextual factors

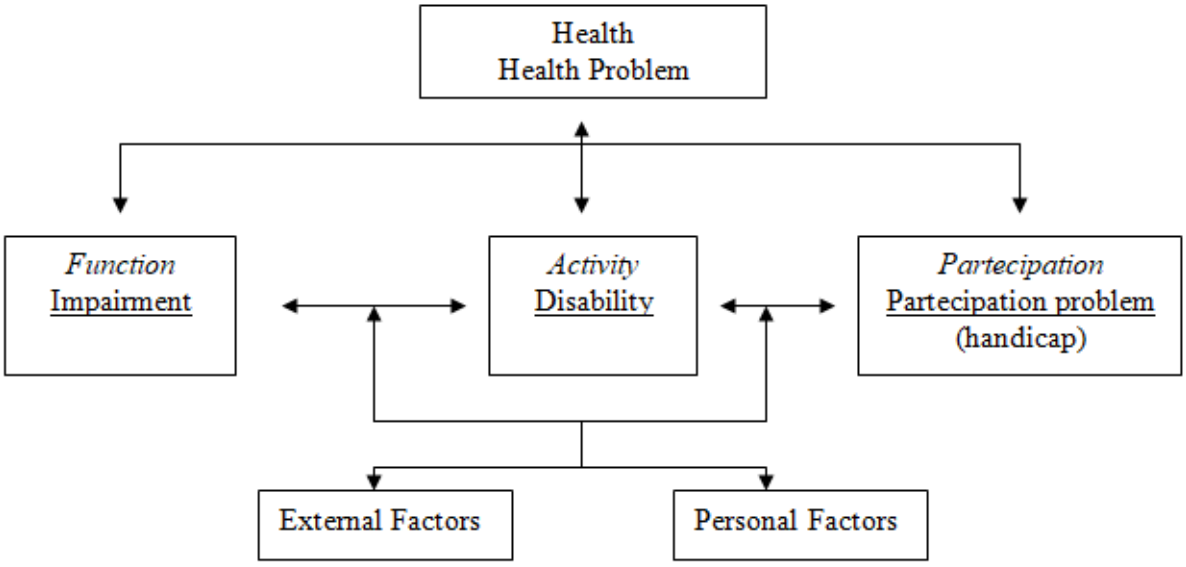
- ICF considers impairments as problems of body functions and structures associated with health conditions

ICF and Bio-psycho-social model

- ICF does not provide diagnostic information about diseases, traumas, etc. (as ICD) but information on the functioning of the person

- ICF responds to the need for a code shared internationally for the interpretation of the phenomenon of disability

International Classification of Functioning, Disability and Health



ICIDH VS ICF

- In ICIDH the vision of the state of health had a negative connotation whereby if there was a problem of function there was the impairment (= decrease of its capacity). The ICIDH talked about disability, and handicap

- With the ICF (that has a more positive vision, of the potential of the individual, although diminished by the state of health) talks about function, activity and participation.

ICIDH VS ICF

- External and internal factors have been added
- Internal or personal factors of each person reacts differently to the situation in which he lives
- External factors take into account the environment

ICIDH VS ICF

- With the ICF, consideration is given to how much the environment affects the patient so that while in ICIDH it was not considered, so it was not known how much the environment affected the patient

- With the ICF, the environment is taken into particular account, because it is different if the individual (inserted in prognostic terms in the sense of health) is inserted into a positive or negative environment.

The biological dimension in the ICF

- Body structures: these are the structural or anatomical parts of the body such as the organs, limbs and their components classified according to body systems.

- Body functions: physiological functions of body systems, including psychological ones.

- "Body" refers to the human organism in its entirety, thus including the brain. This is why mental (or psychological) functions are included in body functions.

The biological dimension in the ICF

- Impairment: it is a loss or an abnormality in the structure of the body or in the physiological function (including mental functions).

- The term "abnormality" is used only and exclusively to indicate a significant deviation from established norms and it should be used only in this sense.

Functioning VS disability in the ICF

- Function: umbrella term for bodily functions, body structures, activity and participation. It indicates the positive aspects of the interaction between an individual (with a health condition) and the contextual factors of that individual (environmental and personal factors).

- Disability: umbrella term for impairments, activity limitations and restrictions on participation. It indicates the negative aspects of the interaction between an individual (with a health condition) and the contextual factors of that individual (environmental and personal factors).

Activity in the ICF

- Activity: execution of a task or action by an individual. It represents the individual perspective of functioning.

- Activity limitationѕ: difficulties that an individual may encounter in carrying out activities. A limitation of the activity can be a slight to severe deviation, in quantitative or qualitative terms, in the performance of the activity with respect to the mode or measure expected by persons without a health condition.

Partecipation in the ICF

- Participation: involvement of a person in a life situation. It represents the social perspective of functioning.

- Restrictions of participation: problems that an individual can experience in involvement in life situations. The presence of a participation restriction is determined by comparing the individual's participation with what is expected of an individual without a disability in that same culture or society culture.

- It replace the handicap term

The person-context interaction in the ICF

- Environmental factors: all aspects of the external world that form the context of an individual's life with an impact on the functioning of the person For example the physical environment and its characteristics, the physical world created by man, other people in different relationships and roles , attitudes and values, social systems and services, and policies, rules and laws

- Personal factors: contextual factors related to the individual (age, sex, social class, life experiences, etc.), which are not currently classified in the ICF

Model of Rehabilitation

- Often patients, despite adequate treatment, cannot completely recover
- They become disabled as a result of illness or trauma and simultaneously lose their role in society.
- The consequences of the disease or the trauma and the disability they entail are the starting point in rehabilitation.

Rehabilitation process

- Rehabilitation takes place as a continuous process designed to avoid an imminent deficiency, and to maintain or develop or restore the person's ability to perform a normal activity.

- The goals of rehabilitation aim to ensure the disabled person, whatever the nature and cause of the disability, the widest independence and optimal participation in social and economic life.

Rehabilitation process

- Rehabilitation is therefore a continuous and global process that, starting from the phase of medical treatment, aims at the social integration of the disabled person at all level.

- To this objective, it incorporates all the measures designed to prevent or to reduce to the inevitable minimum the functional, physical, mental, social and economic consequences of invalidating diseases and traumas, from the beginning of the condition to the reintegration of the patient into his environment

Rehabilitation

- Its objectives are based on two principles:
  - The active participation of the person concerned in their rehabilitation
  - The duty for society to adapt to the specific needs of disabled people

Specific objective of rehabilitation

- Rehabilitation medicine goes beyond what characterizes the curative medicine, because the purpose of the treatment is not only anatomical and physiological healing, but above all the recovery of functions, the inclusion of the integration of the disabled in society.

Specific objective of rehabilitation

- The patient's remaining abilities, the prognosis of the illness or the trauma, the obligations that the society imposes on the patient, the consistency that the patient hopes to give to his existence and the efforts he is willing to do to get there, combined with the effectiveness of the aid offered, determine the choice of objectives and the method of treatment.

Specific objective of rehabilitation

- The rehabilitation, starting from the phase of medical treatment of functional recovery, in order to reduce the deficiency and disability as much as possible, continues its work aimed at optimizing the use of residual functional capacities and compensating for lost capacities, taking into account all aspects of life and person.

Specific objective

- The aspects of rehabilitation that should be implemented and coordinated are:
  - Prevention, identification, diagnosis and assessment of deficiencies, disabilities and handicaps
  - Recovery of personal autonomy through the implementation of functional re-education and the supply of orthoses, prostheses, wheelchairs and other technical aids
  - Socio-family, school and professional reintegration

Specific objective of rehabilitation

- But these invalidating aspects cannot be dissociated from the acts that the rehabilitation clinicians should perform in order to obtain from the society the means necessary to achieve these objectives:
  - Modalities of work of disabled people (work, sheltered work, adaptation of the workplace, activities aimed at professional integration)
  - Technical and social aids, abolition of architectural barriers, accessibility to buildings, adaptation of housing, facilities for communication and transport, leisure, sports, holidays.
  - Without forgetting the problems of health education and information

Methodology of rehabilitation

- Rehabilitation is methodologically implemented on the basis of an inventory (budgets of individual sectors) and on a detailed plan with priorities.

- The patient and his entourage ensure an active role while the multidisciplinary team and the coordination of the physiatrist offer the patient opportunities to change his behavior and his environment on his own and work towards his future in a learning situation.

Methodology of rehabilitation

- By method, rehabilitation means a set of measures and actions whose orderly, coordinated and conveniently programmed sequence should lead to a specific purpose.
- The methodology of rehabilitation is determined by the following factors:
  - The idea that medical and social purposes should be united in one coherent and uninterrupted unit
  - The principle that the disabled person has the right to an existence worth conducting in the social context to which he belongs

Methodology of rehabilitation

- The description of rehabilitation is a set of coherent and coordinated measures in the medical, social, professional, educational and economic fields

- The goal is to return the patient to the social role that belongs to him and to allow him to keep it

Systematic solution of the problems

- In rehabilitation , the activities are always "problem-oriented and patient-centered“
- Consequently, we need a systematic method of solving problems that have standard solutions.
- In general it is a three-step scheme:
  - Problem analysis and orientation
  - Synthesis of the formulation
  - Solution of the problem

Systematic solution of the problems

- The first phase of the problem analysis and orientation involves:
  - The history
  - The exam
  - The orientation
  - First diagnostic and prognostic conclusion
  - Evaluation of functional possibilities
  - Formulation of primary treatment and rehabilitation goals

Global exam

- In Rehabilitation, the balance should be assessed at the three levels of the handicap process:
  - Impairment (function)
  - Disability (activity)
  - Handicap (participation)

Impairment (function)

- On the physical plane, example of impairment (deficit) are:
  - Mobility
  - Muscle strength
  - Sensibility
  - Coordination
  - Control of posture and movement from analgesic reaction
  - Physical condition
  - Circulatory function
  - Respiratory function
  - Bladder function
  - Rectal function
  - Sexual function

Impairment (function)

- On the psychic level, example of deficit are the:
  - Conscience
  - Intelligence
  - Memory
  - Thought
  - Behavior

Disability (activity)

- At the level of disabilities, or functional limitations, problems can be grouped in areas or fields of attention.

- With this term, a set of related skills that present disabilities that disturb the patient in the path of rehabilitation is undertood.

Example of daily living activities

- Feeding
- Get up
- Sit
- Move
- Personal hygiene
- Toileting (WC)
- Moving into the home (including wheelchair conduct)
- Go up and down the stairs
- Manage auxiliary devices (for example, putting on and taking off a prosthesis)

Example of social activity

- Creative activity
- Home activities (including purchases, household activities, care for family members)
- Housing (including accessibility and practical use)
- The possibilities of moving (moving in a wheelchair outside, riding a bicycle, driving a car)
- Continuity of the family role (family problems)
- The availability of adequate financial resources
- The exercise of the profession (including workplace reports, the situation and the content of the work)

Handicap (participation)

- At the handicap level, these will be assessed considering the deficiencies and disabilities in the context of the inadequate situation in which the disabled person will be found.

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Rehabilitation in spinal cord injuries
Lesson: ASIA Assessment

1522/3677

FUNCTIONAL REHABILITATION

to set up an appropriate functional rehabilitation intervention, it is necessary to carry out a global assessment that takes into account generic variables (biological and biological age of the affected person, cognitive status, affective-relational aspect, motivation, aspirations, associated or pre-existing pathologies, family environment , scholastic and / or professional, ect.) and specific inherent variables:

- neurological assessment (neurological level, muscle strength, sensitivity, tone)
- osteo-muscular-articular system
- cardio-vascular system
- respiratory capacity
- Ache
- skin integrity
- Posture
- Equilibriums
- traightening sequences and bed shifts
- functional skills or ADL
- displacements / mobility in space (locomotion with wheelchair, walking with other types of • aids / orthoses / driving possibilities)

FUNCTIONAL REHABILITATION

INTEGRATED EVALUATIONS

- evaluation and planning aids for mobility and home management
- assessment of accessibility and usability of the home environment

ASSESSMENT OF SPECIFIC VARIABLES
Neurological assessment

- The internationally standardized clinical scale for traumatic spinal cord injuries is the A.S.I.A. (American Spinal Injury Association) prepared by the IMSoP. (International Medical Society of Paraplegia), the last revision of which dates back to 1996-2000.

ASSESSMENT OF SPECIFIC VARIABLES
Neurological assessment

- Spinal cord injuries are classified according to The American Spinal Injury Association (ASIA) classification system.
- The classification is based on a standardized motor and sensory assessment.
- It is used to define two motor, two sensory and one neurological level.
- It is also used to classify injuries as either complete (ASIA A) or incomplete (ASIA B, C, D or E).

The A.S.I.A. assessment refers to the following terminology:

- Dermatomer: represents the skin area innervated by the sensory axons of a given single segmental root (posterior root)
- Myomer: the set of muscle fibers innervated by each single segmental motor root (anterior root)
- Skeletal level: level where the radiological examination shows the greatest vertebral damage
- Sensory level: more caudal dermatome of the spinal cord with normal sensory function preserved on both sides of the body;

The A.S.I.A. assessment refers to the following terminology:

- Motor level: key muscle group more caudal on both sides with a strength rating of at least 3 out of 5 if the key muscles above have a normal strength value of 5;
- Neurological level: more caudal level in which both sensitivity and motility (with respect to the key muscles) are normal on both sides;
- Classification of neurological damage by identification of the A.I.S. (ASIA Impairment Scale)

The A.S.I.A. assessment refers to the following terminology:

- Sacral sparing: presence of motor function (voluntary contraction of the external anal sphincter) and / or sensory (tactile and / or painful sensitivity in the S4-S5 segments or deep anal sensation on rectal examination);
- ZPP (zones of partial preservation): used only in complete lesions to indicate caudal sensory and motor metamers that remain innervated for at least three consecutive segments at the neurological level of lesion;

The A.S.I.A. assessment refers to the following terminology:

- Tetraplegia: loss of voluntary and / or sensory motor function of the upper limbs, trunk, lower limbs and alteration of autonomic nervous control with loss of functional integrity of the various systems due to injury to the cervical and medullary tract; the term by definition does not include lesions of the brachial plexus or peripheral nerves outside the neural canal;

The A.S.I.A. assessment refers to the following terminology:

- Paraplegia: loss of voluntary and / or sensory motor function of the trunk, lower limbs and alteration of autonomic nervous control with loss of functional integrity of the various systems in relation to the height of the spinal cord damage due to injury to the thoracic tract or loin sacral; the term is also used for lesions of the cauda equina and medullary cone, but not for lesions of the lumbosacral plexus or peripheral nerves outside the neural canal;
- Complete neurological lesion: tetra / paraplegia with absence of sensory and motor function at the level of the most distal sacral segments (S4-S5);

The A.S.I.A. assessment refers to the following terminology:

- Incomplete neurological injury: tetra / paraplegia with preservation of motor and / or sensory function below the neurological level including sacral segments (S4-S5);
- Classification of Incomplete Type Medullary Syndromes: Medullary Center, Brown-Sequard, Anterior Cordonal, Medullary Cone and Cauda Equina
- Tetraparesis and paraparesis: these terms are little used and therefore not recommended, because they inaccurately describe incomplete lesions.

A.S.I.A. ASSESSMENT

- The evaluation according to the ASIA procedure, consists of two separate components in the description but connected in the global determination of the neurological level, namely the sensitivity examination and the motor examination.

STANDARD NEUROLOGICAL CLASSIFICATION OF SPINAL CORD INJURY

MOTOR
KEY MUSCLES
(scoring on reverse side)

	R	L	
C5			Elbow flexors
C6			Wrist extensors
C7			Elbow extensors
C8			Finger flexors(distal phalanx of middle finger)
T1			Finger abductors (little finger)

UPPER LIMB
TOTAL ☐ + ☐ = ☐
(Maximum) (25) (25) (50)

Comments:

	R	L	
L2			Hip flexors
L3			Knee extensors
L4			Ankle dorsiflexors
L5			Long toe extensors
S1			Ankle plantar flexors

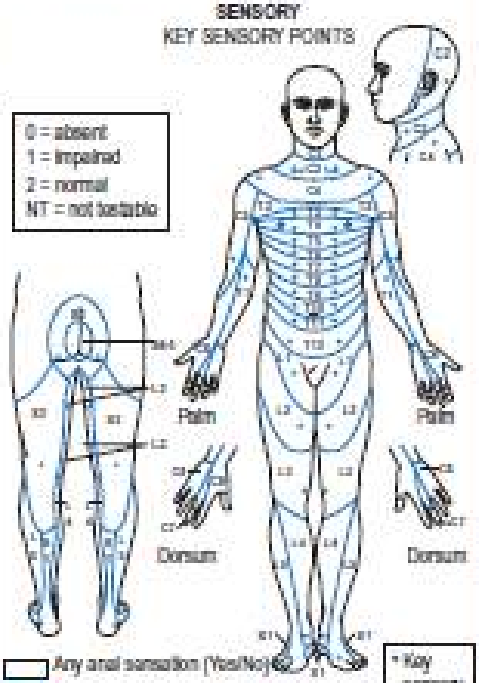
LOWER LIMB
TOTAL ☐ + ☐ = ☐
(Maximum) (25) (25) (50)

Voluntary anal contraction (Yes/No) ☐

	Light touch R	Light touch L	Pin prick R	Pin prick L
C2				
C3				
C4				
C5				
C6				
C7				
C8				
T1				
T2				
T3				
T4				
T5				
T6				
T7				
T8				
T9				
T10				
T11				
T12				
L1				
L2				
L3				
L4				
L5				
S1				
S2				
S3				
S4-5				
TOTALS	☐	☐	☐ + ☐	= ☐ PIN PRICK SCORE (max: 112)
(Maximum)	(56)	(56)	(56) (56)	= ☐ LIGHT TOUCH SCORE (max: 112)

0 = absent
1 = impaired
2 = normal
NT = not testable

SENSORY
KEY SENSORY POINTS



☐ Any anal sensation (Yes/No)

* Key sensory points

		R	L
NEUROLOGICAL LEVEL (The most caudal segment with normal function)	SENSORY	☐	☐
	MOTOR	☐	☐

COMPLETE OR INCOMPLETE? ☐
(Incomplete - Any sensory or motor function in S4-S5)

ASIA IMPAIRMENT SCALE ☐

		R	L
ZONE OF PARTIAL PRESERVATION (Caudal extent of partially innervated segments)	SENSORY	☐	☐
	MOTOR	☐	☐

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ASSESSMENT OF SPECIFIC VARIABLES
Neurological assessment

- The ASIA assessment examines the motor function, through the identification of 10 key muscles according to the muscle examination, and the sensory function in relation to tactile and pain sensitivity using 28 dermatomes per side.

ASSESSMENT OF SPECIFIC VARIABLES
Neurological assessment

- It provides a tool for defining the motor, sensory and neurological level and the type of damage; furthermore, as a lesional metameric asymmetry is very frequent, it allows to highlight any differences between the right and left side of the body.

ASIA

- A motor assessment is used to define two motor levels: one for the right and one for the left side of the body.
- An ASIA motor assessment involves testing the strength of ten key muscles.
- Each key muscle group represents one myotome between C5 and T1, and between L2 and S1

MOTOR EXAMINATION

Using the numerical scale and the methods of application of the universally recognized muscle examination (Kendall 1997), values from 0 to 5 or NT (not testable) of the key muscles are assigned. By this we mean those muscles whose innervation is mainly carried out by a specific myotomer. Ten myotomers are identifiable, bilaterally, which are tested in proximal-distal sequence, and in detail they are:

- C5 – biceps
- C6 - long and short radial extensor carpus
- C7 – triceps
- C8 ¬- deep flexor of the fingers, usually assessed at the distal phalanx of the third finger
- T1 - short abductor of the 5th finger
- L2 – iliopsoas
- L3 – quadriceps
- L4 - anterior tibialis
- L5 - long extensor of the big toe
- S1 - triceps of the sura

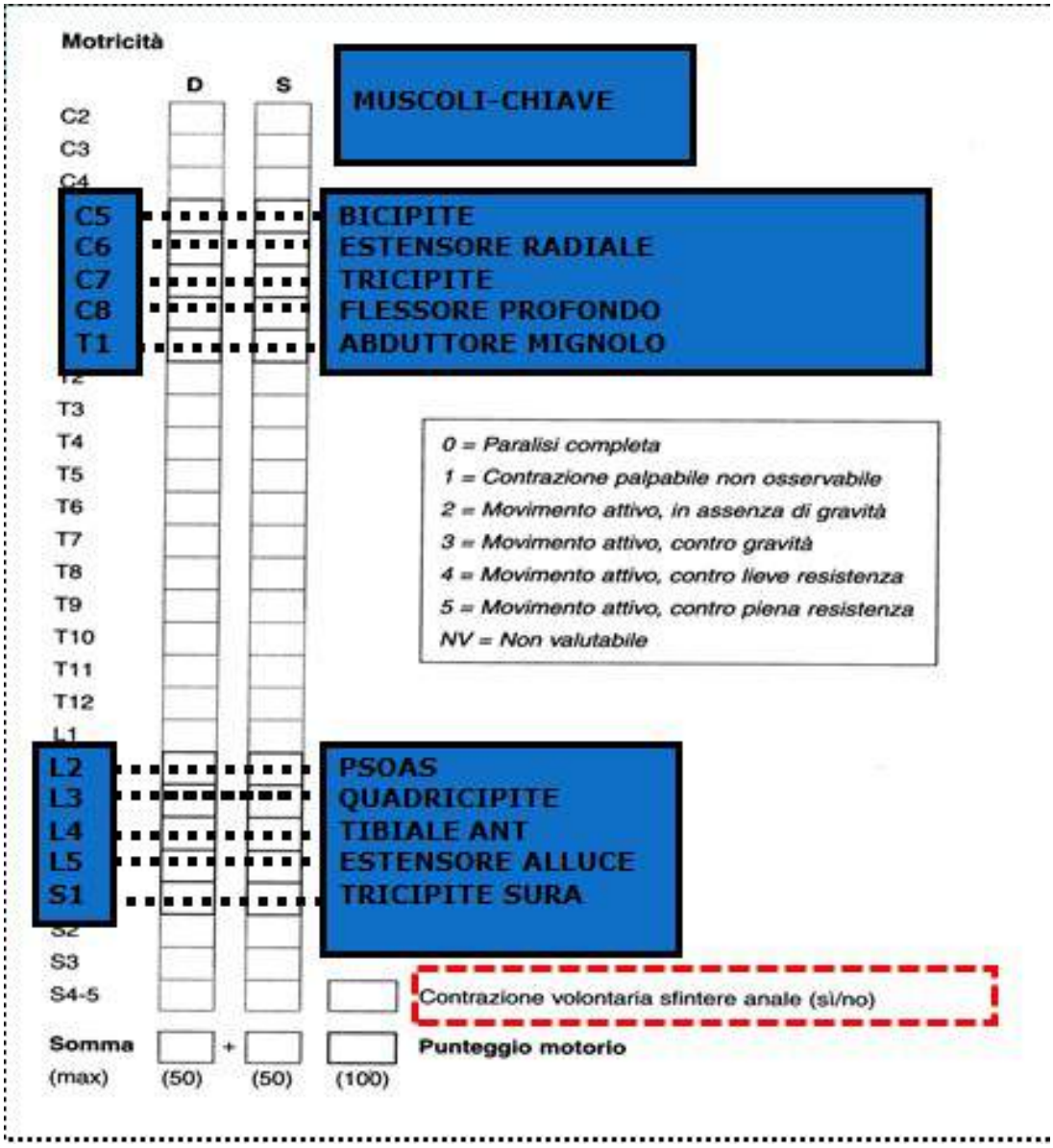
ASIA Motor component

- Each muscle is tested for strength on the original six-point manual muscle testing scale where:

- 0 no muscle contraction
- 1 a flicker of muscle contraction
- 2 full range of motion with gravity eliminated
- 3 full range of motion against gravity
- 4 full range of motion with added resistance
- 5 normal strength

MOTOR EXAMINATION

- For the metamers between T2 and L1 it is not possible to evaluate a key muscle since in this case they give rise to spinal nerves whose motor roots innervate the intercostals anteriorly, the abdominals and posteriorly the dorsals.
- Therefore, in these muscles it is not possible to select the contraction relating to a single myotomer but it is synergistic and due to the recruitment of motor units arranged on multiple spinal levels, so the motor level will correspond to the sensitive level, identified by the sensitivity examination.


Motricità
D
S
MUSCOLI-CHIAVE
C2
C3
C4
C5
C6
C7
C8
T1
BICIPITE
ESTENSORE RADIALE
TRICIPITE
FLESSORE PROFONDO
ABDUTTORE MIGNOLO
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
L1
L2
L3
L4
L5
S1
PSOAS
QUADRICIPITE
TIBIALE ANT
ESTENSORE ALLUCE
TRICIPITE SURA
S3
S4-5
0 = Paralisi completa
1 = Contrazione palpabile non osservabile
2 = Movimento attivo, in assenza di gravità
3 = Movimento attivo, contro gravità
4 = Movimento attivo, contro lieve resistenza
5 = Movimento attivo, contro piena resistenza
NV = Non valutabile
Contrazione volontaria sfintere anale (sì/no)
Somma
(max)
(50)
+
(50)
(100)
Punteggio motorio

International Standards for the Classification of Spinal Cord Injury

Motor Exam Guide

C7 Elbow Extensors | Triceps

Grade 3

Patient Position: The shoulder is in neutral rotation, adducted, and 90°of flexion. The elbow is fully flexed with the palm of the hand resting by the ear.

Examiner Position: Support the upper arm.

Instructions to Patient: "Straighten your arm."

Action: The patient attempts to move through the full range of elbow extension.

Grades 4 & 5

Patient Position: Same as grade 3, except the elbow is in 45° of flexion.

Examiner Position: Support the upper arm. Grasp the wrist and apply resistance to the distal forearm in the direction of elbow flexion.

Instructions to Patient: "Hold this position. Don't let me bend your elbow."

Action: The patient resists the examiner's pressure and attempts to maintain the position of the elbow in 45° of flexion.

Grade 2

Patient Position: The shoulder is in internal rotation and adducted, with the forearm positioned above the abdomen. The forearm is in neutral pronation/supination. The elbow is fully flexed. When checking Grade 2, sufficient flexion of the shoulder must be permitted to allow the forearm to clear and move over the chest and abdomen.

Examiner Position: Support the patient's arm.

Instructions to Patient: "Straighten your arm."

Action: The patient attempts to move through the full range of elbow extension.

Motor assessment

- The main difference between an ASIA motor assessment and a standard manual muscle test is that the ASIA test is performed with patients in the supine position.

- This position is used because it is important to standardize the testing position and often recently injured patients cannot be moved from the supine position.

- Limb positions are manipulated to vary the effects of gravity (e.g. testing the iliopsoas muscle for a grade 2/5 involves asking the patient to flex the hip from an externally rotated position).

- In addition, there are a few complexities in the ASIA motor assessment. For example, grade 1/5 strength in the upper limbs is tested in the gravity-eliminated position whereas in the lower limbs it is tested I the anti-gravity position, except in the case of the plantarflexor muscles

MOTOR EXAMINATION

- The ASIA *motor level for each side of the body is determined by the most caudal* (distal) key muscle that has at least grade 3/5 (anti-gravity) strength provided all key muscles above have grade 5/5 (normal) strength.

- The motor level for the right side of the body may be different from the left. There are no specified ASIA muscles for the thoracic segments of the spinal cord.

- Consequently, the motor level of patients with thoracic paraplegia (lower limb paralysis but no upper limb weakness) is assumed to correspond with their ASIA sensory level.

MOTOR EXAMINATION

- In the event that the T1 myotomer is intact, and therefore the abductor of the little finger has a score of 5 on muscle examination, and the L2 myotomer is injured, with a score of less than 3 on the iliopsoas, the lesion will have occurred in the range of those metamers for which no key muscle is identifiable. The motor level will therefore correspond to the sensitive level, identified by the sensitivity examination.

Ten rules for ASIA motor testing

1 Test for a grade 3/5 first, then test up or down depending on findings

2 Only downgrade strength if due to neurological deficit. Patients unable to fully cooperate due to pain should not be downgraded

3 Do not test if the patient has a serious contracture (50% or more loss of joint mobility), severe pain or severe spasticity (mark as not testable)

4 Test for a grade 1/5 in the upper limbs with the body segment in its gravity-eliminated position

5 Test for a grade 1/5 in the lower limbs with the body segment in its anti-gravity position (except when testing the plantarflexor muscles)

Ten rules for ASIA motor testing

6 Test for a grade 4/5 in the upper and lower limbs with the body segment in the anti-gravity position (except when testing T1 and SI muscles)

7 Do not use half marks, pluses or minuses

8 Test for grade 2/5, 3/5, 4/5 or 5/5 by asking the patient to move all the way through range. Grade 4/5 and 5/5 should be tested with resistance applied throughout range

9 Ensure that the patient is not performing trick movements (e.g. ensure grade 3/5 elbow extension occurs without the shoulder dropping into extension)

10 Modify testing positions if the patient has loss of extensibility in underlying muscles that span two or more joints (e.g. finger flexion can be tested with the wrist flexed if the patient has shortening of the extrinsic finger flexor muscles)

SENSITIVITY EXAMINATION

- A sensory assessment is used to define two sensory levels: one for the right and one for the left side of the body.
- An ASIA sensory assessment involves testing light touchand pinprick sensation in 28 key points on each side of the body. Each point represents one dermatome .

- For example, a precise spot over the back of the hand and just distal to the metacarpophalangeal (MCP) joint of the third digit represents the C7 dermatome

- The procedure involves examining both tactile sensitivity and superficial pain in each of them, which corresponds to the stimulation of a light rubbing (cotton ball) and a shallow puncture (blunt needle).

SENSITIVITY EXAMINATION

For both of these sensory modalities, three numerical scores and one Not tested result are predicted, indicating untestable.

- 0 = corresponds to absent sensitivity (in the case of pain it can mean the perception of a tactile stimulus)
- 1 = altered indicating both partial and altered or confused
- 2 = normal
- NE = not evaluable

SENSITIVITY EXAMINATION

TABLE 1.3 Definitions of ASIA sensory scores for pinprick and light touch

Grade 0	
Light touch	the patient *cannot consistently distinguish* between being touched and not touched with a light cotton bud
Pinprick	the patient *cannot consistently distinguish* between being touched with the sharp end of a safety pin and touched with the blunt end of a safety pin
Grade 1	
Light touch	the patient *can consistently distinguish* between being touched and not touched with a light cotton bud but light touch *feels different* from light touch on the face (this comparison is tested at each dermatome)
Pinprick	the patient *can consistently distinguish* between being touched with the sharp end of a safety pin and touched with the blunt end of a safety pin BUT the sharp side of the pin *feels different* from the sharp side of the pin on the face (this comparison is tested at each dermatome)
Grade 2	
Light touch	the patient *can consistently distinguish* between being touched and not touched with a light cotton bud AND light touch *feels the same as* light touch on the face (this comparison is tested at each dermatome)
Pinprick	the patient *can consistently distinguish* between being touched with the sharp end of a safety pin and touched with the blunt end of a safety pin and the sharp side of the pin *feels the same as* the sharp side of the pin on the face (this comparison is tested at each dermatome)

SENSITIVITY EXAMINATION

- The ASIA *sensory level for each side of the body is determined by the most caudal* (distal) key point that has grade 2/2 for pinprick and light touch, provided all key points above are also grade 2/2.

- Like the motor assessment, the sensory level for the right side of the body may be different from the left.

- It is also possible to sum the scores for light touch and pinprick of all 28 dermatomes on each side of the body.

- The total possible score is 224.

SENSITIVITY EXAMINATION

- The sensory level is the more caudal one at which a score of 2 was obtained both on the right and on the left in both sensitivity modes tested.
- With the ASIA assessment it is therefore possible to trace both the sensory and motor level, and for both the result can be discriminated between the right and left side; moreover, in the case of sensitivity we have information regarding tactile and superficial pain.

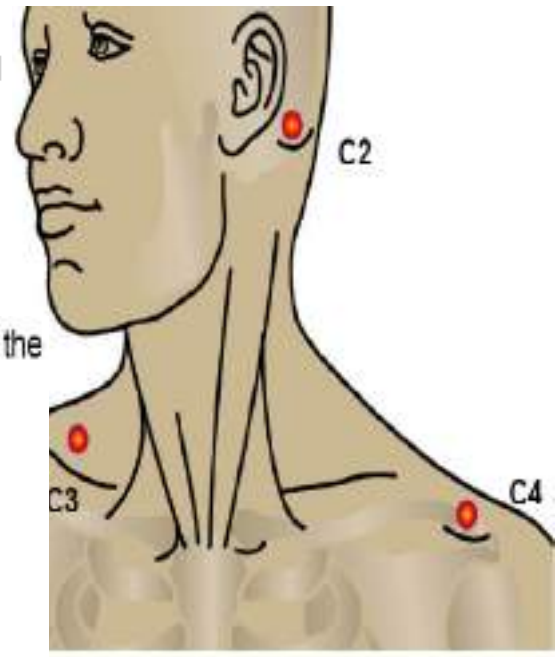
SENSITIVITY EXAMINATION

- But other information can also be collected, not essential for the purpose of the examination but essential in drafting the treatment plan, such as areas of partial innervation.

C2 At least one cm lateral to the occipital protuberance at the base of the skull. Alternately, it can be located at least 3 cm behind the ear.

C3 In the supraclavicular fossa, at the midclavicular line.

C4 Over the acromioclavicular joint.



C5 On the lateral (radial) side of the antecubital fossa just proximal to the elbow (see image below).

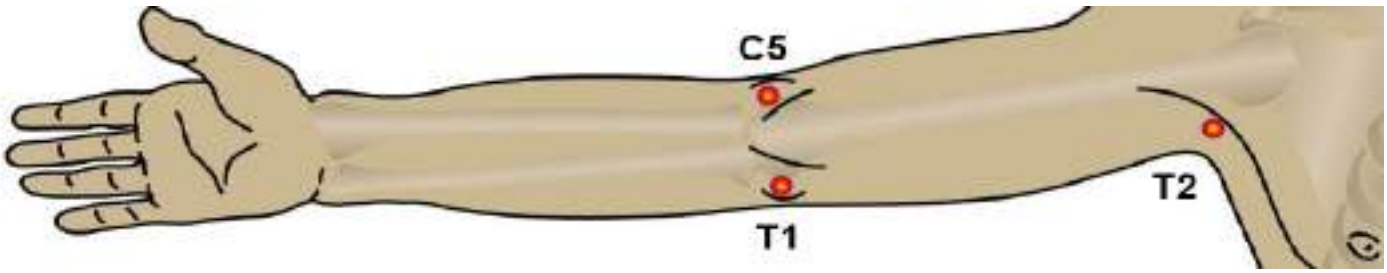
C6 On the dorsal surface of the proximal phalanx of the thumb.

C7 On the dorsal surface of the proximal phalanx of the middle finger.

C8 On the dorsal surface of the proximal phalanx of the little finger.

T1 On the medial (ulnar) side of the antecubital fossa, just proximal to the medial epicondyle of the humerus.

T2 At the apex of the axilla.



SENSITIVE LEVEL IDENTIFICATION

- More caudal dermatome with normal sensory function on both sides

IDENTIFICATION OF THE NEUROLOGICAL LEVEL

- The conserved neurological level therefore corresponds to that metamer that retains normal neurological activity and therefore to the most cranial height at which the motor and sensory level is concomitantly preserved; in practice, the most distal muscle with a score of at least 3 preceded by another with a score of 5 whose metamer is associated with a conserved sensory activity with a score of 2 on both sides.

IDENTIFICATION OF THE NEUROLOGICAL LEVEL

- It is worth specifying that often the motor level and the sensitive level are different on both sides, therefore their differentiated determination is recommended (e.g. to the right C6 motor, C7 sensitive; to the left C7 motor and C6 sensitive) as with this modality it is more correctly described the clinical picture under examination.

IDENTIFICATION OF THE NEUROLOGICAL LEVEL

- More caudal segment in which sensitivity and motility are normal on both sides

TYPE OF NEUROLOGICAL DAMAGE

- FULL INJURY (not sacral sparing)
- INCOMPLETE INJURY (sacral saving)

IDENTIFICATION OF NEUROLOGICAL LEVEL

- Spinal cord injuries are classified as complete (ASIA A) or incomplete (ASIA B, C, D and E).

- The distinction between different ASIA impairments is made on the basis of:

1. Motor function in S4–S5. This is reflected by the ability to voluntarily contract the anal sphincter.
2. Sensory function in S4–S5. This is reflected by appreciation of deep anal pressure or preservation of either light touch or pinprick sensation in the perianal area.
3. Strength in muscles below the motor and neurological level.

- The importance of the S4–S5 segments is linked to prognosis. Its preservation is a strong predictor of neurological recovery. Likewise preservation of pinprick sensation anywhere on the body helps predict motor recovery (this is thought to be due to the proximity of the spinothalamic and corticospinal tracts).

IDENTIFICATION OF NEUROLOGICAL DAMAGE

The A.S.I. A (Impairment A.S.I.A) or modified Frankel classifies spinal cord damage according to whether or not the injury is complete. Five levels are identified:

- A = complete. No neurological function is preserved at the level of the sacral segments
- B = incomplete. Sensory function is preserved but not the motor function below the neurological
- C = incomplete. Motor function is preserved below the neurological level and more than half of the key muscles below the neurological level have a score of less than 3
- D = incomplete. Motor function is preserved below the neurological level, and at least half of the key muscles below the lesion level have a score of 3 or more.
- E = normal. There is no neurological damage, motor and sensory functions are preserved and normal.

The definition of each ASIA impairment is:

- ASIA A: no motor or sensory function in S4–S5.
- ASIA B: preservation of sensory function in S4–S5.
- ASIA C: preservation of sensory function in S4–S5 provided there is also motor function more than three levels below the *motor level OR just preservation of* motor function in S4–S5. In addition, less than grade 3/5 strength (i.e. grades 0/5–2/5) in more than half the key muscles below the *neurological level.*
- ASIA D: preservation of sensory function in S4–S5 provided there is also motor function more than three levels below the *motor level OR preservation of motor* function in S4–S5. In addition, grade 3/5 or more strength (i.e. grades 3/5–5/5) in at least half the key muscles below the *neurological level.*
- ASIA E: normal motor and sensory function.

IDENTIFICATION OF NEUROLOGICAL DAMAGE

- Scale A.S.I.A. it also informs us about the completeness or incompleteness of the lesion, ie whether or not neurological activity is found below the lesion level. This is tested with the anal sensitivity and motility of the external anal sphincter (evaluated with the introduction of an examiner's finger). This is because the fibers relating to the innervation of this region of the body flow into the innermost area of the spinal cord and are therefore generally the ones most difficultly affected by a traumatic injury; it is also understood that if they are damaged, in most cases the other areas will also be damaged.

Complete injuries

- 90% of cases with AIS A at the entrance remain with complete lesions
- the recovery of a neurological level is predictable
- poor functional recovery in pictures that evolve into incomplete lesions

Incomplete injuries

- Cervical and lumbo-sacral lesions are often incomplete due to their anatomical conformation and greater vascularity
- 50% of patients with entry AIS B have a positive prognosis for walking if sacral pain sensitivity is preserved
- 75% of patients with entry AIS C recover their path
- 95% patients with AIS D excellent prognosis

INCOMPLETE SPINAL CORD SYNDROMES

- The latest revision of the International Standard Classification of Spinal Cord Injury defines 5 different spinal cord syndromes of incomplete type, excluding due to its rarity the posterior cord syndrome and the so-called mixed forms, however, not attributable to any of the previous forms.

INCOMPLETE SPINAL CORD SYNDROMES

- The syndromes defined by the International Standards are however not universally accepted given the difficult correspondence between clinical and neuropathological aspects; in fact, the assignment to a clinical picture rather than another is often ambiguous, based only on clinical considerations and not always supported by radiological or anatomical data.

INCOMPLETE SPINAL CORD SYNDROMES

In particular:

- when the spinal cord damage affects more areas, the subjects are classified with more difficulty and are not always attributable to the described pictures (they are the so-called mixed syndromes);
- the neurological lesion associated with the brain or the peripheral nerves requires the implementation of further neurological investigations that facilitate the identification of spinal cord damage;
- Given the complex nature of the spinal cord, it can be said that no two lesions will present exactly the same clinical picture.

INCOMPLETE CLINICAL SYNDROMES according to A.S.I.A .:

- CENTROMIDOLLAR
- BROWN-SEQUARD
- ANTERIOR SPINAL
- MEDULLARY CONE
- CAUDA EQUINA

Centromedullary syndrome

- The lesion that determines the centromedullary syndrome consists, at least initially, in vascular damage at the level of the mid-medullary gray matter ("pencil" lesion), while the longer tracts are relatively spared.
- The development of this type of syndrome occurs mainly due to hyperextension trauma of rigid spine of elderly people. Furthermore, this type of syndrome occurs quite frequently in cases of hematomyelia and syringomyelia.

Centromedullary syndrome

- In hematomyelia, the onset of paralysis occurs rather abruptly and is often accompanied by a sharp and well localized pain in a certain point of the spinal column. In syringomyelia, the syringomyelic cavity mostly tends to be located in the lower part of the cervical cord. This type of injury, in fact, involves the cervical region in particular; while only rarely can it occur at the level of the medullary cone.

Centromedullary syndrome

- Centromedullary syndrome essentially manifests itself with symptoms and signs of the 1st motor neuron in the lower limbs and the 2nd motor neuron in the upper limbs; while sensor deficits are more variable.
- In these patients there is a problematic recovery of the upper limbs. It often happens that the innervation of the distal muscles of the upper limb is relatively spared, but generally, good proximal stability is lacking, so that, in most cases, the upper limb cannot be used functionally.

Centromedullary syndrome

- Recovery generally begins with the proximal extensor muscles and subsequently affects the distal flexors and if the limb is affected by a deficit of thermo-pain sensitivity, recovery occurs before the opposite extremity.

Centromedullary syndrome

- In general, the prognosis for functional outcome is good, as about 70% of patients are able to walk independently upon discharge.
- The most important predictive factor from a functional point of view is the predominant site of the motor deficit: if the deficit prevails in the upper limb, the probability of walking recovery is higher.
- As for the sphincter control deficit, functional recovery occurs from 82% to 89% according to the authors.

Centromedullary syndrome

- In about 50% of cases, there is a good recovery of sphincter control and a motor recovery sufficient for independent walking, with or without aids, even if a certain degree of spasticity in the lower limbs remains.Prognosis is generally inversely proportional to the age of onset of the lesion.

Centromedullary syndrome

To meet the criteria of the International Standards it is characterized as follows:

- motor deficit prevalent in the upper limbs compared to the lower ones as demonstrable by a lower bilateral motor score for the C5T1 segments below the lesion level, compared to the score for the L2-S1 segments;
- level of cervical injury;
- sacral saving;
- neurological bladder (usually urinary retention).

Centromedullary syndrome

- Cervical (central, gray matter) injury
- Upper limb paralysis (with 2nd motor neuron component)
- Partial paralysis of the lower limbs (with strong spasticity due to damage to the cortico-spinal tracts)
- Better prognosis for walking and bladder-sphincter functions, more unfavorable for the recovery of the dexterity of the upper limbs.

Brown-Sèquard syndrome

- Brown-Sèquard syndrome occurs following a lateral hemisection of the medulla.
- The mechanism of injury can be represented by a penetrating wound or by a penetrative trauma to a spine, with a narrower canal, or by intra or extramedullary tumors. Especially as a consequence of dagger or bullet wounds, there will be the manifestation of a "complete" Brown Séquard syndrome; while, in most cases, the hemisection is only partially realized, and certain elements of the syndrome may be missing.

Brown-Sèquard syndrome

- The clinical manifestations characteristic of this syndrome are given by ipsilateral spastic paralysis due to lesion of the pyramidal tracts, loss of proprioceptive, vibratory and pressure sensibility ipsilateral due to lesion of the posterior cords, and, loss of thermal-pain and surface tactile sensitivity in the contralateral tract lateral spinothalamic.

Brown-Sèquard syndrome

- It should be remembered that the fibers entering the spinothalamic tract do not decussate for some segments, so that the level of the contralateral loss of heat pain sensitivity will be some segments lower than the lesional level; the fibers entering the spinal cord at the level of the lesion can be involved before crossing them, causing both a loss of temperature homolaterally to the lesion and a narrow painful area.These patients have about 90% chance of good recovery, both of a functional path without support and for bladder and bowel control.

Brown-Sèquard syndrome

- Ipsilateral sub-lesional motor deficit (cortico-spinal tract)
- Loss of proprioceptive, vibratory and ipsilateral pressure sensitivity (ascending fibers of the dorsal columns)
- Loss of contralateral thermo-pain sensation (ascending spinothalamic fibers)
- Surface tactile sensitivity generally preserved
- Good prognosis for walking and sphincter recovery

Anterior spinal syndrome

- Anterior spinal syndrome more frequently has a vascular origin, but it can also be of traumatic origin. For example, traumatic injuries can occur following a forced flexion, as in the case of a diving accident; while, the vascular causes include: the rupture of an aortic aneurysm, a compression of the cord due to the presence of an angioma, thrombosis of the anterior spinal artery.T
- he anterior spinal artery supplies both the gray and white matter of the anterolateral and posterolateral parts of the spinal cord.

Anterior spinal syndrome

- In this syndrome bilateral sub-lesional motor paralysis is observed, of variable extent, due to the interruption of the cortico-spinal tract and the destruction of the cells of the anterior horns; from the sensory point of view it is possible to observe the bilateral absence of pain, thermal and tactile sensitivity consequent to the damage of the spinothalamic tract, while the discriminative, proprioceptive, vibratory and pallesthetic sensitivity are preserved, thanks to the integrity of the posterior cords. Furthermore, vesico-sphincter disorders are associated.

Anterior spinal syndrome

- Only 10% of patients with this syndrome recover significant functional muscle strength in the lower limbs, 30-40% develop some weak, useless, control of the muscles of the feet and legs, but will not be able to use these muscles in a functional way. for walking and transfer activities. In general, patients have only a 10% to 20% chance of improving muscle strength and in any case always with limited functional results.

Anterior spinal syndrome

To meet the International Standards the following is proposed:

- variable motor deficit evidenced by a lower than normal motor score in at least one myotomer below the lesion level
- loss of thermo-pain sensitivity while the propioceptive is preserved, i.e. a lower than normal score for pain both on the right and on the left under injuries
- normal tactile score below the lesion level

Anterior spinal syndrome

- Motor deficiency under injury
- Loss of pain and heat sensitivity under the injury
- Reduction of superficial tactile sensitivity
- Proprioceptive conservation and deep sub-injury pressure
- Unfavorable prognosis for walking

Medullary cone syndrome

- Medullary cone syndrome follows damage to the lumbosacral cord; generally this damage occurs under L1, at the level of the medullary cone, and of the lumbar roots inside the neuronal canal.
- This syndrome is characterized, from a motor point of view, given the damage to the second motor neuron, by a flaccid and areflexic bladder, intestinal paralysis and flaccid, partial paralysis of the lower limbs; while from the point of view I felt, in this syndrome, a variety of pictures may occur with areas of hypoesthesia alternating with areas of anesthesia or even with intact areas.

Medullary cone syndrome

- Medullary cone syndrome follows damage to the lumbosacral cord; generally this damage occurs under L1, at the level of the medullary cone, and of the lumbar roots inside the neuronal canal

Medullary cone syndrome

- The symptoms will vary in relation to the precise location of the spinal cord injury and the number of anterior and / or posterior roots affected by the damage.
- Sometimes the sacral segments retain reflexes, for example the bulbocavernosum and the reflex of urination, although usually the anal reflex is not functional.

Medullary cone syndrome

- Lower limb flaccid paralysis
- Bladder areflexia and intestinal hypotonia (occasional preservation of sacral reflexes)

Cauda equina syndrome

- Cauda equina syndrome occurs due to a lesion below the medullary cone involving, therefore, the lumbosacral nerve roots within the vertebral specus.
- The most frequent causes of cauda syndromes are represented by intrarachid tumors and herniated discs at the level of L4-LS and L5 -S1.

Cauda equina syndrome

- It manifests itself, from a sensitivity point of view in a very variable way, with areas of hypoesthesia alternating with intact areas or anesthesia and, given the damage at the level of the second motor neuron, with bladder, intestine and areflexic lower limbs, to a variable extent depending on the quantity and quality of damaged fibers.

Cauda equina syndrome

According to some authors it is possible to distinguish in the syndrome of incomplete lesion of the cauda:

- a high variety, involving the roots L2, L3, L4, which manifests itself with paralysis of the quadriceps femoris, hypo-anesthesia in the corresponding root districts and decreased patellar reflex;
- a medium variety, involving the roots L5, SI, S2, characterized by paresis of the muscles innervated by the sciatic, hypo or areflexia achillea, alteration of rectal and genitourinary functions, hypoanesthesia of the foot and of the posterior aspect of the leg and thigh;

Cauda equina syndrome

According to some authors it is possible to distinguish in the syndrome of incomplete lesion of the cauda:

- a low variety, interesting the roots S3, S4, S5, semeiotically similar to the previous one as regards genitourinary disorders (generally more serious), while anesthesia is perineal; bulb-cavernous reflexes are abolished. They lack motor deficits or lower limb atrophy.
- a hemisyndrome of the cauda, characterized by unilateral motor and sensory disorders and by impaired genitourinary function which often represents an initial phase of the incomplete cauda syndrome.

Cauda equina syndrome

- In this type of pathology, as well as in lesions of the medullary cone, given the interruption of the reflex arc, there will be no spasticity, but flaccidity (bladder and intestinal areflexia and flaccid paralysis of the lower limbs), and in both, it will be very important a careful and periodic neurological examination to demonstrate the possible presence of spared nerve roots and the consequent possibility of healing of the root lesion even in the space of six weeks and six months

Cauda equina syndrome

- Compared to the incomplete syndromes of the cauda, in lesions of the medullary cone the impairment of the genitourinary and rectal functions prevails over the motor and sensory symptoms of the two lower limbs. Furthermore, in cone lesions, the symptoms are usually bilateral from the outset, while lesions of the cauda may begin with symptoms prevailing on one side.

Cauda equina syndrome

In order to define inclusion criteria in the International Standards, the two Syndromes are grouped:

- Caudal lesion level at D12
- Motor and sensory score lower than normal for the lumbosacral segments.

Cauda equina syndrome

- Injury of the lumbar sacral roots below the medullary cone within the vertebral canal
- Bladder and intestinal areflexia
- Flaccid paralysis of the lower limbs of varying degrees

GS ITALIA
GRUPPISOLIDARIETÀINTERNAZIONALE

PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Rehabilitation in spinal cord injuries
Lesson: Assessment

1600/3677

EVALUATION OF SPECIFIC VARIABLES
Residual functional capacities

- A scale frequently used to classify the level of functional capacity of the affected person is the F.I.M. (Functional Independence Measure); it explores 18 activities of daily life (6 concerning personal care, 2 sphincter control, 3 transfers, 2 locomotion, 5 communicative and cognitive-relational skills) for each of which it indicates whether the patient is able to provide first person to all the necessary operations, if he needs assistance from third parties or in any case if he uses compensation and adjustments.

F.I.M.

- The National Institute on Disability and Reabilitation Reserch funded a measurement scale in the early 1980s that could be used to assess disability. From the studies that were born it resulted precisely the scale of the Functional Independence Measure, or F.I.M (Functional Indipedence Measure)

F.I.M.

- It explores only some activities related to functional activities for each of which it indicates whether the patient is able to personally provide for all the necessary operations, or if he needs assistance from third parties or in any case if he uses compensation and adaptations.

- From this it appears evident that F.I.M. assess the disability and not the impairment. It also relates to the real abilities of a patient, of which it does not take into account the hypothetical possibilities, and therefore, for example, does not affect the assignment of the score if the patient is unable to perform certain operations due to a real impediment or due to state of depression.

F.I.M

- Instrument for measuring the ability to do certain activities of daily life
- It explores 18 activities divided into 6 functional areas
- Six reference areas have been identified; personal care, sphincter control, mobility, locomotion, communication, interpersonal / communication skills.
- For each of them, moreover, several items have been identified for each of which a score from 1 to 7 can be assigned. 0 does not exist because conceptually each of these operations can be carried out with the assistance of one or more people. The maximum score is 126 while the minimum is 18

Detection criteria

- Evaluate the current and usual execution
- Evaluate what it does in the place where the survey takes place
- It is performed in hospital within 72 hours of admission and within 72 hours of discharge
- Any authorized person can detect it
- Data collected by experts or family members can be used

The FIM can tell us:

- Fixed costs of hospitalization
- Appropriateness of hospitalization
- Effectiveness of hospitalization
- Valuable items
- Correlation with the minutes of assistance
- Duration of hospitalization

FIM

PERSONAL CARE:

- Feeding
- Tightening up
- Washing
- Dressing up upper part
- Dressing up lower part
- Perineal hygiene

FIM

SPHINTERS CONTROL:

- Bladder
- Bowel

TRANSFERS

- Bed
- WC
- Bath/shower

FIM

MOBILITY-LOCOMOTION:

- Walk / wheelchair (at least 50 meters)
- Stairs (flight of 12-14 steps)

COMMUNICATION:

- Understanding
- Expression

RELATIONAL / COGNITIVE SKILLS:

- Relationship with others
- Problem solving
- Memory

A - Feeding

- It includes the use of devices suitable for bringing food to the mouth.
- Including chewing and swallowing, not meal preparation

B - Tightening up

Includes 5 activities

- Brush your teeth
- Comb your hair
- Wash hands
- Wash your face
- Shave or make up (if habitual)

C - Washing

- Wash the body from the neck down excluding the back, with immersion in the tub or shower, or sponging on the bed

D - Dressing up upper part

- The dressing above the waist and the application and removal of prostheses or orthoses when necessary

E - Dressing up lower part

- Dressing below the waist and the application and removal of prostheses or orthoses when necessary

F - Perineal hygiene

- The maintenance of perineal hygiene and the activity of dressing and undressing after using the services or a pan without risk

G - Bladder

- It includes complete voluntary bladder-sphincter control and the use of devices or substances necessary for the control itself

H - Bowel

- It includes complete voluntary or intestinal sphincter control and the use of devices or substances necessary for the control itself

I - Bed-chair-wheelchair transfers

- It includes every aspect of transfers to and from the bed, chair, wheelchair, as well as getting to an upright position if the usual way of locomotion is walking

J - W.C. transfers

- It includes sitting and getting up from the toilet.

K - Bath or shower transfers

- It includes entering a tub or shower cubicle and then exiting it.

L- Walk-wheelchair locomotion

- Includes walking, once the patient is in an upright position, or flat propulsion of a wheelchair, once the patient is seated

M- Stairs

It includes being able to go up and down a flight of 12-14 steps indoors

N- Communication Understanding

- It includes understanding both auditory and visual communication
- self-sufficiency - instructions and discussions of a complex or abstract type
- non self-sufficiency - instructions and interviews relating to elementary needs of daily life

O- Communication Expression

- It includes the ability to express oneself clearly in vocal or non-vocal language
- self-sufficiency - complex ideas and abstract concepts
- non self-sufficiency - simple demands of daily life

P- relationship with others

- It includes the ability to interact with others in therapeutic situations or in social relationships

Q- problem solving

- It includes skills that enable the solution of problems related to everyday life.

R- memory

- Includes the ability to identify and remember what happens in the context of daily life activities both in hospitalization situations and in normal social life

F.I.M

- The scores are divided into three main levels: 7 and 6 indicate self-sufficiency, 5, 4 and 3 indicate partial self-sufficiency, and finally 2 and 1 indicate complete non-self-sufficiency.7- Complete self-sufficiency; all the activities that make up the item in question are performed without risk, without the need for particular changes, without orthopedic aids of any kind and in a reasonably short time.

F.I.M

- 6- Self-sufficiency with adaptations, the activity requires one or more of the following requirements: the use of any device, a longer time than is physiologically reasonable, or precautions to avoid risks.
- 5- Supervision, preparation, adaptations; the patient requires assistance limited to external assistance, to stimuli consisting of indications, suggestions or exhortations, without there being physical contact with the person assisting. Or the person assisting must prepare any aids or prostheses.

F.I.M

- 4- Minimum assistance (subject => 75%); there is only minimal contact between the carer and the patient producing 75% or more of the effort that is required.3- Moderate assistance (subject => 50%); more help than simple physical contact is required or the patient produces an effort between half (50%) and three quarters (75%) of the effort required.

F.I.M

- 2- Intensive assistance (subject => 25%); the patient produces between 25% and 49% of the required effort.
- 1- Total assistance (subject => 0%); the patient produces less than 25% of the required effortF.I.M. it is administered upon entry into the ward and upon discharge, and is a clear indicator of the effectiveness of the treatment.

FIM SCORING

7 - Complete Independence (reasonable time, safety conditions, no aids, no orthoses) 6 - Modified Independence (adaptations, longer time, risk, aids, orthoses,)	No assistance or supervision
5 - Supervision, predisposition (no physical contact) 4 - Minimum assistance (pcs performs 75%) 3 - Medium assistance (patients perform between 74 and 50%) 2 - Intensive assistance (patients perform between 49 and 25%) 1 - Complete assistance (<25%) (1 or 2 operators)Walk / wheelchair (at least 50 meters) distance = or <15m = 2Stairs (flight of 12-14 steps) 4-6 steps = 2	Assistance variable expressed as a percentage

Codice paziente | | | | |

22. FUNCTIONAL INDEPENDENCE MEASURE (FIM)

LIVELLI		
	7. Autosufficienza completa 6. Autosufficienza con adattamenti	SENZA ASSISTENZA
	NON-AUTOSUFFICIENZA PARZIALE 5. Supervisione-predisposizioni/adattamenti 4. Assistenza minima (paziente => 75%) 3. Assistenza moderata (paziente => 50%)	CON ASSISTENZA
	NON-AUTOSUFFICIENZA COMPLETA 2. Assistenza intensa (paziente => 25%) 1. Assistenza totale (paziente => 0%)	CON ASSISTENZA

	INGRESSO	DIMISSIONE
Cura della persona		
A. Nutrirsi		
B. Rassettarsi		
C. Lavarsi		
D. Vestirsi, dalla vita in su		
E. Vestirsi, dalla vita in giù		
F. Igiene perineale		
Controllo sfinterico		
G. Vescica		
H. Alvo		
Mobilità		
Trasferimenti		
I. Letto-sedia-carrozzina		
J. W.C.		
K. Vasca o doccia		
Locomozione		
L. Cammino, carrozzina		
M. Scale		
Comunicazione		
N. Comprensione		
O. Espressione		
Capacità relazionali/cognitive		
P. Rapporto con gli altri		
Q. Soluzione di problemi		
R. Memoria		
PUNTEGGIO TOTALE FIM		

Attenzione: non lasciare caselle bianche. Assegnare il punteggio 1 alle attività non valutabili per motivi di sicurezza del paziente

EVALUATION OF SPECIFIC VARIABLES
Neurological assessment

- To complete the clinical picture, to address any diagnostic investigations and monitor evolution, it is also necessary to evaluate proprioceptive sensitivity, osteotendinous reflexes, muscle tone, reflex spasms, clones and carry out a more detailed evaluation of the motor function, which investigates also muscles not considered "key", especially in incomplete lesions and cervical lesions

Spasticity

- Spasticity is present in up to 80% of patients with spinal cord injury.
- It is only present in patients with intact lower motor neurons so is not present in patients with cauda equina injuries.
- Spasticity is more troublesome for patients with incomplete rather than complete lesions, and tends to gradually increase over the first year before it plateaus.
- The increase may be due to neural sprouting or changes in the sensitivity of neural receptors.
- Spasticity can be elicited with many stimuli but stretch and touch are the most common.

Spasticity

- Sudden increases in spasticity are usually indicative of illness or injury, or an over-distended bladder or bowel.
- Many tests are used to quantify spasticity but the two most widely used are the Tardieu Scale and the Modified Ashworth Scale.
- The usefulness of these and other tests of spasticity is widely debated.

Spasticity

- The neurophysiology of spasticity is complex and not fully understood.
- It can have many different features but the two key ones are an abnormal and velocity-dependent increase in resistance to stretch.
- Spinal cord injury changes the excitability of the tonic and phasic stretch reflexes, which are controlled by the balance of excitatory and inhibitory inputs onto alpha motor neurons.
- These inputs arise from a large number of segmental and descending neural circuits.
- There are many theories about precisely how and to what extent these circuits are disrupted, and which disruption is most important.

Spasticity

- Until recently it was believed that spasticity primarily resulted from unchecked hyperactivity of gamma motor neurons, driving intrafusal muscle fibres and increasing reflex facilitation of alpha motor neurons.

- However, the importance of gamma motor activity has been disputed, and spasticity is now believed to be due primarily to a direct increase in the excitability of the alpha motor neurons.

- This may be related to enhanced sensitivity of the alpha motor neurons.

Spasticity

- The increased excitability of the alpha motor neurons is also thought to be due to a loss in the normal dampening effects of the descending fibres of the corticospinal tract.

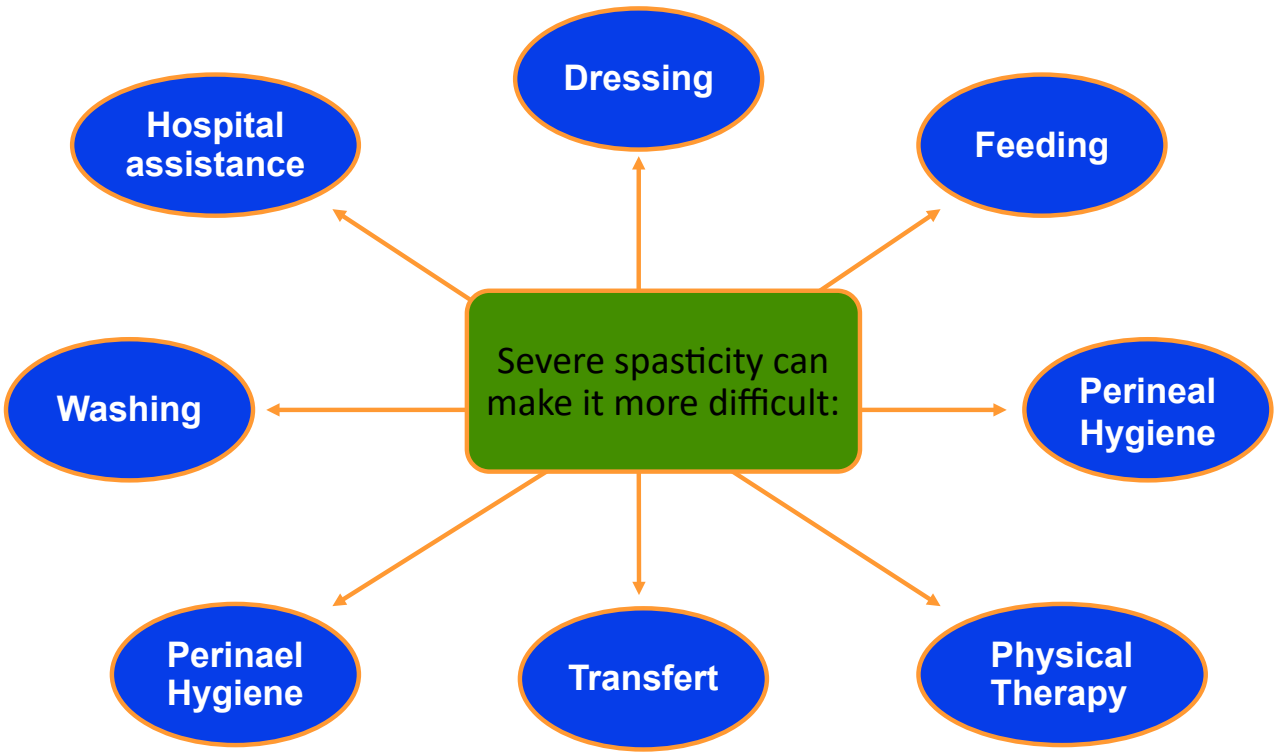
- With less dampening, the alpha motor neurons are more excitable and responsive to sensory inputs.

- The alpha motor neurons of antagonistic muscles are also easily excited because there is a loss of activity in the cells which are responsible for reciprocal inhibition (i.e. Renshaw cells).

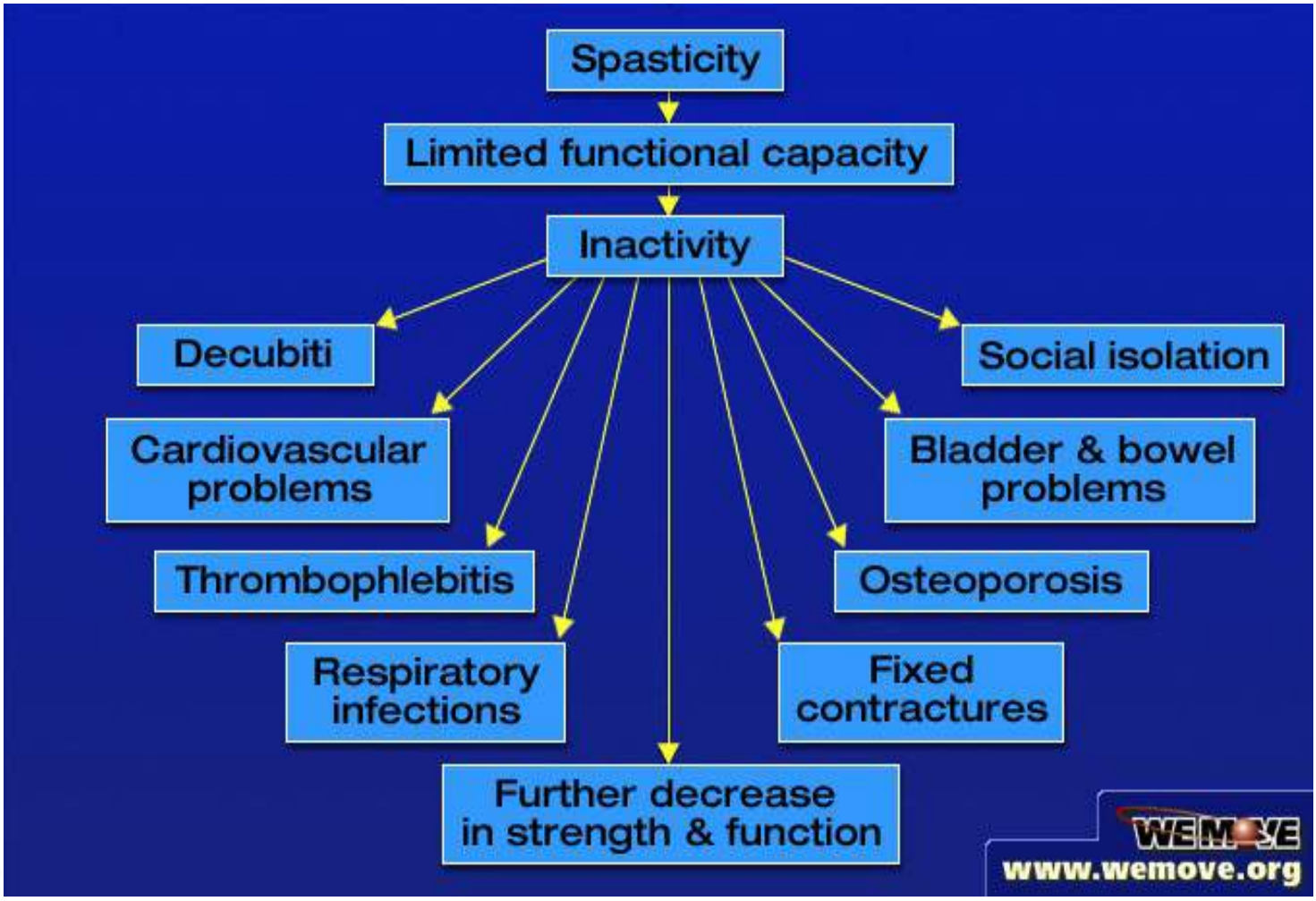
Spasticity

- Present in complete lesions with lesion of short level, to the distal districts
- Present in incomplete lesions
- Sometimes present above the motor level
- Can be:
  - Useful
  - Harmful
- Patterns: Extremely varied depending on the level of lesion and the possible coexistence of peripheral damage

Consequences of spasticity for the ADL



Impact of the spasticity



EVALUATION OF SPECIFIC VARIABLES
Neurological assessment

- For the assessment of spasticity the most frequently used scale is the MAS (modified Ashworth scale) while for the frequency of spasms the Penn scale.

M.A.S.

- Bohannon and Smith in 1987 modified the original Ashworth scale by inserting a new score category (1+) in order to make it more sensitive.
- The MAS is a 6-level scale with which muscle tone is assessed, an element that has a great impact on functional skills; an increase in this tone after a spinal cord injury indicates the end of the spinal shock phase.
- The MAS has a fair sensitivity, the intra-examiner variability is quite good, less that between inter-examiner, especially in the evaluation of the lower limbs.

M.A.S. (Modified Ashworth)

TABLE 1.4 Modified Ashworth Scale	
0	No increase in muscle tone
1	Slight increase in muscle tone, manifested by a catch and release or by minimal resistance at the end of range of motion when the affected part(s) is moved in flexion or extension
1+	Slight increase in muscle tone, manifested by a catch, followed by minimal resistance throughout the remainder (less than half) of the range of motion
2	More marked increase in muscle tone through most of the range of motion but affected part(s) easily moved
3	Considerable increase in muscle tone, passive movement difficult
4	Affected part(s) rigid in flexion or extension

Reproduced from Bohannon RW, Andrews AW: Interrater reliability of hand-held dynamometry. Phys Ther 1987; 67:931–933, with permission of the American Physical Therapy Association.

EVALUATION OF SPECIFIC VARIABLES
Osteoarticular assessment

- The assessment of the joint range is of the goniometric type, the one relating to the shortening of the biarticular muscles refers to muscle length tests.

EVALUATION OF SPECIFIC VARIABLES
Respiratory capacity

- The evaluation includes:
  - detection of vital parameters (heart rate, respiratory rate, blood pressure, temperature, arterial oxygen saturation monitoring)
  - auscultation with phonendoscope (presence of secretions-crackles, rales, presence of whistles, wheezing-bronchospasm-inflammatory problems);
  - instrumental investigations (chest x-ray, blood gas analysis, CT scan)

EVALUATION OF SPECIFIC VARIABLES
Respiratory capacity

- The evaluation includes:
  - spirometry: detection of the actual volumes of filling and emptying of the lungs and evaluation of the strength of the airflow;
  - evaluation of secretions and cough efficacy;
  - assessment of the mobility of the chest wall and paradoxical movements (retractions at the level of the intercostal spaces during inspiration, abnormal abdominal expansion with respect to the chest wall during inspiration, etc.);

EVALUATION OF SPECIFIC VARIABLES Balance (from sitting to carpet, standing)

- The assessment includes the static balance (maintaining a position) and the static-dynamic one (maintaining a position while being asked to perform an activity).
- On the carpet:
  - long-sitting position with and without upper limbs in support;
  - short-sitting position with and without upper limbs in support;

BALANCE EVALUATION

- Seated base extended long sitting
- Seated narrow base or short sitting
- Standing with or without support
- Observation and evocation of equilibrium reactions

- StaticStatic-DynamicPresence of parachute reactions

MOVING IN BED

- Lateral movements, on one side, supine prone and vice versa

STRAIGHTENING SEQUENCES

- Supine-seated
- Sitting upright
- Quadruped position
- Kneeling position
- Get up off the ground

BALANCE EVALUATION

- Observation and evocation of balance reactions and / or parachutes:
- Add standing

Long-sitting with upper limbs / trunk support

↓

Long-sitting without upper limbs / trunk support

↓

Short-sitting with upper limbs / trunk support

↓

Short-sitting without upper limbs / trunk support

↓

Prove d' Equilibrio dinamico

EVALUATION OF SPECIFIC VARIABLES
Pain

- Two-thirds of patients with vertebro-medullary injury report sub-injury pain (in 65% of cases it is chronic) and in one third of these it is severe and debilitating.
- The verbal description that patients use to connote the pain symptom is very rich and varied.
- The terms most often referred to are "burning" which correlates significantly with neuropathic pain and "aching" which mostly identifies supralesional musculoskeletal nociceptive pain.

EVALUATION OF SPECIFIC VARIABLES
Pain

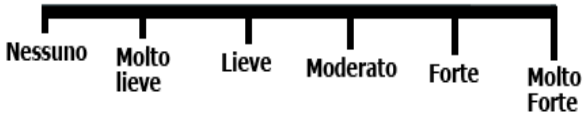
- Many scales have been tested in assessing the quality and intensity of pain, but the universally accepted one is the analog-visual scale (VAS), transposition of the subjective pain sensation into scales displayed in numerical form (e.g. from 0 to 10) or simplified graphics (e.g. a segment within which the patient must indicate his degree of pain)

INTENSITY OF PAIN

- Visual Analog Scale (VAS)

- Numerical Rating Scale (NRS)

- Verbal Rating Scale (VRS)



EVALUATION OF SPECIFIC VARIABLES
Residual functional capacities

- Since 1997, Catz and collaborators have devised a new functional rating scale specific for spinal cord injury (SCIM). In 2007, the results of an international multicentre study were published (participation of 14 centers from around the world) in which the use of SCIM was validated as a reliable quantitative representation of the independence achieved after spinal cord injury. Although a specific validation study has not yet been carried out for our country, the SCIM scale is currently used in the Italian Spinal Units as a measure for functional evaluation for both clinical and research purposes.

Spinal Cord Independence Measures (SCIM)

- The SCIM was developed specifically for patients with spinal cord injury and contains 16 items covering self-care (four items), respiration and sphincter management (four items), and mobility (eight items).

- The original SCIM was modified in 2001 and more recently a questionnaire version has been devised.

SCIM (Spinal Cord Independence Measure)

- S.C.I.M. provides for some fundamental functional areas
- A score was assigned to each functional activity based on its relative weight on the overall activity
- The areas of function analyzed, with the different subgroups are: personal care concerning nutrition, hygiene, clothing, tidying up (subtotal 0 - 20); breathing and sphincter control relating to bladder and intestine (subtotal 0 - 40); mobility both in bed and indoors / outdoors (subtotal 0 - 40).
- The maximum score is 100, the minimum is 0 (complete dependence).

PERSONAL CARE

1. Eating (cutting, opening containers, pouring, bringing food to the mouth, holding a cup with liquids)

- 0 = requires parenteral nutrition, gastrostomy or complete assistance to feed by mouth
- 1 = needs partial assistance to eat and / or drink, or to wear aids
- 2 = eats independently, needs aids or assistance only to cut food and / or pour and / or open containers
- 3 = eats and drinks independently; it does not require assistance or aids

PERSONAL CARE

2. Washing (soaping, rinsing, wiping body and head, manipulating the tap)

A. upper body

B. 0 = requires full assistance

1 = requires partial assistance

2 = washes autonomously, with aids, or in particular conditions (comfortable / shower chair, grab bars)

3 = washes autonomously, does not require aids or special adaptations

PERSONAL CARE

3. Getting dressed (clothes, shoes and permanent orthoses: putting them on, dressing and undressing)

- A. upper body
- 0 = requires total assistance
- 1 = requires partial assistance with clothes without buttons or zippers or laces
- 2 = dresses independently with clothes without buttons, laces and zippers; requires specific aids or adaptations
- 3 = dresses independently with clothes without buttons, laces and zippers; it does not require specific adaptations, it needs assistance or specific adaptations only for buttons, laces and zips
- 4 = dresses (any clothing) independently, does not require specific aids or adaptations

PERSONAL CARE

4.Toilette (wash face and hands, brush teeth, comb, shave, make up)

- 0 = requires total assistance
- 1 = requires partial assistance
- 2 = autonomous with aids
- 3 = autonomous without aids

- SUBTOTAL

BREATHING AND SPHINCTER MANAGEMENT

5. Breathing

0 = requires tracheal tube and permanent or intermittent controlled ventilation

2 = breathe autonomously with tracheal tube: requires O2, a lot of assistance in coughing or managing the tracheal tube

4 = breathes autonomously with the tube, requires minimal assistance in coughing and / or managing the tracheal tube

6 = breathe autonomously without tracheal tube: requires O2, lots of cough assistance, use of CPAP or BIPAP mask

8 = Breathing autonomously without tracheal tube requires minimal assistance or cough stimulation

10 = breathe autonomously without aids or assistance

BREATHING AND SPHINCTER MANAGEMENT

6. Sphincter management: bladder

- 0 = indwelling catheter
- 3 = residual urine volume> 100 cc; no regular catheterization or assisted intermittent catheterization
- 6 = residual urinary volume <100 cc or intermittent self-catheterization; needs assistance for the application of drainage tools
- 9 = intermittent self-catheterization, uses external drainage tools but does not require assistance for application
- 11 = intermittent autocaterism; continent between catheterisms, does not use external drainage tools
- 13 = residual urinary volume <100 cc, only needs external urine drainage, no drainage assistance required
- 15 = residual urinary volume <100 cc, continent, does not use external drainage tools

BREATHING AND SPHINCTER MANAGEMENT

7. Sphincter management: intestine

- 0 = irregular or very low frequency (less than once every three days) of bowel emptying
- 5 = regular attendance but requires assistance (example for the application of the suppository); rare episodes of incontinence (less than twice a month)
- 8 = regular unassisted bowel emptying, rare episodes of incontinence (less than twice a month)
- 10 = regular bowel emptying without assistance and without incontinence

BREATHING AND SPHINCTER MANAGEMENT

8. Use of the toilet (perineal hygiene, arranging clothes before and after, use of towels or sanitary napkins, toilet paper)

- 0 = requires total assistance
- 1 = requires partial assistance; it does not clean itself
- 2 = requires partial assistance cleans itself
- 4 = use the toilet autonomously for all the planned actions but needs aids or special adaptations (e.g. grab bars)
- 5 = use the toilet autonomously, does not require aids or adaptations

MOBILITY (room and bathroom)

- 9. Mobility in bed and actions to prevent pressure ulcers
- 0 = needs assistance in all activities: rotate upper body in bed, rotate lower body in bed, sit in bed, relieve the pressure of the ischium in the wheelchair by lifting, with or without aids but not with electrical devices
- 2 = performs one of the above activities without assistance
- 4 = performs two or three of the above activities without assistance
- 6 = performs all bedside mobility and pressure relief activities autonomously

MOBILITY (room and bathroom)

10.Transfers: bed-wheelchair (braking the wheelchair, raising the footrests, removing and adjusting the armrests / side rails, relocating, lift your feet)

- 0 = requires full assistance
- 1 = requires partial assistance and / or supervision and / or aids (e.g. tablet)2 = autonomous (or does not require a wheelchair)

MOBILITY (room and bathroom)

11.Transfers: wheelchair-toilet (if you use the comfortable: transfer to and from; if you use the manual wheelchair: brake the wheelchair, place the footrests, remove place the armrests, move and lift the feet)

- 0 = requires full assistance
- 1 = requires partial assistance and / or supervision and / or aids (e.g. grab bars)
- 2 = autonomous (or does not require a wheelchair)

MOBILITY (internal and external on a flat surface)

12. Mobility for internal enviroments:

- 0 = requires total assistance
- 1 = requires electric wheelchair or partial assistance to use a manual wheelchair
- 2 = moves autonomously in a manual wheelchair
- 3 = requires walking supervision (with or without aids)
- 4 = walk with a walker or with Canadians (swinging)
- 5 = walk with crutches or with two sticks (walking with alternating step)
- 6 = walk with a cane
- 7 = requires only lower limb orthosis8 = walk unaided and without aids

MOBILITY (internal and external on a flat surface)

13. Mobility for medium distances (from 10 to 100 meters)

- 0 = requires total assistance
- 1 = requires electric wheelchair or partial assistance to use a manual wheelchair
- 2 = moves autonomously in a manual wheelchair
- 3 = requires walking supervision (with or without aids)
- 4 = walk with a walker or with Canadians (swinging)
- 5 = walk with Canadians or with two sticks (I walk with alternating step)
- 6 = walk with a cane
- 7 = requires only lower limb orthosis8 = walk without assistance and without aids

MOBILITY (internal and external on a flat surface)

14. Outdoor mobility (more than 100 meters)0 = requires total assistance

- 1 = requires electric wheelchair or partial assistance to use a manual wheelchair
- 2 = moves autonomously in a manual wheelchair
- 3 = requires walking supervision (with or without aids)
- 4 = walk with a walker or with Canadians (swinging)
- 5 = walk with Canadians or with two sticks (I walk with alternating step)
- 6 = walk with a cane
- 7 = requires only lower limb orthosis8 = walk unaided and without aids

MOBILITY (internal and external on a flat surface)

15. Take the stairs

- 0 = unable to go up or down stairs
- 1 = goes up or down at least 3 steps with the assistance or supervision of another person
- 2 = go up or down at least 3 steps with the support of a handrail and / or Canadian or cane
- 3 = climbs at least 3 steps without any support or supervision

MOBILITY (internal and external on a flat surface)

16. Transfers: wheelchair-car (approaching the car, braking the wheelchair, removing the armrests and footreststransfer in and out of the car, put the wheelchair in and out of the car)

- 0 = requires total assistance
- 1 = requires partial and / or supervised assistance and / or aids
- 2 = autonomous in the transfer, does not require aids (or does not require a wheelchair

MOBILITY (internal and external on a flat surface)

17.Transfers: land – wheelchair

- 0 = requires assistance
- 1 = autonomous in the transfer with or without aids (or does not require a wheelchair

EVALUATION OF SPECIFIC VARIABLES Skin integrity

- Pressure ulcers are feared complications in the subject with spinal cord injury, therefore prevention is important and must be implemented trying to maintain the integrity of the skin, avoid rubbing especially during transfers, avoid burns, erythema, chilblains and treating the personal hygiene.

EVALUATION OF SPECIFIC VARIABLES Skin integrity

Pressure ulcers are areas of necrosis of skin, fat or muscle tissue usually overlying a bony prominence. 4 degrees of staging are identifiable:

- 1st: erythema not reversible to acupressure or alternatively skin detachment, heat and hardening of a circumscribed area;
- 2nd: partial type lesion involving the epidermis or dermis; the ulcer is superficial and looks like an abrasion, a blister or a slight cavity;

EVALUATION OF SPECIFIC VARIABLES Skin integrity

4 degrees of staging are identifiable:

- 3rd: full thickness lesion with necrosis of the skin tissue; the ulcer looks like a deep cavity with serous and / or purulent exudate;
- 4th: tissue necrosis with involvement of the muscle bands and / or bone tissue; it often has a dark-colored (brown-black) crust or a purulent-serous type of exudate.

Braden Scale

- The Braden Scale is commonly used as a tool for risk assessment.
- Braden Scale is the most commonly used tool to assess the risk of pressure injuries, although this is not the best assessment tool for spinal cord injury patients
- The Braden Scale consists of four steps (1), (2), (3), and (4) for six items, sensory perception, moisture, activity, mobility, nutrition, and friction and shear, with 1 highest risk and 4 lowest risk

Braden Scale

- Friction and shear phenomenon are evaluated in three stages, and the score is distributed in 6–23 points.
- The lower the score, the greater the risk of pressure injuries.
- A score of 19–23 is no risk, and a score of 9 or less is a very high risk. 11–19 points are managed as subjects with compression ulcers.

BRADEN SCALE – For Predicting Pressure Sore Risk

SEVERE RISK: Total score ≤ 9 **HIGH RISK**: Total score 10-12
MODERATE RISK: Total score 13-14 **MILD RISK**: Total score 15-18

DATE OF ASSESS ➧

RISK FACTOR	SCORE/DESCRIPTION				1	2	3	4
SENSORY PERCEPTION Ability to respond meaningfully to pressure-related discomfort	**1. COMPLETELY LIMITED** – Unresponsive (does not moan, flinch, or grasp) to painful stimuli, due to diminished level of consciousness or sedation, **OR** limited ability to feel pain over most of body surface.	**2. VERY LIMITED** – Responds only to painful stimuli. Cannot communicate discomfort except by moaning or restlessness, **OR** has a sensory impairment which limits the ability to feel pain or discomfort over ½ of body.	**3. SLIGHTLY LIMITED** – Responds to verbal commands but cannot always communicate discomfort or need to be turned, **OR** has some sensory impairment which limits ability to feel pain or discomfort in 1 or 2 extremities.	**4. NO IMPAIRMENT** – Responds to verbal commands. Has no sensory deficit which would limit ability to feel or voice pain or discomfort.				
MOISTURE Degree to which skin is exposed to moisture	**1. CONSTANTLY MOIST**– Skin is kept moist almost constantly by perspiration, urine, etc. Dampness is detected every time patient is moved or turned.	**2. OFTEN MOIST** – Skin is often but not always moist. Linen must be changed at least once a shift.	**3. OCCASIONALLY MOIST** – Skin is occasionally moist; requiring an extra linen change approximately once a day.	**4. RARELY MOIST** – Skin is usually dry; linen only requires changing at routine intervals.				
ACTIVITY Degree of physical activity	**1. BEDFAST** – Confined to bed.	**2. CHAIRFAST** – Ability to walk severely limited or nonexistent. Cannot bear own weight and/or must be assisted into chair or wheelchair.	**3. WALKS OCCASIONALLY** – Walks occasionally during day, but for very short distances, with or without assistance. Spends majority of each shift in bed or chair.	**4. WALKS FREQUENTLY** – Walks outside the room at least twice a day and inside room at least once every 2 hours during waking hours.				
MOBILITY Ability to change and control body position	**1. COMPLETELY IMMOBILE** – Does not make even slight changes in body or extremity position without assistance.	**2. VERY LIMITED** – Makes occasional slight changes in body or extremity position but unable to make frequent or significant changes independently.	**3. SLIGHTLY LIMITED** – Makes frequent though slight changes in body or extremity position independently.	**4. NO LIMITATIONS** – Makes major and frequent changes in position without assistance.				
NUTRITION Usual food intake pattern [1]NPO: Nothing by mouth. [2]IV: Intravenously [3]TPN: Total parenteral nutrition.	**1. VERY POOR** – Never eats a complete meal. Rarely eats more than 1/3 of any food offered. Eats 2 servings or less of protein (meat or dairy products) per day. Takes fluids poorly. Does not take a liquid dietary supplement, **OR** is NPO[1] and/or maintained on clear liquids or IV[2] for more than 5 days.	**2. PROBABLY INADEQUATE** – Rarely eats a complete meal and generally eats only about ½ of any food offered. Protein intake includes only 3 servings of meat or dairy products per day. Occasionally will take a dietary supplement **OR** receives less than optimum amount of liquid diet or tube feeding.	**3. ADEQUATE** – Eats over half of most meals. Eats a total of 4 servings of protein (meat, dairy products) each day. Occasionally refuses a meal, but will usually take a supplement if offered, **OR** is on a tube feeding or TPN[3] regimen, which probably meets most of nutritional needs.	**4. EXCELLENT** – Eats most of every meal. Never refuses a meal. Usually eats a total of 4 or more servings of meat and dairy products. Occasionally eats between meals. Does not require supplementation.				
FRICTION AND SHEAR	**1. PROBLEM**- Requires moderate to maximum assistance in moving. Complete lifting without sliding against sheets is impossible. Frequently slides down in bed or chair, requiring frequent repositioning with maximum assistance. Spasticity, contractures, or agitation leads to almost constant friction.	**2. POTENTIAL PROBLEM**– Moves feebly or requires minimum assistance. During a move, skin probably slides to some extent against sheets, chair, restraints, or other devices. Maintains relatively good position in chair or bed most of the time but occasionally slides down.	**3. NO APPARENT PROBLEM** – Moves in bed and in chair independently and has sufficient muscle strength to lift up completely during move. Maintains good position in bed or chair at all times.					
TOTAL SCORE	**Total score of 12 or less represents HIGH RISK**							

ASSESS	DATE	EVALUATOR SIGNATURE/TITLE	ASSESS.	DATE	EVALUATOR SIGNATURE/TITLE
1	/ /		3	/ /	
2	/ /		4	/ /	

NAME-Last First Middle	Attending Physician	Record No.	Room/Bed

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BRADEN SCALE

EVALUATION OF SPECIFIC VARIABLES
Posture

- Observation of the resting posture
- Verification of alignment by palpation of bone marks
- Observation of postural changes during functional activities

- Important: There is an "ideal" reference posture but it is not necessarily binding, indeed it can sometimes be harmfulEach patient has his own posture !!!!

EVALUATION OF SPECIFIC VARIABLES

Posture (supine, sitting, standing):

The assessment of posture is carried out by observing the symmetry of body alignment (head, tracks, spine, limbs) on the frontal, horizontal and sagittal plane in the following positions:

- in bed first in the supine position and then in the semi-sitting position;
- sitting in a wheelchair;
- on your feet if possible;

EVALUATION OF SPECIFIC VARIABLES

Posture (supine, sitting, standing):

- On the frontal level, any asymmetries in the alignment of the shoulders, lateral deviations of the spine, asymmetries of the pelvic alignment, dysmetria of the limbs are observed.
- On the sagittal plane, any kyphosis and lordosis, anti / retroversion of the pelvis are observed; on the horizontal plane any rotations of the tracks;

EVALUATION OF SPECIFIC VARIABLES
Posture (supine, sitting, standing):

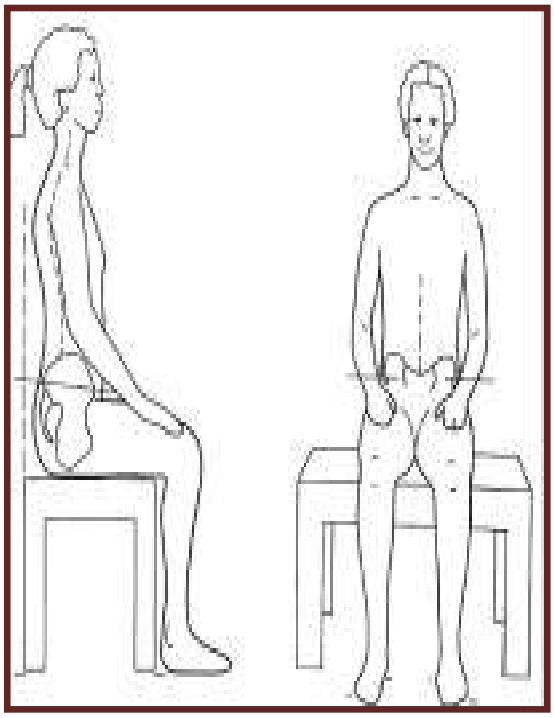
In the standing position in addition to the aforementioned alterations: frontal plane:

- the deviation of the physiological axis of the knees (valgus / varus) and ankles (inversion / eversion);
- sagittal plane: the physiological alteration of the alignment of the knees (hyperextension / accentuated flexion) and of the ankles (inversion / eversion);

EVALUATION OF SPECIFIC VARIABLES
Posture (supine, sitting, standing):

- These postural alterations may or may not be reducible in relation to the etiology (pre-existing dimorphisms, leg length discrepancy, anthropometric differences in the lower limbs, previous and / or associated joint limitations, muscle imbalances, spasticity, motor prevalence due to motor control asymmetry, stabilization results surgical, etc.).

REFERENCE IDEAL POSTURE



- Head erect, aligned with the column, centered, with a horizontal gaze
- Trunk erect, symmetrical and with the physiological curves of the spine preserved
- Pelvis in neutral or slightly anteversion position (SIAS at the same level or slightly lower than SIPS in the sagittal plane; on the horizontal plane the two SIAS are aligned)
- Hips flexed to 80-90 ° and slightly abducted
- Knees flexed at 80-110 °Ankles in zero position
- Upper limbs with relaxed shoulders, arms free to move functionally

Evaluate postural alignment in the three reference planes ...

- WHAT TO OBSERVE?

- Head
- Shoulders
- Trunk
- Hip bone
- Lower limbs
- Foot

SPALLE

Elevazione

	Elevazione destra			Elevazione sinistra	
Fissa •	Riducibile •		Nessuna •	Fissa •	Riducibile •

Depressione

	Depressione destra			Depressione sinistra	
Fissa •	Riducibile •		Nessuna •	Fissa •	Riducibile •

TRONCO

Scoliosi

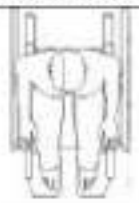
	indicare con una freccia le concavità			indicare con una freccia le concavità	
Fissa •	Riducibile •		Nessuna •	Fissa •	Riducibile •

TRONCO

Rotazione

Destra (~ °)

Fissa • Riducibile •



Nessuna •

Sinistra (~ °)

Fissa • Riducibile •

Cifosi - Lordosi

Cifosi

Fissa • Riducibile •

Curve fisiologiche •

Lordosi

Fissa • Riducibile •

Flessione - Estensione

Flessione

Fissa • Riducibile •

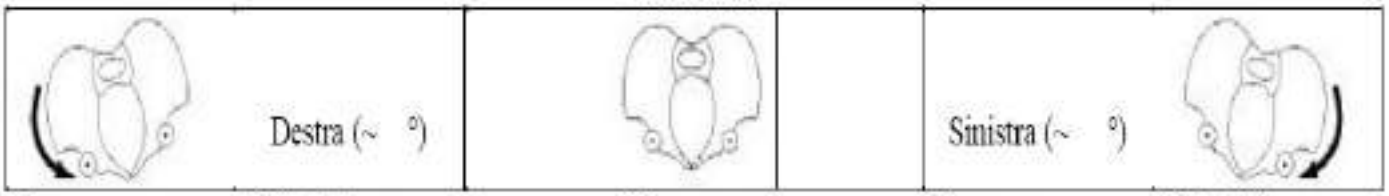
Nessuna •

Estensione

Fissa • Riducibile •

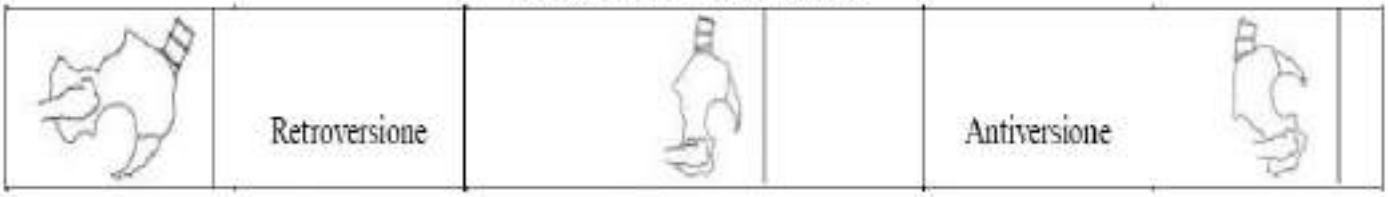
BACINO

Rotazione



Fissa • Riducibile • Nessuna • Fissa • Riducibile •

Antiversione - Retroversione



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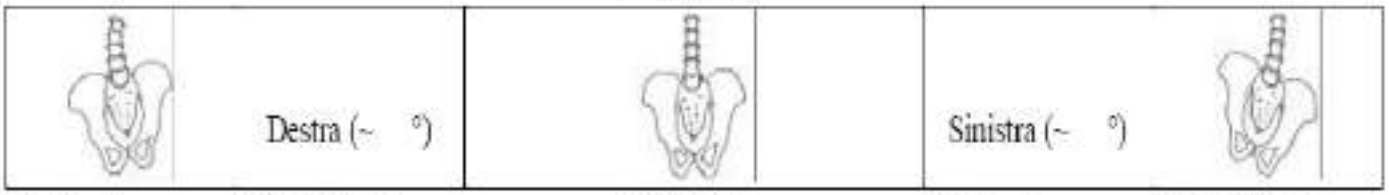
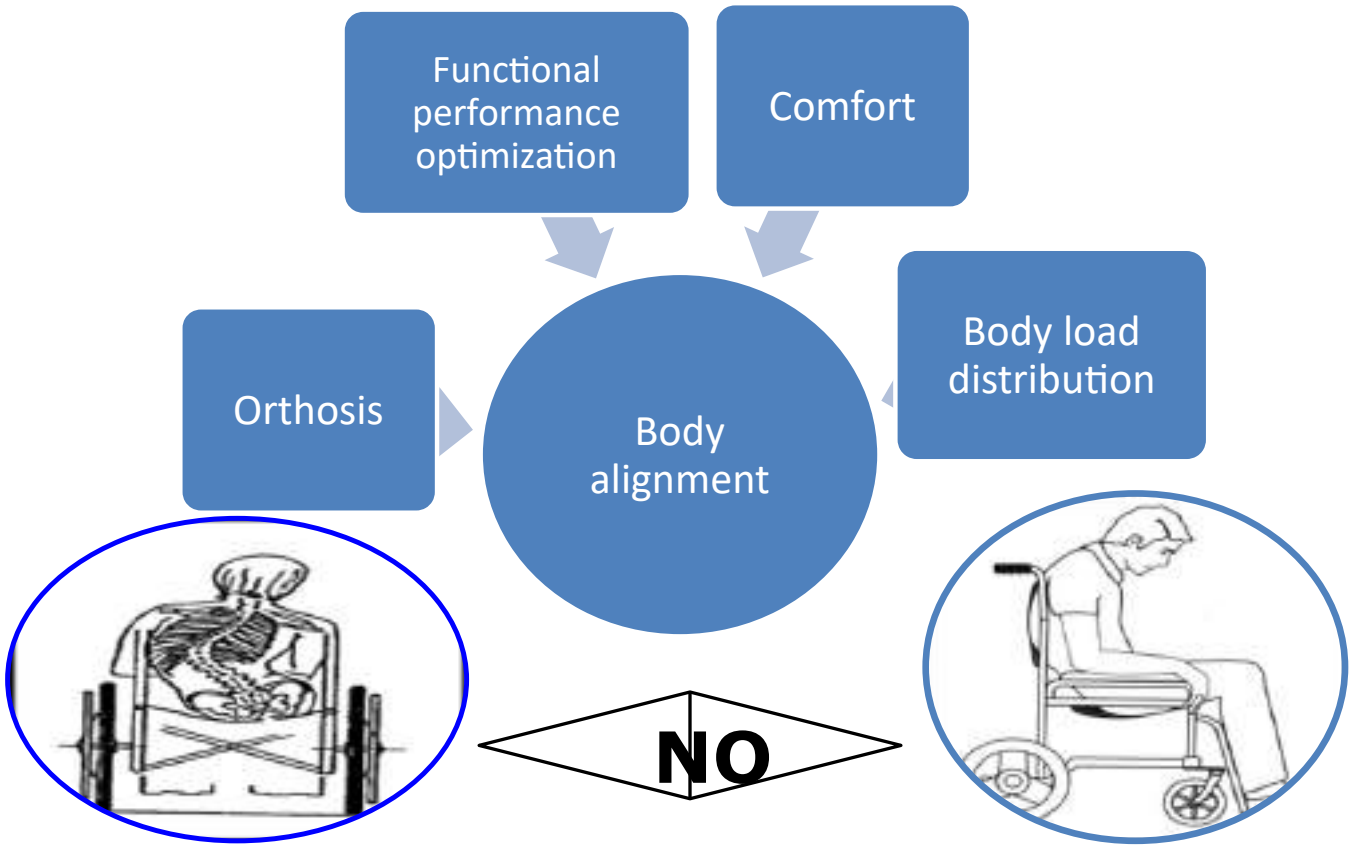
Inclinazione



Fissa • Riducibile • Nessuna • Fissa • Riducibile •

Obliged posture? Editable? Ergonomic?



MOBILITY / LOCOMOTION ASSESSMENT

- USE OF MANUAL / ELECTRONIC WHEELCHAIR
- THERAPEUTIC PATH
- FUNCTIONAL PATH

EVALUATION OF SPECIFIC VARIABLES
Ability to move / move in space

Although it is already included in the functional evaluation, it deserves a separate specification as in relation to the neurological level, type of spinal cord damage, associated complications, associated trauma, it is to be evaluated:

- the exclusive use of the wheelchair (manual and / or electronic);
- the possibility of a therapeutic journey with braces and / or aids (alternating with the use of a wheelchair);
- the possibility of a functional walk with braces and / or aids (alternating or not with the use of a wheelchair);

EVALUATION OF SPECIFIC VARIABLES
Ability to move / move in space

- The use of the manual wheelchair involves various skill steps: pushing on flat ground, putting on and off the brakes, lifting / putting on side rails and / or footrests, making changes of direction, opening and closing a door, slalom, relieve ischial pressure , picking up objects from the ground, pushing up / down, on uneven ground, wheeling, going up and down a step, going up and down stairs, transferring from the wheelchair to the ground and getting up, maintenance of the aid.

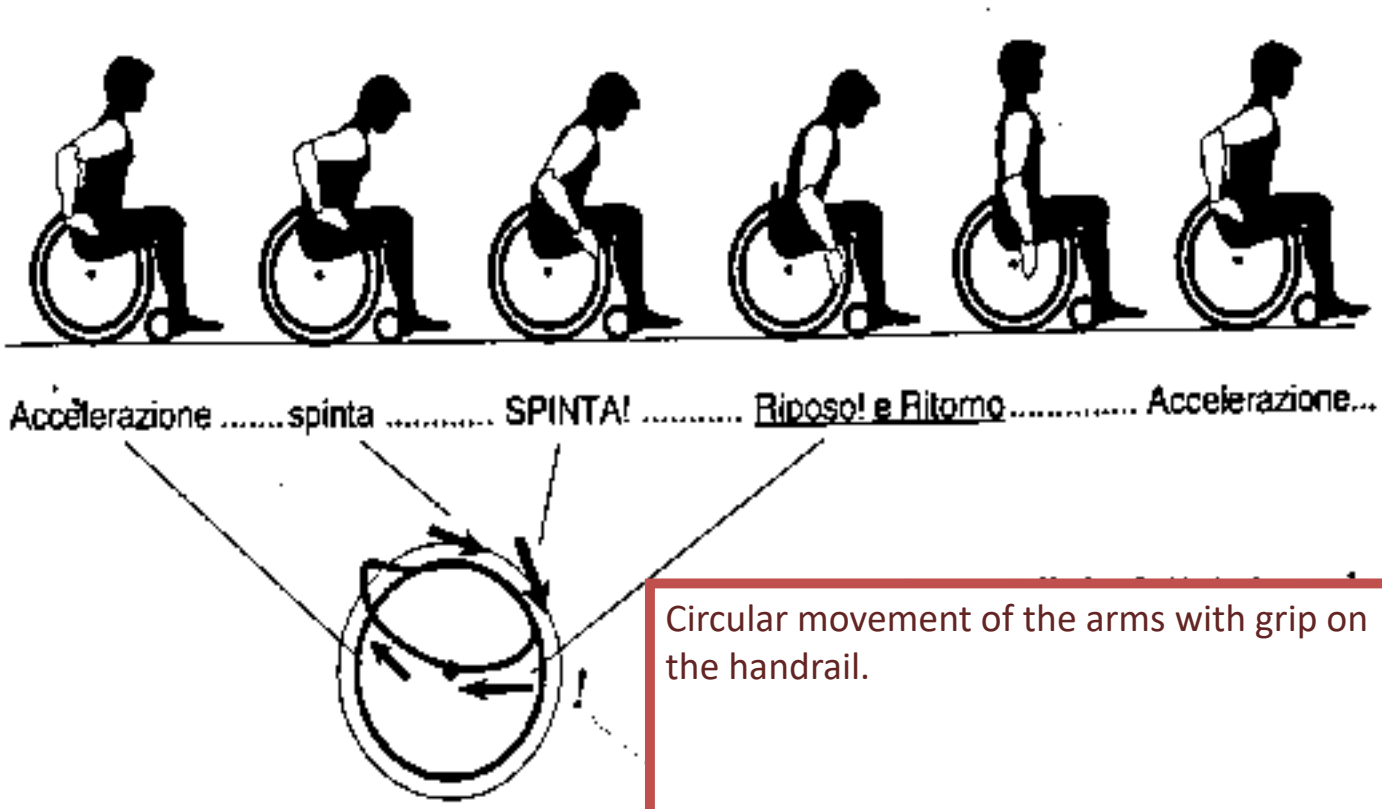
GSI ITALIA
GRUPPISOLIDARIETÀINTERNAZIONALE

PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

MOBILITY in a wheelchair

- 0 ° Space exploration
- 1st Apply / remove the brakes
- 2nd internal / external thrust
- 3 ° Release of ischial pressure
- 4th Ascent / descent
- 5th Balancing on wheels
- 6 ° Overcoming differences in height
- 7 ° Fall and get up
- Maintenance aid

BASIC TECHNIQUE FOR THRUST



Circular movement of the arms with grip on the handrail.

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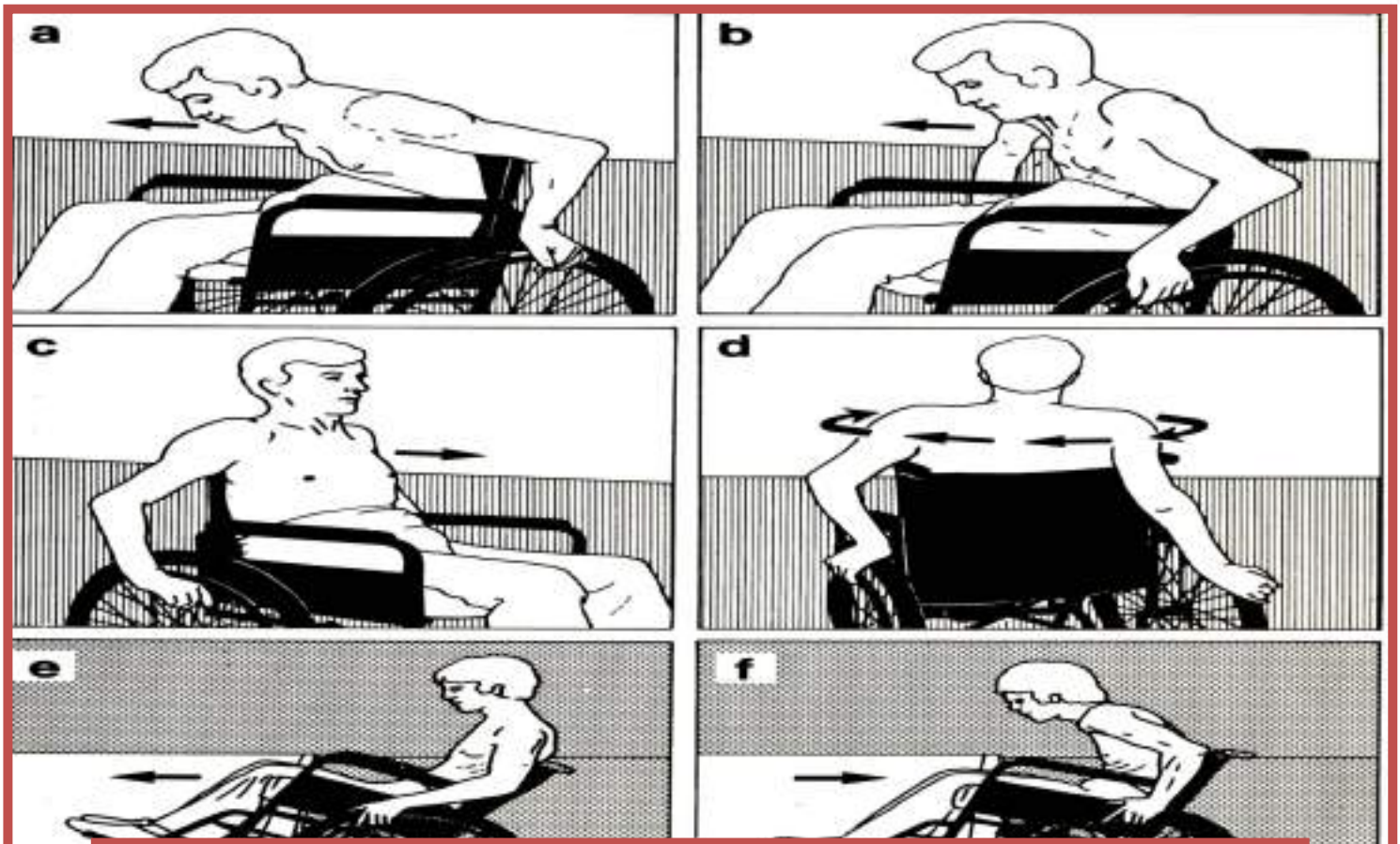
PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

TRAINING manual wheelchair



Ascent-descent technique
Technique for making changes in direction

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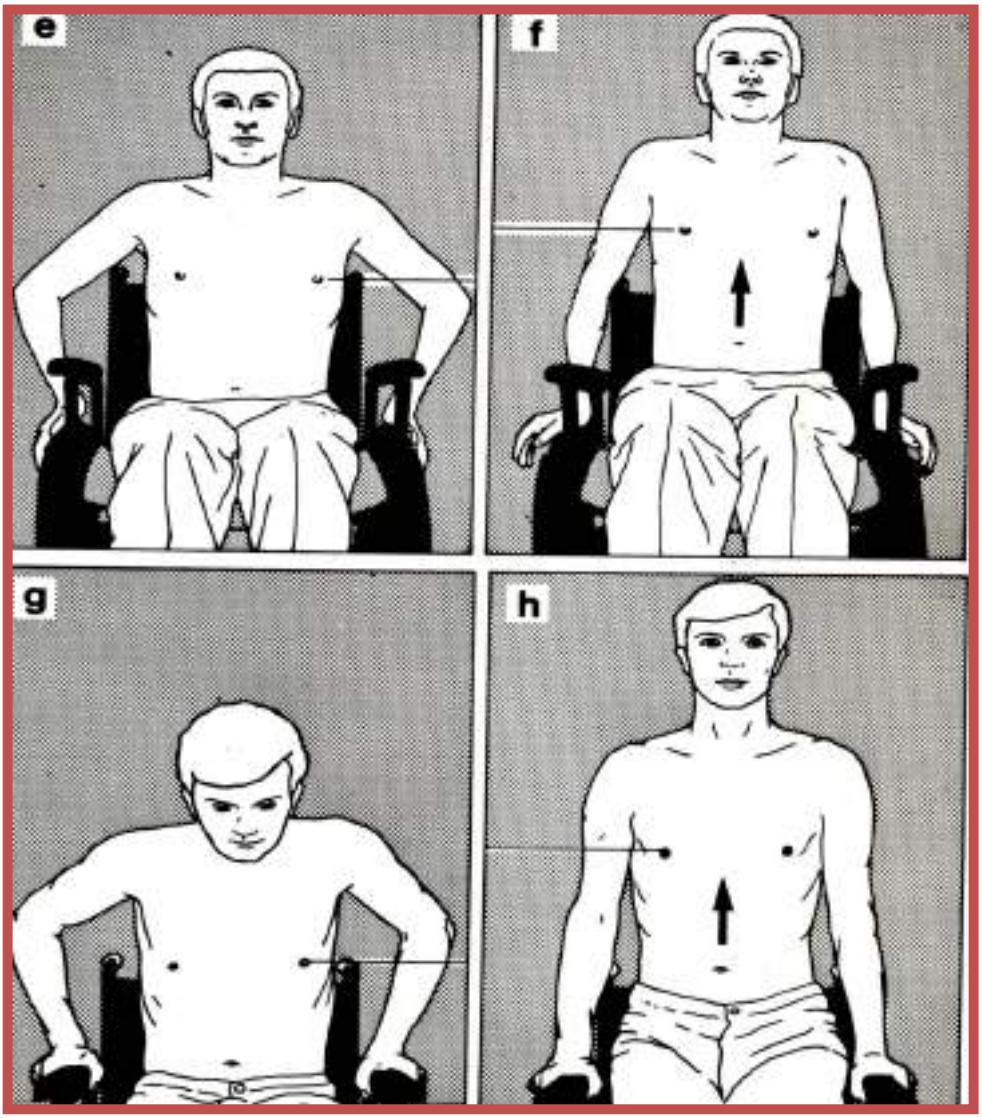
GRUPPISOLIDARIETÀINTERNAZIONALE

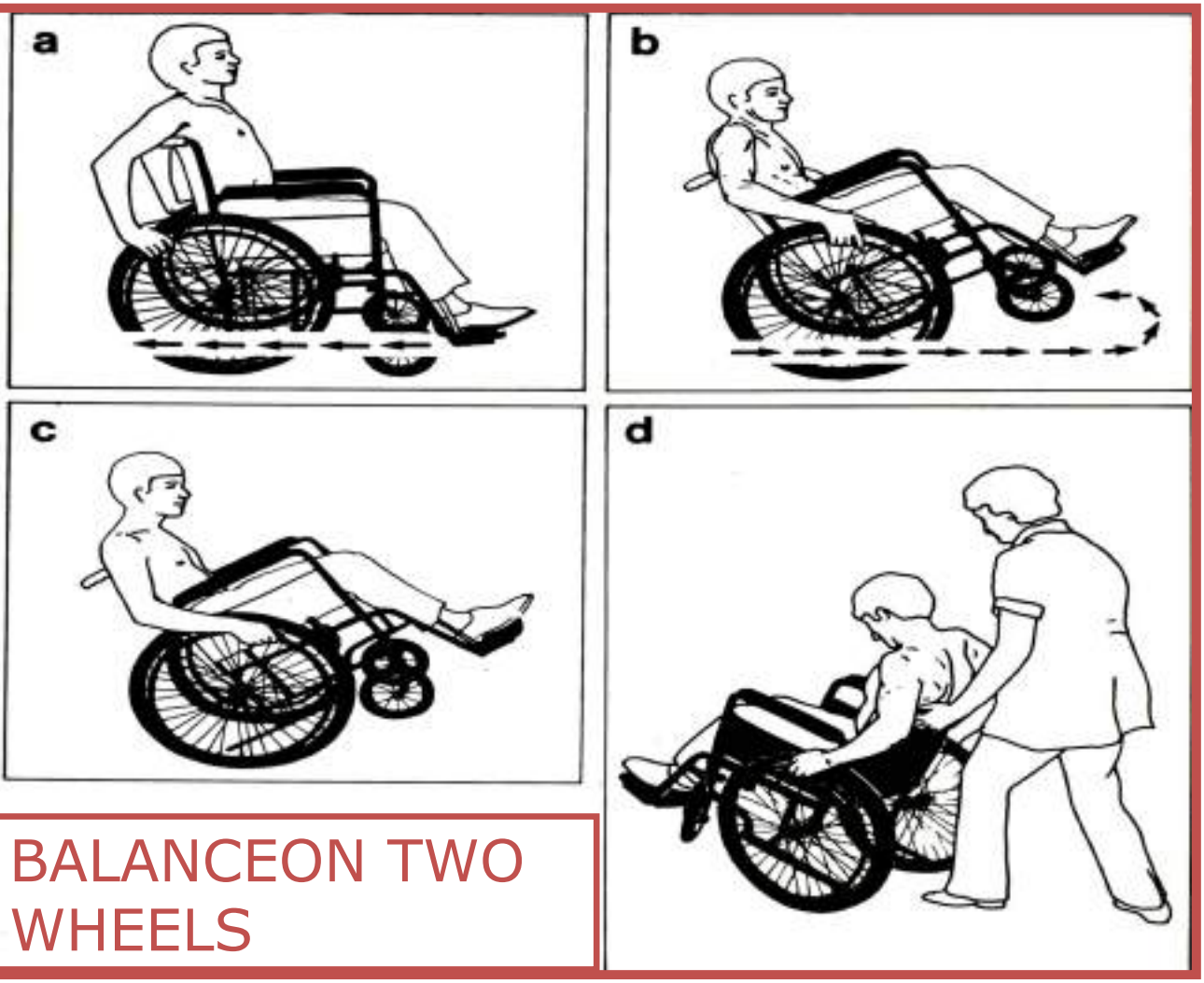
PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

UNLOAD
ISCHIATIC
PRESSURE



GSI ITALIA
GRUPPISOLIDARIETÀINTERNAZIONALE

PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST



BALANCEON TWO WHEELS

1700/3677

Electronic wheelchair

- POSTURAL STRUCTURE
- TYPE OF COMMAND
- INTERNAL / EXTERNAL USE
- ENVIRONMENTAL COMMAND

Canadian Occupational Performance Measure (COPM)

- The COPM was designed to assess patients' perspectives about changes in activity limitations and participation restrictions.
- The COPM is administered in a semi-structured interview where patients are required to identify specific activity limitations and participation restrictions.
- Patients use a 10-point scale to rate each identified problem with respect to importance,0 performance and satisfaction.
- The COPM is primarily used to monitor change

Therapeutic / Functional gait

- Functional Scale (W.I.S.C.I. II): describes the severity of the deficit and not functional independence
- Alternatively or additionally
- Qualitative assessment: indicated in incomplete or complete low lesions

EVALUATION OF SPECIFIC VARIABLES
Ability to mobility / displacement in space

- As regards the evaluation of the walk, a scale built for the spinal cord injury can be used is the W.I.S.C.I. (Walking Index for Spinal Cord Injury) which provides 20 levels progressively ordered from the most deficient to the best performance; quantifies the level of physical assistance required, the equipment and orthoses used during a minimum distance of 10 m.
- In the case of incomplete injuries with indications for re-education to walk, both therapeutic and functional, the use of a qualitative assessment according to the different phases of the gait cycle is implied.

Walking Index for Spinal Cord Injury

- The WISCI was developed specifically for patients with spinal cord injury.
- It measures ability to walk 10 m and need for physical assistance, orthoses and walking aids on an incremental scale ranging from zero (unable to stand or walk) to 20 (ambulates without orthoses, aids or physical assistance).

Walking Index for Spinal Cord Injury (WISCI II)

Nome_____ Cognome_____ Data_____

Deambulazione a 4 punti_____ Deambulazione a 2 punti_____

Individua le varianti che descrivono l'attuale performance del cammino, quindi assegna il più alto livello di tale performance (deficit maggiore = 0; deficit minore = 20)

Nell'assegnare un punteggio si deve scegliere il livello ritenuto sicuro dal terapista, unitamente al grado di agio riferito dal paziente. Se vengono utilizzati ausili diversi da quelli definiti come standard, questi vanno documentati come varianti. Se ci fosse disaccordo tra due esaminatori, deve essere scelto il livello più alto.

*LIVELLO NEUROLOGICO SECONDO A.S.I.A.*_____ *A.I.S.*_____ *Sindrome*_____

VARIANTI

Tipo di Ausili	*Tipo di Tutori/ortesi*	*Livello di Assistenza*	*Livello di agio del pz.*
Parallele < 10 m	Tutore lungo per AI (2 o 1)	Max Assist (2 persone)	Molto agio
Parallele 10 m	Tutore corto per AI (2 o 1)	Min/Mod Assist (2 persone)	Discreto agio
Deambulatore standard, con ruote, con tappi/rumi.	Blocco al ginocchio____ No blocco al ginocchio____	Min/Mod Assist (1 persona)	Nè agio nè disagio
Canadesi (2 o 1)	Altro		Discreto disagio
Bastoni-quadripode (2 o 1)			Molto disagio
No ausili	No tutori/ortesi	No assistenza	

LIVELLI WISCI

Livello	*Tipo di Ausili*	*Tipo di Tutori/ortesi*	*Livello di Assistenza*	*Distanza percorsa*
0	Incapace di raggiungere e/o mantenere autonomamente la stazione eretta			
1	Parallele	Tutori	2 persone	Meno di 10 metri
2	Parallele	Tutori	2 persone	10 metri
3	Parallele	Tutori	1 persona	10 metri
4	Parallele	No tutori	1 persona	10 metri
5	Parallele	Tutori	No assistenza	10 metri
6	Deambulatore	Tutori	1 persona	10 metri
7	2 Canadesi	Tutori	1 persona	10 metri
8	Deambulatore	No tutori	1 persona	10 metri
9	Deambulatore	Tutori	No assistenza	10 metri
10	1 canadese/bastone	Tutori	1 persona	10 metri
11	2 canadesi	No tutori	1 persona	10 metri
12	2 canadesi	Tutori	No assistenza	10 metri
13	Deambulatore	No tutori	No assistenza	10 metri
14	1 canadese/bastone	No tutori	1 persona	10 metri
15	1 canadese/bastone	Tutori	No assistenza	10 metri
16	2 canadesi	No tutori	No assistenza	10 metri
17	No ausili	No tutori	1 persona	10 metri
18	No ausili	Tutori	No assistenza	10 metri
19	1 canadese/bastone	No tutori	No assistenza	10 metri
20	No ausili	No tutori	No assistenza	10 metri

LEGENDA:

La limitazione nella deambulazione secondaria ad una disabilità (es. lesione midollare) viene definita in base al livello di lesione del pz. e indica la capacità funzionale residua nel cammino.

La scala di valutazione va da un minimo di 0 punti ad un massimo di 20 punti (0=totale incapacità di raggiungere o mantenere la stazione eretta autonomamente; 20=deambulazione che non richiede l'utilizzo di ausili, tutori/ortesi nè l'assistenza di altre persone) Tale scala di severità è basata sulla gravità del deficit e non sull'indipendenza funzionale dimostrata nell'ambiente

Assistenza: l'assistenza fisica da parte di 2 persone può essere moderata o massima, se di una persona è minima.

Tutori/Ortesi: "tutori" significa che il pz ne utilizza 1 o 2, corti o lunghi; "no tutori" significa che non utilizza tutori per evitarsi gli arti inferiori.

Deambulatore: deambulatore rigido convenzionale senza ruote.

Canadesi: canadesi con appoggi antibraccio o ascellari.

Bastone: bastone convenzionale rigido.

LIVELLO ASSEGNATO ☐

Nome esaminatore_____

W.I.S.C.I. II

- It ranges from a minimum of 0 to a maximum of 20

- Identify 4 variants for performance (type of aids, type of braces / orthoses, level of assistance, ease of execution perceived by the patient)

VARIANTI

Tpo di Ausili	*Tipo di Tutori/ortesi*	*Livello di Assistenza*	*Livello di agio del pz.*
Parallele < 10 m	Tutore lungo per AI (2 o 1)	Max Assist (2 persone)	Molto agio
Parallele 10 m	Tutore corto per AI (2 o 1)	Min/Mod Assist (2 persone)	Discreto agio
Deambulatore-standard, con ruote, con tappi/ruote.	Blocco al ginocchio____ No blocco al ginocchio___	Min/Mod Assist (1 persona)	Né agio né disagio
Canadesi (2 o 1)	Altro		Discreto disagio
Bastoni-quadripode (2 o 1)			Molto disagio
No ausili	No tutori/ortesi	No assistenza	

LIVELLI WISCI

Livello	*Tipo di Ausili*	*Tipo di Tutori/ortesi*	*Livello di Assistenza*	*Distanza percorsa*
0	Incapace di raggiungere e/o mantenere autonomamente la stazione eretta			
1	Parallele	Tutori	2 persone	Meno di 10 metri
2	Parallele	Tutori	2 persone	10 metri
3	Parallele	Tutori	1 persona	10 metri
4	Parallele	No tutori	1 persona	10 metri
5	Parallele	Tutori	No assistenza	10 metri
6	Deambulatore	Tutori	1 persona	10 metri
7	2 Canadesi	Tutori	1 persona	10 metri
8	Deambulatore	No tutori	1 persona	10 metri
9	Deambulatore	Tutori	No assistenza	10 metri
10	1 canadese/bastone	Tutori	1 persona	10 metri
11	2 canadesi	No tutori	1 persona	10 metri
12	2 canadesi	Tutori	No assistenza	10 metri
13	Deambulatore	No tutori	No assistenza	10 metri
14	1 canadese/bastone	No tutori	1 persona	10 metri
15	1 canadese/bastone	Tutori	No assistenza	10 metri
16	2 canadesi	No tutori	No assistenza	10 metri
17	No ausili	No tutori	1 persona	10 metri
18	No ausili	Tutori	No assistenza	10 metri
19	1 canadese/bastone	No tutori	No assistenza	10 metri
20	No ausili	No tutori	No assistenza	10 metri

Timed Up and Go

- The Timed Up and Go test measures the time taken to stand up from a chair, walk 3 m, turn around and walk back to sit down on the chair. No physical assistance is given.
- Timed Up and Go (TUG) is a timed walk test, originally developed to assess the sense of balance in elderly people and the risk of falling.
- The TUG records the time, in seconds, during which the patient has to get up from a chair, walk 3 m, turn around when he/she reaches the 3-m line, walk back, and sit on the chair.
- If the patient takes more than 30 s to complete the task, the patient usually needs assistance in transfers and going upstairs, and the patient will not go out alone.
- Use of auxiliary equipment is permitted.

10m Walking Test

- The 10m Walk Test measures speed of walking ($m.sec^{-1}$).
- Patients are instructed to walk 14 m at their preferred speed but time is only recorded for the middle 10 m
- It measures the time in seconds required for a patient to walk 10 m.
- Use of assistive devices is permitted.

6-minute Walk Test

- The 6-minute Walk Test is a measure of endurance. Patients are instructed to walk as far as possible in 6 minutes, taking rests whenever required.
- The distance covered and the number of rests required are recorded.

6-minute Walk Test

- The 6-minute walk test measures the distance a patient can walk on a flat surface as quickly as possible in 6 min. The patient may stop and rest, but is not allowed to sit, during the test, and the use of auxiliary equipment is also permitted.

- The test was originally designed for patients with respiratory impairment.

- The 6-minute walk test is particularly suitable for recording further improvements for people with minor impairment

Functional Standing Test

- The FST measures patients' ability to reach while standing.
- It consists of 20 items requiring manipulation and lifting of different objects.
- Orthoses can be worn and the tasks are done as quickly as possible.
- Some of the tasks are from the Jebsen Test of Hand Function.

EVALUATION OF SPECIFIC VARIABLES
Ability to mobility / displacement in space

- However, it must be borne in mind that to travel medium and long distances the car is certainly essential: it is therefore necessary to evaluate, where possible (from C6 onwards), the technical adaptations to be able to obtain the special driving license and for cervical injuries high modalities techniques for quick and safe access by car.

EVALUATION OF SPECIFIC VARIABLES
Planning aids

It includes the following steps:

- the detection of a need inherent in the impossibility of carrying out an activity;
- the assessment of present and potential abilities, of the person's living environment, of any possibilities for external help;
- identification of the aid that best meets the patient's needs according to criteria of personal acceptability, comfort, effectiveness in performing a service (achievement of the purpose for which it is used), efficiency in optimizing the patient's physical resources, cost containment and economic accessibility by the patient, safety in use for the patient and any assistant, technical compatibility with the possible presence of other aids (home automation), adequate technical assistance, good maneuverability and possible portability;

EVALUATION OF SPECIFIC VARIABLES
Planning aids

In relation to the neurological level and type of damage, the following are foreseeable:

- orthosis for the stabilization of the spine (collar, torso, etc.):
- functional hand orthosis (for wrist and hand)
- orthosis for the functional stabilization of the lower limb (long braces, knee and foot orthoses) for walking
- aids to prevent orthostatic hypotension (vasocompressive stockings, belly pad for abdominal containment);
- wrist and hand aids to facilitate grasping in A.D.L. (hygiene, nutrition, writing, etc.);
- aids for the use of personal computers or any home automation systems
- mobility aids in the bed (electric bed with the possibility of adjusting functions via a push-button panel);
- pressure ulcer prevention aids (mattress, seat cushion);mobility aids (wheelchair, walker, Canadian, etc.);
- transfer aids (sliding board, lifter, Balkan);
- aids for statics (vertical stabilizer, vertical wheelchair);
- personal hygiene aids (shower stretcher, shower chair, toilet stand, grab bars);

EVALUATION OF SPECIFIC VARIABLES Accessibility and adaptability of the home environment

The assessment of architectural barriers is inherent in:

- the accessibility of the house, i.e. the possibility of reaching the building, entering it easily and using the various spaces in conditions of adequate safety and autonomy;
- visitability, i.e. the ability to access the relationship spaces (living room or dining room of the accommodation) and at least one toilet in the property;
- adaptability, i.e. the possibility of modifying the built space at low cost to make it as usable as possible.

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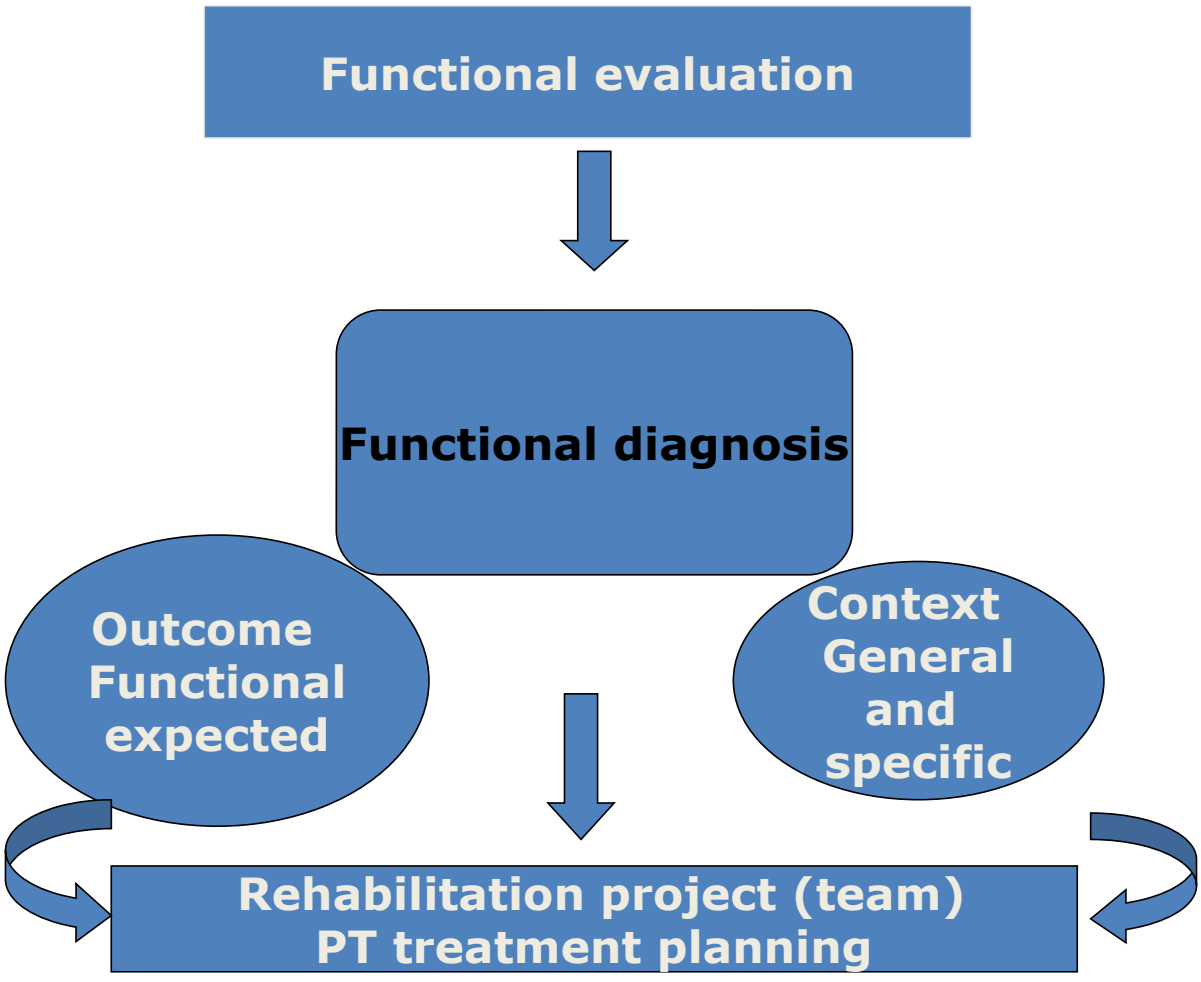
PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Rehabilitation in spinal cord injuries
Lesson: Functional Expected Outcome

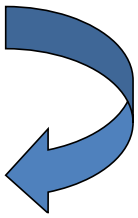
1719/3677

FUNCTIONAL OUTCOME EXPECTED



FUNCTIONAL OUTCOME expected?

PREDICTION OF THE OUTCOME



On what rationale?

EXPECTED FUNCTIONAL OUTCOMES

- It is necessary to establish short and long-term, personalized functional goals, defined by an interprofessional team experienced in the treatment of the myelopic patient
- Correlated to the level of injury and tabulated according to well-defined areas (ADL, care load, required aids, motor FIM, environmental modifications)

EXPECTED FUNCTIONAL OUTCOMES

- Monitor functional skills and modify treatment strategies through the rehabilitation program to maximize functional outcome
- After the achievement of the objectives carry out periodic evaluations of functional skills

EXPECTED FUNCTIONAL OUTCOMES

- In recent years it has become increasingly necessary to codify the functional outcomes resulting from spinal cord injury as a prerequisite for directing the rehabilitation treatment by pursuing realistic and possible objectives.

- Predicting the functional outcome that can be reached in spinal cord injury is rather complex as it is necessary to correlate "primarily" the level and type of neurological damage with the possible functional autonomy that can be achieved, but also take into account other factors, such as secondary complications, medical problems, age, structure physical, cognitive aspects, particular psychological, social or family situations, motivation of the subject.

EXPECTED FUNCTIONAL OUTCOMES

- The tables of the expected functional outcomes for complete lesions elaborated by Paralyzed Veterans of America (1999) are reported below; these schemes offer a global and indicative summary for the definition of the functional outcome in spinal cord injury and therefore not generalizable to all cases.

EXPECTED FUNCTIONAL OUTCOMES

The functional areas taken into consideration concern:

- visceral functions (respiratory: also understood as the ability to manage the elimination of bronchial secretions); bladder and bowel both as a management of emptying and incontinence);
- mobility in bed;
- bed-wheelchair transfers;
- posture and pressure ulcer prevention;
- orthostatism and / or functional walking;
- supply;
- clothing,tidying up (it means washing your face, hands and teeth, combing your hair, shaving and putting on make-up if your usual practice);
- washing (limbs and trunk);
- communication (through communication systems such as telephone, PC, etc.);
- transport (car driving, use of public transport);
- housekeeping (simple meal preparation and basic cleaning).

EXPECTED FUNCTIONAL OUTCOMES

- To express the estimated need for assistance (hours / day) by level of injury, the F.I.M. on a group of patients with complete lesion and mean age of 27 years.

- As for the aids, these have been described in a generic way, given the extreme variability of the selection criteria from person to person.

Spinal complete injury	Spinal incomplete injury
Relative stability of the Neurological framework ↓ Possible to correlate Functional capabilities for level of injury	Variability of the framework Neurological (A.I.S. B –C- D) Not always possible

EXPECTED OUTCOME VARIABLES:

- age
- associated injuries
- complications
- pre-existing diseases
- anthropometric characteristics / weight
- psychological problems
- cultural factors
- economic and social situation

AMERICAN GUIDELINES OF paraplegic VETERANS (P.V.A. Paralyzed Veterans of America) American Consortium for Spinal Cord Medicine (1999)

AREAS:
VISCERAL FUNCTIONS
A.D.L. BASIC
PREVENTION OF PRESSURE ULCERS
MOBILITY / LOCOMOTION
COMMUNICATION
TRANSPORT / GUIDE
AIDS
NEED FOR ASSISTANCE

TABLE 2.3 Typical level of independence attained by patients with ASIA complete spinal cord injury

	C1–C3 tetraplegia	C4 tetraplegia	C5 tetraplegia	C6 tetraplegia	C7–C8 tetraplegia	Thoracic paraplegia	Lumbar and sacral paraplegia
Unassisted ventilation	no	yes	yes	yes	yes	yes	yes
Push manual wheelchair	no	no	limited	limited	yes	yes	yes
Hand to mouth activities	no	no	yes	yes	yes	yes	yes
Self-feeding	no	no	limited	yes	yes	yes	yes
Hand function	no	no	no	limited (tenodesis)	limited (tenodesis)	yes	yes
Driving[64]	no	no	no	yes	yes	yes	yes
Rolling	no	no	limited	yes	yes	yes	yes
Horizontal transfer	no	no	limited	yes	yes	yes	yes
Lying to sitting	no	no	limited	yes	yes	yes	yes
Floor to wheelchair	no	no	no	limited	limited	yes	yes
Standing in parallel bars with orthoses	no	no	no	no	limited	yes	yes
Walking with orthoses and aids	no	no	no	no	no	limited	yes

	TETRAPLEGIA C5	TETRAPLEGIA C6	TETRAPLEGIA C7	TETRAPLEGIA C8
Feeding	with cable ties and adapted cutlery	even with only enlarged cutlery	autonomous with aids	autonomous
Tidy up	splints, aids adapted such as strap combs	partially independent by adapting toothbrush, razor, comb or clamp	autonomous with aids	autonomous with aids
Washing	Dependent	almost autonomous for the super part. With adapter sponge	autonomous with aids	autonomous with aids
Dressing	Dependent	almost autonomous for the super part. With adapted sponge	autonomous with aids also for the lower part of the	autonomous
Pushing the wheelchair	autonomous with splint or push gloves, modified handrails but on flat surfaces	autonomous and facilitated with push gloves	autonomous even on external grounds	autonomous
Transfert Bed-Wheelchair	Dependent	almost autonomous with the tablet for transfers and between surfaces. on the same floor	autonomous	autonomous
Mobility in the bed	Dependent	almost independent with the help of handles or electric beds	autonomous	autonomous
Bladder	Dependent	Dependent	almost independent with some aids	autonomous
Perineal Hygiene	Dependent	Dependent	almost independent with some aids	autonomous

Functional Outcome Expected
LEVEL C1-3

- Innervated muscles: Sterno-cleido-mastoid, cervical paraspinal muscles, neck accessories
- Possible movements: flexion, extension, rotation of the head
- Motor deficit: trunk paralysis, Upper limbs, Lower libs; inability to cough, dependence on respiratory ventilator

C1–C3 tetraplegia

- Patients with C2 and above tetraplegia have total paralysis of the diaphragm and other respiratory muscles and consequently are ventilator-dependent.

- Patients with C3 tetraplegia retain a small amount of diaphragm function but not usually enough to breathe spontaneously

- All have paralysis of upper and lower limbs and trunk muscles but are able to move their heads.

- They are fully dependent on others for all motor tasks and personal care activities. They mobilize in chincontrol power wheelchairs and can use head-, mouth- or voice-activated technology

Functional Outcome Expected LEVEL C1-3

	Functional objectives expected	AIDS	EXPECTED FIM
Breathing	Fan dependent Unable to eliminate secretions	2 fans: one at the bed and one portable. Suction equipment	
Bowel	Complete assistance with alternative control and evacuation methods	Usually evacuation to bed	1
Bladder	Complete assistance with alternative control and emptying methods	Disposable or indwelling catheters	1
Bed mobility	Complete assistance	Bed with electric control	
Bed / wheelchair transfer	Complete assistance	Lifter	1

Functional Outcome Expected LEVEL C1-3

	Functional objectives expected	AIDS	EXPECTED FIM
Pressure release and positioning	Complete or partial assistance if with adequate aids	Reclining and / or tilting electronic wheelchair with head movement control Anti-decubitus pillow Anti-decubitus mattress	
Feeding	Complete assistance		1
Dressing	Complete assistance		1
Self-care (tidying up)	Complete assistance		1

Functional Outcome Expected LEVEL C1-3

	Functional objectives expected	AIDS	EXPECTED FIM
Washing	Complete assistance	Shower stretcher or reclining and tilting WC-shower wheelchair with headrest	1
Mobility in a wheelchair	Manual: full assistance Electronics: independent indoors	Reclining and / or tilting electronic wheelchair with chin control, / puff functions	6
Upright statics and gait	Complete assistance Gait impossible	Static table / verticalizing wheelchair	

Functional Outcome Expected LEVEL C1-3

	Functional objectives expected	AIDS	EXPECTED FIM
Communication	From complete to independent assistance depending on the availability of adaptations / equipment for room control	PC access with specific technological aids, environmental control unit	
Transport	Not the possibility of driving a car	Adapted minivan with direct wheelchair access recommended Accessible public transport	
House management	Complete assistance		
Daily assistance required	24 h of continuous assistance for personal care and home management Able to provide instructions for all aspects of assistance		24h*

Figure 2.2 Patients with C1–C3 tetraplegia mobilize in chin-control wheelchairs and use head-, mouth- or voice-activated technology.

Functional Outcome Expected LEVEL C4

- Innervated muscles: Trapezius upper fibers, diaphragm, cervical paraspinal muscles
- Possible movements: flexion, extension, rotation of the head, elevation of the scapula, inspiration
- Motor deficit: trunk paralysis, Upper limbs, Lower limbs; inability to cough, reduced resistance and respiratory reserve secondary to paralysis of the intercostal muscles, respiratory autonomy with assisted support ventilation

C4 tetraplegia

- Patients with C4 tetraplegia have partial paralysis of the diaphragm and total paralysis of all four limbs and trunk muscles.

- They retain a small amount of voluntary control around the shoulders and have good strength in the rhomboid muscles but still mobilize in a chin-control power wheelchair.

- They can breathe independently but in all other respects their activity limitations are similar to those of patients with C1–C3 tetraplegia.

Functional Outcome Expected LEVEL C4

	Functional objectives expected	AIDS	EXPECTED FIM
Breathing	May be able to breathe without using a ventilator Dependence for elimination of secretions	If fan dependent see C1-C3	
Bowel	Complete assistance with alternative control and evacuation methods	Reclining and tilting WC-shower wheelchair or evacuation to bed	1
Bladder	Complete assistance with alternative control and emptying methods	Disposable or indwelling catheters	1
Bed mobility	Complete assistance	Bed with electric control complete with Trendelemburg function	
Bed / wheelchair transfer	Complete assistance	Lifter	1

Functional Outcome Expected LEVEL C4

	Functional objectives expected	AIDS	EXPECTED FIM
Pressure release and positioning	Complete or partial assistance if with adequate aids	Reclining and / or tilting electronic wheelchair with head movement control Anti-decubitus pillowA nti-decubitus mattress	
Feeding	Complete assistance		1
Dressing	Complete assistance		1
Self-care (tidying up)	Complete assistance		1

Functional Outcome Expected LEVEL C4

	Functional objectives expected	AIDS	EXPECTED FIM
Washing	Complete assistance	Shower stretcher or reclining and tilting WC-shower wheelchair with headrest	1
Mobility in a wheelchair	Manual: full assistance Electronics: independent indoors	Reclining and / or tilting electronic wheelchair with chin control, / puff functions	6
Upright statics and gait	Complete assistance Gait impossible	Static table / verticalizing wheelchair	

Functional Outcome Expected LEVEL C4

	Functional objectives expected	AIDS	EXPECTED FIM
Communication	From complete to independent assistance depending on the availability of adaptations / equipment for room control	Accesso pc con ausili tecnologici specifici, unità di controllo ambientale	
Transport	Not the possibility of driving a car	Adapted minivan with direct wheelchair access recommended Accessible public transport	
House management	Complete assistance		
Daily assistance required	24 h of continuous assistance for personal care and home management Able to provide instructions for all aspects of assistance		24h*

Aids

- Definition:
- "Any product, equipment or technological system of specialized production or of common trade, used by a disabled person to prevent, compensate, reduce or eliminate an impairment or disability"

IDENTIFICATION OF THE AID

IDENTIFICATION AND CUSTOMIZATION of the WHEELCHAIR based on:

- RESIDUAL ENGINE CAPACITY
- AGE
- PROGNOSIS
- BODY CHARACTERISTICS
- LIFESTYLE
- HOUSING SITUATION
- DESIRES OF THE PATIENT

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

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Functional Outcome Expected
LEVEL C5

- Muscles innervated: Deltoid, biceps, brachialis, brachioradialis, rhomboids, dentate ant (partially innervated).
- Possible movements: adduction / abduction of the shoulder blade, flexion, abduction and extension of the shoulder, flexion and supination of the forearm. (passive automatic hand)
- Motor deficit: absence of elbow extension, forearm pronation, no movement in the wrist and hand, complete trunk paralysis and Lower libs.

C5 tetraplegia

- Patients with C5 tetraplegia have partial paralysis of the upper limbs but full paralysis of the trunk and lower limb muscles.

- They have good strength of the deltoid and biceps muscles, but poor strength of other shoulder muscles. They have no function in the triceps muscles or any muscles about the wrist or hand. Despite this, they can use a hand-control power wheelchair with the hand passively rested on or secured to the joystick.

- They are unable to perform gross motor tasks such as transferring, rolling or moving from lying to sitting and require assistance for most personal care activities.

C5 tetraplegia

- They can, however, take their hands to their mouth, head and face.

- They can use the upper limbs to perform simple tasks provided no fine hand control is required and the appliance or utensil is attached to the hand with a splint.

- Upper limb function is usually possible with splints to stabilize the paralysed wrist. For example, a keyboard can be used with a typing stick attached to the hand and a steering wheel of a car can be turned with adaptations to the wheel

Functional Outcome Expected LEVEL C5

	Functional objectives expected	AIDS	EXPECTED FIM
Breathing	Low resistance and vital capacity assist in eliminating secretions		
Bowel	Complete assistance with alternative control and evacuation methods	Reclining / tilting wheelchair for toilet and shower	1
Bladder	Complete assistance with alternative control and emptying methods	Disposable or indwelling catheters	1
Bed mobility	Complete assistance	Letto a tre snodi con controllo elettrico completo di funzione Trendelemburg	
Bed / wheelchair transfer	Complete assistance	Lifter	1

Functional Outcome Expected LEVEL C5

	Functional objectives expected	AIDS	EXPECTED FIM
Pressure release and positioning	Complete or autonomous assistance if with adequate aids	Reclining and / or tilting electronic wheelchair Anti-decubitus pillow Anti-decubitus mattress	
Feeding	Full assistance for the preparation, independent to eat (no knife)	Splint for wrist stabilization with cutlery insertion, goblet glass	5
Dressing	Upper part: partial assistance Lower part: complete assistance	Adapted clothes	1
Self-care (tidying up)	Partial assistance with aids, if necessary	Strap, wrist band, thermoplastic material, modified grips	1-3

Functional Outcome Expected LEVEL C5

	Functional objectives expected	AIDS	EXPECTED FIM
Washing	Complete assistance	Wheelchair for toilet and shower	1
Mobility in a wheelchair	Manual: independent in flat interiors without obstacles; Electronics: independent	Electronic wheelchair with Joy-stick control Super light manual wheelchair with adapted handrail	6
Upright statics and gait	Complete assistance Gait impossible	Verticalizing wheelchair	

Functional Outcome Expected LEVEL C5

	Functional objectives expected	AIDS	EXPECTED FIM
Communication	From complete to independent assistance depending on the availability of adaptations / equipment for room control	Rigid splint for wrist and thumb stabilization, aids for turning pages. Adapted computer systems and environmental control systems.	
Transport	Not the possibility of driving a car	Adapted minivan with direct wheelchair access recommended Accessible public transport	
House management	Complete assistance		
Daily assistance required	Personal care: 10 h / day Management of the home environment: 6 h / day Able to provide instructions for all aspects of assistance		16h*

Functional Outcome Expected LEVEL C6

- Muscles innervated: Head claveare pectoralis major, long and short radial extensor carpus, serratus anterior, great dorsal (partially innervated)
- Possible movements: protraction of the scapula, partial horizontal adduction, supination of the forearm, radial extension of the wrist (active automatic hand)
- Motor Deficit: Absence of wrist flexion, elbow extension, finger movement, complete trunk paralysis and Lower libs

C6 tetraplegia

- There is a large functional difference between patients with C5 and C6 tetraplegia.
- This is due to the preservation of the pectoralis, serratus anterior, latissimus dorsi and wrist extensor muscles. The latissimus dorsi muscle, in combination with the pectoralis and serratus anterior muscles, enables weight bearing through the upper limbs. This provides the potential to lift body weight and transfer
- The latissimus dorsi muscle also provides some trunk stability. Although not normally considered a trunk muscle, the latissimus dorsi becomes important in the absence of other trunk muscles. Preservation of the pectoralis muscles makes it possible to roll over in bed and provides stability around the shoulder when weight bearing.
- Serratus anterior is also important for scapula stability.

C6 tetraplegia

- Patients with C6 tetraplegia have the potential to live independently, provided they are adequately equipped and set up.
- Some can transfer, roll, move from lying to sitting, dress, bathe and attend to personal hygiene, although all these motor tasks are time-consuming and difficult to master.
- Patients with C6 tetraplegia mobilize in a manual wheelchair, but most also use a power wheelchair. Voluntary control of the wrist extensor muscles provides crude grasp (tenodesis grip).
- This makes it possible to hold objects between the index finger and thumb, or in the palm of the hand, despite paralysis of the finger and thumb flexor muscles.

Functional Outcome Expected LEVEL C6

	Functional objectives expected	AIDS	EXPECTED FIM
Breathing	Low resistance and vital capacity, assistance in eliminating secretions		
Bowel	Complete assistance	Wheelchair for shower-toilet	1-2
Bladder	From complete assistance to partial assistance with alternative control and emptying methods	Disposable catheters, adaptations for clothing and grip for self-catheterization	1-2
Bed mobility	Partial assistance	Three-jointed bed with electric control	
Bed / wheelchair transfer	Same level: independent Difference in altitude: from complete to partial assistance	Tablet Lifter	3

Functional Outcome Expected LEVEL C6

	Functional objectives expected	AIDS	EXPECTED FIM
Pressure release and positioning	Independent with aids	Anti-decubitus pillow Anti-decubitus mattress	
Feeding	Independent (aids for using the knife)	C-bar, tool strap	5-6
Dressing	Upper part: partial assistance Lower part: partial assistance	Buttoning aids, loop hooks for zippers, Velcro fasteners	1-3
Self-care (tidying up)	Independent with aids	Assistive devices for vicarious grips (straps, C-bar)	3-6

Functional Outcome Expected LEVEL C6

	Functional objectives expected	AIDS	EXPECTED FIM
Washing	Upper part: independent Lower part: partial assistance	Shower wheelchair – WC Bath lift	1-3
Mobility in a wheelchair	Manual: independent in flat interiors without obstacles, partial assistance for outdoors Electronics: independent on any surface	Super light manual wheelchair with adapted handrail Electronic wheelchair with joystick control	6
Upright statics and gait	Complete assistance Gait impossible	Electric standing / verticalizing wheelchair	

Functional Outcome Expected LEVEL C6

	Functional objectives expected	AIDS	EXPECTED FIM
Communication	From complete to independent assistance depending on the availability of adaptations / equipment for room control	Aids for writing, using PC	
Transport	Possibility of car driving	Modified driving commands	
House management	Full assistance for meal preparation and housework		
Daily assistance required	Personal care: 6h / day Housekeeping: 4h / day		10h*

Functional Outcome Expected LEVEL C7

- Innervated muscles:C7: grand dorsal, sternal head of pectoral grandis, triceps, square pronator, ulnar carpal extensor,
- Possible movements:C7: elbow extension, full wrist extension, (active automatic hand).
- Motor deficit:C7: wrist flexion and all finger movements impossible, complete trunk paralysis and Lower libs

C7 tetraplegia

- Patients with C7 tetraplegia typically attain higher levels of independence than those with C6 tetraplegia because of the function provided by the triceps, wrist flexor and finger extensor muscles.

- The triceps muscles are particularly important because they increase the ability to bear weight through a flexed elbow.

- The triceps muscles also enable patients to carry and hold objects above their heads.

- Patients with C7 tetraplegia still have paralysis of the finger and thumb flexor muscles so, despite the ability to extend the fingers, they rely on a tenodesis grip for hand function.

Functional Outcome Expected LEVEL C8

- Innervated muscles: C8: radial carpal flexor, deep and superficial finger flexor, finger joint extensor, thumb flexor / extensor / abductor, lumbricals partially innervated
- Possible movements:C8: wrist flexion, finger flexion / partial extension, thumb flexion / extension / abductionMotor deficit:
- C8: limited grip release and reduced dexterity resulting from partial paralysis of intrinsic musculature, complete trunk paralysis and Lower libs

C8 tetraplegia

- Patients with lesions at C8 have finger and thumb flexor activity, and therefore can actively grasp and release objects.
- Consequently, hand function is superior to that of patients who rely on a tenodesis grip.
- Greater strength in the triceps and shoulder muscles enables these patients to more easily attain independence than those with lesions at C6 and C7.

Functional Outcome Expected LEVEL C7-8

	Functional objectives expected	AIDS	EXPECTED FIM
Breathing	Low resistance and vital capacity, assistance in eliminating secretions		
Bowel	From complete to partial assistance with alternative control and evacuation modes	Wheelchair for toilet-shower	2-6
Bladder	From complete to partial assistance with alternative control and evacuation modes	Disposable catheters, adaptations for clothing and grip for self-catheterization	1-2
Bed mobility	From partial to independent assistance	Three-jointed bed with electric control	
Bed / wheelchair transfer	Same independent level Difference in altitude: from partial to independent assistance	with or without tablet	3-7

Functional Outcome Expected LEVEL C7-8

	Functional objectives expected	AIDS	EXPECTED FIM
Pressure release and positioning	Independent with aids	Electronic or super light wheelchair Anti-decubitus pillow Anti-decubitus mattress	
Feeding	Independent	Tool straps, adapted cutlery etc.	6-7
Dressing	Upper part: independentLower part: from partial to independent assistance	Buttoning aids, ring hooks for hinges, Velcro fasteners	4-7
Self-care (tidying up)	Independent	Assistive products to facilitate gripping, (e.g. thickening of handles)	6-7

Functional Outcome Expected LEVEL C7-8

	Functional objectives expected	AIDS	EXPECTED FIM
Washing	Upper part: independent Lower part: from partial to independent assistance	Wheelchair for toilet-shower Bath lift	3-6
Mobility in a wheelchair	Manual: independent indoors and with a minimum difference in height or uneven exteriors; partial assistance in rough outdoors Electronics: independent on any surface	Super light manual wheelchair with adapted handrail Electronic wheelchair with joystick control	6
Upright statics and gait	Partial assistance Gait impossible	Electric standing / verticalizing wheelchair	

Functional Outcome Expected LEVEL C7-8

	Functional objectives expected	AIDS	EXPECTED FIM
Communication	Independent	Aids for writing, using PC	
Transport	Possibility of driving a car, assistance from complete to partial for loading and unloading the wheelchair from the car.	Modified driving commands	
House management	Partial assistance for the preparation of simple meals; full assistance for other domestic activities		
Daily assistance required	Personal care: 6h / dayHome care: 2h / day		8h*

Functional Outcome Expected LEVEL T1-T9

- Innervated muscles: Intrinsic of the hand including thumb muscles, (T2 to T9) internal and external intercostals, erector spinae, (from T6) partial innervation of upper abdominal muscles.
- Possible movements: Upper limbs completely intact; limited stability of the upper trunk; still weak cough.
- Motor Deficit: Paralysis of the lower trunk and lower limbs

T1 paraplegia

- Patients with lesions at T1 have near-normal hand function, although they retain some weakness in the intrinsic and lumbrical muscles affecting fine hand control.

- They still have extensive paralysis of the trunk muscles and therefore, like those with higher lesions, have difficulty sitting unsupported.

Thoracic paraplegia

- Patients with thoracic paraplegia have full upper limb movement, varying degrees of paralysis of the trunk and total paralysis of the legs.

- They are predominantly wheelchair- dependent, although some can walk short distances with extensive bracing
- and walking aids.

- Patients with high thoracic paraplegia have more extensive paralysis of the trunk muscles than those with lower thoracic paraplegia, primarily affecting their ability to sit unsupported and master complex transfers.

Functional Outcome Expected LEVEL T1-T9

	Functional objectives expected	AIDS	EXPECTED FIM
Breathing	Independent, reduced vital capacity and resistence		
Bowel	Independent with alternative control and evacuation modes	Raised toilet / grab rails / toilet wheelchair	6
Bladder	Independent with alternative control and emptying modes	Disposable catheters	6
Bed mobility	Independent	Standard double or single bed	
Bed / wheelchair transfer	Independent	With or without tablet	6-7

Functional Outcome Expected LEVEL T1-T9

	Functional objectives expected	AIDS	EXPECTED FIM
Pressure release and positioning	Complete or partial assistance if with adequate aids	Reclining and / or tilting electronic wheelchair with head movement control Anti-decubitus pillow Anti-decubitus mattress	
Feeding	Complete assistance		1
Dressing	Complete assistance		1
Self-care (tidying up)	Complete assistance		1

Functional Outcome Expected LEVEL T1-T9

	Functional objectives expected	AIDS	EXPECTED FIM
Washing	Independent	Wall-mounted shower seat or toilet-shower wheelchair Bath tub aids	6
Mobility in a wheelchair	Independent on manual wheelchair indoors and outdoors	Super light manual wheelchair with rigid or folding frame	6
Upright statics and gait	Independent Non-functional gait (rarely)	Electric standing, stand-up wheelchair K.A.F.O. and Canadian / walker	

Functional Outcome Expected LEVEL T1-T9

	Obiettivi funzionali attesi	AUSILI	FIM ATTESA
Communication	Independent		
Transport	Independent car driving and for loading and unloading of the wheelchair in the car	Modified driving commands	
House management	Independent in preparing an elaborate meal and for some light housework		
Daily assistance required	Housekeeping: 3h / day		3h*

Functional Outcome Expected LEVEL T10-L1

- Muscles innervated: Intercostals, abdominals
- Possible movements: normal upper limbs motor skills, good trunk stability, effective cough
- Motor deficit: paralysis of the lower limbs

Functional Outcome Expected LEVEL T10-L1

	Functional objectives expected	AIDS	EXPECTED FIM
Breathing	Respiratory function intact		
Bowel	Independent with alternative control and evacuation modes	W.C. standard or raised	6
Bladder	Independent with alternative control and emptying modes	Disposable catheters	6
Bed mobility	Independent	Standard double bed or single bed	
Bed / wheelchair transfer	Independent		7

Functional Outcome Expected LEVEL T10-L1

	Functional objectives expected	AIDS	EXPECTED FIM
Pressure release and positioning	Independent	Anti-decubitus pillowAnti-decubitus mattress	
Feeding	Independent		7
Dressing	Independent		7
Self-care (tidying up)	Independent		7

Functional Outcome Expected LEVEL T10-L1

	Functional objectives expected	AIDS	EXPECTED FIM
Washing	Independent	Wall-mounted shower seat or shower wheelchair Bath tub aids	6
Mobility in a wheelchair	Independent on all internal / external surfaces	Super light manual wheelchair rigid or foldable	6
Upright statics and gait	Use of standing: independent Functional path for short distances from partial assistance to independence(T12-L1)	Manual standing K.A.F.O. and Canadian / walker	

Functional Outcome Expected LEVEL T10-L1

	Functional objectives expected	AIDS	EXPECTED FIM
Communication	Independent		
Transport	Independent car driving and for wheelchair loading and unloading	Modified driving commands	
House management	Independent in preparing a complex meal and for light housework, full assistance for the heaviest housework		
Daily assistance required	For housework: 2 hours a day		2h*

Functional Outcome Expected LEVEL L2

- Innervated muscles :L2: ileus psoas, sartorius, quadratus lumborum
- Possible movements: Normal Upper limbs motor skills and trunk. Partial to full control of Lower libss:L2: hip flexion
- Motor deficit: partial paralysis of the lower limbs according to the level of injury.

Functional Outcome Expected LEVEL L3

- Innervated muscles:L3: quadriceps, adductors, gracilis,
- Possible movements: Normal Upper limbs motor skills and trunk. Partial to full control of Lower libss: L3: knee extension
- Motor deficit: partial paralysis of the lower limbs according to the level of injury.

Functional Outcome Expected LEVEL L4

- Innervated muscles:L4: gluteus minor and middle, tensor fascia lata, tibialis anterior
- Possible movements: Normal Upper limbs motor skills and trunk. Partial to full control of Lower libss: L4: dorsiflexion ankle, hip abduction
- Motor deficit: partial paralysis of the lower limbs according to the level of injury.

Functional Outcome Expected LEVEL L5

- Innervated muscles: L5: semitendinosus, semimembranous, hamstring, gluteus maximus, posterior tibialis, peroneal, soleus, extensor fingers and big toe
- Possible movements: Normal Upper limbs motor skills and trunk. Partial to full control of Lower libss: L5: finger and big toe extension, knee flexion and hip extension
- Motor deficit: partial paralysis of the lower limbs according to the level of injury.

Functional Outcome Expected LEVEL S1

- Innervated muscles:S1: flexor fingers and big toe, gastrocnemius
- Possible movements: Normal Upper limbs motor skills and trunk. Partial to full control of Lower libss:S1: plantar flexion of ankle and fingers
- Motor deficit: partial paralysis of the lower limbs according to the level of injury.

Functional Outcome Expected LEVEL S2-3

- Innervated muscles:S2-S3 intrinsic to the foot
- Possible movements: Normal Upper limbs motor skills and trunk. Partial to full control of Lower libss:S3: plantar flexion of ankle and fingers
- Motor deficit: partial paralysis of the lower limbs according to the level of injury.

Functional Outcome Expected LEVEL S4-5

- Innervated muscles:S4-S5 perineum musculature, anal sphincter, urethral sphincter
- Possible movements: Normal Upper limbs motor skills and trunk. Partial to full control of Lower libss:S4-S5: voluntary sphincter control
- Motor deficit: partial paralysis of the lower limbs according to the level of injury.

Lumbar and sacral paraplegia

- Patients with lumbar and sacral paraplegia have varying extents of paralysis of the lower limbs and do not commonly have complete lesions.

- Most can walk with or without aids and orthoses although some remain wheelchair-dependent.

Functional Outcome Expected LEVEL L2-S5

	Functional objectives expected	AIDS	EXPECTED FIM
Breathing	Respiratory function intact		
Bowel	Independent with alternative methods of control and defecation	W.C. standard or padded riser	6-7
Bladder	Independent with alternative control and emptying modes	Disposable catheters	6
Bed mobility	Independent	Standard double bed or single bed	6
Bed / wheelchair transfer	Independent		7

Functional Outcome Expected LEVEL L2-S5

	Functional objectives expected	AIDS	EXPECTED FIM
Pressure release and positioning	Independent	Anti-decubitus cushion for wheelchair	
Feeding	Independent		7
Dressing	Independent		7
Self-care (tidying up)	Independent		7

Functional Outcome Expected LEVEL L2-S5

	Functional objectives expected	AIDS	EXPECTED FIM
Washing	Independent	Wall-mounted shower seat Adaptations for bathtub	7
Mobility in a wheelchair	Independent on all internal / external surfaces	Super light manual wheelchair rigid or foldable	6
Upright statics and gait	Independent Gait: functional from partial or independent assistance	Manual standing K.A.F.O. or A.F.O and Canadians or sticks	

Functional Outcome Expected LEVEL L2-S5

	Functional objectives expected	AIDS	EXPECTED FIM
Communication	Independent		
Transport	Independent car guide, independent for loading and unloading the wheelchair in the car	Modified driving commands	
House management	Independent in preparing a complex meal and for light housework, assistance with heavy housework		
Daily assistance required	For housework: 0-1 hour per day		0-1h*

Recovery of the Gait

- Community ambulation: walking with aids (braces and support for the upper limbs) used as the main method of movement within one's home or in protected communities

RECOVERY OF GAIT

- ASIA A: 3 - 6%
- ASIA B: 50% (absent sacral tactile sensitivity: 10 - 33%)
- ASIA C: 75% (conditioned by age and sub-injury motor rates)
- ASIA D: 95%

Conclusions

- Note how the adaptation of the environment and the strategies used are customized according to individual characteristics.

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Rehabilitation in spinal cord injuries
Lesson: Rehabilitation Treatment

PRINCIPLES OF TREATMENT

The care pathway can be divided into:

- Emergency phase which is the one immediately following the injurious event (generally within the first 12 hours of the trauma) in which all procedures are implemented to limit the damage resulting from the injury and are highly critical for the homeostasis of the individual;
- Acute phase relating to the period immediately following the emergency phase which continues until the general conditions stabilize;

PRINCIPLES OF TREATMENT

The care pathway can be divided into:

- Stabilization phase in which the general conditions have stabilized and any vertebral skeletal damage treated surgically or conservatively; the average duration of this phase is on average 4-6 months for paraplegics and 8-10 months for tetraplegics;
- Post-discharge or re-entry phase, which concerns the prevention and treatment of the numerous complications that may occur after discharge;

Stages of the therapeutic process

- Emergency phase: (first 12 hours after the event) survival and limitation of primary and secondary damage
- Acute phase: (until clinical conditions stabilize) clinical stability and prevention of complications
- Stabilization phase: (until discharge from the ward) monitoring of neurological recovery, functional training and prevention of complications
- Post-discharge or maintenance phase: return home, improvement of functional performance and prevention of long-term complications

Benefits of goals

- Goal setting is an important aspect of a comprehensive physiotherapy and rehabilitation programme. The process needs to be patient- centred.

- Initially, a few key goals of rehabilitation are articulated by the patient and negotiated with the multi-disciplinary team.

- These goals should be expressed in terms of participation restrictions. For example, a key goal of rehabilitation might be to return to work or school.

- Physiotherapy-specific goals then need to be identified and linked to each participation restriction goal. The physiotherapy-specific goals should be functional and purposeful activities as defined within the activity limitation and participation restriction domains of ICF and, specifically, within the ICF sub-domains of mobility, self-care and domestic life.

Benefits of goals

- These sub-domains include tasks such as pushing a manual wheelchair, rolling in bed, moving from lying to sitting, eating, drinking, looking after one's health, and pursuing recreation and leisure interests.

- Physiotherapy-specific goals are formulated in conjunction with the patient and other team members who share responsibility for their attainment. Both short- and long-term goals need to be set. These may include goals to be achieved within a week or goals to be achieved over 6 months. In addition, specific goals (or targets) should be set as part of each treatment session.

Benefits of goals

• Goals are important for several reasons. They ensure that the expectations of patients and staff are similar and realistic, and provide clear indications of what everyone is expected to achieve. If compiled in an appropriate way, they actively engage

• patients in their own rehabilitation plan, empowering them and ensuring that their wishes and expectations are met.

• Without goals, rehabilitation programmes can lack direction, and patients can feel like the passive recipients of mystical interventions.

• Goals also help focus the rehabilitation team on the individual needs of patients, and provide team members with common objectives. Perhaps most importantly, goals provide a source of motivation and enhance adherence.

Benefits of goals

• Goals are also used to monitor the success of therapy and to identify problems.

• Goals achieved indicate success and goals not achieved indicate failure. Failure may be due to any number of reasons which need exploring. For example, a patient may fail to achieve a goal because of medical complications or because equipment fails to arrive, factors which may be difficult to avoid.

• Failure to achieve goals may reflect poor therapy attendance. Alternatively, failure may indicate unrealistic goals which need
revising.

• A risk of excessive reliance on goals to measure success is that it encourages the selection of non-challenging goals which have a high likelihood of success.

Guidelines to setting goals

• Goals should be SMART. That is, they should be: Specific, Measurable, Attainable, Realistic and Timebound.

• Physiotherapy-related goals need to be based on predictions of future independence, taking into account contextual factors such as patients' and families' perspectives, priorities and personal ambitions.

• Other factors which influence outcome include access to products, technology and support, and personal attributes such as age, personality and anthropometrical characteristics.

• Clearly, however, the strongest predictor of future independence is neurological status. Neurological status determines the strength of muscles which in turn largely determines patients' ability to move.

Guidelines to setting goals

• The goals should be performed according to the levels of • innervation for key upper and lower limb muscles. However, the generalization is difficult because muscles have been grouped together even though different muscles and parts of the same muscle often receive innervation from different spinal nerve roots. For example, the pectoralis muscles consist of pectoralis minor and the sternocostal and clavicular parts of pectoralis major. These muscles receive innervation from C5 to T1.

Guidelines to setting goals

• For some patients, particularly those with motor • complete lesions without zones of partial preservation, it is relatively simple to look at the extent of paralysis and identify the optimal levels of independence which patients can hope to attain. For instance, patients with complete T 12 paraplegia and paralysis of the lower limbs have the potential to independently dress and transfer. In contrast, patients with complete C4 tetraplegia do not. However, this type of information can only be used as a starting point.

Guidelines to setting goals

- Not only will outcomes be affected by contextual and other factors, but also by individual variations in neurological status. Often patients with the same ASIA classification have subtle but important differences in strength. For instance, a patient with C6 tetraplegia and grade 4/5 strength in the wrist extensor muscles will generally attain a higher level of function than a patient with the same level of tetraplegia but grade 3/5 strength in the wrist extensor muscles. This is not only due to the implications of wrist extensor strength for function, but also due to the fact that wrist extensor strength is usually indicative of strength in other muscles which are primarily innervated at the C6 level, such as the latissimus dorsi and pectoralis muscles. Weakness in either of these shoulder girdle muscles has deleterious implications for function.

THE EMERGENCY PHASE:

- This is how the first 12 hours after the trauma are defined. The emergency phase begins with the reporting of the accident and should end in a hospital setting (emergency room), with clinical conditions already assessed.

THE EMERGENCY PHASE:

- During the emergency, rescue workers adhere to the international scheme
  - Pre A To secure the subject–
  - A airway: maintenance of the airway patency and – protection of the cervical spine
  - B breathing: breathing and ventilation–
  - C circulation: circulation and control of bleeding –
  - D disability: neurological status–
  - E exposure: discovering the patient to accurately – assess him and at the same time prevent hypothermia.

THE EMERGENCY PHASE:

- If the arrival in the emergency department occurs within a certain time frame (it should be within eight hours), the NASCIS protocol is applied, ie the administration of high-dose cortisone which aims to limit spinal cord damage related to edema.

- Today there is a lot of discussion about the advantages and disadvantages of this treatment but at the moment it is still in use in emergency rooms in the Western world.

THE EMERGENCY PHASE:

- The out-of-hospital emergency phase is very important in order not to aggravate the orthopedic and neurological situation, still 5% of injuries worsen during the first phase of rescue (a percentage still high, but much lower than that of 15 years ago about 30%) .

- An essential component is the relief of associated lesions, although the picture will only be made clear by examinations and in- hospital imaging.

The critical area room

The critical area room

The monitor

- HR Range between 60 and 100
- Rhythmic rhythm or rare extrasystoles•
- Blood pressure: pay attention to both the minimum and the max
- FR <24 acts min: limit of 35 for mechanical assistance.
- Pulse oximeter should never go below 94•
- Temperature If> 38 ° or <35 °•

In the acute phase ...

The assessment and treatment plan are aimed at:

- Framing of the case
- Prevention of complications associated with neurological level, immobilization syndrome, (respiratory, muscle, joint, skin, circulatory) pain, spasticity, anxiety, etc.
- Orthostatic position readjustment
- Search for ergonomic positions and movement strategies that improve the quality of life immediately and in the future

Rehabilitation during the acute phase

- Conventionally, "acute phase" means the period immediately following the emergency phase until the general clinical conditions stabilize.

- Rehabilitation begins already at this stage.

Rehabilitation begins already in this phase …… Why?

- evaluation and hypothesis of qualitative recovery - functional prognosis
- prevention of possible complications
- design of the rehabilitation process (project)
- promotion of strategies in order to improve the immediate and future quality of life.

Rehabilitation approach in the acute phase ...

- Assessment of damage, disability and detection of problems
- Prevention of complications associated with neurological level, immobilization syndrome, (respiratory, muscle, joint, skin, circulatory) pain, spasticity, anxiety, etc.
- Upper limb positioning and search for movement strategies that improve the quality of life immediately and in the future
- Sitting position readjustment
- Identification and customization of aids

What complications?

- Respiratory
  - Bronchial encumbrance
  - Insufficency respiratory
- Vascular / circulatory
  - Tvp – embolisms
  - Orthostatic hypotension
- Cutaneous
  - Pressure ulcers
- Musculo-articular
  - Hypostenia - muscular hypotrophy.
  - muscle shortenings
  - intra-articular calcifications

What complications?

- Pain
- Anxiety
- Alteration of muscle tone
- Urological
- Gastro-intestinal

TREATMENT IN THE ACUTE STAGE

- The global approach to the SCI patient implies a continuous process of evaluation / treatment / re-evaluation in which each member of the team collects clinical data, and each professional interprets the same data according to their own area.
- For these patients - in whom the clinical variability is enormous not only within the pathology but also within the therapeutic path of the same individual - the interpretation of the sign and its processing are fundamental: they translate into therapeutic strategies that lead to the acquisition of the best possible level of autonomy, as a function of social reintegration and psychological well-being.

TREATMENT IN THE ACUTE STAGE

- The know-how of the physiotherapist who deals with the acute phase of spinal cord injury (in reality the same thing applies to the entire path) is very broad and very specific at the same time.
- This accounts for some of the most common (and sometimes irreparable!) treatment setting errors we face when the patient arrives in the Unipolar Spinal Unit weeks or months after the injury.

TREATMENT IN THE ACUTE STAGE

- We can simplify the physiotherapist's intervention by distinguishing:
  - postural care,
  - mobilization and kinesis,
  - evaluation and personalization of aids (sometimes directly their construction!),
  - Respiratory physiotherapy.

TREATMENT IN THE ACUTE STAGE

- In the exemplification of the treatment of the subject with spinal cord injury it is preferable to refer to the traumatic origin because the lesion is stable and not developmental (e.g. in oncological pathology it is very variable)

- Moreover, the person with trauma tends to reconstruct a life as far away from the medicalization, which on the other hand is mandatory in the other forms, which makes long-term rehabilitation work indispensable and of great significance.

THE ACUTE PHASE

- It is the phase characterized by instability .. both lesional and clinical parameters
- At the end of the EMERGENCY phase (about 12 hours after the trauma), the acute phase begins which will end at the end of the spinal shock and the stabilization of the clinical parameters.
- It can last from a few days to a few weeks after the trauma, there is no certainty of the timing.

THE ACUTE PHASE

- The acute phase, defined in general, is a condition in which a subject is in a critical state in which the clinical parameters - the vital signs - are not yet stabilized and therefore the clinical conditions can deteriorate abruptly and suddenly for the most varied reasons.
- In the medical-legal sense it corresponds to the period in which the doctor "reserves the prognosis", ie he cannot guarantee that the patient will survive.

THE ACUTE PHASE

- The concomitance of many injuries in the traumatized subject means that in the event of loss of consciousness it is assumed, until proven otherwise, that there may be a spinal cord injury.
- In fact, the main diagnostic test is CLINICAL: that is,ASIA, which requires a conscious and cooperating patient. Furthermore, the CT and MRI images are not conclusive: there may be frightening fractures in which the spinal cord is almost intact and minimal bone lesions with extensive spinal injury.

THE ACUTE PHASE

- The treatment of the vertebral lesion is almost always SURGICAL with decompression of the medullary canal and evacuation of bone fragments, hematomas, etc. and subsequent stabilization which, depending on the case, involves two or more vertebrae adjacent to the injured one.
- The trend towards ever faster technical evolution makes it unnecessary to go into details that will be obsolete in two years, just remember that the intervention of your patient must be known in detail in order to know the limits and contraindications to therapeutic exercise.

THE ACUTE PHASE

- In rare cases, surgery is not recommended and a CONSERVATIVE treatment is opted for, ie forced to bed for at least 60 days with no load on the injured spine; until a few years ago it was mandatory in severe osteoporosis in which the bone density was too low to ensure the sealing of the syntheses, but today it seems that with special "glues" injected into the rarefied vertebrae this problem is also solved.

THE ACUTE PHASE

- Once the vital parameters have been stabilized and the surgery performed, the traumatized person spends a shorter or longer period in an Intensive Care Unit even if the acute phase is technically ending, but the need for high assistance and highly invasive therapeutic maneuvers is still needed. and clinical control systems.

THE ACUTE PHASE

- During the operation, the patient is intubated and connected to a mechanical ventilator; the resumption of autonomous ventilation involves a series of weaning stages, during which the traumatized patient gradually regains the upper hand over the ventilation machine until he can do without it. The speed with which weaning takes place depends on many factors, in our case the main one is the preserved muscle heritage and the coexistence of traumatic or infectious lung problems.

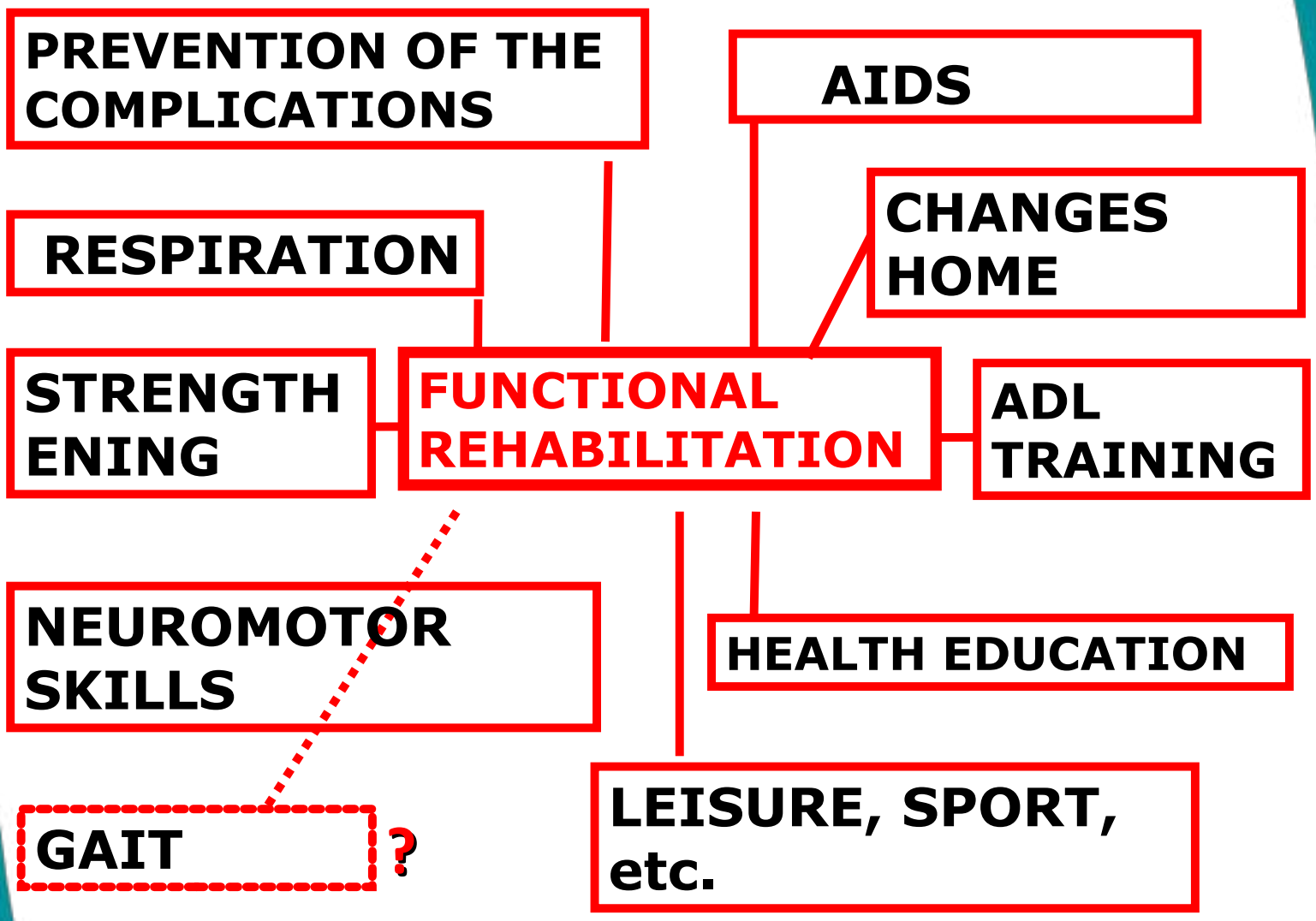
THE ACUTE PHASE

- The management of the injured person BEGINS IN INTENSIVE CARE UNIT to ensure prevention of complications, preparation for subsequent adaptations and elaboration of the recovery plan.
- When the clinical conditions allow it, the patient is transferred to the Unipolar Spinal Unit, in the subintensive section.

In the stabilization phase ...

The assessment and treatment plan are aimed at:

- Prevention of complications
- Neurological recovery monitoring
- Functional training


PREVENTION OF THE COMPLICATIONS
AIDS
CHANGES HOME
RESPIRATION
STRENGTH ENING
FUNCTIONAL REHABILITATION
ADL TRAINING
NEUROMOTOR SKILLS
HEALTH EDUCATION
GAIT
?
LEISURE, SPORT, etc.

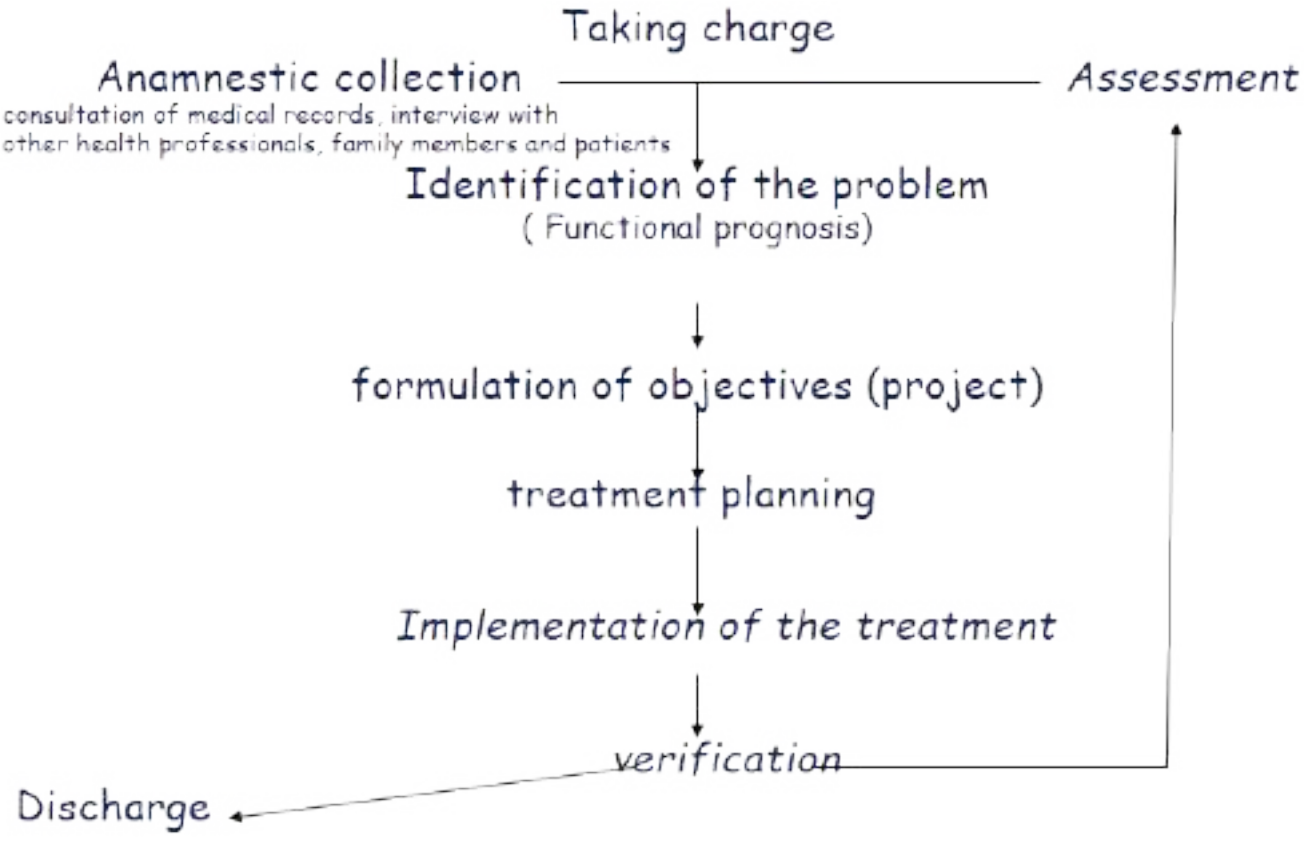
OBJECTIVES

- Maintain joint freedom capable of favoring the achievement of compensation at the shoulder, elbow, wrist and hand level.
- Strengthen the supralesional motor skill
- Attempt to recover sub-injury motor skills
- Control of spasticity.
- Inclusion of compensation as early as possible.

INTERVENTION by the Physiotherapist

- Taking charge, anamnestic collection, consultation of instrumental tests, team consultation, interview with the patient and / or family members
- Functional evaluation and functional prognosis
- Rehabilitation project: consultation and sharing with other professionals as well as with the patient and his family.
- Treatment plan
- Implementation
- Re-evaluations and outcome checks (intermediate and final)Compilation of the file: recording of the clinical evolution (daily diary and attached documents), drafting of essential reports (discharge, aids, etc.)

Physiotherapist operating algorithm



PRINCIPLES OF TREATMENT

- At the time of discharge, the connection between the USU and the local ASL structure that will take care of the patient is essential so that a network of health and / or social services is organized that guarantees the necessary therapeutic continuity to promote social reintegration.

PRINCIPLES OF TREATMENT

- The functional rehabilitation intervention begins in the acute phase and gradually becomes more intensive in the stabilization phase, which corresponds to the moment in which the patient begins to get up in a wheelchair and begins activity in the gym and / or occupational therapy. The distinction between the objectives of the two moments is purely "didactic" as they often overlap and their differentiation derives from priority needs linked to the clinical situation.

PRINCIPLES OF TREATMENT

The first phase is aimed at pursuing the following objectives:

- prevention of the effects of immobilization and its complications through the alternation of decubitus, the positioning of the spine and extremities in correct alignment, the mobilization of the limbs (passive, active- assisted, active);
- respiratory physiotherapy aimed at improving the mechanical structure of the wall and restoring bronchial patency through unblocking maneuvers;
- improvement of skills and motor control with active and / or active-assisted exercises in the districts spared from the injury;

PRINCIPLES OF TREATMENT

The first phase is aimed at pursuing the following objectives:

- gradual re-education in standing position first in the articulated hospital bed and then in a wheelchair using an orthosis for the spine (according to medical prescription, collar, bust), for vasopressure (vasocompressive knee-highs, abdominal belly);

PRINCIPLES OF TREATMENT

The first phase is aimed at pursuing the following objectives:

- In cervical lesions particular attention is paid to the positioning of the hand, seeking a functional attitude that allows to obtain a functional tenodesis of the flexors of the fingers (so-called "automatic hand"); the shortening must be reversible, the complete articular excursion at the level of the interphalangeal joints must be maintained so in the case of neurological recovery normal motor skills can be restored (supported by the use of splints that facilitate harmonious recovery and counteract the onset of deformity);

PRINCIPLES OF TREATMENT

The first phase is aimed at pursuing the following objectives:

- Identification and / or packaging of aids and / or orthoses to facilitate the autonomous performance of daily activities such as nutrition, personal hygiene, etc.

PRINCIPLES OF TREATMENT

In the stabilization phase, the emphasis of functional rehabilitation treatment is placed on the following objectives:

- research and promote motor skills through neuromotor techniques, hydrotherapy, muscle strengthening, bio- feedback, balance exercises straightening sequences;
- reduce / inhibit spasticity by looking for suitable postures, stretching, relaxation exercises and refining the quality of movement;
- reduce / inhibit pain through the search for appropriate positioning and mobilization; physical therapy

PRINCIPLES OF TREATMENT

In the stabilization phase, the emphasis of functional rehabilitation treatment is placed on the following objectives:

- train independence in daily life activities (A.D.L.) with Occupational Therapy training (clothing, personal hygiene, nutrition, travel, transfers, wheelchair mobility, as well as communication and play / recreational activities, etc.);
- to train patients in whom the necessary pre-requisites exist;
- readjustment to the vertical position (standing wheelchairs, vertical stabilizer, use of braces);
- postural re-education for the prevention of vertebral alterations and / or deformities;

PRINCIPLES OF TREATMENT

In the stabilization phase, the emphasis of functional rehabilitation treatment is placed on the following objectives:

- research and identification and / or packaging of aids that facilitate / allow autonomy in the activities of daily life listed above;
- supply (through practices with the competent A.S.L. or I.N.A.I.L.) or construction of the basic aids identified;
- training in the use and maintenance of the identified aids;
- health education of the patient and / or family members to manage the problems resulting from spinal cord injury at home; consultancy for environmental changes;
- driving test advice;
- sport therapy (table tennis, swimming, archery, basketball, tennis)

PRINCIPLES OF TREATMENT

- Within this list, both the objectives and the treatment techniques are chosen on the basis of the major problems encountered during the evaluation and in accordance with the clinical status of the patient, in order to allow their reintegration into the within their socio-family context.

Skin management

- Pressure ulcers are one of the commonest and most troubling complications of spinal cord injury.

- They can occur at any time and are a source of frustration and disruption to patients' lives and rehabilitation.

- In the long term, they can prevent individuals from successfully holding jobs and they can adversely affect quality of life.

- They can also increase spasticity and pain, and predispose to autonomic dysreflexia and contracture. In severe cases, pressure ulcers develop into large wounds which become infected, leading to osteomyelitis and other serious medical complications which may be fatal.

- In some developing countries with limited resources, life-threatening pressure ulcers are a constant threat.

Prevention of pressure ulcers

- The key to pressure management is prevention.

- Prevention requires a multifaceted and interdisciplinary approach involving education, good nutrition, anti-spasticity medication and strategies to ensure regular changes in position.

- Perhaps more importantly, prevention involves the appropriate prescription of pressure-relieving equipment such as bed mattresses, wheelchair cushions and wheelchairs.

Regular change in position

- Recently-injured patients confined to bed are initially turned every 2 hours.
- The frequency of turning is gradually decreased but depends on many factors, including the type of mattress upon which the patient is lying and susceptibility to skin problems.
- Once patients start to sit in their wheelchairs , they need to relieve pressure from under the ischial tuberosities at least once every 15–30 minutes.
- Some evidence indicates that the lift should be sustained for approximately 2 minutes.

Regular change in position

• The frequency and length of pressure relief can often be decreased over time, but only in conjunction with careful monitoring. There are many different ways pressure can be relieved when sitting. A vertical lift that clears the buttocks from the seat is the most commonly used method by those with sufficient upper limb strength. Patients unable to perform a vertical lift can relieve pressure by regularly leaning forwards or sidewards, or, if necessary, by resting forwards with their arms on a table.

• Patients with high levels of tetraplegia sitting in power wheelchairs can redistribute pressure by regularly changing the tilt of their wheelchairs and elevating the feet

Patient, staff and family education

- Education of patients, staff and families is an important aspect of pressure care management.
- All must be made aware of the appropriate use and maintenance of pressure-relieving equipment. A common mistake is to place a wheelchair cushion upside down or around the wrong way.
- This usually reduces the pressure-relieving qualities of the cushion.
- Skin needs to be checked daily and, initially, more regularly if trialling new equipment.

Patient, staff and family education

- Patients need to be aware of the first signs of skin damage. They also should know how to appropriately manage problems when they arise. Adequate pressure relief is particularly important when sitting in cars or on commodes or other hard surfaces. Similarly, pressure from orthoses, splints, straps or casts can be a problem and these need careful monitoring. Medical sheepskin overlays can be used to relieve shearing forces although they should not be used on top of most pressure- relieving cushions or mattresses.

Pressure-relieving equipment

- Pressure-relieving equipment is important for effective skin management. Its prescription is sometimes the responsibility of physiotherapists but more often occupational therapists.

- Therapists prescribing this type of equipment would be well advised to seek additional information and training.

- Prescription of pressure-relieving equipment is something which requires careful consideration with deleterious consequences for patients if it is done poorly.

Pressure-relieving equipment

- Equipment that has provided adequate pressure protection during hospitalization may prove to be insufficient when patients return home. This is partly because patients regularly change position as part of therapy and nursing care programmes when in hospital but may not change position as frequently on discharge. Skin problems at home can be avoided by trialling pressure-relieving equipment under conditions that closely mimic the home situation.
- For example, patients unlikely to turn at night when home need to trial bed mattresses under the same conditions while in hospital. If in doubt, it is better to err on the side of caution and prescribe overprotective equipment.

Bed mattresses

- There are many different varieties of pressure-relieving mattresses.
- Mattresses may be either foam-, air- or water-based. The more expensive ones use power to cycle air through different chambers, systematically alternating pressure.
- A recent Cochrane systematic review concluded that in people at high risk of developing pressure ulcers, foam mattresses designed for relieving pressure are superior to standard hospital mattresses. The merits of more elaborate and expensive mattresses have not been scientifically validated, although most clinicians consider them superior to foam mattresses.

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

1860/3677

Wheelchair cushions

• There has been growing commercialization of wheelchair cushions and there are now hundreds of different types on the market. Most are air-, foam- or gel-based, and designed for specific purposes. The most important pressure-relieving quality of a cushion is its ability to minimize pressures in the soft tissues overlying the ischial tuberosities. These pressures can be measured with either simple or sophisticated equipment designed to measure skin interface pressures.

• However, there is not one critical pressure, below which patients are safe from skin damage and above which they are not. It depends on many factors, including the length of time that pressure remains unrelieved.

• As a general rule, however, peak pressures over vulnerable sites should be kept well be ow 60 mm Hg

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

1862/3677

Wheelchair seating

- Poor seating is a common cause of pressure. Soft tissues that are weight bearing or in contact with the wheelchair, especially those overlying the ischial tuberosities, are most vulnerable to the destructive pressures associated with prolonged sitting. These pressures are influenced by factors such as height of the footplates, tilt of the pelvis, tilt of the wheelchair and length of the seat. For example, footplates which are too high shift weight posteriorly, concentrating pressure over the ischial tuberosities.

- A posteriorly rotated pelvis turns the sacrum into a weight-bearing area, increasing susceptibility to sacral pressure ulcers. A seat which is too short distributes the weight of the thighs over a smaller surface area, increasing pressure. All these issues need to be considered when prescribing wheelchairs.

- Patients with deformities present complex seating problems because correction of deformities invariably requires the application of pressure. Most solutions involve dissipating pressure over wide areas, preferably through soft tissues that do not overlie bony prominences.

Treatment of pressure ulcers

- Not surprisingly, the treatment of pressure ulcers includes strategies to minimize pressure.
- These must be instigated with the first signs of destructive pressure, and may include confinement to bed, adjustment of a wheelchair or cushion, remoulding of a hand splint, realignment of an orthosis, or education.
- If a severe pressure ulcer develops, hospitalization may be required for many months, with or without accompanying surgery. For further details, interested readers are directed to clinical practice guidelines on the treatment and prevention of pressure ulcers.

Prevention of musculo-articular limitations

- Loss of active motion, acute phase bed rest, muscle imbalances between agonists / antagonists in denervated or hypertonic muscles, the use of orthoses to stabilize the spine (collar, torso), the presence of pressure ulcers, etc. they can cause muscle-joint limitations.

- Prevention therefore begins already in the acute phase and continues also in the stabilization phase through:
  - the alternation of decubitus;
  - positioning of the spine and extremities in correct alignment;
  - mobilization (passive, active-assisted, active of the 4 limbs and the spine).

- Warning: in case of conservative treatment of the vertebral fracture or in case of instability of the spine during mobilization, do not exceed 90 ° of flexion of the shoulder and 45 ° of flexion of the hip with knee extended.

Prevention of musculo-articular limitations

Paraplegic subjects and in some cases also quadriplegic subjects learn in the stabilized phase to perform self-mobilization of the lower limbs in order to:

- maintain passive joint excursion in joints without motor control in a self-managed way;
- facilitate dressing maneuvers in bed and / or in a wheelchair;
- favor the re-appropriation of the paralyzed part of the body.

Prevention of pressure ulcers

Pressure ulcers form more frequently in those areas of the body where the subcutaneous muscle layer between the bony prominence and the support surface is less or absent:

- supine position: sacrum, ischium, heel, scapulae, vertebral spinous process and occipital region;
- prone position. iliac crests, knees, dorsum of the foot;
- lateral decubitus: trochanters, femoral condyles, external malleoli, elbows;
- Sitting position: ischial tuberosities.

Prevention of pressure ulcers

The most effective treatment is prevention through an accurate patient education program and the use of anti-decubitus devices. In particular:

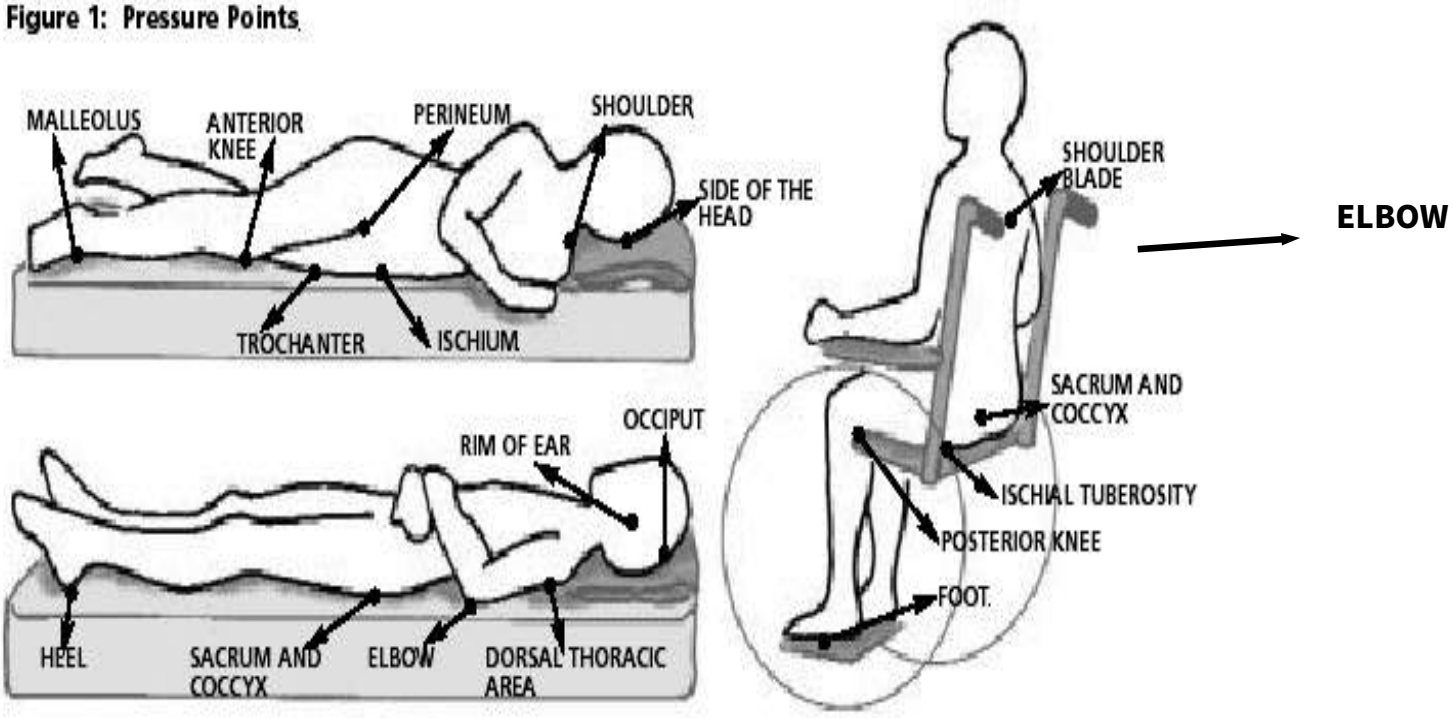
- perform skin inspection, especially in areas at risk, in the morning before getting up and in bed in the evening; for this purpose it may be necessary to use a mirror in the skin areas that are more difficult to see; if even initial signs are detected that characterize the pressure ulcer, avoid skin compressions in those areas by assuming alternative positions;
- always carry out a thorough perineal hygiene after each urination and evacuation, dry the skin well after a shower;
- avoid burns, erythema, chilblains;
- in bed, alternate positions every 3-4 hours;

Prevention of pressure ulcers

- make the transfers avoiding crawling or rubbing the skin tissues, thus lifting the body from the support surface and eliminating anything that can cause damage to the patient and that can hinder the transfer (side rails, armrests, platforms, etc.),
- the person in a wheelchair must learn to relieve pressure on the ischial region by lifting periodically; if it is not possible to rise, it is necessary to bring the trunk forward or to the side in order to unload the ischial area;
- take care of the maintenance of the anti-decubitus devices (pillows and mattresses) which must be checked periodically in accordance with the manufacturer's instructions.

SKIN EVALUATION

Figure 1: Pressure Points



Observation and assessment of risk areas

SKIN COMPLICATIONS

- Formation of compression ulcers due to pressure on capillaries, stretching or slipping of tissues, or frictional forces.

Skin complications prevention

- Correct positioning to reduce compression and stretch forces on soft tissues (especially in semi- sitting position) use semi-fowler position
- Use aids for the correct pressure distribution (pillows, anti-decubitus mattresses, articulated bed, gel supports,) and avoid direct pressure on the bone protrusions
- Vary the placement every 2-4 hours(if allowed by clinical conditions, based on aids and skin condition)

Skin complications prevention

- If it is impossible to perform a positioning every 2 hours, devices for the correct distribution of pressure must be used (anti-decubitus mattresses
- If you use these aids, you can change you position every 4 hours at most. If we use static mattresses, if I use dynamic air aids " even more hours" (Evidence C)

Skin complications prevention

- The use of ring aids (donuts) is strongly discouraged. (Evidence C)
- In bedridden and completely immobile subjects, the heels must always be raised from the bed surface. No anti-decubitus mattress can preserve heels from pressure ulcers (Evidence C)

Skin complications prevention

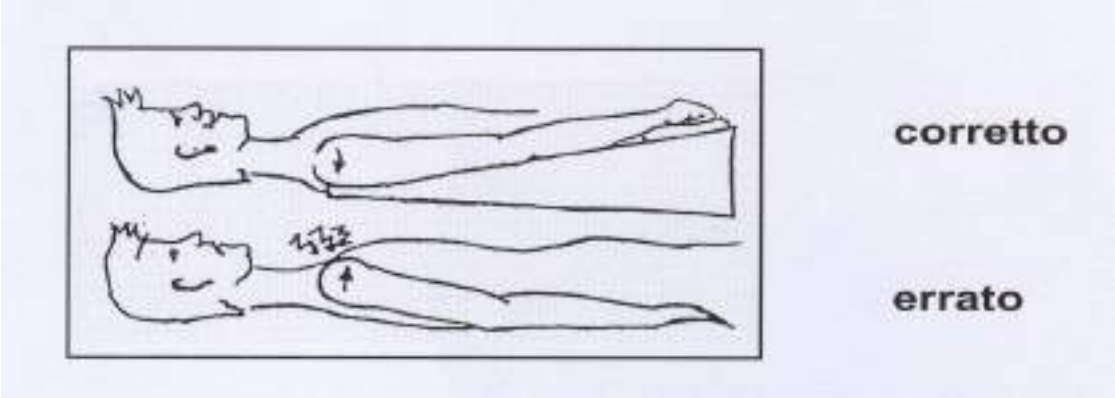
- Global daily visual and tactile inspection of the skin (Evidence C), in particular of:

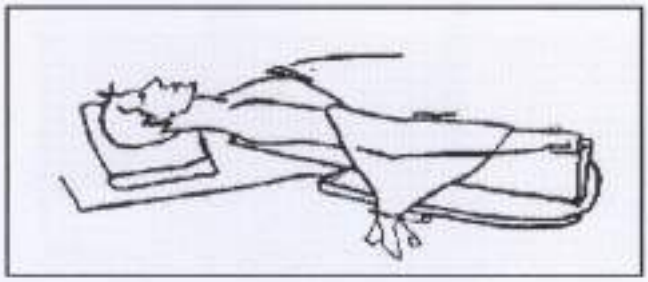
  - Ischium
  - Sacro-coccygeal area
  - Trochanters Heels

Positioning with aids

- On pillows
- Low memory mattresses
- Communicating air cell mattresses
- Air chamber systems with alternating cycle
- Dynamic pressure redistribution systems (fluidized air beds, air release beds)

POSITIONING





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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

MUSCLE-JOINT COMPLICATIONS

- Joint limitations
- Shortening of muscles or tendons
- Calcifications
- Skeletal deformities
- Osteoporosis and Pathological Fractures
- Muscle imbalances
- Spasticity
- Pain

Prevention of musculoskeletal complications

- Correct positioning
- Change of position
- Spasticity-inhibiting postures
- Passive or active assisted mobilization
- Stretching
- Postural exercises
- Correct posture education
- Identification and application of splint and orthosis

Change of position

Lateral / flank avoid direct pressure on the trochanters (30 ° semi / lateral positioning)

- Supine
- Lateral
- Semi-seated
- Prone

Positioning

- Bedsores prevention
- Muscle-tendon shortening prevention
- Edema prevention
- Pain prevention
- Search for functional positioning of the upper limb
- Spasticity Inhibition

NO

- Elevation of the scapula
- >Scapula adduction
- Shoulder abduction
- Elbow flexion
- Supination forearms
- Finger extension

YES

- Depressed scupla
- Scapula protracted
- Shoulders slightly abducted,
- Elbows extended
- Forearms pronated
- Hand closed into a fist-
  → elbow and hand higher than shoulder level

Supine position

• Avoid neck flexion (one pillow under the shoulders and one under the head)Spine aligned
• Also in neutral position between internal and external rotation
• Knees not hyperextended and heels isolated (with pillow)
• Neutral ankles and extended toes (avoid weight of blankets)
• In general, an inclination of the back of the bed of 15 ° - 30 ° is allowed without having to apply an orthosis for vertebral stability, as long as the knees are flexed at 30 °: this allows to reduce the load at the ischial level.

PREVENTION OF DECUBITUS INJURIES

- Important scientific production, only a small part dedicated to the SCI patient
- Very different evaluation, treatment and prevention protocols
- Paralyzed Veterans Administration 2000: guidelines for prevention, evaluation, local, general, surgical therapy, postural norms and aids

PREVENTION OF DECUBITUS INJURIES

- Identification of local and general risk factors
- Daily surveillance of high-risk areas (ischium, sacrum, trochanter, heels)
- Postural changes every 2 hours in the acute phase
- Lack of evidence for hyperbaric oxygen therapy

PREVENTION OF DECUBITUS INJURIES

- The use of local electrical stimulations is recommended
- Adequate bed
- Correct posture in the wheelchair
- Anti-decubitus pillow
- Patient and family education

c) Prevention of orthopedic problems (muscle-tendon shortening, joint limitations, bone decalcification)

- To prevent possible muscle-tendon retractions in the limbs and postural alterations of the spine due to prolonged sitting in a wheelchair, it is important not only the appropriate choice of the wheelchair but also a program of active exercises carried out by the patient, easily learned and also perform while seated

c) Prevention of orthopedic problems (muscle-tendon shortening, joint limitations, bone decalcification)

- The sequence of exercises must be erformed every day in order to prevent spinal deformities and maintain the musculo-articular excursion of the limbs (postural re-education).

c) Prevention of orthopedic problems (muscle-tendon shortening, joint limitations, bone decalcification)

In general, moreover:

- Regularly carry out passive mobilization of the joints without • motor control, on the instruction of the physiotherapist. Movements must be slow and gradual throughout the joint range (R.O.M)Assumption of the vertical position by means of verticalization aids (Stabilizer, verticalizing wheelchair)
- Stretching and other therapeutic interventions to reduce spasticity
- Regularly assume and change postures that allow for good alignment of the head, trunk and limbs.
  Adoption of a diet that guarantees a constant supply of • calcium

Hypotension

- Graduated compression stockings and abdominal binders may help maintain blood pressure although evidence of their effectiveness is conflicting.
- Postural hypotension is particularly pronounced when patients first mobilize after injury, especially if there has been an extended period of prior bedrest. For this reason mobilization needs to be implemented slowly.
- For the first few days the patient may just tolerate sitting up in bed. Subsequently, the patient may then be sat
- out of bed in a reclined wheelchair with the legs elevated.

Over time patients ‘acclimatize’ and better tolerate the transition from lying to sitting; this is thought to be due to an increased tolerance to feelings of lightheadedness with lower blood pressure.

Postural re-education

- The possibility of restoring a sitting posture while respecting the physiological curves of the spine depends on numerous factors. First of all, the neurological level preserved as the higher the lesion, the greater the postural control deficit and the spontaneous attitude of compensation will lead to the development of cervical hyperlordosis. In high thoracic lesions, on the other hand, the spontaneous compensatory attitude leads to hyperkyphosis.

Postural re-education

- Other factors that influence posture are the outcomes and type of surgical stabilization, any pelvic asymmetries for different limb lengths, asymmetrical motor control, presence of pararticular calcifications, hypertonus, psychological reaction to the event, etc.

Postural re-education

- It is therefore in reality a very broad chapter of the treatment aimed at:
  - corrective re-education of functional (unstructured) postural alterations of the spine and muscle-tendon shortenings resulting from prolonged postures (hamstring shortening, spine extensors, iliopsoas, buttocks, adductors, sural triceps, etc.);
  - re-acquisition of the correct sitting posture through the appropriate choice of the wheelchair with relative customization (backrest height, backrest shape, seat inclination, position of the large wheels, footrest height, etc .) and of the anti-decubitus pillow.

Orthostatic rehabilitation

- When the clinical parameters are stabilized, the re-education to standing upright begins gradually moving to the semi-sitting position (semifowler) first in the articulated hospital bed, then in a postural or even reclining wheelchair (it would be better to avoid them) using also orthoses to support the stability of the spine (collar, torso), for vasopressure (vasocompressive knee-highs, abdominal belly)

Orthostatic rehabilitation

- The postural wheelchair is very versatile for the management of the patient's elevation both for the way of transfer from the bed and for pressure problems (possibility of reclining, possibility of adjusting the inclination of the footrests and headrest). Once the pressure values are stable and the ability to support the weight on the spine for a few hours has been reached, the postural wheelchair is abandoned to reach the sitting position using a 90 ° wheelchair.

Orthostatic rehabilitation

- In less complex situations (no complications from polytrauma, young subjects, low injuries, stable pressure parameters) you can reach the 90 ° position on the bed and then get up immediately in the wheelchair at 90 °.
- The next step is the readjustment to verticalization using manual or electric standing , or verticalizing wheelchair.
- In cases of particular difficulty in pressure readjustment, the static bed is used.

Orthostatism re-education

WHEN?

- Based on the presence of the means of synthesis, clinical conditions, presence of complications (PU, DVT, inflammatory states, etc.) and / or associated trauma

HOW?

- Gradual and progressive achievement of the sitting position on the bed and then in the wheelchair

What aids?

- Articulated bed, with trendelemburg and antitrendelemburg position, static table
- Postural or 90 ° wheelchair, anti-decubitus cushion
- Vasocompression orthosis (belly and elastic stockings)
- Support orthosis for stabilization of the spine if necessary (braces, collars)
- Lift or sliding board•

Verticalization

- When the sitting position is maintained with stable pressure values throughout the day, the readjustment to verticalization begins.
- The assumption of an upright posture has beneficial effects:•
  - on the bone system as it improves bone trophism;
  - on the gastro-intestinal system as it stimulates intestinal peristalsis;
  - in the prevention of muscle-tendon retractions in flexion of the lower limbs;
  - from a psychological point of view (not always);
  - Cardio-circulatory system
  - Bladder and intestinal function
  - Muscles of trunk and upper limbs
  - Kidney function

Verticalization

- Initially the maintenance of the upright position can be limited to even a few minutes in relation to the autonomic but also emotional response, then it continues for longer and longer times up to a few hours in the day.

Verticalization

- Verticalization is basically carried out by means of aids.
- In the paraplegic, the stabilizer for static (commonly standing) is generally used, which has the following characteristics:
  - adjustable support for knee support;
  - supports for the support of the upper limbs;
  - back support for the pelvis;
  - front support to prevent falling forward

Verticalization

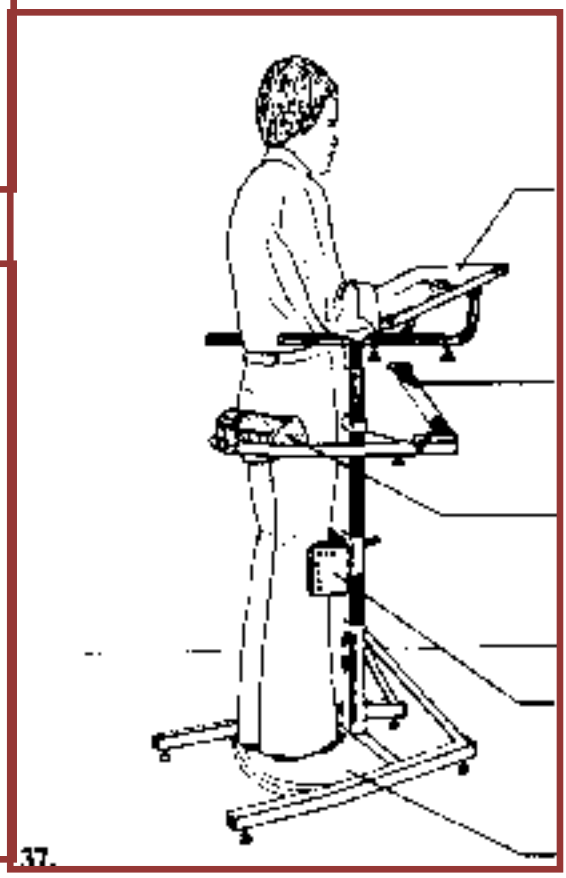
- The verticalization in the quadriplegic generally takes place by means of a verticalizing wheelchair as it allows an easier resolution of any pressure problems allowing to gradually reach the vertical position.

Verticalization

- Gradual readjustment of the load in standing position (vertebral stability !?)

AIDS

Vertical stabilizer (manual or lectric)
Verticalizing wheelchair
Static bed
Elastic stockings
Abdominal bands



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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

1905/3677

Muscle strengthening

The residual muscles must be developed to the maximum to compensate for the lack of movement of the paralyzed part. Therefore, strengthening essentially affects the muscles at the level of the upper limbs and trunk (dorsal, pectoral, large and small round, supra and infraspinous, deltoid, triceps, biceps, extensors of the spine, abdominals, etc.), compatibly with the level neurological preserved, by:

- active exercises or manual counter-resistance in segmental and / or global schemes, also including neuromuscular facilitation techniques such as PNF;
- exercises with pulley weights;
- exercises with rubber bands;
- Bars
- carpet exercises that use the weight of the body as resistance in a sitting • position on the carpet, in a sitting position with the bars (lifting forward, backward, sideways, with difference in height), prone position.

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

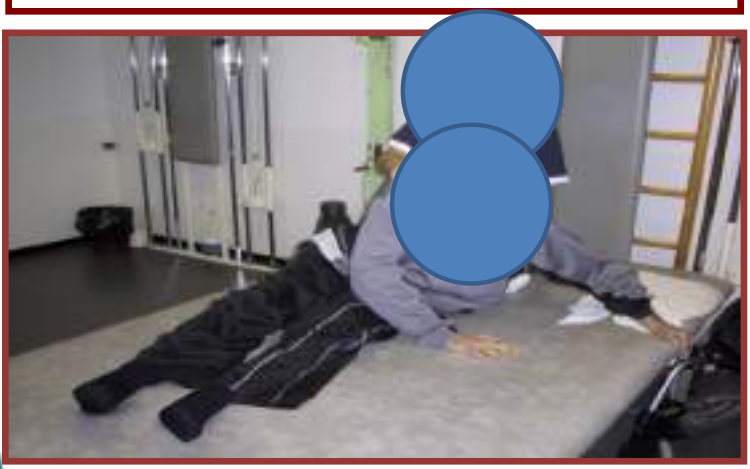
Strengthening whole muscles

PROMOTION OF FUNCTIONAL SKILLS

ASSESSMENT

Possibility of learning new motor patterns that are related to lost motor skills

-
- Balance Exercises
- Changes of position (straightening and carpet movements)
- Lifting



Muscle strengthening

Exclusion criteria:

- instability of the vertebral fracture;
- presence of still unconsolidated fractures of the upper limbs or myotendinous pathologies in progress;
- presence of marked hypertonia (in the upper limbs or onset of pathological irradiation phenomena in the trunk / lower limbs);
- marked imbalance between healthy agonist muscle and paralyzed antagonist

Muscle strengthening

- Muscle strengthening, which began during the bed rest phase, intensifies when the subject gets up through specific training after evaluating the maximum load (one repetition with maximum load in the absence of compensation, pain, pathological irradiation phenomena).
- The training can include a strengthening program (workload equal to 66% of the maximum strength) or an endurance program (workload equal to 33% of the maximum strength) in relation to the muscular examination, the physical condition of the patient, to short-term recovery goals.
- Each training session must end with stretching exercises for the shoulder girdle and upper limbs.

What to avoid and what to look for

	OBJECTIVE	RISK
Shoulder	Joint mobility in the physiological range Avoid pain at all costs Shoulder subluxation prevention	Algodystrophic syndrome Difficulty with abduction, in particular with spastic adductors Tendency to inferior subluxation in C4 lesions
Elbow	Complete range of motion, especially in extension	An extension deficit of even just 10 ° can compromise the ability to be able to transfer independently.
Wrist	Complete range of motion	Prevalence of the tone of the wrist flexors
Long fingers	Prevented emaFunctional hand	Hyperextension or incomplete flexion of the Metacarpophalangeal Stiffness of the interphalangeal joints Flat hand
First Finger	Partial adduction-flexion with extended wrist and abduction with flexed wrist	

Muscle strengthening of the supralesional areas and attempt at sub-injury recovery

- Use of manual techniques of proprioceptive neuromuscular facilitation;
- Synergies: especially those in the prone position on the elbows that reinforce the entire shoulder girdle
- Use of physical tools (dynamometer, pulleys, weights, elastic bands, cycle ergometer…);
- Inclusion in sports therapy programs;
- Activities for autonomy

Attention to

- DELTOID: exercised in a seal, its main function
- SHOULDER ADDUCTORS. Fundamental resource for compensation (shoulder antepulsion to extend the elbow and stabilization of the elbow while seated).
- BRACHIORADIALIS: it can be useful in pushing the wheelchair and usable in functional surgery

Training of straightening sequences

- They are preliminary functional activities to subsequently exercise mobility in bed.
- As mentioned for the re-education of balance, the reacquisitionof the straightening sequences is assisted by new motor strategies "suggested" by the physiotherapist but often activated automatically by the patient himself using the residual muscle heritage.
- For example, the patient without triceps learns to extend the elbow bringing the shoulder into external rotation, or to facilitate the lifting of the trunk while sitting, the patient learns to unbalance himself very much forward with the head and trunk depressing the shoulders.

Training of straightening sequences

Activities to be exercised in increasing order of difficulty and in relation to the neurological level preserved:

- maintenance of long sitting position;
- lifting on the carpet;
- shifts on the carpet sideways, forwards, backwards;
- displacement of paralyzed limbs;
- sit and lie down;
- turn sideways;
- reach the prone position;
- quadruped position;
- kneeling position.

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

1918/3677

Inhibition of spasticity

- The presence of spasticity can sometimes be useful for achieving upright posture and walking, can promote venous return and reduce circulatory stasis, limit muscle atrophy, facilitate intestinal peristalsis.
- When hypertonicity takes on a negative value as it limits the autonomy of the injured person, a treatment is required which may be, in relation to the entity and location of the symptom, pharmacological, physiotherapeutic and / or surgical.

Spasticity

- Spasticity is primarily managed with pharmacological agents.
- There are two main categories of drugs, some acting predominantly within the central nervous system (e.g. baclofen, diazepam, gabapentin, clonidine, tizanidine) and others acting peripherally, either within the muscle or at the neuromuscular junction (e.g. dantrolene and Botulinum toxin).
- Severe spasticity is sometimes managed by administering drugs directly to the spinal cord (i.e. intrathecally).
- The main implications of spasticity are that it predisposes patients to pain, contractures and pressure ulcers, and makes movement and hygiene difficult.

Spasticity

- For some patients, spasticity limits function and quality of life.
- Physiotherapy interventions such as hydrotherapy, stretch, heat, TENS, cold, electrical stimulation, therapeutic exercise techniques, passive movements, standing and vibration may provide transient relief from spasticity, but there is no evidence that any of these interventions produce lasting reductions in spasticity.
- In addition, the application ofheat can cause burns and therefore should only be used with extreme caution in patients who lack sensation.

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

1922/3677

TREATMENT OF SPASTICITY

- One of the major problems resulting from SCI
- Incidence one year after trauma: 67% of SCI, 37% receiving antispasmodic therapy, 11% unsuccessful
- Main effects: limitation in ADLSecondary effects: pain, reduction of ROM, muscle-tendon retractions, joint deformities
- Oral drugs: baclofen, dantrolene, tizanidineIntrathecal baclofen
- Selective neuromuscular blocks

Physiotherapy treatment

- Physiotherapeutic treatment after focal treatment of spasticity is based on techniques of:
- a) Short-term passive manual stretching through muscle stretching maneuvers
- b) Long-lasting passive mechanical stretching through the use of Positioning techniques
- Use of orthoses
- Functional bandage
- Serial plasters

Control of spasticity and maintenance of physiological muscle lengths and lengthening of shortened muscles:

Paid attention to:

- Pectoral muscles
- Biceps: the risk is to encounter upper limbs with a wing in C5 injury limiting autonomy
- Wrist flexors: difficulty in extending the wrist and difficulty in setting the functional hand

Short-term passive manual stretching

Muscle stretching techniques have four basic objectives:

- restore the length and flexibility of the muscle in order to achieve optimal joint range
- preserve the sliding between the elements that make up the muscle in order to contain internal friction
- reduce the patient's feeling of muscle stiffness
- maintain a correct representation of the muscle centrally.

The stretching maneuvers must be performed as follows:

- it is necessary for the patient to actively collaborate for complete relaxation of the muscle. The stretches must be of low intensity and long duration as otherwise they would cause a reflex contraction of the muscle. The maneuvers are more effective when they exploit the principle of contraction-relaxation, through a maximal isometric contraction;
- the stretching must be gentle, slow, gradual and progressive. The average time to obtain a valid muscle relaxation varies from 30 to 60 seconds and increases up to a few minutes in the case of important muscle chains. The number of repetitions on average can be considered around 10 and performed 2 times a day;
- if the temperature of the muscle is increased (eg hydrotherapy) the effect produced by the stretching is more effective and lasts longer

.

Long-lasting passive mechanical stretching

- Long-lasting passive mechanical stretching techniques use various types of aids, such as:
- -Stretching tablets
- - Orthosis
- - Functional bandage
- - Serial chalks
- N.B The choice of the technique varies according to the intensity and duration that you want to obtain from the stretching, the dynamism of the unit, the district to be treated, the patient and family compliance levels

Positioning tablets

- They allow to use a low intensity stimulus keeping the interested part in lengthening. The stretching must be continued for 20/ 30 second each session.

ORTHOSIS - Orthopedic braces

Features

- Keep the segment to be treated in a certain position
- Recover the articular excursion

Types

- Pre-packaged braces in the absence of structured deformities
- Braces tailored to specific cases

ORTHESIS - Requirements

- Be of suitable size
- Be easy to apply (for both patient and caregiver)
- Be smaller in size •
- Be well understood by those who use it or by those who assist the user

WRIST BRACE

- Brace in elastic fabric and velcro closure equipped with two aluminum reinforcement sticks located one in the ventral position and one in the dorsal position. Both splints can be manually molded into the desired position.
- This brace is used in patients who have a modest hypertonicity of the wrist flexor muscles and allows to keep the wrist in extension, leaving the fingers free.

PRE-PACKED BRACES FOR WRIST AND FINGERS

- This brace consists of a pre-molded polyethylene valve with velcro closures. The hand is placed in a functional position with the thumb abducted and the wrist slightly flexed. This device has the characteristic of being minimally moldable at low temperature and therefore adaptable to the patient's needs. It is indicated for patients who do not have established retractions or high hypertonus of the flexor muscles of the wrist and fingers.

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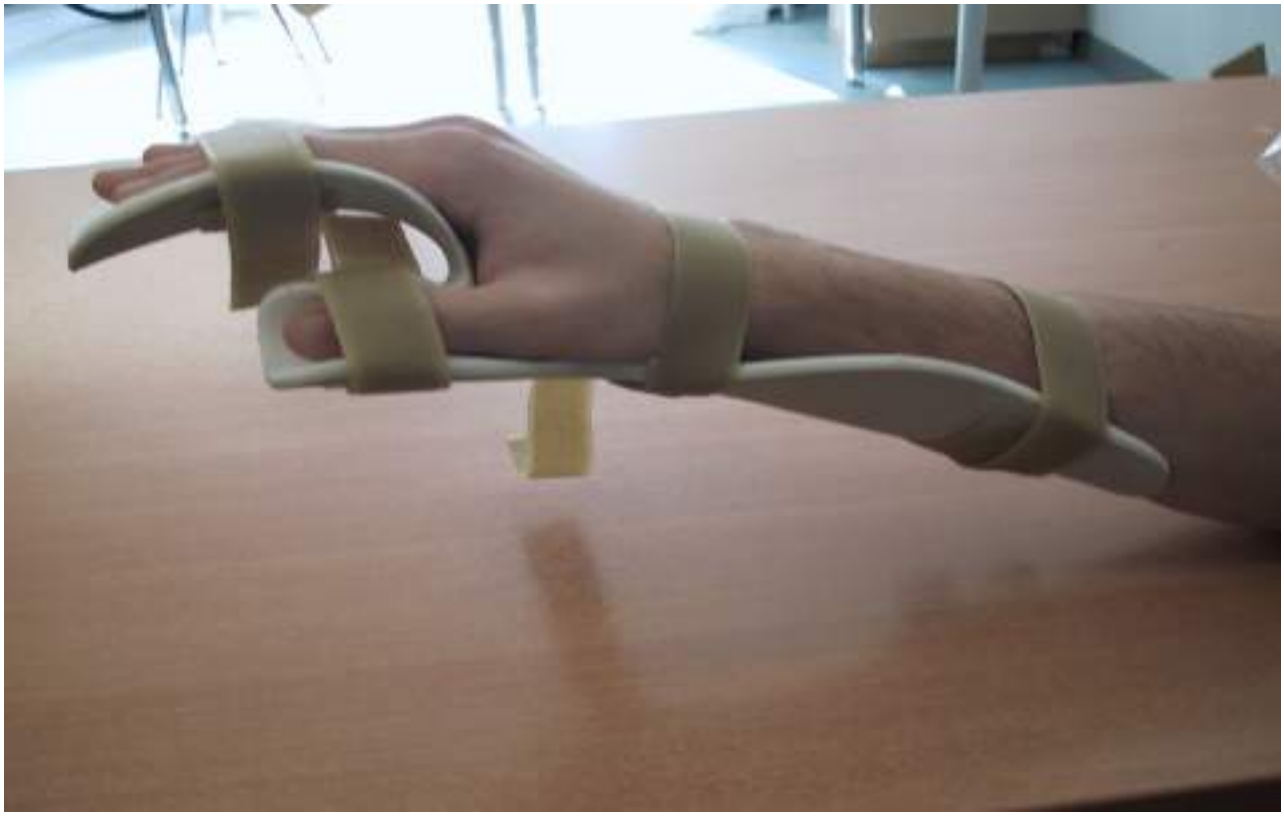
PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST



MADE TO MEASURE PACKED BRACKETS

- Custom-made braces are used when the treatment needs are specific, i.e. when it is necessary to obtain either a particular positioning, impossible to obtain with a standard brace or when deformities or structured retractions are present.
- The material commonly used for the construction of his type of brace is the low temperature thermoplastic one, which can be heated in hot water at 60 ° -70 ° and can be modeled directly on the patient's hand.

FEATURES

- modifiability, which allows you to modify the orthosis by heating it to adapt to the results obtained;
- memory, to reuse a material by remodeling it in the event of errors or major changes to be made;
- conformability, to customize the orthosis to the maximum degree;
- stiffness, to adequately support the joints: the low temperature, to model the material directly on the patient;
- lightness, so as not to weigh down the limb; practicality, to facilitate the use of the orthosis;
- perspiration, to avoid skin injuries by allowing transpiration through small holes in the material or tubular cotton.

Principles for the construction of the orthosis

- the orthoses must have levers long enough to limit the pressure on some areas
- it is necessary to correct the thumb and the distal phalanges first and then rise again shortly
- if the phenomenon of hand grasping is present, it is advisable to build a dorsal and not a palmar orthosis
- it is necessary to pay close attention to the positioning of the istal phalanges because they can more easily go into subluxation
- the orthoses must be built at least 15 days apart. From treatment with botulinum toxin as the hypertonicity can change significantly up to 15 days. after infiltration

Stages of construction

- identify the model of orthosis to be performed taking into account the objectives set and the joints involved;
- draw the basic model of the orthosis on the cast of the patient's hand, place it on the thermoplastic material and cut it out (to facilitate the operation, you can immerse the thermoplastic sheet for a few seconds in hot water to soften it and then cut out the model of the orthosis);
- soften the material in the thermostatic tank, avoiding overheating it in order not to compromise its elongation and conformability characteristics;
- model the orthosis on the patient's hand after removing the thermoplastic material from the water and drying the surfaces on a towel (check the temperature on your skin and possibly protect the patient's skin with a cotton tube);

Stages of construction

• allow the orthosis to cool, remove it from the patient's hand and carry out the finishing touches by softening the material with the heat gun, which must be held about 20 centimeters from the orthosis to prevent it from inflaming (in the case of a shorter distance), or overheating on a too large surface, (in case of greater distance).
• It is necessary to wait for the splint to cool down again before putting it back on the patient;
• have the patient wear the orthosis for 10 minutes, take it off and check for any redness to modify the splint;
• repeat the operation by wearing the splint for 30 minutes;
• apply the velcro fasteners (their length must be such that they can be closed without affecting the patient's blood circulation).

..... THE PHYSIOTHERAPIST MUST ... ..

- - pay particular attention in the presence of scars or skin lesions,
- - do not create pressure points
- - there must be no sharp edges or edges.

... .. THE PATIENT MUST ... ..

- wash the splint often with cold soapy water and dry it thoroughly;
- do not leave it near heat sources, in the sun, in hot water, as it could deform;
- do not leave it near open flames as it is flammable;
- do not try to modify it yourself so as not to compromise its rehabilitation effectiveness .

Inhibition of spasticity

The most common physiotherapy techniques for reducing hypertonia, although their effectiveness is still limited in terms of duration over time, consist of:

- slow and gradual passive mobilization of the joints throughout the joint range;
- slow and prolonged stretching of the hypertonic muscles also through the assumption of certain postures (prone, supine "frog" position, sitting on the knees from the quadrupedal position, verticalization, etc.);
- frequently change position and take correct postures both in bed and in a wheelchair;
- muscle relaxation through slow rhythmic movements with equipment such as the passive pedaler, Bobath balloon, etc.voluntary relaxation through concentration techniques and slow and deep breathing (incomplete lesions);

Inhibition of spasticity

- NB: Somatic or visceral stimuli such as skin pressure ulcers, ingrown toenails, bladder infections, stones, fractures, constipation and other pathologies, can constitute irritating spines that interfere, aggravating, the tone disturbance. Other factors that can increase hypertonia can be: cold, tight shoes or clothes, prolonged bed rest,

- Pharmacological treatment can be oral, intrathecal and local. Commonly used drugs are Baclofen, Diazepam, Rivotril, Dantrolene and Tizanidine. In some patients, the administration of Baclofen may be envisaged by implanting a pump in the abdomen, which through a spinal catheter transports the medicine into the intrathecal space with the advantage of using extremely lower doses of the drug than the oral route and with an efficacy greater. The drugs mainly used locally are local anesthetic drugs (ethyl alcohol, phenol) or at the level of the motive plate (botulinum toxin).

Training in A.D.L .:

I. Locomotion in a wheelchair
   - The electric / electronic wheelchair
   - The manual wheelchair

II. Mobility in bed

III. Transfers

IV. Personal hygiene and self-care training (nutrition, hygiene, clothing, self-catheterization)
   - Feeding
   - Hiene
   - Clothing training

The electric wheelchair

- For some patients who are unable to move in a functional way with a self-propelled wheelchair, given the poor residual motor skills or the easy exhaustion due to age or serious associated cardio-respiratory problems, an electric wheelchair must be identified as the first; this does not mean that a manual wheelchair will also be prescribed, which is sometimes easier to use when traveling by car or as a spare (electric wheelchairs are more subject to problems than mechanical ones).
- Naturally, the subject must be properly trained to drive, evaluating the suitable type of control (chin control, standard joystick or with modified handle, etc.) and the ability to safely manage the locomotion for oneself and for others by means of an electric aid .

ELECTRONIC WHEELCHAIR

IDENTIFICATION AND CUSTOMIZATION of the aid in particular for:

- TYPE OF COMMAND:
  - Joystick
  - Pressure sensor (chin, lips, tongue, shoulder, etc.)
  - Blow sensor
- Indications
  - C5 or higher lesion
  - C6-C7 lesion with need for mobility for medium distances and uneven terrain
  - Tetraplegic in pediatric age

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

WHEELCHAIR WITH JOY-STICK CONTROL

1948/3677

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

WHEELCHAIR WITH CHIN CONTROL

1949/3677

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

1950/3677

The manual wheelchair

In U.S.U. the wheelchair is the main aid. It allows indoor and outdoor movements of medium and long distances. It is of fundamental importance not only to make the appropriate choice of wheelchair in relation to the specifics of the case, but also to carry out adequate training in the use of the aid which, in relation to residual motor skills, includes the acquisition:

- Propulsion technique: circular movement of the arms with grip on the handrail from the extended to the flexed position starting just behind the pelvis; if the propulsion occurs forward, the trunk bends slightly forward, vice versa if it occurs backwards. In the absence of an active grip, the thrust is imparted to the handrail by pressing on the palm (useful thrust gloves that serve both to protect the hand and to increase friction).
- To turn to one side, the ipsilateral arm pushes the wheel backwards and towards the opposite side while the other arm pushes forward.

The manual wheelchair

- Push uphill: accentuate the flexion of the trunk to bring the center of gravity forward, downhill extend the trunk and head as much as possible, keeping the wheels braked by means of tight contact on the handrail.
- Pick up objects from the ground: never in front, but always to the side, bend with the trunk while with the arm of the other side hooks to the push handle or the wheel.

The manual wheelchair

- Balancing on large wheels (wheelie): useful for moving on uneven ground, for overcoming sidewalks / steps or very inclined descents; tilt the wheelchair on the rear wheels by pushing the head and trunk backwards and at the same time push on the wheels from the back to the front, finding a point of balance by means of small oscillations of the head and torso. Taken on the handrail. Once you have found the balance, move forward and backward on two wheels.

The manual wheelchair

• Climb the sidewalk: go to the front to the difference in height; push forward quickly enough managing to lift the small wheels until they rest on the step. Tilt the trunk forward and push on the large wheels.

• Get off the curb: bring the small wheels to the edge. Balance on the big wheels and push; you can also go back down if the step is small.

• Go ashore and go up again

• Fall prevention: in the event of a fall backwards, try to avoid the fall by bending forward as much as possible and otherwise quickly extend your arms backwards to cushion the blow.

• To go back up, lean forward leaning on a wheel while the other limb slides on the floor.

• Knowledge and maintenance of the aid

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

1955/3677

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Mobility in bed

- It includes moving in bed to the side, forwards, backwards, moving the paralyzed limbs, sitting and lying down, turning sideways, lying prone. After the preparatory work carried out in the gym, it is necessary to train these skills in the hospital bed in order to make changes of position during the night, for self-catheterization, to be able to dress and undress, to be able to get up. It may be necessary to use an electric bed with three joints that facilitates reaching the sitting position, or the use of side rails (cervical and upper thoracic injuries).

Transfers

- In principle, the transfers can be divided into three groups by order of difficulty:
  - with lower limbs raised with or without aids (trunk remains flexed)
  - with lower limbs resting on the ground with / or without aids (trunk remains flexed)
  - with lower limbs resting on the ground with difference in height (trunk in extension / flexion)
- For the most serious cases of complete dependence, the use of the lift or alternatively passive transfer mode (by standing or using a tablet, with one or two operators) is foreseeable.

Transfers

- To train for transfers it is essential that:
  - at least initially the surfaces are at the same height;
  - the transfer takes place beyond the big wheel;
  - that the injured person has the head, shoulders and trunk flexed well forward while moving with the butt (head above the knees);
  - upper limb on the side of the transfer moved away from the trunk to allow the trunk to be moved, while the other limb is close to the trunk
  - the wheelchair is in conditions of maximum stability.
- Most easily used aids: sliding board, lifter.

Transfers

Very schematically it can be said that, in the sitting position, each movement of the head in a certain direction corresponds to a displacement of the pelvis in the opposite direction.

- If we flex the trunk forward and lower the head, the pelvis moves upwards.
- If we extend the head backwards, the pelvis has a tendency to slide forward.
- If we bring the head forward, the pelvis flows backwards.
- If we turn our shoulders and head to the side, the pelvis rotates in the opposite direction

TRANSFERS

The most frequent methods:

LIMBS LOWER ON THE GROUND
LIFTED LOWER LIMBS
STANDING PASSAGE

AIDS:

Lifter
Tablet for sliding
Pull handles

- Search for supports
- Balance and capacity for imbalance
- Lifting and moving capacity
- Body weight and characteristics
- Distance of surfaces
- Friction of surfaces
- Difference in altitude

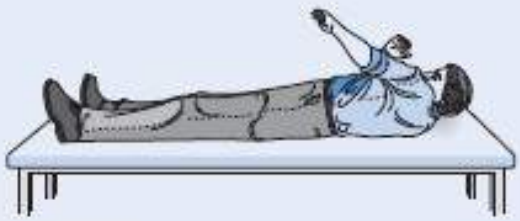
Rolling

- Rolling is used to dress and change position at night. It is also a prerequisite for getting from lying to sitting.
- Able-bodied people roll by placing the leading arm across the body and using trunk and leg muscles to initiate rotation of the body. Patients with thoracic paraplegia and C6 tetraplegia cannot use trunk and leg muscles, so instead rely solely on the head and upper limbs to roll. They roll by rapidly swinging the arms across the body. This generates angular momentum which is transferred to the paralysed lower segments of the body, facilitating rotation. The position of the legs and head influence the ease of rolling. Most patients have less difficulty rolling if the ankles are crossed and the head is lifted off the bed. Rolling is also easier if the trunk is slightly stiff with loss of passive rotation.

Rolling

- Patients with C6 tetraplegia have added difficulties rolling because paralysis of mthe triceps muscles limits their ability to maintain elbow extension. Without appropriate strategies, the elbows flex as the arms move across the body and patients may hit themselves in the face. This is avoided by externally rotating the shoulders, minimizing shoulder flexion, and performing the whole task with sufficient speed to ensure the elbows have little opportunity to flex. Contrary to what some may intuitively think it is not possible to roll with the elbows fully flexed. The shortened upper limbs cannot generate sufficient angular momentum to roll the body, and hand position limits arm swing.
- Patients unable to roll in bed can use bed rails or loops attached to the side of the bed to pull themselves from side to side. Alternatively, they must rely on assistance from others.

TABLE 3.1 A patient with C6 tetraplegia rolling onto the side (some practice strategies are described)

	Sub-task	Practice strategies
 Figure 3.4a	1. Pre-swing: The head and both arms are rotated away from the direction of the roll.	*Practice of this sub-task can be made easier if:* • a small weight is placed in the hands • elbow extension splints are used
Figure 3.4b	2. Swing: The head and both arms are thrown across the body.	• a pillow is placed behind the trunk • the ankles are crossed • the leading hip is supported in 45° flexion • elbow extension splints are used

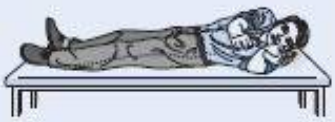
Lying to long sitting

- The ability to move from lying to long sitting is an essential part of dressing and transferring. However, the widespread use of electric beds which move patients into sitting has lessened the importance of attaining independence with this task.
- Two strategies are used to move from lying to sitting. One involves rolling on to the side and then sitting up from a side-lying position . s

Lying to long sitting

- This approach is cumbersome but relatively easy. Paralysis of the triceps muscles adds complexity because it limits the ability to push down through the hands to lift the body. Patients with C6 tetraplegia overcome this problem by aintaining the sidelying position and ‘walking’ one or both elbows around the body towards the knees. From this position, the top arm is hooked under the top leg to pull up into sitting

TABLE 3.3 **A patient with C6 tetraplegia moving from lying to sitting (some practice strategies are described)**

	Sub-task	Practice strategies
 Figure 3.6a	1. Rolling onto the side: see Table 3.1.	*Practice of this sub-task can be made easier if:* • see Table 3.1
Figure 3.6b	2. Lifting the upper trunk off the bed: The left arm is horizontally abducted and weight is borne through the left elbow.	• a pillow is placed under the chest • the sub-task is practised in reverse
Figure 3.6c	3. Supporting the upper trunk: The right hand is placed on the bed to help prevent a forward collapse of the trunk. Alternatively, both elbows are placed on the bed. *(The top arm can bear some weight even though the elbow is flexed and the triceps muscles are paralysed.)*	• a pillow is placed under the chest
Figure 3.6d	4. Positioning the top hand under the leg: The right wrist is extended and hooked behind the right knee.	• a pillow or block is placed under the left elbow (see p. 140, Figure 7.1b)

(continued)

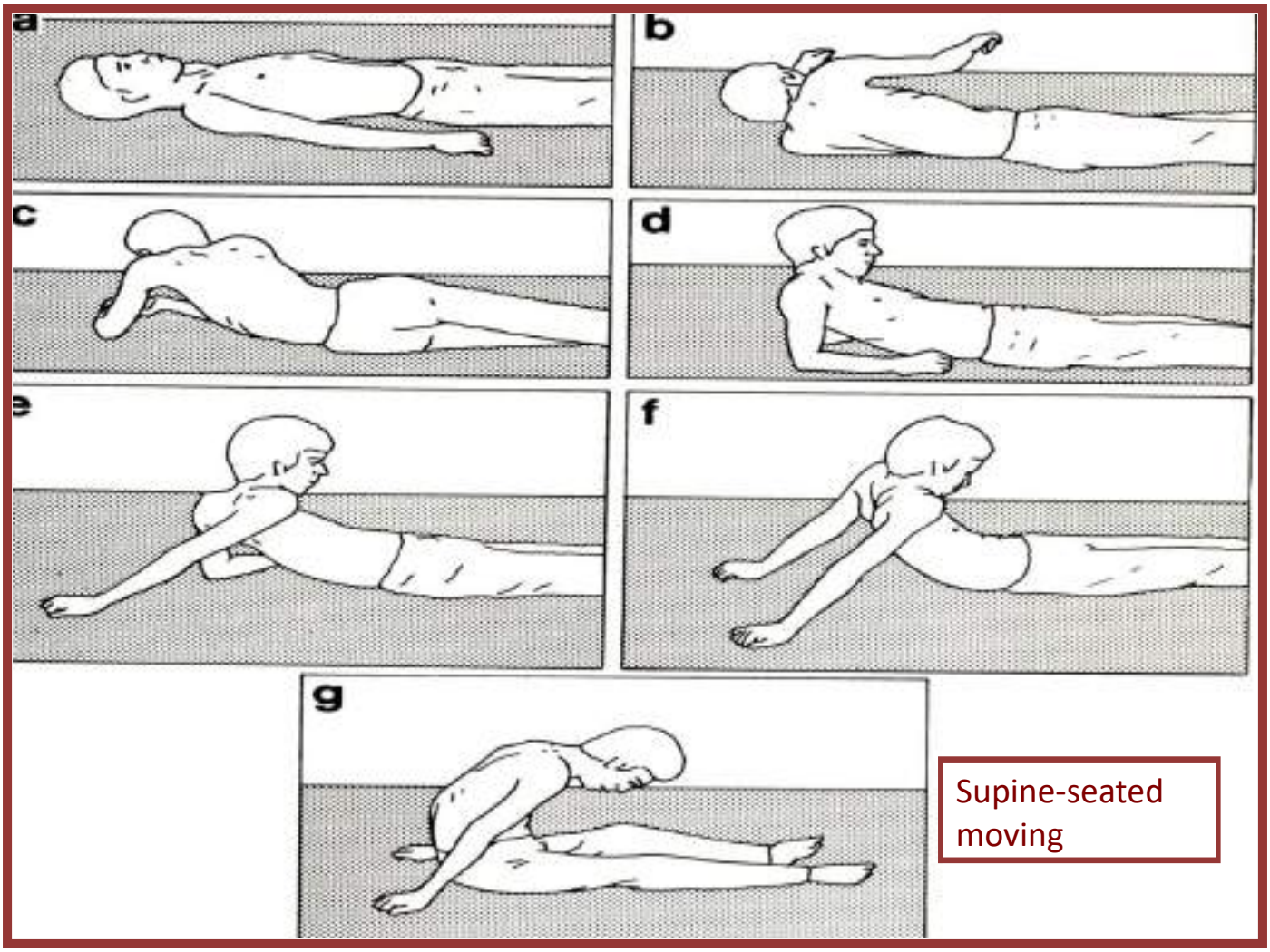
TABLE 3.3 (continued)

	Sub-task	Practice strategies
Figure 3.6e	5. Shuffling the bottom elbow around the body: The right arm is adducted with the wrist anchored behind the knee. This momentarily removes weight from the left elbow. At this instant the left elbow is shuffled a small distance towards the feet. This procedure is repeated several times to 'walk' the left elbow up towards the knees. (see p. 139, Figure 7.1 for a variation of this sub-task)	*Practice of this sub-task can be made easier if:* • a pillow or block is placed under the left elbow (see p. 140, Figure 7.1b) • the sub-task is practised in reverse
Figure 3.6f	6. Moving into the upright position: The right arm is adducted with the wrist anchored behind the knee. The left arm is abducted. The action at both arms pulls/pushes the trunk into the midline.	• a pillow or block is placed under the left elbow (see p. 140, Figure 7.1b) • the sub-task is practised in reverse

Lying to long sitting

- Another strategy for moving from lying to sitting involves using the upper arms to push directly into sitting from the supine position. Patients with paraplegia place the hands behind the body. They then push down through the hands and use elbow extension to lift the trunk. Paralysis of the abdominal muscles makes it difficult to initially position the hands behind the body. Patients with C6 tetraplegia can also move directly from the supine position into sitting; however, a different technique is used which requires awkward positioning of the shoulders.
- Consequently, few patients master the technique and it often causes shoulder pain
- It is therefore probably best avoided.

Figure 3.7 A patient with thoracic paraplegia moving directly into sitting from the supine position.



Supine-seated moving

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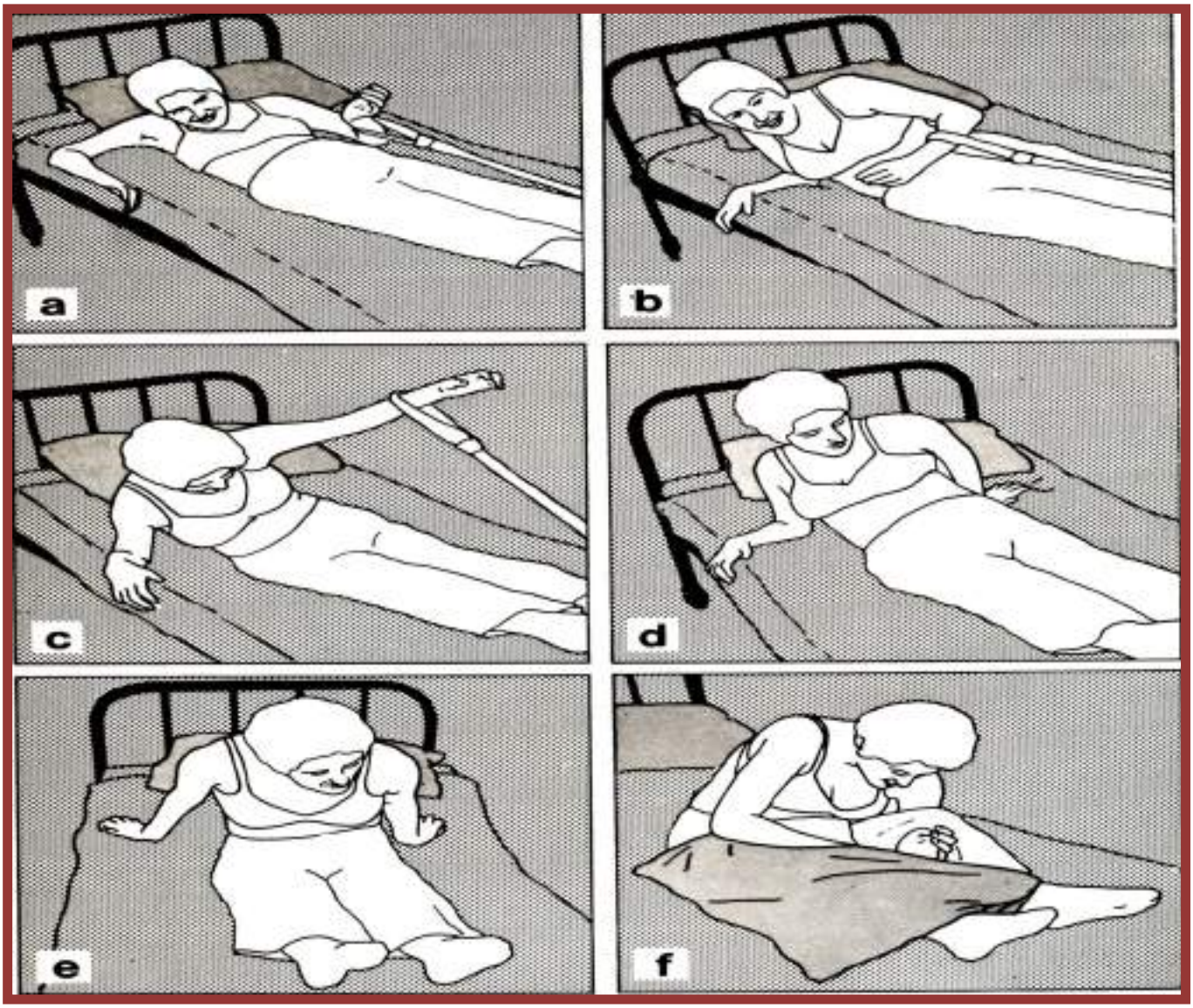
PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST



Supine-seated moving

Vertical lift

- The ability to vertically lift is an important task for patients to master early. Vertical lifts are used to relieve pressure, transfer, dress, and move about the bed. Patients need to be able to lift while sitting in bed with the knees extended and while sitting in their wheelchairs with their knees flexed
- Lifting with the knees extended is often easier because patients can use the paralysed hamstring muscles to help maintain an upright position.

Vertical lift

- To vertically lift, the hands are placed next to the hips, usually on the seating surface but occasionally on adjacent surfaces. The patient then pushes down through the hands to lift the trunk on the stabilized arms. There are three components to the lift: elbow extension, shoulder depression and shoulder flexion. Once the elbows are extended, further lift is achieved by depressing the scapulas on the trunk and by inclining the trunk forwards on the fixed shoulders
- The vertical lift is controlled by the latissimus dorsi, anterior deltoid, pectoralis major and lower trapezius muscles. The glenohumeral joint is stabilized in adduction throughout the lift by the shoulder adductors and rotator cuff muscles.

Vertical lift

TABLE 3.4 A patient with paraplegia lifting in a wheelchair (some practice strategies are described)

	Sub-task	Practice strategies
Figure 3.8a	1. Positioning the hands: The hands are placed on the apex of the back wheels.	*Practice of this sub-task can be made easier if:*
Figure 3.8b	2. Lifting the body: The elbows are extended and the shoulders adducted and depressed.	• the vertical position of the back wheels is adjusted to optimize elbow position • the thickness of the cushion is adjusted to optimize elbow position

Transfers

- The term ‘transfer’ refers to movement between surfaces while maintaining a seated upright position. It includes moving to and from wheelchair, car, toilet, bath, commode and bed. Generally transfers onto lower surfaces are easier than transfers onto higher surfaces.
- Transfers to and from a bed can be performed with the legs up or down or with one leg up and one leg down. There are advantages and disadvantages of each approach. The main advantage of transferring with the legs up is that the extended knees increase passive tension in the paralysed hamstring muscles, helping to maintain the trunk in an upright position.

Transfert

- Transferring with the legs up when moving in and out of bed also avoids the need to lift or lower the legs when precariously perched on the edge of the bed. Instead, the legs are lifted or lowered when patients are sitting supported in the wheelchair. The disadvantage of transferring with the legs up is that it makes moving forwards and backwards difficult. For example, when transferring out of a wheelchair into bed, it is difficult to move forwards during the transfer because the feet dig into the mattress. Similarly, when transferring into the wheelchair it is difficult to move the buttocks back into the wheelchair because the feet drag on the mattress.

TABLE 3.7 A patient with paraplegia transferring from wheelchair to bed with the legs down and using the rotatory strategy (some practice strategies are described)

	Sub-task	Practice strategies
Figure 3.12a	1. Moving to the front edge of the wheelchair: The elbows are extended and the shoulders adducted and depressed to vertically lift the body (see Table 3.4). The shoulders are then extended to push the trunk and legs forwards on the seat.	*Practice of this sub-task can be made easier if:* • a firm cushion is used (this prevents the buttocks from sinking into the cushion) • the back of the wheelchair is raised so gravity assists the forward movement • the cushion cover and the patient's lower limb clothing are slippery • the feet are placed on the ground (this increases the tendency to slide forwards) • the vertical position of the back wheels is adjusted to optimize elbow position • the thickness of the cushion is adjusted to optimize elbow position
Figure 3.12b	2. Positioning the feet on the floor: The left arm lifts the right leg onto the ground. The right arm is used to hold the trunk upright. The mirror of this procedure is used to position the left leg on the floor.	

(continued)

TABLE 3.7 (continued)

	Sub-task	Practice strategies
Figure 3.12c	3. Positioning the hands: The right hand is placed on the bed and the left hand on the front corner of the wheelchair.	*Practice of this sub-task can be made easier if:* • the wheelchair is positioned as close as possible to the bed • the bed is slightly lower than the wheelchair • additional beds are placed in front and to the side of the patient (this decreases the fear of falling)
Figure 3.12d	4. Lifting and shifting the body onto the bed: The elbows are extended and the shoulders adducted and depressed to vertically lift the body (see Table 3.4). The right shoulder is adducted and the left shoulder is abducted to laterally shift the body.	• the wheelchair is positioned as close as possible to the bed • the bed is slightly lower than the wheelchair • the cushion is firm (this prevents the hands sinking into the cushion when lifting) • a slideboard is used
Figure 3.12e	5. Lifting the legs onto the bed: Weight is borne through the right elbow while the left arm is used to lift each leg onto the bed.	• the feet are placed on a raised stool to decrease the height the legs need to be lifted • a strap is used to help lift the legs

TABLE 3.8 A patient with C6 tetraplegia moving laterally from wheelchair to bed with the legs up using the translatory strategy (some practice strategies are described)

	Sub-task	Practice strategies
Figure 3.13a	1. Moving to the front edge of the wheelchair: The head and trunk are extended over the back of the wheelchair. The hands are pushed in behind the back. The hips are levered forwards by external rotation of the shoulders and extension of the wrists. The sides and top of the backrest are used as a fulcrum.	*Practice of this sub-task can be made easier if:* • a firm cushion is used (this prevents the buttocks from sinking into the cushion) • the back of the wheelchair is raised so gravity assists the forward movement • the cushion cover and the patient's lower limb clothing are slippery • the feet are placed on the ground (this increases the tendency to slide forwards) • the backrest of the wheelchair is lowered
Figure 3.13b	2. Lifting the first leg onto the bed: The left arm is hooked around the back of the wheelchair to prevent a forward fall. The right arm is used to lift the leg onto the bed. The leg is held with a wrist extension hook.	• the feet are placed on a raised stool to decrease the height the legs need to be lifted • a strap is used to help lift the legs

(continued)

TABLE 3.8 (continued)

	Sub-task	Practice strategies
Figure 3.13c	3. Lifting the second leg onto the bed: As above.	*Practice of this sub-task can be made easier if:* As above
Figure 3.13d	4. Positioning the hands: The left hand is placed on the bed and the right hand on the apex of the far wheel. Passive stretch of the hamstring muscles prevents a forward fall.	• the wheelchair is positioned as close as possible to the bed • the bed is slightly lower than the wheelchair • additional beds are placed to the front and to the side of the patient (this decreases the fear of falling)
Figure 3.13e	5. Lifting and shifting the body onto the bed: The shoulders are externally rotated and depressed and the elbows are 'passively' extended to vertically lift the body (see p. 68 and Figure 3.11). The left shoulder is adducted and the right shoulder is abducted to shift the body laterally.	• the wheelchair is positioned as close as possible to the bed • the bed is slightly lower than the wheelchair • additional beds are placed to the front and to the side of the patient (this decreases the fear of falling) • the cushion is firm (this prevents the hands sinking into the cushion when lifting) • a slideboard is used • a slide sheet or slideboard is placed under the feet • the shoes are removed and a slide sheet or slideboard is placed under the feet

Wheelchair-bed transfer

- Place your feet forward with your heels turned slightly towards the bed.
- Move your butt forward to the edge of the cushion.
- Flex the trunk forward.
- Turn your head in the opposite direction of the transfer so that your butt slides more easily towards the bed.
- Lift up and rotate towards the bed.
- Turn the pelvis parallel to the bed.
- Get one leg after the other on the bed.

Slideboards

- Slideboards can be used to bridge the gap between transfer surfaces . They are used by patients with limited ability to lift upwards and sideways and can be used either for training purposes or for long-term use. It is best if the slideboard is positioned on an angle between the two transfer surfaces. This encourages patients to rotate around as they move sidewards. It also discourages patients from sliding off the back edge of the slideboard and scraping their buttocks on the wheel. Patients often struggle with positioning slideboards under the buttocks because this requires shifting weight while at the same time manipulating the slideboard.
- The task of positioning the slideboard is best done when sitting supported in the back of the wheelchair. However, patients then need to ensure that the slideboard does not move forwards out of position as they move forwards in the wheelchair.
- This can be avoided by placing one hand on the slideboard when moving forwards.

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

PASSAGE WITH FOOT ON THE GROUND AND TABLET

1984/3677

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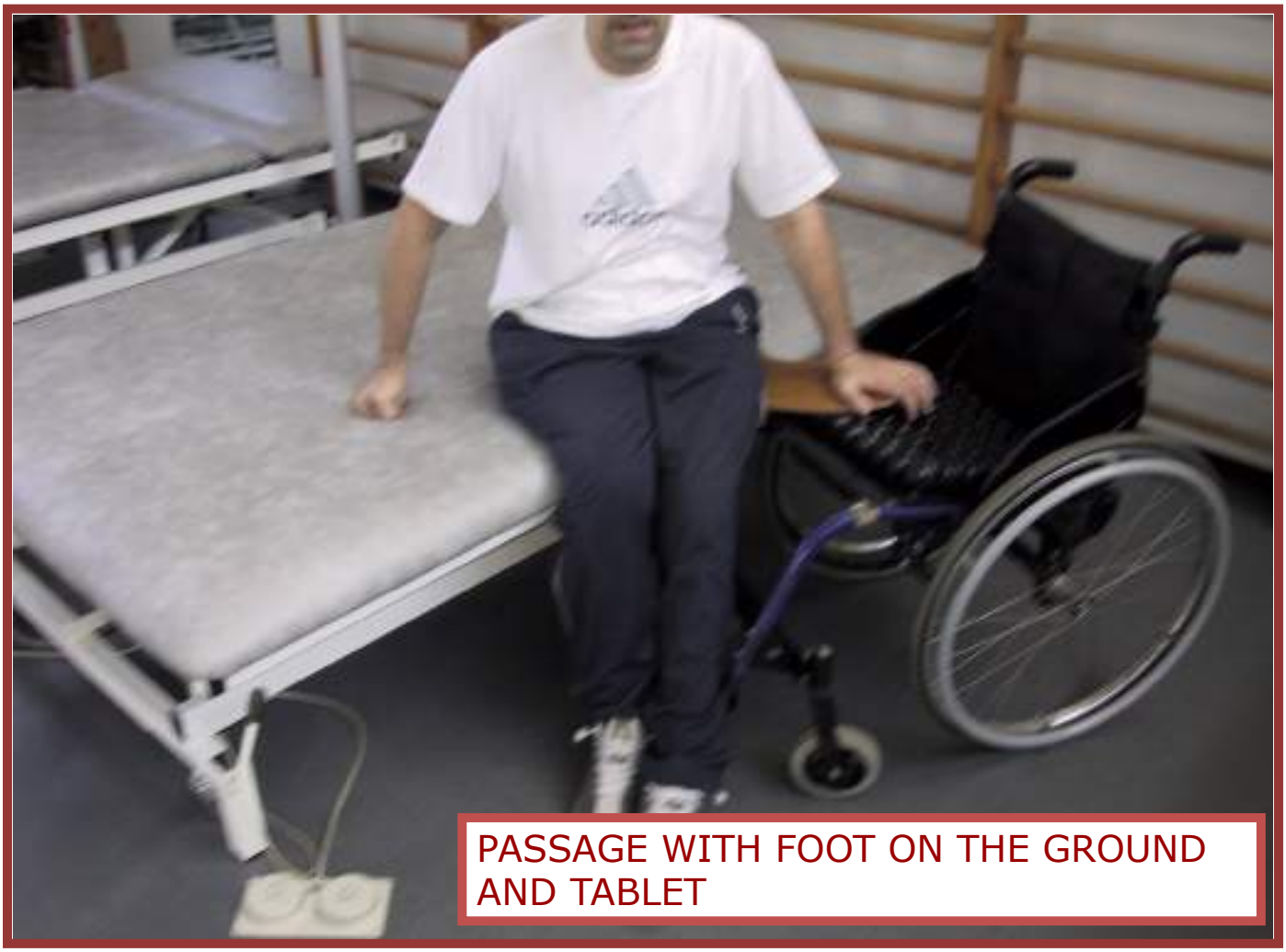
PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST



PASSAGE WITH FOOT ON THE GROUND AND TABLET

1985/3677

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Wheelchair-bed transfer

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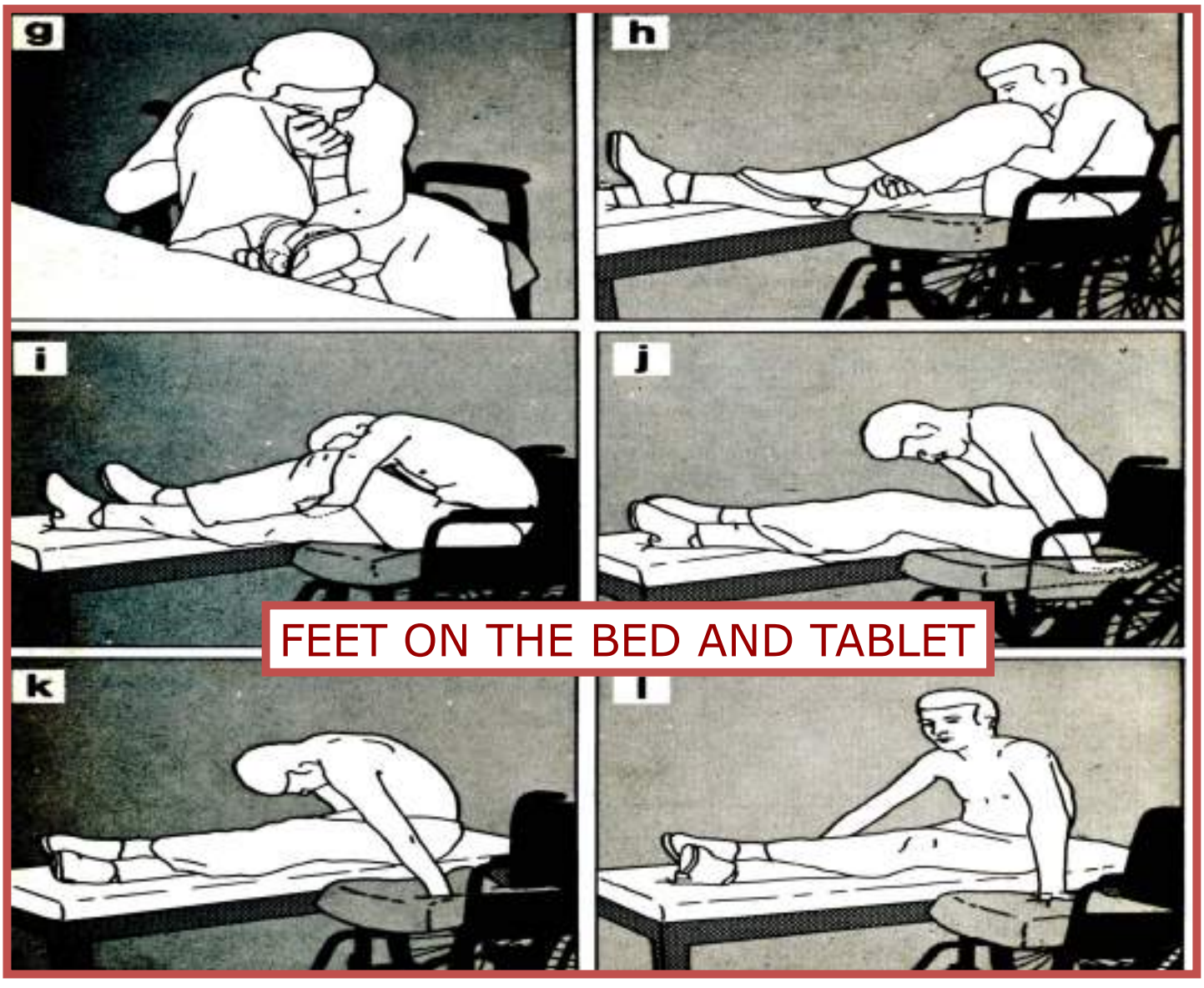
REHABILITATION PHYSIOTHERAPIST



FEET ON THE BED AND TABLET

1987/3677

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Wheelchair-toilet transfer

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Wheelchair-toilet transfer

1989/3677

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Wheelchair-tub transfer

1990/3677

Wheelchair-tub transfer

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REHABILITATION PHYSIOTHERAPIST

Wheelchair-to-car transfer

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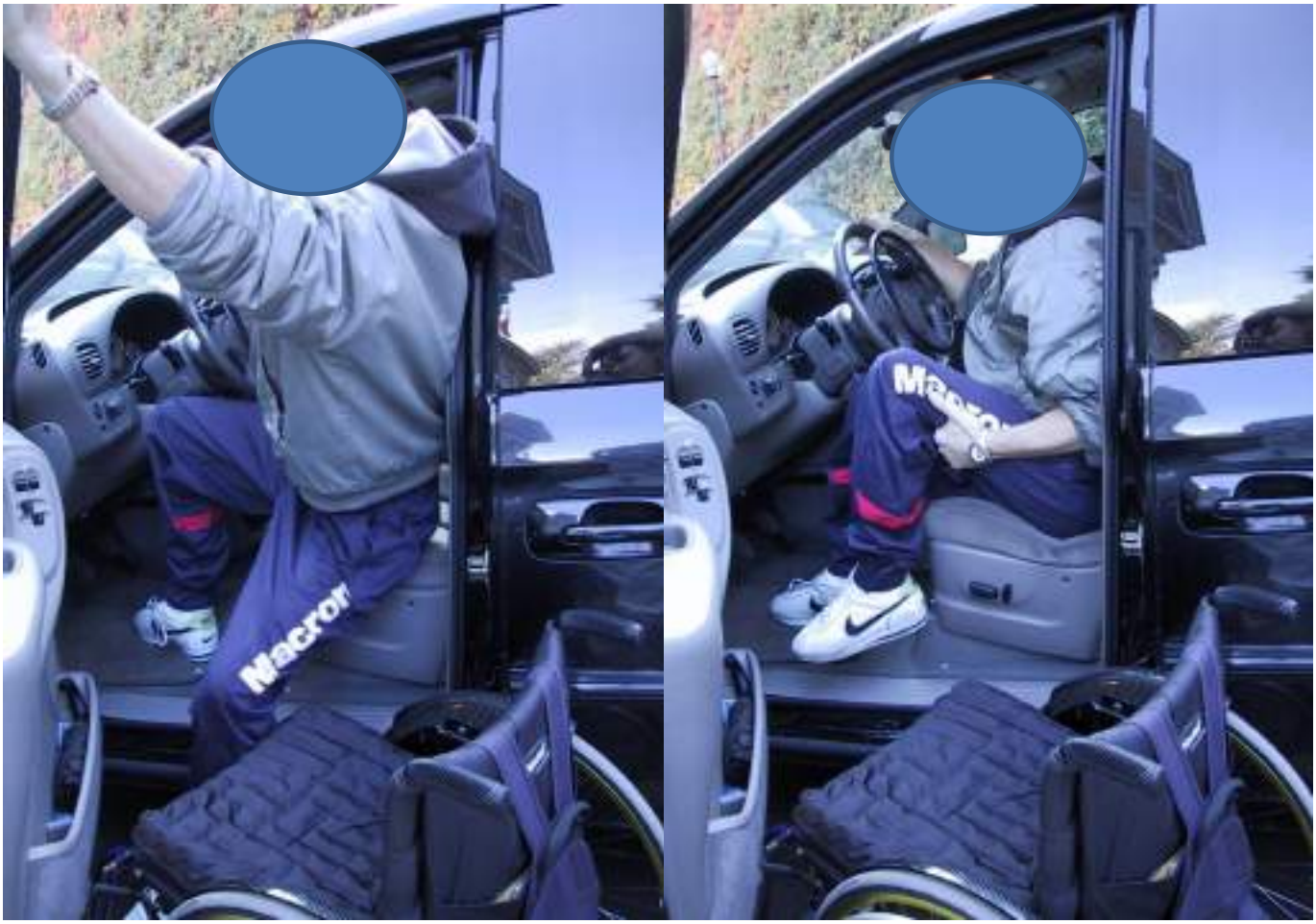
PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST



1993/3677

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Wheelchair-car transfer with aids

1994/3677

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Wheelchair-car transfer with aids

1995/3677

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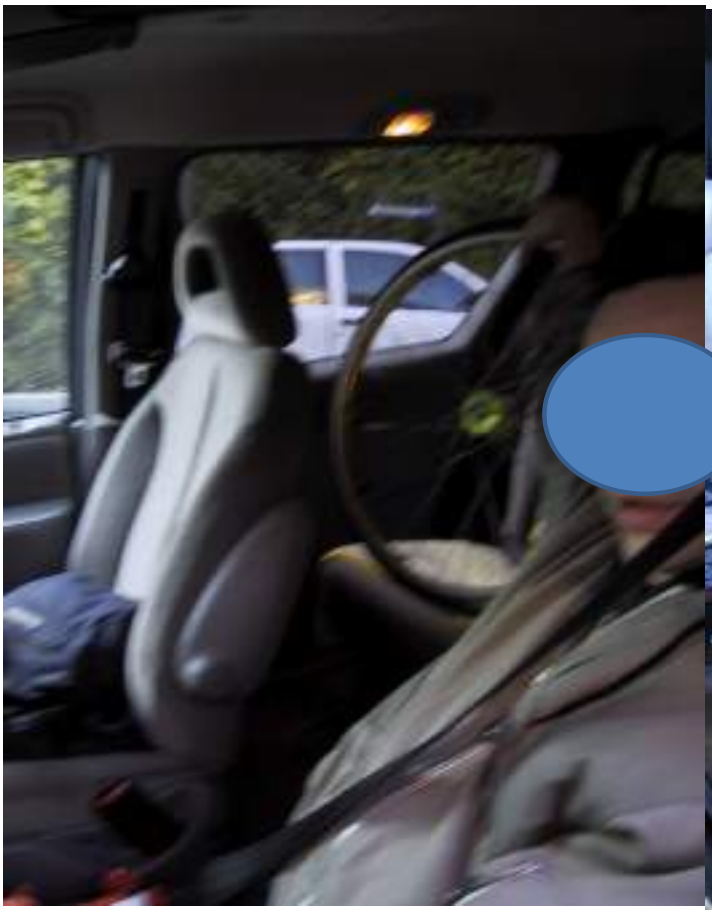
PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Loading the wheelchair in the car

Loading the wheelchair in the car



Loading the wheelchair in the car

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

1999/3677

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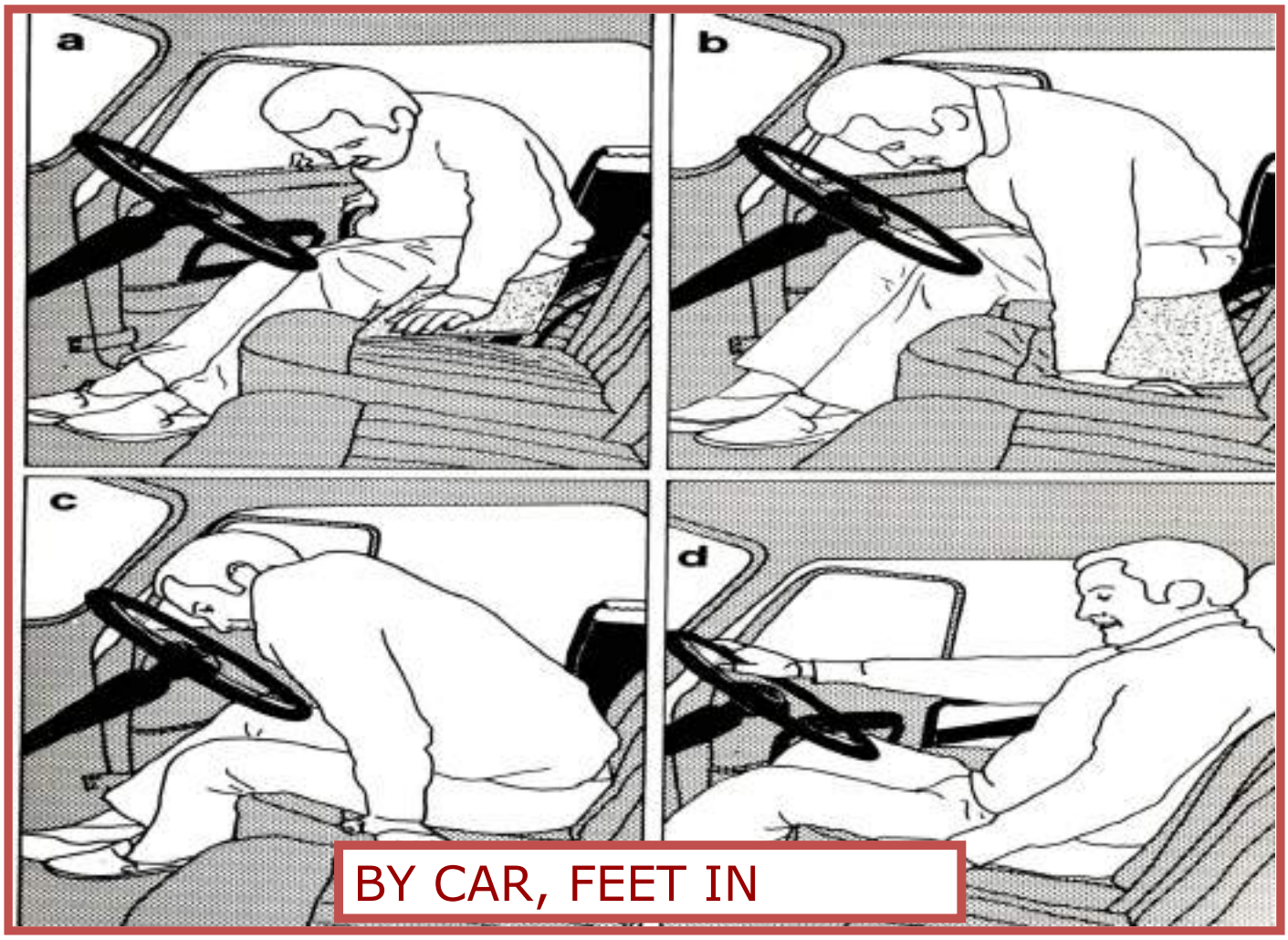
PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST



BY CAR, FEET IN

2000/3677

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

Balancing on the rear wheels and falls

2001/3677

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Wheelchair-to-ground transfer

2002/3677

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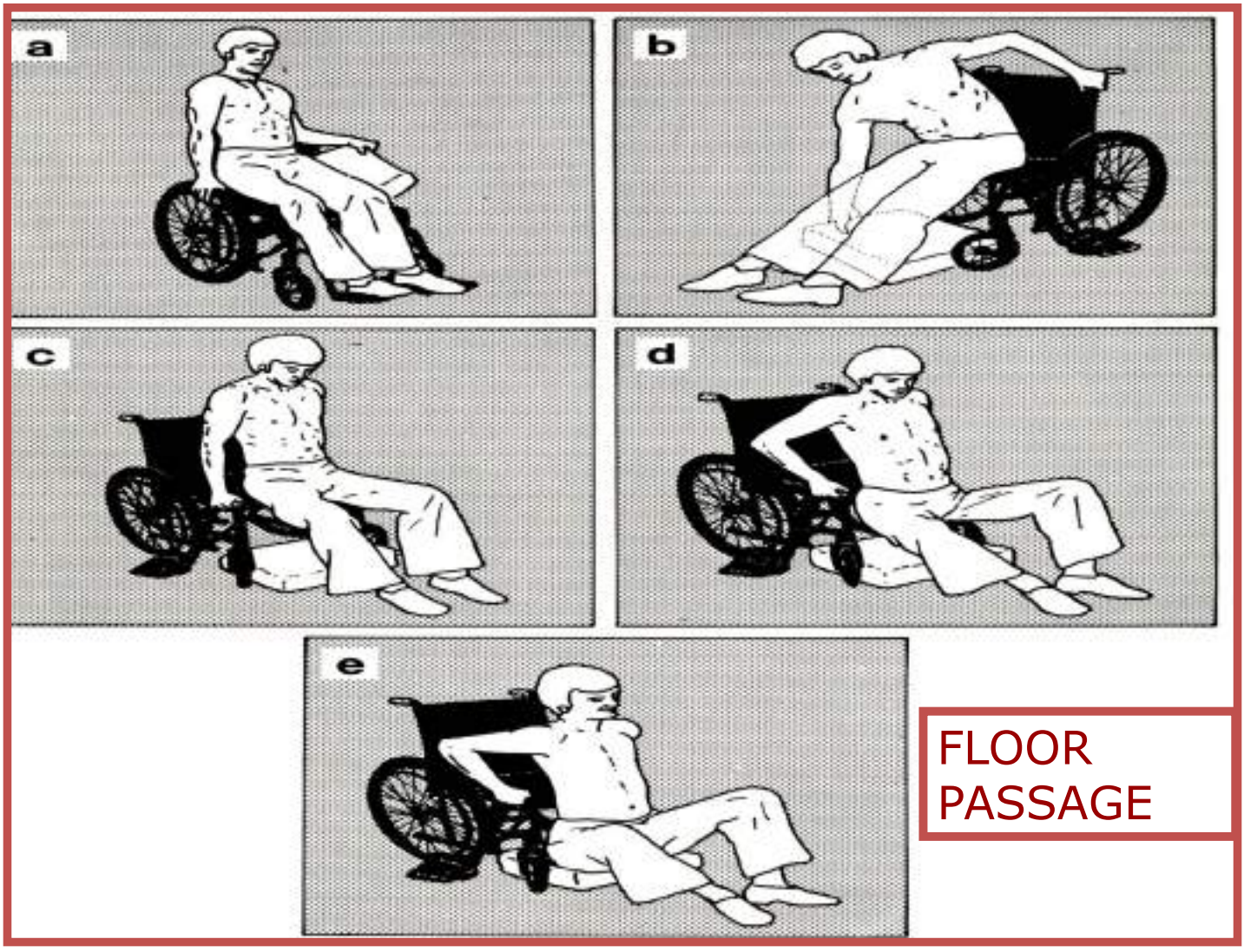
PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST



FLOOR PASSAGE

2003/3677

Sports therapy

- Based on the experiences of the European spinal units starting from the Stoke-Mandeville center, born in 1944, for some years sport therapy has also appeared as a discipline that can further improve within the rehabilitation project of the person with spinal cord injury. motor and autonomy possibilities.

Sports therapy

- This center was the first to start the "pioneering" activity of sports therapy thanks to an intuition of its director Dr. L. Guttmann, who recognized that an active participation of the patient, suffering from mental depression, respiratory diseases, bedsores, in the rehabilitation program could prevent these complications.

Sports therapy

- He introduced sporting activity as a "means" to be able to involve young para-quadriplegic patients in the rehabilitation process, but later realized that in addition to the psychological improvement there was a notable increase in the muscular, respiratory and wheelchair management skills that with traditional methods could hardly obtain.

- Dr. Guttmann's initiative was very successful, and on July 28, 1948, the first Stoke Mandeville Games for disabled athletes were held, in which former members of the British Armed Forces participated in disabled sports.

- Since then the Stoke Mandeville Games became international and in 1960 they took place in the context of the Rome Olympics, indicating the way for the organization of the Paralympics every 4 years in conjunction with the Olympics.

Sports therapy

- In relation to the phase of the rehabilitation project in which sport is inserted and the value that you want to give it, we can distinguish activities such as sport therapy and recreational-sporting activity that can lead to competitive sport.

Aims

- Improve fine motor skills or movement.
- Improve sensory skills.Improve the physical gesture.
- Improve coordination of movements.
- Improve reflexes with particular reference to eye-hand ones.
- Increase muscle strength.
- Improve respiratory capacity.
- Improve gas exchange and blood oxygenation.
- Increase resistance to fatigue.

Aims

- Encourage aggregation and social relationships.
- Stimulate the person to face difficulties.
- Learn skills through a range of experiences.
- Contribute to the construction or reconstruction of one's own identity.
- For wheelchair users, it is a further learning in the ability to drive, push and move in space.

Sports therapy

The beneficial effects of sports therapy concern:

- improvement of motor skills (strengthening of residual muscles, control of hypertonia, improvement of trunk control, optimization of compensation, extreme use of aids);
- improvement of cardio-respiratory functions, prevention of osteoporosis and circulatory disorders, improvement of intestinal function);encourage aggregation and social relationships as group activity improves mood, promotes relationships and socialization.

Sports therapy

In particular:

- swimming allows a global strengthening and respiratory function;
- table tennis and archery improve hand-eye coordination, trunk balance and muscle strengthening;
- basketball and hand-biking improve muscle resistance to fatigue, functional to pushing the wheelchair in the activities of daily life.

Sports therapy

- The recreational-sporting activity, to be started as an introduction to sports in the hospital and recommended for everyone to continue with the discharge, has mainly recreational purposes, social reintegration and the prevention of secondary damage to reduced mobility; it can in fact constitute a valid alternative to boring maintenance motor re-education sessions.
- Competitive sport, to be undertaken after resignation, with sporting purposes and personal fulfillment, is obviously aimed at the most motivated and gifted people.

When to start?

- There is no fixed rule, it depends on the patient's clinical condition and the type of sport

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Occupational Therapy

- The World Federation of Occupational Therapy (1989) provides the following definition of Occupational Therapy: "discipline that deals with the evaluation and treatment of physical and mental diseases with the aim of helping people to reach their maximum level of function and independence in all aspects of daily life ".

Occupational Therapy

Fields of intervention in spinal cord injury:

- treatment of the sensory-motor deficit of the upper limb;
- identification and packaging of orthoses for the upper limb;
- training for A.D.L. basic (personal hygiene, self-care, nutrition, clothing, bed mobility, transfers, preparation for bladder and intestinal emptying);
- training for A.D.L. instrumental or I.A.D.L. regarding the ability to use the telephone, the complete management of the home environment and daily needs (shopping, cleaning your home, washing, ironing, etc.), the ability to travel with your own or public means, the ability to take drugs and handle money;

Occupational Therapy

Fields of intervention in spinal cord injury:

- training in the use of the wheelchair (electronic and / or manual);
- training in the use of the PC and computer aids,
- planning of environmental control systems (high-tech devices that allow access to a series of commands such as call systems, TV-radio ignition, door / lift opening, etc. even for people with severe motor disabilities);

Occupational Therapy

Fields of intervention in spinal cord injury:

- advice on modified controls for driving or identifying aids and access methods for means of transport for high injuries;
- consultancy for social and work re-integration including the removal of architectural barriers and orientation to leisure and sports activities;
- health education aimed at the patient and his family on the management of the assistance needs of the person with SCI.

Functional hand

- THESE ARE THOSE TRICKS THAT THE PATIENT WITH TETRAPLEGIA SPONTANEOUSLY PUTS INTO OR IS EDUCATED TO DO WITH THE PURPOSE OF REACHING A FUNCTIONAL OBJECTIVE NOT OBTAINABLE THROUGH THE NORMAL METHODS.

Aims

- Maintain joint freedom capable of favoring the achievement of compensation at the shoulder, elbow, wrist and hand level.

- Strengthen the supralesional motor quotas.

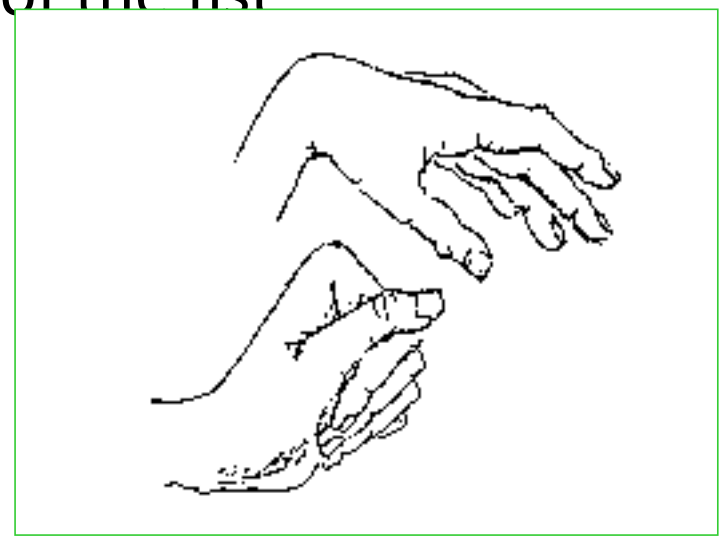
- Check for spasticity.

The functional hand

- Through tenodesis of the flexor muscles of the fingers and thumb, the hand may be able to make light functional grips even in the absence of an active preensor muscle capacity of the fingers.

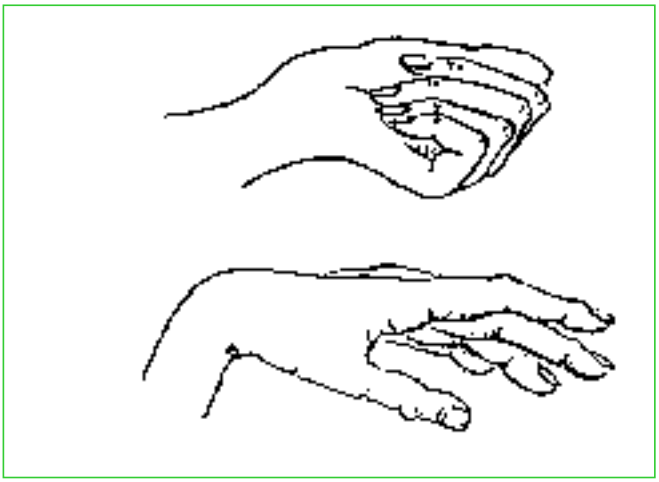
Active functional hand (presence of wrist extensors)

- The flexion of the wrist determines the opening of the hand
- The extension of the wrist determines the closing of the fist



Passive functional hand (no wrist extension)

- Supination of the forearm causes extension of the wrist with closing of the hand
- Pronation of the forearm determines the flexion of the wrist with the opening of the hand



Hand positioning

- Wrist: 30 ° extension (C5, C6 deficient, or start of treatment)
- Fingers:
  - 90 ° metacarpophalangeal flexion and proximal interphalangeal joint
  - 0 ° distal interphalangeal joint
- Thumb:
  - 0-30 ° metacarpophalangeal flexion
  - 0 ° interphalangeal jointthe thumb must be close to the proximal interphalangeal joint of the index finger and not its metacarpophalangeal joint

The functional hand

- The development of functional hands is a cornerstone in the initial phase of the treatment of patients with tetraplegia. In this period the positioning of the hands must produce the correct muscle lengths to allow the "tenodesi effect“
- Aims:
  - Promote the shortening of the flexors of the fingers and thumb
  - Prevent shortening of the finger extensors
  - Prevent the shortening of the collateral ligaments of the wrist and finger joints, so as to maintain optimal joint mobility

The active functional hand (C6-C7)

The flexion of the wrist determines the opening of the hand

The extension of the wrist determines the closing of the fist

HOW TO GET IT?

- functional bandage with velcro straps

- electrotherapy with wrist extensors (if absent), finger and intrinsic flexors
- splint to keep the wrist in extension

Automatic or functional hand

- We talk about "active automatic hand" if the radial carpal extensor is present (lesions at the level of C6-C7) or "passive automatic hand" if only biceps control is present (C5) and therefore a 'orthosis that stabilizes the wrist.

Automatic or functional hand

- The automatic hand allows, in the absence of an active finger prensor muscle capacity, to carry out light, functional and useful grips in daily life activities, through the tenodesis of the flexors of the fingers and thumb.

Automatic or functional hand

- Muscle shortening must be reversible in the case of a possible recovery of finger motility or in the case of rehabilitation surgery.
- The positioning must be carried out in the acute phase using hypoallergenic patches, leather or neoprene gloves, cloth armored cuffs, etc.

Automatic or functional hand

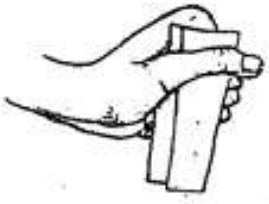
- Adequate mobilization must prevent the shortening of the extensor muscles and collateral ligaments of the wrist and fingers (in particular of the metacarpophalangeal muscles) in order to allow the passive relaxation of the hand when the wrist flexes.

The main grip of the functional hand

Handheld digital Grip

Cylindrical grip

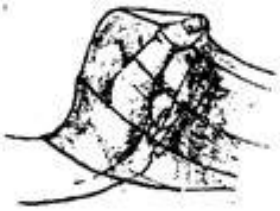
Lateral grip



Interdigital Grip

Braided grip

Hook grip



The shape of the hand

If the hand is not positioned correctly, it often takes on these non-functional forms

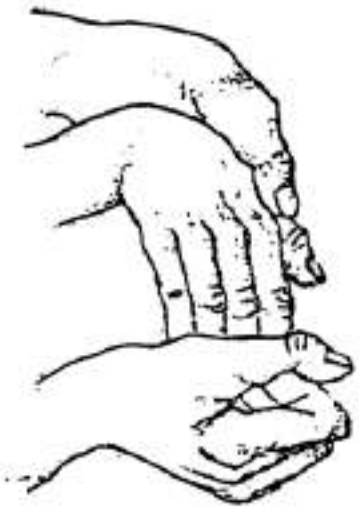
Claw hand

Flat hand

Passive hand mobilization

Upon completion of the positioning, the hand must be mobilized correctly and frequently enough to avoid joint contractures:

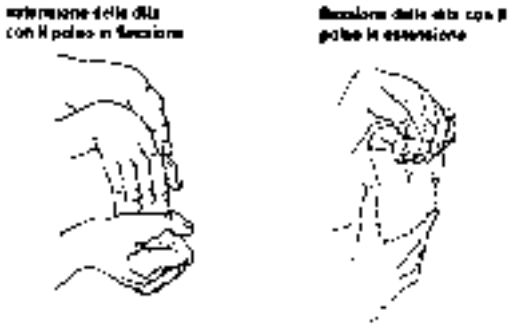
Extension of the fingers with the wrist in flexion



Flexion of the fingers with the wrist in extension

mobilization in compliance with the automatic functional hand

- - the hand, the mobilization of which takes place in compliance with the shortening of the flexor lodge.
- - the metacarpophalangeal joints, in which extension beyond the neutral position is never sought because they tend to hyperextend spontaneously



UPPER LIMB POSITIONING

Hand mobilization

Finger extension with wrist in flexion

Flexion of the fingerswith wrist in extension

How it should NOT be

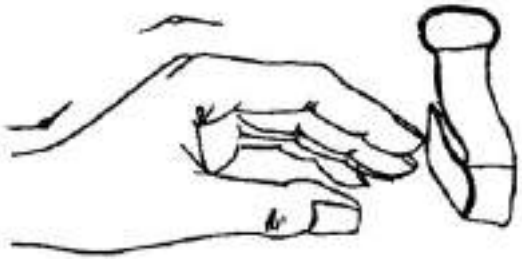
The main mistake in the positioning of the functional hand

- - The orthosis positioned incorrectly: the orthosis positioned too much blocks a 90 ° flexion of the meta-carpophalangeal joints, shortens the extensors of the fingers, the ligaments and often also the capsules. This error causes incomplete closing or a scratching hand. To prevent this problem it is important not to make the orthosis too long in the palm. Pre-made cuffs often need to be shortened (sew the edge to the correct length)

errato

The main mistake in the positioning of the functional hand

- The orthosis and aids are placed and removed incorrectly: the hand is opened while the wrist is in the wrong position (i.e. in extension). In order not to jeopardize a sufficient shortening of the flexors of the fingers, it is essential to open the hand during the activities of daily life, always with the wrist flexed



errato

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Passive and active assisted mobilization

- Musculotendinous shortening prevention
- Maintenance of joint mobility
- Edema prevention
- Pain prevention
- Improvement of residual motor skills

Prepration of the Automatic functional hand

- The hand should be positioned with wrist at 30 ° of extension, metacarpophalangeal at 90 °, proximal interphalangeal at 90 °, distal interphalangeal at extended. This position is maintained over 24 hours or at repeated 3-4 hour positioning intervals, except for periods of mobilization and hygiene.

Prepration of the Automatic functional hand

- The shortening of the flexor lodge is a sine qua non for the functional use of the hand if the only active muscle remains the radial extensor of the carpus.

Prepration of the Automatic functional hand

- If there is no active component of extension to the wrist, the closed hand will still allow some functional activities by flexing the active elbow and releasing the passive elbow. If a neurological recovery occurs, stretching the shortened area will take a few weeks at the most

Prepration of the Automatic functional hand

- To maintain the correct positioning, the physiotherapist who has the possibility can make gloves (fig.) with soft and hygienic material that does not cause irritation or overheating of the skin. The gloves are personalized, they must be easy to remove and put on, they require constant skin inspection, they are to be re-evaluated every day.

- fig. correct positioning with neoprene band

Prepration of the Automatic functional hand

- If there is no possibility of making or building orthoses, the correct positioning must still be maintained for 24 hours by checking whether the skin tolerates the chosen means, eg. wristbands, paper patches, elastic bands.Positioning with orthoses, plasters, or bands can be alternated with moments of freedom as long as avoiding the extension of the metacarpophalanges. Neglecting this aspect leads to the "claw hand", not surprisingly common in progressive paralysis.

fig. 4 - la mano aperta e la mano ad artiglio: l'una conduce all'altra

Prepration of the Automatic functional hand

- Edema is not a reason not to position the hand, on the contrary: hands that remain edematous for a long time become paddle hands, useless to manipulate and grasp. When there is edema the entire arm is positioned in the unloading area, mobilized more often, the hand is closed in a less constricting manner, and inspected every 1-2 hours.

Prepration of the Automatic functional hand

- The positioning of the pelvic girdle and lower limbs is less complicated but no less important. Falling into external rotation must be avoided, the popliteal fossa should be kept free and slightly flexed, the heel protected and the ankle at 90 °.
- The correct position is never just one: the basis of good postural management is an effective alternation of positions that protects the skin, modifies the ventilation / perfusion ratio, alternates sloping areas, etc ...

Prepration of the Automatic functional hand

- No position, even the most comfortable, can be held in a fixed way without consequences. Unless there are genuine security reasons, the choice of serial positioning is always a winner (fig. 5). The use of air mattresses has greatly improved comfort and safety, but encouraged us to consider this aspect of the management of the critically ill patient to be less important.

- Fig. 5 - Positioning on the side of the tetraplegic patient. Note: the underlying "free" shoulder supported by the pillow under the head and by the one under the chest, the alignment of the column obtained with the lower limbs staggered and not overlapping as in classic positioning. The groin is not squeezed with the advantage of the genitourinary system and the control of the bladder catheter. The hands are closed and the elbows extended.

Prepration of the Automatic functional hand

- For didactic simplicity the patient described here has a complete lesion and is in the phase of spinal shock. In reality, injuries that are incomplete or of non-traumatic origin, or with traumatic brain components make everything more indistinct, variable and harbinger of further problems in terms of recovery. Individual assessment remains the only reliable procedure.

MOBILIZATION AND KINESI

- Mobilization is often the patient's first conscious contact with the paralyzed and insensitive part of his body, as well as the first sign that “something is being done” for his paralysis; for the physiotherapist it is a moment of constant evaluation (as well as treatment), during which changes in the clinical picture are highlighted such as the appearance of muscle tone - to be further distinguished in involuntary discharges or voluntary and repeatable contractions - the appearance of joint limitations or muscle shortening, changes in temperature or texture of the tissues that could make one suspect the onset of DVT,

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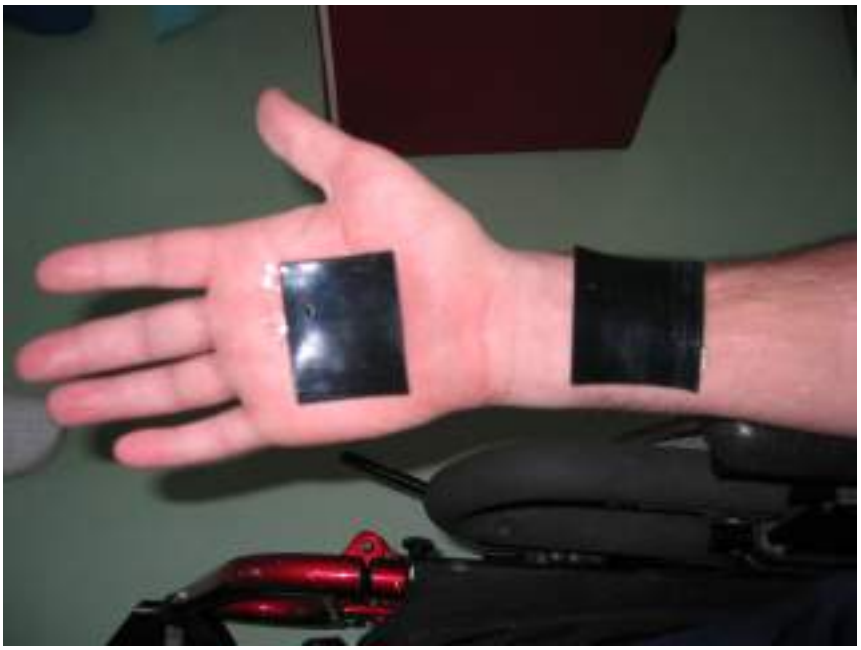
Functional bandage

ELECTROTHERAPY

- Research and reinforcement of wrist extensorsfunctional hand setting electrostimulating especially those intrinsic to:
  - Wrist extended
  - Flexed metacarpal-phalangeal joints

- Example of median and ulnar stimulation for the induction of a correct functional attitude



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REHABILITATION PHYSIOTHERAPIST

WRIST POSITIONING

WHO TO GET IT FROM?

- Starting at a C5 level•
- ATTENTION: if it is a peripheral hand then with flaccidity of fingers muscles
- DANGER OF ARTICLE BLOCKS

ESSENTIAL RESULT:

- place the splint and bandage 24h / 24 h during the first 3-4 months
- remove them only during physiotherapy treatment for the CORRECT mobilization and during hygienic care.
- maintain the correct length of flexors and extensors of the fingers
- avoid joint blocks

CORRECT APPROACH TO THE FUNCTIONAL HAND:

- Extend your fingers with your wrist flexed
- Flex your fingers with your wrist extended
- Do not mobilize your thumb individually while
  - washing their hands
  - when placing and removing positioning orthoses
  - in transfers
  - in dressing and undressing

If the functional hand has been set correctly, various types of grips are possible, the most important are:

- Fingerprint grip
- Side-side grip

- These are the grips that are also sought after with functional surgery

PASSIVE HAND

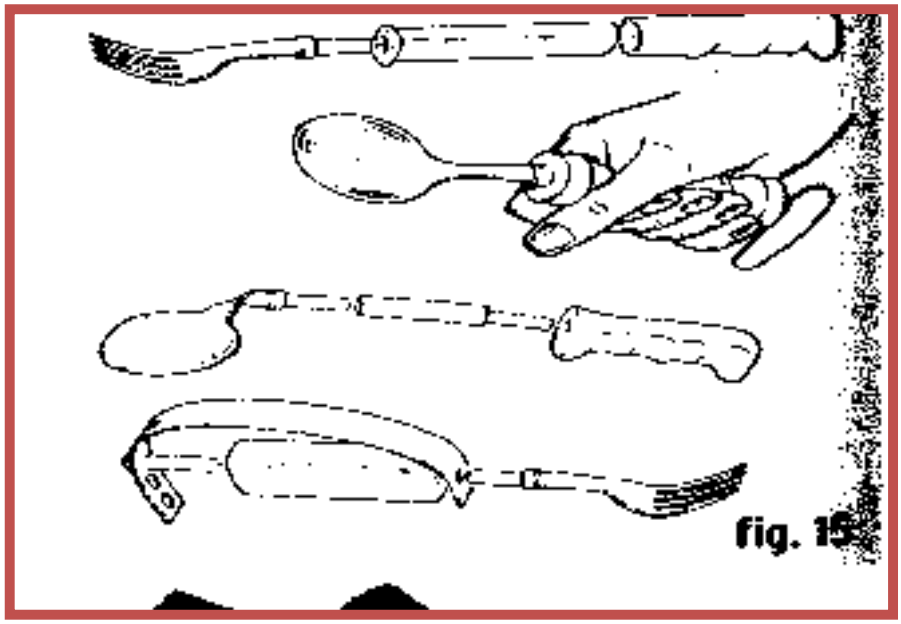
Supination of the forearm causes an extension of the wrist with closing of the fist

Pronation of the forearm determines wrist flexion with hand opening

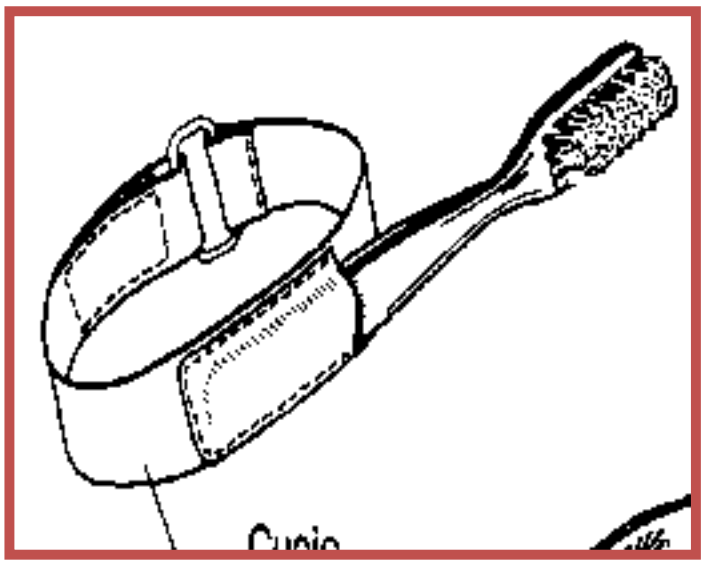
Supination in this case is an active movement, pronation for the most part is passive, performed through a momentum

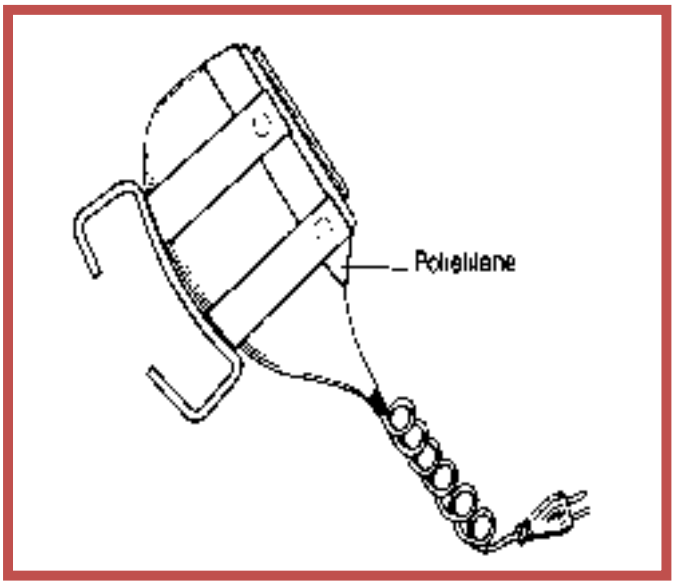
What strategies? ....

PERSONALIZED HANDLES



What strategies? .... AID





Tool strap
Thermoplastic orthoses
Object pocket with fork

TYPES OF GRIPS:

Forearm grip

Grip with wrist extension

ADL

- WHAT ARE THE OBJECTIVES,
- FROM THE POINT OF VIEW OF THE ADL,•
- THAT WE CAN REACH•
- •USING COMPENSATION•

ACCORDING TO THE LEVEL OF INJURY?•

	TETRAPLEGY C5	TETRAPLEGIYC6	TETRAPLEGY C7	TETRAPLEGY C8
Feeding	with ties and adapted cutlery	even with only thick cutlery	independent with aids	independent
Shaving	splint, adapted aids such as combs with straps	partially independent by adapting toothbrush, razor, comb or with strap	independent with aids	independent with aids
Washing		almost independet for the upper part. With adapted sponge	independent with aids	independent with aids
Dressing		autonomous for the upper part with specific aids: eyelets on the hinges, hooks	autonomous with aids also for the lower part of the	independent
Pushing the wheelchair	autonomous with splint or push gloves, modified handrails but on flat surfaces	autonomous and facilitated with push gloves	autonomous even on external land	independent
Transfering Bed-Wheelchair		almost autonomous with the tablet for transfers and between surfaces on the same floor	independent	independent
Mobility in bed		almost independent with the help of handles or electric beds	independent	independent
Bladder			almost independent with some aids	independent
Perinael Hygiene			almost independent with some aids	independent

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FEEDING

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Feeding: cutlery management

Feeding: glass management

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PERSONAL HYGIENE

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Difficulty brushing teeth and face

Difficulty combing

Difficulty in nail care

Difficulty shaving / putting on make-up

COMUNICATION

- Alternative grips
- Modified handle
- Thermoplastic orthosis (splint)
- Other aids: electronic turntables
- Personal Computer and computer aids

DRESSING

Alternative strategy

Modified clothing

Aids

C5-C6 (upper quadrant only)

C7-C8 (upper and lower quadrant)

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Dressing / Undressing

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BLADDER EMPTYVESCICALE

Alternative strategy(modified sockets, body position)

Modified clothing

Aids (catheter, orthosis, supports)

C6 man → partial independence

C7 man → complete independence

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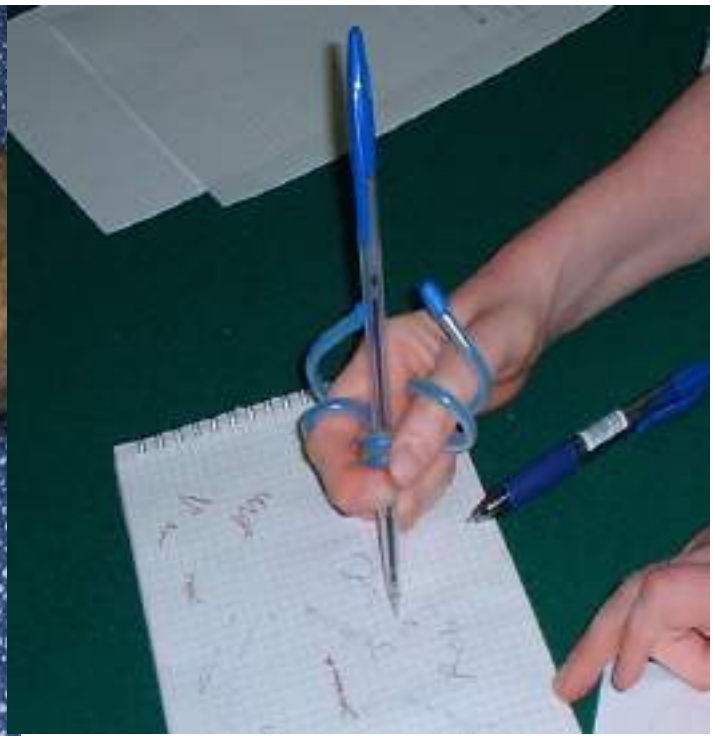
Writing



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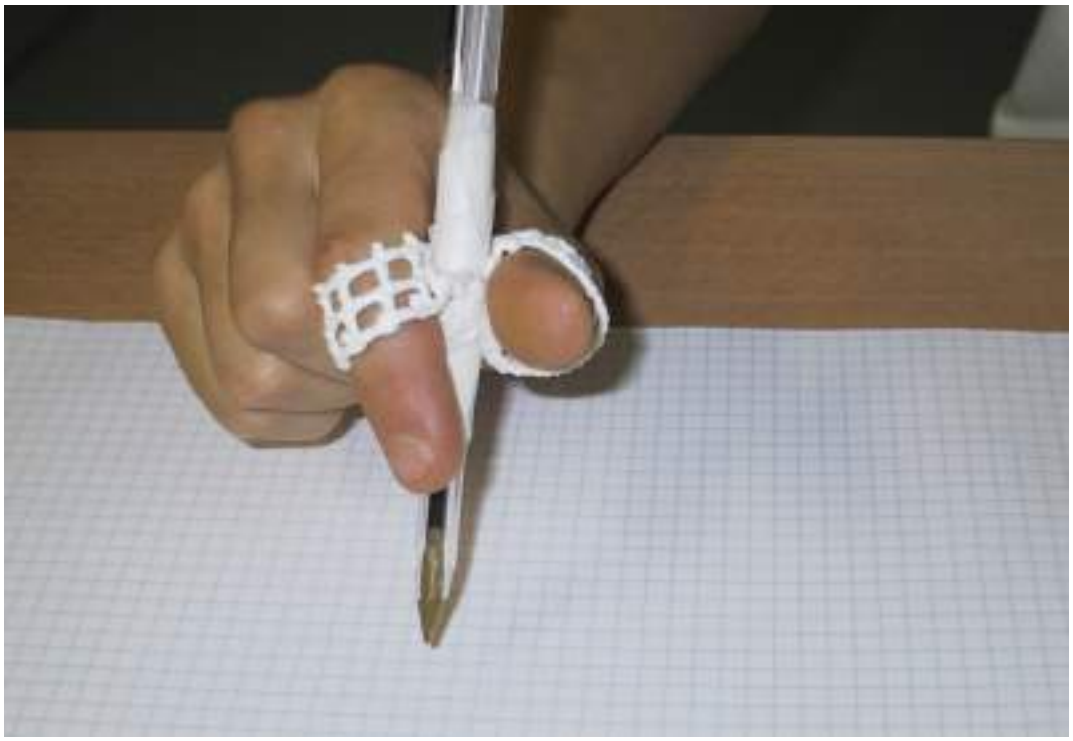
Writing



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Rehabilitation in spinal cord injuries
Lesson: Rehabilitation Treatment

2085/3677

PRINCIPLES OF TREATMENT

The care pathway can be divided into:

- Emergency phase which is the one immediately following the injurious event (generally within the first 12 hours of the trauma) in which all procedures are implemented to limit the damage resulting from the injury and are highly critical for the homeostasis of the individual;
- Acute phase relating to the period immediately following the emergency phase which continues until the general conditions stabilize;

PRINCIPLES OF TREATMENT

The care pathway can be divided into:

- Stabilization phase in which the general conditions have stabilized and any vertebral skeletal damage treated surgically or conservatively; the average duration of this phase is on average 4-6 months for paraplegics and 8-10 months for tetraplegics;
- Post-discharge or re-entry phase, which concerns the prevention and treatment of the numerous complications that may occur after discharge;

Stages of the therapeutic process

- Emergency phase: (first 12 hours after the event) survival and limitation of primary and secondary damage
- Acute phase: (until clinical conditions stabilize) clinical stability and prevention of complications
- Stabilization phase: (until discharge from the ward) monitoring of neurological recovery, functional training and prevention of complications
- Post-discharge or maintenance phase: return home, improvement of functional performance and prevention of long-term complications

Benefits of goals

- Goal setting is an important aspect of a comprehensive physiotherapy and rehabilitation programme. The process needs to be patient-centred.

- Initially, a few key goals of rehabilitation are articulated by the patient and negotiated with the multi-disciplinary team.

- These goals should be expressed in terms of participation restrictions. For example, a key goal of rehabilitation might be to return to work or school.

- Physiotherapy-specific goals then need to be identified and linked to each participation restriction goal. The physiotherapy-specific goals should be functional and purposeful activities as defined within the activity limitation and participation restriction domains of ICF and, specifically, within the ICF sub-domains of mobility, self-care and domestic life.

Benefits of goals

- These sub-domains include tasks such as pushing a manual wheelchair, rolling in bed, moving from lying to sitting, eating, drinking, looking after one's health, and pursuing recreation and leisure interests.

- Physiotherapy-specific goals are formulated in conjunction with the patient and other team members who share responsibility for their attainment. Both short- and long-term goals need to be set. These may include goals to be achieved within a week or goals to be achieved over 6 months. In addition, specific goals (or targets) should be set as part of each treatment session.

Benefits of goals

- Goals are important for several reasons. They ensure that the expectations of patients and staff are similar and realistic, and provide clear indications of what everyone is expected to achieve. If compiled in an appropriate way, they actively engage
- patients in their own rehabilitation plan, empowering them and ensuring that their wishes and expectations are met.

- Without goals, rehabilitation programmes can lack direction, and patients can feel like the passive recipients of mystical interventions.

- Goals also help focus the rehabilitation team on the individual needs of patients, and provide team members with common objectives. Perhaps most importantly, goals provide a source of motivation and enhance adherence.

Benefits of goals

- Goals are also used to monitor the success of therapy and to identify problems.

- Goals achieved indicate success and goals not achieved indicate failure. Failure may be due to any number of reasons which need exploring. For example, a patient may fail to achieve a goal because of medical complications or because equipment fails to arrive, factors which may be difficult to avoid.

- Failure to achieve goals may reflect poor therapy attendance. Alternatively, failure may indicate unrealistic goals which need
- revising.

- A risk of excessive reliance on goals to measure success is that it encourages the selection of non-challenging goals which have a high likelihood of success.

Guidelines to setting goals

- Goals should be SMART. That is, they should be: Specific, Measurable, Attainable, Realistic and Timebound.
- Physiotherapy-related goals need to be based on predictions of future independence, taking into account contextual factors such as patients' and families' perspectives, priorities and personal ambitions.
- Other factors which influence outcome include access to products, technology and support, and personal attributes such as age, personality and anthropometrical characteristics.
- Clearly, however, the strongest predictor of future independence is neurological status. Neurological status determines the strength of muscles which in turn largely determines patients' ability to move.

Guidelines to setting goals

- The goals should be performed according to the levels of innervation for key upper and lower limb muscles. However, the generalization is difficult because muscles have been grouped together even though different muscles and parts of the same muscle often receive innervation from different spinal nerve roots. For example, the pectoralis muscles consist of pectoralis minor and the sternocostal and clavicular parts of pectoralis major. These muscles receive innervation from C5 to T1

.

Guidelines to setting goals

- For some patients, particularly those with motor complete lesions without zones of partial preservation, it is relatively simple to look at the extent of paralysis and identify the optimal levels of independence which patients can hope to attain. For instance, patients with complete T12 paraplegia and paralysis of the lower limbs have the potential to independently dress and transfer. In contrast, patients with complete C4 tetraplegia do not. However, this type of information can only be used as a starting point.

Guidelines to setting goals

- Not only will outcomes be affected by contextual and other factors, but also by individual variations in neurological status. Often patients with the same ASIA classification have subtle but important differences in strength. For instance, a patient with C6 tetraplegia and grade 4/5 strength in the wrist extensor muscles will generally attain a higher level of function than a patient with the same level of tetraplegia but grade 3/5 strength in the wrist extensor muscles. This is not only due to the implications of wrist extensor strength for function, but also due to the fact that wrist extensor strength is usually indicative of strength in other muscles which are primarily innervated at the C6 level, such as the latissimus dorsi and pectoralis muscles. Weakness in either of these shoulder girdle muscles has deleterious implications for function.

THE EMERGENCY PHASE:

- This is how the first 12 hours after the trauma are defined. The emergency phase begins with the reporting of the accident and should end in a hospital setting (emergency room), with clinical conditions already assessed.

THE EMERGENCY PHASE:

- During the emergency, rescue workers adhere to the international scheme
  - Pre A To secure the subject
  - A airway: maintenance of the airway patency and protection of the cervical spine
  - B breathing: breathing and ventilation
  - C circulation: circulation and control of bleeding
  - D disability: neurological status
  - E exposure: discovering the patient to accurately assess him and at the same time prevent hypothermia.

THE EMERGENCY PHASE:

- If the arrival in the emergency department occurs within a certain time frame (it should be within eight hours), the NASCIS protocol is applied, ie the administration of high-dose cortisone which aims to limit spinal cord damage related to edema.
- Today there is a lot of discussion about the advantages and disadvantages of this treatment but at the moment it is still in use in emergency rooms in the Western world.

THE EMERGENCY PHASE:

- The out-of-hospital emergency phase is very important in order not to aggravate the orthopedic and neurological situation, still 5% of injuries worsen during the first phase of rescue (a percentage still high, but much lower than that of 15 years ago about 30%) .
- An essential component is the relief of associated lesions, although the picture will only be made clear by examinations and in-hospital imaging.

The critical area room

The critical area room

The monitor

- HR Range between 60 and 100
- Rhythmic rhythm or rare extrasystoles
- Blood pressure: pay attention to both the minimum and the max
- FR <24 acts min: limit of 35 for mechanical assistance.
- Pulse oximeter should never go below 94
- Temperature If> 38 ° or <35 °

In the acute phase ...

The assessment and treatment plan are aimed at:

- Framing of the case
- Prevention of complications associated with neurological level, immobilization syndrome, (respiratory, muscle, joint, skin, circulatory) pain, spasticity, anxiety, etc.
- Orthostatic position readjustment
- Search for ergonomic positions and movement strategies that improve the quality of life immediately and in the future

Rehabilitation during the acute phase

- Conventionally, "acute phase" means the period immediately following the emergency phase until the general clinical conditions stabilize.

- Rehabilitation begins already at this stage.

Rehabilitation begins already in this phase …… Why?

- evaluation and hypothesis of qualitative recovery - functional prognosis
- prevention of possible complications
- design of the rehabilitation process (project)
- promotion of strategies in order to improve the immediate and future quality of life.

Rehabilitation approach in the acute phase ...

- Assessment of damage, disability and detection of problems
- Prevention of complications associated with neurological level, immobilization syndrome, (respiratory, muscle, joint, skin, circulatory) pain, spasticity, anxiety, etc.
- Upper limb positioning and search for movement strategies that improve the quality of life immediately and in the future
- Sitting position readjustment
- Identification and customization of aids

What complications?

- Respiratory
  - Bronchial encumbrance
  - Insufficency respiratory
- Vascular / circulatory
  - Tvp – embolisms
  - Orthostatic hypotension
- Cutaneous
  - Pressure ulcers
- Musculo-articular
  - Hypostenia - muscular hypotrophy.
  - muscle shortenings
  - intra-articular calcifications

What complications?

- Pain
- Anxiety
- Alteration of muscle tone
- Urological
- Gastro-intestinal

TREATMENT IN THE ACUTE STAGE

- The global approach to the SCI patient implies a continuous process of evaluation / treatment / re-evaluation in which each member of the team collects clinical data, and each professional interprets the same data according to their own area.
- For these patients - in whom the clinical variability is enormous not only within the pathology but also within the therapeutic path of the same individual - the interpretation of the sign and its processing are fundamental: they translate into therapeutic strategies that lead to the acquisition of the best possible level of autonomy, as a function of social reintegration and psychological well-being.

TREATMENT IN THE ACUTE STAGE

- The know-how of the physiotherapist who deals with the acute phase of spinal cord injury (in reality the same thing applies to the entire path) is very broad and very specific at the same time.
- This accounts for some of the most common (and sometimes irreparable!) treatment setting errors we face when the patient arrives in the Unipolar Spinal Unit weeks or months after the injury.

TREATMENT IN THE ACUTE STAGE

- We can simplify the physiotherapist's intervention by distinguishing:
  - postural care,
  - mobilization and kinesis,
  - evaluation and personalization of aids (sometimes directly their construction!),
  - Respiratory physiotherapy.

TREATMENT IN THE ACUTE STAGE

- In the exemplification of the treatment of the subject with spinal cord injury it is preferable to refer to the traumatic origin because the lesion is stable and not developmental (e.g. in oncological pathology it is very variable)
- Moreover, the person with trauma tends to reconstruct a life as far away from the medicalization, which on the other hand is mandatory in the other forms, which makes long-term rehabilitation work indispensable and of great significance.

THE ACUTE PHASE

- It is the phase characterized by instability .. both lesional and clinical parameters
- At the end of the EMERGENCY phase (about 12 hours after the trauma), the acute phase begins which will end at the end of the spinal shock and the stabilization of the clinical parameters.
- It can last from a few days to a few weeks after the trauma, there is no certainty of the timing.

THE ACUTE PHASE

- The acute phase, defined in general, is a condition in which a subject is in a critical state in which the clinical parameters - the vital signs - are not yet stabilized and therefore the clinical conditions can deteriorate abruptly and suddenly for the most varied. reasons.
- In the medical-legal sense it corresponds to the period in which the doctor "reserves the prognosis", ie he cannot guarantee that the patient will survive.

THE ACUTE PHASE

- The concomitance of many injuries in the traumatized subject means that in the event of loss of consciousness it is assumed, until proven otherwise, that there may be a spinal cord injury.
- In fact, the main diagnostic test is CLINICAL: that is, ASIA, which requires a conscious and cooperating patient. Furthermore, the CT and MRI images are not conclusive: there may be frightening fractures in which the spinal cord is almost intact and minimal bone lesions with extensive spinal injury.

THE ACUTE PHASE

- The treatment of the vertebral lesion is almost always SURGICAL with decompression of the medullary canal and evacuation of bone fragments, hematomas, etc. and subsequent stabilization which, depending on the case, involves two or more vertebrae adjacent to the injured one.
- The trend towards ever faster technical evolution makes it unnecessary to go into details that will be obsolete in two years, just remember that the intervention of your patient must be known in detail in order to know the limits and contraindications to therapeutic exercise.

THE ACUTE PHASE

- In rare cases, surgery is not recommended and a CONSERVATIVE treatment is opted for, ie forced to bed for at least 60 days with no load on the injured spine; until a few years ago it was mandatory in severe osteoporosis in which the bone density was too low to ensure the sealing of the syntheses, but today it seems that with special "glues" injected into the rarefied vertebrae this problem is also solved.

THE ACUTE PHASE

- Once the vital parameters have been stabilized and the surgery performed, the traumatized person spends a shorter or longer period in an Intensive Care Unit even if the acute phase is technically ending, but the need for high assistance and highly invasive therapeutic maneuvers is still needed. and clinical control systems.

THE ACUTE PHASE

- During the operation, the patient is intubated and connected to a mechanical ventilator; the resumption of autonomous ventilation involves a series of weaning stages, during which the traumatized patient gradually regains the upper hand over the ventilation machine until he can do without it. The speed with which weaning takes place depends on many factors, in our case the main one is the preserved muscle heritage and the coexistence of traumatic or infectious lung problems.

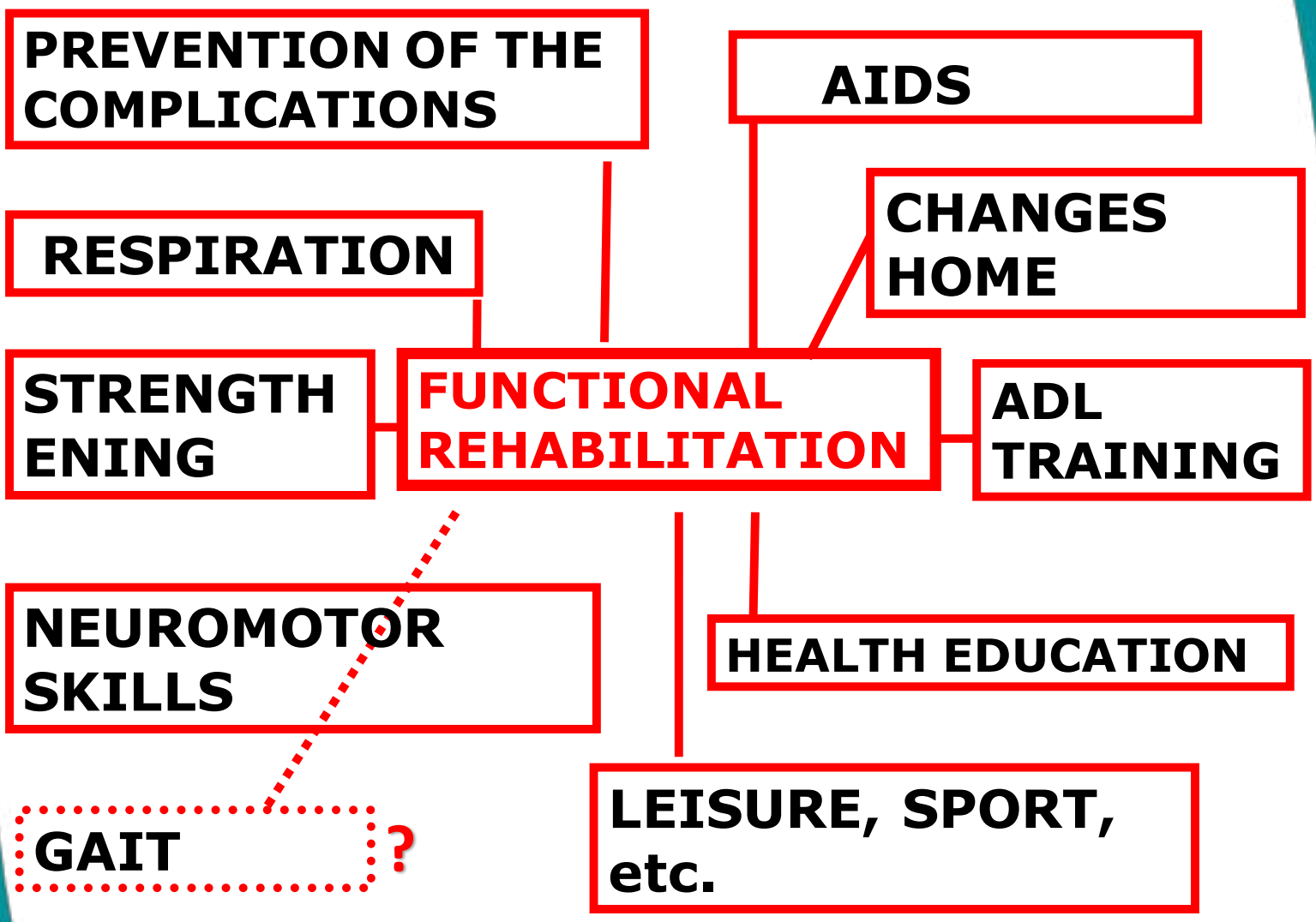
THE ACUTE PHASE

- The management of the injured person BEGINS IN INTENSIVE CARE UNIT to ensure prevention of complications, preparation for subsequent adaptations and elaboration of the recovery plan.
- When the clinical conditions allow it, the patient is transferred to the Unipolar Spinal Unit, in the subintensive section.

In the stabilization phase ...

The assessment and treatment plan are aimed at:

- Prevention of complications
- Neurological recovery monitoring
- Functional training


PREVENTION OF THE COMPLICATIONS
AIDS
RESPIRATION
CHANGES HOME
STRENGTH ENING
FUNCTIONAL REHABILITATION
ADL TRAINING
NEUROMOTOR SKILLS
HEALTH EDUCATION
GAIT
?
LEISURE, SPORT, etc.

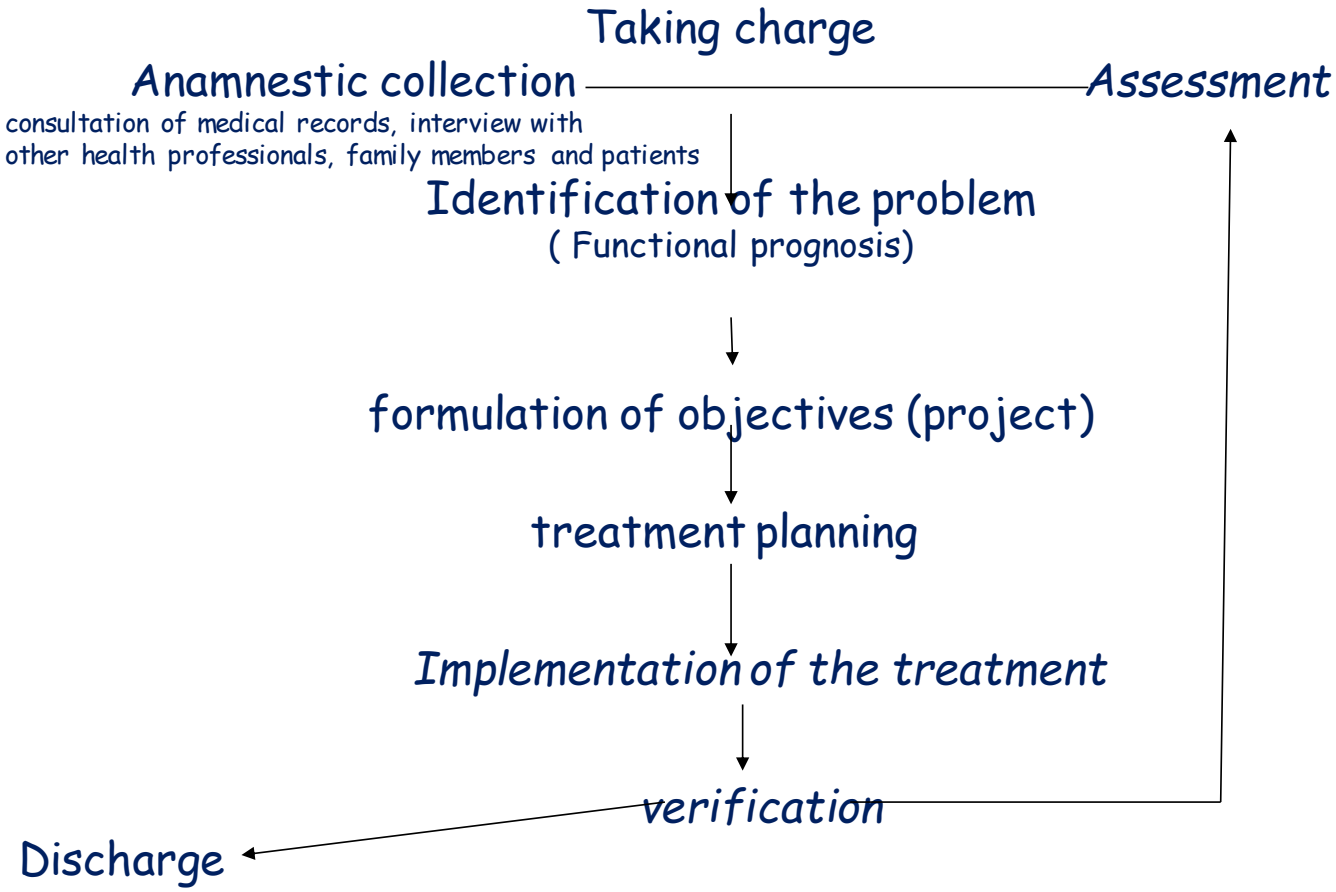
OBJECTIVES

- Maintain joint freedom capable of favoring the achievement of compensation at the shoulder, elbow, wrist and hand level.
- Strengthen the supralesional motor skills.
- Attempt to recover sub-injury motor skills
- Control of spasticity.
- Inclusion of compensation as early as possible.

INTERVENTION by the Physiotherapist

- Taking charge, anamnestic collection, consultation of instrumental tests, team consultation, interview with the patient and / or family members
- Functional evaluation and functional prognosis
- Rehabilitation project: consultation and sharing with other professionals as well as with the patient and his family.
- Treatment plan
- Implementation
- Re-evaluations and outcome checks (intermediate and final)Compilation of the file: recording of the clinical evolution (daily diary and attached documents), drafting of essential reports (discharge, aids, etc.)

Physiotherapist operating algorithm



PRINCIPLES OF TREATMENT

- At the time of discharge, the connection between the USU and the local ASL structure that will take care of the patient is essential so that a network of health and / or social services is organized that guarantees the necessary therapeutic continuity to promote social reintegration.

PRINCIPLES OF TREATMENT

- The functional rehabilitation intervention begins in the acute phase and gradually becomes more intensive in the stabilization phase, which corresponds to the moment in which the patient begins to get up in a wheelchair and begins activity in the gym and / or occupational therapy. The distinction between the objectives of the two moments is purely "didactic" as they often overlap and their differentiation derives from priority needs linked to the clinical situation.

PRINCIPLES OF TREATMENT

The first phase is aimed at pursuing the following objectives:

- prevention of the effects of immobilization and its complications through the alternation of decubitus, the positioning of the spine and extremities in correct alignment, the mobilization of the limbs (passive, active-assisted, active);
- respiratory physiotherapy aimed at improving the mechanical structure of the wall and restoring bronchial patency through unblocking maneuvers;
- improvement of skills and motor control with active and / or active-assisted exercises in the districts spared from the injury;

PRINCIPLES OF TREATMENT

The first phase is aimed at pursuing the following objectives:

- gradual re-education in standing position first in the articulated hospital bed and then in a wheelchair using an orthosis for the spine (according to medical prescription, collar, bust), for vasopressure (vasocompressive knee-highs, abdominal belly);

PRINCIPLES OF TREATMENT

The first phase is aimed at pursuing the following objectives:

- In cervical lesions particular attention is paid to the positioning of the hand, seeking a functional attitude that allows to obtain a functional tenodesis of the flexors of the fingers (so-called "automatic hand"); the shortening must be reversible, the complete articular excursion at the level of the interphalangeal joints must be maintained so in the case of neurological recovery normal motor skills can be restored (supported by the use of splints that facilitate harmonious recovery and counteract the onset of deformity);

PRINCIPLES OF TREATMENT

The first phase is aimed at pursuing the following objectives:

- Identification and / or packaging of aids and / or orthoses to facilitate the autonomous performance of daily activities such as nutrition, personal hygiene, etc.

PRINCIPLES OF TREATMENT

In the stabilization phase, the emphasis of functional rehabilitation treatment is placed on the following objectives:

- research and promote motor skills through neuromotor techniques, hydrotherapy, muscle strengthening, bio-feedback, balance exercises, straightening sequences;
- reduce / inhibit spasticity by looking for suitable postures, stretching, relaxation exercises and refining the quality of movement;
- reduce / inhibit pain through the search for appropriate positioning and mobilization; physical therapy

PRINCIPLES OF TREATMENT

In the stabilization phase, the emphasis of functional rehabilitation treatment is placed on the following objectives:

- train independence in daily life activities (A.D.L.) with Occupational Therapy training (clothing, personal hygiene, nutrition, travel, transfers, wheelchair mobility, as well as communication and play / recreational activities, etc.);
- to train patients in whom the necessary pre-requisites exist;
- readjustment to the vertical position (standing wheelchairs, vertical stabilizer, use of braces);
- postural re-education for the prevention of vertebral alterations and / or deformities;

PRINCIPLES OF TREATMENT

In the stabilization phase, the emphasis of functional rehabilitation treatment is placed on the following objectives:

- research and identification and / or packaging of aids that facilitate / allow autonomy in the activities of daily life listed above;
- supply (through practices with the competent A.S.L. or I.N.A.I.L.) or construction of the basic aids identified;
- training in the use and maintenance of the identified aids;
- health education of the patient and / or family members to manage the problems resulting from spinal cord injury at home; consultancy for environmental changes;
- driving test advice;
- sport therapy (table tennis, swimming, archery, basketball, tennis)

PRINCIPLES OF TREATMENT

- Within this list, both the objectives and the treatment techniques are chosen on the basis of the major problems encountered during the evaluation and in accordance with the clinical status of the patient, in order to allow their reintegration into the within their socio-family context.

Skin management

- Pressure ulcers are one of the commonest and most troubling complications of spinal cord injury.
- They can occur at any time and are a source of frustration and disruption to patients' lives and rehabilitation.
- In the long term, they can prevent individuals from successfully holding jobs and they can adversely affect quality of life.
- They can also increase spasticity and pain, and predispose to autonomic dysreflexia and contracture. In severe cases, pressure ulcers develop into large wounds which become infected, leading to osteomyelitis and other serious medical complications which may be fatal.
- In some developing countries with limited resources, life-threatening pressure ulcers are a constant threat.

Prevention of pressure ulcers

- The key to pressure management is prevention.
- Prevention requires a multifaceted and interdisciplinary approach involving education, good nutrition, anti-spasticity medication and strategies to ensure regular changes in position.
- Perhaps more importantly, prevention involves the appropriate prescription of pressure-relieving equipment such as bed mattresses, wheelchair cushions and wheelchairs.

Regular change in position

- Recently-injured patients confined to bed are initially turned every 2 hours.
- The frequency of turning is gradually decreased but depends on many factors, including the type of mattress upon which the patient is lying and susceptibility to skin problems.
- Once patients start to sit in their wheelchairs, they need to relieve pressure from under the ischial tuberosities at least once every 15–30 minutes.
- Some evidence indicates that the lift should be sustained for approximately 2 minutes.

Regular change in position

- The frequency and length of pressure relief can often be decreased over time, but only in conjunction with careful monitoring. There are many different ways pressure can be relieved when sitting. A vertical lift that clears the buttocks from the seat is the most commonly used method by those with sufficient upper limb strength. Patients unable to perform a vertical lift can relieve pressure by regularly leaning forwards or sidewards, or, if necessary, by resting forwards with their arms on a table.
- Patients with high levels of tetraplegia sitting in power wheelchairs can redistribute pressure by regularly changing the tilt of their wheelchairs and elevating the feet

Patient, staff and family education

- Education of patients, staff and families is an important aspect of pressure care management.
- All must be made aware of the appropriate use and maintenance of pressure-relieving equipment. A common mistake is to place a wheelchair cushion upside down or around the wrong way.
- This usually reduces the pressure-relieving qualities of the cushion.
- Skin needs to be checked daily and, initially, more regularly if trialling new equipment.

Patient, staff and family education

- Patients need to be aware of the first signs of skin damage. They also should know how to appropriately manage problems when they arise. Adequate pressure relief is particularly important when sitting in cars or on commodes or other hard surfaces. Similarly, pressure from orthoses, splints, straps or casts can be a problem and these need careful monitoring. Medical sheepskin overlays can be used to relieve shearing forces although they should not be used on top of most pressure-relieving cushions or mattresses.

Pressure-relieving equipment

- Pressure-relieving equipment is important for effective skin management. Its prescription is sometimes the responsibility of physiotherapists but more often occupational therapists.
- Therapists prescribing this type of equipment would be well advised to seek additional information and training.
- Prescription of pressure-relieving equipment is something which requires careful consideration with deleterious consequences for patients if it is done poorly.

Pressure-relieving equipment

- Equipment that has provided adequate pressure protection during hospitalization may prove to be insufficient when patients return home. This is partly because patients regularly change position as part of therapy and nursing care programmes when in hospital but may not change position as frequently on discharge. Skin problems at home can be avoided by trialling pressure-relieving equipment under conditions that closely mimic the home situation.
- For example, patients unlikely to turn at night when home need to trial bed mattresses under the same conditions while in hospital. If in doubt, it is better to err on the side of caution and prescribe overprotective equipment.

Bed mattresses

- There are many different varieties of pressure-relieving mattresses.
- Mattresses may be either foam-, air- or water-based. The more expensive ones use power to cycle air through different chambers, systematically alternating pressure.
- A recent Cochrane systematic review concluded that in people at high risk of developing pressure ulcers, foam mattresses designed for relieving pressure are superior to standard hospital mattresses. The merits of more elaborate and expensive mattresses have not been scientifically validated, although most clinicians consider them superior to foam mattresses.

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Wheelchair cushions

- There has been growing commercialization of wheelchair cushions and there are now hundreds of different types on the market. Most are air-, foam- or gel-based, and designed for specific purposes. The most important pressure-relieving quality of a cushion is its ability to minimize pressures in the soft tissues overlying the ischial tuberosities. These pressures can be measured with either simple or sophisticated equipment designed to measure skin interface pressures.
- However, there is not one critical pressure, below which patients are safe from skin damage and above which they are not. It depends on many factors, including the length of time that pressure remains unrelieved.
- As a general rule, however, peak pressures over vulnerable sites should be kept well below 60 mm Hg

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2148/3677

Wheelchair seating

- Poor seating is a common cause of pressure. Soft tissues that are weight bearing or in contact with the wheelchair, especially those overlying the ischial tuberosities, are most vulnerable to the destructive pressures associated with prolonged sitting. These pressures are influenced by factors such as height of the footplates, tilt of the pelvis, tilt of the wheelchair and length of the seat. For example, footplates which are too high shift weight posteriorly, concentrating pressure over the ischial tuberosities.

- A posteriorly rotated pelvis turns the sacrum into a weight-bearing area, increasing susceptibility to sacral pressure ulcers. A seat which is too short distributes the weight of the thighs over a smaller surface area, increasing pressure. All these issues need to be considered when prescribing wheelchairs.

- Patients with deformities present complex seating problems because correction of deformities invariably requires the application of pressure. Most solutions involve dissipating pressure over wide areas, preferably through soft tissues that do not overlie bony prominences.

Treatment of pressure ulcers

- Not surprisingly, the treatment of pressure ulcers includes strategies to minimize pressure.
- These must be instigated with the first signs of destructive pressure, and may include confinement to bed, adjustment of a wheelchair or cushion, remoulding of a hand splint, realignment of an orthosis, or education.
- If a severe pressure ulcer develops, hospitalization may be required for many months, with or without accompanying surgery. For further details, interested readers are directed to clinical practice guidelines on the treatment and prevention of pressure ulcers.

Prevention of musculo-articular limitations

- Loss of active motion, acute phase bed rest, muscle imbalances between agonists / antagonists in denervated or hypertonic muscles, the use of orthoses to stabilize the spine (collar, torso), the presence of pressure ulcers, etc. they can cause muscle-joint limitations.
- Prevention therefore begins already in the acute phase and continues also in the stabilization phase through:
  - the alternation of decubitus;
  - positioning of the spine and extremities in correct alignment;
  - mobilization (passive, active-assisted, active of the 4 limbs and the spine).
- Warning: in case of conservative treatment of the vertebral fracture or in case of instability of the spine during mobilization, do not exceed 90 ° of flexion of the shoulder and 45 ° of flexion of the hip with knee extended.

Prevention of musculo-articular limitations

Paraplegic subjects and in some cases also quadriplegic subjects learn in the stabilized phase to perform self-mobilization of the lower limbs in order to:

- maintain passive joint excursion in joints without motor control in a self-managed way;
- facilitate dressing maneuvers in bed and / or in a wheelchair;
- favor the re-appropriation of the paralyzed part of the body.

Prevention of pressure ulcers

Pressure ulcers form more frequently in those areas of the body where the subcutaneous muscle layer between the bony prominence and the support surface is less or absent:

- supine position: sacrum, ischium, heel, scapulae, vertebral spinous process and occipital region;
- prone position. iliac crests, knees, dorsum of the foot;
- lateral decubitus: trochanters, femoral condyles, external malleoli, elbows;
- Sitting position: ischial tuberosities.

Prevention of pressure ulcers

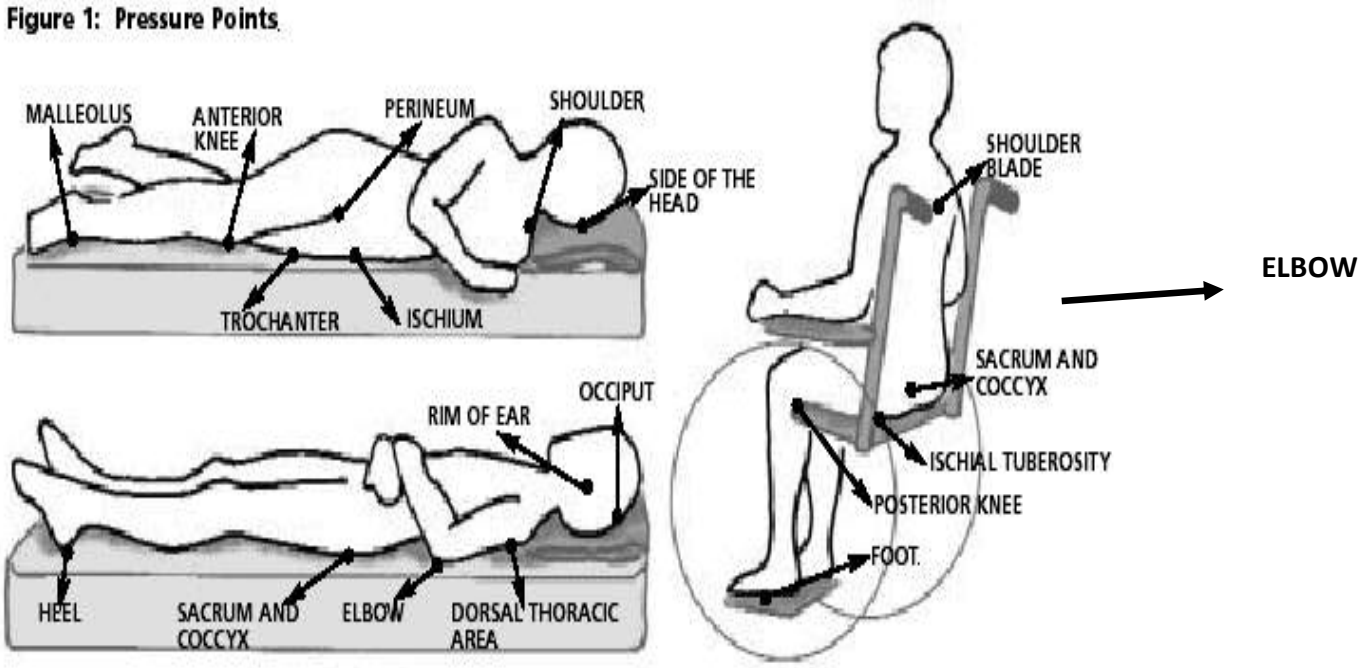
The most effective treatment is prevention through an accurate patient education program and the use of anti-decubitus devices. In particular:

- perform skin inspection, especially in areas at risk, in the morning before getting up and in bed in the evening; for this purpose it may be necessary to use a mirror in the skin areas that are more difficult to see; if even initial signs are detected that characterize the pressure ulcer, avoid skin compressions in those areas by assuming alternative positions;
- always carry out a thorough perineal hygiene after each urination and evacuation, dry the skin well after a shower;
- avoid burns, erythema, chilblains;
- in bed, alternate positions every 3-4 hours;

Prevention of pressure ulcers

- make the transfers avoiding crawling or rubbing the skin tissues, thus lifting the body from the support surface and eliminating anything that can cause damage to the patient and that can hinder the transfer (side rails, armrests, platforms, etc.),
- the person in a wheelchair must learn to relieve pressure on the ischial region by lifting periodically; if it is not possible to rise, it is necessary to bring the trunk forward or to the side in order to unload the ischial area;
- take care of the maintenance of the anti-decubitus devices (pillows and mattresses) which must be checked periodically in accordance with the manufacturer's instructions.

SKIN EVALUATION



Observation and assessment of risk areas

SKIN COMPLICATIONS

- Formation of compression ulcers due to pressure on capillaries, stretching or slipping of tissues, or frictional forces.

Skin complications prevention

- Correct positioning to reduce compression and stretch forces on soft tissues (especially in semi-sitting position) use semi-fowler position
- Use aids for the correct pressure distribution (pillows, anti-decubitus mattresses, articulated bed, gel supports,) and avoid direct pressure on the bone protrusions
- Vary the placement every 2-4 hours(if allowed by clinical conditions, based on aids and skin condition)

Skin complications prevention

- If it is impossible to perform a positioning every 2 hours, devices for the correct distribution of pressure must be used (anti-decubitus mattresses
- If you use these aids, you can change your position every 4 hours at most. If we use static mattresses, if I use dynamic air aids "even more hours" (Evidence C)

Skin complications prevention

- The use of ring aids (donuts) is strongly discouraged. (Evidence C)
- In bedridden and completely immobile subjects, the heels must always be raised from the bed surface. No anti-decubitus mattress can preserve heels from pressure ulcers (Evidence C)

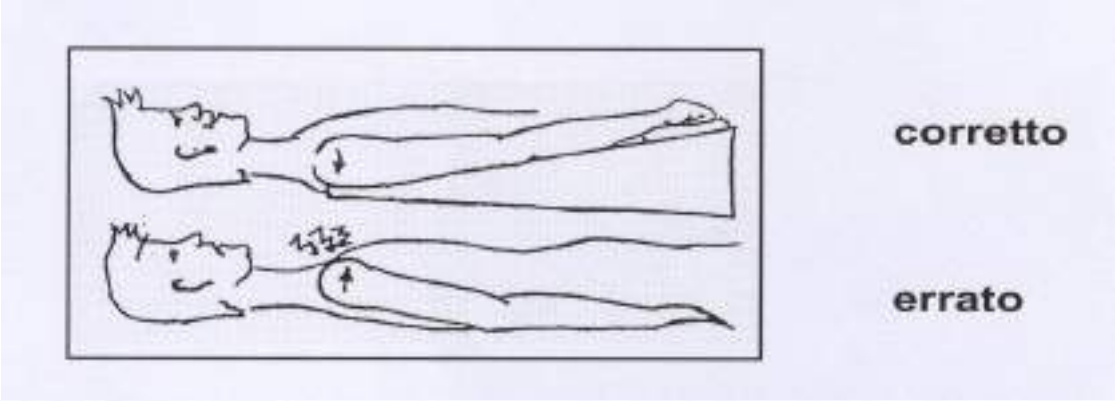
Skin complications prevention

- Global daily visual and tactile inspection of the skin (Evidence C), in particular of:
  - Ischium
  - Sacro-coccygeal area
  - Trochanters Heels

Positioning with aids

- On pillows
- Low memory mattresses
- Communicating air cell mattresses
- Air chamber systems with alternating cycle
- Dynamic pressure redistribution systems (fluidized air beds, air release beds)

POSITIONING



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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

MUSCLE-JOINT COMPLICATIONS

- Joint limitations
- Shortening of muscles or tendons
- Calcifications
- Skeletal deformities
- Osteoporosis and Pathological Fractures
- Muscle imbalances
- Spasticity
- Pain

Prevention of musculoskeletal complications

- Correct positioning
- Change of position
- Spasticity-inhibiting postures
- Passive or active assisted mobilization
- Stretching
- Postural exercises
- Correct posture education
- Identification and application of splint and orthosis

Change of position

Lateral / flank avoid direct pressure on the trochanters (30 ° semi / lateral positioning)

- Supine
- Lateral
- Semi-seated
- Prone

Positioning

- Bedsores prevention
- Muscle-tendon shortening prevention
- Edema prevention
- Pain prevention
- Search for functional positioning of the upper limb
- Spasticity Inhibition

NO

- Elevation of the scapula
- >Scapula adduction
- Shoulder abduction
- Elbow flexion
- Supination forearms
- Finger extension

YES

- Depressed scupla
- Scapula protracted
- Shoulders slightly abducted,
- Elbows extended
- Forearms pronated
- Hand closed into a fist- → elbow and hand higher than shoulder level

Supine position

- Avoid neck flexion (one pillow under the shoulders and one under the head)Spine aligned
- Also in neutral position between internal and external rotation
- Knees not hyperextended and heels isolated (with pillow)
- Neutral ankles and extended toes (avoid weight of blankets)
- In general, an inclination of the back of the bed of 15 ° -30 ° is allowed without having to apply an orthosis for vertebral stability, as long as the knees are flexed at 30 °: this allows to reduce the load at the ischial level.

PREVENTION OF DECUBITUS INJURIES

- Important scientific production, only a small part dedicated to the SCI patient
- Very different evaluation, treatment and prevention protocols
- Paralyzed Veterans Administration 2000: guidelines for prevention, evaluation, local, general, surgical therapy, postural norms and aids

PREVENTION OF DECUBITUS INJURIES

- Identification of local and general risk factors
- Daily surveillance of high-risk areas (ischium, sacrum, trochanter, heels)
- Postural changes every 2 hours in the acute phase
- Lack of evidence for hyperbaric oxygen therapy

PREVENTION OF DECUBITUS INJURIES

- The use of local electrical stimulations is recommended
- Adequate bed
- Correct posture in the wheelchair
- Anti-decubitus pillow
- Patient and family education

c) Prevention of orthopedic problems (muscle-tendon shortening, joint limitations, bone decalcification)

- To prevent possible muscle-tendon retractions in the limbs and postural alterations of the spine due to prolonged sitting in a wheelchair, it is important not only the appropriate choice of the wheelchair but also a program of active exercises carried out by the patient, easily learned and also perform while seated

c) Prevention of orthopedic problems (muscle-tendon shortening, joint limitations, bone decalcification)

- The sequence of exercises must be performed every day in order to prevent spinal deformities and maintain the musculo-articular excursion of the limbs (postural re-education).

c) Prevention of orthopedic problems (muscle-tendon shortening, joint limitations, bone decalcification)

In general, moreover:

- Regularly carry out passive mobilization of the joints without motor control, on the instruction of the physiotherapist. Movements must be slow and gradual throughout the joint range (R.O.M)Assumption of the vertical position by means of verticalization aids (Stabilizer, verticalizing wheelchair)
- Stretching and other therapeutic interventions to reduce spasticity
- Regularly assume and change postures that allow for good alignment of the head, trunk and limbs.
- Adoption of a diet that guarantees a constant supply of calcium

MOBILIZATION AND KINESI

• Also for mobilization and kinesi we can simplify schematically : a) mobilization can be passive , active assisted or active; the three modalities must be specified for limbs or for limb segments.

b) for each joint there is a tendency to reach the complete Range of Movement (ROM) in a slow and repeated way; exceptions are:

- - the glenohumeral joint in cervical lesions that are not stabilized, or stabilized but unsafe; in this case we remain within the 90 ° ROM in all directions so as not to involve the shoulder girdle;
- - the coxofemoral joint in back and lumbar lesions: the lower the level of bone lesion, the lower the angle of flexion allowed;

MOBILIZATION AND KINESI

- c) an attempt is made to maintain the muscle length of the greatest number of groups (especially stretching of the innervated groups that have paralyzed antagonists) and the muscles of the posterior lodge of the lower limbs (hamstring, etc.) are stretched to facilitate the sitting position with legs extended.
- d) the presence of pain requires the differential diagnosis on its origin; variations in intensity, type and trend are observed. It can be a reason for stopping treatment;
- e) mobilization is repeated twice a day;

MOBILIZATION AND KINESI

- f) if it is possible to increase the activity against resistance, we remind you that:
- *** the muscles that have paralyzed antagonists are not strengthened! (see brachial biceps / triceps);
- *** very limited loads are used (1 kg or a little more) because resistance is significant only as a contrast to non-use, not as strengthening (which is postponed to the stabilization phase).

MOBILIZATION AND KINESI

- Towards the end of the acute phase, specific activities are introduced to facilitate access to the wheelchair and increase the amount of "activities of daily living" (ADL). The postural readjustment to the sitting / sitting with legs down / semi-vertical position is introduced; at the beginning, the degree of verticalization in bed is increased, then the transition to the reclining wheelchair or, more rarely, to the static table. Orthostatic hypotension characterizes all position changes and can constitute a significant brake on the rehabilitation process

MOBILIZATION AND KINESI

- Maintaining the semi-sitting position in a wheelchair is potentially dangerous for the pelvis to slide forward and the consequent disastrous formation of skin lesions. In general, a “postural” wheelchair (with seat tilting) is preferable to a simple wheelchair with a reclining backrest. An inclination of 5 ° on the horizontal plane of the seat is sufficient for the pelvis to remain well seated without slipping (fig. 6).

- Fig. 6 - a) In the sitting position the patient tends to slide forward causing a stretching dangerous for the sacral area and ends up not having a safe load distribution over the entire support base, also due to the raised lower limbs; in b) we can see how a 5 ° inclination on the horizontal plane maintains the torso-thigh angle at 90 ° avoiding slipping and misalignm

MOBILIZATION AND KINESI

- The first lift in the wheelchair is a very important moment for both the patient and the physiotherapist, you take all the time you need and calculate all the variables (aids, number of operators, adverse events ...)

MOBILIZATION AND KINESI

- a) prepare the patient: at least one week before getting up, the patient begins postural re-education, that is, orthostatic readjustment. In addition to the problem of hypotension, there is another component that should not be underestimated, that is, the patient must get used to checking with his eyes the body that no longer has proprioceptive sensitivity. It can be a very tough time to deal with so let's take care to reinforce the positive message of "finally out of bed!".

MOBILIZATION AND KINESI

- During this week it is essential that the vasopressure aids are already in place and that they are worn for the first lift. In addition, it may be necessary to wear a corset or collar, which must be previously customized and worn on the supine patient.

MOBILIZATION AND KINESI

- The patient must be dressed: there is no excess of zeal, thermoregulation is compromised, there may be hypothermia without a sensation of cold (or the temperature may rise for a few hours of exposure to the sun). In particular, you have to check the clothes, better to use natural fibers and make sure that the stitches are thin and do not remain under the support surface. The shoes must be at least one number larger, softer, with smooth internal ribs and when wearing them, care must be taken that the fingers are well extended, otherwise the flexion of the fingers with the rubbing of the back against the upper will cause redness and lesions.

MOBILIZATION AND KINESI

- b) prepare the aids: the wheelchair must be chosen according to the level of injury to the type and therefore to the residual functional capacities, it will often be a recliner or better still a postural one. The size of the seat (in width and depth) must be adequate at the start, while the height of the backrest, the headrest (always!), The footrests with leg rests and the armrests will be adjusted to the patient after the transfer. The anti-decubitus pillow must be of a suitable size and of a safe type: in the first lifts it is preferable to be too cautious. If the cushion is air-filled, the swelling can be adjusted after the transfer.

MOBILIZATION AND KINESI

- To make the transfer you use the sliding board (rollboard) with the level of the bed and that of the wheelchair compatible: generally the rollboard allows a difference in height of 15/20 cm. It is good not to try to transfer seated, so no tablets and even less taken between the knees. If there is really no rollboard, it is better to transfer with a lift or a stretcher with three or four operators (but the latter is very tiring and must be kept between emergency maneuvers).

MOBILIZATION AND KINESI

- It goes without saying that the brakes must be perfect, the pull-out sides and the pressure points on arrival all checked again. The torso is not used as a grip point and the patient is not pulled by the arms! It moves with force on the tracks and supports the legs and head.

MOBILIZATION AND KINESI

- c- Prepare the operators: it is not trivial, it is not certain that all nurses and OSS know how to make a transfer of this type. In any case, you decide first who does what and make sure that no one does a maneuver that hinders the others.

MOBILIZATION AND KINESI

- d- Prepare the setting: starting a maneuver and realizing that something essential is not in the room, that the bladder catheter is pulling or a drip is being removed, presupposes going back, fixing things and starting over. Then make sure that the therapy aids are made safe, that everything you need (even if any) is at hand, that the maneuver is safe and ergonomic for the patient and operators.

MOBILIZATION AND KINESI

- e- Check the clinical status: the patient must never be left alone at the first lift, especially if the lesion is high and ringing the bell is difficult. Blood pressure and heart rate should be checked regularly and the chair extended at the first sign of critical hypotension. Sometimes fainting is not preceded by dizziness but simply by repeated yawning.

RESPIRATORY PHYSIOTHERAPY

- Flaccid sub-injury paralysis severely impairs ventilation, especially as it establishes itself acutely. Until a few years ago, the treatment of the quadriplegic patient was essentially based on techniques typical of COPD, and only recently the long-term survival of severe paralyzed patients follows a rationale typical of restrictive wall pathologies. In this sense the most authoritative sources are Estenne and De Troyer in Europe and John R. Bach in the United States.

Respiratory rehabilitation

- Of fundamental importance in the acute phase as it allows the prevention of respiratory complications, also reducing the frequency of recourse to tracheotomy, it must also be continued in the subsequent phase for correct respiratory prophylaxis, especially in cervical and upper thoracic lesions (up to D6) .
- For C1 to C3 lesions, without voluntary control over the diaphragm, permanent assisted ventilation is required.
- Patients with lower cervical lesions retain the ability to breathe autonomously but are extremely vulnerable to secondary complications such as bronchopulmonary foci, pulmonary atelectasis, acute respiratory failure.

Respiratory rehabilitation

- Trauma so violent as to cause bone damage is often accompanied by a range of soft tissue injuries: especially in thoracic injuries in which the lungs are involved in various capacities with hemothorax/ pneumothorax, aortic or mediastinal injuries, etc. which implies that a good number of acute bone marrow patients are also post-thoracic surgery.
- In the stabilized phase, the level of injury and the patient's age have a predictive value on the incidence of respiratory complications. The degree of completeness is minimally predictive, while the years elapsed since the injury seem to have no influence on the incidence of mortality.

b) Prevention of respiratory complications:

With lesions greater than D6, respiratory problems must be prevented by:

- Frequent changes of position with a preference for the prone position.
- Activities, including playful ones, which involve respiratory education, eg. sing, blow up a balloon, speak loudly, etc.
- In tetraplegics, and in subjects with a previous obstructive pathology, even good self-management is not enough. The use of a non-invasive ventilator Must be trained to prevent micro atelectatic outbreaks and to resolve acute infectious situations
- In the presence of bronchial obstruction, adequate cough assistance maneuvers carried out by self-management or by the caregiver

RESPIRATORY EVALUATION

- Vital parameters instrumental examinations
  - FC, FR, PA, temperature,
  - O2 peripheral saturation monitoring
  - Chest x-ray, CT, blood gas
- Auscultation
  - wet / dry noises
  - hypophonesis
- Cough
  - effectiveness
  - type and quantity of secretions

RESPIRATORY EVALUATION

- Mechanical alterations
  - chest mobility
  - paradoxical movements
- Respiratory fatigue
  - Fr> 30 dyspnea
  - Sat O2 <92%
  - increased breath paradox

RESPIRATORY COMPLICATIONS

- Chest instability (paradoxical breathing)
- Hypoventilation
- Respiratory fatigue
- Ineffective cough
- Bronchial encumbrance
- Respiratory failure

Prevention of respiratory complications

- Containment orthosis
  - Stabilization of the cage by positioning the elastic girdle and Sanglage
- Cool-down techniques
  - Exhalation released controlled exercise
- Bronchial clearance exercises
  - Bronchial drainage techniques: positioning, exhalation with parted lips, P.E.P.
- Volume assisted cough:
  - Mechanical assisted cough: chest squeezing

Hypotension

- Graduated compression stockings and abdominal binders may help maintain blood pressure although evidence of their effectiveness is conflicting.
- Postural hypotension is particularly pronounced when patients first mobilize after injury, especially if there has been an extended period of prior bedrest. For this reason mobilization needs to be implemented slowly.
- For the first few days the patient may just tolerate sitting up in bed. Subsequently, the patient may then be sat
- out of bed in a reclined wheelchair with the legs elevated. Over time patients 'acclimatize' and better tolerate the transition from lying to sitting; this is thought to be due to an increased tolerance to feelings of lightheadedness with lower blood pressure.

Postural re-education

- The possibility of restoring a sitting posture while respecting the physiological curves of the spine depends on numerous factors. First of all, the neurological level preserved as the higher the lesion, the greater the postural control deficit and the spontaneous attitude of compensation will lead to the development of cervical hyperlordosis. In high thoracic lesions, on the other hand, the spontaneous compensatory attitude leads to hyperkyphosis.

Postural re-education

- Other factors that influence posture are the outcomes and type of surgical stabilization, any pelvic asymmetries for different limb lengths, asymmetrical motor control, presence of pararticular calcifications, hypertonus, psychological reaction to the event, etc.

Postural re-education

- It is therefore in reality a very broad chapter of the treatment aimed at:
  - corrective re-education of functional (unstructured) postural alterations of the spine and muscle-tendon shortenings resulting from prolonged postures (hamstring shortening, spine extensors, iliopsoas, buttocks, adductors, sural triceps, etc.);
  - re-acquisition of the correct sitting posture through the appropriate choice of the wheelchair with relative customization (backrest height, backrest shape, seat inclination, position of the large wheels, footrest height, etc.) and of the anti-decubitus pillow.

Orthostatic rehabilitation

- When the clinical parameters are stabilized, the re-education to standing upright begins gradually moving to the semi-sitting position (semifowler) first in the articulated hospital bed, then in a postural or even reclining wheelchair (it would be better to avoid them) using also orthoses to support the stability of the spine (collar, torso), for vasopressure (vasocompressive knee-highs, abdominal belly)

Orthostatic rehabilitation

- The postural wheelchair is very versatile for the management of the patient's elevation both for the way of transfer from the bed and for pressure problems (possibility of reclining, possibility of adjusting the inclination of the footrests and headrest). Once the pressure values are stable and the ability to support the weight on the spine for a few hours has been reached, the postural wheelchair is abandoned to reach the sitting position using a 90 ° wheelchair.

Orthostatic rehabilitation

- In less complex situations (no complications from polytrauma, young subjects, low injuries, stable pressure parameters) you can reach the 90 ° position on the bed and then get up immediately in the wheelchair at 90 °.
- The next step is the readjustment to verticalization using manual or electric standing, or verticalizing wheelchair.
- In cases of particular difficulty in pressure readjustment, the static bed is used.

Orthostatism re-education

- WHEN?
- Based on the presence of the means of synthesis, clinical conditions, presence of complications (PU, DVT, inflammatory states, etc.) and / or associated trauma

- HOW?
- Gradual and progressive achievement of the sitting position on the bed and then in the wheelchair

What aids?

- Articulated bed, with trendelemburg and antitrendelemburg position, static table
- Postural or 90 ° wheelchair, anti-decubitus cushion
- Vasocompression orthosis (belly and elastic stockings)
- Support orthosis for stabilization of the spine if necessary (braces, collars)
- Lift or sliding board

Verticalization

- When the sitting position is maintained with stable pressure values throughout the day, the readjustment to verticalization begins.
- The assumption of an upright posture has beneficial effects:
  - on the bone system as it improves bone trophism;
  - on the gastro-intestinal system as it stimulates intestinal peristalsis;
  - in the prevention of muscle-tendon retractions in flexion of the lower limbs;
  - from a psychological point of view (not always);
  - Cardio-circulatory system
  - Bladder and intestinal function
  - Muscles of trunk and upper limbs
  - Kidney function

Verticalization

- Initially the maintenance of the upright position can be limited to even a few minutes in relation to the autonomic but also emotional response, then it continues for longer and longer times up to a few hours in the day.

Verticalization

- Verticalization is basically carried out by means of aids.
- In the paraplegic, the stabilizer for static (commonly standing) is generally used, which has the following characteristics:
  - adjustable support for knee support;
  - supports for the support of the upper limbs;
  - back support for the pelvis;
  - front support to prevent falling forward

Verticalization

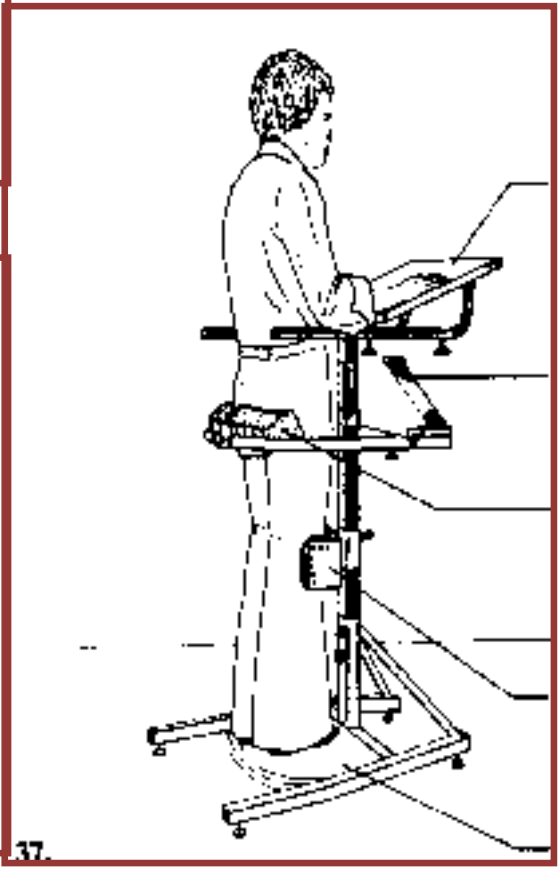
- The verticalization in the quadriplegic generally takes place by means of a verticalizing wheelchair as it allows an easier resolution of any pressure problems allowing to gradually reach the vertical position.

Verticalization

- Gradual readjustment of the load in standing position (vertebral stability !?)

AIDS

Vertical stabilizer (manual or lectric)
Verticalizing wheelchair
Static bed
Elastic stockings
Abdominal bands



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Muscle strengthening

The residual muscles must be developed to the maximum to compensate for the lack of movement of the paralyzed part. Therefore, strengthening essentially affects the muscles at the level of the upper limbs and trunk (dorsal, pectoral, large and small round, supra and infraspinous, deltoid, triceps, biceps, extensors of the spine, abdominals, etc.), compatibly with the level neurological preserved, by:

- active exercises or manual counter-resistance in segmental and / or global schemes, also including neuromuscular facilitation techniques such as PNF;
- exercises with pulley weights;
- exercises with rubber bands;
- Bars
- carpet exercises that use the weight of the body as resistance in a sitting position on the carpet, in a sitting position with the bars (lifting forward, backward, sideways, with difference in height), prone position.

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Strengthening whole muscles

PROMOTION OF FUNCTIONAL SKILLS

ASSESSMENT

Possibility of learning new motor patterns that are related to lost motor skills

- Balance Exercises
- Changes of position (straightening and carpet movements)
- Lifting

Muscle strengthening

Exclusion criteria:

- instability of the vertebral fracture;
- presence of still unconsolidated fractures of the upper limbs or myotendinous pathologies in progress;
- presence of marked hypertonia (in the upper limbs or onset of pathological irradiation phenomena in the trunk / lower limbs);
- marked imbalance between healthy agonist muscle and paralyzed antagonist

Muscle strengthening

- Muscle strengthening, which began during the bed rest phase, intensifies when the subject gets up through specific training after evaluating the maximum load (one repetition with maximum load in the absence of compensation, pain, pathological irradiation phenomena).
- The training can include a strengthening program (workload equal to 66% of the maximum strength) or an endurance program (workload equal to 33% of the maximum strength) in relation to the muscular examination, the physical condition of the patient, to short-term recovery goals.
- Each training session must end with stretching exercises for the shoulder girdle and upper limbs.

What to avoid and what to look for

	OBJECTIVE	RISK
Shoulder	Joint mobility in the physiological range Avoid pain at all costs Shoulder subluxation prevention	Algodystrophic syndrome Difficulty with abduction, in particular with spastic adductors Tendency to inferior subluxation in C4 lesions
Elbow	Complete range of motion, especially in extension	An extension deficit of even just 10 ° can compromise the ability to be able to transfer independently.
Wrist	Complete range of motion	Prevalence of the tone of the wrist flexors
Long fingers	Prevent edema Functional hand	Hyperextension or incomplete flexion of the Metacarpophalangeal Stiffness of the interphalangeal joints Flat hand
First Finger	Partial adduction-flexion with extended wrist and abduction with flexed wrist	

Muscle strengthening of the supralesional areas and attempt at sub-injury recovery

- Use of manual techniques of proprioceptive neuromuscular facilitation;
- Synergies: especially those in the prone position on the elbows that reinforce the entire shoulder girdle
- Use of physical tools (dynamometer, pulleys, weights, elastic bands, cycle ergometer…);
- Inclusion in sports therapy programs;
- Activities for autonomy

Attention to

- DELTOID: exercised in a seal, its main function
- SHOULDER ADDUCTORS. Fundamental resource for compensation (shoulder antepulsion to extend the elbow and stabilization of the elbow while seated).
- BRACHIORADIALIS: it can be useful in pushing the wheelchair and usable in functional surgery

Training of straightening sequences

- They are preliminary functional activities to subsequently exercise mobility in bed.
- As mentioned for the re-education of balance, the reacquisition of the straightening sequences is assisted by new motor strategies "suggested" by the physiotherapist but often activated automatically by the patient himself using the residual muscle heritage.
- For example, the patient without triceps learns to extend the elbow bringing the shoulder into external rotation, or to facilitate the lifting of the trunk while sitting, the patient learns to unbalance himself very much forward with the head and trunk depressing the shoulders.

Training of straightening sequences

Activities to be exercised in increasing order of difficulty and in relation to the neurological level preserved:

- maintenance of long sitting position;
- lifting on the carpet;
- shifts on the carpet sideways, forwards, backwards;
- displacement of paralyzed limbs;
- sit and lie down;
- turn sideways;
- reach the prone position;
- quadruped position;
- kneeling position.

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Inhibition of spasticity

- The presence of spasticity can sometimes be useful for achieving upright posture and walking, can promote venous return and reduce circulatory stasis, limit muscle atrophy, facilitate intestinal peristalsis.
- When hypertonicity takes on a negative value as it limits the autonomy of the injured person, a treatment is required which may be, in relation to the entity and location of the symptom, pharmacological, physiotherapeutic and / or surgical.

Spasticity

- Spasticity is primarily managed with pharmacological agents.
- There are two main categories of drugs, some acting predominantly within the central nervous system (e.g. baclofen, diazepam, gabapentin, clonidine, tizanidine) and others acting peripherally, either within the muscle or at the neuromuscular junction (e.g. dantrolene and Botulinum toxin).
- Severe spasticity is sometimes managed by administering drugs directly to the spinal cord (i.e. intrathecally).
- The main implications of spasticity are that it predisposes patients to pain, contractures and pressure ulcers, and makes movement and hygiene difficult.

Spasticity

- For some patients, spasticity limits function and quality of life.
- Physiotherapy interventions such as hydrotherapy, stretch, heat, TENS, cold, electrical stimulation, therapeutic exercise techniques, passive movements, standing and vibration may provide transient relief from spasticity, but there is no evidence that any of these interventions produce lasting reductions in spasticity.
- In addition, the application ofheat can cause burns and therefore should only be used with extreme caution in patients who lack sensation.

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TREATMENT OF SPASTICITY

- One of the major problems resulting from SCI
- Incidence one year after trauma: 67% of SCI, 37% receiving antispasmodic therapy, 11% unsuccessful
- Main effects: limitation in ADLSecondary effects: pain, reduction of ROM, muscle-tendon retractions, joint deformities
- Oral drugs: baclofen, dantrolene, tizanidineIntrathecal baclofen
- Selective neuromuscular blocks

Physiotherapy treatment

- Physiotherapeutic treatment after focal treatment of spasticity is based on techniques of:
- a) Short-term passive manual stretching through muscle stretching maneuvers
- b) Long-lasting passive mechanical stretching through the use of Positioning techniques
- Use of orthoses
- Functional bandage
- Serial plasters

Control of spasticity and maintenance of physiological muscle lengths and lengthening of shortened muscles:

Paid attention to:

- Pectoral muscles
- Biceps: the risk is to encounter upper limbs with a wing in C5 injury limiting autonomy
- Wrist flexors: difficulty in extending the wrist and difficulty in setting the functional hand

Short-term passive manual stretching

Muscle stretching techniques have four basic objectives:

- restore the length and flexibility of the muscle in order to achieve optimal joint range
- preserve the sliding between the elements that make up the muscle in order to contain internal friction
- reduce the patient's feeling of muscle stiffness
- maintain a correct representation of the muscle centrally.

The stretching maneuvers must be performed as follows:

- it is necessary for the patient to actively collaborate for complete relaxation of the muscle. The stretches must be of low intensity and long duration as otherwise they would cause a reflex contraction of the muscle. The maneuvers are more effective when they exploit the principle of contraction-relaxation, through a maximal isometric contraction;
- the stretching must be gentle, slow, gradual and progressive. The average time to obtain a valid muscle relaxation varies from 30 to 60 seconds and increases up to a few minutes in the case of important muscle chains. The number of repetitions on average can be considered around 10 and performed 2 times a day;
- if the temperature of the muscle is increased (eg hydrotherapy) the effect produced by the stretching is more effective and lasts longer.

Long-lasting passive mechanical stretching

- Long-lasting passive mechanical stretching techniques use various types of aids, such as:
- -Stretching tablets
- - Orthosis
- - Functional bandage
- - Serial chalks
- N.B The choice of the technique varies according to the intensity and duration that you want to obtain from the stretching, the dynamism of the unit, the district to be treated, the patient and family compliance levels

Positioning tablets

- They allow to use a low intensity stimulus keeping the interested part in lengthening. The stretching must be continued for 20/30 second each session.

ORTHOSIS - Orthopedic braces

Features

- Keep the segment to be treated in a certain position
- Recover the articular excursion

Types

- Pre-packaged braces in the absence of structured deformities
- Braces tailored to specific cases

ORTHESIS - Requirements

- Be of suitable size
- Be easy to apply (for both patient and caregiver)
- Be smaller in size
- Be well understood by those who use it or by those who assist the user

WRIST BRACE

- Brace in elastic fabric and velcro closure equipped with two aluminum reinforcement sticks located one in the ventral position and one in the dorsal position. Both splints can be manually molded into the desired position.
- This brace is used in patients who have a modest hypertonicity of the wrist flexor muscles and allows to keep the wrist in extension, leaving the fingers free.

PRE-PACKED BRACES FOR WRIST AND FINGERS

- This brace consists of a pre-molded polyethylene valve with velcro closures. The hand is placed in a functional position with the thumb abducted and the wrist slightly flexed. This device has the characteristic of being minimally moldable at low temperature and therefore adaptable to the patient's needs. It is indicated for patients who do not have established retractions or high hypertonus of the flexor muscles of the wrist and fingers.

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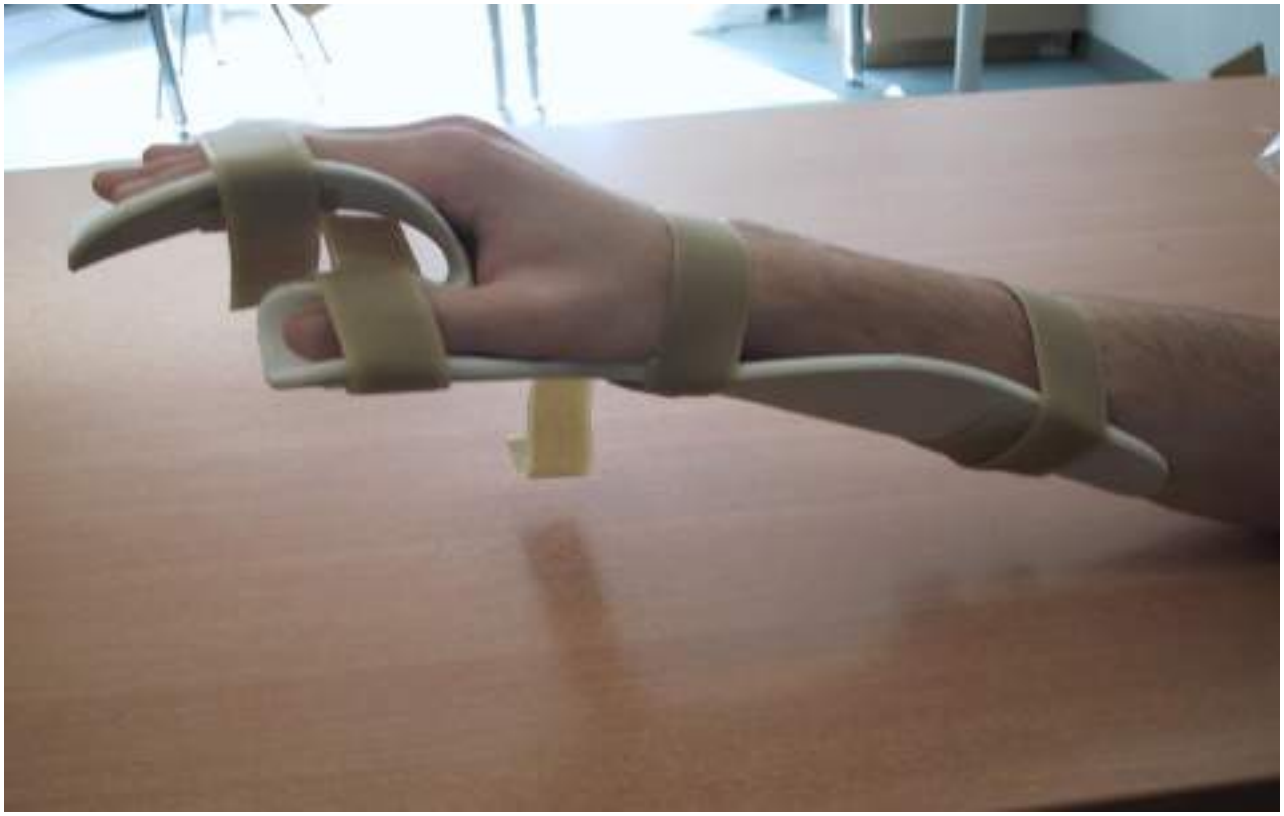

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MADE TO MEASURE PACKED BRACKETS

- Custom-made braces are used when the treatment needs are specific, i.e. when it is necessary to obtain either a particular positioning, impossible to obtain with a standard brace or when deformities or structured retractions are present.
- The material commonly used for the construction of this type of brace is the low temperature thermoplastic one, which can be heated in hot water at 60 ° -70 ° and can be modeled directly on the patient's hand.

FEATURES

- modifiability, which allows you to modify the orthosis by heating it to adapt to the results obtained;
- memory, to reuse a material by remodeling it in the event of errors or major changes to be made;
- conformability, to customize the orthosis to the maximum degree;
- stiffness, to adequately support the joints: the low temperature, to model the material directly on the patient;
- lightness, so as not to weigh down the limb; practicality, to facilitate the use of the orthosis;
- perspiration, to avoid skin injuries by allowing transpiration through small holes in the material or tubular cotton.

Principles for the construction of the orthosis

- the orthoses must have levers long enough to limit the pressure on some areas
- it is necessary to correct the thumb and the distal phalanges first and then rise again shortly
- if the phenomenon of hand grasping is present, it is advisable to build a dorsal and not a palmar orthosis
- it is necessary to pay close attention to the positioning of the distal phalanges because they can more easily go into subluxation
- the orthoses must be built at least 15 days apart. From treatment with botulinum toxin as the hypertonicity can change significantly up to 15 days. after infiltration

Stages of construction

- identify the model of orthosis to be performed taking into account the objectives set and the joints involved;
- draw the basic model of the orthosis on the cast of the patient's hand, place it on the thermoplastic material and cut it out (to facilitate the operation, you can immerse the thermoplastic sheet for a few seconds in hot water to soften it and then cut out the model of the orthosis);
- soften the material in the thermostatic tank, avoiding overheating it in order not to compromise its elongation and conformability characteristics;
- model the orthosis on the patient's hand after removing the thermoplastic material from the water and drying the surfaces on a towel (check the temperature on your skin and possibly protect the patient's skin with a cotton tube);

Stages of construction

- allow the orthosis to cool, remove it from the patient's hand and carry out the finishing touches by softening the material with the heat gun, which must be held about 20 centimeters from the orthosis to prevent it from inflaming (in the case of a shorter distance), or overheating on a too large surface, (in case of greater distance).
- It is necessary to wait for the splint to cool down again before putting it back on the patient;
- have the patient wear the orthosis for 10 minutes, take it off and check for any redness to modify the splint;
- repeat the operation by wearing the splint for 30 minutes;
- apply the velcro fasteners (their length must be such that they can be closed without affecting the patient's blood circulation).

..... THE PHYSIOTHERAPIST MUST ... ..

- - pay particular attention in the presence of scars or skin lesions,
- - do not create pressure points
- - there must be no sharp edges or edges.

… .. THE PATIENT MUST … ..

- wash the splint often with cold soapy water and dry it thoroughly;
- do not leave it near heat sources, in the sun, in hot water, as it could deform;
- do not leave it near open flames as it is flammable;
- do not try to modify it yourself so as not to compromise its rehabilitation effectiveness.

The orthoses that are most frequently indicated in the treatment of subjects with spinal cord injury, mostly cervical, are static ones and, in particular:·

- Volar wrist orthosis;
- Volar orthosis for wrist and trapezium-metacarpal joint;
- Volar orthosis for wrist and metacarpophalangeal joints of long fingers;
- Volar position orthosis;
- Dorsal wrist orthosis;
- Dorsal position orthosis;
- Dorsal orthosis for metacarpophalangeal joints of the long fingers.

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Wrist-hand-finger orthosis / for extending the radio-carpal joint and five fingers

PROGRESSIVE CORRECTION ELBOW BRACE

- This type of brace consists of two polyethylene valves with Velcro fasteners, articulated at the elbow by a mechanism that can be manually calibrated in flexion-extension.
- It is indicated for all those patients who have been treated with phenol on the musculocutaneous nerve and / or with botulinum toxin in the brachial biceps and / or radial brachio and who require a gradual recovery of elbow extension over time.

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REHABILITATION PHYSIOTHERAPIST

FOOT BRACE

- They are semi-finished braces in thermoformable material at 170/180 °. They are divided into different types based on the function they perform:

- if a pronation effect of the foot is sought after focal treatment of the spasticity of the plantar and supinator flexor muscles of the foot, the most suitable brace is the A.F.O.

- if you want to block the ankle joint on the lateral plane, the use of the peromed is recommended

- if you want to block the ankle joint in the sagittal plane and correct equinus and talismus, the use of the codivilla spring is recommended.

KNEE BRACE

They are divided into:

- a) brace for immobilization of the knee, built from a fabric base to which splints placed in a longitudinal position are fixed, capable of maintaining a fairly rigid structure and with velcro strips for closure. It is indicated to keep the lower limb fully extended and is used in all cases where the hypertonicity is modest or there are no muscle-tendon retractions;
- b) brace with variation of the flexion-extension angle; indicated in all cases where a gradual recovery of knee extension is required (such as after treatment with botulinum toxin on the hamstring muscles).

Brace for knee immobilization

Brace with variation of the flexion-extension angle of the knee.

FUNCTIONAL BANDAGE

- The functional bandage provides a degree of stretching which tends to be lower than that of gypsum, but has greater dynamism and the possibility of controlling the body segments.
- It is generally used at night for the first week after drug treatment, ensuring correct alignment of the affected segments.
- The bandage must be renewed with progressively increasing traction every day.

SERIAL PLASTERS

- Serial casts are used as a technique especially for lengthening the plantar flexor muscles of the foot.
- The advantage of their use is represented by the continuous lengthening over time unlike orthoses in thermoplastic material, which are placed only for a few hours a day, and therefore more easily used to preserve the result achieved.
- The disadvantage that instead derives from their use is that they are not very controllable for secondary complications, first of all pressure injuries.
- The casts must be repeated after 7-10 days in a position of gradual elongation and involve greater costs and times than the techniques described above.

Maintenance of physiological muscle lengths and lengthening of shortened muscles:

- Use of proprioceptive muscle inhibition techniques;
- Use of adjustable elbow pads, functional bandages and positioning splints;
- Correct positioning in bed and in a wheelchair;

Inhibition of spasticity

The most common physiotherapy techniques for reducing hypertonia, although their effectiveness is still limited in terms of duration over time, consist of:

- slow and gradual passive mobilization of the joints throughout the joint range;
- slow and prolonged stretching of the hypertonic muscles also through the assumption of certain postures (prone, supine "frog" position, sitting on the knees from the quadrupedal position, verticalization, etc.);I
- frequently change position and take correct postures both in bed and in a wheelchair;
- muscle relaxation through slow rhythmic movements with equipment such as the passive pedaler, Bobath balloon, etc.voluntary relaxation through concentration techniques and slow and deep breathing (incomplete lesions);

Inhibition of spasticity

- NB: Somatic or visceral stimuli such as skin pressure ulcers, ingrown toenails, bladder infections, stones, fractures, constipation and other pathologies, can constitute irritating spines that interfere, aggravating, the tone disturbance. Other factors that can increase hypertonia can be: cold, tight shoes or clothes, prolonged bed rest,

- Pharmacological treatment can be oral, intrathecal and local. Commonly used drugs are Baclofen, Diazepam, Rivotril, Dantrolene and Tizanidine. In some patients, the administration of Baclofen may be envisaged by implanting a pump in the abdomen, which through a spinal catheter transports the medicine into the intrathecal space with the advantage of using extremely lower doses of the drug than the oral route and with an efficacy greater. The drugs mainly used locally are local anesthetic drugs (ethyl alcohol, phenol) or at the level of the motive plate (botulinum toxin).

Training in A.D.L .:

I. Locomotion in a wheelchair
   - The electric / electronic wheelchair
   - The manual wheelchair

II. Mobility in bed

III. Transfers

IV. Personal hygiene and self-care training (nutrition, hygiene, clothing, self-catheterization)
   - Feeding
   - Hygiene
   - Clothing training

The electric wheelchair

- For some patients who are unable to move in a functional way with a self-propelled wheelchair, given the poor residual motor skills or the easy exhaustion due to age or serious associated cardio-respiratory problems, an electric wheelchair must be identified as the first; this does not mean that a manual wheelchair will also be prescribed, which is sometimes easier to use when traveling by car or as a spare (electric wheelchairs are more subject to problems than mechanical ones).
- Naturally, the subject must be properly trained to drive, evaluating the suitable type of control (chin control, standard joystick or with modified handle, etc.) and the ability to safely manage the locomotion for oneself and for others by means of an electric aid .

ELECTRONIC WHEELCHAIR

IDENTIFICATION AND CUSTOMIZATION of the aid in particular for:

- TYPE OF COMMAND:
  - Joystick
  - Pressure sensor (chin, lips, tongue, shoulder, etc.)
  - Blow sensor
- Indications
  - C5 or higher lesion
  - C6-C7 lesion with need for mobility for medium distances and uneven terrain
  - Tetraplegic in pediatric age

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

WHEELCHAIR WITH JOY-STICK CONTROL

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

WHEELCHAIR WITH CHIN CONTROL

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

The manual wheelchair

In U.S.U. the wheelchair is the main aid. It allows indoor and outdoor movements of medium and long distances. It is of fundamental importance not only to make the appropriate choice of wheelchair in relation to the specifics of the case, but also to carry out adequate training in the use of the aid which, in relation to residual motor skills, includes the acquisition:

- Propulsion technique: circular movement of the arms with grip on the handrail from the extended to the flexed position starting just behind the pelvis; if the propulsion occurs forward, the trunk bends slightly forward, vice versa if it occurs backwards. In the absence of an active grip, the thrust is imparted to the handrail by pressing on the palm (useful thrust gloves that serve both to protect the hand and to increase friction).
- To turn to one side, the ipsilateral arm pushes the wheel backwards and towards the opposite side while the other arm pushes forward.

The manual wheelchair

- Push uphill: accentuate the flexion of the trunk to bring the center of gravity forward, downhill extend the trunk and head as much as possible, keeping the wheels braked by means of tight contact on the handrail.
- Pick up objects from the ground: never in front, but always to the side, bend with the trunk while with the arm of the other side hooks to the push handle or the wheel.

The manual wheelchair

- Balancing on large wheels (wheelie): useful for moving on uneven ground, for overcoming sidewalks / steps or very inclined descents; tilt the wheelchair on the rear wheels by pushing the head and trunk backwards and at the same time push on the wheels from the back to the front, finding a point of balance by means of small oscillations of the head and torso. Taken on the handrail. Once you have found the balance, move forward and backward on two wheels.

The manual wheelchair

- Climb the sidewalk: go to the front to the difference in height; push forward quickly enough managing to lift the small wheels until they rest on the step. Tilt the trunk forward and push on the large wheels.
- Get off the curb: bring the small wheels to the edge. Balance on the big wheels and push; you can also go back down if the step is small.
- Go ashore and go up again
- Fall prevention: in the event of a fall backwards, try to avoid the fall by bending forward as much as possible and otherwise quickly extend your arms backwards to cushion the blow.
- To go back up, lean forward leaning on a wheel while the other limb slides on the floor.
- Knowledge and maintenance of the aid

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

2279/3677

Mobility in bed

- It includes moving in bed to the side, forwards, backwards, moving the paralyzed limbs, sitting and lying down, turning sideways, lying prone. After the preparatory work carried out in the gym, it is necessary to train these skills in the hospital bed in order to make changes of position during the night, for self-catheterization, to be able to dress and undress, to be able to get up. It may be necessary to use an electric bed with three joints that facilitates reaching the sitting position, or the use of side rails (cervical and upper thoracic injuries).

Transfers

- In principle, the transfers can be divided into three groups by order of difficulty:
  - with lower limbs raised with or without aids (trunk remains flexed)
  - with lower limbs resting on the ground with / or without aids (trunk remains flexed)
  - with lower limbs resting on the ground with difference in height (trunk in extension / flexion)
- For the most serious cases of complete dependence, the use of the lift or alternatively passive transfer mode (by standing or using a tablet, with one or two operators) is foreseeable.

Transfers

- To train for transfers it is essential that:
  - at least initially the surfaces are at the same height;
  - the transfer takes place beyond the big wheel;
  - that the injured person has the head, shoulders and trunk flexed well forward while moving with the butt (head above the knees);
  - upper limb on the side of the transfer moved away from the trunk to allow the trunk to be moved, while the other limb is close to the trunk
  - the wheelchair is in conditions of maximum stability.
- Most easily used aids: sliding board, lifter.

Transfers

Very schematically it can be said that, in the sitting position, each movement of the head in a certain direction corresponds to a displacement of the pelvis in the opposite direction.

- If we flex the trunk forward and lower the head, the pelvis moves upwards.
- If we extend the head backwards, the pelvis has a tendency to slide forward.
- If we bring the head forward, the pelvis flows backwards.
- If we turn our shoulders and head to the side, the pelvis rotates in the opposite direction

TRANSFERS

The most frequent methods:

LIMBS LOWER ON THE GROUND
LIFTED LOWER LIMBS
STANDING PASSAGE

AIDS:

Lifter
Tablet for sliding
Pull handles

- Search for supports
- Balance and capacity for imbalance
- Lifting and moving capacity
- Body weight and characteristics
- Distance of surfaces
- Friction of surfaces
- Difference in altitude

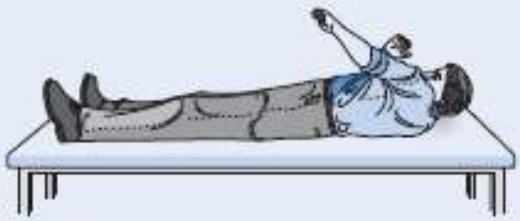
Rolling

- Rolling is used to dress and change position at night. It is also a prerequisite for getting from lying to sitting.
- Able-bodied people roll by placing the leading arm across the body and using trunk and leg muscles to initiate rotation of the body. Patients with thoracic paraplegia and C6 tetraplegia cannot use trunk and leg muscles, so instead rely solely on the head and upper limbs to roll. They roll by rapidly swinging the arms across the body. This generates angular momentum which is transferred to the paralysed lower segments of the body, facilitating rotation. The position of the legs and head influence the ease of rolling. Most patients have less difficulty rolling if the ankles are crossed and the head is lifted off the bed. Rolling is also easier if the trunk is slightly stiff with loss of passive rotation.

Rolling

- Patients with C6 tetraplegia have added difficulties rolling because paralysis of mthe triceps muscles limits their ability to maintain elbow extension. Without appropriate strategies, the elbows flex as the arms move across the body and patients may hit themselves in the face. This is avoided by externally rotating the shoulders, minimizing shoulder flexion, and performing the whole task with sufficient speed to ensure the elbows have little opportunity to flex. Contrary to what some may intuitively think it is not possible to roll with the elbows fully flexed. The shortened upper limbs cannot generate sufficient angular momentum to roll the body, and hand position limits arm swing.
- Patients unable to roll in bed can use bed rails or loops attached to the side of the bed to pull themselves from side to side. Alternatively, they must rely on assistance from others.

TABLE 3.1 A patient with C6 tetraplegia rolling onto the side (some practice strategies are described)

	Sub-task	Practice strategies
 Figure 3.4a	1. Pre-swing: The head and both arms are rotated away from the direction of the roll.	*Practice of this sub-task can be made easier if:* • a small weight is placed in the hands • elbow extension splints are used
Figure 3.4b	2. Swing: The head and both arms are thrown across the body.	• a pillow is placed behind the trunk • the ankles are crossed • the leading hip is supported in 45° flexion • elbow extension splints are used

Lying to long sitting

- The ability to move from lying to long sitting is an essential part of dressing and transferring. However, the widespread use of electric beds which move patients into sitting has lessened the importance of attaining independence with this task.
- Two strategies are used to move from lying to sitting. One involves rolling on to the side and then sitting up from a side-lying position . s

Lying to long sitting

- This approach is cumbersome but relatively easy. Paralysis of the triceps muscles adds complexity because it limits the ability to push down through the hands to lift the body. Patients with C6 tetraplegia overcome this problem by aintaining the sidelying position and ‘walking’ one or both elbows around the body towards the knees. From this position, the top arm is hooked under the top leg to pull up into sitting

TABLE 3.3 **A patient with C6 tetraplegia moving from lying to sitting (some practice strategies are described)**

	Sub-task	Practice strategies
Figure 3.6a	1. Rolling onto the side: see Table 3.1.	*Practice of this sub-task can be made easier if:* • see Table 3.1
Figure 3.6b	2. Lifting the upper trunk off the bed: The left arm is horizontally abducted and weight is borne through the left elbow.	• a pillow is placed under the chest • the sub-task is practised in reverse
Figure 3.6c	3. Supporting the upper trunk: The right hand is placed on the bed to help prevent a forward collapse of the trunk. Alternatively, both elbows are placed on the bed. *(The top arm can bear some weight even though the elbow is flexed and the triceps muscles are paralysed.)*	• a pillow is placed under the chest
Figure 3.6d	4. Positioning the top hand under the leg: The right wrist is extended and hooked behind the right knee.	• a pillow or block is placed under the left elbow (see p. 140, Figure 7.1b)

(continued)

TABLE 3.3 (continued)

	Sub-task	Practice strategies
Figure 3.6e	5. Shuffling the bottom elbow around the body: The right arm is adducted with the wrist anchored behind the knee. This momentarily removes weight from the left elbow. At this instant the left elbow is shuffled a small distance towards the feet. This procedure is repeated several times to 'walk' the left elbow up towards the knees. (see p. 139, Figure 7.1 for a variation of this sub-task)	Practice of this sub-task can be made easier if: • a pillow or block is placed under the left elbow (see p. 140, Figure 7.1b) • the sub-task is practised in reverse
Figure 3.6f	6. Moving into the upright position: The right arm is adducted with the wrist anchored behind the knee. The left arm is abducted. The action at both arms pulls/pushes the trunk into the midline.	• a pillow or block is placed under the left elbow (see p. 140, Figure 7.1b) • the sub-task is practised in reverse

Lying to long sitting

- Another strategy for moving from lying to sitting involves using the upper arms to push directly into sitting from the supine position. Patients with paraplegia place the hands behind the body. They then push down through the hands and use elbow extension to lift the trunk. Paralysis of the abdominal muscles makes it difficult to initially position the hands behind the body. Patients with C6 tetraplegia can also move directly from the supine position into sitting; however, a different technique is used which requires awkward positioning of the shoulders.
- Consequently, few patients master the technique and it often causes shoulder pain
- It is therefore probably best avoided.

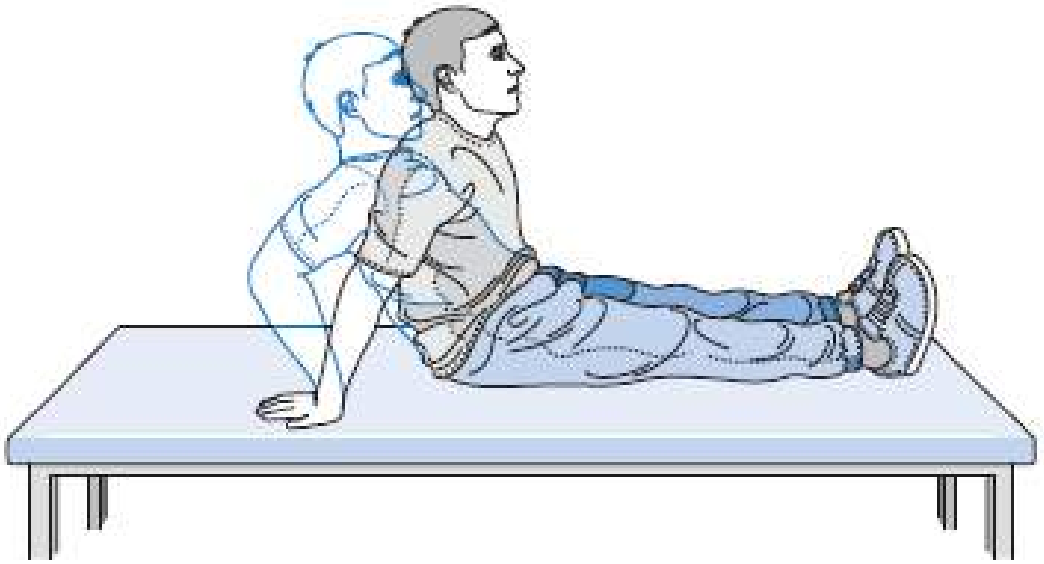
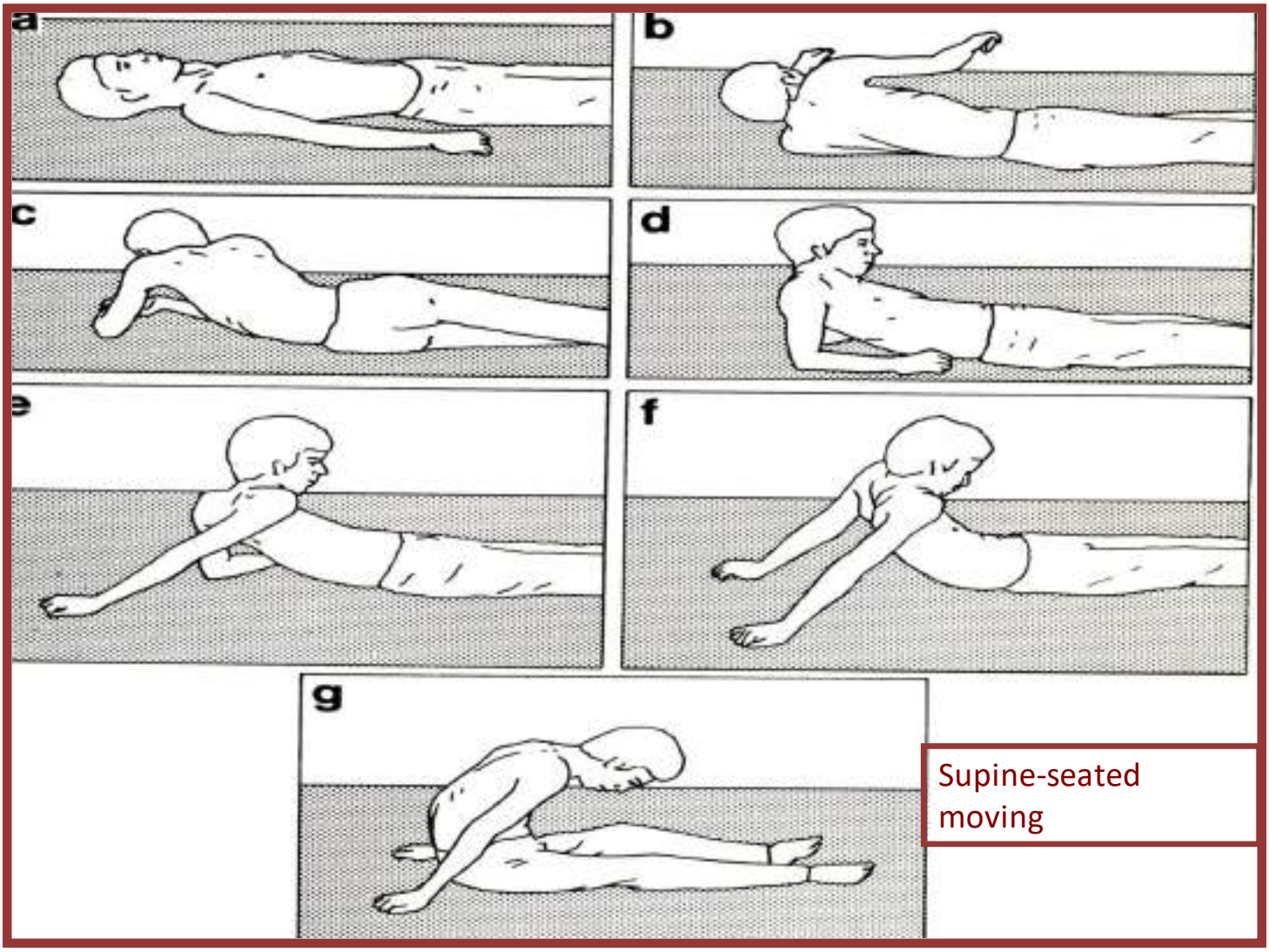


Figure 3.7 A patient with thoracic paraplegia moving directly into sitting from the supine position.



Supine-seated moving

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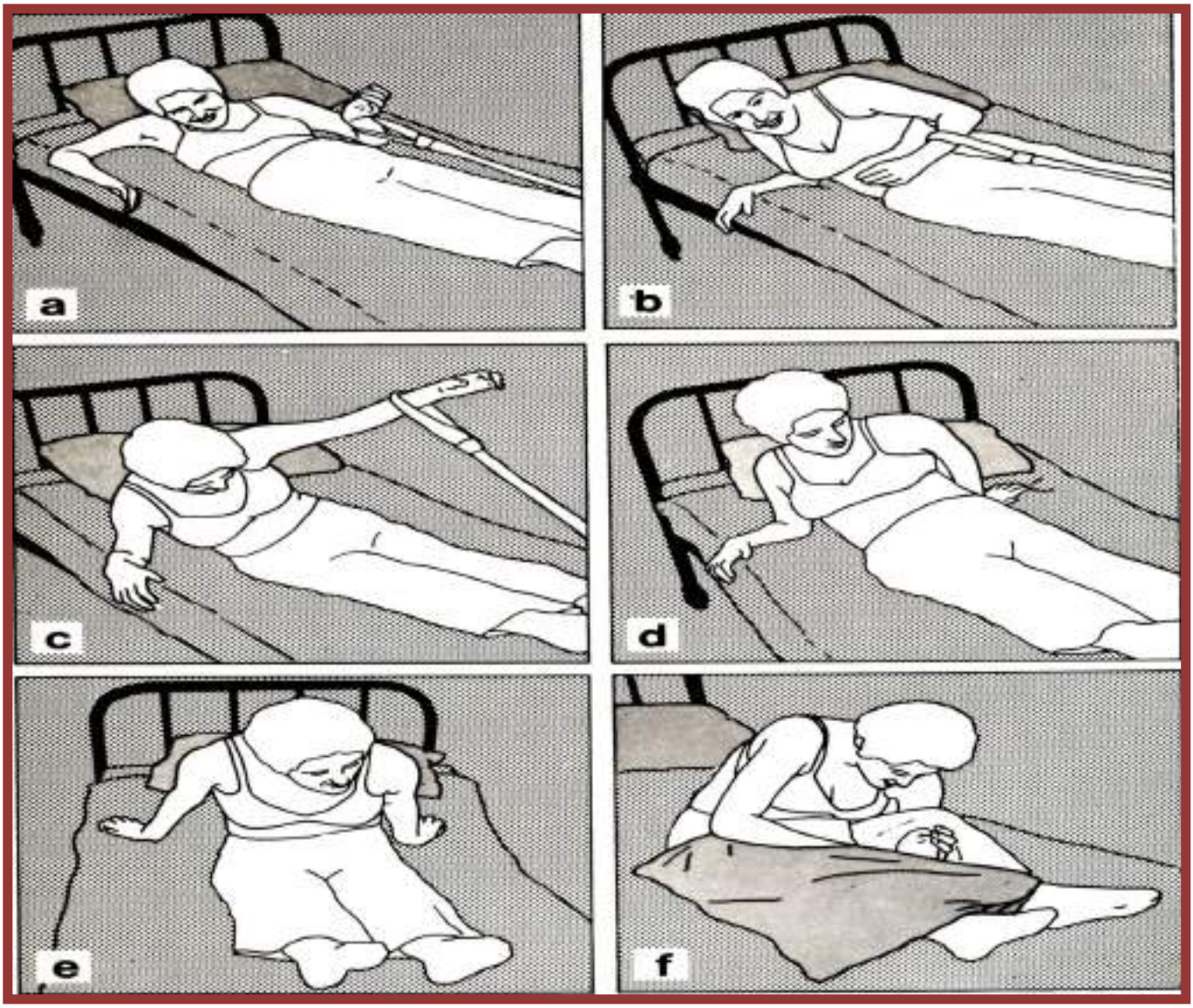

Supine-seated moving

Vertical lift

- The ability to vertically lift is an important task for patients to master early. Vertical lifts are used to relieve pressure, transfer, dress, and move about the bed. Patients need to be able to lift while sitting in bed with the knees extended and while sitting in their wheelchairs with their knees flexed
- Lifting with the knees extended is often easier because patients can use the paralysed hamstring muscles to help maintain an upright position.

Vertical lift

- To vertically lift, the hands are placed next to the hips, usually on the seating surface but occasionally on adjacent surfaces. The patient then pushes down through the hands to lift the trunk on the stabilized arms. There are three components to the lift: elbow extension, shoulder depression and shoulder flexion. Once the elbows are extended, further lift is achieved by depressing the scapulas on the trunk and by inclining the trunk forwards on the fixed shoulders
- The vertical lift is controlled by the latissimus dorsi, anterior deltoid, pectoralis major and lower trapezius muscles. The glenohumeral joint is stabilized in adduction throughout the lift by the shoulder adductors and rotator cuff muscles.

Vertical lift

TABLE 3.4 **A patient with paraplegia lifting in a wheelchair (some practice strategies are described)**

	Sub-task	Practice strategies
Figure 3.8a	1. Positioning the hands: The hands are placed on the apex of the back wheels.	*Practice of this sub-task can be made easier if:*
Figure 3.8b	2. Lifting the body: The elbows are extended and the shoulders adducted and depressed.	• the vertical position of the back wheels is adjusted to optimize elbow position • the thickness of the cushion is adjusted to optimize elbow position

Transfers

- The term ‘transfer’ refers to movement between surfaces while maintaining a seated upright position. It includes moving to and from wheelchair, car, toilet, bath, commode and bed. Generally transfers onto lower surfaces are easier than transfers onto higher surfaces.
- Transfers to and from a bed can be performed with the legs up or down or with one leg up and one leg down. There are advantages and disadvantages of each approach. The main advantage of transferring with the legs up is that the extended knees increase passive tension in the paralysed hamstring muscles, helping to maintain the trunk in an upright position.

Transfert

- Transferring with the legs up when moving in and out of bed also avoids the need to lift or lower the legs when precariously perched on the edge of the bed. Instead, the legs are lifted or lowered when patients are sitting supported in the wheelchair. The disadvantage of transferring with the legs up is that it makes moving forwards and backwards difficult. For example, when transferring out of a wheelchair into bed, it is difficult to move forwards during the transfer because the feet dig into the mattress. Similarly, when transferring into the wheelchair it is difficult to move the buttocks back into the wheelchair because the feet drag on the mattress.

TABLE 3.7 A patient with paraplegia transferring from wheelchair to bed with the legs down and using the rotatory strategy (some practice strategies are described)

	Sub-task	Practice strategies
Figure 3.12a	1. Moving to the front edge of the wheelchair: The elbows are extended and the shoulders adducted and depressed to vertically lift the body (see Table 3.4). The shoulders are then extended to push the trunk and legs forwards on the seat.	*Practice of this sub-task can be made easier if:* • a firm cushion is used (this prevents the buttocks from sinking into the cushion) • the back of the wheelchair is raised so gravity assists the forward movement • the cushion cover and the patient's lower limb clothing are slippery • the feet are placed on the ground (this increases the tendancy to slide forwards) • the vertical position of the back wheels is adjusted to optimize elbow position • the thickness of the cushion is adjusted to optimize elbow position
Figure 3.12b	2. Positioning the feet on the floor: The left arm lifts the right leg onto the ground. The right arm is used to hold the trunk upright. The mirror of this procedure is used to position the left leg on the floor.	

(continued)

TABLE 3.7 (continued)

	Sub-task	Practice strategies
Figure 3.12c	3. Positioning the hands: The right hand is placed on the bed and the left hand on the front corner of the wheelchair.	*Practice of this sub-task can be made easier if:* • the wheelchair is positioned as close as possible to the bed • the bed is slightly lower than the wheelchair • additional beds are placed in front and to the side of the patient (this decreases the fear of falling)
Figure 3.12d	4. Lifting and shifting the body onto the bed: The elbows are extended and the shoulders adducted and depressed to vertically lift the body (see Table 3.4). The right shoulder is adducted and the left shoulder is abducted to laterally shift the body.	• the wheelchair is positioned as close as possible to the bed • the bed is slightly lower than the wheelchair • the cushion is firm (this prevents the hands sinking into the cushion when lifting) • a slideboard is used
Figure 3.12e	5. Lifting the legs onto the bed: Weight is borne through the right elbow while the left arm is used to lift each leg onto the bed.	• the feet are placed on a raised stool to decrease the height the legs need to be lifted • a strap is used to help lift the legs

TABLE 3.8 A patient with C6 tetraplegia moving laterally from wheelchair to bed with the legs up using the translatory strategy (some practice strategies are described)

	Sub-task	Practice strategies
Figure 3.13a	1. Moving to the front edge of the wheelchair: The head and trunk are extended over the back of the wheelchair. The hands are pushed in behind the back. The hips are levered forwards by external rotation of the shoulders and extension of the wrists. The sides and top of the backrest are used as a fulcrum.	*Practice of this sub-task can be made easier if:* • a firm cushion is used (this prevents the buttocks from sinking into the cushion) • the back of the wheelchair is raised so gravity assists the forward movement • the cushion cover and the patient's lower limb clothing are slippery • the feet are placed on the ground (this increases the tendency to slide forwards) • the backrest of the wheelchair is lowered
Figure 3.13b	2. Lifting the first leg onto the bed: The left arm is hooked around the back of the wheelchair to prevent a forward fall. The right arm is used to lift the leg onto the bed. The leg is held with a wrist extension hook.	• the feet are placed on a raised stool to decrease the height the legs need to be lifted • a strap is used to help lift the legs

(continued)

TABLE 3.8 (continued)

	Sub-task	Practice strategies
Figure 3.13c	3. Lifting the second leg onto the bed: As above.	*Practice of this sub-task can be made easier if:* As above
Figure 3.13d	4. Positioning the hands: The left hand is placed on the bed and the right hand on the apex of the far wheel. Passive stretch of the hamstring muscles prevents a forward fall.	• the wheelchair is positioned as close as possible to the bed • the bed is slightly lower than the wheelchair • additional beds are placed to the front and to the side of the patient (this decreases the fear of falling)
Figure 3.13e	5. Lifting and shifting the body onto the bed: The shoulders are externally rotated and depressed and the elbows are 'passively' extended to vertically lift the body (see p. 68 and Figure 3.11). The left shoulder is adducted and the right shoulder is abducted to shift the body laterally.	• the wheelchair is positioned as close as possible to the bed • the bed is slightly lower than the wheelchair • additional beds are placed to the front and to the side of the patient (this decreases the fear of falling) • the cushion is firm (this prevents the hands sinking into the cushion when lifting) • a slideboard is used • a slide sheet or slideboard is placed under the feet • the shoes are removed and a slide sheet or slideboard is placed under the feet

Wheelchair-bed transfer

- Place your feet forward with your heels turned slightly towards the bed.
- Move your butt forward to the edge of the cushion.
- Flex the trunk forward.
- Turn your head in the opposite direction of the transfer so that your butt slides more easily towards the bed.
- Lift up and rotate towards the bed.
- Turn the pelvis parallel to the bed.
- Get one leg after the other on the bed.

Slideboards

- Slideboards can be used to bridge the gap between transfer surfaces . They are used by patients with limited ability to lift upwards and sideways and can be used either for training purposes or for long-term use. It is best if the slideboard is positioned on an angle between the two transfer surfaces. This encourages patients to rotate around as they move sidewards. It also discourages patients from sliding off the back edge of the slideboard and scraping their buttocks on the wheel. Patients often struggle with positioning slideboards under the buttocks because this requires shifting weight while at the same time manipulating the slideboard.
- The task of positioning the slideboard is best done when sitting supported in the back of the wheelchair. However, patients then need to ensure that the slideboard does not move forwards out of position as they move forwards in the wheelchair.
- This can be avoided by placing one hand on the slideboard when moving forwards.

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

PASSAGE WITH FOOT ON THE GROUND AND TABLET

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PASSAGE WITH FOOT ON THE GROUND AND TABLET

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Wheelchair-bed transfer

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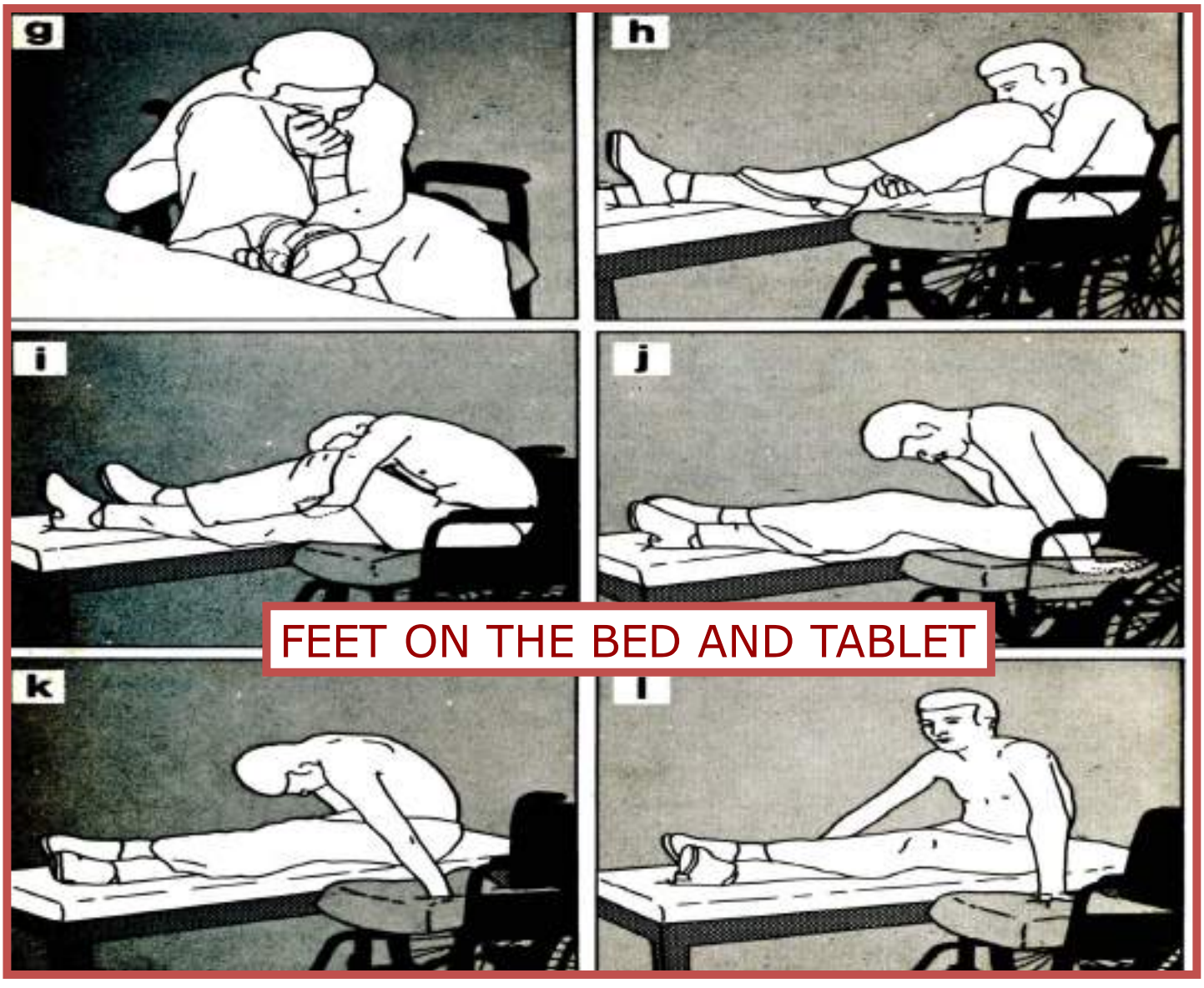

FEET ON THE BED AND TABLET

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Wheelchair-toilet transfer

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Wheelchair-toilet transfer

Wheelchair-tub transfer

Wheelchair-tub transfer

Wheelchair-to-car transfer

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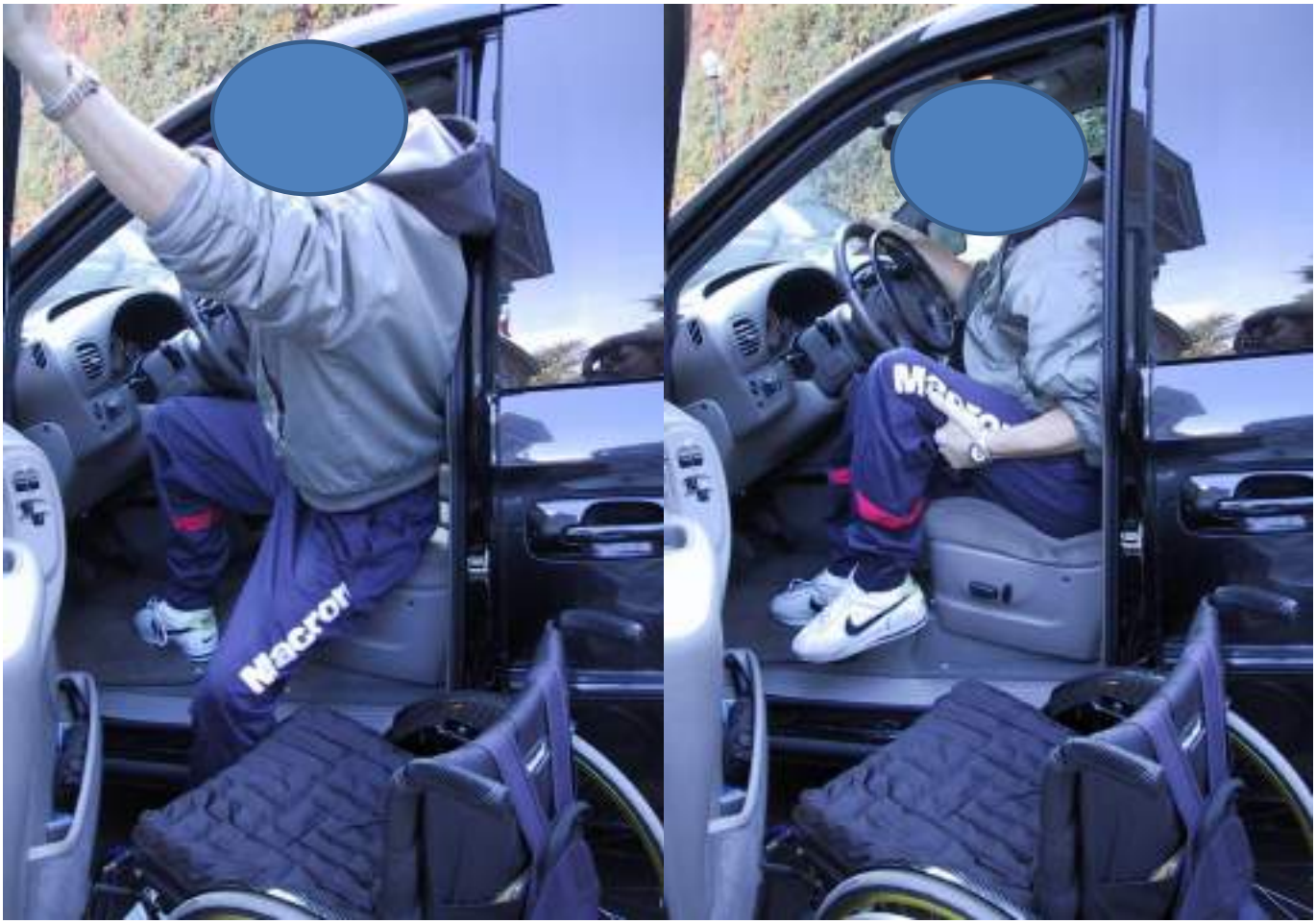

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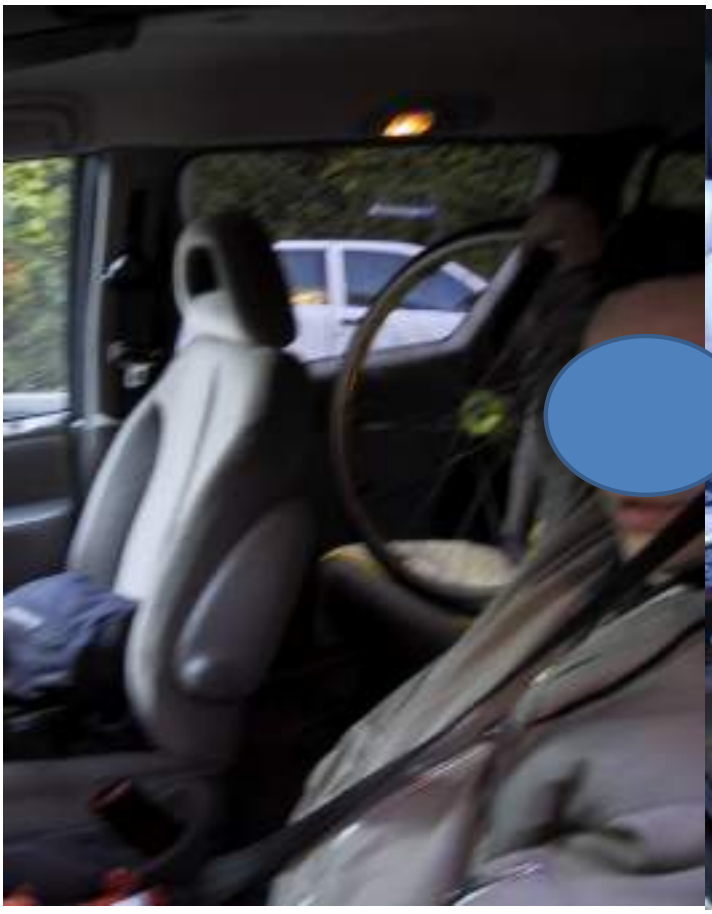
PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Wheelchair-car transfer with aids

Wheelchair-car transfer with aids

Loading the wheelchair in the car

Loading the wheelchair in the car



Loading the wheelchair in the car

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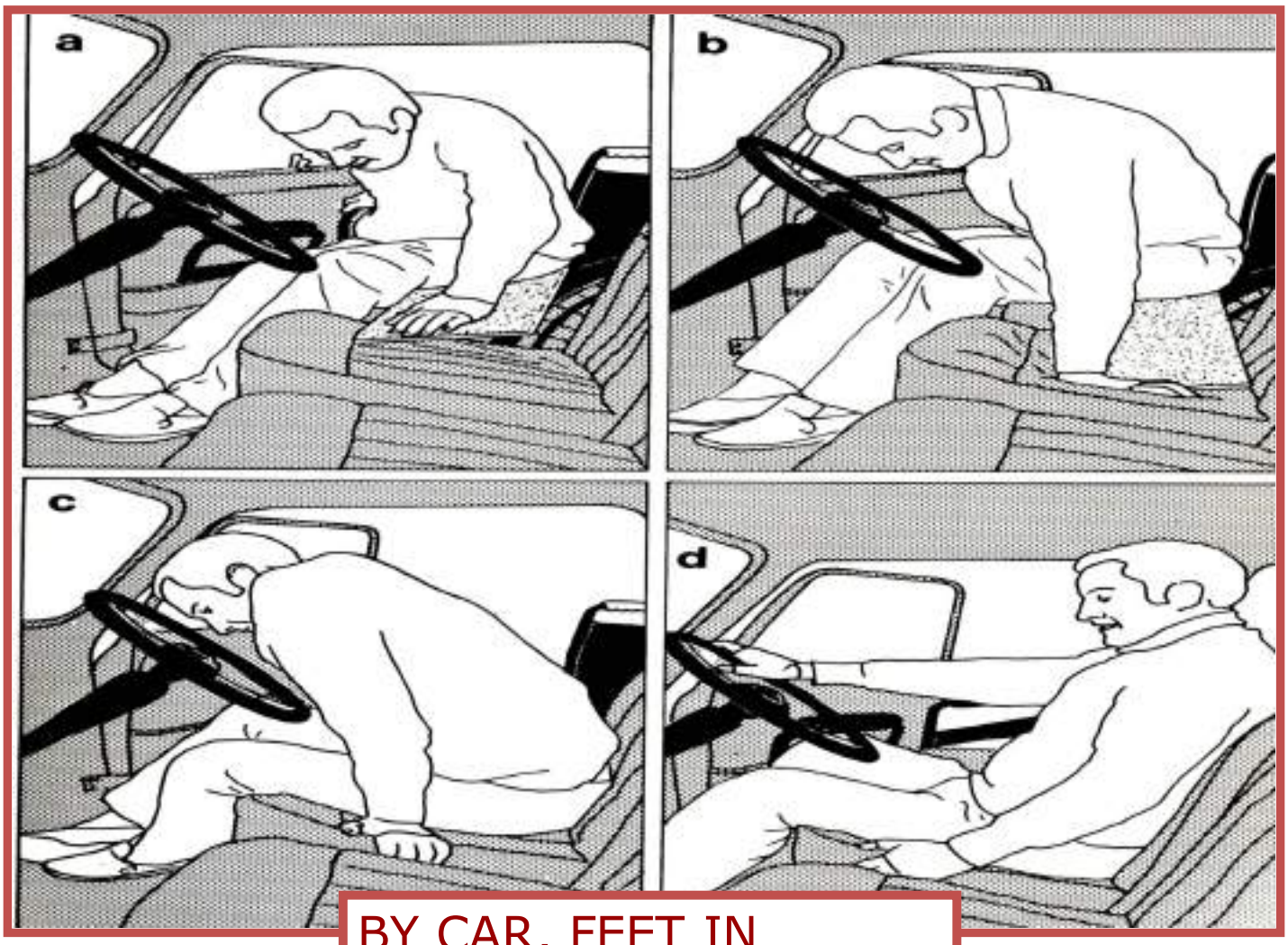
PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST



BY CAR, FEET IN

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Balancing on the rear wheels and falls

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Wheelchair-to-ground transfer

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PRACTICAL TEACHINGS FOR THE
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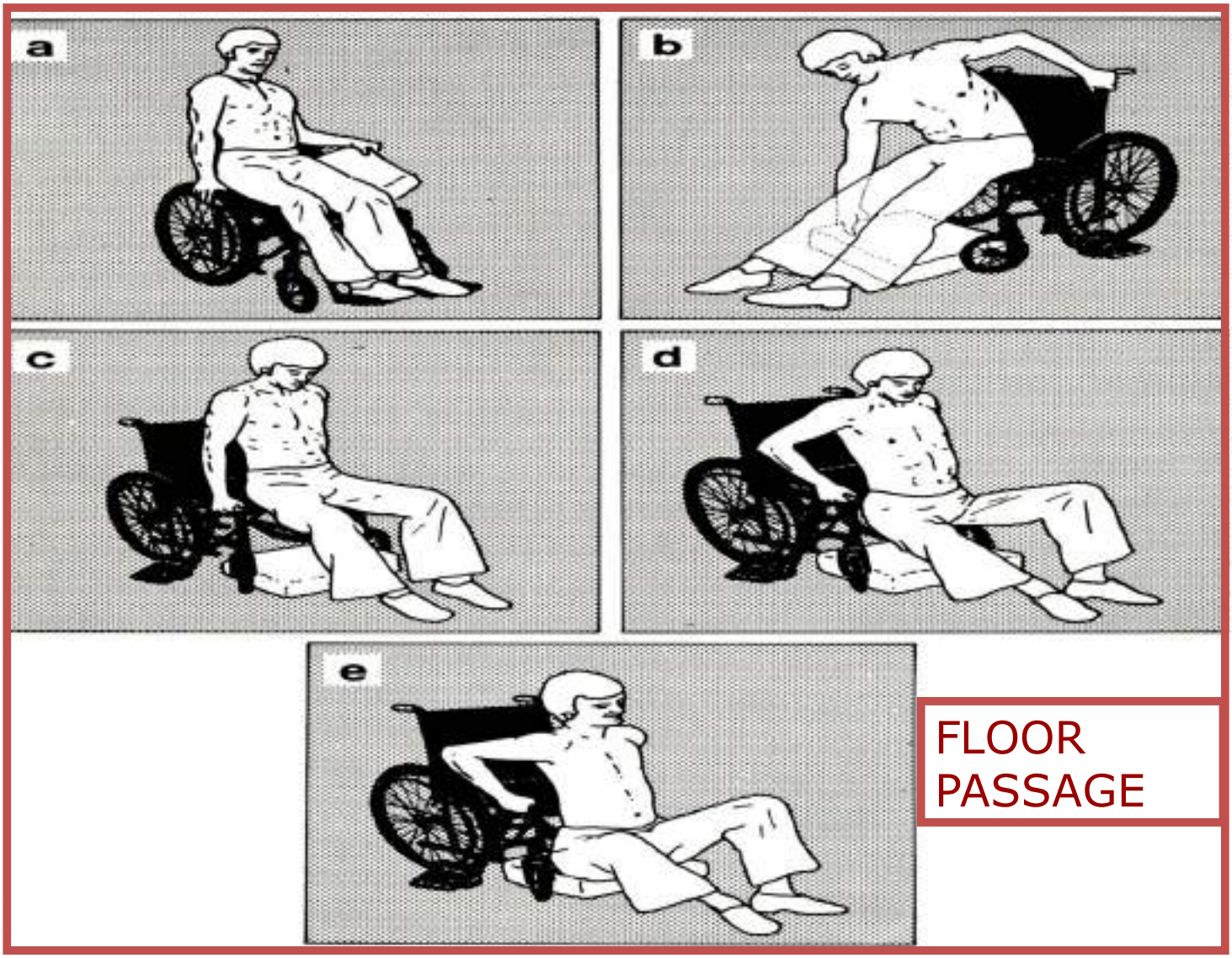


FLOOR PASSAGE

Feeding

- Drinking and eating are important social activities and when possible it is psychologically important to make the individual independent in this area.
- Feeding can be facilitated by adapting the grip of the cutlery (enlarged handles), using straps in which to insert the cutlery or in higher lesions by means of a wrist strap that stabilizes the wrist and supports the cutlery (fork and spoon).
- Especially in the initial phase, the use of non-slip material on which to place the plate, or plates with a raised edge can be useful.
- To drink, it may be necessary to use straws, goblets or light cups.

Hygiene

- The person with a high injury must be able to wash the face and upper part of the body using sponge gloves, the sink must allow the elbows to rest and to approach well with the wheelchair. Useful liquid soap with dispenser.
- For dental hygiene, shaving, make-up, adaptations and splints can be envisaged, as well as for feeding, straps, wristbands, etc.

Clothing training

- General indications: abundant, comfortable clothing, of non-rigid fabric, and for quadriplegics closures with velcro, zippers, rings to insert the thumb.
- The person with a high cervical injury can dress the upper body while sitting in a wheelchair or resting in bed. To wear a garment, first put both upper limbs on, pass the back of the garment behind the head, to bring it down you can shake your shoulders or put your thumbs or wrists in extension under the side and front of the garment.

Clothing training

- The person with low cervical injury may be able to dress even the lower part while in bed, while remaining very difficult in a wheelchair. To wear the pants, cross one leg over the opposite knee and put on one leg of the pants; repeat the same operation on the other side; bring the pants over the thighs; hook one hand to the back of the wheelchair, turn well to the side and pull up the pants; turn over on the other side and repeat the operation several times.
- A paraplegic patient can dress and undress even in a wheelchair, which is very important in terms of toilet use.

Bladder, bowel and sexual function

- Spinal cord injury commonly affects bladder, bowel and sexual function. One of the most comprehensive studies in this area found that 81% of people with spinal cord injury had impaired bladder function and 63% had impaired bowel function 1 year post injury.
- While the control of these three bodily functions is complex, they all rely on coordinated activity between the sympathetic and parasympathetic nervous system as well as skeletal muscle control via the S2–S4 nerve roots. Injuries below the conus result in a flaccid paralysis of skeletal muscles associated with bladder, bowel and sexual function, and loss of the sacral part of parasympathetic spinal cord-mediated reflexes.
- In contrast, injuries above the conus result in a spastic paralysis of the bladder, bowel and sexual skeletal muscles with retention of sacral reflexes. The site of the lesion therefore has important implications for management and function.

Bladder management

- Bladder drainage can be managed in several different ways. Most patients with some hand function perform intermittent catheterization. This requires the patient (or the patient's carer) to temporarily introduce a catheter into the bladder every 3–6 hours.
- The catheter is removed once the bladder is drained. Intermittent catheterization is preferred over other options because it is associated with lower rates of infection and is aesthetically more acceptable (i.e. it does not require use of external leg bags
- to collect urine).91 In males, external drainage sheaths can be used to ensure continence.
- These are like condoms that cover the penis and are attached to leg bags.

Bladder management

- There is no equivalent device for females so sanitary pads are often used.
- Patients who are unable to intermittently catheterize typically have an indwelling catheter.
- The catheter is initially inserted via the urethra but ultimately is often inserted surgically through the suprapubic abdominal wall.

Bladder management

- Some patients rely on reflex emptying of the bladder: voiding is elicited by either tapping over the bladder or manually stimulating the perineal region. This technique can be assisted by manual overpressure on the bladder provided there is no risk of urine tracking up to the kidneys.
- Patients with spinal cord injury have an increased susceptibility to bladder stones, kidney stones and urinary tract infections, all contributing to an increased risk of late-life kidney failure.
- All these potential problems are managed and monitored by controlling fluid intake, optimizing medication and by regularly
- reviewing kidney and bladder function. Urinary incontinence can be an ongoing problem for some patients.

Urological problems:

- Fundamental is education in proper bladder hygiene and correct catheterization or self-catheterization maneuvers.
- The catheter is a device that allows vesicle emptying: it can be left in place (indwelling catheterization) or only for the time necessary for emptying (intermittent catheterization).
- The use of fixed catheterization is limited to special cases because it exposes the person to numerous complications, while intermittent catheterization if properly performed is a modality that allows good management of the bladder and decreases the risk of complications of the urinary system.

Bowel management

- Bowel management is an important and often time-consuming issue for people with spinal cord injury. Patients with lower motor neuron lesions tend to have more problems with incontinence because they have flaccid paralysis of the anal sphincter and loss of associated spinal cord-mediated reflexes.
- In contrast, patients with upper motor neuron lesions can take advantage of remaining bowel reflexes. Bowels can be managed in a variety of ways, but key strategies include a highfibre diet, adequate fluid intake and a regular routine for bowel emptying. Other options include oral and/or anal medication, digital stimulation or manual evacuation.
- Often bowel regimes are initially difficult to establish and faecal incontinence or constipation can be a problem. It is not unusual for bowel accidents to be precipitated by exercise.

Sexuality

- When people think of spinal cord injuries and sexuality, they most commonly think of the physical aspects of sex. Spinal cord injury clearly affects sexual intercourse and the associated physical sexual responses in both males and females.
- Patients with upper motor neuron lesions retain reflexive but not psychogenic responses, patients with lower motor neuron lesions lose reflexive but may retain psychogenic responses, and all retain the ability for non-genital sexual arousal
- Spinal cord injury can affect male fertility by impairing ejaculation and reducing semen quality. However semen, if required, can often be obtained with vibration and electro-ejaculation techniques. More sophisticated techniques are being increasingly used for fertilization. Female fertility and menstruation are largely unchanged by spinal cord injury but pregnancies are associated with increased risks.

Sexuality

- Females generally cease menstruating for 1–3 months following injury. Studies of men with spinal cord injury have found that genital sensation, erectile function and capacity for orgasm are not strong predictors of sexual satisfaction nor behaviour.
- The stronger predictors are perceptions of partners' satisfaction with the sexual relationship, intimacy of relationships and willingness for sexual experimentation.
- Spinal cord injuries have implications not only for patients' experiences of sexual intercourse but also for males' and females' sexuality. That is, spinal cord injury affects how people perceive their own maleness or femaleness. For example, a spinal cord injury may affect a male's ability to earn money for the family, play sport with the kids, drink beer with the mates or pump iron at the gym. Some men perceive that the inability to readily engage in these types of activities undermines their maleness.

Sexuality

- In the same way, a female may perceive that her femininity has been adversely affected by her difficulty wearing fashion shoes, making up her face, looking after her children or going to nightclubs. The issues are complex and management often involves reappraisal of preconceived ideas about the expression of both sex and sexuality.
- Most rehabilitation teams have psychologists, social workers, nurses or medical personnel specifically trained to counsel patients on sex and sexuality. Ongoing sexual support and education post-discharge are particularly important. Physiotherapists need a general understanding of these issues so they can be appropriately supportive and knowledgeable when these issues are raised during therapy sessions.
- However, it is not normally the physiotherapist's role to provide counselling or detailed information on these issues.

Osteoporosis

- Osteoporosis is a common long-term complication of spinal cord injury which predisposes individuals to fractures.
- Over a lifetime patients may experience a 25–50% reduction in bone mineral content of the lower limbs with most bone mineral loss occurring in the first year following injury. It has been assumed that bone mineral loss is primarily due to the lack of weight bearing and axial loading.
- However, it is now believed that bone mineral loss is due to multiple factors involving metabolic, endocrine, neural and vascular changes associated with spinal cord injury.
- Bone loss is primarily managed with pharmacological agents (i.e. bisphosphonates).
- Early standing and electrical stimulation programmes are also advocated, although their effectiveness is yet to be clearly demonstrated.

Gait

- In complete lesions above L2, a therapeutic path is foreseeable, that is, possible in "protected" contexts, but not replaceable for the use of the wheelchair; this type of walk is therefore comparable to a therapeutic activity that contrasts bone demineralization caused by immobility and the absence of load on the lower limbs, helps to maintain good functionality of the cardio-vascular and respiratory system, counteracts the onset of joint limitations and muscle shortening.

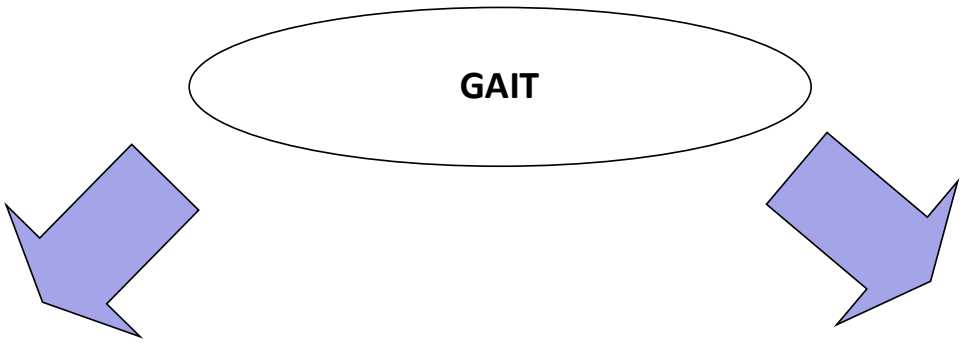
Gait

- In AIS D incomplete lesions or in those below L2, a functional path is generally achievable that is characterized by its finalistic use in a daily situation (although often restricted to certain places or conditioned by environmental elements), in response to stimuli, interests , needs of the individual
- Obviously, among the prerequisites indicated below, a favorable anthropometry must be understood (limb / trunk length ratio, body weight / muscle strength, age, motivation, collaboration, absence of clinical complications - heart disease).

THE GAIT IN PARAPLEGIC SUBJECTS WITH COMPLETE SPINAL LESION

Indications:

- absence of clinical contraindications (eg: sub-dislocations of the hips, hyperextension and / or instability of the knees, lumbar hyperlordosis, joint pains that appear during activity);
- strong motivation of the patient, as the activity involves a large expenditure of energy.



Functional

Analytical evaluation of the phases of the walk in order to create the most correct program with the use of the most suitable orthosis (process in evolution and clinical picture evolution).

Therapeutic

at the beginning of the re-education program it can then be transformed into a functional path always only therapeutic in the case of the paraplegic with complete injury (tutored walk).

Tutors for the paraplegic patient's walk(high braces, stabilizers like Vannini, R.G.O., A.R.G.O.)

Prerequisites for (functional) walking in incomplete lesions

- Valid motor skills in the upper limbs and shoulder girdle
- Ability to assume and keep the static upright
- Valid antigravity motor skills of the trunk
- Absence or little interference with the gait pattern by pathological changes in muscle tone
- Sufficient range of joint excursion of the hip - from about 30 ° of flexion to 10 ° of extension (knee and ankle can be compensated by orthoses)Valid antigravity motor skills of the proximal districts of the lower limbs
- Absence of significant agonist / antagonist muscle imbalances
- Preservation of kinesthetic and exteroceptive sensitivity
- Coordination

Prerequisites for (functional) walking in complete lesions

- Valid motor skills in the upper limbs and shoulder girdle
- Ability to assume and maintain an upright position
- Valid antigravity motor skills of the trunk (depending on the level of injury)
- Absence or little interference with the gait pattern by pathological changes in muscle tone
- Sufficient range of joint excursion of the hip - from about 30 ° of flexion to 10 ° of extension (knee and ankle can be compensated by orthoses).

Gait rehabilitation

- The training for both types of injury can be superimposed without prejudice to the use of FES systems which instead provide for a long treatment training with electrostimulation, calibration and training in the use of the chosen system.
- We can distinguish a preparatory phase and a training phase proper.

Gait rehabilitation

In the preparatory phase, the treatment is aimed at the following objectives:

- it can be useful to do an intensive strengthening training for the upper limbs, especially for the shoulders, which must carry a large part of the body's weight, in some cases and especially in complete injuries
- Strengthen the muscles that have normal innervation and / or those that have lesions of the second motor neuron;
- Acquire new motor skills by improving motor control and balance in various postures by following the progression that leads to standing (sitting posture, prone resting on elbows, quadruped, kneeling, modified plantigrade, standing position);
- Inhibit spasticity and any associated pathological reactions;

Gait rehabilitation

- When the patient has achieved the ability to assume and maintain the station with and without support and is able to exercise load shifts with a correct balance between agonist-antagonist muscles, walking training begins.
- At the beginning it is foreseeable the use of aids that reduce the weight of the body on the lower limbs, using the upper limbs as supports, and / or orthoses that improve the qualitative pattern of the walk.

Gait rehabilitation

- The training is aimed at making the walk as functional as possible compatibly with the motor potential of the patient, progressively increasing the difficulty steps, whenever the patient acquires safety and skills (walking on uneven ground, stairs, overcoming the sidewalk, falling and getting up from the ground) and reducing the use of aids, freeing the upper limbs from the support function when possible in order to carry out functional activities of various types (opening a door, taking objects from cabinets, picking up objects from the ground etc.)

Incomplete Injury Treatment

The treatment of these subjects reflects the principles of neuromotor treatment:

- promotion and improvement of spontaneous neurological recovery through activities aimed at improving motor control, reducing muscle imbalance between innervated agonists and weak or even absent antagonists, reducing hypertonicity and the appearance of pathological patterns
- electrostimulation and bio-feedback in the presence of lesions mainly of the second motor neuron and / or in selected cases
- re-education of orthostatic skills and where possible walking with or without aids and orthoses;

Incomplete Injury Treatment

- The treatment will also pursue, with times and methods identified, case by case, in relation to the type of lesion, the neurological level, AIS, as well as the evolution of neurological recovery, objectives for functional autonomy as provided for the lesions. full type.

Prognostic factors for the recovery of gait

The results of some studies show that subjects with incomplete cervical injury (Ais C or D) have a good chance of a good functional recovery. Regarding independent walking, it was possible to observe that:

- patients with centro-medullary syndrome of traumatic origin returned to walk independently with a variable percentage between 57 and 86%;

Prognostic factors for the recovery of gait

- patients with centro-medullary syndrome secondary to cervical spondylosis return to walk independently in about 31% of cases;
- the gaitprognosis in patients with Brown-Sèquard syndrome appears to be very favorable

Prognostic factors for the recovery of gait

- The aforementioned data, however, are not related either to the age of the subjects under examination or to their neurological damage; contrary to what happens in a study carried out by Burns et coll. conducted on 105 patients with cervical injury (ASIA C or D) of traumatic origin.

Prognostic factors for the recovery of gait

The conclusions of this study are that:

- All patients classified as Ais D, immediately or within 72 hours of injury, were able to walk on discharge.
- Tetraplegic patients with 50 years of age and older, classified as Ais C, immediately after the traumatic event or within the immediate 72 hours, have a less likely recovery of walking due to various factors (higher incidence and severity of secondary complications, pre-existing pathologies such as peripheral neuropathies, heart and / or lung disorders, reduced neuronal plasticity)

Gait orthosis

- short or "soft" orthoses indicated to stabilize the ankle at 0 ° of flexion such as the Codivilla spring and the Ottobock spring;
- knee orthosis: their function is mainly to block hyperextension of the knee;
- Plaster: built in thermoplastic material or moldable PVC;
- long braces: the load from the trunk passes to the ischial tuberosities and instead of weighing on the knee, it is discharged to the ground through the skeleton of the brace;
- articulated braces: equipped with a knee extension release mechanism thus allowing flexion.

Shoe fixes:

- fixed orthoses as they are fixed to the sole, heel and upper (lifts, medial spur, lateral, etc);
- mobile orthoses: insoles.

Walking aids

The effects common to all aids belonging to this category are the following:

- increase the support base;
- stabilize the pelvis on the frontal plane;
- reduce the force required to support the load.

Walking aids

This group of aids includes:

- walkers: there are different types: with directional, articulated, axillary front wheels.
- crutches: there are two types, the axillary ones, which offer greater support to the trunk and the Canadian ones which have anti-brachial support.
- sticks: generally they bear up to 25% of body weight; they are used in particular in the Brown-Sèquard.

Aid Plan

Once a need has been identified that is inherent in the impossibility of carrying out an activity in relation to the subject's present and potential abilities, the person's living environment, any possibility of external help, it is necessary to proceed:

1. identifying the aids that best meet the patient's needs according to criteria of personal acceptability, comfort, effectiveness in performing a service (achievement of the purpose for which it is used), efficiency in optimizing the patient's physical resources, cost containment and accessibility economic by the patient, safety in use for the patient and any assistant, technical compatibility with the possible presence of other aids (home automation), adequate technical assistance, good maneuverability and possible portability;
2. customization that allows the adaptation of the selected aid in relation to the patient's anthropometric parameters and his specific needs;
3. training in the use and proper maintenance of the aid.

Health Education

- The rehabilitation intervention in the person with SCI aims not only at a functional goal but also at activating, as early as possible, the ability to decide and exercise conscious control (empowerment) on the new health condition. The "active involvement" of the affected person begins gradually in the stabilization phase, taking into account the individual psycho-physical adaptation path to the pathology and becomes a priority objective in the pre-discharge phase, when the patient prepares for the "detachment“ From the USU

Health Education

- In fact, in anticipation of socio-family reintegration, the person with SCI and his family entourage must begin to independently put into practice the knowledge and management skills acquired in the rehabilitation process at the U.S.U. and therefore it is also essential to prevent tertiary complications.

Health Education

- Therefore, the educational intervention is a fundamental "piece" of the rehabilitation process of the person with spinal cord injury to acquire knowledge about:
  - the disease / disability
  - the management of the new condition in a competent manner
  - the prevention of avoidable complications
- The most important specific areas of health education intervention in the U.S.U are described below. addressed to the patient and / or his family, taking into account the complexity of the pathology and its disabling repercussions on both the sensory-motor and visceral system

PRINCIPLES OF HEALTH EDUCATION

- Take care of yourself
- Avoid trauma to the joints
- Avoid skin injuries (heat, pressure, friction, etc.)
- Skin self-inspection
- Posture control
- Variations in position and ischial discharge
- Upright statics
- Self-mobilization
- Implementation of the ADL
- Beware of respiratory tract infections
- Attention hypotension and thermoregulation

Psychological well-being

- The psychological implications of spinal cord injury are profound.
- Some of the common emotions experienced immediately after injury include anger, grief, despondency, denial, depression and apathy.
- Factors found to be associated with patients' psychological reactions include coping skills, pre-morbid personality, family support, substance abuse, extent of permanent paralysis and home situation.
- Some studies put the rate of depression in the first 2 years following spinal cord injury as high as 38%,83 although most place it between 15% and 23%.184–186 The incidence of ongoing depression appears to be strongly linked to restrictions in participation.

Psychological well-being

- Suicide rates are higher amongst people with spinal cord injury than in the general population. However, these statistics mask the proportion of people with spinal cord injury who go on to live happy and fulfilling lives. Health care workers often underestimate the long-term satisfaction with life following spinal cord injury.
- Psychological distress impacts on patients' ability to cooperate with physiotherapy programmes, especially when the distress is associated with poor sleep, appetite and energy. In particular, psychological distress can lead to passivity, self-neglect,
- poor drive and motivation, and low adherence. Not surprisingly, patients with depressive symptoms achieve poorer outcomes than their non-depressed counterparts.
- However, psychological distress is not always associated with poor adherence.
- It can present as unbridled determination and drive for success in physiotherapy. Sometimes this is expressed by unrealistic goals, especially those that are gait orientated (e.g. "I am going to walk at any cost"). Alternatively, it can be expressed
- by preoccupation with physiotherapy and unrealistic demands for intensive attention from therapists. These issues are best managed through a coordinated team response under the leadership of a clinical psychologist

Family and friends

- Families and friends of people with spinal cord injury are often overlooked by health professionals. However, the practical and psychological implications for parents, siblings, children or friends can be multifaceted. Family members, particularly spouses,
- are often the primary providers of physical and emotional support.
- The marital status of a patient with spinal cord injury is the strongest predictor of long-term psychological adjustment and quality of life, although divorce is common.
- Family members often become responsible for providing a range of care services. This can cause them considerable stress, burnout, resentment and depression.
- In the early days after injury physiotherapists can assist members of the family and friends by involving them as much as possible in patients' programmes. Family and friends often welcome the opportunity to assist in real and tangible ways. This can be achieved by requesting them to help patients with practice activities, positioning and stretching programmes, and helping monitor skin integrity, either within or outside formal therapy sessions. Of course, patients must be happy to have family and friends involved in this way; patient consent for family involvement should not be assumed.

Cardiovascular system

- Overall, several factors contribute to the formation of deep vein thrombosis (DVT) in the middle small vessels of the lower limbs, especially in the solar and femoral veins.
- During external compression, these formations can detach and enter the circulation, stopping only in the body's natural "filter," that is, the lungs.
- When a pulmonary embolism occurs the danger is very great, it can range from sudden death if the lung vessel is large in size to necrotic injury if it is small in size.
- In any case, it requires adequate therapy and it is often necessary to bring the patient back to resuscitation.
- A sudden increase in heart rate above 100/120 rpm during or after mobilization is an alarm to be reported immediately to the doctor.

Cardiovascular system

- In the first 30 days after the injury and only after it was ascertained that the patient performed an ECOCOLORDOPPLER that did not have DVT in place, lower limb pressure therapy was performed for 3 hours a day, this greatly reduced the incidence of DVT in the acute phase. In addition, low molecular weight heparin is administered but the dosage should be contained, especially if there are other blood clots and potential areas of bleeding.
- Mobilization, in addition to neuromuscular and joint treatment, also aims to promote venous return; it should only be performed after it has been ascertained that the patient has performed ECOCOLORDOPPLER which excludes dangerous DVT. Often there are small solar DVTs that allow you to mobilize your hip and knee, but they do not recommend the flexed extension of the ankle because it is during the stretching of the sural triceps that the distal squeezing is more powerful.

Cardiovascular system

- The revaluation of the lower limbs for DVT is daily and concerns all staff. Since the patient does not usually experience pain and the possible thrombosis is deep, redness of the skin should not be sought, only the swelling and consistency of the tissues can be used to clinically detect DVT.
- Generally generalized edema of the limb is related to thrombosis of very large vessels (eg at the femoral-iliac level), while below the knee there may be only a slight asymmetry of caliber with the contralateral limb and a consistency different from the tissues, for example a greater pastiness than without reaching the frank edema (therefore without fovea) still suggests the accumulation of fluids in a deeper layer.
- Careful inspection is therefore essential before mobilization (it should be done by uncovering both lower limbs and comparing any diameter asymmetries) and, when in doubt, refrain and compare with the doctor.

Cardiovascular system

- At the time of admission the patient can be provided with long preventive compression stockings (antithrombus) which have a compression of about 15-18 mmHg
- At the time of getting into the wheelchair, instead it will be necessary that the level of compression is higher to help contrast hypotension and we will resort to aids, even if shorter for practicality, knee-highs with compression of about 19-21mmHg.

Cardiovascular system

- In addition to the lower limbs, venous blood can have stagnant areas in the abdominal viscera, complicating the paralysis of the abdominal muscles and the width of the mesenteric vascular bed. A zone of "seizure" will form in which the slowed circulation will subtract a significant percentage of the volume, so as to facilitate the fall of systolic pressure at the time of verticalization of the trunk.

Cardiovascular system

- This seizure is partially addressed by the use of an ELASTIC BELLY that must be worn when verticalization begins.
- Both the abdomen and the legs, ie the VASO PRESSURE AID, are identified, tested and tested by the physiotherapist. Only if there are particular problems, for example significant DVT or generalized edema, will there be a prescription for vasopressor aids by the cardiologist (eg long socks or higher compression level) and in this case the physiotherapist will adhere to the deliveries of the cardiologist, discontinuing the use of such aids only upon express prescription. Like any other aid, a thorough skin inspection should be performed to ensure that they do not cause dangerous redness.

Prevention of circulatory problems (stasis, edema in the lower districts, DVT)

- Teach what are the signs and symptoms of a DVT: (edema leading to an increase in the circumference of the limb, difference in temperature of the limbs, increase in body temperature, pain.
- Changing lifestyles that could be a risk factor (achieving and maintaining an adequate body weight, abstaining from smoking, avoiding the use of tight-fitting clothing that can counteract venous outflow.
- Daily ankle mobilization by venous pump.

CIRCULATORY COMPLICATIONS

- Bradycardia – hypotension
- Orthostatic hypotension
- Paroxysmal hypertension or hypertensive crisis
- Declining edema
- DVT
- Pulmonary embolism

Prevention of circulatory complications

- Elasticized aids: elastic bands, elastic stockings
- Prolonged mobilization therapy with alternating pressure "fisiopres" (3 hours per day)
- mobilization (passive / active-assisted. / active)
- Positioning in the unloading and position changesDrug therapy: low molecular weight heparins

PREVENTION OF THROMBOEMBOLISM

- 37% of deaths in the first year due to DVT
- Venous stagnation, hypercoagulability
- 40% of TVMs in the absence of prophylaxis develop DVT (80% on venography)
- 80% of DVT occurs within 2 weeks of trauma, is more common in ASIA A patients and paraplegics

PREVENTION OF THROMBOEMBOLISM

- Application of compression stockings or external pneumatic supports for 2 weeks after trauma
- Thromboprophylaxis with low molecular weight heparin to be initiated within 72 hours of trauma
- Prophylaxis should be continued for at least 8 - 12 weeks (complete, complicated motor injuries with risk factors)

PREVENTION OF THROMBOEMBOLISM

- Resumption of therapy in chronically bedridden patients or at risk for other situations
- Early passive mobilization
- In the case of documented DVT, mobilization must be started 48 - 72 hours after the start of antithrombotic therapy

Nervous system and skeletal muscle

- obviously the lesion causes absence of sensitivity and motility below the lesion level. In addition to the trophic and vascular effects, paralysis involves a significant drop in muscle mass, in addition to the lack of voluntary movement. The clinical examination of the ASIA and subsequently the neurophysiological examination will frame the lesion and suggest the possible prognosis.

Nervous system and skeletal muscle

- In principle, the reappearance of a voluntary and repeatable movement below the level of injury is a positive prognostic sign, but it could also be an isolated reappearance and without any functional relapse so it is a good rule to always work on the picture that is presents without making mortgages on the future; unfortunately, the phases of denial and accumulation of false hope greatly slow down the path of adaptation to the new condition.

Nervous system and skeletal muscle

- It is possible that the vertebral fracture is not stable even after surgery and in this case the patient will be provided with stabilization aids: prescribed by the orthopedist, customized by the physiotherapist and used according to prescription and safety by all department staff.
- The most common are the bivalve collar (Philadelphia) and the Three-Pointed Bust

Nervous system and skeletal muscle

- The collar is bivalve, ie it has a back and a front that are joined with velcro straps; it has variable height and width and must ensure stability between the trapeze curve and the jaw, especially in the anterior and lateral direction. It prevents little rotation, while the extension is usually controlled by the patient's natural posture. It can be provided with a wide anterior hole to make room for the tracheostomy cannula. It is usually worn as a supine or within 30 ° of lifting the trunk and except in cases of particular instability it is not worn in bed.

Nervous system and skeletal muscle

- The three-point torso consists of aluminum bars covered in imitation leather and are: two transverse: a fixed sternum (point 1) and an iliac, which can also be articulated to give more comfort during the sitting position (point 2) , connected to each other by two longitudinal bars (adjustable length) that run on the sides of the trunk and end just below the axillary cable on the middle axillary line. Later, to be placed centrally on the point of bone injury, runs an adjustable band with a semi-rigid bearing in the center called the ball (point 3). With two front pushes and one back, the bust thus becomes three-point. If the fracture is high dorsal (eg D1, D2 etc. up to D6) the three-point torso is not effective and a small steel bar (connected to the anterior sternum bar) must be added with a chin support (somi brace) or opt for a Minerva-type torso or an extended bivalve collar that also contains the sternum anteriorly and posteriorly the vertebrae up to about D8.

Nervous system and skeletal muscle

- The three-point torso has a series of adjustment points that are not trivial at all, it is good to test it with the orthopedic technician and check the pressure points well. Especially in back injuries in which the surgical wound is still fresh, it is necessary to assess whether the thrust of the ball is compatible with the healing process.

Nervous system and skeletal muscle

- The torso is never comfortable: at the time of the wheelchair lift the patient will have a longer or less adaptation phase, but you are wary if you do not complain about the torso, it is probably too little content!
- Be careful never to use the torso as a point of attachment in transfers because it will move, ending up being unnecessarily uncomfortable or, worse, not performing the function for which it is worn.

Nervous system and skeletal muscle

- Sensitivity is a fundamental component for the movement of the body in space and for carrying out intentional activities. The fact that the position of the body and the contact with the support surface is not perceived is extremely destabilizing.
- The sensitivity of the sacral area is then connected to the most private individuality (sphincter regulation and sexual activity) and its loss is particularly depriving.
- Not all sensitivity is lost at the same level of severity: there may be areas of hypoaesthesia in the passage metamers of the lesion and incomplete lesions, there may be partial preservation of thermo-painful sensitivity (prognostic favorable sign) and many variations on the subject, e.g. . Brown Sequard syndrome in which motor injury and loss of sensitivity are on two different emulsions.
- In principle, the recovery of sensitivity should be monitored at the same level as that of motor skills because it can have very important functional implications (eg saddle sensitivity in the prevention of pressure injuries from sitting, sensitivity of partial areas of the hand to facilitate fine activities).

Nervous system and skeletal muscle

- A particularly unpleasant aspect of altered sensitivity is PAIN. In a simplistic way it is thought that the loss of sensitivity also translates into the absence of pain, but most of the time this is not the case.
- Apart from the pain resulting from injuries above the level of injury, there are very often areas of painful hyperesthesia, typically in the border metamers but not elusively, and pain that accompanies the resumption of muscle contraction from discharge under injury at the exit from shock. .
- Sometimes there are real storms of intractable pain even pharmacologically and the level of malaise and discomfort of the patient is such as to make torture even the nursing wheels. In these cases it is necessary to pose the problem of being as much relief as possible during the treatment, which in any case is interrupted only in exceptional cases.

Nervous system and skeletal muscle

- The exit from the spinal shock is announced with the reappearance of the osteotendinous reflexes and the appearance of discharges of muscle contractions alone or, more often, in groups.
- Not all devices end the shock phase at the same time, typically the genitourinary system resumes autonomous activity later than the skeletal muscles.
- In principle, the functional prognosis is all the more favorable the shorter the shock phase, while the prolonged state of complete flaccidity does not lead to a favorable modification of the lesion.

Urological problems:

- Fundamental is education in proper bladder hygiene and correct catheterization or self-catheterization maneuvers.
- The catheter is a device that allows vesicle emptying: it can be left in place (indwelling catheterization) or only for the time necessary for emptying (intermittent catheterization).
- The use of fixed catheterization is limited to special cases because it exposes the person to numerous complications, while intermittent catheterization if properly performed is a modality that allows good management of the bladder and decreases the risk of complications of the urinary system.

Tips for maintaining the physical and functional performance achieved

- To stimulate the patient to continue at home to maintain the level of functional ability achieved in the U.S. U (transfers, wheelchair travel, personal care, etc .);
- Sensitize the patient about the importance of maintaining a body mass index in the expected range based on age, sex, height;
- Compatibly with the level of injury and the interests of the person with spinal cord injury promote sports activities adapted to residual motor skills

f) Dysreflexic crises:

- Autonomic dysreflexia of the spinal cord is an overreaction of the autonomic nervous system to a spinal cord injury that causes a life-threatening rise in blood pressure (hypertension).
- If the lesion is higher than D6, teach to recognize and manage the prodromal symptoms and any triggering factors

MANAGEMENT OF AUTONOMIC DYSREFLEXIA CRISIS

- Lesions greater than D6
- Causes: bladder overdistension, fecalomas, pressure ulcers, diagnostic or therapeutic maneuvers on the urinary tractSymptoms: headache, hypertension, bradycardia, sweating

Hydrotherapy

The hydrotherapy treatment shares the "dry" objectives of the functional re-education intervention, constituting an additional tool that not only favors a global approach to the problems of myeloles but where it proves to be a modality pleasing to the patient it can also offer prospects for recreational-sport integration

Hydrotherapy

- Objectives of hydrotherapy treatment in complete lesions:
  - Aquaticity
  - Start of swimming
  - Ability in the water

Hydrotherapy

- Objectives of hydrotherapy treatment in incomplete lesions:
  - Motor control
  - Reinforcement
  - Gait

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

PHYSIOLOGICAL AND THERAPEUTIC EFFECTS OF HYDROTHERAPY

- *Musculoskeletal system*
- *Respiratory system*
- *Kidney system*
- *At the level of the PNS and CNS*
- *On a psychological level*

Musculoskeletal system:

- squeezing of superficial and lymphatic blood vessels, with consequent reduction of any edema and joint effusions;
- diastasis of the joint heads, with consequent progressive recovery of ROM and analgesic action;
- reduction of muscular effort with consequent facilitation of movement;
- increased muscle effort with consequent muscle strengthening;
- muscle relaxation, with consequent analgesic and decontracting power.

Respiratory system:

- increased pulmonary ventilation;
- decrease in the volume of the expiratory reserve;
- increased workload for the inspiratory muscles

Kidney system

- decreased production of ADH (antidiuretic hormone) and Aldosterone;
- increased secretion of Sodium (Na) and Potassium (K);
- All this promotes diuresis, with a consequent reduction in blood pressure and increased elimination of metabolic waste.

At the level of the PNS and CNS

- sensory stimulation
- pain reduction
- facilitation of postural reactions / facilitation of balance reactions

On a psychological level:

- the possibility of performing movements that would be too difficult on the ground, constitutes a strong "moral" push for the patient
- the patient becomes more confident in his abilities
- improve social relationships, especially in group therapies

ABSOLUTE CONTRAINDICATIONS

- severe heart failure
- acute (recent) or unstable ischemic heart disease
- high-risk arrhythmias
- congenital heart disease and cardiomyopathyacute cardiac inflammation (pericarditis, myocarditis, endocarditis)
- severe and / or pharmacologically poorly controlled arterial hypertension
- phlebitis
- severe respiratory failure
- active lung infections
- chronic otitis
- evolved neurological pathologies
- neoplasms (with skin wounds that can contaminate water)
- permanent intravenous catheter.

RELATIVE CONTRAINDICATIONS

- epilepsy, which will be evaluated based on the frequency and intensity of the seizures
- peripheral vascular pathologies
- severe dysphagia
- risk of infections in immunosuppressed patients
- impaired thermoregulation
- Hydrophobia
- urinary incontinence
- fecal incontinence
- hypersensitivity to the products used for the water.

TEMPORARY CONTRAINDICATIONS

- skin infections (mycosis, eczema, warts, etc.)
- infectious conjunctivitis
- unhealed skin rashes
- unhealed skin wounds
- fever
- infectious diseases of childhood

"Water as an element of evaluation and diagnosis"

- In the spinal injured patient, how much are the residual motor skills affected by the force of gravity?
- It is conceivable:
  - that the context in which the movement is requested may affect the actual ability to perform it
  - that not exercising certain motor patterns can lead to an aggravation of the "disability" in a functional key.

- In spinal cord injuries, Hydrokinesitherapy is almost a treatment of choice
- obvious benefits on motor performance
- positive effects on secondary problems related to wheelchair permanence

Hydrokinesitherapy

- Allows work in an orthostatic position
- Allows a decompression of the column
- Promotes better circulation in the lower limbs
- Optimizes complete emptying of the bladder (in case of stagnation)
- Attenuates the intensity and frequency of spasms
- Promotes the recovery of stereognosy

Hydrokinesitherapy

- The use of different levels and floating aids allows you to vary the possibilities offered by water as a microgravity environment
- Water slowing down movement facilitates learning
- It has recreational, playful and social contents that allow you to propose new rehabilitation addresses without boring.

PATIENT SELECTION

- The absolute criterion that is followed regardless of the severity of the disease, the level or extent of the injury is the potential for improvement

TREATMENT

- Entry into the water
- Assisted setting
- Aquaticity in progression
- Assessment
- Protocols

Assisted setting

- Set of procedures that allow the patient to approach the water with tranquility, safety and confidence (essential requirements to be able to propose it as a renewed rehabilitation and therapeutic element)

Aquaticity in progression

- Set of complex motor skills to be acquired, preparatory to the achievement of the Therapeutic and / or Recreational objectives set.

Globality

- By virtue of the physical laws of water, each exercise sequence allows you to work simultaneously on the following areas:
  - Muscle recruitment
  - Proprioceptivity
  - Equilibrium
  - Body diagram
  - Stereognosy
  - Segmental exercises also need to be placed in a global context

CONCLUSION

- An accurate dry evaluation, an accurate evaluation in water, a plausible therapeutic project make the treatment in water an effective additional tool available to the physiotherapist; the environment allows for optimal social reintegration; over time, swimming becomes good maintenance

Home organization

- The spaces required for the use of a wheelchair are:
  - 360 ° rotation space;
  - 180 ° reversal space (140 x 170 cm);
  - 90 ° turning space with a minimum width of 90 cm, with a free space before 140 cm and after 170 cm;
  - Passage space 70-80 cm wide

Access to the home

- adequate width of the doors (standard 80 cm because if they are
  higher they become too heavy and difficult to manage);
- level door opening spaces;
- threshold with a maximum height of 2.5 cm, preferably lower;
- door return spring calibrated to a maximum of 2 kg, better if less;
- where possible, sliding or automated doors;
- correct height of handles and intercoms;
- parking space in front of and behind the doors of at least 150 cm;
- entrance protection from atmospheric agents (wall units, porches, etc.);

Access to the home

- access ramps with a recommended maximum slope of 5%, even if by law the maximum is 8%, with flat lay-bys, a wheel beater and a minimum width of 90 cm;
- lifts with a good self-leveling system, automatic opening, buttons at a height of 110-120 cm in a central position, doors with a clear opening of 80 cm;
- the dimensions of the lift cabins can vary from 140 x 110 cm for non-residential uses, to 130 x 95 cm for residential uses, to 120 x 80 cm, in case of structure adaptation;
- stairlifts and elevators must overcome limited height differences and guarantee safety conditions and space for maneuvering.

Bathroom area

- washbasin with a free front space of at least 80 cm to allow front access;
- shelf basin, with leaning or recessed siphon, about 80 cm high from the ground;
- lever tap with thermostatic mixer;
- mirror starting from the sink;
- W.C., with shower telephone next to it, about 50 cm high from the ground, with a distance from the front edge to the wall of about 80 cm;

Bathroom area

- fixed or folding handles, arranged according to the mode used to perform the transfer;
- free space on the side of the toilet to allow the lateral approach for the transfer (about 80 cm from the edge of the toilet);
- shower with tray flush with the floor with a 1% slope of 90 x 90 cm;
- folding seat about 50 cm from the ground with taps on the sidetub with dimensions of 80 x 140 cm with space for lateral approach to perform the transfer or seats for tub.

Kitchen area

- free area under the sink, the hob and the worktop to facilitate access;
- use of cantilevered wall units, pull-out furniture, revolving shelves, to store objects
- worktop to the side of the cooking area and sink, in order to facilitate the placement of utensils;
- oven at worktop height;
- fiberglass hob to reduce the risk of burns;
- handles that allow an easy grip;
- sink drain pipe placed so that it does not cause contact burns.

Living area

- avoid carpets;
- arrangement of the furniture in such a way as to guarantee space for maneuvering the wheelchair;
- desk or work table about 75-80 cm high from the ground and with the space underneath free for easy access.

bedroom

- free space between the bed and the wall and between the bed and the wardrobe of at least 90 cm;
- height of the bed equal to that of the wheelchair;
- walk-in wardrobes or wardrobes with sliding doors and devices to lower the clothes rail to an accessible height.

Sports therapy

- Based on the experiences of the European spinal units starting from the Stoke-Mandeville center, born in 1944, for some years sport therapy has also appeared as a discipline that can further improve within the rehabilitation project of the person with spinal cord injury. motor and autonomy possibilities.

Sports therapy

- This center was the first to start the "pioneering" activity of sports therapy thanks to an intuition of its director Dr. L. Guttmann, who recognized that an active participation of the patient, suffering from mental depression, respiratory diseases, bedsores, in the rehabilitation program could prevent these complications.

Sports therapy

- He introduced sporting activity as a "means" to be able to involve young para-quadriplegic patients in the rehabilitation process, but later realized that in addition to the psychological improvement there was a notable increase in the muscular, respiratory and wheelchair management skills that with traditional methods could hardly obtain.

- Dr. Guttmann's initiative was very successful, and on July 28, 1948, the first Stoke Mandeville Games for disabled athletes were held, in which former members of the British Armed Forces participated in disabled sports.

- Since then the Stoke Mandeville Games became international and in 1960 they took place in the context of the Rome Olympics, indicating the way for the organization of the Paralympics every 4 years in conjunction with the Olympics.

Sports therapy

- In relation to the phase of the rehabilitation project in which sport is inserted and the value that you want to give it, we can distinguish activities such as sport therapy and recreational-sporting activity that can lead to competitive sport.

Aims

- Improve fine motor skills or movement.
- Improve sensory skills.Improve the physical gesture.
- Improve coordination of movements.
- Improve reflexes with particular reference to eye-hand ones.
- Increase muscle strength.
- Improve respiratory capacity.
- Improve gas exchange and blood oxygenation.
- Increase resistance to fatigue.

Aims

- Favorire l'aggregazione ed i rapporti sociali.
- Stimolare la persona ad affrontare le difficoltà.
- Apprendere delle capacità attraverso una serie di esperienze.
- Contribuire alla costruzione o alla ricostruzione della propria identità.
- Per chi usa la carrozzina è un ulteriore apprendimento nella capacità di conduzione, di spinta e di spostamenti nello spazio.

Sports therapy

The beneficial effects of sports therapy concern:

- improvement of motor skills (strengthening of residual muscles, control of hypertonia, improvement of trunk control, optimization of compensation, extreme use of aids);
- improvement of cardio-respiratory functions, prevention of osteoporosis and circulatory disorders, improvement of intestinal function);encourage aggregation and social relationships as group activity improves mood, promotes relationships and socialization.

Sports therapy

In particular:

- swimming allows a global strengthening and respiratory function;
- table tennis and archery improve hand-eye coordination, trunk balance and muscle strengthening;
- basketball and hand-biking improve muscle resistance to fatigue, functional to pushing the wheelchair in the activities of daily life.

Sports therapy

- The recreational-sporting activity, to be started as an introduction to sports in the hospital and recommended for everyone to continue with the discharge, has mainly recreational purposes, social reintegration and the prevention of secondary damage to reduced mobility; it can in fact constitute a valid alternative to boring maintenance motor re-education sessions.
- Competitive sport, to be undertaken after resignation, with sporting purposes and personal fulfillment, is obviously aimed at the most motivated and gifted people.

When to start?

- There is no fixed rule, it depends on the patient's clinical condition and the type of sport

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Occupational Therapy

- The World Federation of Occupational Therapy (1989) provides the following definition of Occupational Therapy: "discipline that deals with the evaluation and treatment of physical and mental diseases with the aim of helping people to reach their maximum level of function and independence in all aspects of daily life ".

Occupational Therapy

Fields of intervention in spinal cord injury:

- treatment of the sensory-motor deficit of the upper limb;
- identification and packaging of orthoses for the upper limb;
- training for A.D.L. basic (personal hygiene, self-care, nutrition, clothing, bed mobility, transfers, preparation for bladder and intestinal emptying);
- training for A.D.L. instrumental or I.A.D.L. regarding the ability to use the telephone, the complete management of the home environment and daily needs (shopping, cleaning your home, washing, ironing, etc.), the ability to travel with your own or public means, the ability to take drugs and handle money;

Occupational Therapy

Fields of intervention in spinal cord injury:

- training in the use of the wheelchair (electronic and / or manual);
- training in the use of the PC and computer aids,
- planning of environmental control systems (high-tech devices that allow access to a series of commands such as call systems, TV-radio ignition, door / lift opening, etc. even for people with severe motor disabilities);

Occupational Therapy

Fields of intervention in spinal cord injury:

- advice on modified controls for driving or identifying aids and access methods for means of transport for high injuries;
- consultancy for social and work re-integration including the removal of architectural barriers and orientation to leisure and sports activities;
- health education aimed at the patient and his family on the management of the assistance needs of the person with SCI.

Functional hand

- THESE ARE THOSE TRICKS THAT THE PATIENT WITH TETRAPLEGIA SPONTANEOUSLY PUTS INTO OR IS EDUCATED TO DO WITH THE PURPOSE OF REACHING A FUNCTIONAL OBJECTIVE NOT OBTAINABLE THROUGH THE NORMAL METHODS.

Aims

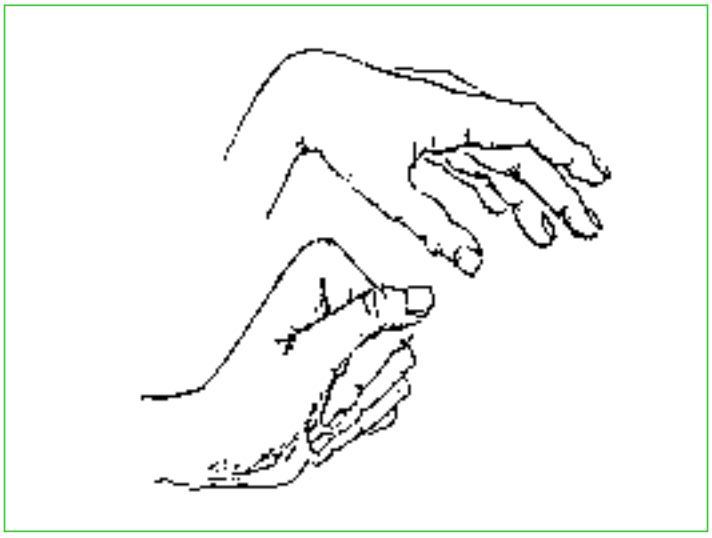
- Maintain joint freedom capable of favoring the achievement of compensation at the shoulder, elbow, wrist and hand level.
- Strengthen the supralesional motor quotas.
- Check for spasticity.

The functional hand

- Through tenodesis of the flexor muscles of the fingers and thumb, the hand may be able to make light functional grips even in the absence of an active preensor muscle capacity of the fingers.

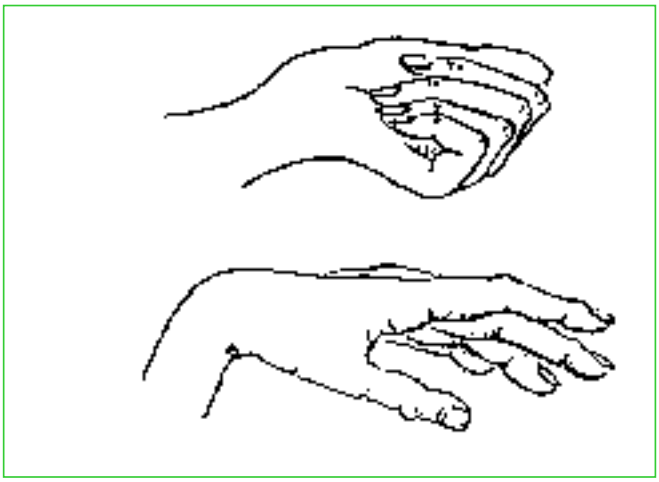
Active functional hand (presence of wrist extensors)

- The flexion of the wrist determines the opening of the hand
- The extension of the wrist determines the closing of the fist



Passive functional hand (no wrist extension)

- Supination of the forearm causes extension of the wrist with closing of the hand
- Pronation of the forearm determines the flexion of the wrist with the opening of the hand



Hand positioning

- Wrist: 30 ° extension (C5, C6 deficient, or start of treatment)
- Fingers:
  - 90 ° metacarpophalangeal flexion and proximal interphalangeal joint
  - 0 ° distal interphalangeal joint
- Thumb:
  - 0-30 ° metacarpophalangeal flexion
  - 0 ° interphalangeal jointthe thumb must be close to the proximal interphalangeal joint of the index finger and not its metacarpophalangeal joint

The functional hand

- The development of functional hands is a cornerstone in the initial phase of the treatment of patients with tetraplegia. In this period the positioning of the hands must produce the correct muscle lengths to allow the "tenodesi effect“
- Aims:
  - Promote the shortening of the flexors of the fingers and thumb
  - Prevent shortening of the finger extensors
  - Prevent the shortening of the collateral ligaments of the wrist and finger joints, so as to maintain optimal joint mobility

The active functional hand (C6-C7)

The flexion of the wrist determines the opening of the hand

The extension of the wrist determines the closing of the fist

HOW TO GET IT?

- functional bandage with velcro straps
- electrotherapy with wrist extensors (if absent), finger and intrinsic flexors
- splint to keep the wrist in extension

Automatic or functional hand

- We talk about "active automatic hand" if the radial carpal extensor is present (lesions at the level of C6-C7) or "passive automatic hand" if only biceps control is present (C5) and therefore a 'orthosis that stabilizes the wrist.

Automatic or functional hand

- The automatic hand allows, in the absence of an active finger prensor muscle capacity, to carry out light, functional and useful grips in daily life activities, through the tenodesis of the flexors of the fingers and thumb.

Automatic or functional hand

- Muscle shortening must be reversible in the case of a possible recovery of finger motility or in the case of rehabilitation surgery.
- The positioning must be carried out in the acute phase using hypoallergenic patches, leather or neoprene gloves, cloth armored cuffs, etc.

Automatic or functional hand

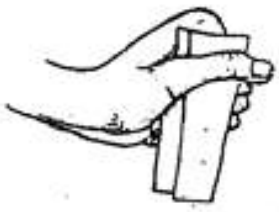
- Adequate mobilization must prevent the shortening of the extensor muscles and collateral ligaments of the wrist and fingers (in particular of the metacarpophalangeal muscles) in order to allow the passive relaxation of the hand when the wrist flexes.

The main grip of the functional hand

Handheld digital Grip

Cylindrical grip

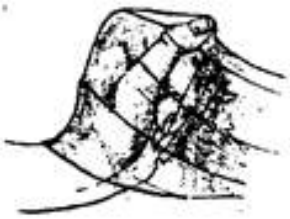
Lateral grip



Interdigital Grip

Braided grip

Hook grip



The shape of the hand

If the hand is not positioned correctly, it often takes on these non-functional forms

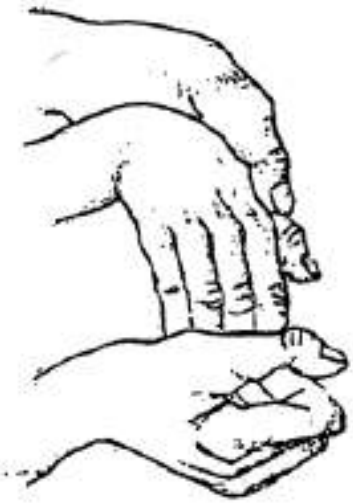
Claw hand

Flat hand

Passive hand mobilization

Upon completion of the positioning, the hand must be mobilized correctly and frequently enough to avoid joint contractures:

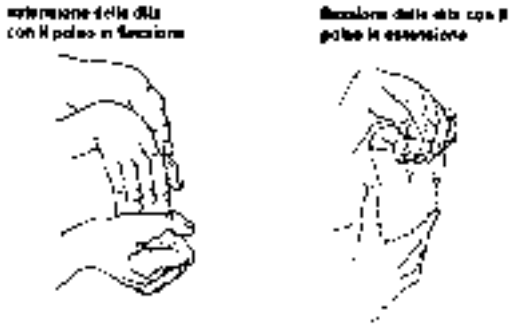
Extension of the fingers with the wrist in flexion



Flexion of the fingers with the wrist in extension

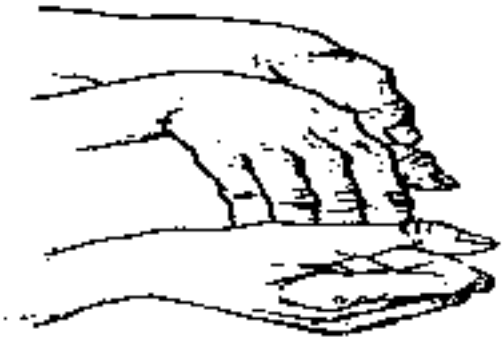
mobilization in compliance with the automatic functional hand

- - the hand, the mobilization of which takes place in compliance with the shortening of the flexor lodge.
- - the metacarpophalangeal joints, in which extension beyond the neutral position is never sought because they tend to hyperextend spontaneously



UPPER LIMB POSITIONING

Hand mobilization



Finger extension with wrist in flexion

Flexion of the fingerswith wrist in extension

How it should NOT be

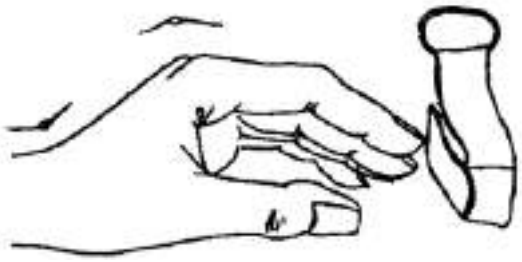
The main mistake in the positioning of the functional hand

- - The orthosis positioned incorrectly: the orthosis positioned too much blocks a 90 ° flexion of the meta-carpophalangeal joints, shortens the extensors of the fingers, the ligaments and often also the capsules. This error causes incomplete closing or a scratching hand. To prevent this problem it is important not to make the orthosis too long in the palm. Pre-made cuffs often need to be shortened (sew the edge to the correct length)

errato

The main mistake in the positioning of the functional hand

- The orthosis and aids are placed and removed incorrectly: the hand is opened while the wrist is in the wrong position (i.e. in extension). In order not to jeopardize a sufficient shortening of the flexors of the fingers, it is essential to open the hand during the activities of daily life, always with the wrist flexed.



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The main mistake in the positioning of the functional hand

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Passive and active assisted mobilization

- Musculotendinous shortening prevention
- Maintenance of joint mobility
- Edema prevention
- Pain prevention
- Improvement of residual motor skills

Prepration of the Automatic functional hand

- The hand should be positioned with wrist at 30 ° of extension, metacarpophalangeal at 90 °, proximal interphalangeal at 90 °, distal interphalangeal at extended. This position is maintained over 24 hours or at repeated 3-4 hour positioning intervals, except for periods of mobilization and hygiene.

Prepration of the Automatic functional hand

- The shortening of the flexor lodge is a sine qua non for the functional use of the hand if the only active muscle remains the radial extensor of the carpus.

Prepration of the Automatic functional hand

- If there is no active component of extension to the wrist, the closed hand will still allow some functional activities by flexing the active elbow and releasing the passive elbow. If a neurological recovery occurs, stretching the shortened area will take a few weeks at the most

Prepration of the Automatic functional hand

- To maintain the correct positioning, the physiotherapist who has the possibility can make gloves (fig.) with soft and hygienic material that does not cause irritation or overheating of the skin. The gloves are personalized, they must be easy to remove and put on, they require constant skin inspection, they are to be re-evaluated every day.

- fig. correct positioning with neoprene band

Prepration of the Automatic functional hand

- If there is no possibility of making or building orthoses, the correct positioning must still be maintained for 24 hours by checking whether the skin tolerates the chosen means, eg. wristbands, paper patches, elastic bands.Positioning with orthoses, plasters, or bands can be alternated with moments of freedom as long as avoiding the extension of the metacarpophalanges. Neglecting this aspect leads to the "claw hand", not surprisingly common in progressive paralysis.

fig. 4 - la mano aperta e la mano ad artiglio: l'una conduce all'altra

Prepration of the Automatic functional hand

- Edema is not a reason not to position the hand, on the contrary: hands that remain edematous for a long time become paddle hands, useless to manipulate and grasp. When there is edema the entire arm is positioned in the unloading area, mobilized more often, the hand is closed in a less constricting manner, and inspected every 1-2 hours.

Prepration of the Automatic functional hand

- The positioning of the pelvic girdle and lower limbs is less complicated but no less important. Falling into external rotation must be avoided, the popliteal fossa should be kept free and slightly flexed, the heel protected and the ankle at 90 °.
- The correct position is never just one: the basis of good postural management is an effective alternation of positions that protects the skin, modifies the ventilation / perfusion ratio, alternates sloping areas, etc ...

Prepration of the Automatic functional hand

- No position, even the most comfortable, can be held in a fixed way without consequences. Unless there are genuine security reasons, the choice of serial positioning is always a winner (fig. 5). The use of air mattresses has greatly improved comfort and safety, but encouraged us to consider this aspect of the management of the critically ill patient to be less important.

- Fig. 5 - Positioning on the side of the tetraplegic patient. Note: the underlying "free" shoulder supported by the pillow under the head and by the one under the chest, the alignment of the column obtained with the lower limbs staggered and not overlapping as in classic positioning. The groin is not squeezed with the advantage of the genitourinary system and the control of the bladder catheter. The hands are closed and the elbows extended.

Prepration of the Automatic functional hand

- For didactic simplicity the patient described here has a complete lesion and is in the phase of spinal shock. In reality, injuries that are incomplete or of non-traumatic origin, or with traumatic brain components make everything more indistinct, variable and harbinger of further problems in terms of recovery. Individual assessment remains the only reliable procedure.

MOBILIZATION AND KINESI

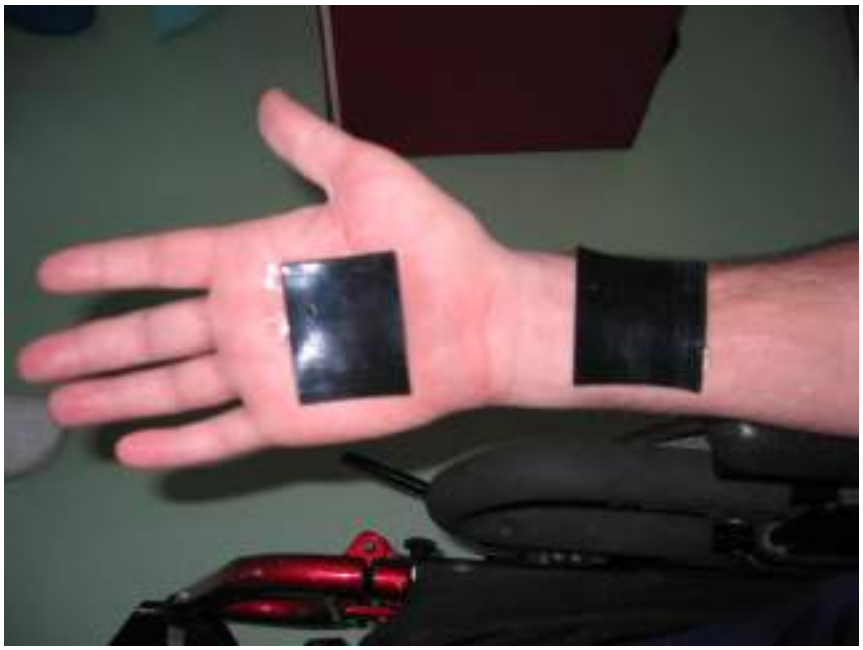
- Mobilization is often the patient's first conscious contact with the paralyzed and insensitive part of his body, as well as the first sign that “something is being done” for his paralysis; for the physiotherapist it is a moment of constant evaluation (as well as treatment), during which changes in the clinical picture are highlighted such as the appearance of muscle tone - to be further distinguished in involuntary discharges or voluntary and repeatable contractions - the appearance of joint limitations or muscle shortening, changes in temperature or texture of the tissues that could make one suspect the onset of DVT,

Functional bandage

ELECTROTHERAPY

- Research and reinforcement of wrist extensorsfunctional hand setting electrostimulating especially those intrinsic to:
  - Wrist extended
  - Flexed metacarpal-phalangeal joints

- Example of median and ulnar stimulation for the induction of a correct functional attitude



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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

WRIST POSITIONING

WHO TO GET IT FROM?

- Starting at a C5 level
- ATTENTION: if it is a peripheral hand then with flaccidity of fingers muscles
- DANGER OF ARTICLE BLOCKS

ESSENTIAL RESULT:

- place the splint and bandage 24h / 24 h during the first 3-4 months
- remove them only during physiotherapy treatment for the CORRECT mobilization and during hygienic care.
- maintain the correct length of flexors and extensors of the fingers
- avoid joint blocks

CORRECT APPROACH TO THE FUNCTIONAL HAND:

- Extend your fingers with your wrist flexed
- Flex your fingers with your wrist extended
- Do not mobilize your thumb individually while
  - washing their hands
  - when placing and removing positioning orthoses
  - in transfers
  - in dressing and undressing

If the functional hand has been set correctly, various types of grips are possible, the most important are:

- Fingerprint grip
- Side-side grip

- These are the grips that are also sought after with functional surgery

PASSIVE HAND

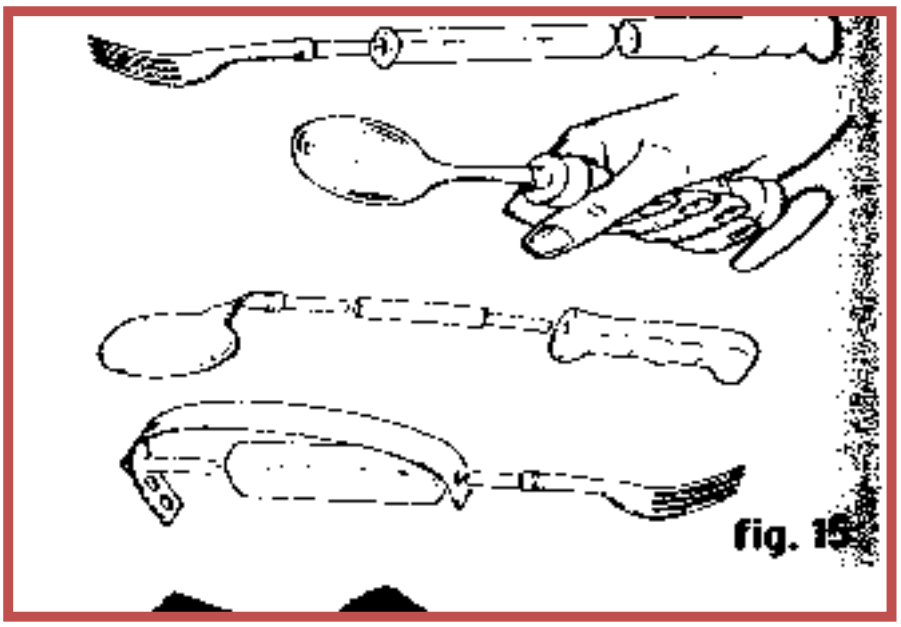
Supination of the forearm causes an extension of the wrist with closing of the fist

Pronation of the forearm determines wrist flexion with hand opening

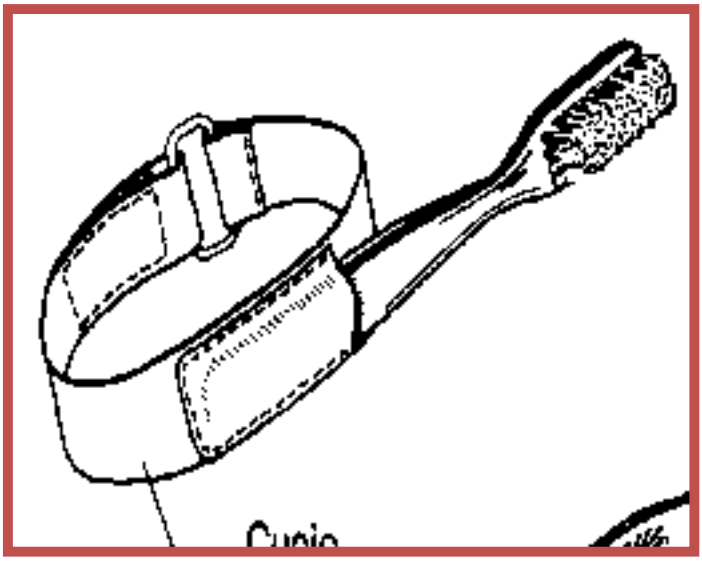
Supination in this case is an active movement, pronation for the most part is passive, performed through a momentum

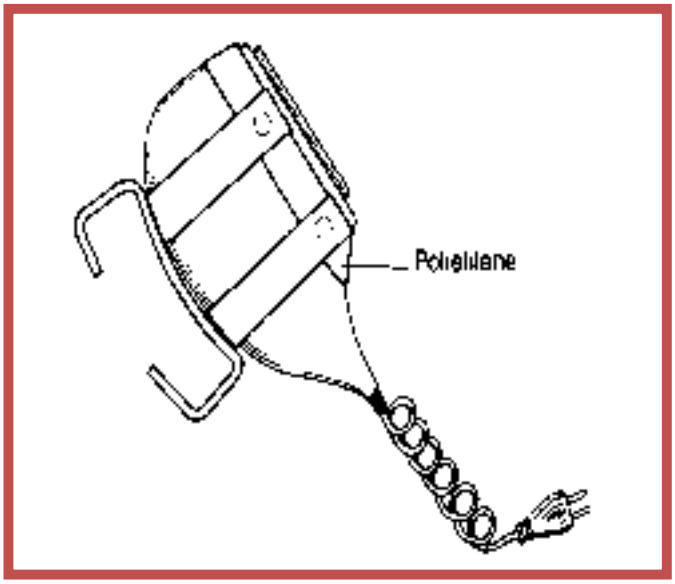
What strategies? ....

PERSONALIZED HANDLES



What strategies? .... AID





Tool strap
Thermoplastic orthoses
Object pocket with fork

TYPES OF GRIPS:

Forearm grip

Grip with wrist extension

ADL

- WHAT ARE THE OBJECTIVES,
- FROM THE POINT OF VIEW OF THE ADL,
- THAT WE CAN REACH
- USING COMPENSATION
- ACCORDING TO THE LEVEL OF INJURY?

	TETRAPLEGY C5	TETRAPLEGIYC6	TETRAPLEGY C7	TETRAPLEGY C8
Feeding	with ties and adapted cutlery	even with only thick cutlery	independent with aids	independent
Shaving	splint, adapted aids such as combs with straps	partially independent by adapting toothbrush, razor, comb or with strap	independent with aids	independent with aids
Washing		almost independet for the upper part. With adapted sponge	independent with aids	independent with aids
Dressing		autonomous for the upper part with specific aids: eyelets on the hinges, hooks	autonomous with aids also for the lower part of the	independent
Pushing the wheelchair	autonomous with splint or push gloves, modified handrails but on flat surfaces	autonomous and facilitated with push gloves	autonomous even on external land	independent
Transfering Bed-Wheelchair		almost autonomous with the tablet for transfers and between surfaces on the same floor	independent	independent
Mobility in bed		almost independent with the help of handles or electric beds	independent	independent
Bladder			almost independent with some aids	independent
Perinael Hygiene			almost independent with some aids	independent

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

FEEDING

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Feeding: cutlery management

Feeding: glass management

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PERSONAL HYGIENE

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PRACTICAL TEACHINGS FOR THE
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Difficulty brushing teeth and face

Difficulty combing

Difficulty in nail care

Difficulty shaving / putting on make-up

COMUNICATION

- Alternative grips
- Modified handle
- Thermoplastic orthosis (splint)
- Other aids: electronic turntables
- Personal Computer and computer aids

DRESSING

Alternative strategy

Modified clothing

Aids

C5-C6 (upper quadrant only)

C7-C8 (upper and lower quadrant)

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PRACTICAL TEACHINGS FOR THE
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Dressing / Undressing

BLADDER EMPTYVESCICALE

Alternative strategy(modified sockets, body position)

Modified clothing

Aids (catheter, orthosis, supports)

C6 man → partial independence

C7 man → complete independence

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PRACTICAL TEACHINGS FOR THE
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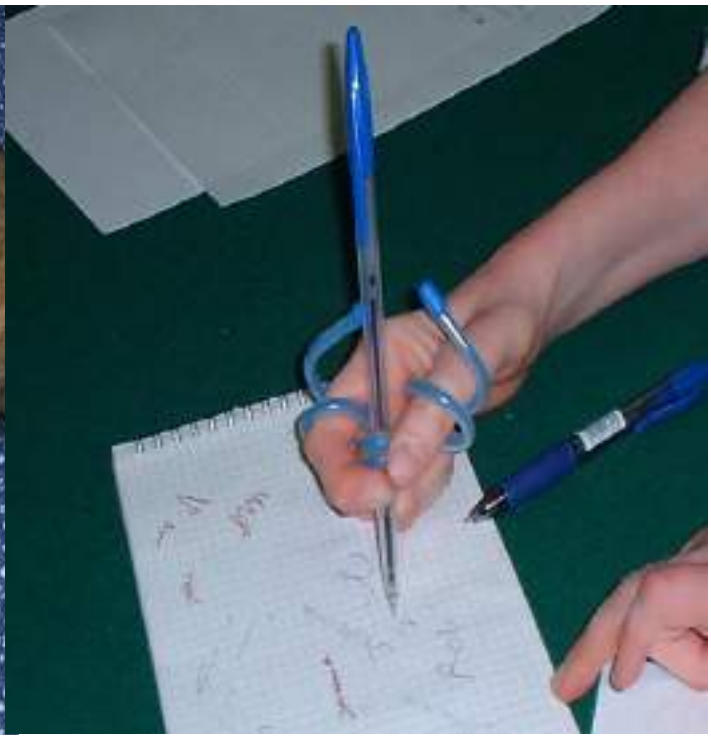
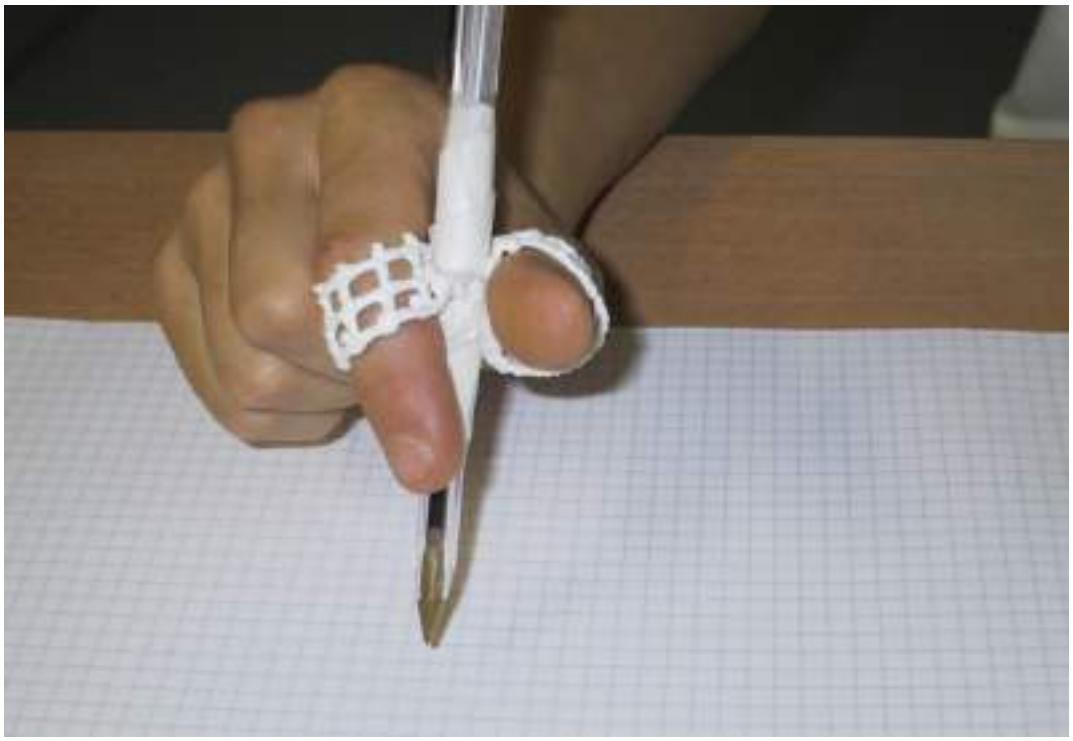
Writing



Writing



POSTURAL CARE

a) correct alignment according to the pathology
b) automatic hand preparation
c) search for muscle / joint balance lost at the time of injury

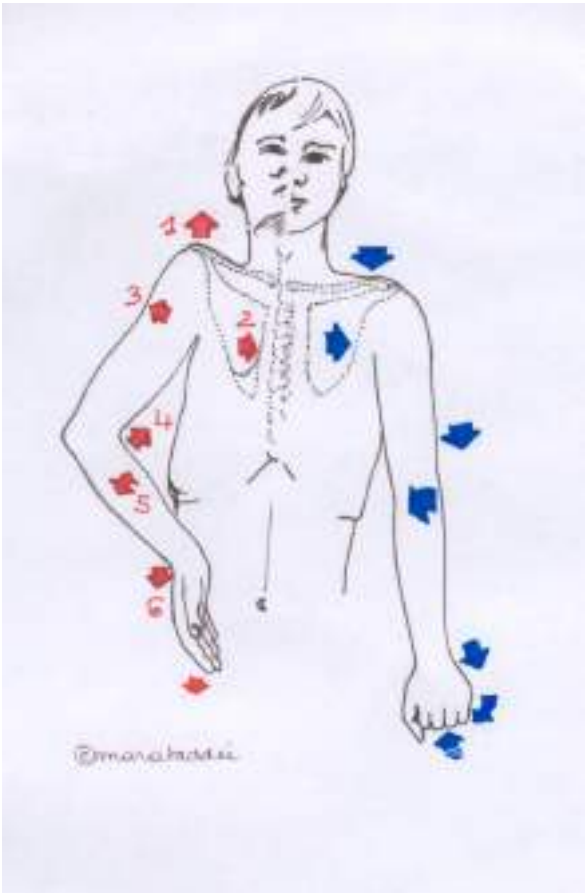
POSTURE EVALUATION

- Observation of the resting posture
- Verification of alignment by palpation of bone marks
- Observation of postural changes during functional activities
- Important: There is an "ideal" posture of reference but it is not necessarily binding, indeed it can sometimes be harmful
- Each patient has his own posture !!!!

POSTURAL CARE

- Positioning aids begin with the choice of bed: a time (until about fifteen years ago) when vertebral injuries did not stabilize was almost always in the first phase a bed (EGERTON) with joints in the longitudinal direction that allowed the management alternating positioning while maintaining the required vertebral alignment is now used in rare cases of non-surgical stabilization. Today, however, patients are usually stabilized in the first hours after trauma and therefore, almost always, the bed used is the one articulated with three cross sections. The most used mattress is the air decubitus mattress with pressure sensors to minimize the pressure exerted on the patient's body, for the fluctuation that this aid can not be used in unstable spinal injuries.

Positioning



- In the figure you see the position that the person with C5 / C6 lesion assumes spontaneously (left) and the correct postural pattern "functional" to the pathology (right).

Spontaneous posture....

- 1 - Elevation of the shoulders: the muscles of the upper trapezius, scalene, scapula, sternocleidomastoid and splenic of the head are all preserved and explain their action of dragging the scapular girdle towards the skull without being counteracted by the abdominal muscles that "hook" the chest to the basin. The patient reinforces his tendency to have his head more and more embedded in his shoulders because he also recruits these muscles to ventilate (the compensation is exhausted due to active insufficiency, ie the muscle is so shortened that it no longer produces movement).

Spontaneous posture….

- 2 - Scapular adduction: rhomboids have a high innervation while pectorals and anterior dentate are functional below the level of C6 lesion preserved. The scapulae are attached and adhere to the vertebral edge (up to the decubitus injury of the medial edge!). The chest is fixed rigidly in an inspiratory position.

Spontaneous posture….

- 3 - Abduction of the shoulder: deltoid and supraspinatus are active: although contact with the bed and the weight of the upper limb limit the tendency to abduction, any attempt by the patient to move accentuates it (further inspiratory component of the cage).

Spontaneous posture….

- 4/5 - Brachial biceps + brachioradial: the elbow has completely lost the extensors (triceps: C7) so the flexors, already powerful muscles, impose their balance angle on the elbow. The brachioradialis is also free in its forearm supinator component and this increases the dorsal fall of the hand.

Spontaneous posture....

- 6 - Radial extensor of the carpus: it is usually the first trace of C6 partially or completely preserved. The ability to actively extend the wrist makes a difference in a large number of upper limb activities, but in this postural pattern, far from being useful, the dorsal fall of the hand increases. Without any trace of flexors, the hand is extended to the passive tension, with the fingers falling.

… And the correct one

1 - The shoulders should be depressed, you should not tire of repositioning them whenever necessary. Positioning with cushions can be encouraged, but blocking with sandbags and the like is not recommended. The only absolute indication is the pre-stabilization period when the patient must cough or be bronchoaspirated, a maneuver during which it is necessary for an operator to maintain the alignment of the shoulders.

- assisted cough with an unstabilized patient. One operator assists in coughing, the other prevents the scapular girdle from moving

… And the correct one

2 - The shoulder blades should be extended and possibly held in place with the use of small wedge-shaped latex cushions.

3 - If the track is well positioned the shoulder does not have excessive freedom of abduction. Remember that pain at the level of injury is a very serious problem for the patient. The humeral glenoid joint should be preserved and maintained at its natural angle of 30 ° flexion relative to the bed plane (given the likelihood that it will remain the only upper limb joint with complete innervation it is critical that it is not painful!)

… And the correct one

- 4 - The elbow should be kept extended with the forearm pronounced within 24 hours except for moments of physiotherapy and hygiene. The late problems resulting from the total non-extension of the elbow are so many and serious that a separate intervention would be needed.

… And the correct one

- 5 - The wrist must maintain its functional curvature at 30 ° extension.
- 6 - The hand is placed closed and the preparation of the “automatic hand” begins immediately

IDENTIFICATION AND CUSTOMIZATION OF ORTHOSES AND AIDS

- During the acute phase, the activity allowed to the patient is so reduced that it suggests that aids are the least of the problems: in reality, it starts immediately.

IDENTIFICATION AND CUSTOMIZATION OF ORTHOSES AND AIDS

- First of all we will take care of ensuring the possibility of calling the nurse. Environmental modifications to make the management of immediate space as much as possible the normal doorbell can be modified in an ergonomic sense to be maneuvered with a movement of the entire forearm, with the blow command (which however requires an already adapted circuit) and, if really there is no other means, an intercom for babies can be useful. The position of the bedside table must also be taken care of or in the case of subjects with very high lesions, make changes to be able to give the patient what is possible.

IDENTIFICATION AND CUSTOMIZATION OF ORTHOSES AND AIDS

- We will provide positioning orthoses for the hand (gloves or cuffs or any device to prevent hand deformities) and we will take care of the rotation of their use in the 24h with precise deliveries and exhaustive explanations to the nursing staff and to the patient himself.

IDENTIFICATION AND CUSTOMIZATION OF ORTHOSES AND AIDS

- We will facilitate the venous return with vasopressure aids, which will become indispensable at the time of postural readjustment (classically belly - belly - elastic and compression socks up to 21mmHg). If necessary, in the presence of inveterate DVT, upper compression stockings or bandages will be identified on the cardiologist / angiologist's recommendation.

IDENTIFICATION AND CUSTOMIZATION OF ORTHOSES AND AIDS

- On the recommendation of the orthopedist, we will customize vertebral orthoses (collars, minerves, busts), for each orthosis the indications and precautions must be explicit and shared by all staff.
- Finally, last but not least, we will identify the postural wheelchair (for width) and the anti-decubitus pillow (for the need for prevention) and we will customize the height of the footrests, armrests and so on to the measurements of our patient.

AIDS PLANNING

- Need detection aids
- Evaluation of present and potential skills
- Identification of aids and their customization

Proposal for the use of aids for ADLs:

- Transfer board;
- Non-slip gloves;
- Metacarpal bracelets for nutrition and oral hygiene;
- Aids for writing and using digital equipment;
- Dressing aids (zippers, rings, button threader), self-catheterization, self-care;

Sequence of actions for readjustment to sitting out of bed

- Assess the clinical conditions together with the team: agree with the referring physician and specialist, nurse, psychologist.
- Inform the patient and caregivers (psychological aspect, clothing)
- Identify and provide orthoses: spinal stability, abdominal restraint, anti-thrombus stockings, more.
- Re-educate to the sitting position in bed (gradualness and correct position)Identify and provide aids: wheelchair, cushion, tablet, lifter,
- Carry out the transfer, check the wheelchair sitting position and vital signs (especially BP)
- Re-evaluate: position maintenance, points of support, pain, hypotension, psychological aspect?

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

ORTESIS

C1 -C7

C7-T6

T6-L2

L2 - S1

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

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REHABILITATION OF MYELOLESION IN THE POST-ACUTE PHASE

- Rehabilitation in the post-acute phase can be defined as an "intensive rehabilitation" characterized by intensive evaluative and therapeutic interventions. It is usually placed in the so-called immediate post-acute phase of the disease, when the rehabilitation intervention can positively influence the biological processes that underlie the recovery, containing and reducing the extent of the impairment, and the disability is more modifiable; this phase may also be necessary in situations of exacerbation and relapses of the pathological event.

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Rehabilitation in spinal cord injuries
Lesson: Rehabilitation Treatment

PRINCIPLES OF TREATMENT

The care pathway can be divided into:

- Emergency phase which is the one immediately following the injurious event (generally within the first 12 hours of the trauma) in which all procedures are implemented to limit the damage resulting from the injury and are highly critical for the homeostasis of the individual;
- Acute phase relating to the period immediately following the emergency phase which continues until the general conditions stabilize;

PRINCIPLES OF TREATMENT

The care pathway can be divided into:

- Stabilization phase in which the general conditions have stabilized and any vertebral skeletal damage treated surgically or conservatively; the average duration of this phase is on average 4-6 months for paraplegics and 8-10 months for tetraplegics;
- Post-discharge or re-entry phase, which concerns the prevention and treatment of the numerous complications that may occur after discharge;

Stages of the therapeutic process

- Emergency phase: (first 12 hours after the event) survival and limitation of primary and secondary damage
- Acute phase: (until clinical conditions stabilize) clinical stability and prevention of complications
- Stabilization phase: (until discharge from the ward) monitoring of neurological recovery, functional training and prevention of complications
- Post-discharge or maintenance phase: return home, improvement of functional performance and prevention of long-term complications

Benefits of goals

- Goal setting is an important aspect of a comprehensive physiotherapy and rehabilitation programme. The process needs to be patient-centred.

- Initially, a few key goals of rehabilitation are articulated by the patient and negotiated with the multi-disciplinary team.

- These goals should be expressed in terms of participation restrictions. For example, a key goal of rehabilitation might be to return to work or school.

- Physiotherapy-specific goals then need to be identified and linked to each participation restriction goal. The physiotherapy-specific goals should be functional and purposeful activities as defined within the activity limitation and participation restriction domains of ICF and, specifically, within the ICF sub-domains of mobility, self-care and domestic life.

Benefits of goals

- These sub-domains include tasks such as pushing a manual wheelchair, rolling in bed, moving from lying to sitting, eating, drinking, looking after one's health, and pursuing recreation and leisure interests.

- Physiotherapy-specific goals are formulated in conjunction with the patient and other team members who share responsibility for their attainment. Both short- and long-term goals need to be set. These may include goals to be achieved within a week or goals to be achieved over 6 months. In addition, specific goals (or targets) should be set as part of each treatment session.

Benefits of goals

- Goals are important for several reasons. They ensure that the expectations of patients and staff are similar and realistic, and provide clear indications of what everyone is expected to achieve. If compiled in an appropriate way, they actively engage
- patients in their own rehabilitation plan, empowering them and ensuring that their wishes and expectations are met.

- Without goals, rehabilitation programmes can lack direction, and patients can feel like the passive recipients of mystical interventions.

- Goals also help focus the rehabilitation team on the individual needs of patients, and provide team members with common objectives. Perhaps most importantly, goals provide a source of motivation and enhance adherence.

Benefits of goals

- Goals are also used to monitor the success of therapy and to identify problems.

- Goals achieved indicate success and goals not achieved indicate failure. Failure may be due to any number of reasons which need exploring. For example, a patient may fail to achieve a goal because of medical complications or because equipment fails to arrive, factors which may be difficult to avoid.

- Failure to achieve goals may reflect poor therapy attendance. Alternatively, failure may indicate unrealistic goals which need
- revising.

- A risk of excessive reliance on goals to measure success is that it encourages the selection of non-challenging goals which have a high likelihood of success.

Guidelines to setting goals

- Goals should be SMART. That is, they should be: Specific, Measurable, Attainable, Realistic and Timebound.
- Physiotherapy-related goals need to be based on predictions of future independence, taking into account contextual factors such as patients' and families' perspectives, priorities and personal ambitions.
- Other factors which influence outcome include access to products, technology and support, and personal attributes such as age, personality and anthropometrical characteristics.
- Clearly, however, the strongest predictor of future independence is neurological status. Neurological status determines the strength of muscles which in turn largely determines patients' ability to move.

Guidelines to setting goals

- The goals should be performed according to the levels of innervation for key upper and lower limb muscles. However, the generalization is difficult because muscles have been grouped together even though different muscles and parts of the same muscle often receive innervation from different spinal nerve roots. For example, the pectoralis muscles consist of pectoralis minor and the sternocostal and clavicular parts of pectoralis major. These muscles receive innervation from C5 to T1

Guidelines to setting goals

- For some patients, particularly those with motor complete lesions without zones of partial preservation, it is relatively simple to look at the extent of paralysis and identify the optimal levels of independence which patients can hope to attain. For instance, patients with complete T12 paraplegia and paralysis of the lower limbs have the potential to independently dress and transfer. In contrast, patients with complete C4 tetraplegia do not. However, this type of information can only be used as a starting point.

Guidelines to setting goals

- Not only will outcomes be affected by contextual and other factors, but also by individual variations in neurological status. Often patients with the same ASIA classification have subtle but important differences in strength. For instance, a patient with C6 tetraplegia and grade 4/5 strength in the wrist extensor muscles will generally attain a higher level of function than a patient with the same level of tetraplegia but grade 3/5 strength in the wrist extensor muscles. This is not only due to the implications of wrist extensor strength for function, but also due to the fact that wrist extensor strength is usually indicative of strength in other muscles which are primarily innervated at the C6 level, such as the latissimus dorsi and pectoralis muscles. Weakness in either of these shoulder girdle muscles has deleterious implications for function.

THE EMERGENCY PHASE:

- This is how the first 12 hours after the trauma are defined. The emergency phase begins with the reporting of the accident and should end in a hospital setting (emergency room), with clinical conditions already assessed.

THE EMERGENCY PHASE:

- During the emergency, rescue workers adhere to the international scheme
  - Pre A To secure the subject
  - A airway: maintenance of the airway patency and protection of the cervical spine
  - B breathing: breathing and ventilation
  - C circulation: circulation and control of bleeding
  - D disability: neurological status
  - E exposure: discovering the patient to accurately assess him and at the same time prevent hypothermia.

THE EMERGENCY PHASE:

- If the arrival in the emergency department occurs within a certain time frame (it should be within eight hours), the NASCIS protocol is applied, ie the administration of high-dose cortisone which aims to limit spinal cord damage related to edema.
- Today there is a lot of discussion about the advantages and disadvantages of this treatment but at the moment it is still in use in emergency rooms in the Western world.

THE EMERGENCY PHASE:

- The out-of-hospital emergency phase is very important in order not to aggravate the orthopedic and neurological situation, still 5% of injuries worsen during the first phase of rescue (a percentage still high, but much lower than that of 15 years ago about 30%) .
- An essential component is the relief of associated lesions, although the picture will only be made clear by examinations and in-hospital imaging.

The critical area room

The critical area room

The monitor

- HR Range between 60 and 100
- Rhythmic rhythm or rare extrasystoles
- Blood pressure: pay attention to both the minimum and the max
- FR <24 acts min: limit of 35 for mechanical assistance.
- Pulse oximeter should never go below 94
- Temperature If> 38 ° or <35 °

In the acute phase ...

The assessment and treatment plan are aimed at:

- Framing of the case
- Prevention of complications associated with neurological level, immobilization syndrome, (respiratory, muscle, joint, skin, circulatory) pain, spasticity, anxiety, etc.
- Orthostatic position readjustment
- Search for ergonomic positions and movement strategies that improve the quality of life immediately and in the future

Rehabilitation during the acute phase

- Conventionally, "acute phase" means the period immediately following the emergency phase until the general clinical conditions stabilize.

- Rehabilitation begins already at this stage.

Rehabilitation begins already in this phase …… Why?

- evaluation and hypothesis of qualitative recovery - functional prognosis
- prevention of possible complications
- design of the rehabilitation process (project)
- promotion of strategies in order to improve the immediate and future quality of life.

Rehabilitation approach in the acute phase ...

- Assessment of damage, disability and detection of problems
- Prevention of complications associated with neurological level, immobilization syndrome, (respiratory, muscle, joint, skin, circulatory) pain, spasticity, anxiety, etc.
- Upper limb positioning and search for movement strategies that improve the quality of life immediately and in the future
- Sitting position readjustment
- Identification and customization of aids

What complications?

- Respiratory
  - Bronchial encumbrance
  - Insufficency respiratory
- Vascular / circulatory
  - Tvp – embolisms
  - Orthostatic hypotension
- Cutaneous
  - Pressure ulcers
- Musculo-articular
  - Hypostenia - muscular hypotrophy.
  - muscle shortenings
  - intra-articular calcifications

What complications?

- Pain
- Anxiety
- Alteration of muscle tone
- Urological
- Gastro-intestinal

TREATMENT IN THE ACUTE STAGE

- The global approach to the SCI patient implies a continuous process of evaluation / treatment / re-evaluation in which each member of the team collects clinical data, and each professional interprets the same data according to their own area.
- For these patients - in whom the clinical variability is enormous not only within the pathology but also within the therapeutic path of the same individual - the interpretation of the sign and its processing are fundamental: they translate into therapeutic strategies that lead to the acquisition of the best possible level of autonomy, as a function of social reintegration and psychological well-being.

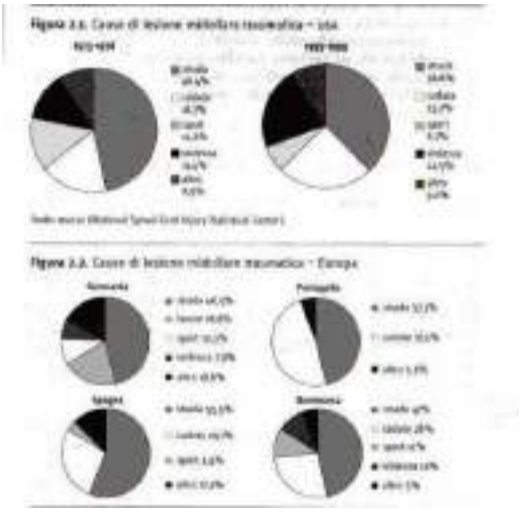
TREATMENT IN THE ACUTE STAGE

- The know-how of the physiotherapist who deals with the acute phase of spinal cord injury (in reality the same thing applies to the entire path) is very broad and very specific at the same time.
- This accounts for some of the most common (and sometimes irreparable!) treatment setting errors we face when the patient arrives in the Unipolar Spinal Unit weeks or months after the injury.

TREATMENT IN THE ACUTE STAGE

- We can simplify the physiotherapist's intervention by distinguishing:
  - postural care,
  - mobilization and kinesis,
  - evaluation and personalization of aids (sometimes directly their construction!),
  - Respiratory physiotherapy.

TREATMENT IN THE ACUTE STAGE



- The origin of the spinal cord injury is traumatic in 67% of cases and non-traumatic in the remaining 33%.
- The most common non-traumatic causes are inflammatory, neoplastic and vascular.
- The most common sites of trauma are the cervical and lumbar segments with a slight prevalence of the latter, while the dorsal segment is less represented.
- The numerical ratio of complete lesions to incomplete lesions is roughly 1: 1 even if incomplete lesions are growing.

TREATMENT IN THE ACUTE STAGE

- In the exemplification of the treatment of the subject with spinal cord injury it is preferable to refer to the traumatic origin because the lesion is stable and not developmental (e.g. in oncological pathology it is very variable)
- Moreover, the person with trauma tends to reconstruct a life as far away from the medicalization, which on the other hand is mandatory in the other forms, which makes long-term rehabilitation work indispensable and of great significance.

THE ACUTE PHASE

- It is the phase characterized by instability .. both lesional and clinical parameters
- At the end of the EMERGENCY phase (about 12 hours after the trauma), the acute phase begins which will end at the end of the spinal shock and the stabilization of the clinical parameters.
- It can last from a few days to a few weeks after the trauma, there is no certainty of the timing.

THE ACUTE PHASE

- The acute phase, defined in general, is a condition in which a subject is in a critical state in which the clinical parameters - the vital signs - are not yet stabilized and therefore the clinical conditions can deteriorate abruptly and suddenly for the most varied. reasons.
- In the medical-legal sense it corresponds to the period in which the doctor "reserves the prognosis", ie he cannot guarantee that the patient will survive.

THE ACUTE PHASE

- The concomitance of many injuries in the traumatized subject means that in the event of loss of consciousness it is assumed, until proven otherwise, that there may be a spinal cord injury.
- In fact, the main diagnostic test is CLINICAL: that is, ASIA, which requires a conscious and cooperating patient. Furthermore, the CT and MRI images are not conclusive: there may be frightening fractures in which the spinal cord is almost intact and minimal bone lesions with extensive spinal injury.

THE ACUTE PHASE

- Early detection and evaluation of associated injuries is important:
  - about one third of craniofacial trauma has a double diagnosis of cervical injury
  - almost all back fractures have associated injuries at the thoracic level, from fractures of the sternum and ribs to pulmonary compression, to hemo
  - pneumothorax of varying severity. In the most severe cases, the large vessels of the mediastinum are involved and in that case the prognosis for life is very bad.
  - the same applies to the abdominal cavity in the case of lumbar injuries.
  - in the case of a vertical fall from above, i.e. a jump, with fractures of heels and long bones and / or fractures of the sacrum and pelvis, a low spinal cord injury is generally investigated.

THE ACUTE PHASE

- The treatment of the vertebral lesion is almost always SURGICAL with decompression of the medullary canal and evacuation of bone fragments, hematomas, etc. and subsequent stabilization which, depending on the case, involves two or more vertebrae adjacent to the injured one.
- The trend towards ever faster technical evolution makes it unnecessary to go into details that will be obsolete in two years, just remember that the intervention of your patient must be known in detail in order to know the limits and contraindications to therapeutic exercise.

THE ACUTE PHASE

- In rare cases, surgery is not recommended and a CONSERVATIVE treatment is opted for, ie forced to bed for at least 60 days with no load on the injured spine; until a few years ago it was mandatory in severe osteoporosis in which the bone density was too low to ensure the sealing of the syntheses, but today it seems that with special "glues" injected into the rarefied vertebrae this problem is also solved.

THE ACUTE PHASE

- Cancer patients are very often excluded from the surgical approach, both because the vertebral collapse with consequent paralysis arrives late or in the terminal phase, and because they are often frail from many points of view and would not tolerate highly invasive interventions. Given the increase in survival in oncological pathology, a significant increase in these subjects can be expected.

THE ACUTE PHASE

- On the other hand, those who have had a spinal cord injury on a vascular basis do not need intervention (since they do not have bone lesions), except in the case that there is no room for significant edema, sometimes following the haemorrhagic lesion; it is generally a terrible complication of thoracic and / or abdominal aortic dissection repair surgery and its origin is ischemic, rarely hemorrhagic.
- Like the previous ones, they are rarely sick young, rarely with monopathology; in fact they are more demanding from the point of view of their clinical management but extremely less complex for physiotherapists who generally limit themselves to identifying basic aids (pillow, wheelchair, anti-decubitus mattress) and health education for caregivers.

THE ACUTE PHASE

- Once the vital parameters have been stabilized and the surgery performed, the traumatized person spends a shorter or longer period in an Intensive Care Unit even if the acute phase is technically ending, but the need for high assistance and highly invasive therapeutic maneuvers is still needed. and clinical control systems.

THE ACUTE PHASE

- During the operation, the patient is intubated and connected to a mechanical ventilator; the resumption of autonomous ventilation involves a series of weaning stages, during which the traumatized patient gradually regains the upper hand over the ventilation machine until he can do without it. The speed with which weaning takes place depends on many factors, in our case the main one is the preserved muscle heritage and the coexistence of traumatic or infectious lung problems.

THE ACUTE PHASE

- The management of the injured person BEGINS IN INTENSIVE CARE UNIT to ensure prevention of complications, preparation for subsequent adaptations and elaboration of the recovery plan.
- When the clinical conditions allow it, the patient is transferred to the Unipolar Spinal Unit, in the subintensive section.

THE SPINAL SHOCK

- The acute phase in the Spinal Unit normally coincides with the spinal shock: a condition of loss of functions and control below the level of the lesion, therefore loss of sensitivity, motor skills and control of the autonomic nervous system. The lesion is complete or incomplete requires a high level of surveillance and a series of clinical observations and instrumental examinations. Let's see the main complications that accompany an acute spinal cord injury.

THE SPINAL SHOCK

- Absence of any voluntary or involuntary neurological activity below the lesion.

- It manifests immediately after the trauma and can last from a few hours to several weeks until the appearance of reflexes (or hyperreflexia), hypertension and spasms, voluntary movements (at least if it is not a damage to the peripheral motor neuron)

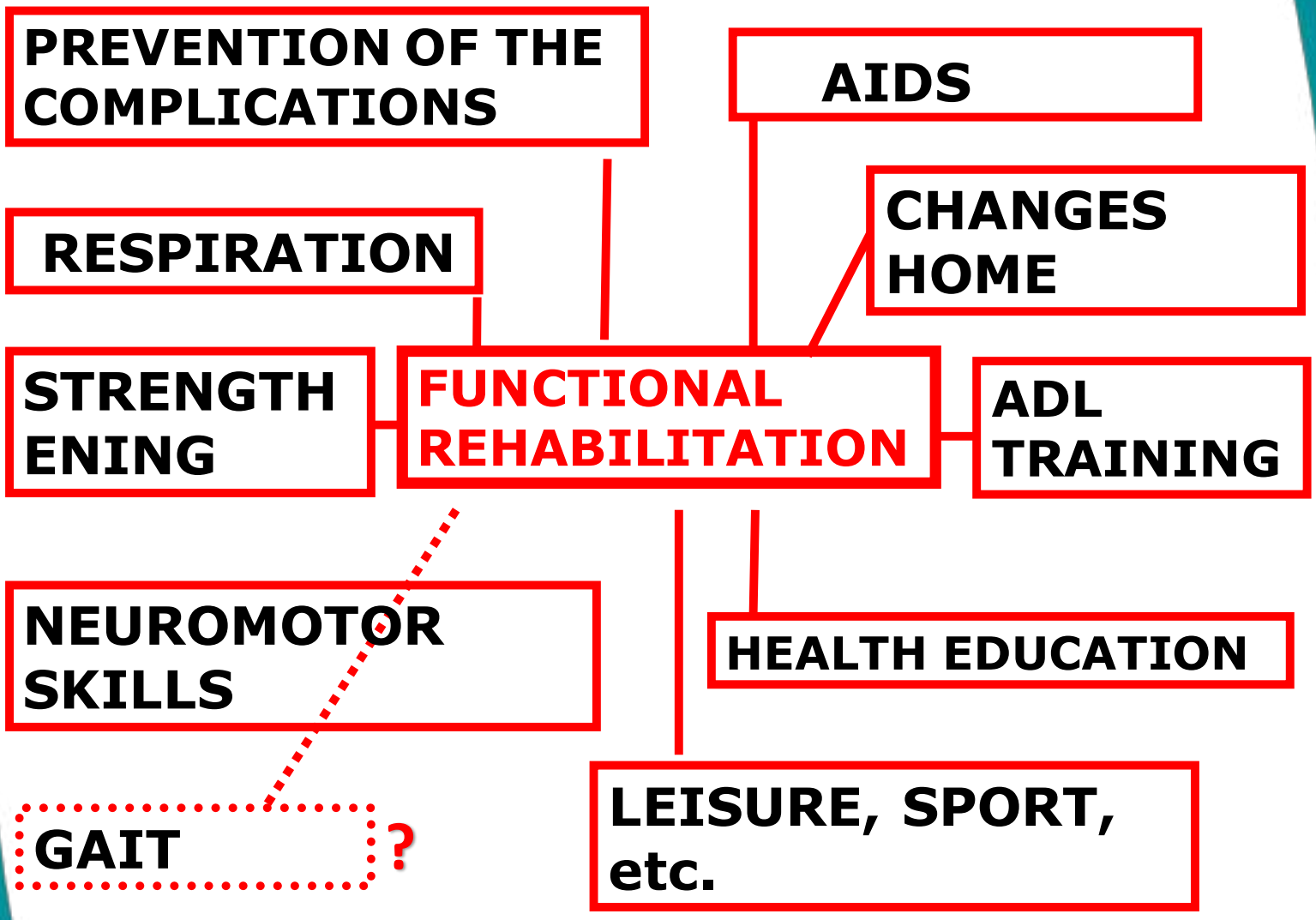
Spinal Shock Phase

- Sensory-motor paralysis
- Marked muscular hypotonia, flaccidity
- Abolition of tendon and skin reflexes
- Vasoparalysis (hypotension, reduction of tissue perfusion, hypothermia)
- Bladder sagging with urinary retention and urinary reflux
- Paralytic ileus and fecal retention
- Decrease in cardiac output, bradycardia.

In the stabilization phase ...

The assessment and treatment plan are aimed at:

- Prevention of complications
- Neurological recovery monitoring
- Functional training


PREVENTION OF THE COMPLICATIONS
AIDS
CHANGES HOME
RESPIRATION
STRENGTH ENING
FUNCTIONAL REHABILITATION
ADL TRAINING
NEUROMOTOR SKILLS
HEALTH EDUCATION
GAIT
?
LEISURE, SPORT, etc.

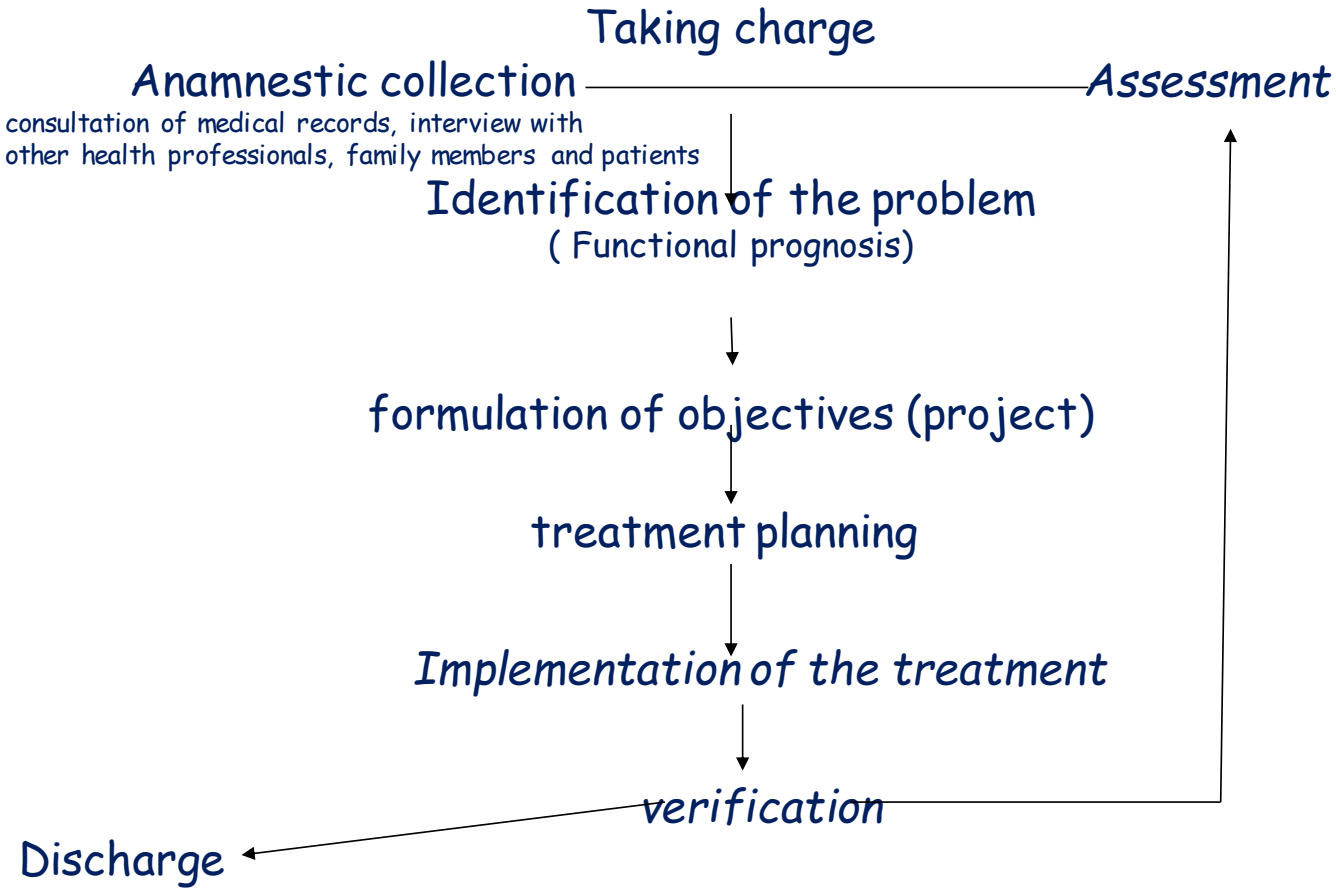
OBJECTIVES

- Maintain joint freedom capable of favoring the achievement of compensation at the shoulder, elbow, wrist and hand level.
- Strengthen the supralesional motor skills.
- Attempt to recover sub-injury motor skills
- Control of spasticity.
- Inclusion of compensation as early as possible.

INTERVENTION by the Physiotherapist

- Taking charge, anamnestic collection, consultation of instrumental tests, team consultation, interview with the patient and / or family members
- Functional evaluation and functional prognosis
- Rehabilitation project: consultation and sharing with other professionals as well as with the patient and his family.
- Treatment plan
- Implementation
- Re-evaluations and outcome checks (intermediate and final)Compilation of the file: recording of the clinical evolution (daily diary and attached documents), drafting of essential reports (discharge, aids, etc.)

Physiotherapist operating algorithm



PHYSIOTHERAPY ASSESSMENT

- It is a process that aims to identify the patient's current functional problems and to provide information on his residual potential, in order to be able to address the appropriate treatment objectives and the paths to be put in place to achieve maximum autonomy and / or self-sufficiency by level and type of injury.

GLOBAL FUNCTIONAL evaluation

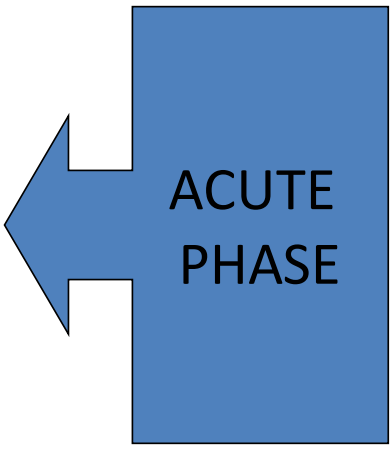
- GENERIC VARIABLES
- SPECIFIC VARIABLES
- MULTIDIMENSIONAL VARIABLES (aid plan and architectural barriers)

GENERIC VARIABLES

- Clinical history: proximate medical history, associated lesions and complications, type of intervention, instrumental tests, drugs; past medical history and pre-existing pathologies
  - Age
  - Socio-family history
  - Work / study activity, free time activity
  - Educational, cultural level
  - Housing situation
  - State of consciousness / orientation
  - Vital signs (monitor or manual detection)

SPECIFIC VARIABLES

- Neurological level
- Respiratory capacity
- Pain
- Skin integrity / edema
- R.o.M.
- Tone
- Muscle imbalances
- Posture
- Functional capabilities



- In ACUTE TRAUMATIC TETRAPLEGY it has given good results both as a control of the ventilatory paradox (reduction of respiratory rate) than as a means of bronchial clearing. (landmark: tip of the xiphoid)
- there are no studies yet! In the literature in the term "external mechanical assistance"

PRINCIPLES OF TREATMENT

- At the time of discharge, the connection between the USU and the local ASL structure that will take care of the patient is essential so that a network of health and / or social services is organized that guarantees the necessary therapeutic continuity to promote social reintegration.

PRINCIPLES OF TREATMENT

- The functional rehabilitation intervention begins in the acute phase and gradually becomes more intensive in the stabilization phase, which corresponds to the moment in which the patient begins to get up in a wheelchair and begins activity in the gym and / or occupational therapy. The distinction between the objectives of the two moments is purely "didactic" as they often overlap and their differentiation derives from priority needs linked to the clinical situation.

PRINCIPLES OF TREATMENT

The first phase is aimed at pursuing the following objectives:

- prevention of the effects of immobilization and its complications through the alternation of decubitus, the positioning of the spine and extremities in correct alignment, the mobilization of the limbs (passive, active-assisted, active);
- respiratory physiotherapy aimed at improving the mechanical structure of the wall and restoring bronchial patency through unblocking maneuvers;
- improvement of skills and motor control with active and / or active-assisted exercises in the districts spared from the injury;

PRINCIPLES OF TREATMENT

The first phase is aimed at pursuing the following objectives:

- gradual re-education in standing position first in the articulated hospital bed and then in a wheelchair using an orthosis for the spine (according to medical prescription, collar, bust), for vasopressure (vasocompressive knee-highs, abdominal belly);

PRINCIPLES OF TREATMENT

The first phase is aimed at pursuing the following objectives:

- In cervical lesions particular attention is paid to the positioning of the hand, seeking a functional attitude that allows to obtain a functional tenodesis of the flexors of the fingers (so-called "automatic hand"); the shortening must be reversible, the complete articular excursion at the level of the interphalangeal joints must be maintained so in the case of neurological recovery normal motor skills can be restored (supported by the use of splints that facilitate harmonious recovery and counteract the onset of deformity);

PRINCIPLES OF TREATMENT

The first phase is aimed at pursuing the following objectives:

- Identification and / or packaging of aids and / or orthoses to facilitate the autonomous performance of daily activities such as nutrition, personal hygiene, etc.

PRINCIPLES OF TREATMENT

In the stabilization phase, the emphasis of functional rehabilitation treatment is placed on the following objectives:

- research and promote motor skills through neuromotor techniques, hydrotherapy, muscle strengthening, bio-feedback, balance exercises, straightening sequences;
- reduce / inhibit spasticity by looking for suitable postures, stretching, relaxation exercises and refining the quality of movement;
- reduce / inhibit pain through the search for appropriate positioning and mobilization; physical therapy

PRINCIPLES OF TREATMENT

In the stabilization phase, the emphasis of functional rehabilitation treatment is placed on the following objectives:

- train independence in daily life activities (A.D.L.) with Occupational Therapy training (clothing, personal hygiene, nutrition, travel, transfers, wheelchair mobility, as well as communication and play / recreational activities, etc.);
- to train patients in whom the necessary pre-requisites exist;
- readjustment to the vertical position (standing wheelchairs, vertical stabilizer, use of braces);
- postural re-education for the prevention of vertebral alterations and / or deformities;

PRINCIPLES OF TREATMENT

In the stabilization phase, the emphasis of functional rehabilitation treatment is placed on the following objectives:

- research and identification and / or packaging of aids that facilitate / allow autonomy in the activities of daily life listed above;
- supply (through practices with the competent A.S.L. or I.N.A.I.L.) or construction of the basic aids identified;
- training in the use and maintenance of the identified aids;
- health education of the patient and / or family members to manage the problems resulting from spinal cord injury at home; consultancy for environmental changes;
- driving test advice;
- sport therapy (table tennis, swimming, archery, basketball, tennis)

PRINCIPLES OF TREATMENT

- Within this list, both the objectives and the treatment techniques are chosen on the basis of the major problems encountered during the evaluation and in accordance with the clinical status of the patient, in order to allow their reintegration into the within their socio-family context.

Skin management

- Pressure ulcers are one of the commonest and most troubling complications of spinal cord injury.
- They can occur at any time and are a source of frustration and disruption to patients' lives and rehabilitation.
- In the long term, they can prevent individuals from successfully holding jobs and they can adversely affect quality of life.
- They can also increase spasticity and pain, and predispose to autonomic dysreflexia and contracture. In severe cases, pressure ulcers develop into large wounds which become infected, leading to osteomyelitis and other serious medical complications which may be fatal.
- In some developing countries with limited resources, life-threatening pressure ulcers are a constant threat.

Prevention of pressure ulcers

- The key to pressure management is prevention.
- Prevention requires a multifaceted and interdisciplinary approach involving education, good nutrition, anti-spasticity medication and strategies to ensure regular changes in position.
- Perhaps more importantly, prevention involves the appropriate prescription of pressure-relieving equipment such as bed mattresses, wheelchair cushions and wheelchairs.

Regular change in position

- Recently-injured patients confined to bed are initially turned every 2 hours.
- The frequency of turning is gradually decreased but depends on many factors, including the type of mattress upon which the patient is lying and susceptibility to skin problems.
- Once patients start to sit in their wheelchairs, they need to relieve pressure from under the ischial tuberosities at least once every 15–30 minutes.
- Some evidence indicates that the lift should be sustained for approximately 2 minutes.

Regular change in position

- The frequency and length of pressure relief can often be decreased over time, but only in conjunction with careful monitoring. There are many different ways pressure can be relieved when sitting. A vertical lift that clears the buttocks from the seat is the most commonly used method by those with sufficient upper limb strength. Patients unable to perform a vertical lift can relieve pressure by regularly leaning forwards or sidewards, or, if necessary, by resting forwards with their arms on a table.
- Patients with high levels of tetraplegia sitting in power wheelchairs can redistribute pressure by regularly changing the tilt of their wheelchairs and elevating the feet

Patient, staff and family education

- Education of patients, staff and families is an important aspect of pressure care management.
- All must be made aware of the appropriate use and maintenance of pressure-relieving equipment. A common mistake is to place a wheelchair cushion upside down or around the wrong way.
- This usually reduces the pressure-relieving qualities of the cushion.
- Skin needs to be checked daily and, initially, more regularly if trialling new equipment.

Patient, staff and family education

- Patients need to be aware of the first signs of skin damage. They also should know how to appropriately manage problems when they arise. Adequate pressure relief is particularly important when sitting in cars or on commodes or other hard surfaces. Similarly, pressure from orthoses, splints, straps or casts can be a problem and these need careful monitoring. Medical sheepskin overlays can be used to relieve shearing forces although they should not be used on top of most pressure-relieving cushions or mattresses.

Pressure-relieving equipment

- Pressure-relieving equipment is important for effective skin management. Its prescription is sometimes the responsibility of physiotherapists but more often occupational therapists.
- Therapists prescribing this type of equipment would be well advised to seek additional information and training.
- Prescription of pressure-relieving equipment is something which requires careful consideration with deleterious consequences for patients if it is done poorly.

Pressure-relieving equipment

- Equipment that has provided adequate pressure protection during hospitalization may prove to be insufficient when patients return home. This is partly because patients regularly change position as part of therapy and nursing care programmes when in hospital but may not change position as frequently on discharge. Skin problems at home can be avoided by trialling pressure-relieving equipment under conditions that closely mimic the home situation.
- For example, patients unlikely to turn at night when home need to trial bed mattresses under the same conditions while in
- hospital. If in doubt, it is better to err on the side of caution and prescribe overprotective equipment.

Bed mattresses

- There are many different varieties of pressure-relieving mattresses.
- Mattresses may be either foam-, air- or water-based. The more expensive ones use power to cycle air through different chambers, systematically alternating pressure.
- A recent Cochrane systematic review concluded that in people at high risk of developing pressure ulcers, foam mattresses designed for relieving pressure are superior to standard hospital mattresses. The merits of more elaborate and expensive mattresses have not been scientifically validated, although most clinicians consider them superior to foam mattresses.

Wheelchair cushions

- There has been growing commercialization of wheelchair cushions and there are now hundreds of different types on the market. Most are air-, foam- or gel-based, and designed for specific purposes. The most important pressure-relieving quality of a cushion is its ability to minimize pressures in the soft tissues overlying the ischial tuberosities. These pressures can be measured with either simple or sophisticated equipment designed to measure skin interface pressures.
- However, there is not one critical pressure, below which patients are safe from skin damage and above which they are not. It depends on many factors, including the length of time that pressure remains unrelieved.
- As a general rule, however, peak pressures over vulnerable sites should be kept well below 60 mm Hg

Wheelchair seating

- Poor seating is a common cause of pressure. Soft tissues that are weight bearing or in contact with the wheelchair, especially those overlying the ischial tuberosities, are most vulnerable to the destructive pressures associated with prolonged sitting. These pressures are influenced by factors such as height of the footplates, tilt of the pelvis, tilt of the wheelchair and length of the seat. For example, footplates which are too high shift weight posteriorly, concentrating pressure over the ischial tuberosities.

- A posteriorly rotated pelvis turns the sacrum into a weight-bearing area, increasing susceptibility to sacral pressure ulcers. A seat which is too short distributes the weight of the thighs over a smaller surface area, increasing pressure. All these issues need to be considered when prescribing wheelchairs.

- Patients with deformities present complex seating problems because correction of deformities invariably requires the application of pressure. Most solutions involve dissipating pressure over wide areas, preferably through soft tissues that do not overlie bony prominences.

Treatment of pressure ulcers

- Not surprisingly, the treatment of pressure ulcers includes strategies to minimize pressure.
- These must be instigated with the first signs of destructive pressure, and may include confinement to bed, adjustment of a wheelchair or cushion, remoulding of a hand splint, realignment of an orthosis, or education.
- If a severe pressure ulcer develops, hospitalization may be required for many months, with or without accompanying surgery. For further details, interested readers are directed to clinical practice guidelines on the treatment and prevention of pressure ulcers.

Prevention of musculo-articular limitations

- Loss of active motion, acute phase bed rest, muscle imbalances between agonists / antagonists in denervated or hypertonic muscles, the use of orthoses to stabilize the spine (collar, torso), the presence of pressure ulcers, etc. they can cause muscle-joint limitations.
- Prevention therefore begins already in the acute phase and continues also in the stabilization phase through:
  - the alternation of decubitus;
  - positioning of the spine and extremities in correct alignment;
  - mobilization (passive, active-assisted, active of the 4 limbs and the spine).
- Warning: in case of conservative treatment of the vertebral fracture or in case of instability of the spine during mobilization, do not exceed 90 ° of flexion of the shoulder and 45 ° of flexion of the hip with knee extended.

Prevention of musculo-articular limitations

Paraplegic subjects and in some cases also quadriplegic subjects learn in the stabilized phase to perform self-mobilization of the lower limbs in order to:

- maintain passive joint excursion in joints without motor control in a self-managed way;
- facilitate dressing maneuvers in bed and / or in a wheelchair;
- favor the re-appropriation of the paralyzed part of the body.

Prevention of pressure ulcers

Pressure ulcers form more frequently in those areas of the body where the subcutaneous muscle layer between the bony prominence and the support surface is less or absent:

- supine position: sacrum, ischium, heel, scapulae, vertebral spinous process and occipital region;
- prone position. iliac crests, knees, dorsum of the foot;
- lateral decubitus: trochanters, femoral condyles, external malleoli, elbows;
- Sitting position: ischial tuberosities.

Prevention of pressure ulcers

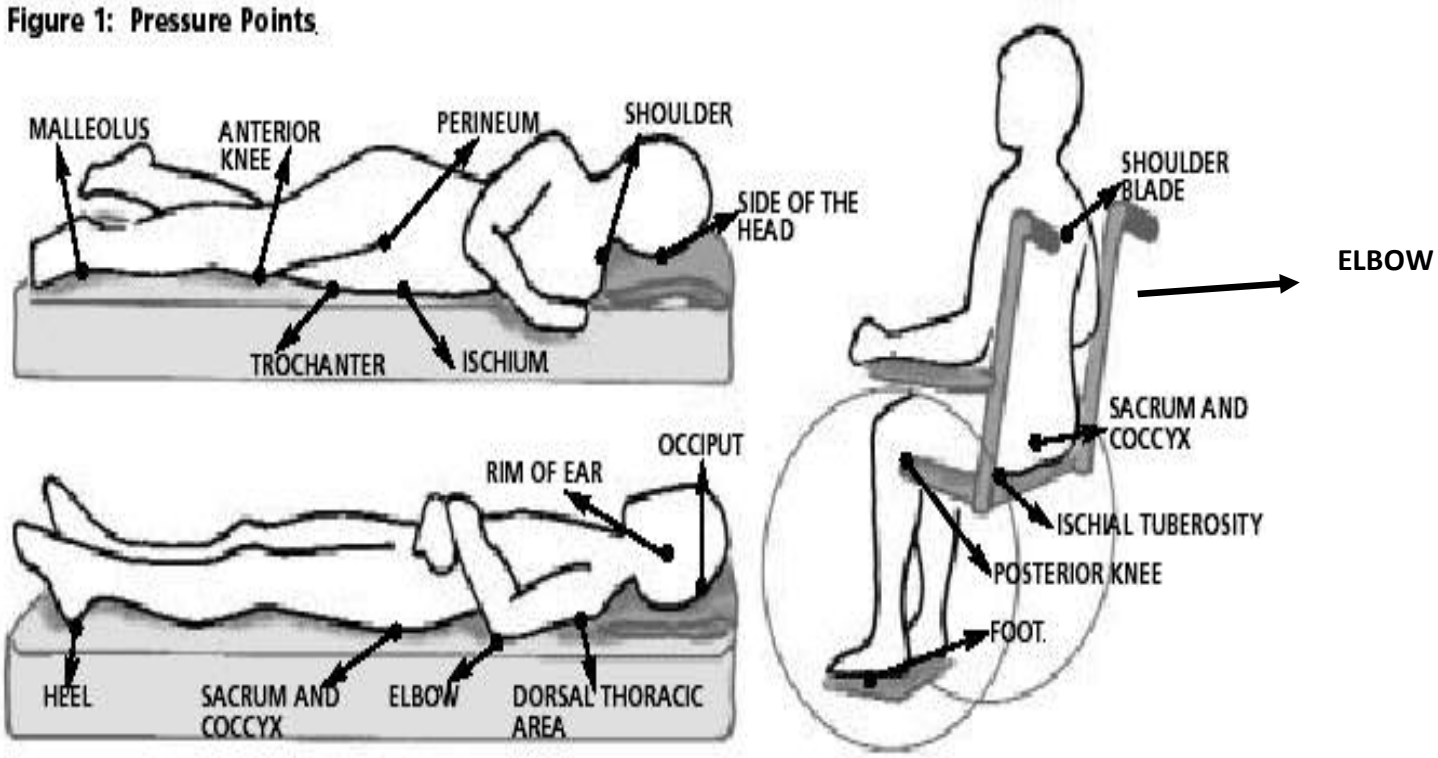
The most effective treatment is prevention through an accurate patient education program and the use of anti-decubitus devices. In particular:

- perform skin inspection, especially in areas at risk, in the morning before getting up and in bed in the evening; for this purpose it may be necessary to use a mirror in the skin areas that are more difficult to see; if even initial signs are detected that characterize the pressure ulcer, avoid skin compressions in those areas by assuming alternative positions;
- always carry out a thorough perineal hygiene after each urination and evacuation, dry the skin well after a shower;
- avoid burns, erythema, chilblains;
- in bed, alternate positions every 3-4 hours;

Prevention of pressure ulcers

- make the transfers avoiding crawling or rubbing the skin tissues, thus lifting the body from the support surface and eliminating anything that can cause damage to the patient and that can hinder the transfer (side rails, armrests, platforms, etc.),
- the person in a wheelchair must learn to relieve pressure on the ischial region by lifting periodically; if it is not possible to rise, it is necessary to bring the trunk forward or to the side in order to unload the ischial area;
- take care of the maintenance of the anti-decubitus devices (pillows and mattresses) which must be checked periodically in accordance with the manufacturer's instructions.

SKIN EVALUATION



Observation and assessment of risk areas

Staging of pressure ulcers

- 1st: erythema not reversible to acupressure
- 2nd: partial type lesion (epidermis or dermis): abrasion, blister or a slight cavity;
- 3rd: full thickness lesion (necrosis of the skin tissue (deep cavity with serous exudate);
- 4th: tissue necrosis with involvement of the muscle bands and / or bone tissue;

SKIN COMPLICATIONS

- Formation of compression ulcers due to pressure on capillaries, stretching or slipping of tissues, or frictional forces.

Skin complications prevention

- Correct positioning to reduce compression and stretch forces on soft tissues (especially in semi-sitting position) use semi-fowler position
- Use aids for the correct pressure distribution (pillows, anti-decubitus mattresses, articulated bed, gel supports,) and avoid direct pressure on the bone protrusions
- Vary the placement every 2-4 hours(if allowed by clinical conditions, based on aids and skin condition)

Skin complications prevention

- If it is impossible to perform a positioning every 2 hours, devices for the correct distribution of pressure must be used (anti-decubitus mattresses
- If you use these aids, you can change your position every 4 hours at most. If we use static mattresses, if I use dynamic air aids "even more hours" (Evidence C)

Skin complications prevention

- The use of ring aids (donuts) is strongly discouraged. (Evidence C)
- In bedridden and completely immobile subjects, the heels must always be raised from the bed surface. No anti-decubitus mattress can preserve heels from pressure ulcers (Evidence C)

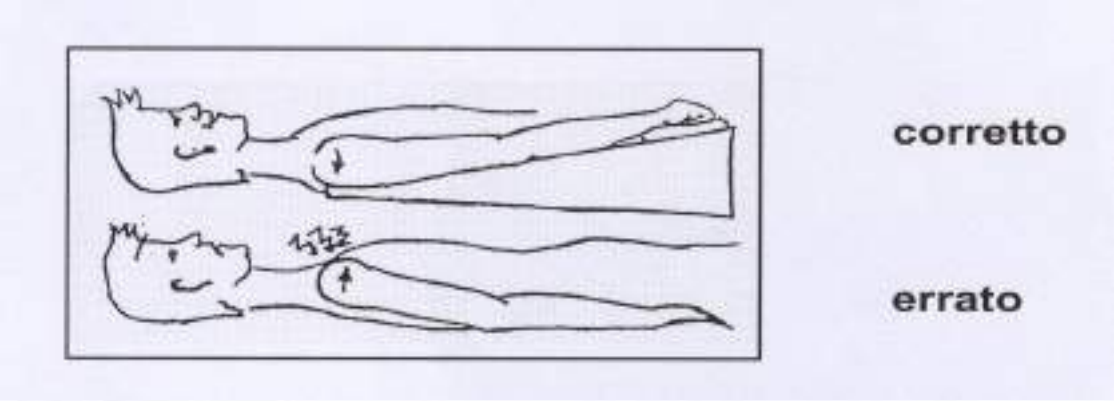
Skin complications prevention

- Global daily visual and tactile inspection of the skin (Evidence C), in particular of:
  - Ischium
  - Sacro-coccygeal area
  - Trochanters Heels

Positioning with aids

- On pillows
- Low memory mattresses
- Communicating air cell mattresses
- Air chamber systems with alternating cycle
- Dynamic pressure redistribution systems (fluidized air beds, air release beds)

POSITIONING



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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

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MUSCLE-JOINT COMPLICATIONS

- Joint limitations
- Shortening of muscles or tendons
- Calcifications
- Skeletal deformities
- Osteoporosis and Pathological Fractures
- Muscle imbalances
- Spasticity
- Pain

Prevention of musculoskeletal complications

- Correct positioning
- Change of position
- Spasticity-inhibiting postures
- Passive or active assisted mobilization
- Stretching
- Postural exercises
- Correct posture education
- Identification and application of splint and orthosis

Change of position

Lateral / flank avoid direct pressure on the trochanters (30 ° semi / lateral positioning)

- Supine
- Lateral
- Semi-seated
- Prone

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Supine position and in antitrendelemburg

Positioning

- Bedsores prevention
- Muscle-tendon shortening prevention
- Edema prevention
- Pain prevention
- Search for functional positioning of the upper limb
- Spasticity Inhibition

NO

- Elevation of the scapula
- >Scapula adduction
- Shoulder abduction
- Elbow flexion
- Supination forearms
- Finger extension

YES

- Depressed scupla
- Scapula protracted
- Shoulders slightly abducted,
- Elbows extended
- Forearms pronated
- Hand closed into a fist- → elbow and hand higher than shoulder level

Supine position

- Avoid neck flexion (one pillow under the shoulders and one under the head)Spine aligned
- Also in neutral position between internal and external rotation
- Knees not hyperextended and heels isolated (with pillow)
- Neutral ankles and extended toes (avoid weight of blankets)
- In general, an inclination of the back of the bed of 15 ° -30 ° is allowed without having to apply an orthosis for vertebral stability, as long as the knees are flexed at 30 °: this allows to reduce the load at the ischial level.

PREVENTION OF DECUBITUS INJURIES

- Important scientific production, only a small part dedicated to the SCI patient
- Very different evaluation, treatment and prevention protocols
- Paralyzed Veterans Administration 2000: guidelines for prevention, evaluation, local, general, surgical therapy, postural norms and aids

PREVENTION OF DECUBITUS INJURIES

- Identification of local and general risk factors
- Daily surveillance of high-risk areas (ischium, sacrum, trochanter, heels)
- Postural changes every 2 hours in the acute phase
- Lack of evidence for hyperbaric oxygen therapy

PREVENTION OF DECUBITUS INJURIES

- The use of local electrical stimulations is recommended
- Adequate bed
- Correct posture in the wheelchair
- Anti-decubitus pillow
- Patient and family education

Tegumentary apparatus

- The skin is a complex structure whose trophism is ensured by many factors. A traumatized person may have associated injuries of many types that should be considered areas of respect and should be consulted with a physician. In addition, the lack of nerve regulation leads to a very slow regeneration of the tissues, which results in the possibility of infectious complications on the wounds themselves. Lack of sensitivity causes injuries, abrasions, burns to occur without the patient noticing, so inspection by staff must be constant and very careful.

Tegumentary apparatus

- A particularly frightening lesion is PRESSURE INJURY, formerly known as pressure sore, which occurs due to prolonged ischemia resulting in necrosis. In the spinal cord, the systemic circulation is slowed down by immobility, by a reduction in blood pressure, by a lack of muscle tone and an active contraction of the skeletal muscles.

Tegumentary apparatus

- The bad trophism of the skin combined with these factors means that even a redness is an enemy to be identified and fought promptly.

Tegumentary apparatus

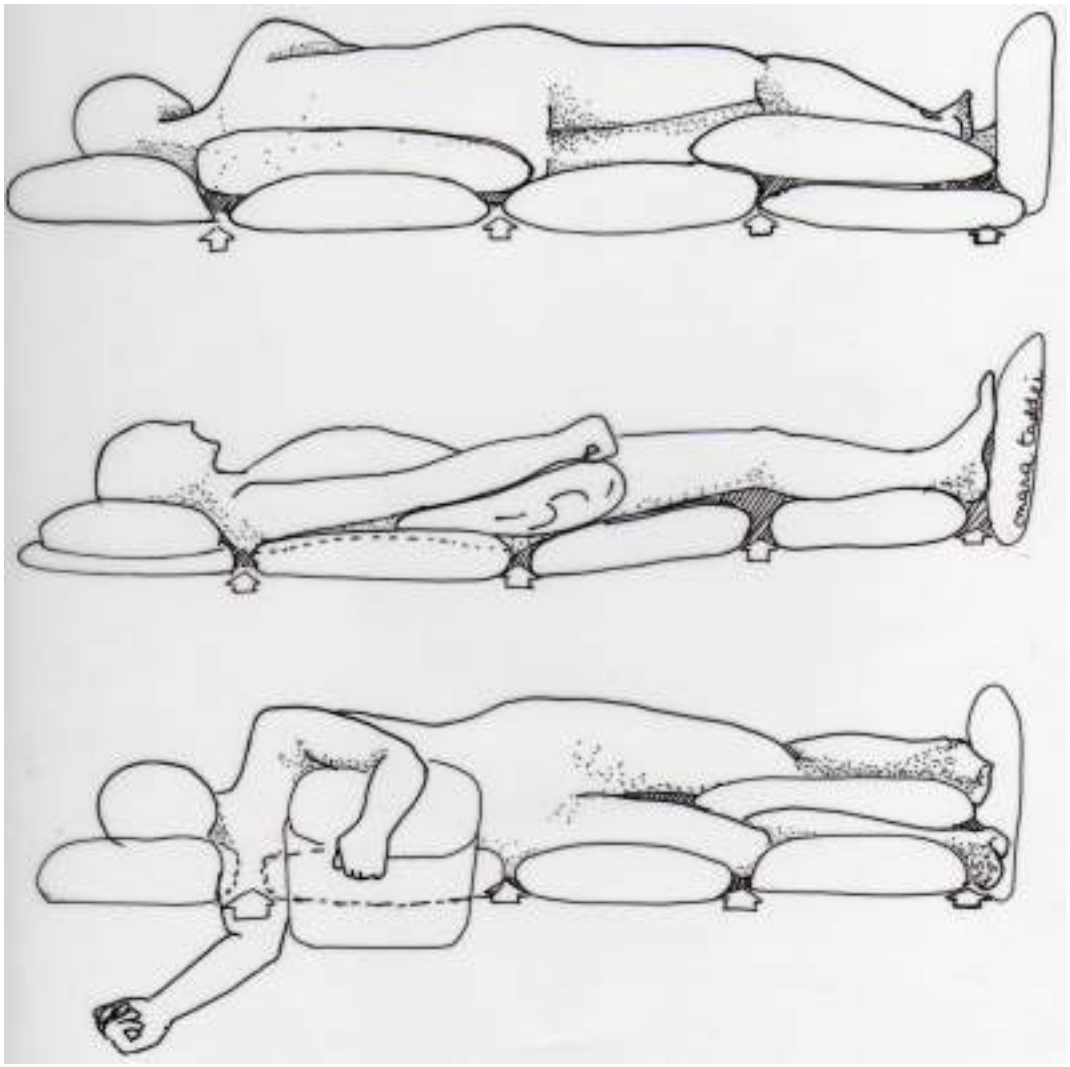
- The site of redness, and subsequent injuries, is almost always a bony bulge:
  - supine position: occipital bone, scapula, spinous processes, iliac crest. SACRUM, ischium, Achilles tendon. Heel and sole of the foot.
  - prone position: ear, elbow, anterior thorax, anterior iliac crest, thigh, knee, ankle, dorsum of the foot, big toe.lateral decubitus: ear, shoulder, iliac crest, trochanter, medial epicondyle, lateral epicondyle, lower leg, medial malleolus, lateral malleolus and lateral edge of the foot
  - sitting position: scapulae, sacrum and coccyx, ISCHIUM, popliteal cord, heels and sole of the foot.

Tegumentary apparatus

- The positioning schemes promoted by the operators of the Spinal Units, and in particular Ida Bromley of Stocke Mandeville, are partially overcome by the introduction of alternating inflated air beds, but the principles of positioning on pillows and the concept of respect for bone prominences in 24 hours are assets not to be dispersed for two reasons:
  - it is not said that an acute myelosis arrives in the first hours in a specialized and equipped center (we think of a development project of second and third world and we imagine the role of the physiotherapist in a generic hospital with limited resources)
  - it is not obvious that a person with a chronic injury, hospitalized for intercurrent complications, has a Spinal Unit. Positioning and 24-hour adjustments may need to be made in a medical department

Tegumentary apparatus

- Memorize it keeping in mind the points of relief from the pressures because it can also be useful in the chronicle in the nursing home or at home.
- In a patient con SCI, the skin is a priority: a decubitus injury excludes any other therapy because it heals within months and sometimes does not heal at all, leaving a site always ready to reopen at the slightest distraction.



c) Prevention of orthopedic problems (muscle-tendon shortening, joint limitations, bone decalcification)

- To prevent possible muscle-tendon retractions in the limbs and postural alterations of the spine due to prolonged sitting in a wheelchair, it is important not only the appropriate choice of the wheelchair but also a program of active exercises carried out by the patient, easily learned and also perform while seated

c) Prevention of orthopedic problems (muscle-tendon shortening, joint limitations, bone decalcification)

- The sequence of exercises must be performed every day in order to prevent spinal deformities and maintain the musculo-articular excursion of the limbs (postural re-education).

c) Prevention of orthopedic problems (muscle-tendon shortening, joint limitations, bone decalcification)

In general, moreover:

- Regularly carry out passive mobilization of the joints without motor control, on the instruction of the physiotherapist. Movements must be slow and gradual throughout the joint range (R.O.M)Assumption of the vertical position by means of verticalization aids (Stabilizer, verticalizing wheelchair)
- Stretching and other therapeutic interventions to reduce spasticity
- Regularly assume and change postures that allow for good alignment of the head, trunk and limbs.
- Adoption of a diet that guarantees a constant supply of calcium

MOBILIZATION AND KINESI

• Also for mobilization and kinesi we can simplify schematically: a) mobilization can be passive, active assisted or active; the three modalities must be specified for limbs or for limb segments.

b) for each joint there is a tendency to reach the complete Range of Movement (ROM) in a slow and repeated way; exceptions are:

- - the glenohumeral joint in cervical lesions that are not stabilized, or stabilized but unsafe; in this case we remain within the 90 ° ROM in all directions so as not to involve the shoulder girdle;
- - the coxofemoral joint in back and lumbar lesions: the lower the level of bone lesion, the lower the angle of flexion allowed;

MOBILIZATION AND KINESI

- c) an attempt is made to maintain the muscle length of the greatest number of groups (especially stretching of the innervated groups that have paralyzed antagonists) and the muscles of the posterior lodge of the lower limbs (hamstring, etc.) are stretched to facilitate the sitting position with legs extended.
- d) the presence of pain requires the differential diagnosis on its origin; variations in intensity, type and trend are observed. It can be a reason for stopping treatment;
- e) mobilization is repeated twice a day;

MOBILIZATION AND KINESI

- f) if it is possible to increase the activity against resistance, we remind you that:
- *** the muscles that have paralyzed antagonists are not strengthened! (see brachial biceps / triceps);
- *** very limited loads are used (1 kg or a little more) because resistance is significant only as a contrast to non-use, not as strengthening (which is postponed to the stabilization phase).

MOBILIZATION AND KINESI

- Towards the end of the acute phase, specific activities are introduced to facilitate access to the wheelchair and increase the amount of "activities of daily living" (ADL). The postural readjustment to the sitting / sitting with legs down / semi-vertical position is introduced; at the beginning, the degree of verticalization in bed is increased, then the transition to the reclining wheelchair or, more rarely, to the static table. Orthostatic hypotension characterizes all position changes and can constitute a significant brake on the rehabilitation process

MOBILIZATION AND KINESI

- Maintaining the semi-sitting position in a wheelchair is potentially dangerous for the pelvis to slide forward and the consequent disastrous formation of skin lesions. In general, a “postural” wheelchair (with seat tilting) is preferable to a simple wheelchair with a reclining backrest. An inclination of 5 ° on the horizontal plane of the seat is sufficient for the pelvis to remain well seated without slipping (fig. 6).

- Fig. 6 - a) In the sitting position the patient tends to slide forward causing a stretching dangerous for the sacral area and ends up not having a safe load distribution over the entire support base, also due to the raised lower limbs; in b) we can see how a 5 ° inclination on the horizontal plane maintains the torso-thigh angle at 90 ° avoiding slipping and misalignm

MOBILIZATION AND KINESI

- The first lift in the wheelchair is a very important moment for both the patient and the physiotherapist, you take all the time you need and calculate all the variables (aids, number of operators, adverse events ...)

MOBILIZATION AND KINESI

- a) prepare the patient: at least one week before getting up, the patient begins postural re-education, that is, orthostatic readjustment. In addition to the problem of hypotension, there is another component that should not be underestimated, that is, the patient must get used to checking with his eyes the body that no longer has proprioceptive sensitivity. It can be a very tough time to deal with so let's take care to reinforce the positive message of "finally out of bed!".

MOBILIZATION AND KINESI

- During this week it is essential that the vasopressure aids are already in place and that they are worn for the first lift. In addition, it may be necessary to wear a corset or collar, which must be previously customized and worn on the supine patient.

MOBILIZATION AND KINESI

- The patient must be dressed: there is no excess of zeal, thermoregulation is compromised, there may be hypothermia without a sensation of cold (or the temperature may rise for a few hours of exposure to the sun). In particular, you have to check the clothes, better to use natural fibers and make sure that the stitches are thin and do not remain under the support surface. The shoes must be at least one number larger, softer, with smooth internal ribs and when wearing them, care must be taken that the fingers are well extended, otherwise the flexion of the fingers with the rubbing of the back against the upper will cause redness and lesions.

MOBILIZATION AND KINESI

- b) prepare the aids: the wheelchair must be chosen according to the level of injury to the type and therefore to the residual functional capacities, it will often be a recliner or better still a postural one. The size of the seat (in width and depth) must be adequate at the start, while the height of the backrest, the headrest (always!), The footrests with leg rests and the armrests will be adjusted to the patient after the transfer. The anti-decubitus pillow must be of a suitable size and of a safe type: in the first lifts it is preferable to be too cautious. If the cushion is air-filled, the swelling can be adjusted after the transfer.

MOBILIZATION AND KINESI

- To make the transfer you use the sliding board (rollboard) with the level of the bed and that of the wheelchair compatible: generally the rollboard allows a difference in height of 15/20 cm. It is good not to try to transfer seated, so no tablets and even less taken between the knees. If there is really no rollboard, it is better to transfer with a lift or a stretcher with three or four operators (but the latter is very tiring and must be kept between emergency maneuvers).

MOBILIZATION AND KINESI

- It goes without saying that the brakes must be perfect, the pull-out sides and the pressure points on arrival all checked again. The torso is not used as a grip point and the patient is not pulled by the arms! It moves with force on the tracks and supports the legs and head.

MOBILIZATION AND KINESI

- c- Prepare the operators: it is not trivial, it is not certain that all nurses and OSS know how to make a transfer of this type. In any case, you decide first who does what and make sure that no one does a maneuver that hinders the others.

MOBILIZATION AND KINESI

- d- Prepare the setting: starting a maneuver and realizing that something essential is not in the room, that the bladder catheter is pulling or a drip is being removed, presupposes going back, fixing things and starting over. Then make sure that the therapy aids are made safe, that everything you need (even if any) is at hand, that the maneuver is safe and ergonomic for the patient and operators.

MOBILIZATION AND KINESI

- e- Check the clinical status: the patient must never be left alone at the first lift, especially if the lesion is high and ringing the bell is difficult. Blood pressure and heart rate should be checked regularly and the chair extended at the first sign of critical hypotension. Sometimes fainting is not preceded by dizziness but simply by repeated yawning.

ROM Assessment

- GONIOMETRY
- MUSCLE LENGTH TEST

- Don't forget to consider:
  - any pre-existing pathologies
  - clinical condition of the patient
  - short-term revaluation

RESPIRATORY PHYSIOTHERAPY

- Flaccid sub-injury paralysis severely impairs ventilation, especially as it establishes itself acutely. Until a few years ago, the treatment of the quadriplegic patient was essentially based on techniques typical of COPD, and only recently the long-term survival of severe paralyzed patients follows a rationale typical of restrictive wall pathologies. In this sense the most authoritative sources are Estenne and De Troyer in Europe and John R. Bach in the United States.

Respiratory rehabilitation

- Of fundamental importance in the acute phase as it allows the prevention of respiratory complications, also reducing the frequency of recourse to tracheotomy, it must also be continued in the subsequent phase for correct respiratory prophylaxis, especially in cervical and upper thoracic lesions (up to D6) .
- For C1 to C3 lesions, without voluntary control over the diaphragm, permanent assisted ventilation is required.
- Patients with lower cervical lesions retain the ability to breathe autonomously but are extremely vulnerable to secondary complications such as bronchopulmonary foci, pulmonary atelectasis, acute respiratory failure.

Respiratory rehabilitation

- Trauma so violent as to cause bone damage is often accompanied by a range of soft tissue injuries: especially in thoracic injuries in which the lungs are involved in various capacities with hemothorax/ pneumothorax, aortic or mediastinal injuries, etc. which implies that a good number of acute bone marrow patients are also post-thoracic surgery.
- In the stabilized phase, the level of injury and the patient's age have a predictive value on the incidence of respiratory complications. The degree of completeness is minimally predictive, while the years elapsed since the injury seem to have no influence on the incidence of mortality.

Respiratory rehabilitation

We briefly describe the problems and methods of physiotherapy treatment:

- instability of the chest wall during breathing; for injuries above D6 it is essential to resort to physical means (orthoses) for the mechanical stabilization of the thorax and containment of the paradoxical dynamics of the breath by means of an abdominal vent;
- respiratory fatigue due to overload of the residual muscles; useful cooling down techniques and positive pressure ventilation (BiPAP.);
- alveolar hypoventilation with areas of microatelectasis, loss of thoracic distensibility; it is necessary to improve ventilation with techniques such as deflation, P.E.P., positive pressure ventilation (BiPAP);

b) Prevention of respiratory complications:

- For correct bronchial hygiene in general rules of behavior such as: abstention from smoking, frequent postural changes, avoid dehydration, avoid sedentary lifestyles compatibly with the residual functional potential, recommend flu vaccination

b) Prevention of respiratory complications:

- The signs that should alert you to a possible respiratory compromise are non-specific, but must be recognized and followed carefully: for example, inhaling more frequently during speech, needing to make food into smaller pieces in order to eat, have a cough productive that stops suddenly without relief of other symptoms.

b) Prevention of respiratory complications:

- Whenever there is a fever, even if not of a respiratory type (flu or cooling) that requires stay in bed, a stasis of bronchial mucus can be established.

b) Prevention of respiratory complications:

With lesions greater than D6, respiratory problems must be prevented by:

- Frequent changes of position with a preference for the prone position.
- Activities, including playful ones, which involve respiratory education, eg. sing, blow up a balloon, speak loudly, etc.
- In tetraplegics, and in subjects with a previous obstructive pathology, even good self-management is not enough. The use of a non-invasive ventilator Must be trained to prevent micro atelectatic outbreaks and to resolve acute infectious situations
- In the presence of bronchial obstruction, adequate cough assistance maneuvers carried out by self-management or by the caregiver

RESPIRATORY EVALUATION

- Vital parameters instrumental examinations
  - FC, FR, PA, temperature,
  - O2 peripheral saturation monitoring
  - Chest x-ray, CT, blood gas
- Auscultation
  - wet / dry noises
  - hypophonesis
- Cough
  - effectiveness
  - type and quantity of secretions

RESPIRATORY EVALUATION

- Mechanical alterations
  - chest mobility
  - paradoxical movements
- Respiratory fatigue
  - Fr> 30 dyspnea
  - Sat O2 <92%
  - increased breath paradox

RESPIRATORY COMPLICATIONS

- Chest instability (paradoxical breathing)
- Hypoventilation
- Respiratory fatigue
- Ineffective cough
- Bronchial encumbrance
- Respiratory failure

Prevention of respiratory complications

- Containment orthosis
  - Stabilization of the cage by positioning the elastic girdle and Sanglage
- Cool-down techniques
  - Exhalation released controlled exercise
- Bronchial clearance exercises
  - Bronchial drainage techniques: positioning, exhalation with parted lips, P.E.P.
- Volume assisted cough:
  - Mechanical assisted cough: chest squeezing

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

COUGH

AIR- STOCKING

WITH AMBU

WITH POSITIVE PRESSURE GENERATOR (FAN, ETC.)

PERIPHERAL DRAINAGE

What techniques?

- Flow acceleration: these are generally tiring techniques, often check the parameters of FR and O2 saturation
- Expiratory brakes (expiratory incentives with resistance): fatigue aside, they only work beyond a certain flow, so evaluate well!
- PEP MASK: possible beyond a certain CV! Never under a liter

PERIPHERAL DRAINAGE

- DEFLATION
- Puts the chest into an expiratory position forcing the same volume of air to circulate in "tubes" of smaller caliber,
- in this way a passive acceleration of the flow is obtained

DEFLATION

- The DEFLATION applies somanual
- by positioning (ELTGOL) through sanglage: 5 cm high double velcro band that maintains constant tension for small variations in length.
- First used by Chevaillier for autogenous drainage, currently also used for neuromuscular (Belgian school)

DEFLATION

- A single band is applied at the mid-costal level or two bands, one mid-sternal and one abdominal.
- When thoracic compliance is reduced and the attitude is inspiratory, it is better to use two. In the tetraplegic, the abdomen cannot be blocked and therefore only one is used.

DEFLATION

Band tension: measured on a bony protrusion about 2KG on the caliper manometer.

Precautions: in subjects that desaturate easily check the parameters continuously.

The heart rate should not vary much (if it decreases we are interfering with venous return)

Peripheral drainage

- Hypoventilation and the formation of microatelectatic areas compromise the parenchyma (which may have received direct insults at the time of the injury!) In a more or less serious way. In theory, the airways should not be compromised, except for bronchodynamic components (due to pre-existing allergies or ANS activity), but the entrainment component of the mucous film is lost due to variations in the air flow (there is no possibility of increasing the CV).

Peripheral drainage

- Treatment aimed at peripheral unblocking will try to restore volume changes and flow acceleration and may include:
  a. to. Pep-mask - exploits the peep effect and is effective at tidal volume. The resistance must not exceed 10 cm of water and the total treatment must not exceed 1 hour in 24. Colleagues who do not have masks available have always used the water column and rubber hose.
  b. Deflation - exploits the effect of accelerating the flow by reducing the caliber of the bronchus, is the basis of coded techniques (autogenous drainage, ELTGOL), is performed by positioning and / or sanglage. It can have consequences on the intrathoracic pressure and therefore on the venous return. To be carried out only by the physiotherapist for sessions not exceeding 20 minutes.

Peripheral drainage

- c. Percussionaire (IPV2) - It is the latest generation of IPPB (Bird-Gastech) and is aimed at the treatment of restrictive syndromes with reduced compliance (eg Duchenne, SMA, ALS ..). It allows to administer aerosols with great effectiveness and releases small boluses of compressed air (not used with O2) at high frequency: the result is an intrabronchial percussion that recalls the secretions from the pulmonary periphery and is very useful in the resolution of atelectasis in conjunction with bronchoscopy . The literature on the subject is limited, but the American Evidence Based (2) includes it among the means of peripheral unblocking in spinal cord injury. It is a complex device that requires specific training.
- d. Serial positioning: it is the oldest and most forgotten means by virtue of air beds.

Peripheral drainage

- e. Non-invasive ventilation: any means that can increase the inspired volume without causing fatigue can play a role in the acute phase (35% of the medullaries need some form of ventilation during the first hospitalization). Ventilated patients are not accepted in the Spinal Unit, but a Bipap (which also provides good thoracic stretching) can be useful both as a treatment for hypercapnia and in increasing ventilation for unblocking purposes.

Peripheral drainage

- f. Incentivators: we are very critical of the indiscriminate use of these devices. Their use has been studied and codified and only makes sense if the recommendations of the Consensus are respected. In summary: any incentive induces fatigue for which its use and the result of the treatment must be appropriate and manifest; the most suitable device must be chosen for each patient; the resistance level or the volume threshold or whatever must be established in a personalized way; patient training is prolonged over time, with such conditioning as to guarantee correct use even without an operator.

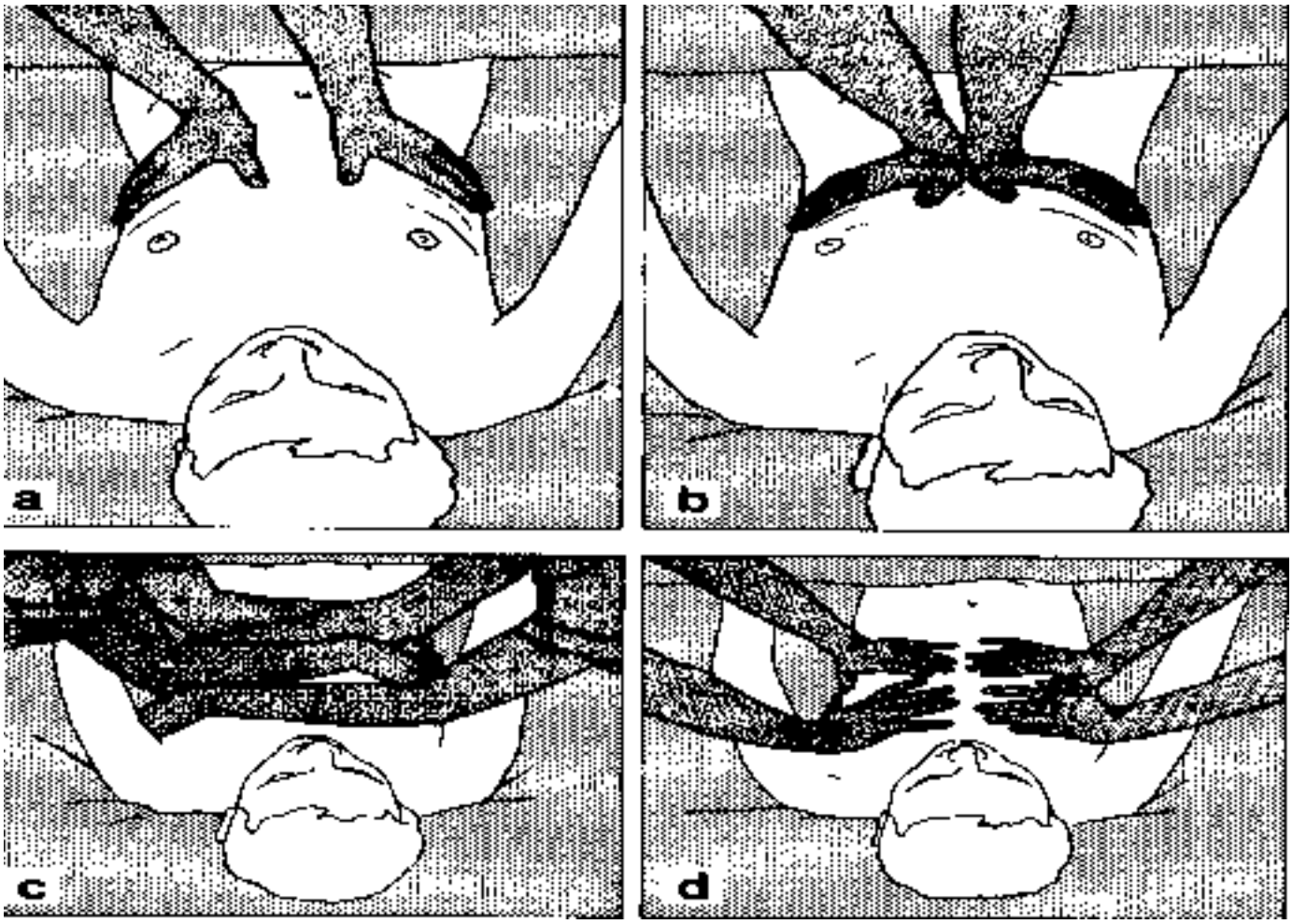
Peripheral drainage

- Guided ventilation: it is the basis of respiratory physiotherapy, it presupposes a good auscultatory technique and a remarkable sensitivity towards the patient, his discomfort, pain, fatigue. No machine or technique replaces a therapist who uses guided ventilation with knowledge of the facts.

Cough Assist Technique (Manual Compression):

- Before carrying out this maneuver it is advisable to have the patient perform 3 or 4 breaths and during exhalation help him by compressing the ribs inwards and downwards (this serves both to make the secretions progress towards the upper airways and to synchronize with the rhythm respiratory system of the patient),
  - if the patient is in bed, the assistant places his hands on the abdomen, caring for the function of the abdominals; when the patient tries to cough, the assistant pushes the abdominal wall inward and upward;
  - if the patient is sitting in a wheelchair, the assistant places himself behind his shoulders, passes his arms under his armpits, crossing his hands under the diaphragm, keeping the trunk flexed forward; when the patient tries to cough, the assistant pushes in on the abdomen.
- Warning: the amount of air that the patient inhales is not necessarily sufficient to cough! If the maneuver fails, additional air must be administered (ambu balloon)
- Fundamental rules of behavior are: refrain from smoking, make frequent postural changes, avoid dehydration, avoid sedentary lifestyles compatibly with residual functional potential, flu vaccination.

ASSISTED COUGH



ASSISTED COUGH

- INSPIRATORY AID = AIR STACKING
- EXPIRATORY AID = MANUAL COMPRESSION
- IN – EXUFFLATOR:
  - RAPID FLOW EXCURSION from +40 CM H2o in Inspiration at -40 cm H2O in exhalation

Assisted cough

The most striking problem, however, is the clearing of the upper airways, where the mucociliary escalator diligently collects secretions that can only be expelled with a cough. To overcome the glottic barrage, a PEF of 180L / min (160 L / min for Bach) is required, with a CV of at least 1.5L.

In reality the cough at 230L / min is still weak, it can be considered effective and safe above 300 L / min of PEF. Obviously, if the unblocking is not safe, the artificial airway becomes mandatory.

Assisted cough

- Assisted cough is a practice that all staff must share even if it is the physiotherapist's own to construct the sequence of maneuvers in the most effective and personalized way. The simplest thing is to follow the physiology of the cough and to supervise where necessary:
- 1. -maximal inspiration: an effective cough has a pretussive volume of about 70% of the CV, unthinkable in a spinal cord injury. It takes the lead by providing the patient with an additional amount of air (with a balloon or positive pressure device) (Fig. 9).
- 2. seal with glottis closed: it depends on whether the patient has a tracheostomy or not; if he can hold the air for a few seconds, small boluses of air can be administered in sequence to reach the necessary volume.

Assisted cough

- 3.thoracoabdominal cocontraction: phase abolished for obvious reasons
- 4.Explosive opening of the glottis: see point 2
- 5.maximal contraction of the abdominal and intercostal muscles: replaced by compression on the abdomen and/or chest carried out by the operators.

Assisted cough

- In general, to determine which is the most comfortable sequence (or, sometimes, the only possible one), spirometry is performed to know the CV and PEF with three maneuvers: spontaneous, with cough, with abdominal contraction. After that the patient is taught to inhale and hold a portion of air that we supply, to give us time to place our hands on his abdomen and to open the glottis at the same time as the pressure exerted by us. This sequence is called air stacking (Bach, Soudon).

Assisted cough

- A home ventilator or a Bipap can also provide the air to be stored, which puts the patient in safe conditions even at night.
- The combined inspiratory aid (in whatever form) / expiratory aid maneuver always provides a viable route unless the patient has cooperation problems. In 2002, a device dedicated to clearing the upper airways called In-Exufflator (Emerson-Vivisol) was also awarded the CE mark, which provides an inspiratory pressure (from 0 to 40 cm of water) followed by a sudden depression (up to 40 cm of water) which has the purpose of "mimicking" a huffing, that is a cough with an open glottis. Created for the home patient, it has undoubted advantages even in the ward.

The main ventilatory alterations induced by paralysis are summarized as follows:

- Chest instability
- The instability of the thorax does not find an adequate mechanical correction for now, on the contrary it seems that the thoracic rigidity that is established in the chronic phase is a natural compensation for the paradox: the more the instability was dangerous in the shock phase, the more rapid and unchangeable (and serious for the future!) will be the stiffening of the chest (De Troyer).Classically, an attempt is made to limit abdominal compliance with an elastic girdle, or to provide the diaphragm with a fixed point at the appropriate area: this is the sanglage technique, suggested and supported by clinical experience but still lacking in certain evidence. The strap used is a velcro band with particular elastic characteristics that acts as an "external muscle", subjectively reducing the patient's discomfort (which often requires it within 24 hours) and objectively maintaining the respiratory rate within 20 beats per minute.

The main ventilatory alterations induced by paralysis are summarized as follows:

- Chest instability
- To facilitate the ventilatory pattern, the positioning of the shoulders in depression is also fundamental. One possible way suggested by Bach is the use of non-invasive positive pressure ventilation to stretch the thoracic structures up from the acute phase, preventing the establishment of small volumes of the cage once the lesion has become chronic.

The main ventilatory alterations induced by paralysis are summarized as follows:

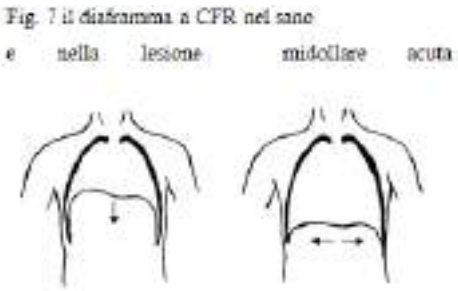
- Bronchial obstruction
- Bronchial clearing is vital, essential and must be shared on time and in the manner with all staff within 24 hours. It will therefore be useful for the doctor to make a mental distinction in the indications of "physiotherapy" between the respiratory physiotherapy treatment, typical of the physiotherapist, and assisted cough, a maneuver that must be known and practiced uniformly by all caregivers.

Muscles

MUSCLES	INNERVATION LEVEL	ROLE IN VENTILATION
Sternocleidomastoid	C2-C3	Accessory inspiratory
Trapezius	C2-C3-C4	Accessory inspiratory
Scaleni	C3-C4-C5-C6-C7	**Primary Inspirators**
Diaphragm	C3-**C4**-C5	**Primary Inspirators**
Pectoralis	C4-C5	Stabilizers
Greater Phboids – upper part.	C5-C6-C7	Accessory inspiratory, an action is also recognized in exhalation
Serratus anterior	C5-C6-C7-C8	Accessory inspiratory
Pectoralis Major - lower part	C6-C7-C8-T1	Accessory inspiratory
Pectoralis Lesser	C7-C8-T1	Accessory inspiratory
Parasternals	T1-T12	**Primary Inspirators**
Intercostals int./ext.	T1-T12	Stabilizers and accessories in the inhalation or exhalation depending on the starting volume
Rib elevators	T1-T12	Accessory inspiratory
Chest transverse	T1-T8	Accessory Expiratory

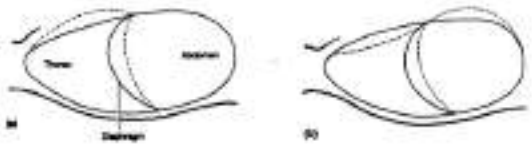
The main ventilatory alterations induced by paralysis are summarized as follows:

- 1-loss of the appositional component of the diaphragm Excessive compliance due to abdominal paralysis and loss of tone of the intercostal muscles cause the diaphragmatic dome to flatten.
- Losing its appositional part, the diaphragm contracts in an ineffective way (therefore with the same contraction it develops less force) and is at a disadvantage according to Laplace's law (the radius of curvature increases, therefore, for the same voltage produced, the developed pressure -fig. 7-)



The main ventilatory alterations induced by paralysis are summarized as follows:

- 2 - loss of parasternal intercostals The parasternal joints connect the central area of the ribs (from the 3rd to the 7th) to the ventral aspect of the sternal plate and stabilize the thorax anteriorly. Their paralysis implies a reversal of curvature of the anterior thorax which is no longer opposed to pleural negativity. The diaphragm contracts to the maximum in the attempt to provoke an adequate inhalation and "sucks" the sternal part giving rise to the pathognomonic phenomenon of the "paradox" (fig. 8).If we add to this the paralysis of the scalenes (C5), the heeling of the upper chest is such as to make the diaphragm ineffective.



The main ventilatory alterations induced by paralysis are summarized as follows:

3 - loss of abdominal muscles. The forced components of the exhalation, and especially the cough, are ineffective or absent.

Summarizing

- Inspiration is effective only at a tidal volume, it does not have the possibility of being voluntarily increased. Until a few years ago, the physiotherapist was asked to "strengthen the diaphragm" and the patient to "take deep breaths": it is obvious that the diaphragm is already at the limit of fatigue in basal conditions and that deep breathing is not within the range of voluntary behavior!
- Exhalation occurs only passively, the forced flow is directly proportional to the level of injury.
- Hypoventilation and inability to cough are the best allies of bronchial encumbrance: instead of intervening in a non-specific way (for example using postural drainage) it is good to understand the deficits analyzed so far and provide specific countermeasures.

Hypotension

- Postural hypotension is typically a problem for patients with lesions above T6.
- It is due to a loss of supraspinal control of the sympathetic nervous system and the resultant inability to regulate blood pressure. It is exacerbated by poor venous return secondary to lower limb paralysis and the loss of the lower limb 'muscle pump'
- Postural hypotension predominantly occurs when patients move from lying to sitting. Without leg movement or a capacity to increase sympathetic activity, blood remains pooled in the legs and abdomen, and blood pressure drops. This causes the patient to feel faint and to lose consciousness. The immediate treatment is to lie the patient down and raise the feet or tilt the wheelchair backwards.

Hypotension

- Graduated compression stockings and abdominal binders may help maintain blood pressure although evidence of their effectiveness is conflicting.
- Postural hypotension is particularly pronounced when patients first mobilize after injury, especially if there has been an extended period of prior bedrest. For this reason mobilization needs to be implemented slowly.
- For the first few days the patient may just tolerate sitting up in bed. Subsequently, the patient may then be sat
- out of bed in a reclined wheelchair with the legs elevated. Over time patients 'acclimatize' and better tolerate the transition from lying to sitting; this is thought to be due to an increased tolerance to feelings of lightheadedness with lower blood pressure.

Postural re-education

- The possibility of restoring a sitting posture while respecting the physiological curves of the spine depends on numerous factors. First of all, the neurological level preserved as the higher the lesion, the greater the postural control deficit and the spontaneous attitude of compensation will lead to the development of cervical hyperlordosis. In high thoracic lesions, on the other hand, the spontaneous compensatory attitude leads to hyperkyphosis.

Postural re-education

- Other factors that influence posture are the outcomes and type of surgical stabilization, any pelvic asymmetries for different limb lengths, asymmetrical motor control, presence of pararticular calcifications, hypertonus, psychological reaction to the event, etc.

Postural re-education

- It is therefore in reality a very broad chapter of the treatment aimed at:
  - corrective re-education of functional (unstructured) postural alterations of the spine and muscle-tendon shortenings resulting from prolonged postures (hamstring shortening, spine extensors, iliopsoas, buttocks, adductors, sural triceps, etc.);
  - re-acquisition of the correct sitting posture through the appropriate choice of the wheelchair with relative customization (backrest height, backrest shape, seat inclination, position of the large wheels, footrest height, etc.) and of the anti-decubitus pillow.

Orthostatic rehabilitation

- When the clinical parameters are stabilized, the re-education to standing upright begins gradually moving to the semi-sitting position (semifowler) first in the articulated hospital bed, then in a postural or even reclining wheelchair (it would be better to avoid them) using also orthoses to support the stability of the spine (collar, torso), for vasopressure (vasocompressive knee-highs, abdominal belly)

Orthostatic rehabilitation

- The postural wheelchair is very versatile for the management of the patient's elevation both for the way of transfer from the bed and for pressure problems (possibility of reclining, possibility of adjusting the inclination of the footrests and headrest). Once the pressure values are stable and the ability to support the weight on the spine for a few hours has been reached, the postural wheelchair is abandoned to reach the sitting position using a 90 ° wheelchair.

Orthostatic rehabilitation

- In less complex situations (no complications from polytrauma, young subjects, low injuries, stable pressure parameters) you can reach the 90 ° position on the bed and then get up immediately in the wheelchair at 90 °.
- The next step is the readjustment to verticalization using manual or electric standing, or verticalizing wheelchair.
- In cases of particular difficulty in pressure readjustment, the static bed is used.

Orthostatism re-education

- WHEN?
- Based on the presence of the means of synthesis, clinical conditions, presence of complications (PU, DVT, inflammatory states, etc.) and / or associated trauma

- HOW?
- Gradual and progressive achievement of the sitting position on the bed and then in the wheelchair

What aids?

- Articulated bed, with trendelemburg and antitrendelemburg position, static table
- Postural or 90 ° wheelchair, anti-decubitus cushion
- Vasocompression orthosis (belly and elastic stockings)
- Support orthosis for stabilization of the spine if necessary (braces, collars)
- Lift or sliding board

Verticalization

- When the sitting position is maintained with stable pressure values throughout the day, the readjustment to verticalization begins.
- The assumption of an upright posture has beneficial effects:
  - on the bone system as it improves bone trophism;
  - on the gastro-intestinal system as it stimulates intestinal peristalsis;
  - in the prevention of muscle-tendon retractions in flexion of the lower limbs;
  - from a psychological point of view (not always);
  - Cardio-circulatory system
  - Bladder and intestinal function
  - Muscles of trunk and upper limbs
  - Kidney function

Verticalization

- Initially the maintenance of the upright position can be limited to even a few minutes in relation to the autonomic but also emotional response, then it continues for longer and longer times up to a few hours in the day.

Verticalization

- Verticalization is basically carried out by means of aids.
- In the paraplegic, the stabilizer for static (commonly standing) is generally used, which has the following characteristics:
  - adjustable support for knee support;
  - supports for the support of the upper limbs;
  - back support for the pelvis;
  - front support to prevent falling forward

Verticalization

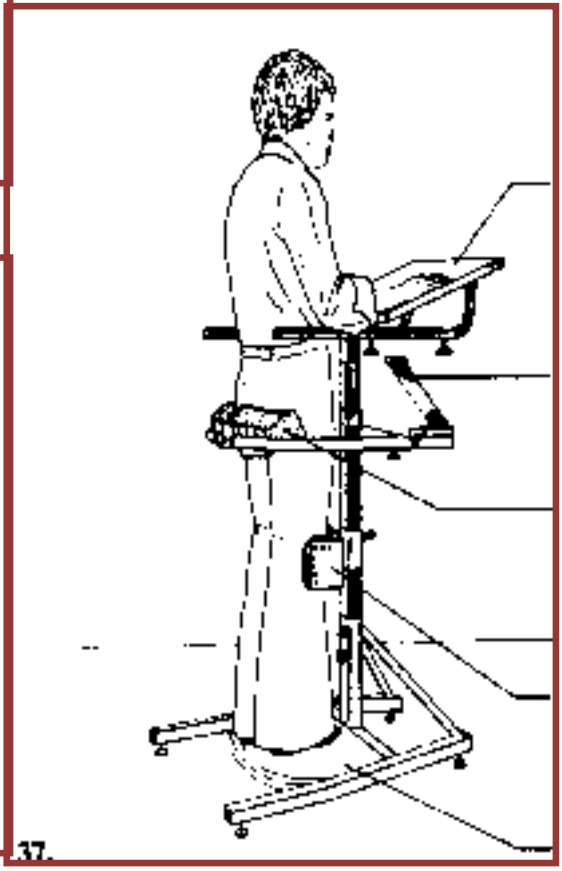
- The verticalization in the quadriplegic generally takes place by means of a verticalizing wheelchair as it allows an easier resolution of any pressure problems allowing to gradually reach the vertical position.

Verticalization

- Gradual readjustment of the load in standing position (vertebral stability !?)

AIDS

Vertical stabilizer (manual or lectric)
Verticalizing wheelchair
Static bed
Elastic stockings
Abdominal bands



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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

2723/3677

Rehabilitation of balance

- Re-education of the sense of balance is very important for gaining good control of the sitting position in the wheelchair, which is essential for all daily activities (pushing yourself in a wheelchair, nutrition, hygiene, etc.).
- The loss of perception of the position and movements of the paralyzed parts of the body in space leads to difficulties in maintaining balance in the sitting position.
- It is possible to substitute this postural control deficit by developing a new pattern of postural sensitivity through the proprioceptive afferents of the muscles that have high innervation and a large attack on the spine and pelvis

Rehabilitation of balance

- The most important are the great dorsal (C6, C7, C8) which constitutes a "bridge" between the paralyzed and non-paralyzed parts of the body and the trapezius (C3, C4) with its low insertion up to T12.The re-education of balance begins in front of the mirror (visual inspection is generally a very useful facilitation in the initial phase, or at least until the patient reacquires a new sensory pattern) and with the support of the hands on the mat.

Rehabilitation of balance

- Gradually the patient manages to maintain the balance of the trunk with his arms raised and without the mirror. Then progress is made according to the level of injury with exercises that require the execution of dynamic activities with the upper limbs, such as throwing the ball, or making the support base unstable (tilting platform).In high cervical injuries the exercises are limited to reaching the sitting position with the support of the upper limbs.

Muscle strengthening

The residual muscles must be developed to the maximum to compensate for the lack of movement of the paralyzed part. Therefore, strengthening essentially affects the muscles at the level of the upper limbs and trunk (dorsal, pectoral, large and small round, supra and infraspinous, deltoid, triceps, biceps, extensors of the spine, abdominals, etc.), compatibly with the level neurological preserved, by:

- active exercises or manual counter-resistance in segmental and / or global schemes, also including neuromuscular facilitation techniques such as PNF;
- exercises with pulley weights;
- exercises with rubber bands;
- Bars
- carpet exercises that use the weight of the body as resistance in a sitting position on the carpet, in a sitting position with the bars (lifting forward, backward, sideways, with difference in height), prone position.

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Strengthening whole muscles

PROMOTION OF FUNCTIONAL SKILLS

ASSESSMENT

Possibility of learning new motor patterns that are related to lost motor skills

- Balance Exercises
- Changes of position (straightening and carpet movements)
- Lifting

Muscle strengthening

Exclusion criteria:

- instability of the vertebral fracture;
- presence of still unconsolidated fractures of the upper limbs or myotendinous pathologies in progress;
- presence of marked hypertonia (in the upper limbs or onset of pathological irradiation phenomena in the trunk / lower limbs);
- marked imbalance between healthy agonist muscle and paralyzed antagonist

Muscle strengthening

- Muscle strengthening, which began during the bed rest phase, intensifies when the subject gets up through specific training after evaluating the maximum load (one repetition with maximum load in the absence of compensation, pain, pathological irradiation phenomena).
- The training can include a strengthening program (workload equal to 66% of the maximum strength) or an endurance program (workload equal to 33% of the maximum strength) in relation to the muscular examination, the physical condition of the patient, to short-term recovery goals.
- Each training session must end with stretching exercises for the shoulder girdle and upper limbs.

Training of straightening sequences

- They are preliminary functional activities to subsequently exercise mobility in bed.
- As mentioned for the re-education of balance, the reacquisition of the straightening sequences is assisted by new motor strategies "suggested" by the physiotherapist but often activated automatically by the patient himself using the residual muscle heritage.
- For example, the patient without triceps learns to extend the elbow bringing the shoulder into external rotation, or to facilitate the lifting of the trunk while sitting, the patient learns to unbalance himself very much forward with the head and trunk depressing the shoulders.

What to avoid and what to look for

	OBJECTIVE	RISK
Shoulder	Joint mobility in the physiological range Avoid pain at all costs Shoulder subluxation prevention	Algodystrophic syndrome Difficulty with abduction, in particular with spastic adductors Tendency to inferior subluxation in C4 lesions
Elbow	Complete range of motion, especially in extension	An extension deficit of even just 10 ° can compromise the ability to be able to transfer independently.
Wrist	Complete range of motion	Prevalence of the tone of the wrist flexors
Long fingers	Prevent edema Functional hand	Hyperextension or incomplete flexion of the Metacarpophalangeal Stiffness of the interphalangeal joints Flat hand
First Finger	Partial adduction-flexion with extended wrist and abduction with flexed wrist	

Muscle strengthening of the supralesional areas and attempt at sub-injury recovery

- Use of manual techniques of proprioceptive neuromuscular facilitation;
- Synergies: especially those in the prone position on the elbows that reinforce the entire shoulder girdle
- Use of physical tools (dynamometer, pulleys, weights, elastic bands, cycle ergometer…);
- Inclusion in sports therapy programs;
- Activities for autonomy

Attention to

- DELTOID: exercised in a seal, its main function
- SHOULDER ADDUCTORS. Fundamental resource for compensation (shoulder antepulsion to extend the elbow and stabilization of the elbow while seated).
- BRACHIORADIALIS: it can be useful in pushing the wheelchair and usable in functional surgery

Training of straightening sequences

Activities to be exercised in increasing order of difficulty and in relation to the neurological level preserved:

- maintenance of long sitting position;
- lifting on the carpet;
- shifts on the carpet sideways, forwards, backwards;
- displacement of paralyzed limbs;
- sit and lie down;
- turn sideways;
- reach the prone position;
- quadruped position;
- kneeling position.

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

Inhibition of spasticity

- The presence of spasticity can sometimes be useful for achieving upright posture and walking, can promote venous return and reduce circulatory stasis, limit muscle atrophy, facilitate intestinal peristalsis.
- When hypertonicity takes on a negative value as it limits the autonomy of the injured person, a treatment is required which may be, in relation to the entity and location of the symptom, pharmacological, physiotherapeutic and / or surgical.

Spasticity

- Spasticity is primarily managed with pharmacological agents.
- There are two main categories of drugs, some acting predominantly within the central nervous system (e.g. baclofen, diazepam, gabapentin, clonidine, tizanidine) and others acting peripherally, either within the muscle or at the neuromuscular junction (e.g. dantrolene and Botulinum toxin).
- Severe spasticity is sometimes managed by administering drugs directly to the spinal cord (i.e. intrathecally).
- The main implications of spasticity are that it predisposes patients to pain, contractures and pressure ulcers, and makes movement and hygiene difficult.

Spasticity

- For some patients, spasticity limits function and quality of life.
- Physiotherapy interventions such as hydrotherapy, stretch, heat, TENS, cold, electrical stimulation, therapeutic exercise techniques, passive movements, standing and vibration may provide transient relief from spasticity, but there is no evidence that any of these interventions produce lasting reductions in spasticity.
- In addition, the application ofheat can cause burns and therefore should only be used with extreme caution in patients who lack sensation.

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

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TREATMENT OF SPASTICITY

- One of the major problems resulting from SCI
- Incidence one year after trauma: 67% of SCI, 37% receiving antispasmodic therapy, 11% unsuccessful
- Main effects: limitation in ADLSecondary effects: pain, reduction of ROM, muscle-tendon retractions, joint deformities
- Oral drugs: baclofen, dantrolene, tizanidineIntrathecal baclofen
- Selective neuromuscular blocks

TREATMENT OF SPASTICITY literature review - EBM

- Taricco et al: Cochrane Library 2001: of 53 studies, only 9 included.
- Outcome measures: Ashworth, Spasm score, EMG, ADL, Gait analysis (no uniformity)
- Clear efficacy of Baclofen and Tizanidine versus placebo, little evidence in the rational approach to spasticity.
- Tizanidine with significant side effects (sedation)
- Intrathecal baclofen: proven efficacy, used according to non-univocal and clear parameters, to be used exclusively for "non-responders" patients

TREATMENT OF SPASTICITY

- Selective neuromuscular blocks (botulinum toxin, phenol): currently there are no data to prove their efficacy in randomized controlled trials in patients with SCI
- Rehabilitation therapies: they are not accompanied by any evidence-based efficacy data

TREATMENT OF SPASTICITY

- Authors' conclusions: There is insufficient evidence in decision making for a rational approach to the treatment of spasticity in SCI.
- Evidence for a decision tree approach (less invasive more invasive) is weak
- New research is urgently needed

Physiotherapy treatment

- Physiotherapeutic treatment after focal treatment of spasticity is based on techniques of:
- a) Short-term passive manual stretching through muscle stretching maneuvers
- b) Long-lasting passive mechanical stretching through the use of Positioning techniques
- Use of orthoses
- Functional bandage
- Serial plasters

Control of spasticity and maintenance of physiological muscle lengths and lengthening of shortened muscles:

Paid attention to:

- Pectoral muscles
- Biceps: the risk is to encounter upper limbs with a wing in C5 injury limiting autonomy
- Wrist flexors: difficulty in extending the wrist and difficulty in setting the functional hand

Short-term passive manual stretching

Muscle stretching techniques have four basic objectives:

- restore the length and flexibility of the muscle in order to achieve optimal joint range
- preserve the sliding between the elements that make up the muscle in order to contain internal friction
- reduce the patient's feeling of muscle stiffness
- maintain a correct representation of the muscle centrally.

The stretching maneuvers must be performed as follows:

- it is necessary for the patient to actively collaborate for complete relaxation of the muscle. The stretches must be of low intensity and long duration as otherwise they would cause a reflex contraction of the muscle. The maneuvers are more effective when they exploit the principle of contraction-relaxation, through a maximal isometric contraction;
- the stretching must be gentle, slow, gradual and progressive. The average time to obtain a valid muscle relaxation varies from 30 to 60 seconds and increases up to a few minutes in the case of important muscle chains. The number of repetitions on average can be considered around 10 and performed 2 times a day;
- if the temperature of the muscle is increased (eg hydrotherapy) the effect produced by the stretching is more effective and lasts longer.

Long-lasting passive mechanical stretching

- Long-lasting passive mechanical stretching techniques use various types of aids, such as:
- -Stretching tablets
- - Orthosis
- - Functional bandage
- - Serial chalks
- N.B The choice of the technique varies according to the intensity and duration that you want to obtain from the stretching, the dynamism of the unit, the district to be treated, the patient and family compliance levels

Positioning tablets

- They allow to use a low intensity stimulus keeping the interested part in lengthening. The stretching must be continued for 20/30 second each session.

ORTHOSIS - Orthopedic braces

Features

- Keep the segment to be treated in a certain position
- Recover the articular excursion

Types

- Pre-packaged braces in the absence of structured deformities
- Braces tailored to specific cases

ORTHESIS - Requirements

- Be of suitable size
- Be easy to apply (for both patient and caregiver)
- Be smaller in size
- Be well understood by those who use it or by those who assist the user

WRIST BRACE

- Brace in elastic fabric and velcro closure equipped with two aluminum reinforcement sticks located one in the ventral position and one in the dorsal position. Both splints can be manually molded into the desired position.
- This brace is used in patients who have a modest hypertonicity of the wrist flexor muscles and allows to keep the wrist in extension, leaving the fingers free.

PRE-PACKED BRACES FOR WRIST AND FINGERS

- This brace consists of a pre-molded polyethylene valve with velcro closures. The hand is placed in a functional position with the thumb abducted and the wrist slightly flexed. This device has the characteristic of being minimally moldable at low temperature and therefore adaptable to the patient's needs. It is indicated for patients who do not have established retractions or high hypertonus of the flexor muscles of the wrist and fingers.

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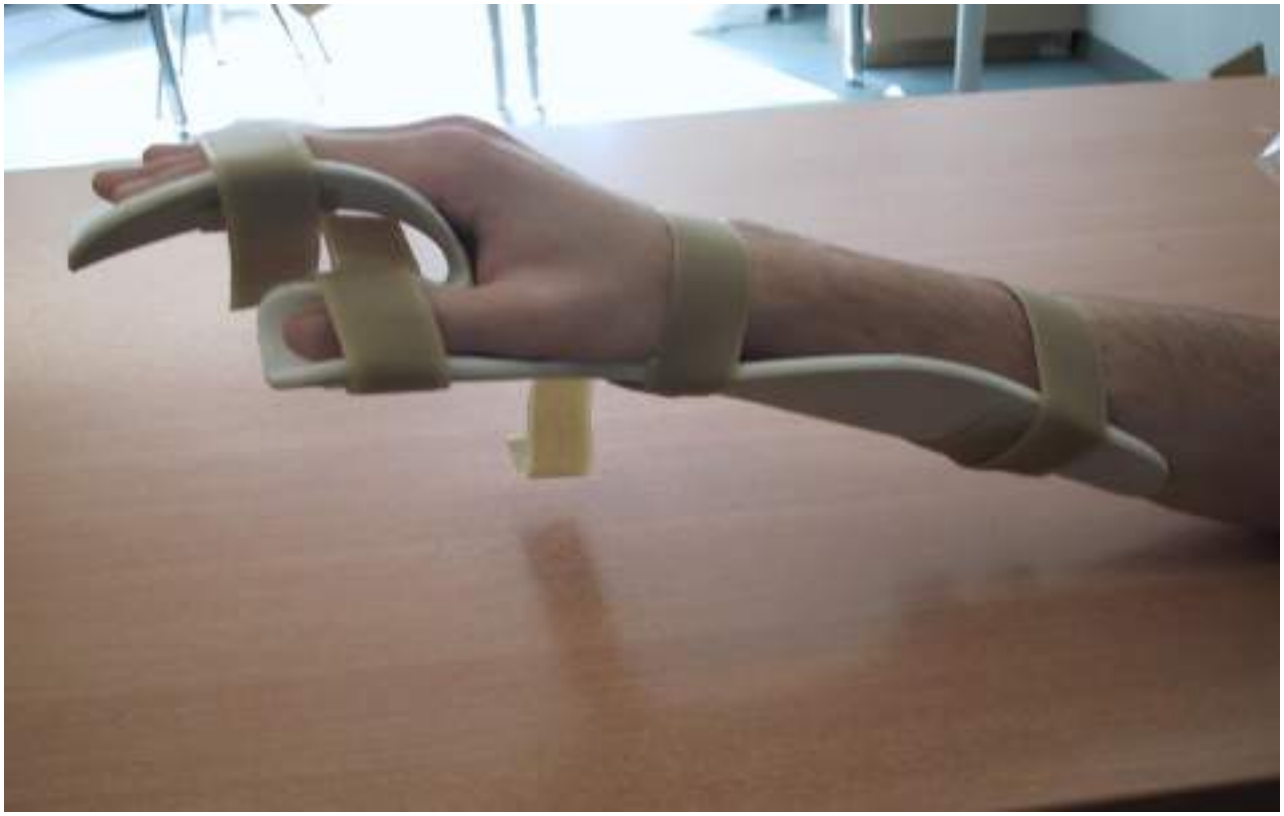

MADE TO MEASURE PACKED BRACKETS

- Custom-made braces are used when the treatment needs are specific, i.e. when it is necessary to obtain either a particular positioning, impossible to obtain with a standard brace or when deformities or structured retractions are present.
- The material commonly used for the construction of this type of brace is the low temperature thermoplastic one, which can be heated in hot water at 60 ° -70 ° and can be modeled directly on the patient's hand.

FEATURES

- modifiability, which allows you to modify the orthosis by heating it to adapt to the results obtained;
- memory, to reuse a material by remodeling it in the event of errors or major changes to be made;
- conformability, to customize the orthosis to the maximum degree;
- stiffness, to adequately support the joints: the low temperature, to model the material directly on the patient;
- lightness, so as not to weigh down the limb; practicality, to facilitate the use of the orthosis;
- perspiration, to avoid skin injuries by allowing transpiration through small holes in the material or tubular cotton.

Principles for the construction of the orthosis

- the orthoses must have levers long enough to limit the pressure on some areas
- it is necessary to correct the thumb and the distal phalanges first and then rise again shortly
- if the phenomenon of hand grasping is present, it is advisable to build a dorsal and not a palmar orthosis
- it is necessary to pay close attention to the positioning of the distal phalanges because they can more easily go into subluxation
- the orthoses must be built at least 15 days apart. From treatment with botulinum toxin as the hypertonicity can change significantly up to 15 days. after infiltration

Stages of construction

- identify the model of orthosis to be performed taking into account the objectives set and the joints involved;
- draw the basic model of the orthosis on the cast of the patient's hand, place it on the thermoplastic material and cut it out (to facilitate the operation, you can immerse the thermoplastic sheet for a few seconds in hot water to soften it and then cut out the model of the orthosis);
- soften the material in the thermostatic tank, avoiding overheating it in order not to compromise its elongation and conformability characteristics;
- model the orthosis on the patient's hand after removing the thermoplastic material from the water and drying the surfaces on a towel (check the temperature on your skin and possibly protect the patient's skin with a cotton tube);

Stages of construction

- allow the orthosis to cool, remove it from the patient's hand and carry out the finishing touches by softening the material with the heat gun, which must be held about 20 centimeters from the orthosis to prevent it from inflaming (in the case of a shorter distance), or overheating on a too large surface, (in case of greater distance).
- It is necessary to wait for the splint to cool down again before putting it back on the patient;
- have the patient wear the orthosis for 10 minutes, take it off and check for any redness to modify the splint;
- repeat the operation by wearing the splint for 30 minutes;
- apply the velcro fasteners (their length must be such that they can be closed without affecting the patient's blood circulation).

..... THE PHYSIOTHERAPIST MUST ... ..

- - pay particular attention in the presence of scars or skin lesions,
- - do not create pressure points
- - there must be no sharp edges or edges.

… .. THE PATIENT MUST … ..

- wash the splint often with cold soapy water and dry it thoroughly;
- do not leave it near heat sources, in the sun, in hot water, as it could deform;
- do not leave it near open flames as it is flammable;
- do not try to modify it yourself so as not to compromise its rehabilitation effectiveness.

The orthoses that are most frequently indicated in the treatment of subjects with spinal cord injury, mostly cervical, are static ones and, in particular:·

- Volar wrist orthosis;
- Volar orthosis for wrist and trapezium-metacarpal joint;
- Volar orthosis for wrist and metacarpophalangeal joints of long fingers;
- Volar position orthosis;
- Dorsal wrist orthosis;
- Dorsal position orthosis;
- Dorsal orthosis for metacarpophalangeal joints of the long fingers.

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Wrist-hand-finger orthosis / for extending the radio-carpal joint and five fingers

PROGRESSIVE CORRECTION ELBOW BRACE

- This type of brace consists of two polyethylene valves with Velcro fasteners, articulated at the elbow by a mechanism that can be manually calibrated in flexion-extension.
- It is indicated for all those patients who have been treated with phenol on the musculocutaneous nerve and / or with botulinum toxin in the brachial biceps and / or radial brachio and who require a gradual recovery of elbow extension over time.

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FOOT BRACE

- They are semi-finished braces in thermoformable material at 170/180 °. They are divided into different types based on the function they perform:

- if a pronation effect of the foot is sought after focal treatment of the spasticity of the plantar and supinator flexor muscles of the foot, the most suitable brace is the A.F.O.

- if you want to block the ankle joint on the lateral plane, the use of the peromed is recommended

- if you want to block the ankle joint in the sagittal plane and correct equinus and talismus, the use of the codivilla spring is recommended.

KNEE BRACE

They are divided into:

- a) brace for immobilization of the knee, built from a fabric base to which splints placed in a longitudinal position are fixed, capable of maintaining a fairly rigid structure and with velcro strips for closure. It is indicated to keep the lower limb fully extended and is used in all cases where the hypertonicity is modest or there are no muscle-tendon retractions;
- b) brace with variation of the flexion-extension angle; indicated in all cases where a gradual recovery of knee extension is required (such as after treatment with botulinum toxin on the hamstring muscles).

Brace for knee immobilization

Brace with variation of the flexion-extension angle of the knee.

FUNCTIONAL BANDAGE

- The functional bandage provides a degree of stretching which tends to be lower than that of gypsum, but has greater dynamism and the possibility of controlling the body segments.
- It is generally used at night for the first week after drug treatment, ensuring correct alignment of the affected segments.
- The bandage must be renewed with progressively increasing traction every day.

SERIAL PLASTERS

- Serial casts are used as a technique especially for lengthening the plantar flexor muscles of the foot.
- The advantage of their use is represented by the continuous lengthening over time unlike orthoses in thermoplastic material, which are placed only for a few hours a day, and therefore more easily used to preserve the result achieved.
- The disadvantage that instead derives from their use is that they are not very controllable for secondary complications, first of all pressure injuries.
- The casts must be repeated after 7-10 days in a position of gradual elongation and involve greater costs and times than the techniques described above.

Maintenance of physiological muscle lengths and lengthening of shortened muscles:

- Use of proprioceptive muscle inhibition techniques;
- Use of adjustable elbow pads, functional bandages and positioning splints;
- Correct positioning in bed and in a wheelchair;

Inhibition of spasticity

The most common physiotherapy techniques for reducing hypertonia, although their effectiveness is still limited in terms of duration over time, consist of:

- slow and gradual passive mobilization of the joints throughout the joint range;
- slow and prolonged stretching of the hypertonic muscles also through the assumption of certain postures (prone, supine "frog" position, sitting on the knees from the quadrupedal position, verticalization, etc.);I
- frequently change position and take correct postures both in bed and in a wheelchair;
- muscle relaxation through slow rhythmic movements with equipment such as the passive pedaler, Bobath balloon, etc.voluntary relaxation through concentration techniques and slow and deep breathing (incomplete lesions);

Inhibition of spasticity

- NB: Somatic or visceral stimuli such as skin pressure ulcers, ingrown toenails, bladder infections, stones, fractures, constipation and other pathologies, can constitute irritating spines that interfere, aggravating, the tone disturbance. Other factors that can increase hypertonia can be: cold, tight shoes or clothes, prolonged bed rest,

- Pharmacological treatment can be oral, intrathecal and local. Commonly used drugs are Baclofen, Diazepam, Rivotril, Dantrolene and Tizanidine. In some patients, the administration of Baclofen may be envisaged by implanting a pump in the abdomen, which through a spinal catheter transports the medicine into the intrathecal space with the advantage of using extremely lower doses of the drug than the oral route and with an efficacy greater. The drugs mainly used locally are local anesthetic drugs (ethyl alcohol, phenol) or at the level of the motive plate (botulinum toxin).

Training in A.D.L .:

I. Locomotion in a wheelchair
   - The electric / electronic wheelchair
   - The manual wheelchair

II. Mobility in bed

III. Transfers

IV. Personal hygiene and self-care training (nutrition, hygiene, clothing, self-catheterization)
   - Feeding
   - Hygiene
   - Clothing training

The electric wheelchair

- For some patients who are unable to move in a functional way with a self-propelled wheelchair, given the poor residual motor skills or the easy exhaustion due to age or serious associated cardio-respiratory problems, an electric wheelchair must be identified as the first; this does not mean that a manual wheelchair will also be prescribed, which is sometimes easier to use when traveling by car or as a spare (electric wheelchairs are more subject to problems than mechanical ones).
- Naturally, the subject must be properly trained to drive, evaluating the suitable type of control (chin control, standard joystick or with modified handle, etc.) and the ability to safely manage the locomotion for oneself and for others by means of an electric aid .

ELECTRONIC WHEELCHAIR

IDENTIFICATION AND CUSTOMIZATION of the aid in particular for:

- TYPE OF COMMAND:
  - Joystick
  - Pressure sensor (chin, lips, tongue, shoulder, etc.)
  - Blow sensor
- Indications
  - C5 or higher lesion
  - C6-C7 lesion with need for mobility for medium distances and uneven terrain
  - Tetraplegic in pediatric age

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WHEELCHAIR WITH JOY-STICK CONTROL

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PRACTICAL TEACHINGS FOR THE
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WHEELCHAIR WITH CHIN CONTROL

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

The manual wheelchair

In U.S.U. the wheelchair is the main aid. It allows indoor and outdoor movements of medium and long distances. It is of fundamental importance not only to make the appropriate choice of wheelchair in relation to the specifics of the case, but also to carry out adequate training in the use of the aid which, in relation to residual motor skills, includes the acquisition:

- Propulsion technique: circular movement of the arms with grip on the handrail from the extended to the flexed position starting just behind the pelvis; if the propulsion occurs forward, the trunk bends slightly forward, vice versa if it occurs backwards. In the absence of an active grip, the thrust is imparted to the handrail by pressing on the palm (useful thrust gloves that serve both to protect the hand and to increase friction).
- To turn to one side, the ipsilateral arm pushes the wheel backwards and towards the opposite side while the other arm pushes forward.

The manual wheelchair

- Push uphill: accentuate the flexion of the trunk to bring the center of gravity forward, downhill extend the trunk and head as much as possible, keeping the wheels braked by means of tight contact on the handrail.
- Pick up objects from the ground: never in front, but always to the side, bend with the trunk while with the arm of the other side hooks to the push handle or the wheel.

The manual wheelchair

- Balancing on large wheels (wheelie): useful for moving on uneven ground, for overcoming sidewalks / steps or very inclined descents; tilt the wheelchair on the rear wheels by pushing the head and trunk backwards and at the same time push on the wheels from the back to the front, finding a point of balance by means of small oscillations of the head and torso. Taken on the handrail. Once you have found the balance, move forward and backward on two wheels.

The manual wheelchair

- Climb the sidewalk: go to the front to the difference in height; push forward quickly enough managing to lift the small wheels until they rest on the step. Tilt the trunk forward and push on the large wheels.
- Get off the curb: bring the small wheels to the edge. Balance on the big wheels and push; you can also go back down if the step is small.
- Go ashore and go up again
- Fall prevention: in the event of a fall backwards, try to avoid the fall by bending forward as much as possible and otherwise quickly extend your arms backwards to cushion the blow.
- To go back up, lean forward leaning on a wheel while the other limb slides on the floor.
- Knowledge and maintenance of the aid

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

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Mobility in bed

- It includes moving in bed to the side, forwards, backwards, moving the paralyzed limbs, sitting and lying down, turning sideways, lying prone. After the preparatory work carried out in the gym, it is necessary to train these skills in the hospital bed in order to make changes of position during the night, for self-catheterization, to be able to dress and undress, to be able to get up. It may be necessary to use an electric bed with three joints that facilitates reaching the sitting position, or the use of side rails (cervical and upper thoracic injuries).

Transfers

- In principle, the transfers can be divided into three groups by order of difficulty:
  - with lower limbs raised with or without aids (trunk remains flexed)
  - with lower limbs resting on the ground with / or without aids (trunk remains flexed)
  - with lower limbs resting on the ground with difference in height (trunk in extension / flexion)
- For the most serious cases of complete dependence, the use of the lift or alternatively passive transfer mode (by standing or using a tablet, with one or two operators) is foreseeable.

Transfers

- To train for transfers it is essential that:
  - at least initially the surfaces are at the same height;
  - the transfer takes place beyond the big wheel;
  - that the injured person has the head, shoulders and trunk flexed well forward while moving with the butt (head above the knees);
  - upper limb on the side of the transfer moved away from the trunk to allow the trunk to be moved, while the other limb is close to the trunk
  - the wheelchair is in conditions of maximum stability.
- Most easily used aids: sliding board, lifter.

Transfers

Very schematically it can be said that, in the sitting position, each movement of the head in a certain direction corresponds to a displacement of the pelvis in the opposite direction.

- If we flex the trunk forward and lower the head, the pelvis moves upwards.
- If we extend the head backwards, the pelvis has a tendency to slide forward.
- If we bring the head forward, the pelvis flows backwards.
- If we turn our shoulders and head to the side, the pelvis rotates in the opposite direction

TRANSFERS

The most frequent methods:

LIMBS LOWER ON THE GROUND
LIFTED LOWER LIMBS
STANDING PASSAGE

AIDS:

Lifter
Tablet for sliding
Pull handles

- Search for supports
- Balance and capacity for imbalance
- Lifting and moving capacity
- Body weight and characteristics
- Distance of surfaces
- Friction of surfaces
- Difference in altitude

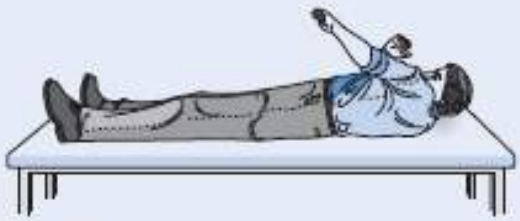
Rolling

- Rolling is used to dress and change position at night. It is also a prerequisite for getting from lying to sitting.
- Able-bodied people roll by placing the leading arm across the body and using trunk and leg muscles to initiate rotation of the body. Patients with thoracic paraplegia and C6 tetraplegia cannot use trunk and leg muscles, so instead rely solely on the head and upper limbs to roll. They roll by rapidly swinging the arms across the body. This generates angular momentum which is transferred to the paralysed lower segments of the body, facilitating rotation. The position of the legs and head influence the ease of rolling. Most patients have less difficulty rolling if the ankles are crossed and the head is lifted off the bed. Rolling is also easier if the trunk is slightly stiff with loss of passive rotation.

Rolling

- Patients with C6 tetraplegia have added difficulties rolling because paralysis of mthe triceps muscles limits their ability to maintain elbow extension. Without appropriate strategies, the elbows flex as the arms move across the body and patients may hit themselves in the face. This is avoided by externally rotating the shoulders, minimizing shoulder flexion, and performing the whole task with sufficient speed to ensure the elbows have little opportunity to flex. Contrary to what some may intuitively think it is not possible to roll with the elbows fully flexed. The shortened upper limbs cannot generate sufficient angular momentum to roll the body, and hand position limits arm swing.
- Patients unable to roll in bed can use bed rails or loops attached to the side of the bed to pull themselves from side to side. Alternatively, they must rely on assistance from others.

TABLE 3.1 A patient with C6 tetraplegia rolling onto the side (some practice strategies are described)

	Sub-task	Practice strategies
 Figure 3.4a	1. Pre-swing: The head and both arms are rotated away from the direction of the roll.	*Practice of this sub-task can be made easier if:* • a small weight is placed in the hands • elbow extension splints are used
Figure 3.4b	2. Swing: The head and both arms are thrown across the body.	• a pillow is placed behind the trunk • the ankles are crossed • the leading hip is supported in 45° flexion • elbow extension splints are used

Lying to long sitting

- The ability to move from lying to long sitting is an essential part of dressing and transferring. However, the widespread use of electric beds which move patients into sitting has lessened the importance of attaining independence with this task.
- Two strategies are used to move from lying to sitting. One involves rolling on to the side and then sitting up from a side-lying position . s

Lying to long sitting

- This approach is cumbersome but relatively easy. Paralysis of the triceps muscles adds complexity because it limits the ability to push down through the hands to lift the body. Patients with C6 tetraplegia overcome this problem by aintaining the sidelying position and ‘walking’ one or both elbows around the body towards the knees. From this position, the top arm is hooked under the top leg to pull up into sitting

TABLE 3.3 **A patient with C6 tetraplegia moving from lying to sitting (some practice strategies are described)**

	Sub-task	Practice strategies
Figure 3.6a	1. Rolling onto the side: see Table 3.1.	*Practice of this sub-task can be made easier if:* • see Table 3.1
Figure 3.6b	2. Lifting the upper trunk off the bed: The left arm is horizontally abducted and weight is borne through the left elbow.	• a pillow is placed under the chest • the sub-task is practised in reverse
Figure 3.6c	3. Supporting the upper trunk: The right hand is placed on the bed to help prevent a forward collapse of the trunk. Alternatively, both elbows are placed on the bed. *(The top arm can bear some weight even though the elbow is flexed and the triceps muscles are paralysed.)*	• a pillow is placed under the chest
Figure 3.6d	4. Positioning the top hand under the leg: The right wrist is extended and hooked behind the right knee.	• a pillow or block is placed under the left elbow (see p. 140, Figure 7.1b)

(continued)

TABLE 3.3 (continued)

	Sub-task	Practice strategies
Figure 3.6e	5. Shuffling the bottom elbow around the body: The right arm is adducted with the wrist anchored behind the knee. This momentarily removes weight from the left elbow. At this instant the left elbow is shuffled a small distance towards the feet. This procedure is repeated several times to 'walk' the left elbow up towards the knees. (see p. 139, Figure 7.1 for a variation of this sub-task)	*Practice of this sub-task can be made easier if:* • a pillow or block is placed under the left elbow (see p. 140, Figure 7.1b) • the sub-task is practised in reverse
Figure 3.6f	6. Moving into the upright position: The right arm is adducted with the wrist anchored behind the knee. The left arm is abducted. The action at both arms pulls/pushes the trunk into the midline.	• a pillow or block is placed under the left elbow (see p. 140, Figure 7.1b) • the sub-task is practised in reverse

Lying to long sitting

- Another strategy for moving from lying to sitting involves using the upper arms to push directly into sitting from the supine position. Patients with paraplegia place the hands behind the body. They then push down through the hands and use elbow extension to lift the trunk. Paralysis of the abdominal muscles makes it difficult to initially position the hands behind the body. Patients with C6 tetraplegia can also move directly from the supine position into sitting; however, a different technique is used which requires awkward positioning of the shoulders.
- Consequently, few patients master the technique and it often causes shoulder pain
- It is therefore probably best avoided.

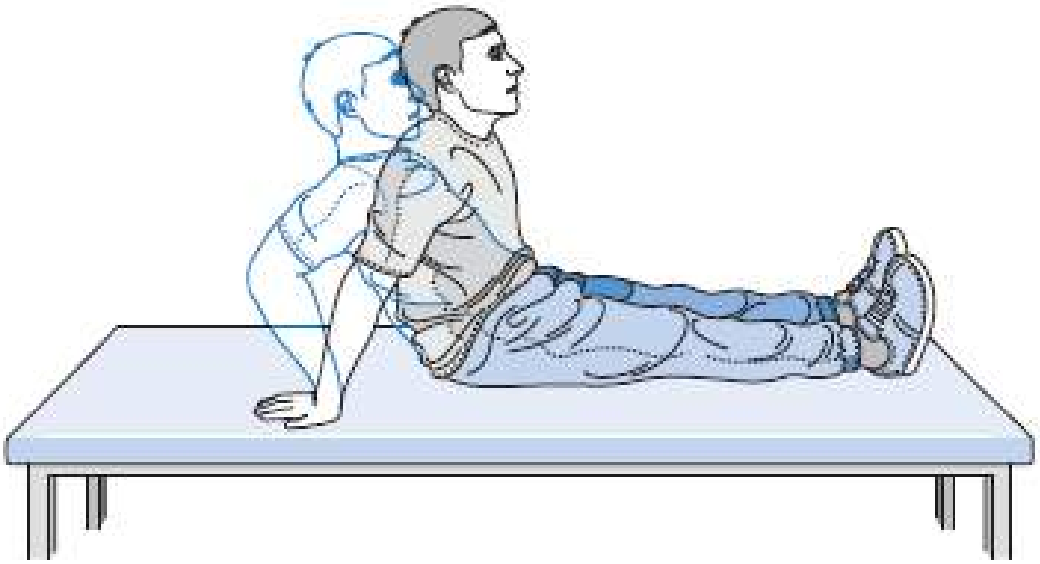


Figure 3.7 A patient with thoracic paraplegia moving directly into sitting from the supine position.

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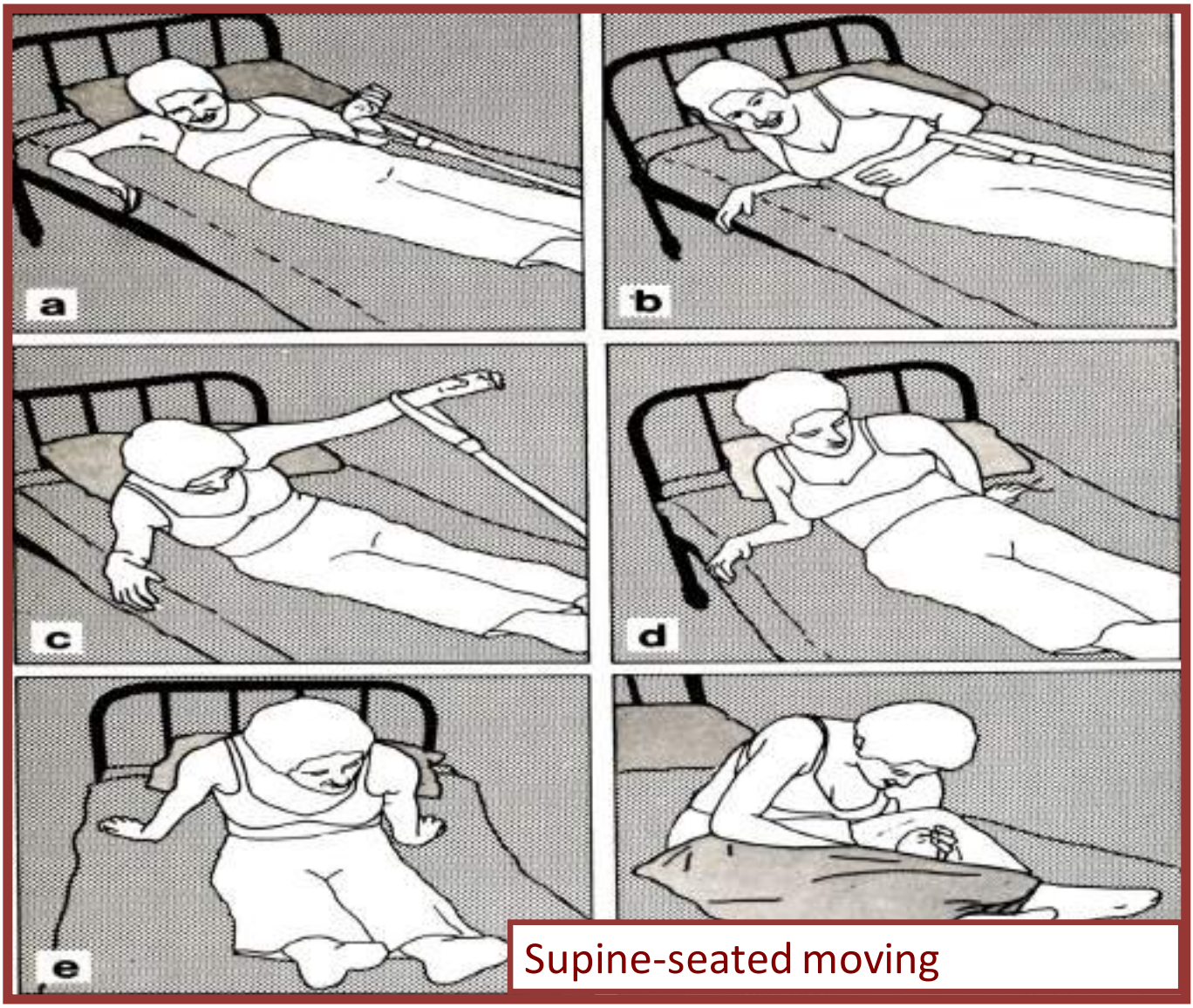
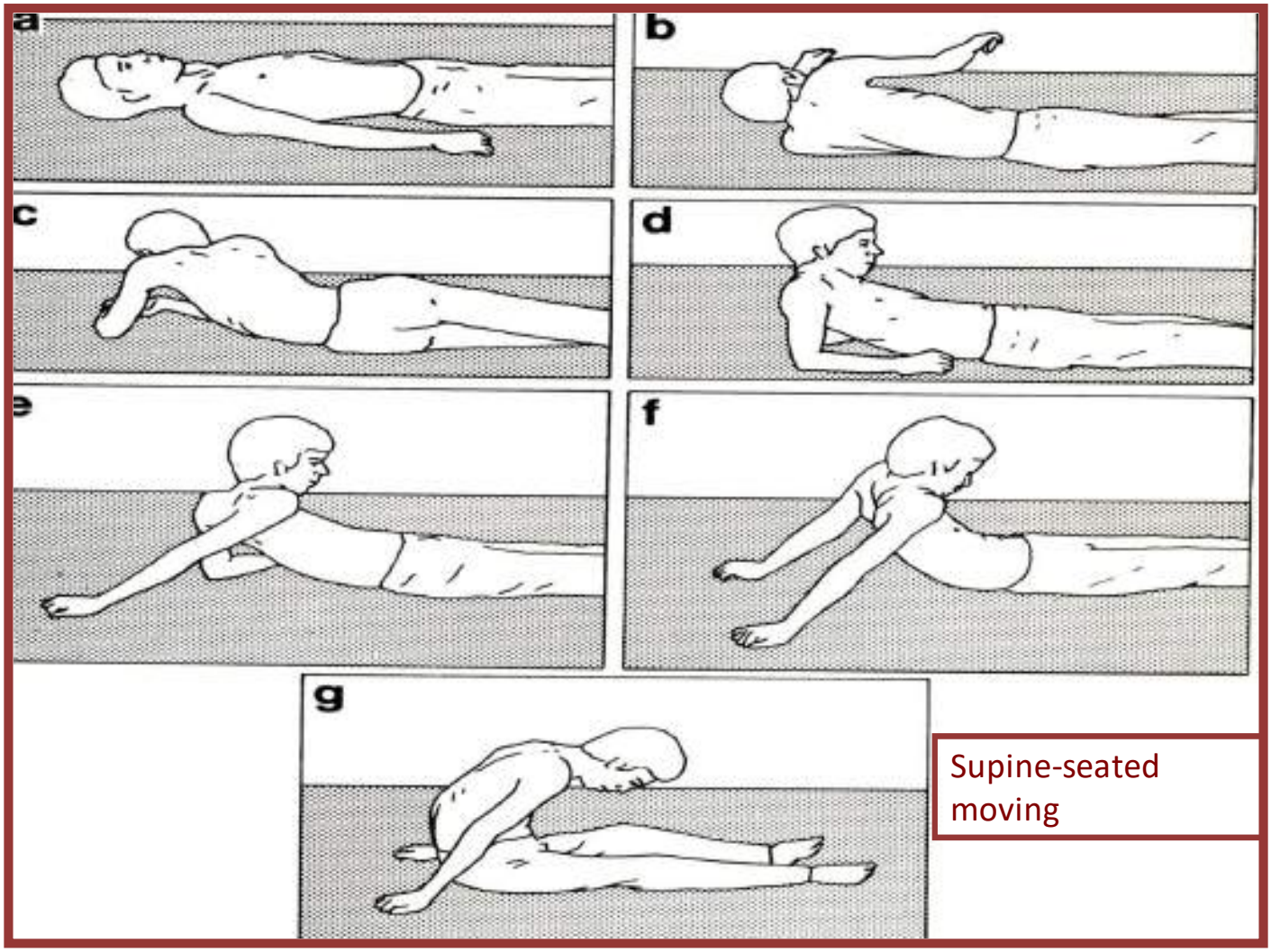


Supine-seated moving



Supine-seated moving

Vertical lift

- The ability to vertically lift is an important task for patients to master early. Vertical lifts are used to relieve pressure, transfer, dress, and move about the bed. Patients need to be able to lift while sitting in bed with the knees extended and while sitting in their wheelchairs with their knees flexed
- Lifting with the knees extended is often easier because patients can use the paralysed hamstring muscles to help maintain an upright position.

Vertical lift

- To vertically lift, the hands are placed next to the hips, usually on the seating surface but occasionally on adjacent surfaces. The patient then pushes down through the hands to lift the trunk on the stabilized arms. There are three components to the lift: elbow extension, shoulder depression and shoulder flexion. Once the elbows are extended, further lift is achieved by depressing the scapulas on the trunk and by inclining the trunk forwards on the fixed shoulders
- The vertical lift is controlled by the latissimus dorsi, anterior deltoid, pectoralis major and lower trapezius muscles. The glenohumeral joint is stabilized in adduction throughout the lift by the shoulder adductors and rotator cuff
- muscles.

Vertical lift

TABLE 3.4 **A patient with paraplegia lifting in a wheelchair (some practice strategies are described)**

	Sub-task	Practice strategies
Figure 3.8a	1. Positioning the hands: The hands are placed on the apex of the back wheels.	*Practice of this sub-task can be made easier if:*
Figure 3.8b	2. Lifting the body: The elbows are extended and the shoulders adducted and depressed.	• the vertical position of the back wheels is adjusted to optimize elbow position • the thickness of the cushion is adjusted to optimize elbow position

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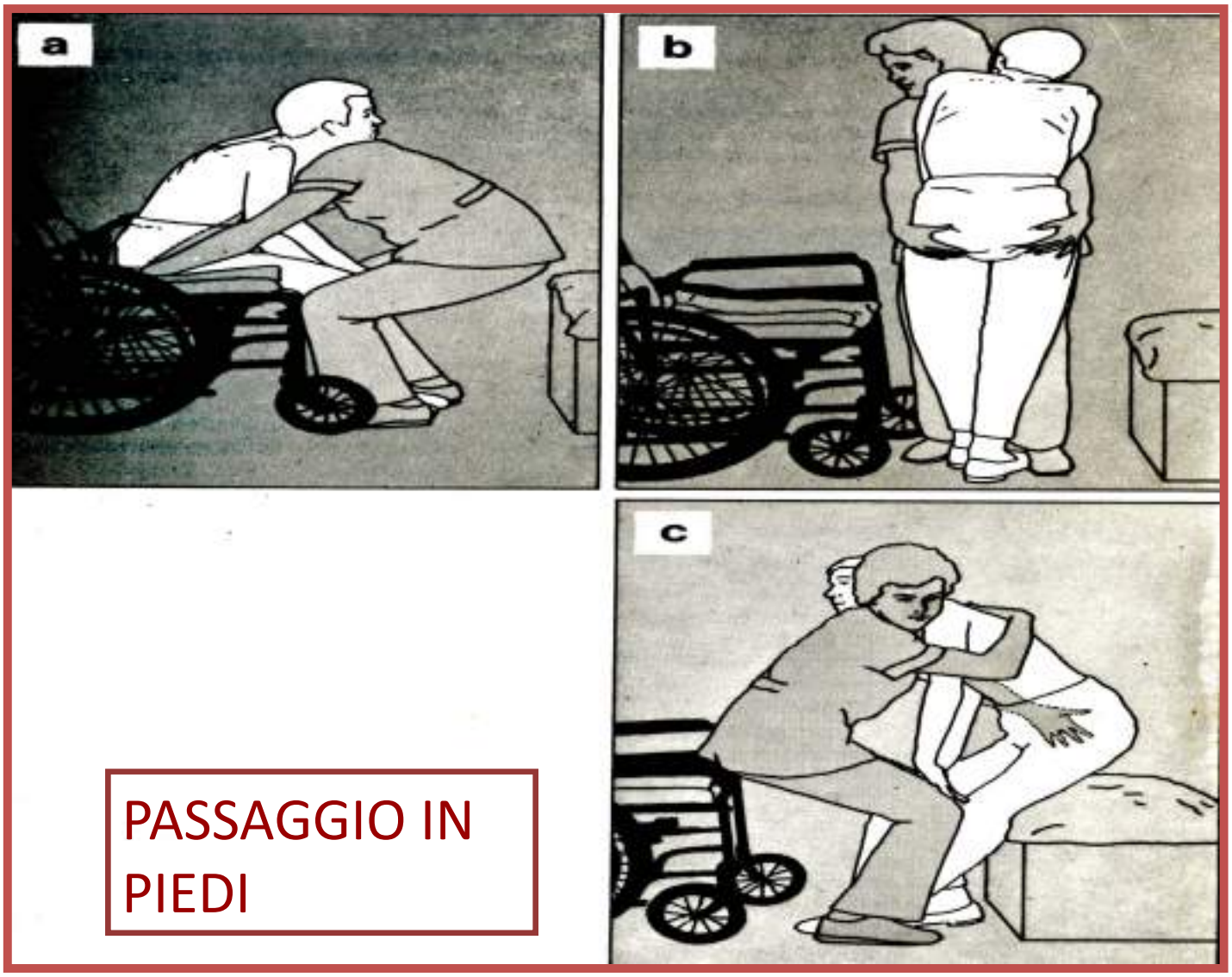

PASSAGGIO IN PIEDI

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Wheelchair-bed transfer

Transfers

- The term ‘transfer’ refers to movement between surfaces while maintaining a seated upright position. It includes moving to and from wheelchair, car, toilet, bath, commode and bed. Generally transfers onto lower surfaces are easier than transfers onto higher surfaces.
- Transfers to and from a bed can be performed with the legs up or down or with one leg up and one leg down. There are advantages and disadvantages of each approach. The main advantage of transferring with the legs up is that the extended knees increase passive tension in the paralysed hamstring muscles, helping to maintain the trunk in an upright position.

Transfert

- Transferring with the legs up when moving in and out of bed also avoids the need to lift or lower the legs when precariously perched on the edge of the bed. Instead, the legs are lifted or lowered when patients are sitting supported in the wheelchair. The disadvantage of transferring with the legs up is that it makes moving forwards and backwards difficult. For example, when transferring out of a wheelchair into bed, it is difficult to move forwards during the transfer because the feet dig into the mattress. Similarly, when transferring into the wheelchair it is difficult to move the buttocks back into the wheelchair because the feet drag on the mattress.

TABLE 3.7 A patient with paraplegia transferring from wheelchair to bed with the legs down and using the rotatory strategy (some practice strategies are described)

	Sub-task	Practice strategies
Figure 3.12a	1. Moving to the front edge of the wheelchair: The elbows are extended and the shoulders adducted and depressed to vertically lift the body (see Table 3.4). The shoulders are then extended to push the trunk and legs forwards on the seat.	*Practice of this sub-task can be made easier if:* • a firm cushion is used (this prevents the buttocks from sinking into the cushion) • the back of the wheelchair is raised so gravity assists the forward movement • the cushion cover and the patient's lower limb clothing are slippery • the feet are placed on the ground (this increases the tendency to slide forwards) • the vertical position of the back wheels is adjusted to optimize elbow position • the thickness of the cushion is adjusted to optimize elbow position
Figure 3.12b	2. Positioning the feet on the floor: The left arm lifts the right leg onto the ground. The right arm is used to hold the trunk upright. The mirror of this procedure is used to position the left leg on the floor.	

(continued)

TABLE 3.7 (continued)

	Sub-task	Practice strategies
Figure 3.12c	3. Positioning the hands: The right hand is placed on the bed and the left hand on the front corner of the wheelchair.	*Practice of this sub-task can be made easier if:* • the wheelchair is positioned as close as possible to the bed • the bed is slightly lower than the wheelchair • additional beds are placed in front and to the side of the patient (this decreases the fear of falling)
Figure 3.12d	4. Lifting and shifting the body onto the bed: The elbows are extended and the shoulders adducted and depressed to vertically lift the body (see Table 3.4). The right shoulder is adducted and the left shoulder is abducted to laterally shift the body.	• the wheelchair is positioned as close as possible to the bed • the bed is slightly lower than the wheelchair • the cushion is firm (this prevents the hands sinking into the cushion when lifting) • a slideboard is used
Figure 3.12e	5. Lifting the legs onto the bed: Weight is borne through the right elbow while the left arm is used to lift each leg onto the bed.	• the feet are placed on a raised stool to decrease the height the legs need to be lifted • a strap is used to help lift the legs

TABLE 3.8 A patient with C6 tetraplegia moving laterally from wheelchair to bed with the legs up using the translatory strategy (some practice strategies are described)

	Sub-task	Practice strategies
Figure 3.13a	1. Moving to the front edge of the wheelchair: The head and trunk are extended over the back of the wheelchair. The hands are pushed in behind the back. The hips are levered forwards by external rotation of the shoulders and extension of the wrists. The sides and top of the backrest are used as a fulcrum.	*Practice of this sub-task can be made easier if:* • a firm cushion is used (this prevents the buttocks from sinking into the cushion) • the back of the wheelchair is raised so gravity assists the forward movement • the cushion cover and the patient's lower limb clothing are slippery • the feet are placed on the ground (this increases the tendency to slide forwards) • the backrest of the wheelchair is lowered
Figure 3.13b	2. Lifting the first leg onto the bed: The left arm is hooked around the back of the wheelchair to prevent a forward fall. The right arm is used to lift the leg onto the bed. The leg is held with a wrist extension hook.	• the feet are placed on a raised stool to decrease the height the legs need to be lifted • a strap is used to help lift the legs

(continued)

TABLE 3.8 (continued)

	Sub-task	Practice strategies
Figure 3.13c	3. Lifting the second leg onto the bed: As above.	*Practice of this sub-task can be made easier if:* As above
Figure 3.13d	4. Positioning the hands: The left hand is placed on the bed and the right hand on the apex of the far wheel. Passive stretch of the hamstring muscles prevents a forward fall.	• the wheelchair is positioned as close as possible to the bed • the bed is slightly lower than the wheelchair • additional beds are placed to the front and to the side of the patient (this decreases the fear of falling)
Figure 3.13e	5. Lifting and shifting the body onto the bed: The shoulders are externally rotated and depressed and the elbows are 'passively' extended to vertically lift the body (see p. 68 and Figure 3.11). The left shoulder is adducted and the right shoulder is abducted to shift the body laterally.	• the wheelchair is positioned as close as possible to the bed • the bed is slightly lower than the wheelchair • additional beds are placed to the front and to the side of the patient (this decreases the fear of falling) • the cushion is firm (this prevents the hands sinking into the cushion when lifting) • a slideboard is used • a slide sheet or slideboard is placed under the feet • the shoes are removed and a slide sheet or slideboard is placed under the feet

Wheelchair-bed transfer

- Place your feet forward with your heels turned slightly towards the bed.
- Move your butt forward to the edge of the cushion.
- Flex the trunk forward.
- Turn your head in the opposite direction of the transfer so that your butt slides more easily towards the bed.
- Lift up and rotate towards the bed.
- Turn the pelvis parallel to the bed.
- Get one leg after the other on the bed.

Slideboards

- Slideboards can be used to bridge the gap between transfer surfaces . They are used by patients with limited ability to lift upwards and sideways and can be used either for training purposes or for long-term use. It is best if the slideboard is positioned on an angle between the two transfer surfaces. This encourages patients to rotate around as they move sidewards. It also discourages patients from sliding off the back edge of the slideboard and scraping their buttocks on the wheel. Patients often struggle with positioning slideboards under the buttocks because this requires shifting weight while at the same time manipulating the slideboard.
- The task of positioning the slideboard is best done when sitting supported in the back of the wheelchair. However, patients then need to ensure that the slideboard does not move forwards out of position as they move forwards in the wheelchair.
- This can be avoided by placing one hand on the slideboard when moving forwards.

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PASSAGE WITH FOOT ON THE GROUND AND TABLET

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PASSAGE WITH FOOT ON THE GROUND AND TABLET

Wheelchair-bed transfer

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PRACTICAL TEACHINGS FOR THE
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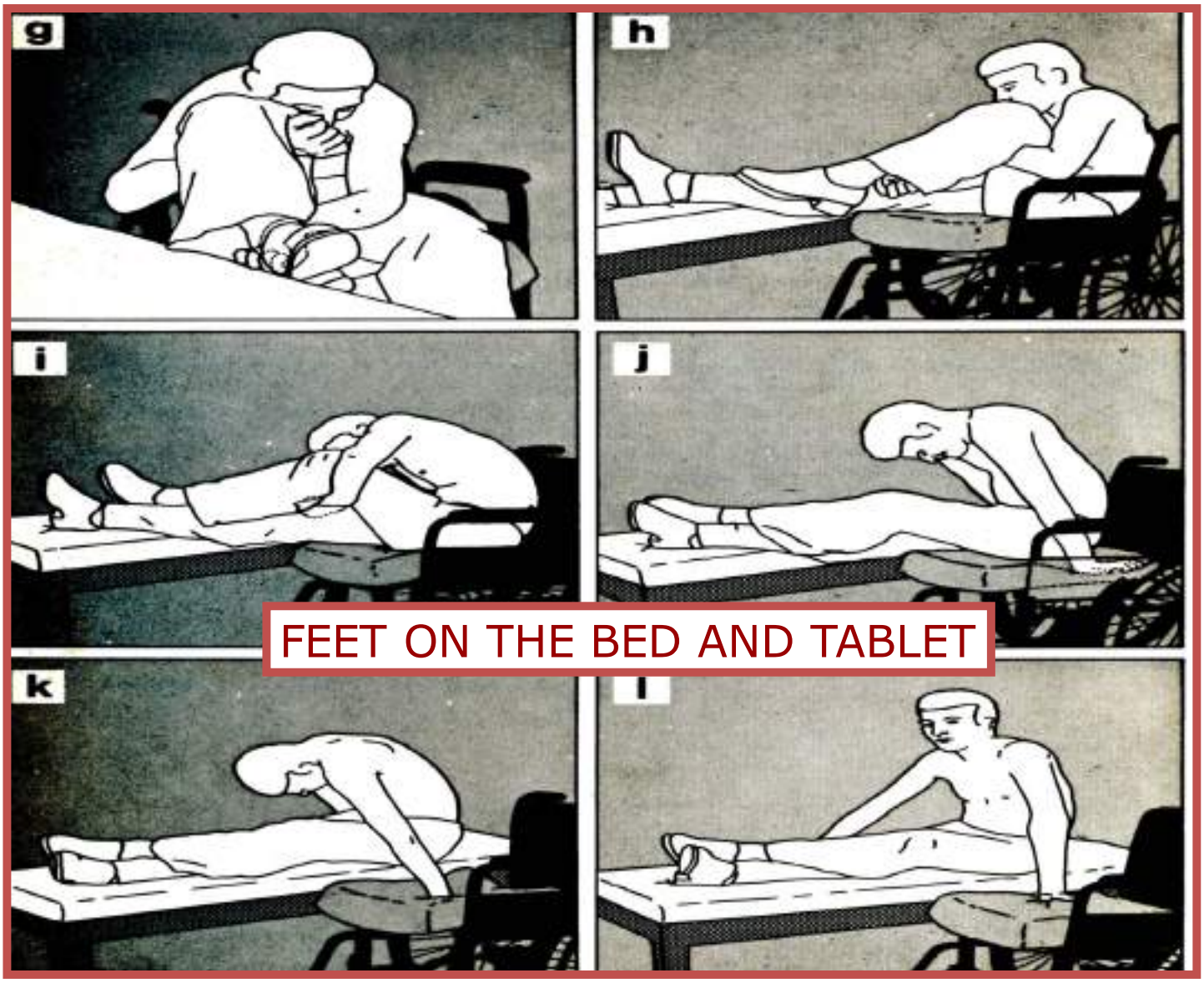

FEET ON THE BED AND TABLET

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Wheelchair-toilet transfer

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Wheelchair-toilet transfer

Wheelchair-tub transfer

Wheelchair-tub transfer

Wheelchair-to-car transfer

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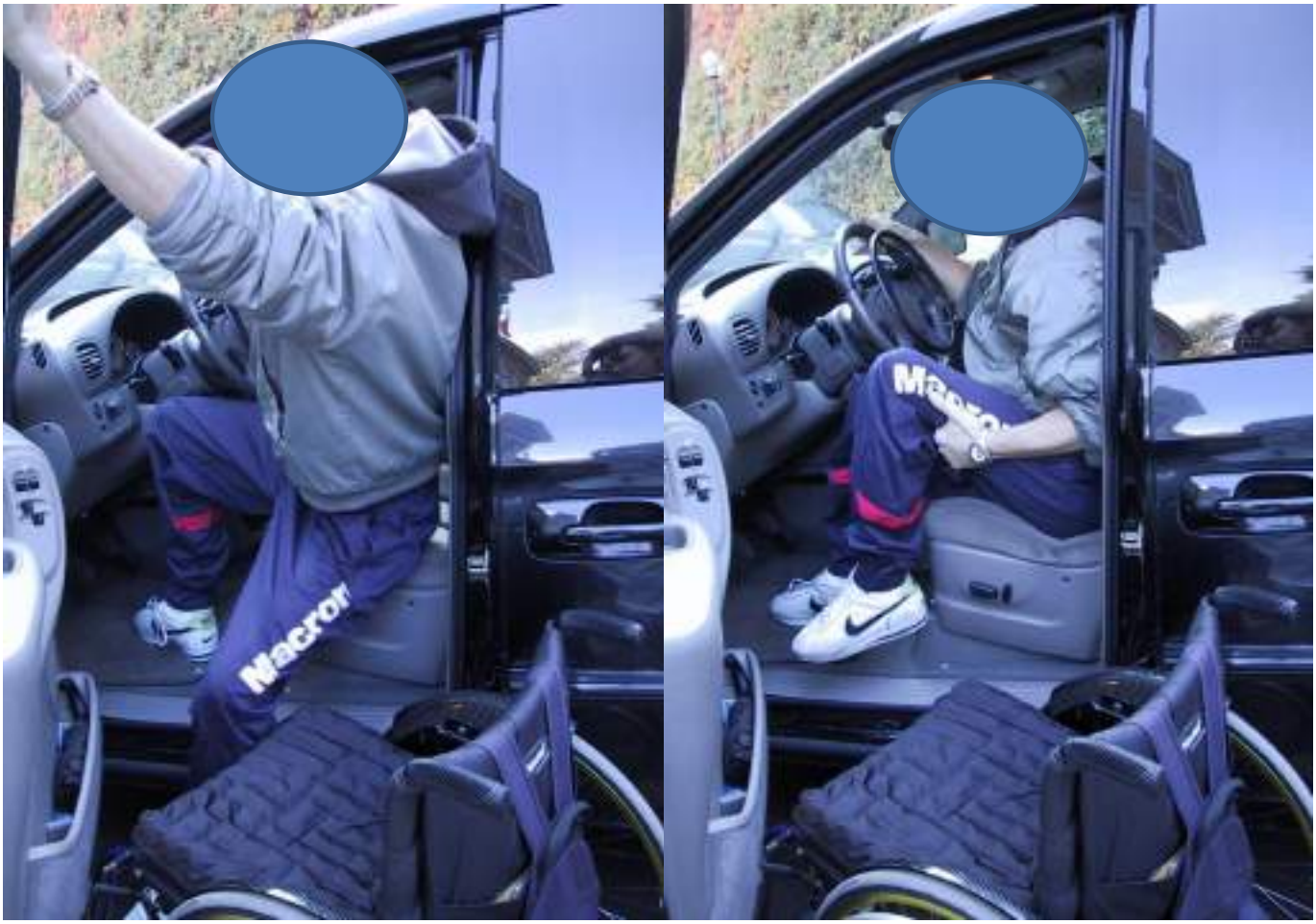

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PRACTICAL TEACHINGS FOR THE
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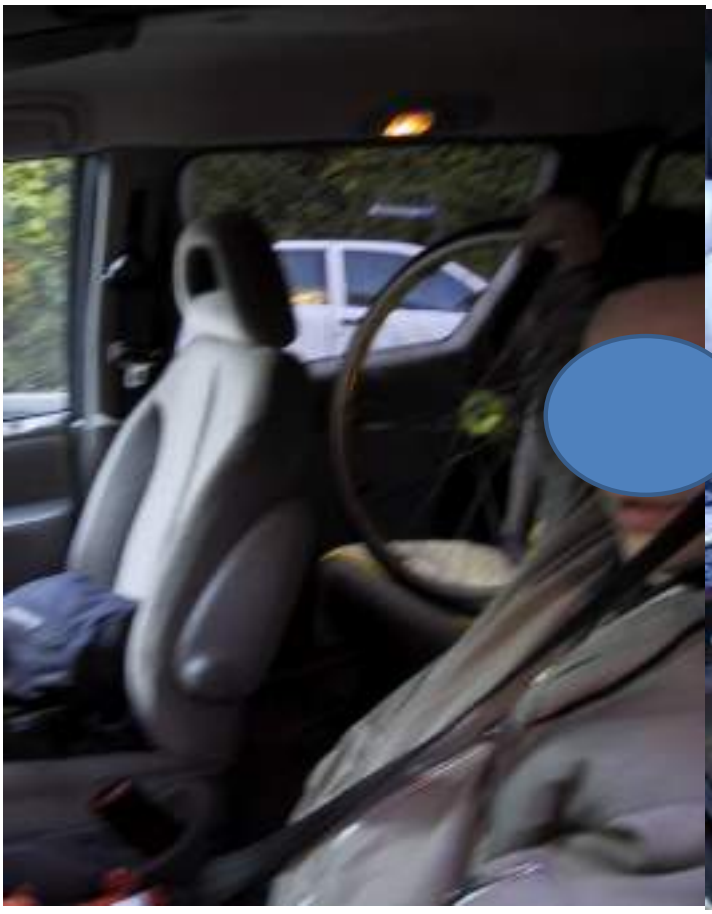
Wheelchair-car transfer with aids

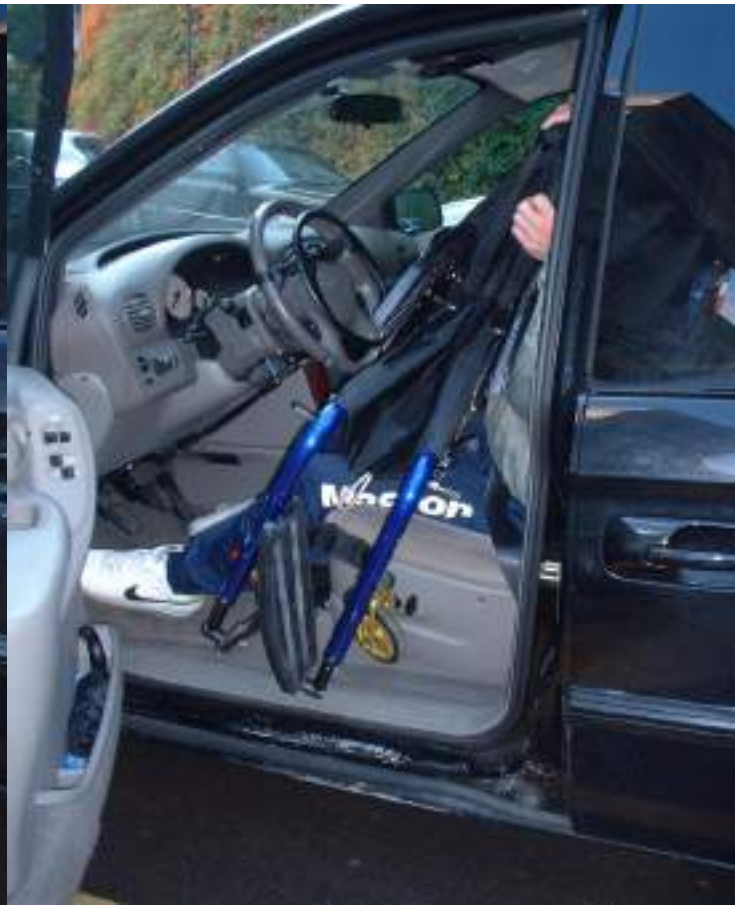
Wheelchair-car transfer with aids

Loading the wheelchair in the car

Loading the wheelchair in the car



Loading the wheelchair in the car



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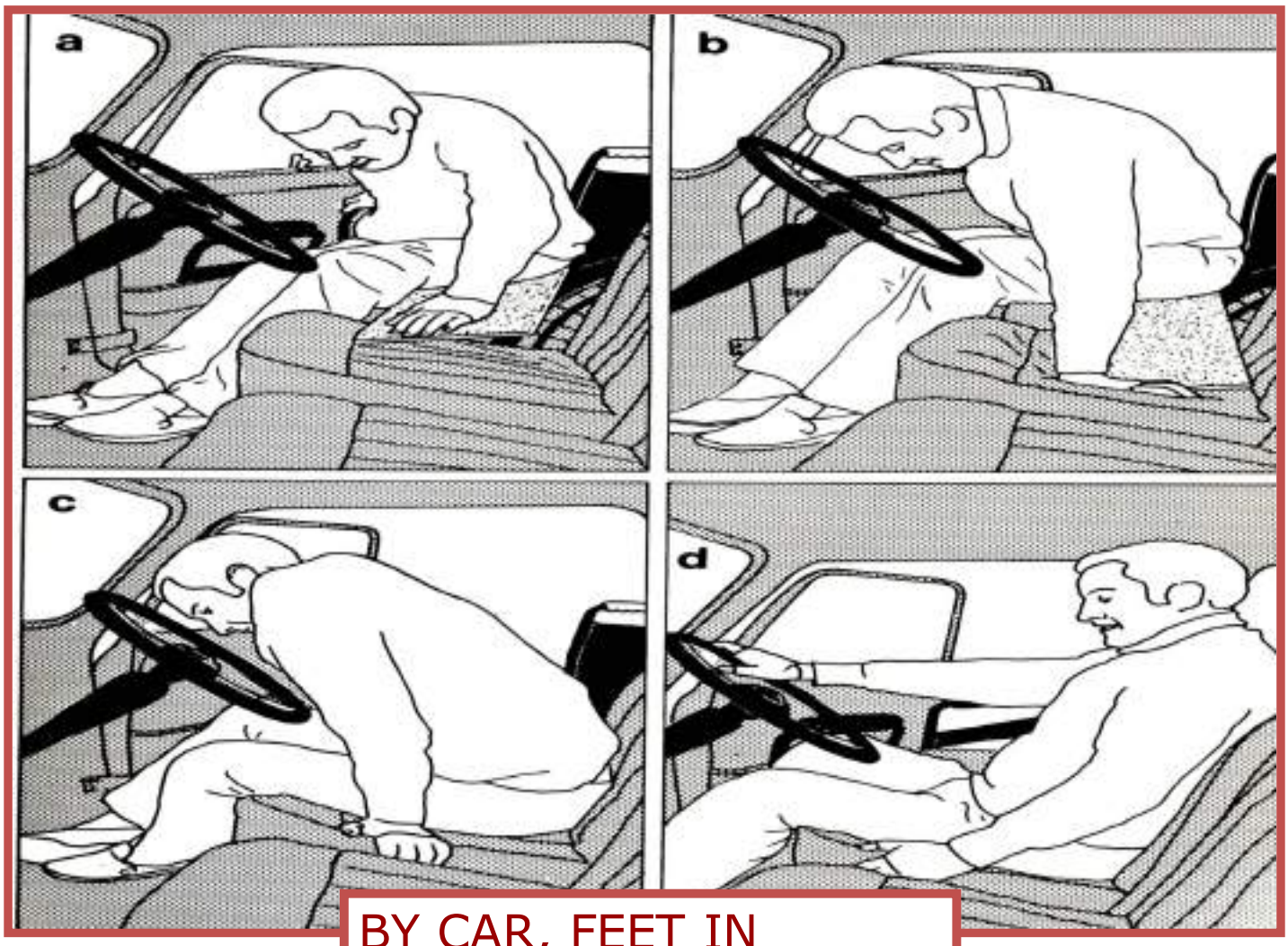
PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST



BY CAR, FEET IN

Balancing on the rear wheels and falls

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Wheelchair-to-ground transfer

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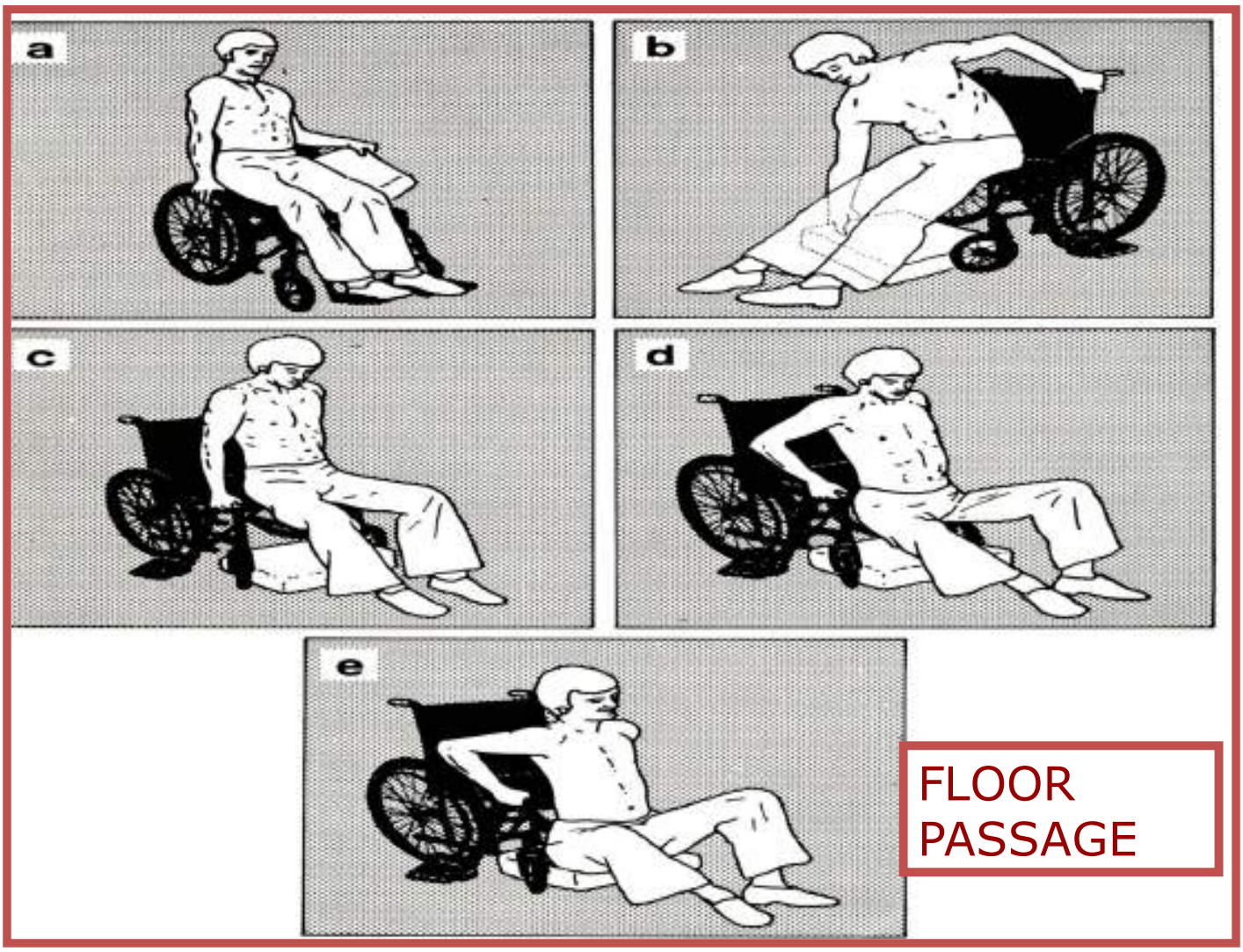
PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST



FLOOR PASSAGE

Feeding

- Drinking and eating are important social activities and when possible it is psychologically important to make the individual independent in this area.
- Feeding can be facilitated by adapting the grip of the cutlery (enlarged handles), using straps in which to insert the cutlery or in higher lesions by means of a wrist strap that stabilizes the wrist and supports the cutlery (fork and spoon).
- Especially in the initial phase, the use of non-slip material on which to place the plate, or plates with a raised edge can be useful.
- To drink, it may be necessary to use straws, goblets or light cups.

Hygiene

- The person with a high injury must be able to wash the face and upper part of the body using sponge gloves, the sink must allow the elbows to rest and to approach well with the wheelchair. Useful liquid soap with dispenser.
- For dental hygiene, shaving, make-up, adaptations and splints can be envisaged, as well as for feeding, straps, wristbands, etc.

Clothing training

- General indications: abundant, comfortable clothing, of non-rigid fabric, and for quadriplegics closures with velcro, zippers, rings to insert the thumb.
- The person with a high cervical injury can dress the upper body while sitting in a wheelchair or resting in bed. To wear a garment, first put both upper limbs on, pass the back of the garment behind the head, to bring it down you can shake your shoulders or put your thumbs or wrists in extension under the side and front of the garment.

Clothing training

- The person with low cervical injury may be able to dress even the lower part while in bed, while remaining very difficult in a wheelchair. To wear the pants, cross one leg over the opposite knee and put on one leg of the pants; repeat the same operation on the other side; bring the pants over the thighs; hook one hand to the back of the wheelchair, turn well to the side and pull up the pants; turn over on the other side and repeat the operation several times.
- A paraplegic patient can dress and undress even in a wheelchair, which is very important in terms of toilet use.

Bladder, bowel and sexual function

- Spinal cord injury commonly affects bladder, bowel and sexual function. One of the most comprehensive studies in this area found that 81% of people with spinal cord injury had impaired bladder function and 63% had impaired bowel function 1 year post injury.
- While the control of these three bodily functions is complex, they all rely on coordinated activity between the sympathetic and parasympathetic nervous system as well as skeletal muscle control via the S2–S4 nerve roots. Injuries below the conus result in a flaccid paralysis of skeletal muscles associated with bladder, bowel and sexual function, and loss of the sacral part of parasympathetic spinal cord-mediated reflexes.
- In contrast, injuries above the conus result in a spastic paralysis of the bladder, bowel and sexual skeletal muscles with retention of sacral reflexes. The site of the lesion therefore has important implications for management and function.

Bladder management

- Bladder drainage can be managed in several different ways. Most patients with some hand function perform intermittent catheterization. This requires the patient (or the patient's carer) to temporarily introduce a catheter into the bladder every 3–6 hours.
- The catheter is removed once the bladder is drained. Intermittent catheterization is preferred over other options because it is associated with lower rates of infection and is aesthetically more acceptable (i.e. it does not require use of external leg bags
- to collect urine).91 In males, external drainage sheaths can be used to ensure continence.
- These are like condoms that cover the penis and are attached to leg bags.

Bladder management

- There is no equivalent device for females so sanitary pads are often used.
- Patients who are unable to intermittently catheterize typically have an indwelling catheter.
- The catheter is initially inserted via the urethra but ultimately is often inserted surgically through the suprapubic abdominal wall.

Bladder management

- Some patients rely on reflex emptying of the bladder: voiding is elicited by either tapping over the bladder or manually stimulating the perineal region. This technique can be assisted by manual overpressure on the bladder provided there is no risk of urine tracking up to the kidneys.
- Patients with spinal cord injury have an increased susceptibility to bladder stones, kidney stones and urinary tract infections, all contributing to an increased risk of late-life kidney failure.
- All these potential problems are managed and monitored by controlling fluid intake, optimizing medication and by regularly
- reviewing kidney and bladder function. Urinary incontinence can be an ongoing problem for some patients.

Urological problems:

- Fundamental is education in proper bladder hygiene and correct catheterization or self-catheterization maneuvers.
- The catheter is a device that allows vesicle emptying: it can be left in place (indwelling catheterization) or only for the time necessary for emptying (intermittent catheterization).
- The use of fixed catheterization is limited to special cases because it exposes the person to numerous complications, while intermittent catheterization if properly performed is a modality that allows good management of the bladder and decreases the risk of complications of the urinary system.

Bowel management

- Bowel management is an important and often time-consuming issue for people with spinal cord injury. Patients with lower motor neuron lesions tend to have more problems with incontinence because they have flaccid paralysis of the anal sphincter and loss of associated spinal cord-mediated reflexes.
- In contrast, patients with upper motor neuron lesions can take advantage of remaining bowel reflexes. Bowels can be managed in a variety of ways, but key strategies include a highfibre diet, adequate fluid intake and a regular routine for bowel emptying. Other options include oral and/or anal medication, digital stimulation or manual evacuation.
- Often bowel regimes are initially difficult to establish and faecal incontinence or constipation can be a problem. It is not unusual for bowel accidents to be precipitated by exercise.

Sexuality

- When people think of spinal cord injuries and sexuality, they most commonly think of the physical aspects of sex. Spinal cord injury clearly affects sexual intercourse and the associated physical sexual responses in both males and females.
- Patients with upper motor neuron lesions retain reflexive but not psychogenic responses, patients with lower motor neuron lesions lose reflexive but may retain psychogenic responses, and all retain the ability for non-genital sexual arousal
- Spinal cord injury can affect male fertility by impairing ejaculation and reducing semen quality. However semen, if required, can often be obtained with vibration and electro-ejaculation techniques. More sophisticated techniques are being increasingly used for fertilization. Female fertility and menstruation are largely unchanged by spinal cord injury but pregnancies are associated with increased risks.

Sexuality

- Females generally cease menstruating for 1–3 months following injury. Studies of men with spinal cord injury have found that genital sensation, erectile function and capacity for orgasm are not strong predictors of sexual satisfaction nor behaviour.
- The stronger predictors are perceptions of partners' satisfaction with the sexual relationship, intimacy of relationships and willingness for sexual experimentation.
- Spinal cord injuries have implications not only for patients' experiences of sexual intercourse but also for males' and females' sexuality. That is, spinal cord injury affects how people perceive their own maleness or femaleness. For example, a spinal cord injury may affect a male's ability to earn money for the family, play sport with the kids, drink beer with the mates or pump iron at the gym. Some men perceive that the inability to readily engage in these types of activities undermines their maleness.

Sexuality

- In the same way, a female may perceive that her femininity has been adversely affected by her difficulty wearing fashion shoes, making up her face, looking after her children or going to nightclubs. The issues are complex and management often involves reappraisal of preconceived ideas about the expression of both sex and sexuality.
- Most rehabilitation teams have psychologists, social workers, nurses or medical personnel specifically trained to counsel patients on sex and sexuality. Ongoing sexual support and education post-discharge are particularly important. Physiotherapists need a general understanding of these issues so they can be appropriately supportive and knowledgeable when these issues are raised during therapy sessions.
- However, it is not normally the physiotherapist's role to provide counselling or detailed information on these issues.

Osteoporosis

- Osteoporosis is a common long-term complication of spinal cord injury which predisposes individuals to fractures.
- Over a lifetime patients may experience a 25–50% reduction in bone mineral content of the lower limbs with most bone mineral loss occurring in the first year following injury. It has been assumed that bone mineral loss is primarily due to the lack of weight bearing and axial loading.
- However, it is now believed that bone mineral loss is due to multiple factors involving metabolic, endocrine, neural and vascular changes associated with spinal cord injury.
- Bone loss is primarily managed with pharmacological agents (i.e. bisphosphonates).
- Early standing and electrical stimulation programmes are also advocated, although their effectiveness is yet to be clearly demonstrated.

Gait

- In complete lesions above L2, a therapeutic path is foreseeable, that is, possible in "protected" contexts, but not replaceable for the use of the wheelchair; this type of walk is therefore comparable to a therapeutic activity that contrasts bone demineralization caused by immobility and the absence of load on the lower limbs, helps to maintain good functionality of the cardio-vascular and respiratory system, counteracts the onset of joint limitations and muscle shortening.

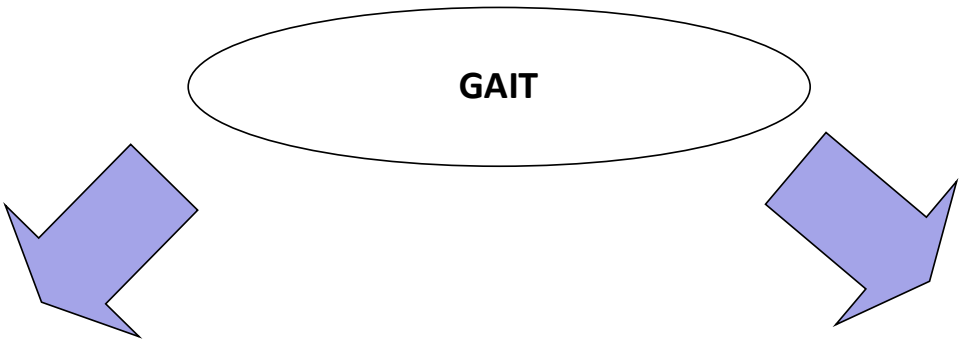
Gait

- In AIS D incomplete lesions or in those below L2, a functional path is generally achievable that is characterized by its finalistic use in a daily situation (although often restricted to certain places or conditioned by environmental elements), in response to stimuli, interests , needs of the individual
- Obviously, among the prerequisites indicated below, a favorable anthropometry must be understood (limb / trunk length ratio, body weight / muscle strength, age, motivation, collaboration, absence of clinical complications - heart disease).

THE GAIT IN PARAPLEGIC SUBJECTS WITH COMPLETE SPINAL LESION

Indications:

- absence of clinical contraindications (eg: sub-dislocations of the hips, hyperextension and / or instability of the knees, lumbar hyperlordosis, joint pains that appear during activity);
- strong motivation of the patient, as the activity involves a large expenditure of energy.



Functional

Analytical evaluation of the phases of the walk in order to create the most correct program with the use of the most suitable orthosis (process in evolution and clinical picture evolution).

Therapeutic

at the beginning of the re-education program it can then be transformed into a functional path always only therapeutic in the case of the paraplegic with complete injury (tutored walk).

Tutors for the paraplegic patient's walk(high braces, stabilizers like Vannini, R.G.O., A.R.G.O.)

Prerequisites for (functional) walking in incomplete lesions

- Valid motor skills in the upper limbs and shoulder girdle
- Ability to assume and keep the static upright
- Valid antigravity motor skills of the trunk
- Absence or little interference with the gait pattern by pathological changes in muscle tone
- Sufficient range of joint excursion of the hip - from about 30 ° of flexion to 10 ° of extension (knee and ankle can be compensated by orthoses)Valid antigravity motor skills of the proximal districts of the lower limbs
- Absence of significant agonist / antagonist muscle imbalances
- Preservation of kinesthetic and exteroceptive sensitivity
- Coordination

Prerequisites for (functional) walking in complete lesions

- Valid motor skills in the upper limbs and shoulder girdle
- Ability to assume and maintain an upright position
- Valid antigravity motor skills of the trunk (depending on the level of injury)
- Absence or little interference with the gait pattern by pathological changes in muscle tone
- Sufficient range of joint excursion of the hip - from about 30 ° of flexion to 10 ° of extension (knee and ankle can be compensated by orthoses).

Gait rehabilitation

- The training for both types of injury can be superimposed without prejudice to the use of FES systems which instead provide for a long treatment training with electrostimulation, calibration and training in the use of the chosen system.
- We can distinguish a preparatory phase and a training phase proper.

Gait rehabilitation

In the preparatory phase, the treatment is aimed at the following objectives:

- it can be useful to do an intensive strengthening training for the upper limbs, especially for the shoulders, which must carry a large part of the body's weight, in some cases and especially in complete injuries
- Strengthen the muscles that have normal innervation and / or those that have lesions of the second motor neuron;
- Acquire new motor skills by improving motor control and balance in various postures by following the progression that leads to standing (sitting posture, prone resting on elbows, quadruped, kneeling, modified plantigrade, standing position);
- Inhibit spasticity and any associated pathological reactions;

Gait rehabilitation

- When the patient has achieved the ability to assume and maintain the station with and without support and is able to exercise load shifts with a correct balance between agonist-antagonist muscles, walking training begins.
- At the beginning it is foreseeable the use of aids that reduce the weight of the body on the lower limbs, using the upper limbs as supports, and / or orthoses that improve the qualitative pattern of the walk.

Gait rehabilitation

- The training is aimed at making the walk as functional as possible compatibly with the motor potential of the patient, progressively increasing the difficulty steps, whenever the patient acquires safety and skills (walking on uneven ground, stairs, overcoming the sidewalk, falling and getting up from the ground) and reducing the use of aids, freeing the upper limbs from the support function when possible in order to carry out functional activities of various types (opening a door, taking objects from cabinets, picking up objects from the ground etc.)

Incomplete Injury Treatment

The treatment of these subjects reflects the principles of neuromotor treatment:

- promotion and improvement of spontaneous neurological recovery through activities aimed at improving motor control, reducing muscle imbalance between innervated agonists and weak or even absent antagonists, reducing hypertonicity and the appearance of pathological patterns
- electrostimulation and bio-feedback in the presence of lesions mainly of the second motor neuron and / or in selected cases
- re-education of orthostatic skills and where possible walking with or without aids and orthoses;

Incomplete Injury Treatment

- The treatment will also pursue, with times and methods identified, case by case, in relation to the type of lesion, the neurological level, AIS, as well as the evolution of neurological recovery, objectives for functional autonomy as provided for the lesions. full type.

Prognostic factors for the recovery of gait

The results of some studies show that subjects with incomplete cervical injury (Ais C or D) have a good chance of a good functional recovery. Regarding independent walking, it was possible to observe that:

- patients with centro-medullary syndrome of traumatic origin returned to walk independently with a variable percentage between 57 and 86%;

Prognostic factors for the recovery of gait

- patients with centro-medullary syndrome secondary to cervical spondylosis return to walk independently in about 31% of cases;
- the gaitprognosis in patients with Brown-Sèquard syndrome appears to be very favorable

Prognostic factors for the recovery of gait

- The aforementioned data, however, are not related either to the age of the subjects under examination or to their neurological damage; contrary to what happens in a study carried out by Burns et coll. conducted on 105 patients with cervical injury (Ais C or D) of traumatic origin.

Prognostic factors for the recovery of gait

The conclusions of this study are that:

- All patients classified as Ais D, immediately or within 72 hours of injury, were able to walk on discharge.
- Tetraplegic patients with 50 years of age and older, classified as Ais C, immediately after the traumatic event or within the immediate 72 hours, have a less likely recovery of walking due to various factors (higher incidence and severity of secondary complications, pre-existing pathologies such as peripheral neuropathies, heart and / or lung disorders, reduced neuronal plasticity)

Gait orthosis

- short or "soft" orthoses indicated to stabilize the ankle at 0 ° of flexion such as the Codivilla spring and the Ottobock spring;
- knee orthosis: their function is mainly to block hyperextension of the knee;
- Plaster: built in thermoplastic material or moldable PVC;
- long braces: the load from the trunk passes to the ischial tuberosities and instead of weighing on the knee, it is discharged to the ground through the skeleton of the brace;
- articulated braces: equipped with a knee extension release mechanism thus allowing flexion.

Shoe fixes:

- fixed orthoses as they are fixed to the sole, heel and upper (lifts, medial spur, lateral, etc);
- mobile orthoses: insoles.

Walking aids

The effects common to all aids belonging to this category are the following:

- increase the support base;
- stabilize the pelvis on the frontal plane;
- reduce the force required to support the load.

Walking aids

This group of aids includes:

- walkers: there are different types: with directional, articulated, axillary front wheels.
- crutches: there are two types, the axillary ones, which offer greater support to the trunk and the Canadian ones which have anti-brachial support.
- sticks: generally they bear up to 25% of body weight; they are used in particular in the Brown-Sèquard.

Aid Plan

Once a need has been identified that is inherent in the impossibility of carrying out an activity in relation to the subject's present and potential abilities, the person's living environment, any possibility of external help, it is necessary to proceed:

1. identifying the aids that best meet the patient's needs according to criteria of personal acceptability, comfort, effectiveness in performing a service (achievement of the purpose for which it is used), efficiency in optimizing the patient's physical resources, cost containment and accessibility economic by the patient, safety in use for the patient and any assistant, technical compatibility with the possible presence of other aids (home automation), adequate technical assistance, good maneuverability and possible portability;
2. customization that allows the adaptation of the selected aid in relation to the patient's anthropometric parameters and his specific needs;
3. training in the use and proper maintenance of the aid.

Health Education

- The rehabilitation intervention in the person with SCI aims not only at a functional goal but also at activating, as early as possible, the ability to decide and exercise conscious control (empowerment) on the new health condition. The "active involvement" of the affected person begins gradually in the stabilization phase, taking into account the individual psycho-physical adaptation path to the pathology and becomes a priority objective in the pre-discharge phase, when the patient prepares for the "detachment“ From the USU

Health Education

- In fact, in anticipation of socio-family reintegration, the person with SCI and his family entourage must begin to independently put into practice the knowledge and management skills acquired in the rehabilitation process at the U.S.U. and therefore it is also essential to prevent tertiary complications.

Health Education

- Therefore, the educational intervention is a fundamental "piece" of the rehabilitation process of the person with spinal cord injury to acquire knowledge about:
  - the disease / disability
  - the management of the new condition in a competent manner
  - the prevention of avoidable complications
- The most important specific areas of health education intervention in the U.S.U are described below. addressed to the patient and / or his family, taking into account the complexity of the pathology and its disabling repercussions on both the sensory-motor and visceral system

PRINCIPLES OF HEALTH EDUCATION

- Take care of yourself
- Avoid trauma to the joints
- Avoid skin injuries (heat, pressure, friction, etc.)
- Skin self-inspection
- Posture control
- Variations in position and ischial discharge
- Upright statics
- Self-mobilization
- Implementation of the ADL
- Beware of respiratory tract infections
- Attention hypotension and thermoregulation

Psychological well-being

- The psychological implications of spinal cord injury are profound.
- Some of the common emotions experienced immediately after injury include anger, grief, despondency, denial, depression and apathy.
- Factors found to be associated with patients' psychological reactions include coping skills, pre-morbid personality, family support, substance abuse, extent of permanent paralysis and home situation.
- Some studies put the rate of depression in the first 2 years following spinal cord injury as high as 38%,83 although most place it between 15% and 23%.184–186 The incidence of ongoing depression appears to be strongly linked to restrictions in participation.

Psychological well-being

- Suicide rates are higher amongst people with spinal cord injury than in the general population. However, these statistics mask the proportion of people with spinal cord injury who go on to live happy and fulfilling lives. Health care workers often underestimate the long-term satisfaction with life following spinal cord injury.
- Psychological distress impacts on patients' ability to cooperate with physiotherapy programmes, especially when the distress is associated with poor sleep, appetite and energy. In particular, psychological distress can lead to passivity, self-neglect,
- poor drive and motivation, and low adherence. Not surprisingly, patients with depressive symptoms achieve poorer outcomes than their non-depressed counterparts.
- However, psychological distress is not always associated with poor adherence.
- It can present as unbridled determination and drive for success in physiotherapy. Sometimes this is expressed by unrealistic goals, especially those that are gait orientated (e.g. "I am going to walk at any cost"). Alternatively, it can be expressed
- by preoccupation with physiotherapy and unrealistic demands for intensive attention from therapists. These issues are best managed through a coordinated team response under the leadership of a clinical psychologist

Family and friends

- Families and friends of people with spinal cord injury are often overlooked by health professionals. However, the practical and psychological implications for parents, siblings, children or friends can be multifaceted. Family members, particularly spouses,
- are often the primary providers of physical and emotional support.
- The marital status of a patient with spinal cord injury is the strongest predictor of long-term psychological adjustment and quality of life, although divorce is common.
- Family members often become responsible for providing a range of care services. This can cause them considerable stress, burnout, resentment and depression.
- In the early days after injury physiotherapists can assist members of the family and friends by involving them as much as possible in patients' programmes. Family and friends often welcome the opportunity to assist in real and tangible ways. This can be achieved by requesting them to help patients with practice activities, positioning and stretching programmes, and helping monitor skin integrity, either within or outside formal therapy sessions. Of course, patients must be happy to have family and friends involved in this way; patient consent for family involvement should not be assumed.

Autonomic nervous system

- The sympathetic reaches the organs by blurring the sympathetic paravertebral synaptic ganglia, so when there is a spinal cord injury the sympathetic is injured at the same level.
- The vagus that turns forward from the floor of the fourth ventricle, crosses the stony rock of the thunderstorm and descends into the thorax through the vascular-nervous bundle of the neck which is free.

Autonomic nervous system

- So acute patients will be hypervagal so hypothesized, bradycardic, with a paralytic ileum etc.…
- With a lesion at the cervical level, all subjects suffer from AUTONOMOUS DYSPHREFLEXIA, deriving from a vague out of control with respect to the physiological balance that is established with the orthosympathetic.

Autonomic nervous system

- The orthosympathetic, in turn, will look for a way to "make himself felt" in any way, which will turn into "storms" of uncontrolled discharges that will lead to hypertension, tachyarrhythmia, skin rashes. Dyslexic seizures are usually triggered by visceral stimuli, which make the bladder and pelvis too full, and can become very dangerous. They begin to appear at the end of the shock phase and can persist for a lifetime.

Autonomic nervous system

- If the lesion is below D6, on the other hand, there will be no dysriflex seizures because at that level there is an intermediate orthosympathetic station that restores partial control.
- The disparity of autonomic innervation of the internal organs also includes paralytic ileus and loss of evacuation automatism. Rehabilitation of the bladder and pelvis is a priority goal of rehabilitation and fundamental to the subsequent quality of life.

Cardiovascular system

the venous return from the lower limbs to the vena cava is markedly reduced after spinal injury due to several factors:

- increase in blood viscosity due to the release of coagulation factors secondary to fracture. This is a phenomenon that affects all fractures, the more they involve very vascularized bones, the more they will trigger the attempt to repair damaged vessels. How many times have we heard of people affected by pulmonary embolism when removing a cast?
- In addition, there may be lesions associated with further blood extravasation and the need to activate coagulation factors.
- Loss of muscle pump. The motor paralysis of the lower limbs does not allow the physiological "squeezing" of the venous vessels.
- Immobility. Although the mobilization is started early, it is still limited in time.

Cardiovascular system

- Overall, several factors contribute to the formation of deep vein thrombosis (DVT) in the middle small vessels of the lower limbs, especially in the solar and femoral veins.
- During external compression, these formations can detach and enter the circulation, stopping only in the body's natural "filter," that is, the lungs.
- When a pulmonary embolism occurs the danger is very great, it can range from sudden death if the lung vessel is large in size to necrotic injury if it is small in size.
- In any case, it requires adequate therapy and it is often necessary to bring the patient back to resuscitation.
- A sudden increase in heart rate above 100/120 rpm during or after mobilization is an alarm to be reported immediately to the doctor.

Cardiovascular system

- In the first 30 days after the injury and only after it was ascertained that the patient performed an ECOCOLORDOPPLER that did not have DVT in place, lower limb pressure therapy was performed for 3 hours a day, this greatly reduced the incidence of DVT in the acute phase. In addition, low molecular weight heparin is administered but the dosage should be contained, especially if there are other blood clots and potential areas of bleeding.
- Mobilization, in addition to neuromuscular and joint treatment, also aims to promote venous return; it should only be performed after it has been ascertained that the patient has performed ECOCOLORDOPPLER which excludes dangerous DVT. Often there are small solar DVTs that allow you to mobilize your hip and knee, but they do not recommend the flexed extension of the ankle because it is during the stretching of the sural triceps that the distal squeezing is more powerful.

Cardiovascular system

- The revaluation of the lower limbs for DVT is daily and concerns all staff. Since the patient does not usually experience pain and the possible thrombosis is deep, redness of the skin should not be sought, only the swelling and consistency of the tissues can be used to clinically detect DVT.
- Generally generalized edema of the limb is related to thrombosis of very large vessels (eg at the femoral-iliac level), while below the knee there may be only a slight asymmetry of caliber with the contralateral limb and a consistency different from the tissues, for example a greater pastiness than without reaching the frank edema (therefore without fovea) still suggests the accumulation of fluids in a deeper layer.
- Careful inspection is therefore essential before mobilization (it should be done by uncovering both lower limbs and comparing any diameter asymmetries) and, when in doubt, refrain and compare with the doctor.

Cardiovascular system

- At the time of admission the patient can be provided with long preventive compression stockings (antithrombus) which have a compression of about 15-18 mmHg
- At the time of getting into the wheelchair, instead it will be necessary that the level of compression is higher to help contrast hypotension and we will resort to aids, even if shorter for practicality, knee-highs with compression of about 19-21mmHg.

Cardiovascular system

- In addition to the lower limbs, venous blood can have stagnant areas in the abdominal viscera, complicating the paralysis of the abdominal muscles and the width of the mesenteric vascular bed. A zone of "seizure" will form in which the slowed circulation will subtract a significant percentage of the volume, so as to facilitate the fall of systolic pressure at the time of verticalization of the trunk.

Cardiovascular system

- This seizure is partially addressed by the use of an ELASTIC BELLY that must be worn when verticalization begins.
- Both the abdomen and the legs, ie the VASO PRESSURE AID, are identified, tested and tested by the physiotherapist. Only if there are particular problems, for example significant DVT or generalized edema, will there be a prescription for vasopressor aids by the cardiologist (eg long socks or higher compression level) and in this case the physiotherapist will adhere to the deliveries of the cardiologist, discontinuing the use of such aids only upon express prescription. Like any other aid, a thorough skin inspection should be performed to ensure that they do not cause dangerous redness.

Prevention of circulatory problems (stasis, edema in the lower districts, DVT)

- Teach what are the signs and symptoms of a DVT: (edema leading to an increase in the circumference of the limb, difference in temperature of the limbs, increase in body temperature, pain.
- Changing lifestyles that could be a risk factor (achieving and maintaining an adequate body weight, abstaining from smoking, avoiding the use of tight-fitting clothing that can counteract venous outflow.
- Daily ankle mobilization by venous pump.

CIRCULATORY COMPLICATIONS

- Bradycardia – hypotension
- Orthostatic hypotension
- Paroxysmal hypertension or hypertensive crisis
- Declining edema
- DVT
- Pulmonary embolism

Prevention of circulatory complications

- Elasticized aids: elastic bands, elastic stockings
- Prolonged mobilization therapy with alternating pressure "fisiopres" (3 hours per day)
- mobilization (passive / active-assisted. / active)
- Positioning in the unloading and position changesDrug therapy: low molecular weight heparins

PREVENTION OF THROMBOEMBOLISM

- 37% of deaths in the first year due to DVT
- Venous stagnation, hypercoagulability
- 40% of TVMs in the absence of prophylaxis develop DVT (80% on venography)
- 80% of DVT occurs within 2 weeks of trauma, is more common in ASIA A patients and paraplegics

PREVENTION OF THROMBOEMBOLISM

- Application of compression stockings or external pneumatic supports for 2 weeks after trauma
- Thromboprophylaxis with low molecular weight heparin to be initiated within 72 hours of trauma
- Prophylaxis should be continued for at least 8 - 12 weeks (complete, complicated motor injuries with risk factors)

PREVENTION OF THROMBOEMBOLISM

- Resumption of therapy in chronically bedridden patients or at risk for other situations
- Early passive mobilization
- In the case of documented DVT, mobilization must be started 48 - 72 hours after the start of antithrombotic therapy

Nervous system and skeletal muscle

- obviously the lesion causes absence of sensitivity and motility below the lesion level. In addition to the trophic and vascular effects, paralysis involves a significant drop in muscle mass, in addition to the lack of voluntary movement. The clinical examination of the ASIA and subsequently the neurophysiological examination will frame the lesion and suggest the possible prognosis.

Nervous system and skeletal muscle

- In principle, the reappearance of a voluntary and repeatable movement below the level of injury is a positive prognostic sign, but it could also be an isolated reappearance and without any functional relapse so it is a good rule to always work on the picture that is presents without making mortgages on the future; unfortunately, the phases of denial and accumulation of false hope greatly slow down the path of adaptation to the new condition.

Nervous system and skeletal muscle

- It is possible that the vertebral fracture is not stable even after surgery and in this case the patient will be provided with stabilization aids: prescribed by the orthopedist, customized by the physiotherapist and used according to prescription and safety by all department staff.
- The most common are the bivalve collar (Philadelphia) and the Three-Pointed Bust

Nervous system and skeletal muscle

- The collar is bivalve, ie it has a back and a front that are joined with velcro straps; it has variable height and width and must ensure stability between the trapeze curve and the jaw, especially in the anterior and lateral direction. It prevents little rotation, while the extension is usually controlled by the patient's natural posture. It can be provided with a wide anterior hole to make room for the tracheostomy cannula. It is usually worn as a supine or within 30 ° of lifting the trunk and except in cases of particular instability it is not worn in bed.

Nervous system and skeletal muscle

- The three-point torso consists of aluminum bars covered in imitation leather and are: two transverse: a fixed sternum (point 1) and an iliac, which can also be articulated to give more comfort during the sitting position (point 2) , connected to each other by two longitudinal bars (adjustable length) that run on the sides of the trunk and end just below the axillary cable on the middle axillary line. Later, to be placed centrally on the point of bone injury, runs an adjustable band with a semi-rigid bearing in the center called the ball (point 3). With two front pushes and one back, the bust thus becomes three-point. If the fracture is high dorsal (eg D1, D2 etc. up to D6) the three-point torso is not effective and a small steel bar (connected to the anterior sternum bar) must be added with a chin support (somi brace) or opt for a Minerva-type torso or an extended bivalve collar that also contains the sternum anteriorly and posteriorly the vertebrae up to about D8.

Nervous system and skeletal muscle

- The three-point torso has a series of adjustment points that are not trivial at all, it is good to test it with the orthopedic technician and check the pressure points well. Especially in back injuries in which the surgical wound is still fresh, it is necessary to assess whether the thrust of the ball is compatible with the healing process.

Nervous system and skeletal muscle

- The torso is never comfortable: at the time of the wheelchair lift the patient will have a longer or less adaptation phase, but you are wary if you do not complain about the torso, it is probably too little content!
- Be careful never to use the torso as a point of attachment in transfers because it will move, ending up being unnecessarily uncomfortable or, worse, not performing the function for which it is worn.

Nervous system and skeletal muscle

- Sensitivity is a fundamental component for the movement of the body in space and for carrying out intentional activities. The fact that the position of the body and the contact with the support surface is not perceived is extremely destabilizing.
- The sensitivity of the sacral area is then connected to the most private individuality (sphincter regulation and sexual activity) and its loss is particularly depriving.
- Not all sensitivity is lost at the same level of severity: there may be areas of hypoaesthesia in the passage metamers of the lesion and incomplete lesions, there may be partial preservation of thermo-painful sensitivity (prognostic favorable sign) and many variations on the subject, e.g. . Brown Sequard syndrome in which motor injury and loss of sensitivity are on two different emulsions.
- In principle, the recovery of sensitivity should be monitored at the same level as that of motor skills because it can have very important functional implications (eg saddle sensitivity in the prevention of pressure injuries from sitting, sensitivity of partial areas of the hand to facilitate fine activities).

Nervous system and skeletal muscle

- A particularly unpleasant aspect of altered sensitivity is PAIN. In a simplistic way it is thought that the loss of sensitivity also translates into the absence of pain, but most of the time this is not the case.
- Apart from the pain resulting from injuries above the level of injury, there are very often areas of painful hyperesthesia, typically in the border metamers but not elusively, and pain that accompanies the resumption of muscle contraction from discharge under injury at the exit from shock. .
- Sometimes there are real storms of intractable pain even pharmacologically and the level of malaise and discomfort of the patient is such as to make torture even the nursing wheels. In these cases it is necessary to pose the problem of being as much relief as possible during the treatment, which in any case is interrupted only in exceptional cases.

Nervous system and skeletal muscle

- The exit from the spinal shock is announced with the reappearance of the osteotendinous reflexes and the appearance of discharges of muscle contractions alone or, more often, in groups.
- Not all devices end the shock phase at the same time, typically the genitourinary system resumes autonomous activity later than the skeletal muscles.
- In principle, the functional prognosis is all the more favorable the shorter the shock phase, while the prolonged state of complete flaccidity does not lead to a favorable modification of the lesion.

Urological problems:

- Fundamental is education in proper bladder hygiene and correct catheterization or self-catheterization maneuvers.
- The catheter is a device that allows vesicle emptying: it can be left in place (indwelling catheterization) or only for the time necessary for emptying (intermittent catheterization).
- The use of fixed catheterization is limited to special cases because it exposes the person to numerous complications, while intermittent catheterization if properly performed is a modality that allows good management of the bladder and decreases the risk of complications of the urinary system.

Tips for maintaining the physical and functional performance achieved

- To stimulate the patient to continue at home to maintain the level of functional ability achieved in the U.S. U (transfers, wheelchair travel, personal care, etc.);
- Sensitize the patient about the importance of maintaining a body mass index in the expected range based on age, sex, height;
- Compatibly with the level of injury and the interests of the person with spinal cord injury promote sports activities adapted to residual motor skills

f) Dysreflexic crises:

- Autonomic dysreflexia of the spinal cord is an overreaction of the autonomic nervous system to a spinal cord injury that causes a life-threatening rise in blood pressure (hypertension).
- If the lesion is higher than D6, teach to recognize and manage the prodromal symptoms and any triggering factors

MANAGEMENT OF AUTONOMIC DYSREFLEXIA CRISIS

- Lesions greater than D6
- Causes: bladder overdistension, fecalomas, pressure ulcers, diagnostic or therapeutic maneuvers on the urinary tractSymptoms: headache, hypertension, bradycardia, sweating

MANAGEMENT OF THE BOWEL

- Topic considered, wrongly, of the second level
- Scarce, non-homogeneous literature focused on complications
- Paralyzed Veterans Administration 1998: many recommendations given with the support of the panel, rather than with material found in the literature

MANAGEMENT OF THE BOWEL

- Carry out a "bowel program" that takes into account the following aspects
  - Methods of evacuation
  - Diet
  - Fluid intake (40 ml / kg / day + 500 ml)
  - Aids

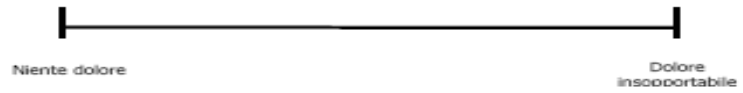
MANAGEMENT OF THE BOWEL

- Chronic constipation, most frequent symptomatology: use of prokinetics in case of failure of other measures
- Bio-feedback: poorly effective
- Refer the patient to colorectal cancer prevention programs

CHRONIC PAIN

- 65% of SCI patients complain of pain
- One third of these patients define pain as "severe“
- Pain is the complication of spinal cord injury that most compromises the quality of life, in some cases more than the spinal cord injury itself

PAIN ASSESSMENT

- V.A.S / Visual analog scale;
- 

- N R S/ Numerical Rating Scale
-
- Verbal Rating Scale (V.R.S): absent, mild, moderate / annoying, severe / horrible

PAIN ASSESSMENT

- Provoked by
  - What makes it worse?
  - What makes it improve?
- Quality
  - What does it look like
- Irradiation
  - Where is the pain
  - Where does it go?
- Severity
  - How strong it is
- Time
  - it always there or does it come and go?

CHRONIC PAIN

- There are several classifications, none of which are satisfactory
- Neuropathic pain (supralesional, lesional, sub-lesional), musculoskeletal, visceral
- There are no guidelines for the treatment of painful syndromes in SCI patient

CHRONIC PAIN

- Clonazepam, carbamazepine, gabapentin: never studied in RCTs in SCI
- Clonidine, in association with morphine intrathecally
- Antidepressants: poor efficacyIntrathecal baclofen: no efficacy

CHRONIC PAIN

- Opioids: alfentanil, effective in an RCT study
- Other methods (nerve blocks, electrical stimulations - medullary or thalamic - surgical procedures, physiotherapy): they have no scientific proof of efficacy

Hydrotherapy

The hydrotherapy treatment shares the "dry" objectives of the functional re-education intervention, constituting an additional tool that not only favors a global approach to the problems of myeloles but where it proves to be a modality pleasing to the patient it can also offer prospects for recreational-sport integration
.

Hydrotherapy

- Objectives of hydrotherapy treatment in complete lesions:
  - Aquaticity
  - Start of swimming
  - Ability in the water

Hydrotherapy

- Objectives of hydrotherapy treatment in incomplete lesions:
  - Motor control
  - Reinforcement
  - Gait

PHYSIOLOGICAL AND THERAPEUTIC EFFECTS OF HYDROTHERAPY

- *Musculoskeletal system*
- *Respiratory system*
- *Kidney system*
- *At the level of the PNS and CNS*
- *On a psychological level*

Musculoskeletal system:

- squeezing of superficial and lymphatic blood vessels, with consequent reduction of any edema and joint effusions;
- diastasis of the joint heads, with consequent progressive recovery of ROM and analgesic action;
- reduction of muscular effort with consequent facilitation of movement;
- increased muscle effort with consequent muscle strengthening;
- muscle relaxation, with consequent analgesic and decontracting power.

Respiratory system:

- increased pulmonary ventilation;
- decrease in the volume of the expiratory reserve;
- increased workload for the inspiratory muscles

Kidney system

- decreased production of ADH (antidiuretic hormone) and Aldosterone;
- increased secretion of Sodium (Na) and Potassium (K);
- All this promotes diuresis, with a consequent reduction in blood pressure and increased elimination of metabolic waste.

At the level of the PNS and CNS

- sensory stimulation
- pain reduction
- facilitation of postural reactions / facilitation of balance reactions

On a psychological level:

- the possibility of performing movements that would be too difficult on the ground, constitutes a strong "moral" push for the patient
- the patient becomes more confident in his abilities
- improve social relationships, especially in group therapies

ABSOLUTE CONTRAINDICATIONS

- severe heart failure
- acute (recent) or unstable ischemic heart disease
- high-risk arrhythmias
- congenital heart disease and cardiomyopathyacute cardiac inflammation (pericarditis, myocarditis, endocarditis)
- severe and / or pharmacologically poorly controlled arterial hypertension
- phlebitis
- severe respiratory failure
- active lung infections
- chronic otitis
- evolved neurological pathologies
- neoplasms (with skin wounds that can contaminate water)
- permanent intravenous catheter.

RELATIVE CONTRAINDICATIONS

- epilepsy, which will be evaluated based on the frequency and intensity of the seizures
- peripheral vascular pathologies
- severe dysphagia
- risk of infections in immunosuppressed patients
- impaired thermoregulation
- Hydrophobia
- urinary incontinence
- fecal incontinence
- hypersensitivity to the products used for the water.

TEMPORARY CONTRAINDICATIONS

- skin infections (mycosis, eczema, warts, etc.)
- infectious conjunctivitis
- unhealed skin rashes
- unhealed skin wounds
- fever
- infectious diseases of childhood

"Water as an element of evaluation and diagnosis"

- In the spinal injured patient, how much are the residual motor skills affected by the force of gravity?
- It is conceivable:
  - that the context in which the movement is requested may affect the actual ability to perform it
  - that not exercising certain motor patterns can lead to an aggravation of the "disability" in a functional key.

- In spinal cord injuries, Hydrokinesitherapy is almost a treatment of choice
- obvious benefits on motor performance
- positive effects on secondary problems related to wheelchair permanence

Hydrokinesitherapy

- Allows work in an orthostatic position
- Allows a decompression of the column
- Promotes better circulation in the lower limbs
- Optimizes complete emptying of the bladder (in case of stagnation)
- Attenuates the intensity and frequency of spasms
- Promotes the recovery of stereognosy

Hydrokinesitherapy

- The use of different levels and floating aids allows you to vary the possibilities offered by water as a microgravity environment
- Water slowing down movement facilitates learning
- It has recreational, playful and social contents that allow you to propose new rehabilitation addresses without boring.

PATIENT SELECTION

- The absolute criterion that is followed regardless of the severity of the disease, the level or extent of the injury is the potential for improvement

TREATMENT

- Entry into the water
- Assisted setting
- Aquaticity in progression
- Assessment
- Protocols

Assisted setting

- Set of procedures that allow the patient to approach the water with tranquility, safety and confidence (essential requirements to be able to propose it as a renewed rehabilitation and therapeutic element)

Aquaticity in progression

- Set of complex motor skills to be acquired, preparatory to the achievement of the Therapeutic and / or Recreational objectives set.

Globality

- By virtue of the physical laws of water, each exercise sequence allows you to work simultaneously on the following areas:
  - Muscle recruitment
  - Proprioceptivity
  - Equilibrium
  - Body diagram
  - Stereognosy
  - Segmental exercises also need to be placed in a global context

CONCLUSION

- An accurate dry evaluation, an accurate evaluation in water, a plausible therapeutic project make the treatment in water an effective additional tool available to the physiotherapist; the environment allows for optimal social reintegration; over time, swimming becomes good maintenance

Home organization

- The spaces required for the use of a wheelchair are:
  - 360 ° rotation space;
  - 180 ° reversal space (140 x 170 cm);
  - 90 ° turning space with a minimum width of 90 cm, with a free space before 140 cm and after 170 cm;
  - Passage space 70-80 cm wide

Access to the home

- adequate width of the doors (standard 80 cm because if they are higher they become too heavy and difficult to manage);
- level door opening spaces;
- threshold with a maximum height of 2.5 cm, preferably lower;
- door return spring calibrated to a maximum of 2 kg, better if less;
- where possible, sliding or automated doors;
- correct height of handles and intercoms;
- parking space in front of and behind the doors of at least 150 cm;
- entrance protection from atmospheric agents (wall units, porches, etc.);

Access to the home

- access ramps with a recommended maximum slope of 5%, even if by law the maximum is 8%, with flat lay-bys, a wheel beater and a minimum width of 90 cm;
- lifts with a good self-leveling system, automatic opening, buttons at a height of 110-120 cm in a central position, doors with a clear opening of 80 cm;
- the dimensions of the lift cabins can vary from 140 x 110 cm for non-residential uses, to 130 x 95 cm for residential uses, to 120 x 80 cm, in case of structure adaptation;
- stairlifts and elevators must overcome limited height differences and guarantee safety conditions and space for maneuvering.

Bathroom area

- washbasin with a free front space of at least 80 cm to allow front access;
- shelf basin, with leaning or recessed siphon, about 80 cm high from the ground;
- lever tap with thermostatic mixer;
- mirror starting from the sink;
- W.C., with shower telephone next to it, about 50 cm high from the ground, with a distance from the front edge to the wall of about 80 cm;

Bathroom area

- fixed or folding handles, arranged according to the mode used to perform the transfer;
- free space on the side of the toilet to allow the lateral approach for the transfer (about 80 cm from the edge of the toilet);
- shower with tray flush with the floor with a 1% slope of 90 x 90 cm;
- folding seat about 50 cm from the ground with taps on the sidetub with dimensions of 80 x 140 cm with space for lateral approach to perform the transfer or seats for tub.

Kitchen area

- free area under the sink, the hob and the worktop to facilitate access;
- use of cantilevered wall units, pull-out furniture, revolving shelves, to store objects
- worktop to the side of the cooking area and sink, in order to facilitate the placement of utensils;
- oven at worktop height;
- fiberglass hob to reduce the risk of burns;
- handles that allow an easy grip;
- sink drain pipe placed so that it does not cause contact burns.

Living area

- avoid carpets;
- arrangement of the furniture in such a way as to guarantee space for maneuvering the wheelchair;
- desk or work table about 75-80 cm high from the ground and with the space underneath free for easy access.

bedroom

- free space between the bed and the wall and between the bed and the wardrobe of at least 90 cm;
- height of the bed equal to that of the wheelchair;
- walk-in wardrobes or wardrobes with sliding doors and devices to lower the clothes rail to an accessible height.

Sports therapy

- Based on the experiences of the European spinal units starting from the Stoke-Mandeville center, born in 1944, for some years sport therapy has also appeared as a discipline that can further improve within the rehabilitation project of the person with spinal cord injury. motor and autonomy possibilities.

Sports therapy

- This center was the first to start the "pioneering" activity of sports therapy thanks to an intuition of its director Dr. L. Guttmann, who recognized that an active participation of the patient, suffering from mental depression, respiratory diseases, bedsores, in the rehabilitation program could prevent these complications.

Sports therapy

- He introduced sporting activity as a "means" to be able to involve young para-quadriplegic patients in the rehabilitation process, but later realized that in addition to the psychological improvement there was a notable increase in the muscular, respiratory and wheelchair management skills that with traditional methods could hardly obtain.

- Dr. Guttmann's initiative was very successful, and on July 28, 1948, the first Stoke Mandeville Games for disabled athletes were held, in which former members of the British Armed Forces participated in disabled sports.

- Since then the Stoke Mandeville Games became international and in 1960 they took place in the context of the Rome Olympics, indicating the way for the organization of the Paralympics every 4 years in conjunction with the Olympics.

Sports therapy

- In relation to the phase of the rehabilitation project in which sport is inserted and the value that you want to give it, we can distinguish activities such as sport therapy and recreational-sporting activity that can lead to competitive sport.

Aims

- Improve fine motor skills or movement.
- Improve sensory skills.Improve the physical gesture.
- Improve coordination of movements.
- Improve reflexes with particular reference to eye-hand ones.
- Increase muscle strength.
- Improve respiratory capacity.
- Improve gas exchange and blood oxygenation.
- Increase resistance to fatigue.

Aims

- Favorire l'aggregazione ed i rapporti sociali.
- Stimolare la persona ad affrontare le difficoltà.
- Apprendere delle capacità attraverso una serie di esperienze.
- Contribuire alla costruzione o alla ricostruzione della propria identità.
- Per chi usa la carrozzina è un ulteriore apprendimento nella capacità di conduzione, di spinta e di spostamenti nello spazio.

Sports therapy

The beneficial effects of sports therapy concern:

- improvement of motor skills (strengthening of residual muscles, control of hypertonia, improvement of trunk control, optimization of compensation, extreme use of aids);
- improvement of cardio-respiratory functions, prevention of osteoporosis and circulatory disorders, improvement of intestinal function);encourage aggregation and social relationships as group activity improves mood, promotes relationships and socialization.

Sports therapy

In particular:

- swimming allows a global strengthening and respiratory function;
- table tennis and archery improve hand-eye coordination, trunk balance and muscle strengthening;
- basketball and hand-biking improve muscle resistance to fatigue, functional to pushing the wheelchair in the activities of daily life.

Sports therapy

- The recreational-sporting activity, to be started as an introduction to sports in the hospital and recommended for everyone to continue with the discharge, has mainly recreational purposes, social reintegration and the prevention of secondary damage to reduced mobility; it can in fact constitute a valid alternative to boring maintenance motor re-education sessions.
- Competitive sport, to be undertaken after resignation, with sporting purposes and personal fulfillment, is obviously aimed at the most motivated and gifted people.

When to start?

- There is no fixed rule, it depends on the patient's clinical condition and the type of sport

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

Occupational Therapy

- The World Federation of Occupational Therapy (1989) provides the following definition of Occupational Therapy: "discipline that deals with the evaluation and treatment of physical and mental diseases with the aim of helping people to reach their maximum level of function and independence in all aspects of daily life ".

Occupational Therapy

Fields of intervention in spinal cord injury:

- treatment of the sensory-motor deficit of the upper limb;
- identification and packaging of orthoses for the upper limb;
- training for A.D.L. basic (personal hygiene, self-care, nutrition, clothing, bed mobility, transfers, preparation for bladder and intestinal emptying);
- training for A.D.L. instrumental or I.A.D.L. regarding the ability to use the telephone, the complete management of the home environment and daily needs (shopping, cleaning your home, washing, ironing, etc.), the ability to travel with your own or public means, the ability to take drugs and handle money;

Occupational Therapy

Fields of intervention in spinal cord injury:

- training in the use of the wheelchair (electronic and / or manual);
- training in the use of the PC and computer aids,
- planning of environmental control systems (high-tech devices that allow access to a series of commands such as call systems, TV-radio ignition, door / lift opening, etc. even for people with severe motor disabilities);

Occupational Therapy

Fields of intervention in spinal cord injury:

- advice on modified controls for driving or identifying aids and access methods for means of transport for high injuries;
- consultancy for social and work re-integration including the removal of architectural barriers and orientation to leisure and sports activities;
- health education aimed at the patient and his family on the management of the assistance needs of the person with SCI.

Functional positioning of the upper limb

- In the cervical lesion from C5 to C7, some strategic muscle shortenings are sought, always avoiding joint limitations:
- AUTONOMATIC HAND
- - slight shortening of Hemiplegic antagonists muscles to decrease imbalance eg: C5 pronators; C5- C6 major pectoralis

Functional hand

- THESE ARE THOSE TRICKS THAT THE PATIENT WITH TETRAPLEGIA SPONTANEOUSLY PUTS INTO OR IS EDUCATED TO DO WITH THE PURPOSE OF REACHING A FUNCTIONAL OBJECTIVE NOT OBTAINABLE THROUGH THE NORMAL METHODS.

Aims

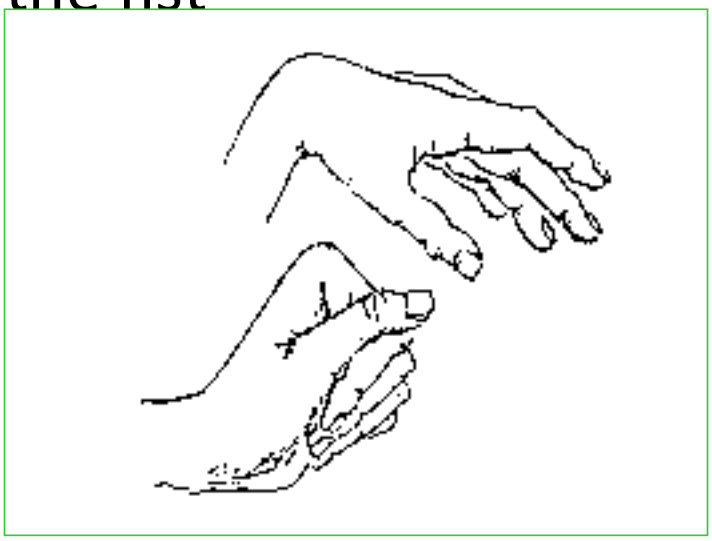
- Maintain joint freedom capable of favoring the achievement of compensation at the shoulder, elbow, wrist and hand level.
- Strengthen the supralesional motor quotas.
- Check for spasticity.

The functional hand

- Through tenodesis of the flexor muscles of the fingers and thumb, the hand may be able to make light functional grips even in the absence of an active preensor muscle capacity of the fingers.

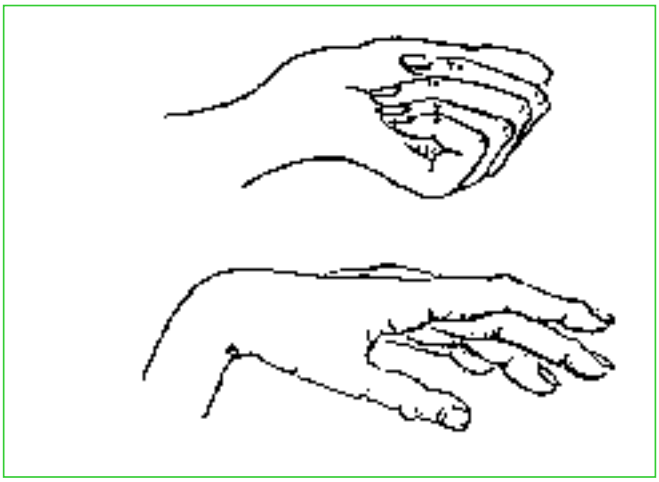
Active functional hand (presence of wrist extensors)

- The flexion of the wrist determines the opening of the hand
- The extension of the wrist determines the closing of the fist



Passive functional hand (no wrist extension)

- Supination of the forearm causes extension of the wrist with closing of the hand
- Pronation of the forearm determines the flexion of the wrist with the opening of the hand



Hand positioning

- Wrist: 30 ° extension (C5, C6 deficient, or start of treatment)
- Fingers:
  - 90 ° metacarpophalangeal flexion and proximal interphalangeal joint
  - 0 ° distal interphalangeal joint
- Thumb:
  - 0-30 ° metacarpophalangeal flexion
  - 0 ° interphalangeal jointthe thumb must be close to the proximal interphalangeal joint of the index finger and not its metacarpophalangeal joint

The functional hand

- The development of functional hands is a cornerstone in the initial phase of the treatment of patients with tetraplegia. In this period the positioning of the hands must produce the correct muscle lengths to allow the "tenodesi effect“
- Aims:
  - Promote the shortening of the flexors of the fingers and thumb
  - Prevent shortening of the finger extensors
  - Prevent the shortening of the collateral ligaments of the wrist and finger joints, so as to maintain optimal joint mobility

The active functional hand (C6-C7)

The flexion of the wrist determines the opening of the hand

The extension of the wrist determines the closing of the fist

HOW TO GET IT?

- functional bandage with velcro straps
- electrotherapy with wrist extensors (if absent), finger and intrinsic flexors
- splint to keep the wrist in extension

Automatic or functional hand

- We talk about "active automatic hand" if the radial carpal extensor is present (lesions at the level of C6-C7) or "passive automatic hand" if only biceps control is present (C5) and therefore a 'orthosis that stabilizes the wrist.

Automatic or functional hand

- The automatic hand allows, in the absence of an active finger prensor muscle capacity, to carry out light, functional and useful grips in daily life activities, through the tenodesis of the flexors of the fingers and thumb.

Automatic or functional hand

- Muscle shortening must be reversible in the case of a possible recovery of finger motility or in the case of rehabilitation surgery.
- The positioning must be carried out in the acute phase using hypoallergenic patches, leather or neoprene gloves, cloth armored cuffs, etc.

Automatic or functional hand

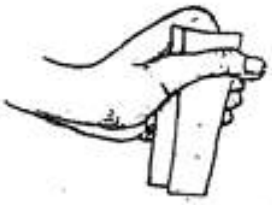
- Adequate mobilization must prevent the shortening of the extensor muscles and collateral ligaments of the wrist and fingers (in particular of the metacarpophalangeal muscles) in order to allow the passive relaxation of the hand when the wrist flexes.

The main grip of the functional hand

Handheld digital Grip

Cylindrical grip

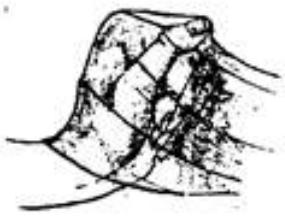
Lateral grip



Interdigital Grip

Braided grip

Hook grip



The shape of the hand

If the hand is not positioned correctly, it often takes on these non-functional forms

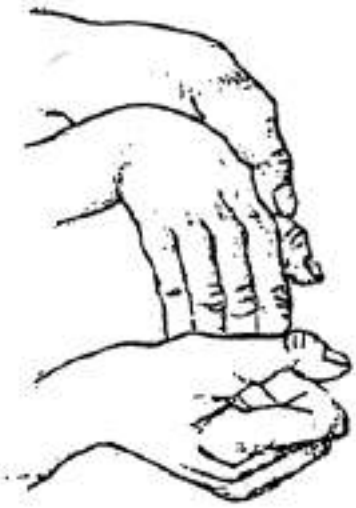
Claw hand

Flat hand

Passive hand mobilization

Upon completion of the positioning, the hand must be mobilized correctly and frequently enough to avoid joint contractures:

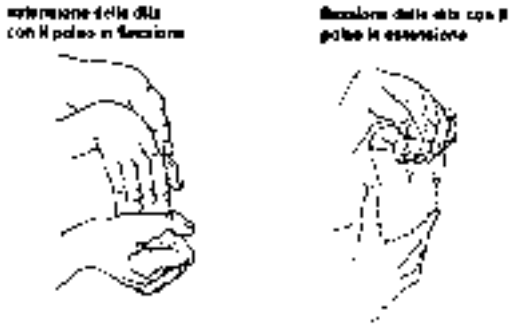
Extension of the fingers with the wrist in flexion



Flexion of the fingers with the wrist in extension

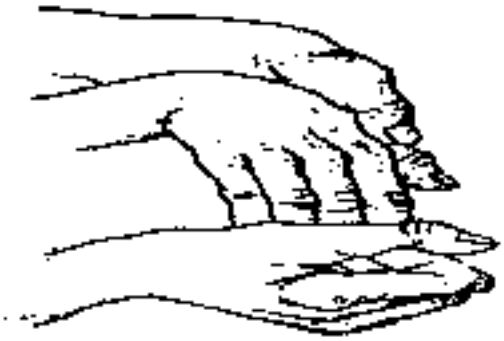
mobilization in compliance with the automatic functional hand

- - the hand, the mobilization of which takes place in compliance with the shortening of the flexor lodge.
- - the metacarpophalangeal joints, in which extension beyond the neutral position is never sought because they tend to hyperextend spontaneously



UPPER LIMB POSITIONING

Hand mobilization



Finger extension with wrist in flexion

Flexion of the fingerswith wrist in extension

How it should NOT be

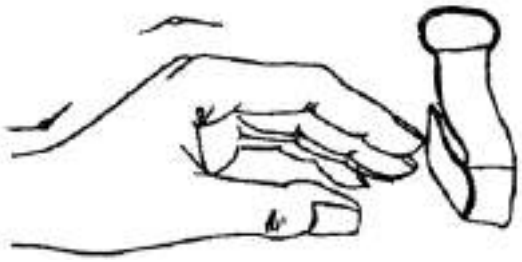
The main mistake in the positioning of the functional hand

- - The orthosis positioned incorrectly: the orthosis positioned too much blocks a 90 ° flexion of the meta-carpophalangeal joints, shortens the extensors of the fingers, the ligaments and often also the capsules. This error causes incomplete closing or a scratching hand. To prevent this problem it is important not to make the orthosis too long in the palm. Pre-made cuffs often need to be shortened (sew the edge to the correct length)

errato

The main mistake in the positioning of the functional hand

- The orthosis and aids are placed and removed incorrectly: the hand is opened while the wrist is in the wrong position (i.e. in extension). In order not to jeopardize a sufficient shortening of the flexors of the fingers, it is essential to open the hand during the activities of daily life, always with the wrist flexed.



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Passive and active assisted mobilization

- Musculotendinous shortening prevention
- Maintenance of joint mobility
- Edema prevention
- Pain prevention
- Improvement of residual motor skills

Prepration of the Automatic functional hand

- The hand should be positioned with wrist at 30 ° of extension, metacarpophalangeal at 90 °, proximal interphalangeal at 90 °, distal interphalangeal at extended. This position is maintained over 24 hours or at repeated 3-4 hour positioning intervals, except for periods of mobilization and hygiene.

Prepration of the Automatic functional hand

- The shortening of the flexor lodge is a sine qua non for the functional use of the hand if the only active muscle remains the radial extensor of the carpus.

Prepration of the Automatic functional hand

- If there is no active component of extension to the wrist, the closed hand will still allow some functional activities by flexing the active elbow and releasing the passive elbow. If a neurological recovery occurs, stretching the shortened area will take a few weeks at the most

Prepration of the Automatic functional hand

- To maintain the correct positioning, the physiotherapist who has the possibility can make gloves (fig.) with soft and hygienic material that does not cause irritation or overheating of the skin. The gloves are personalized, they must be easy to remove and put on, they require constant skin inspection, they are to be re-evaluated every day.

- fig. correct positioning with neoprene band

Prepration of the Automatic functional hand

- If there is no possibility of making or building orthoses, the correct positioning must still be maintained for 24 hours by checking whether the skin tolerates the chosen means, eg. wristbands, paper patches, elastic bands.Positioning with orthoses, plasters, or bands can be alternated with moments of freedom as long as avoiding the extension of the metacarpophalanges. Neglecting this aspect leads to the "claw hand", not surprisingly common in progressive paralysis.

fig. 4 - la mano aperta e la mano ad artiglio: l'una conduce all'altra

Prepration of the Automatic functional hand

- Edema is not a reason not to position the hand, on the contrary: hands that remain edematous for a long time become paddle hands, useless to manipulate and grasp. When there is edema the entire arm is positioned in the unloading area, mobilized more often, the hand is closed in a less constricting manner, and inspected every 1-2 hours.

Prepration of the Automatic functional hand

- The positioning of the pelvic girdle and lower limbs is less complicated but no less important. Falling into external rotation must be avoided, the popliteal fossa should be kept free and slightly flexed, the heel protected and the ankle at 90 °.
- The correct position is never just one: the basis of good postural management is an effective alternation of positions that protects the skin, modifies the ventilation / perfusion ratio, alternates sloping areas, etc ...

Prepration of the Automatic functional hand

- No position, even the most comfortable, can be held in a fixed way without consequences. Unless there are genuine security reasons, the choice of serial positioning is always a winner (fig. 5). The use of air mattresses has greatly improved comfort and safety, but encouraged us to consider this aspect of the management of the critically ill patient to be less important.

- Fig. 5 - Positioning on the side of the tetraplegic patient. Note: the underlying "free" shoulder supported by the pillow under the head and by the one under the chest, the alignment of the column obtained with the lower limbs staggered and not overlapping as in classic positioning. The groin is not squeezed with the advantage of the genitourinary system and the control of the bladder catheter. The hands are closed and the elbows extended.

Prepration of the Automatic functional hand

- For didactic simplicity the patient described here has a complete lesion and is in the phase of spinal shock. In reality, injuries that are incomplete or of non-traumatic origin, or with traumatic brain components make everything more indistinct, variable and harbinger of further problems in terms of recovery. Individual assessment remains the only reliable procedure.

MOBILIZATION AND KINESI

- Mobilization is often the patient's first conscious contact with the paralyzed and insensitive part of his body, as well as the first sign that “something is being done” for his paralysis; for the physiotherapist it is a moment of constant evaluation (as well as treatment), during which changes in the clinical picture are highlighted such as the appearance of muscle tone - to be further distinguished in involuntary discharges or voluntary and repeatable contractions - the appearance of joint limitations or muscle shortening, changes in temperature or texture of the tissues that could make one suspect the onset of DVT,

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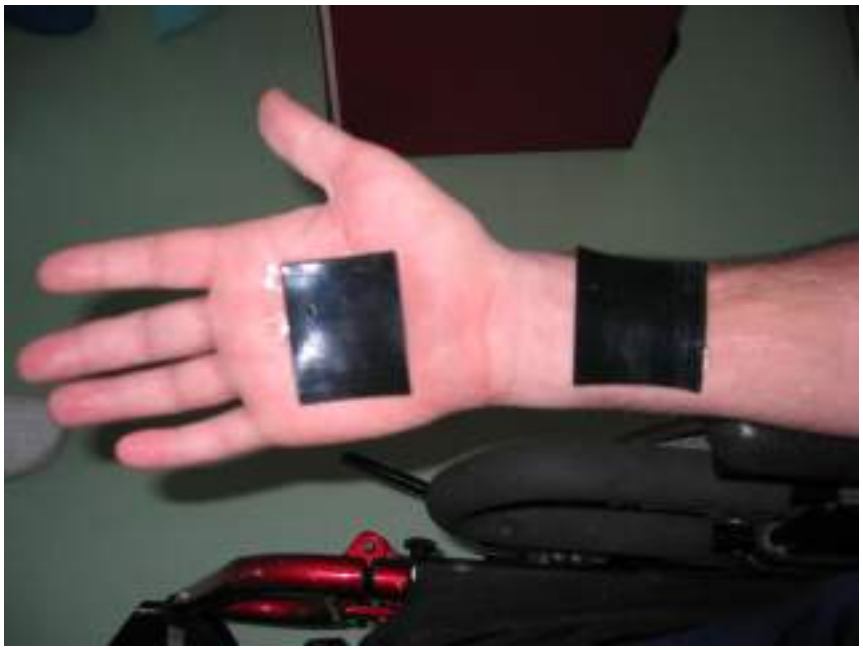
Functional bandage

ELECTROTHERAPY

- Research and reinforcement of wrist extensorsfunctional hand setting electrostimulating especially those intrinsic to:
  - Wrist extended
  - Flexed metacarpal-phalangeal joints

- Example of median and ulnar stimulation for the induction of a correct functional attitude



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PRACTICAL TEACHINGS FOR THE
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WRIST POSITIONING

WHO TO GET IT FROM?

- Starting at a C5 level
- ATTENTION: if it is a peripheral hand then with flaccidity of fingers muscles
- DANGER OF ARTICLE BLOCKS

ESSENTIAL RESULT:

- place the splint and bandage 24h / 24 h during the first 3-4 months
- remove them only during physiotherapy treatment for the CORRECT mobilization and during hygienic care.
- maintain the correct length of flexors and extensors of the fingers
- avoid joint blocks

CORRECT APPROACH TO THE FUNCTIONAL HAND:

- Extend your fingers with your wrist flexed
- Flex your fingers with your wrist extended
- Do not mobilize your thumb individually while
  - washing their hands
  - when placing and removing positioning orthoses
  - in transfers
  - in dressing and undressing

If the functional hand has been set correctly, various types of grips are possible, the most important are:

- Fingerprint grip
- Side-side grip

- These are the grips that are also sought after with functional surgery

PASSIVE HAND

Supination of the forearm causes an extension of the wrist with closing of the fist

Pronation of the forearm determines wrist flexion with hand opening

Supination in this case is an active movement, pronation for the most part is passive, performed through a momentum

TYPES OF GRIPS:

Handheld grip

Side grip of an object at the table

Side grip

Bi-manual grip

What strategies? .... THE GRIPS

presa laterale

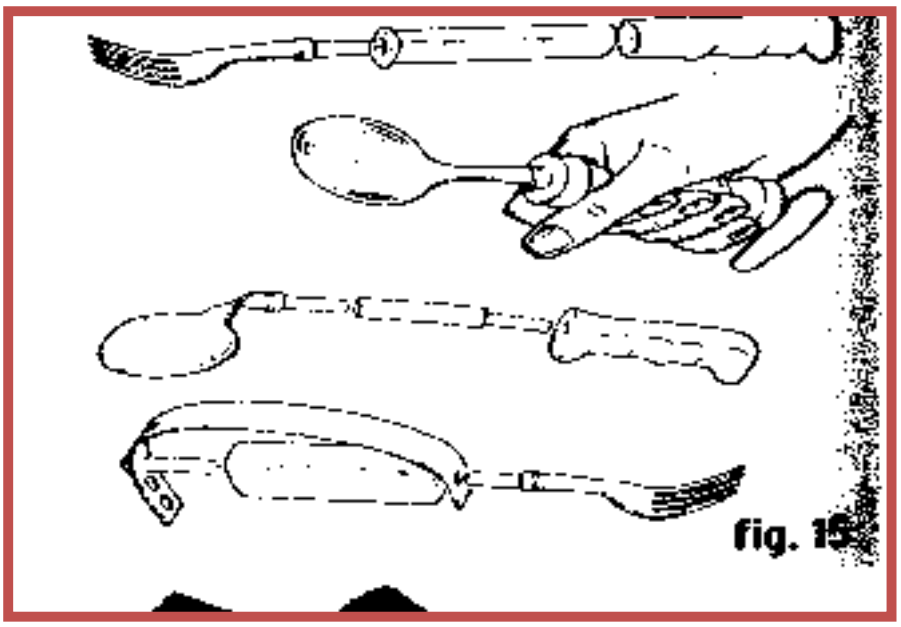
presa interdigitale

presa a gancio

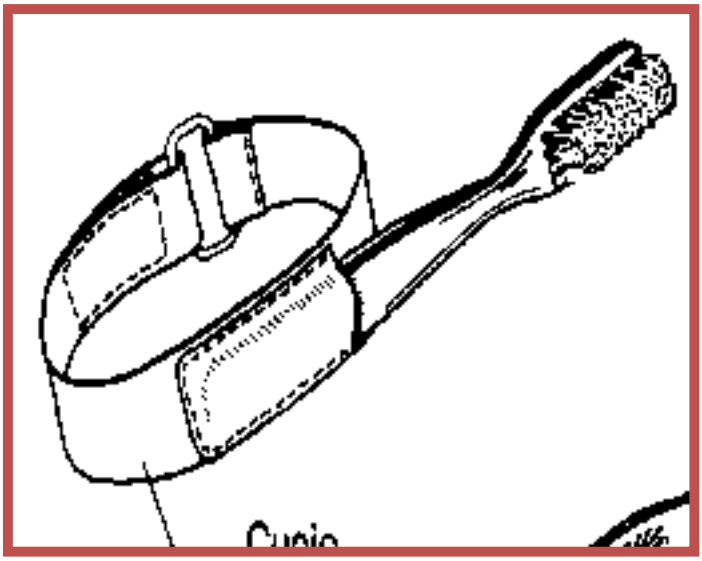
presa intrecciata

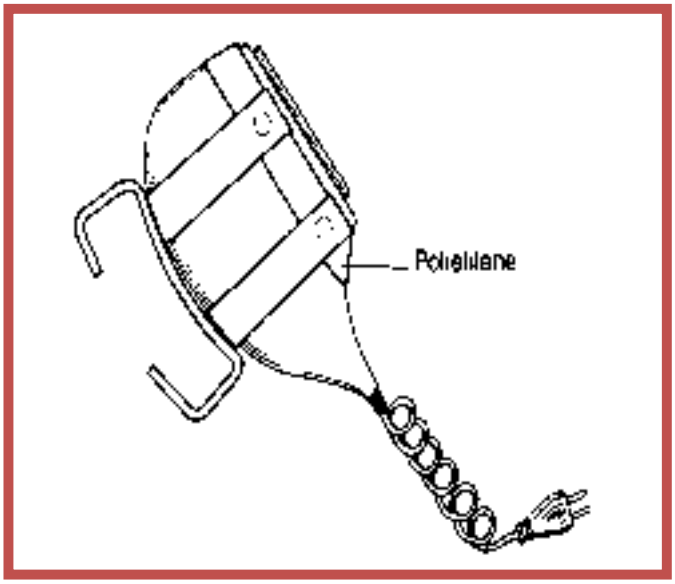
What strategies? ....

PERSONALIZED HANDLES



What strategies? .... AID





Tool strap
Thermoplastic orthoses
Object pocket with fork

TYPES OF GRIPS:

Forearm grip

Grip with wrist extension

ADL

- WHAT ARE THE OBJECTIVES,
- FROM THE POINT OF VIEW OF THE ADL,
- THAT WE CAN REACH
- USING COMPENSATION
- ACCORDING TO THE LEVEL OF INJURY?

	TETRAPLEGY C5	TETRAPLEGIYC6	TETRAPLEGY C7	TETRAPLEGY C8
Feeding	with ties and adapted cutlery	even with only thick cutlery	independent with aids	independent
Shaving	splint, adapted aids such as combs with straps	partially independent by adapting toothbrush, razor, comb or with strap	independent with aids	independent with aids
Washing		almost independet for the upper part. With adapted sponge	independent with aids	independent with aids
Dressing		autonomous for the upper part with specific aids: eyelets on the hinges, hooks ..	autonomous with aids also for the lower part of the	independent
Pushing the wheelchair	autonomous with splint or push gloves, modified handrails but on flat surfaces	autonomous and facilitated with push gloves	autonomous even on external land	independent
Transfering Bed-Wheelchair		almost autonomous with the tablet for transfers and between surfaces on the same floor	independent	independent
Mobility in bed		almost independent with the help of handles or electric beds	independent	independent
Bladder			almost independent with some aids	independent
Perinael Hygiene			almost independent with some aids	independent

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FEEDING

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Feeding: cutlery management

Feeding: glass management

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PERSONAL HYGIENE

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Difficulty brushing teeth and face

Difficulty combing

Difficulty in nail care

Difficulty shaving / putting on make-up

COMUNICATION

- Alternative grips
- Modified handle
- Thermoplastic orthosis (splint)
- Other aids: electronic turntables
- Personal Computer and computer aids

DRESSING

Alternative strategy

Modified clothing

Aids

C5-C6 (upper quadrant only)

C7-C8 (upper and lower quadrant)

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Dressing / Undressing

BLADDER EMPTYVESCICALE

Alternative strategy(modified sockets, body position)

Modified clothing

Aids (catheter, orthosis, supports)

C6 man → partial independence

C7 man → complete independence

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PRACTICAL TEACHINGS FOR THE
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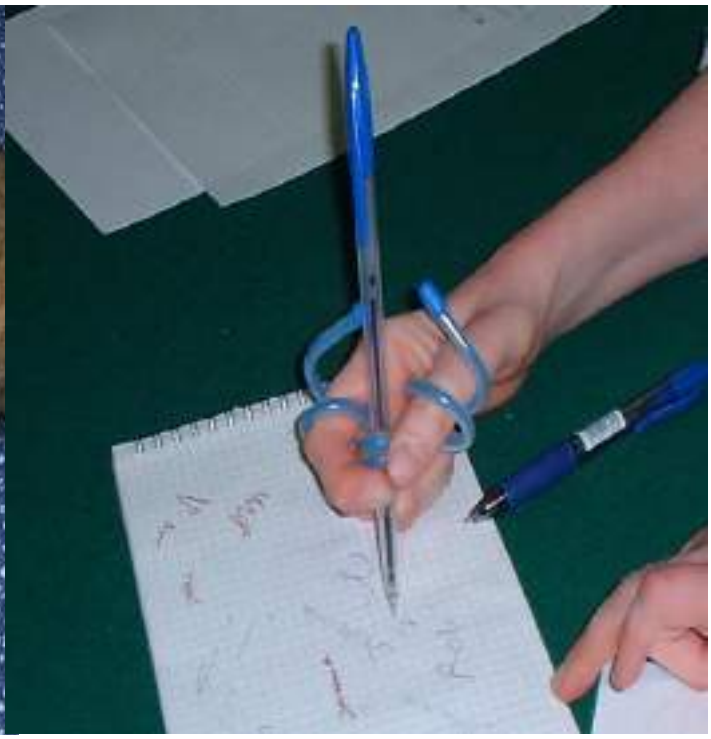
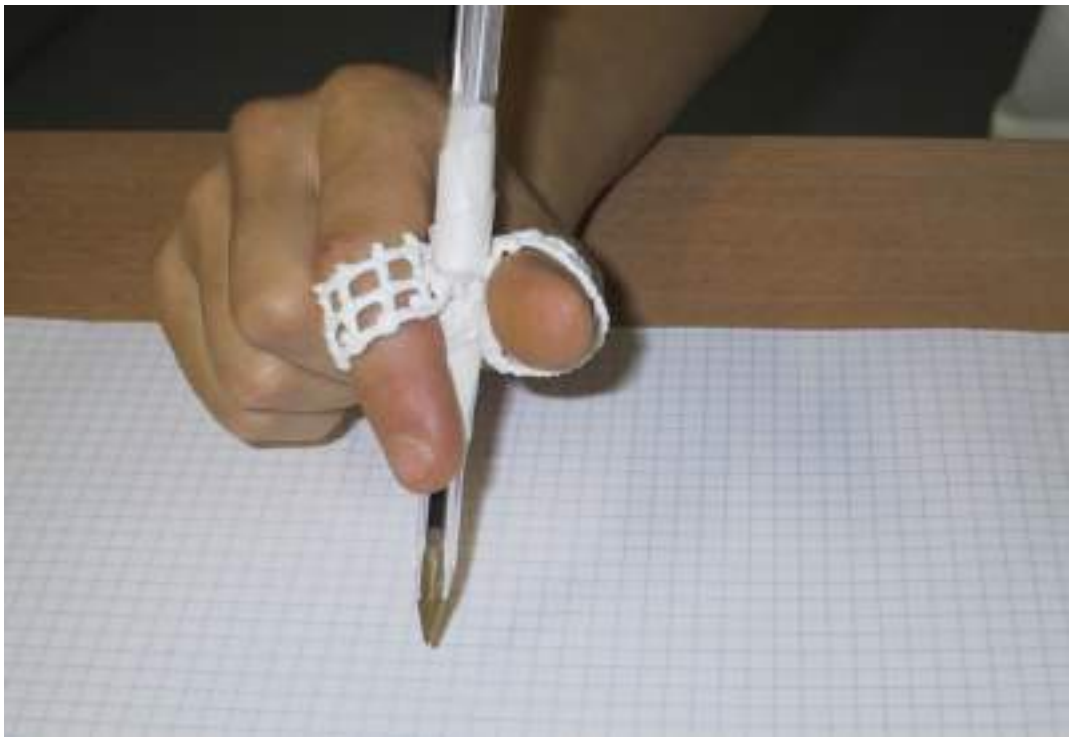
Writing



Writing



POSTURAL CARE

a) correct alignment according to the pathology
b) automatic hand preparation
c) search for muscle / joint balance lost at the time of injury

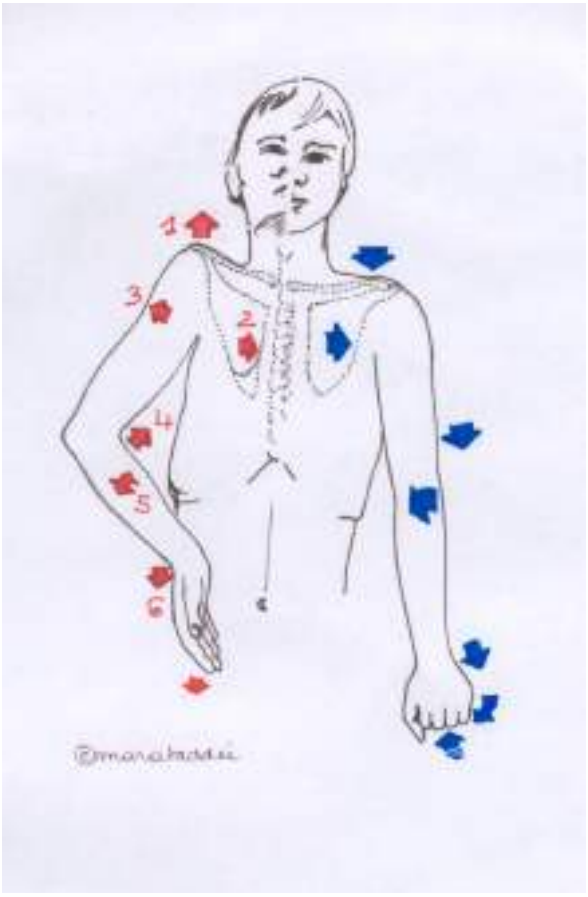
POSTURE EVALUATION

- Observation of the resting posture
- Verification of alignment by palpation of bone marks
- Observation of postural changes during functional activities
- Important: There is an "ideal" posture of reference but it is not necessarily binding, indeed it can sometimes be harmful
- Each patient has his own posture !!!!

POSTURAL CARE

- Positioning aids begin with the choice of bed: a time (until about fifteen years ago) when vertebral injuries did not stabilize was almost always in the first phase a bed (EGERTON) with joints in the longitudinal direction that allowed the management alternating positioning while maintaining the required vertebral alignment is now used in rare cases of non-surgical stabilization. Today, however, patients are usually stabilized in the first hours after trauma and therefore, almost always, the bed used is the one articulated with three cross sections. The most used mattress is the air decubitus mattress with pressure sensors to minimize the pressure exerted on the patient's body, for the fluctuation that this aid can not be used in unstable spinal injuries.

Positioning



- In the figure you see the position that the person with C5 / C6 lesion assumes spontaneously (left) and the correct postural pattern "functional" to the pathology (right).

Spontaneous posture....

- 1 - Elevation of the shoulders: the muscles of the upper trapezius, scalene, scapula, sternocleidomastoid and splenic of the head are all preserved and explain their action of dragging the scapular girdle towards the skull without being counteracted by the abdominal muscles that "hook" the chest to the basin. The patient reinforces his tendency to have his head more and more embedded in his shoulders because he also recruits these muscles to ventilate (the compensation is exhausted due to active insufficiency, ie the muscle is so shortened that it no longer produces movement).

Spontaneous posture….

- 2 - Scapular adduction: rhomboids have a high innervation while pectorals and anterior dentate are functional below the level of C6 lesion preserved. The scapulae are attached and adhere to the vertebral edge (up to the decubitus injury of the medial edge!). The chest is fixed rigidly in an inspiratory position.

Spontaneous posture….

- 3 - Abduction of the shoulder: deltoid and supraspinatus are active: although contact with the bed and the weight of the upper limb limit the tendency to abduction, any attempt by the patient to move accentuates it (further inspiratory component of the cage).

Spontaneous posture....

- 4/5 - Brachial biceps + brachioradial: the elbow has completely lost the extensors (triceps: C7) so the flexors, already powerful muscles, impose their balance angle on the elbow. The brachioradialis is also free in its forearm supinator component and this increases the dorsal fall of the hand.

Spontaneous posture....

- 6 - Radial extensor of the carpus: it is usually the first trace of C6 partially or completely preserved. The ability to actively extend the wrist makes a difference in a large number of upper limb activities, but in this postural pattern, far from being useful, the dorsal fall of the hand increases. Without any trace of flexors, the hand is extended to the passive tension, with the fingers falling.

… And the correct one

1 - The shoulders should be depressed, you should not tire of repositioning them whenever necessary. Positioning with cushions can be encouraged, but blocking with sandbags and the like is not recommended. The only absolute indication is the pre-stabilization period when the patient must cough or be bronchoaspirated, a maneuver during which it is necessary for an operator to maintain the alignment of the shoulders.

- assisted cough with an unstabilized patient. One operator assists in coughing, the other prevents the scapular girdle from moving

… And the correct one

2 - The shoulder blades should be extended and possibly held in place with the use of small wedge-shaped latex cushions.

3 - If the track is well positioned the shoulder does not have excessive freedom of abduction. Remember that pain at the level of injury is a very serious problem for the patient. The humeral glenoid joint should be preserved and maintained at its natural angle of 30 ° flexion relative to the bed plane (given the likelihood that it will remain the only upper limb joint with complete innervation it is critical that it is not painful!)

… And the correct one

- 4 - The elbow should be kept extended with the forearm pronounced within 24 hours except for moments of physiotherapy and hygiene. The late problems resulting from the total non-extension of the elbow are so many and serious that a separate intervention would be needed.

… And the correct one

- 5 - The wrist must maintain its functional curvature at 30 ° extension.
- 6 - The hand is placed closed and the preparation of the “automatic hand” begins immediately

IDENTIFICATION AND CUSTOMIZATION OF ORTHOSES AND AIDS

- During the acute phase, the activity allowed to the patient is so reduced that it suggests that aids are the least of the problems: in reality, it starts immediately.

IDENTIFICATION AND CUSTOMIZATION OF ORTHOSES AND AIDS

- First of all we will take care of ensuring the possibility of calling the nurse. Environmental modifications to make the management of immediate space as much as possible the normal doorbell can be modified in an ergonomic sense to be maneuvered with a movement of the entire forearm, with the blow command (which however requires an already adapted circuit) and, if really there is no other means, an intercom for babies can be useful. The position of the bedside table must also be taken care of or in the case of subjects with very high lesions, make changes to be able to give the patient what is possible.

IDENTIFICATION AND CUSTOMIZATION OF ORTHOSES AND AIDS

- We will provide positioning orthoses for the hand (gloves or cuffs or any device to prevent hand deformities) and we will take care of the rotation of their use in the 24h with precise deliveries and exhaustive explanations to the nursing staff and to the patient himself.

IDENTIFICATION AND CUSTOMIZATION OF ORTHOSES AND AIDS

- We will facilitate the venous return with vasopressure aids, which will become indispensable at the time of postural readjustment (classically belly - belly - elastic and compression socks up to 21mmHg). If necessary, in the presence of inveterate DVT, upper compression stockings or bandages will be identified on the cardiologist / angiologist's recommendation.

IDENTIFICATION AND CUSTOMIZATION OF ORTHOSES AND AIDS

- On the recommendation of the orthopedist, we will customize vertebral orthoses (collars, minerves, busts), for each orthosis the indications and precautions must be explicit and shared by all staff.
- Finally, last but not least, we will identify the postural wheelchair (for width) and the anti-decubitus pillow (for the need for prevention) and we will customize the height of the footrests, armrests and so on to the measurements of our patient.

AIDS PLANNING

- Need detection aids
- Evaluation of present and potential skills
- Identification of aids and their customization

Proposal for the use of aids for ADLs:

- Transfer board;
- Non-slip gloves;
- Metacarpal bracelets for nutrition and oral hygiene;
- Aids for writing and using digital equipment;
- Dressing aids (zippers, rings, button threader), self-catheterization, self-care;

Sequence of actions for readjustment to sitting out of bed

- Assess the clinical conditions together with the team: agree with the referring physician and specialist, nurse, psychologist.
- Inform the patient and caregivers (psychological aspect, clothing)
- Identify and provide orthoses: spinal stability, abdominal restraint, anti-thrombus stockings, more.
- Re-educate to the sitting position in bed (gradualness and correct position)Identify and provide aids: wheelchair, cushion, tablet, lifter,
- Carry out the transfer, check the wheelchair sitting position and vital signs (especially BP)
- Re-evaluate: position maintenance, points of support, pain, hypotension, psychological aspect?

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

ORTESIS

C1 -C7

C7-T6

T6-L2

L2 - S1

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

3070/3677

REHABILITATION OF MYELOLESION IN THE POST-ACUTE PHASE

- Rehabilitation in the post-acute phase can be defined as an "intensive rehabilitation" characterized by intensive evaluative and therapeutic interventions. It is usually placed in the so-called immediate post-acute phase of the disease, when the rehabilitation intervention can positively influence the biological processes that underlie the recovery, containing and reducing the extent of the impairment, and the disability is more modifiable; this phase may also be necessary in situations of exacerbation and relapses of the pathological event.

GENERAL OBJECTIVES

Achievement of maximum skill in the ADL

Home reintegration

FAMILY INVOLVEMENT(especially in the case of tetraplegia)

MOBILIZATION

- PASSIVE
  - Where no motor skills are present
  - Recovery of physiological articular degrees
  - Hand tetraplegic person
- PASSIVE - MECHANICS
  - Kinetek and / or Cyclette
- ACTIVE - ASSISTED
  - Motor skills are present
    Participation

POSTURE

- The importance of correctly posturing tetraplegic and paraplegic patients and of varying postures often (at least every two to three hours during the night) derives from the facilitation or inhibition of movements so from a correct management of muscle tone and the limitation of secondary risks .
- Correct postures to the bed and adapted to each individual patient;
- Frequent variation;
- Avoid supine decubitus as much as possible because it enhances spasticity.

STRETCHING

- Elongation with contraction of the agonist muscle;
- Elongation with contraction of the antagonist muscle;
- Passive stretching: the FT performs a slow and progressive traction to tension the affected muscle structure (pay attention to compensation and pain);
- Postures in progressive lengthening.
- The most used methods in myelolesions are the last two as they are fundamental in the sub-lesional, hypertonic muscle groups. In fact, due to muscle imbalances they are often subject to retractions.

MUSCLE STRENGHTHENING

- Active-assisted and against resistance;
- Isometric, isotonic, eccentric and concentric contraction;
- Analytical and global.

GLOBAL DYNAMIC EXERCISEMore effective reinforcement strategy in spinal injuries

Kabat Method (PNF)

Search for Synergies

VERTICALIZATION

FUNDAMENTAL!!!
Preventive action
Stimulating action

Standing

ADL TRAINING

- When residual motor skills allow, they use small movement strategiesthe person is stimulated and trained to perform small functional activities so that the person can better manage the surrounding space.(e.g. ring the bell, wash your face, eat)

TRAINING OF FUNCTIONAL ACTIVITIES

WHICHEXPECTED FUNCTIONAL OUTCOMES?

- Transfers
- Movements in the bed
- Mobility
- Feeding
- Personal hygiene
- Dressing
- Self-care (skin, bladder, intestines)
- CommunicationI.
- A.D.L.training

Pain prevention / treatment

- Correct positioning
- Frequent changes of position
- Drug therapy / cryotherapy
- Psychological support
- Periodic assessment of pain intensity (VAS, NRS, VRS)

State of anxiety

- We must never forget the emotional repercussions of a sudden and upsetting event like this.
- Sensory deprivation
- Inability to explore the space around
- feeling of being in danger of life

THE DEPRESSION

- It affects 25% of males and 47% of women who have undergone a SCI
- It can have very important effects both for re-hospitalization and for the onset of complications in which active prevention of the patient is essential (bedsores, neurogenic bladder management)

THE DEPRESSION

- Specific risk factors: completeness of the lesion and concomitant brain injury
- Evaluation: symptoms specific to depression, clinical picture related to TVM, environmental and patient care factors, substance abuse and concomitant drug therapy

THE DEPRESSION

- The treatment, both psychotherapeutic and pharmacological, follows the same principles as in the non-myelically injured patient
- There are no drug trials performed exclusively on patients with SCI

THE NEUROGENIC BLADDER

- The recommendations of the ICS are taken into consideration
- In myelic lesions greater than S3 (detrusor hyperreflexia with the presence of DDSS in 75% of cases) treatment should begin with the administration of anticholinergics (oxybutynin, tolterodine) and intermittent catheterization

THE NEUROGENIC BLADDER

- The recommendations of the ICS are taken into consideration
- In myelic lesions greater than S3 treatment should begin with the administration of anticholinergics (oxybutynin, tolterodine) and intermittent catheterization

THE NEUROGENIC BLADDER

- Surgical treatment (posterior sacral rhizotomy, bladder enlargement) is reserved for blisters at risk or in the presence of complications
- Reflex urination maneuvers can only be performed in the presence of a "non-dissynergic" bladder (25% of all supracral lesions)

THE NEUROGENIC BLADDER

- In sacral lesions (S3 - S5) the treatment of choice is represented by intermittent self-catheterization: the use of the abdominal press may be recommended only in women

CHARACTERISTICS OF COMMUNICATION IN THE THERAPEUTIC ALLIANCE

- We can define the therapeutic alliance as the relationship of trust that is established between the team, formed by health professionals, and the patient and his family, a relationship that guarantees the possibility of joining the therapeutic project.
- This relationship has as its main objective the transformation of a situation in which the pain perceived by the person with spinal cord injury is hardly tolerable, into a situation in which the pain begins to become tolerable.

CHARACTERISTICS OF COMMUNICATION IN THE THERAPEUTIC ALLIANCE

- It is a process that takes place over time, with knowledge and communication, in daily exchange.
- It begins with the initial welcome and proceeds throughout the rehabilitation process

Elements that favor the establishment of the therapeutic alliance with the patient and his family

- Respect for the patient and his family
- Empathetic attitude
- Communication technique of active listening
- Knowledge of the patient

Respect for the patient

- Respect for the aspects that belong to the person's character
- Respect of the proper times for the elaboration of the situation and adaptation to the new condition of life
- Respect for defensive mechanisms (own ways of dealing with the event, coping strategies)

The empathic attitude

- By empathy we mean the ability to identify with the other by capturing their thoughts and moods without getting confused with the other.
- The operator's function is to act as a container for the emotional aspects, the feelings that arise from the conscious or unconscious perception of the change that the person experiences, of his or her existential condition (feelings of anguish, pain, sadness, anger, etc.)
- It requires listening and thinking skills.

Communication technique of active listening

- In communication it is essential to know how to listen, or to be centered on the interlocutor and his needs.
- Active listening is a communication technique that is based on empathy and acceptance of the person in front of us.
- It allows the creation of a positive relationship in which the person can feel understood and not judged.
- Active listening allows you to learn even non-obvious information and weak signals, such as those transmitted through body language.

For effective listening

- To achieve this type of communication it is necessary to avoid the barriers of communication (giving orders, warning, moralizing, judging, etc.).
- Ways to put effective communication into practice:
  - Silence
  - open questions
  - Reformulation
  - precision questions
  - Encouragement
- Listening decodes the affective modulation (proximity or distance) and allows us to know the person's state of mind.

Knowledge of the patient

- We must keep in mind that the psychic reality of the person with spinal cord injury is different from the reality determined solely by the pathophysiological or physical aspects:
  - level of the lesion;
  - clinical pathologies connected to the lesion (bedsores, paraosteoartopathies, etc.);
  - invasive instruments (presence of probe, cannula, etc.).
- Psychic reality is represented by how that patient is experiencing that particular situation at that precise moment, therefore it is wider, because it includes elements that are not immediately present to the eye and ear of the operator.
- The patient's story can provide information that is needed to better understand his psychic reality.

Relevant anamnestic elements:

- Composition of his family unit;
- Meaningful emotional relationships;
- Significant existential events.
- Other elements useful for the knowledge of the patient's psychic reality derive from the situation that caused the injury:
  - pathology;
  - traumatic event (type, dynamics of the event).
- It is important to underline that the experience of the event is the element that allows us to know the person's reaction, with the feelings that are connected to it (for example: anxiety about the loss of control over one's existence, sense of guilt for having been the cause of the event, etc).

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

Respiratory Rehabilitation - Introduction

Respiratory rehabilitation

- Pulmonary rehabilitation is an integral component of comprehensive medical therapy for patients with chronic respiratory disease.
- In general, pulmonary rehabilitation provides the greatest improvements in symptoms, exercise capacity, and health-related quality of life of any therapy available for patients with COPD.
- In light of this, pulmonary rehabilitation is now prominently placed in virtually all major guidelines for the treatment of COPD.
- There is also strong rationale and a growing body of evidence for its use and effectiveness in patients with other respiratory disorders.

Respiratory rehabilitation

- According to the 2006 American Thoracic Society/European Respiratory Society statement on pulmonary rehabilitation, “Pulmonary rehabilitation is an evidence-based, multidisciplinary, and comprehensive intervention for patients with chronic respiratory diseases who are symptomatic and often have decreased daily life activities.
- Integrated into the individualized treatment of the patient, pulmonary rehabilitation is designed to reduce symptoms, optimize functional status, increase participation and reduce health care costs through stabilizing or reversing systemic manifestations of the disease.”
- Pulmonary rehabilitation includes patient assessment and goal setting, self-management education, exercise training, psychosocial support, and outcome measurement.

Respiratory Rehabilitation

- “Respiratory rehabilitation is an evidence-based, multidisciplinary and comprehensive intervention for patients with chronic respiratory diseases who are symptomatic and often have a reduction in the ability to carry out normal activities of daily living.
- Integrated with the patient's remaining treatment, respiratory rehabilitation aims to reduce symptoms, optimize functional status, increase participation and reduce health costs through stabilization or regression of the systemic manifestations of the disease. "

Respiratory Rehabilitation

- Respiratory rehabilitation has been defined as "a set of services directed to people with respiratory diseases and their families by an interdisciplinary team of specialists with the aim of achieving and maintaining the highest level of independence and activity in the community".

Respiratory Rehabilitation

- This definition underlines some fundamental aspects characterizing the rehabilitation activity in the respiratory field: in particular the multidisciplinary nature of the therapeutic program and the aim of re-introducing the patient into his environment, adding the important educational aspect in order to promote a better management of the disease by the patient and his/her family.
- Thus, respiratory rehabilitation programs (PRP) should be considered as an option that can improve the standard of therapy with the aim of optimizing functional capacity and returning patients to the highest possible level of functional independence.

Definition

- According to the European Respiratory Society (ERS) “Respiratory rehabilitation is aimed at recovering patients to a productive and satisfying independent lifestyle and preventing further clinical deterioration compatible with the state of the disease".
- This definition confirms another important aspect: rehabilitation programs have the purpose and capacity to influence the natural evolution of the disease.

Respiratory Rehabilitation

- Pulmonary rehabilitation should be considered for COPD patients who have dyspnea or other respiratory symptoms, reduced exercise capacity, restriction in activities, or impaired health status.
- In general, pulmonary rehabilitation is considered an option for moderate disease, as symptoms become present on a daily basis.
- As the symptom burden increases, the need for pulmonary rehabilitation increases.

Rationale

- As stated earlier, pulmonary rehabilitation generally provides the greatest benefits of any therapy available over a wide range of outcome areas, including symptom relief, exercise tolerance, and health-related quality of life.
- There is also an emerging body of evidence indicating it reduces health care utilization

ACCP/AA CVPR Ev idence- Based Guidelines on Pulmonary Rehabilitation

- This document, produced by collaborative efforts of the American College of Chest Physicians and the American Association of Cardiovascular and Pulmonary Rehabilitation, updated a previous evidence-based guidelines review of pulmonary rehabilitation.
- Their recommendations were categorized as *strong (grade 1)* or *weak (grade 2).*
- *The strength of evidence was* determined based on the quality of the data: *high* (grade A, from well-designed randomized clinical trials yielding consistent and directly applicable results or from overwhelming evidence from observational studies), *moderate (grade B, for the* most part randomized clinical trials with limitations that may include methodological flaws or inconsistent results), and *low (grade C, from other* types of observational studies).

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- 1. A program of exercise training of the muscles of ambulation is recommended as a mandatory component of pulmonary rehabilitation for patients with COPD. *Grade of recommendation: 1A*
- 2. Pulmonary rehabilitation improves the symptom of dyspnea in patients with COPD. *Grade of recommendation: 1A*

ACCP/AA CVPR Ev idence- Based Guidelines on Pulmonary Rehabilitation

- 3. Pulmonary rehabilitation improves healthrelated quality of life in patients with COPD. *Grade of recommendation: 1A*
- 4. Pulmonary rehabilitation reduces the number of hospital days and other measures of health care utilization in patients with COPD. G*rade of recommendation: 2B*
- 5. Pulmonary rehabilitation is cost-effective in patients with COPD. *Grade of recommendation: 2C*
- 6. There is insufficient evidence to determine if pulmonary rehabilitation improves survival in patients with COPD. *No recommendation is provided.*

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- 7. There are psychosocial benefits from comprehensive pulmonary rehabilitation programs in patients with COPD. *Grade of recommendation: 2B*
- 8. Six to 12 weeks of pulmonary rehabilitation produces benefits in several outcomes that decline gradually over 12 to 18 months. *Grade of recommendation: 1A*
- 9. Some benefits, such as health-related quality of life, remain above control at 12 to 18 months. *Grade of recommendation: 1C*
- 10. Longer pulmonary rehabilitation programs (12 weeks) produce greater sustained benefits than shorter programs. *Grade of recommendation: 2C*

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- 11. Maintenance strategies following pulmonary rehabilitation have a modest effect on longterm outcomes. *Grade of recommendation: 2C*
- 12. Lower-extremity exercise training at higher exercise intensity produces greater physiological benefits than lower-intensity training in patients with COPD. *Grade of recommendation: 1B*
- 13. Both low- and high-intensity exercise training produce clinical benefits for patients with COPD. *Grade of recommendation: 1A*

ACCP/AA CVPR Ev idence- Based Guidelines on Pulmonary Rehabilitation

- 14. Addition of a strength training component to a program of pulmonary rehabilitation increases muscle strength and muscle mass. *Strength of evidence: 1A*
- 15. Current scientific evidence does not support the routine use of anabolic agents in pulmonary rehabilitation for patients with COPD. *Grade of recommendation: 2C*
- 16. Unsupported endurance training of the upper extremities is beneficial in patients with COPD and should be included in pulmonary rehabilitation programs. *Grade of recommendation: 1A*

ACCP/AA CVPR Ev idence- Based Guidelines on Pulmonary Rehabilitation

- 17. The scientific evidence does not support the routine use of inspiratory muscle training as an essential component of pulmonary rehabilitation. *Grade of recommendation: 1B*
- 18. Education should be an integral component of pulmonary rehabilitation. Education should include information on collaborative selfmanagement and prevention and treatment of exacerbations. *Grade of recommendation: 1B*
- 19. There is minimal evidence to support the benefits of psychosocial interventions as a single therapeutic modality. *Grade of recommendation: 2C*

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- 20. Although no recommendation is provided since scientific evidence is lacking, current practice and expert opinion support the inclusion of psychosocial interventions as a component of comprehensive pulmonary rehabilitation programs for patients with COPD.
- 21. Supplemental oxygen should be used during rehabilitative exercise training in patients with severe exercise-induced hypoxemia. *Grade of recommendation: 1C*
- 22. Administering supplemental oxygen during high-intensity exercise programs in patients without exercise-induced hypoxemia may improve gains in exercise endurance. *Grade of recommendation: 2C*

ACCP/AA CVPR Ev idence- Based Guidelines on Pulmonary Rehabilitation

- 23. As an adjunct to exercise training in selected patients with severe COPD, noninvasive ventilation produces modest additional improvements in exercise performance. *Grade of recommendation: 2B*
- 24. There is insufficient evidence to support the routine use of nutritional supplementation in pulmonary rehabilitation of patients with COPD. *No recommendation is provided.*
- 25. Pulmonary rehabilitation is beneficial for some patients with chronic respiratory diseases other than COPD. *Grade of recommendation: 1B*
- 26. Although no recommendation is provided since scientific evidence is lacking, current practice and expert opinion suggest that pulmonary rehabilitation for patients with chronic respiratory diseases other than COPD should be modified to include treatment strategies specific to individual diseases and patients in addition to treatment strategies common to both COPD and non-COPD patients

Objectives

- Respiratory rehabilitation programs (PRPs) improve dyspnea, exercise tolerance, and quality of life in people with COPD.
- In fact, these programs are now considered an integral part of the overall treatment of this pathology.
- The goals are to reduce symptoms, teach patients how to successfully treat their disease process, maintain an active and independent lifestyle, maximize functional abilities, reduce the consumption of healthcare resources and, if possible, improve survival.

Objectives

- For this reason it is necessary to make the patient aware of the pre-established objectives and the therapeutic methods necessary to achieve them;
- For this purpose it is necessary to involve the team that follows the patient and the general practitioner who will then be an important figure in the follow-up and in the prevention of relapses, as well as in the management of complex therapies such as O2 therapy and mechanical ventilation domiciliary.

Objectives

The Respiratory Rehabilitation aims to:

- reduce symptoms
- improve respiratory function
- increase participation
- reduce the consumption of health resources
- optimize the individual's overall functional status and increase their activity and social participation
- cost reduction of health interventions
- stabilize or contrast the systemic manifestations of the disease

Objectives

- Prevention and treatment of hospital and mechanical ventilation lung infections
- Collaboration in the maintenance of adequate gas exchanges in the various phases of respiration with techniques to facilitate ventilation and improve perfusion
- Containment of physiopathological changes in the respiratory system (increased segmental lung re-expansion, increased rib cage compliance)

Contraindications

- Unstable cardiac disease (such as unstable angina or critical aortic stenosis)
- Severe, inadequately treated pulmonary hypertension
- Acute undrained pneumothorax
- Acute asthma or bronchospasm
- Active hemoptysis
- Acute undrained pneumothorax
- Acute pulmonary embolism

Selection of the patient

- The success of a rehabilitation program depends on the careful selection of candidates for treatment: for this it would be of great help to have the criteria available to identify the ideal patient.
- According to Ries, it would be a subject with moderate-severe functional limitation, in conditions of clinical stability and with optimized medical therapy, without other important comorbidities, capable of learning and motivated to spend the time and effort necessary to benefit from the programs.

Selection of the patient

- It is obvious that using these selective criteria, the number of “treatable” subjects would be greatly reduced
- For this reason, it seems more reasonable to adopt less rigid criteria, even if an appropriate initial assessment is required: this must necessarily include a study of impairment, activity and participation

Selection of the patient

- A comprehensive pulmonary rehabilitation program should be adapted for the individual patient with chronic respiratory disease. The practice of reserving pulmonary rehabilitation for patients with end-stage respiratory disease or severe limitation of function results in many patients being denied the opportunity to benefit from this intervention.
- Therefore, pulmonary rehabilitation specialists need to educate the public and the medical community about the importance of the prevention and early detection of respiratory disease, as well as the rehabilitation of patients with respiratory disease.

Selection of the patient

- The initial component of a pulmonary rehabilitation program is the interdisciplinary team assessment. The components of pulmonary rehabilitation, including self-management education, exercise training, and psychosocial interventions, are insufficient without an initial and ongoing individualized assessment.
- The assessment sets the foundation for all subsequent services provided during pulmonary rehabilitation, allowing for the development of a plan of care according to the patient's individualized goals. This assessment is under the direction of the medical director and the program coordinator.

Selection of the patient

- Although helpful in patient evaluation, pulmonary function test data, such as the FEV1, are not sufficient as selection criteria. Patients seek therapy because of distressing symptoms, decreased exercise tolerance, difficulty performing activities, or a decreased sense of well-being; these may not correlate well with pulmonary function test results.
- Difficulty in workplace performance or increases in medical resource consumption may also prompt referral.
- Therefore, persistent symptoms, functional status limitation, quality of life impairment, and increases in health care utilization, despite otherwise standard medical therapy, dictate the need for pulmonary rehabilitation.
- Comorbidity is common in patients with chronic respiratory diseases such as COPD, and this also contributes to the symptom burden and functional limitation in patients.

What does respiratory physiotherapy do?

- Patient with obstructive pathology
- Patient with restrictive pathology
- Deconditioned patient

Obstructive pathologies

- Increased secretions within the airways
- Treatment: drainage of secretions
- Example:
  - COPD
  - Bronchial asthma
  - Bronchiectasis
  - Post-surgical patients (upper abdominal surgery)

Restrictive pathologies

- Reduction of static and dynamic lung volumes.
- Treatment: lung expansion exercises, spirometric stimulators and non-invasive supportive mechanical ventilation C-PAP/PSV
- Example:
  - Pulmonary fibrosis
  - Pulmonary edema / embolism
  - Pneumothorax
  - Pleural effusion
  - Scoliosis
  - Neuromuscular disease (ALS, guillain barre, poliomyelitis)
  - Post-surgical patients (thoracic surgery)

Figure 2.1 Examples of conditions appropriate for pulmonary rehabilitation

Obstructive Diseases

- COPD (including alpha-1 antitrypsin deficiency)
- Persistent asthma
- Bronchiectasis
- Cystic fibrosis
- Bronchiolitis obliterans

Restrictive Diseases

- Interstitial diseases
  - Interstitial fibrosis
  - Occupational or environmental lung disease
  - Sarcoidosis
- Chest wall diseases
  - Kyphoscoliosis
  - Ankylosing spondylitis
- Neuromuscular diseases
  - Parkinson's disease
  - Postpolio syndrome
  - Amyotrophic lateral sclerosis
  - Diaphragmatic dysfunction
  - Multiple sclerosis
  - Posttuberculosis syndrome

Other Conditions

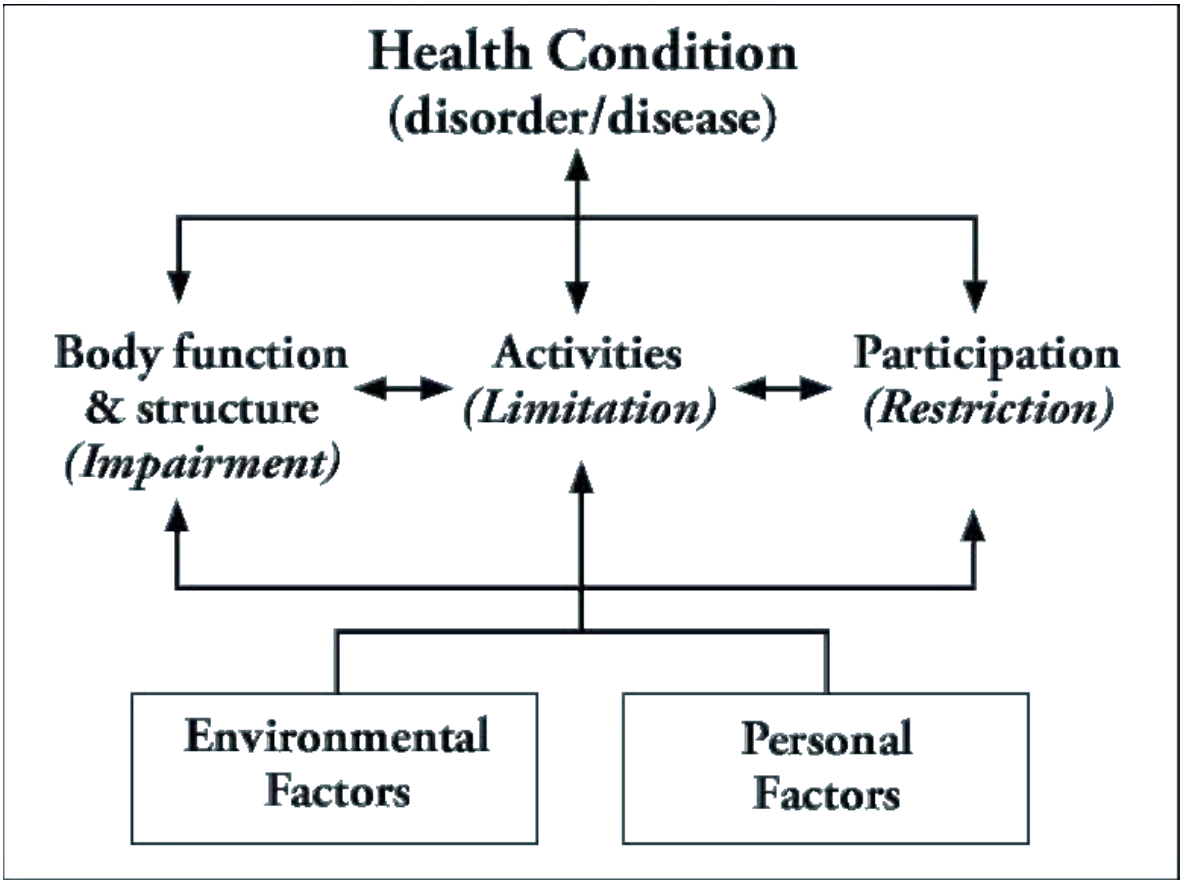
- Lung cancer
- Primary pulmonary hypertension
- Before and after thoracic and abdominal surgery
- Before and after lung transplantation
- Before and after lung volume reduction surgery
- Ventilator dependency
- Pediatric patients with respiratory disease
- Obesity-related respiratory disease

From *Pulmonary rehabilitation: Guidelines to success*, 2nd ed., edited by J.E. Hodgkin, G.L. Connors, and C.W. Bell, Organization and management of a pulmonary rehabilitation program, L. Beytas and G.L. Connors, Copyright Elsevier 1993.

Figure 2.2 Conditions that commonly lead to referrals for pulmonary rehabilitation

- Dyspnea, fatigue, and chronic respiratory symptoms
- Impaired health-related quality of life
- Decreased functional status
- Decreased occupational performance
- Difficulty performing activities of daily living
- Difficulty with the medical regimen
- Psychosocial problems attendant to the underlying respiratory illness
- Nutrition depletion
- Increased use of medical resources (eg., hospitalizations, emergency room visits, physician visits)
- Gas exchange abnormalities including hypoxemia

International Classification of Functioning Disability and Health



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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

Assessment in respiratory physiotherapy

Patient assessment

- Patient assessment, through the development of the individualized plan of care, is the foundation for all services provided by pulmonary rehabilitation
- The assessment process identifies the unique problems of the patient, thereby setting the stage for directing additional resources, when necessary, to meet these needs

Components of the initial patient assessment

- These assessments must be documented in the patient's pulmonary rehabilitation medical record.
- Reassessment of the patient during the pulmonary rehabilitation program is necessary to review progress and adjust the program in order to best meet the patient's goals.
- Although a physician referral is necessary for pulmonary rehabilitation, it is also useful to communicate with the patient's health care providers regarding factors that contribute to symptoms and functional limitation

Figure 2.3 Components of the initial patient assessment

Patient interview
Medical history
Physical exam
Diagnostic tests
Symptom assessment
Musculoskeletal and exercise assessment
Activities of daily living assessment
Nutrition assessment
Education assessment
Psychosocial assessment
Goal development
Pain assessment

The meeting with the patient

- Not only does the physiotherapy practice begin with the evaluation, but the relationship between physiotherapist and patient begins to take shape
  - More or less agreement
  - Determining factor for the quality of the treatment
  - Patient involvement must be as active and participatory as possible

Assessment

- The moment of the assessment takes on the value of a meeting that initiates what is called a therapeutic alliance, an indispensable prerequisite without which it is not possible to obtain and maintain adherence to the treatment

Assessment

- Each evaluation is carried out through a complex system of behaviors consisting of technical actions aimed at providing the necessary data to adapt the physiotherapy intervention to the patient's condition.

Assessment

- The same actions, even if practiced with the sole purpose of carrying out an evaluation, are not only and solely evaluative actions, but also and simultaneously actions of a communicative nature, which initiate a real "hand-to-hand" dialogue between the patient and the physiotherapist

Assessment

- The technical data of the patient's biological state that emerged from the evaluation are not considered unique and sufficient to explain and guide the physiotherapist's actions
- They are supported by data regarding the patient's subjectivity, in order to improve the technical action, dictated by the biological state, with a communicative value that allows the patient to feel the protagonist of what he/she is doing

Therapeutic alliance

- Building the therapeutic alliance in the context of a physiotherapy intervention is a delicate operation, because the two sides of the disease must be combined: the biological one (disease), and the lived or experience of illness (illness)
- The alliance is achieved through the understanding of two competences: those of the physiotherapist, concerning the organic pathology and the rehabilitative procedures connected to it, and that of the patient, concerning the illness.

Therapeutic alliance

- The therapeutic alliance can represent a way to satisfy this research, but it requires the patient to feel from the physiotherapist not only a specific technical competence, but also a capacity for human input and relationship that knows how to dialogue positively with his/her subjectivity.

The professional physiotherapist

- The inclusion of subjectivity, determined by the impossibility of excluding it and of practicing physiotherapy without encountering these problems, means that the physiotherapist has to deal with it.
- Just as the skills in respiratory physiology and pathophysiology do not attribute to the physiotherapist the right to replace the pulmonologist, even those of a psychological nature do not authorize him to psychological practices.
- But just as the notions of pneumology guide the physiotherapist in his/her technical action, those of a psychological and humanistic nature can guide the physiotherapist in the management of the relationship through a conscious and competent choice of the meaning of the words and of the analogical language to be adopted.

Approaches in physiotherapy

- There are two different perspectives of doing rehabilitation:
  - on the one hand there is an approach that "forces" the patient to adhere
  - and on the other an approach that "involves" him/her.

- These approaches refer to two different biomedical models:
  - one disease centered
  - another patient centered.

Communication

- The therapeutic alliance cannot be established with good will or with human (or moral) sensitivity
- Ability to listen, to read, to welcome, to contain is needed, which are skills that can be acquired, with an adequate training course, and which protect both the patient and the operator.

Interview

- The initial assessment should begin with a patient interview.
- An in-depth interview with the patient and his family or significant other is necessary to set the stage for the assessment.
- The importance of the initial interview cannot be overstated. Not only are important data obtained, but the foundations of trust and credibility are established at this time. The interview allows the patient to interact on a personal level with the rehabilitation staff.
- Coming in for the interview allows the patient to see where the program is located and possibly meet rehabilitation graduates.

Respiratory ananmesis

- The collection of information is the basis of any evaluation.
- The main objective is to outline a precise picture of the patient's perception of his/her past and present state of health and of how his/her health problems affect his personal, family and social life.

Objective of the anamnesis

- The objective with which the respiratory physiotherapist collects information is to build a precise assessment of the functional alteration (impairment), the limitation of activities (disability) and the restriction in his participation in social life (handicap)

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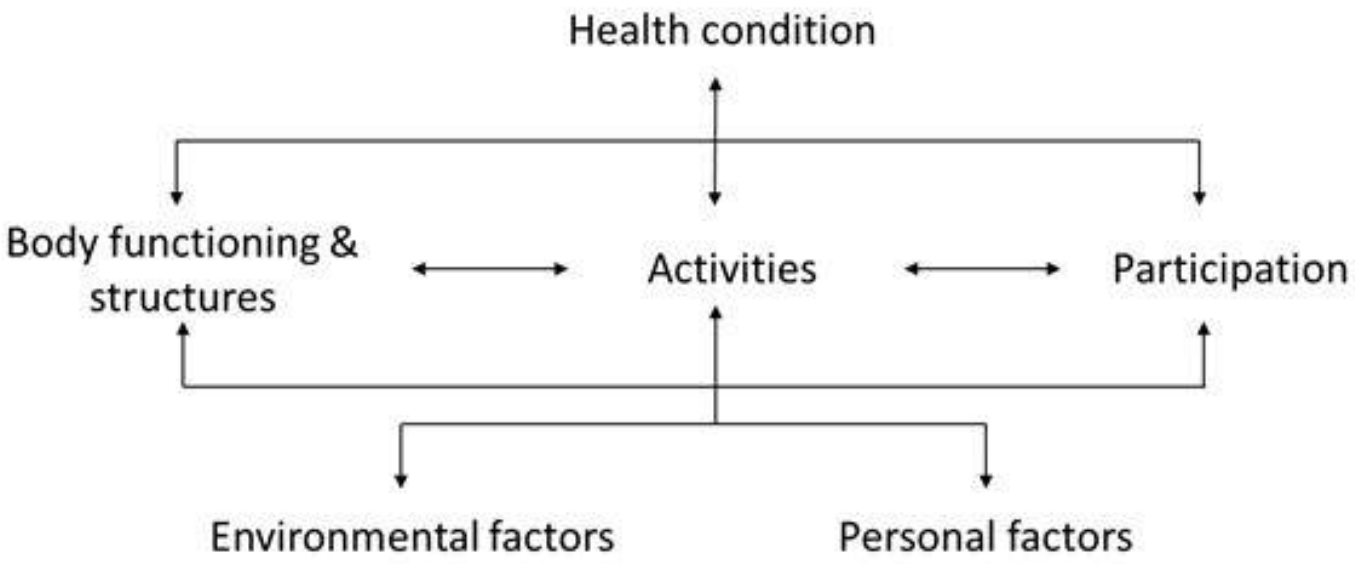


Objective of the anamnesis

- Ultimately, all this is aimed at the possibility of structuring an adequate treatment plan that is as individualized as possible and focused on solving the health problems of the individual patient and responds to precise inherent expectations.

- The information collected must then be aimed at identifying both the problems that can be faced with the tools of physiotherapy and respiratory rehabilitation, and those that can, on the other hand, hinder or contraindicate the implementation of the treatment.

Medical history

- A thorough review of the patient's medical status is essential for the initial assessment. Much of this information can be obtained from patient records from the physician's office or the hospital.
- The medical history provides information on the severity of respiratory disease, such as symptom burden, exacerbations, medication requirements, supplemental oxygen use, physical limitations, and health resource utilization.
- The medical history is also important in highlighting comorbid conditions that may have a direct bearing on the patient's health, safety, and response to pulmonary rehabilitation. For example, unstable angina should be treated and stabilized before pulmonary rehabilitation, and an orthopedic disorder may necessitate changes in the frequency, intensity, and mode of exercise.

Data collection

- The data that the physiotherapist collects contains a brief summary of information about the patient (name, surname, date of birth, address, medical record number and hospitalization unit, doctor responsible for the treatment, diagnosis and the reasons for which the patient was referred to the physiotherapist).
- A second part of the collection includes the patient's history taken from the medical record, from the interview with the patient, from the interview with family members and with the care staff.

Components of the Medical History

- Respiratory history
- Comorbidities (especially coronary artery disease, diabetes, osteoporosis, sleep apnea)
- Other medical and surgical history
- Family history of respiratory disease
- Use of medical resources (e.g., hospitalizations, urgent care or emergency room visits,
- physician visits)
- All current medications including over-thecounter drugs and herbal supplements; this includes the dose, route, and frequency
- Oxygen use: how it is prescribed and how the patient actually uses it
- Allergies and drug intolerance
- Smoking history
- Occupational, environmental, and recreational exposures
- Alcohol and other substance abuse history
- Social supports

Interview with the patient

- The environmental context in which the interview takes place can affect the patient's availability for the interview: the physiotherapist must choose a quiet environment, where privacy is respected, and avoid interrupting the interview.
- The ideal interview is one in which the patient feels comfortable and free to talk about matters that concern him/her.
- The conversation could start with open-ended questions (for example, "what's the main problem?"), Which allow the patient to discuss what is most important to him at the time. Subsequently closed questions (for example, "when did the cough start?") Can help focus the problems.

Anamnesis

- Respiratory symptoms are often manifestations of pathologies of other than respiratory systems.
- On the other hand, respiratory changes can affect other functions; for this reason the evaluation cannot be limited to the chest and respiratory function, but must consider the patient as a whole

History of current conditions (recent medical history)

- Chronologically and in detail describes the symptoms that led the patient to our observation and the repercussions they have on his/her daily life.
- For each symptom described by the patient it will be necessary to investigate
  - the onset (when and how, whether suddenly or progressively),
  - the circumstances (the cause or activity that provoke the onset of the symptom),
  - localization (in which body segment the symptom is located and if there is irradiation),
  - severity (the intensity of the symptom and its impact on the activities of daily living),
  - the characteristics, the frequency with which it occurs, the duration (how long it lasts, if it is constant or intermittent),
  - the trend (whether it is worsening, improving or unchanged),
  - associated symptoms, factors that can aggravate it (for example, location, exercise, anxiety, temperature, weather conditions),
  - the factors that can alleviate it (position, rest or other).

Previous medical history (past medical history)

- It collects the medical and surgical problems that the patient has had in the past. It includes previous illnesses and therapies to which the patient has undergone, personal attitudes and habits that can interfere with health conditions and adherence to the treatment plan.
- The physiotherapist must know the patient's history regarding previous illnesses, traumas, surgeries, treatments to which he was subjected, any allergies and adverse reactions.

Previous medical history (past medical history)

- Obviously the attention will be focused on the cardiorespiratory system with regard to previous diseases (pneumonia, bronchitis, pleurisy, tuberculosis, pneumothorax, history of heart disease), surgical interventions (cardiac surgery, thoracic and upper abdominal surgery) and trauma to the chest, but it will also be important to investigate all the conditions that may limit the rehabilitation intervention and which must be taken into account when drawing up the treatment plan.
- Particular attention must therefore be paid to gathering information on previous pathologies, neurological or psychiatric, or traumas affecting the musculoskeletal system.

Drugs therapies

- The drug therapies the patient has undergone and those in progress are also an important element of the evaluation. We have already mentioned the overriding importance of noting any reactions
- However, details relating to intolerances to various drugs, medicaments or excipients (for example, inhalation of aerosol with physiological solution) should not be overlooked. Concurrent treatments should be noted in this section if possible

Family history (family history)

- Its purpose is to know the health conditions of family members who may have any connection with the pathology or symptomatology reported by the patient.
- Therefore, hereditary or familial diseases of the respiratory system (for example, cystic fibrosis, allergies, asthma) or those that can directly or indirectly affect respiratory function (neuromuscular, cardiovascular, autoimmune or immunological diseases in general) must be investigated.

Family history (family history)

- Finally, the possibility of exposure, through the family or work environment, to infectious agents (for example, flu syndromes, tuberculosis, AIDS, psittacosis, legionellosis) or to other agents (for example, passive smoking) should not be neglected).

Family history (family history)

- The patient's lifestyle provides a lot of information about his/her state of health. Many habits, in fact, can contribute to the onset or worsening of respiratory disease, first of all tobacco smoking, in the form of cigar, pipe, but more often cigarette. Cigarette smoking, present or past, is frequently found in patients with COPD or lung cancer.
- Cigarette consumption is commonly recorded as "pack-years", (calculated as the number of cigarettes per day divided by 20 multiplied by the number of years of smoking).
- It is also important to consider the age at which the patient started smoking, changes in smoking habits and attempts to quit.

Family history (family history)

- Another important element in evaluating the respiratory patient is the professional and work history.

- Numerous workplace conditions can expose you to the risk of respiratory disease or worsen the symptoms of pre-existing diseases.

Family history (family history)

- However, it should not be forgotten that, in a broader context, the main objective should be not only and not so much the occupational history, but rather an "environmental" anamnesis, aimed at outlining the "professional and domestic" environment (understood as a hobby or recreational activity, as well as the location of the house itself) in which the patient lives.
- Knowing the profession is also useful in planning a rehabilitation project, which must necessarily take into account the patient's recovery expectations and reach the goal of bringing functional skills as close as possible to the requests.

Current illness

- Symptoms related to work activity
- Other workers suffering from similar symptoms
- Current exposure to dusts, vapors, chemicals or biohazard
- Previous first report of professional injury

Work history

- Describe any work history, job or job changes; description of the typical day
- Work environment
- Ventilation, medical surveillance and industrial hygiene; active and passive protection measures
- Lost work days (causes); previous requests for reimbursement for work causes

Past history

- Exposure to noise pollution, vibrations, radiation, chemicals, asbestos

Past history

- Current and past location of work place and home
- Pollution
- Hobby: painting, sculpture, engraving and woodworking
- Domestic insulation / heating
- Agents employed for house cleaning
- Exposure to pesticides
- Possession and use of firearms at home

Hobby

- Many lifestyle habits can help maintain or improve health.
- Physical activity, the practice of a sport suited to one's athletic training conditions, but also, on another side, dedicating oneself to a hobby or cultural, recreational or voluntary activities, are all habits that can affect physical conditions , intellectual and psychological of a person.
- Knowing the variations that have occurred in these activities allows us to understand how much the respiratory disease has changed the state of health understood not as a mere absence of disease, but as the possibility for the individual to fully play their role in society.
- It also provides useful information on his expectations and which components of the rehabilitation program to insist on to reinforce his motivation for recovery.

Social framework

- Finally, the social framework in which the patient usually lives must be outlined as precisely as possible, with particular regard to the type and degree of family support.
- There must also be a brief description of the patient's places of life, with particular reference to the presence of stairs and or architectural barriers capable of determining the onset of respiratory symptoms.

Physical Assessment

- Physical assessment adds important information to data obtained from the patient's history and from record and laboratory review. While a complete physical examination is part of the initial assessment, the aspects of this assessment represent the minimal information that should be obtained.

Physical Assessment

- Vital signs: blood pressure, pulse, respiratory rate, temperature
- Height; weight; BMI, either calculated (weight [in kg] divided by height [in meters] squared [kg/m2]) or determined from a table
- Arterial oxygen saturation measured with pulse oximetry at rest and with activity
- Breathing pattern
- Use of accessory muscles of respiration
- Chest exam: inspection, palpation, percussion, symmetry, diaphragm position, breath sounds, adventitious sounds (crackles, wheezes, rhonchi), duration of expiratory phase, forced expiratory time
- Cardiac exam: cardiac rate and rhythm, murmur, gallops, jugular venous distention
- Presence of finger clubbing
- Upper- and lower- extremity evaluation: signs of vascular insufficiency, joint disease, musculoskeletal dysfunction, range of motion, muscle atrophy, edema

Diagnostic Tests

- Essential information to assist in the proper diagnosis of the rehabilitation candidate and the development of an appropriate plan of care is listed in the figure.
- Many of these tests will already be available and current at the time of the assessment and do not need repeating
- Some of the tests, such as the 6-minute walk test or an assessment for anxiety or depression, are usually not already available from the medical record and should be obtained.
- These diagnostic tests help establish a baseline of the patient's current clinical status and may be used postprogram to evaluate outcomes.

Figure 2.4 Essential diagnostic data needed for the initial medical evaluation of the pulmonary rehabilitation candidate

- Spirometry
- Oxygen saturation at rest and with walking exercise upon program entry
- Chest radiograph
- Electrocardiogram
- Field test of exercise capacity, such as the 6-minute walk test or the shuttle walk test, upon program entry
- Screening assessment of anxiety and depression, such as the Beck Depression Inventory or the Hospital Anxiety and Depression Scale, upon program entry
- CBC

Symptom Assessment

- Information from symptom assessment is often utilized in goal setting, may be used to document outcomes, and may be used by third-party payers to determine the medical necessity for the service.

Symptom Assessment

- The following is a list of items to include in the symptom assessment:
- Dyspnea
- Fatigue
- Cough and sputum production
- Wheeze
- Hemoptysis
- Chest pain
- Postnasal drainage
- Reflux, heartburn
- Edema
- Dysphagia
- Extremity pain or weakness
- Feelings of anxiety, panic, fear, isolation
- Depressive symptoms.

Symptoms

- The interview with the patient aims to "highlight subjective symptoms. This" goal can be achieved by starting with open questions ("What is the main problem?"; "What is bothering you most?"), To lead the patient to discuss which aspect is most important to him/her at the time (prevalent symptom).

Symptoms

- As the interview continues, the questions may focus more on the aspects that need to be clarified most. As previously mentioned, often the recording of the symptoms is the result of an elaborative synthesis by the physician or physiotherapist who conducts the interview. To avoid making the mistake of "filtering" what the patient reported, at least the prevailing symptom should be transcribed with the same words used by the patient.
- The main symptoms of respiratory diseases are: dyspnea, cough, sputum, hemoptysis, chest pain

Dyspnea

- Dyspnea is the term generally used to describe the uncomfortable sensation of difficulty in breathing.
- In this context it is certain that a symptom can only be described by the subject who perceives it; recent studies in the literature have also confirmed the existence of different types of dyspnea: the dyspnea symptom, in fact, is generated not only by physiological mechanisms, but is also influenced by psychological, social and environmental mechanisms.

Dyspnea

- The context in which the sensation of dyspnea is generated can also modify the perception: for example, the fact that dyspnea arises at the peak of exercise or at rest can be experienced by the subject as a normal event in the first case or pathological in the second case, and therefore a source of anxiety as it is considered as indicative of pathology.

Dyspnea

Dyspnea can be generated by:

- Increased ventilatory demand, which occurs in normal subjects or subjects suffering from pathologies of the lung parenchyma during physical exercise;
- Abnormality of the respiratory muscles due to weakness (neuromuscular diseases) or mechanical inefficiency (COPD);
- Altered ventilatory impedance, which occurs due to increased airway resistance (during asthma or COPD) or increased elastic load (interstitial diseases);
- Alteration of the breathing pattern, which occurs as a reflex mechanism (rapid and shallow breathing) in chronic (emphysema) or acute (pulmonary edema, strenuous exercise) pathologies;
- Abnormality of gas exchange, which occur in the course of hypoxemia and / or hypercapnia (the latter through the altered concentration of hydrogen ions in the blood and liquor and chemoreceptors).

Dyspnea

- Dyspnea is the most frequent symptom in respiratory diseases and is the most frequent reason why the respiratory patient goes to the physician, although it is present in many other clinical situations.
- In fact, it can be the consequence of pulmonary, cardiac, haematological, neurological, metabolic and endocrine, psychiatric and mechanical disorders.

Dyspnea

- Dyspnoea can occur acutely, as in acute asthma, spontaneous pneumothorax, acute pulmonary edema, upper airway obstruction, or have a chronic progressive course, as can be seen in COPD, pulmonary fibrosing disease, or heart failure.

- In these cases, the dyspnea manifests itself first under exertion, then with increasingly lighter exertions.

- By limiting the ability to sustain effort, it often "interferes with the simplest activities of daily life, such as eating, washing, talking, and is therefore the main cause of disability.

- Finally, it can also be present at rest or force the patient to posture (orthopnea, the patient is unable to maintain the supine position except by lifting the head and trunk).

Dyspnea

- Pulmonary causes of dyspnea can fall into the two categories of restrictive and obstructive syndromes.
- In restrictive syndromes, dyspnea is usually absent at rest, but appears and progressively increases during an effort.
- In obstructive syndromes, as previously mentioned, it is above all the limitation to the air flow that causes the neuromechanical dissociation responsible for the genesis of dyspnea, and therefore dyspnea can be present even at rest.

Dyspnea

- Due to the impact that this symptom has on the patient's quality of life, the possibility of giving a precise assessment is of great importance.

Cough

- Cough is another common symptom in respiratory diseases.
- The cough can be acute, chronic or paroxysmal.
- An acute episode, limited in time, is commonly attributable to a cold syndrome.
- The most common cause of persistent chronic cough is postnasal drip syndrome, followed by asthma, gastroesophageal reflux, chronic bronchitis, bronchiectasis and other conditions, such as heart failure, lung tumors and sarcoidosis.
- In smokers, chronic cough is usually caused by chronic bronchitis. Postnasal drip syndrome, asthma and gastroesophageal reflux are responsible for most cases of chronic cough in non-smokers who do not have changes on the chest X-ray and do not take ACE inhibitors.

Cough

Cough can be described as

- effective (with enough force to clear the airways)
- ineffective (too weak to mobilize secretions)
- productive (the cough causes the expulsion of mucus or other material)
- dry (without sputum production)

Cough

Cough can also be characterized by timbre or rhythm.

- Weak or aphonic cough, mainly linked to incomplete continence of the glottic rim (therefore caused by an insufficient compressive phase). The disorder in this case may be due to local conditions (laryngeal inflammation, infiltration or neoplastic destruction or infectious diphtheria which can be associated with general conditions of adynamia due to cachectic state, neuro-muscular diseases, etc.);
- Barking cough, characterized by a high and sonorous but hoarse tone, due to incomplete closing of the true cords and approaching of the false cords, can be associated with tirage and cornage and is an expression of laryngotracheal involvement. Very often it is also associated with alterations of the voice (for example hoarseness, in acute hypoglottic laryngitis and aphonia in diphtheria laryngitis), or with dysphagia when associated with parallel involvement of the epiglottis;
- Bleating or panting cough, characterized by a shrill or stunted tone, mainly linked to related stenosis and consequent alteration of the vibratility of the vocal cords, as occurs in the course of mediastinal swelling, neoplasms, cysts, intrathoracic goiters or following the paralysis of the recurrent by compression from aneurysm of the aorta or anonymous artery or due to neoplastic infiltration.

Sputum

- By sputum we mean the material, of bronchopulmonary origin, expelled through the tracheo-bronchial tree, usually by coughing.
- When, in pathological conditions, the production of mucus increases, its accumulation triggers the cough reflex, which causes its expulsion.
- Since expectoration, as well as coughing, are not socially accepted behaviors, there may be a tendency on the part of the patient to minimize or hide the presence of these symptoms; it is therefore important to ask the patient specific questions, and even more important are the collection and examination of the characteristics of the mucus.

Sputum

- The distinctive characteristics of the sputum are the color, the consistency, the quantity, the time of day in which it is produced, the smell, the presence of blood or other material.
- These characteristics allow to trace the cause of alteration in the production of mucus

Characteristics of the sputum

	Descrizione	Cause
Mucous sputum	Transparent or white	Chronic bronchitis without infection, asthma
Mucopurulent sputum	Slightly colored, but not frankly purulent	Bronchiectasis, cystic fibrosis, pneumonia
Purulent sputum	Dense, viscous: • yellowish • dark green / brown • rust • currant jelly	• Haemophilus influenzae • Pseudomonas • Pneumococcus, mycoplasma • Klebsìella
Escreato sieroso	Clear or rosy	Pulmonary edema
Hemoptysis	Hemorrhagic sputum, frank hemoptysis, presence of clots	Infection (tuberculosis, bronchiectasis), carcinoma, vasculitis, trauma, heart disease
Black sputum	Dark particles within mucous secretions	Inhalation of smoke (tobacco or other), ash

Sputum

- A small amount of sputum, mainly produced upon awakening, is common among smokers. Abundant mucous sputum is characteristic of chronic stable-stage bronchitis, while mucopurulent or purulent secretions may indicate an exacerbation of COPD or cystic fibrosis and are often present in patients with bronchiectasis.
- A watery sputum, often pink due to the presence of small amounts of blood, is instead observed in cases of acute pulmonary edema.

Hemoptysis

- By haemophtoe or hemoptysis we mean the expectoration of blood that originates from bleeding in the airways.
- It must therefore be distinguished from other haemorrhages originating from the esophagus or stomach and which also cause the emission of blood from the mouth (haematemesis) or from the expectoration of blood originating from the upper digestive tract, or from the upper airways following its inhalation (pseudohemoptysis)

Chest pain

- Chest pain can be somatic (resulting from somatic elements such as skeleton, muscles, bones, and skin) or visceral (coming from internal organs).
- Chest pain can be the expression of a disorder affecting the organs of the chest or abdomen.

Other symptoms

- Other symptoms, not directly affecting the respiratory system, may be associated with lung disease.
- Muscle and osteo-articular pains are often present in patients with chronic lung disease.
- Another symptom reported by patients with lung disease is headache; this can be caused by an inadequate supply of oxygen to the brain, which can occur in different situations: in a lung disease, in the case of anemia or when the amount of oxygen in the inspired air decreases (as happens at high altitudes).

Musculoskeleta and Exercise Assessment

- The safety of an exercise training program and the appropriateness of the exercise prescription are determined by a thorough initial musculoskeletal assessment. This assessment includes an evaluation of the patient's ability to exercise, physical limitations, requirements for supplemental oxygen, and need for adaptive equipment.
- An evaluation of gait, balance, and fall risk should also be included in the assessment.
- The assessment of physical limitations establishes a baseline of strength, range of motion, posture, functional abilities, and activities. The evaluation should also address orthopedic limitations, any activity restrictions requiring exercise modification, and transferring abilities such as from a chair to a standing position or from the floor to a standing position.

Musculoskeletal and Exercise Assessment

- The following is a list of the information to be obtained in the exercise assessment:
  - Physical limitations (e.g., strength, range of motion, posture, functional abilities, and activities)
  - Orthopedic limitations
  - Transferring abilities
  - Exercise tolerance
  - Exercise hypoxemia including the need for supplemental oxygen therapy
  - Gait and balance

Activities of Daily Living Assessment

- Symptoms of respiratory disease such as dyspnea and fatigue often lead to a decreased ability and willingness to perform activities of daily living (ADLs).
- Patients often do not realize that their activities have been curtailed and often attribute their functional limitations to “getting older.”
- An interview with a significant other frequently adds complementary information to the patient’s selfreport.
- ADLs assessment should include which activities have been limited or eliminated because of the disease, its comorbidity, or its therapy.
- Elimination of an activity often depends on the level of distressing symptoms it engenders and its importance to the patient.

Activities of Daily Living Assessment

- This initial assessment will direct subsequent therapy such as energy conservation techniques, extremity strength and range of motion exercises, proper pacing and breathing techniques, and the need for adaptive equipment. If appropriate, functional task performance and the work environment's demands should be assessed to establish a baseline for planning treatment and measuring outcomes.

Nutrition Assessment

- Patients with respiratory disease often have significant alterations in nutrition status and body composition. This includes patients who are underweight, those with normal body weight yet depleted muscle mass, and those who are obese.

Nutrition Assessment

- Cachexia, or muscle depletion, in chronic respiratory disease such as COPD is multifactorial in etiology, including increased energy expenditure during breathing, systemic inflammation, and chronic corticosteroid use.
- Malabsorption is also important in cystic fibrosis.
- Problems maintaining adequate nutrition are present in a sizeable percentage of patients with COPD, and decreased body mass and muscle depletion are significant independent predictors of mortality.
- Obesity is associated with increased work of breathing due to the high metabolic costs of exercise and can be associated with hypoxemia from ventilation-perfusion mismatching or hypercarbia (obesity-hypoventilation syndrome).
- Obese patients are more likely to have significant comorbid illnesses such as musculoskeletal problems, sleep apnea, and cardiovascular disease.

Nutrition Assessment

- Minimal nutrition assessment should include the measurement of height and weight, the calculation of body mass index (BMI), and the documentation of a recent weight change. BMI can be calculated with the following formula:

BMI = weight (kg)/height2 (m2)

Education Assessment

- Assessing the educational needs of pulmonary rehabilitation patients begins with a determination of how they understand and manage their disease.
- This provides information needed to formulate the education component of the program.
- It also can be used to establish a baseline for evaluating change in knowledge and self-efficacy; thus it can be used in documenting outcomes.
- The educational focus of pulmonary rehabilitation has transitioned from didactic lectures imparting knowledge to practice and promotion of selfmanagement in collaboration with the health care providers.
- Collaborative self-management requires that the patient understand certain aspects of the disease and its treatment and the need to contact the health care provider.
- For instance, the early recognition and treatment of COPD exacerbations reduces subsequent morbidity. The patient should know what an exacerbation is and when it begins, when to initiate specific therapy such as anti- biotics and corticosteroids, and when and how to contact the health care provider

Psychosocial Assessment

- Routine psychosocial assessment is an integral component of pulmonary rehabilitation. The initial clinical assessment by the pulmonary rehabilitation team should be complemented by the use of screening questionnaires that assess symptoms of anxiety and depression.
- Patients identified with significant psychosocial problems are referred for further evaluation to appropriate professionals, such as a clinical social worker, psychiatric nurse, psychologist, psychiatrist, or palliative care specialist.

Psychosocial Assessment

- The psychosocial assessment should address several areas: motivation level, emotional distress, family and home situation, substance abuse, cognitive impairment, interpersonal conflict, other psychopathology (e.g., depression, anxiety), significant neuropsychological impairment (e.g., memory, attention and concentration, problemsolving impairments during daily activities), coping style, and sexual dysfunction.
- Failure to detect and address the presence of significant psychosocial pathology may result in poor progress in rehabilitation.
- The findings from the psychosocial assessment are most useful if they lead to specific and individually tailored treatment goals and are integrated into the overall interdisciplinary treatment plan

Goal Development

- Goal development is a direct reflection of the rehabilitation candidate's potential and must include short-term and long-term goals. Program goals must incorporate and reflect these individual patient goals.
- Measurable patient-specific goals are formulated from data collected during the initial patient assessment. Setting realistic goals that are compatible with the patient's underlying disease, her needs and expectations, and the program's objectives is important.

Goal Development

- Goals should be formulated with the patient. Examples include the ability to return to work, care for family, walk to the mailbox, bowl, play golf, perform proper breathing techniques, and better understand the disease and its therapy. The patient must have a clear understanding of the goals and should agree to work toward achieving them.
- Reviewing progress toward goals throughout the program facilitates their attainment. Involving significant others in the goal-setting process at the beginning of the program helps ensure that everyone understands what can and cannot be expected as a result of the program

Goal Development

- The challenge of the pulmonary rehabilitation team is to translate the patient's individual goals into a measurable format for assessment and documentation during the course of therapy. The following are some examples of patient goals:
  - Breathe easier
  - Be more active
  - Be able to play with grandchildren
  - Be able to walk farther
  - Be able to perform activities of daily living, such as taking a shower or pursuing hobbies
  - Be able to travel with greater ease
  - Experience decreased anxiety, depression, or fear of activities that cause shortness of breath
  - Experience fewer exacerbations and hospitalizations
  - Be more independent and self-reliant
  - Return to work
  - Be able to clean house
  - Be able to go to a movie

Evaluation of lung volumes and diffusion

- The measurement of lung volumes and respiratory flows has become a routine investigation in the evaluation of the respiratory patient. The spirometric examination, in fact, is widely used for the diagnosis of the main pathologies, for the evaluation of the effectiveness of therapeutic interventions, for the follow-up of pathologies, as well as for clinical, experimental or epidemiological analyzes of respiratory function in population studies. or on the effects of aging on function itself.

Evaluation of lung volumes and diffusion

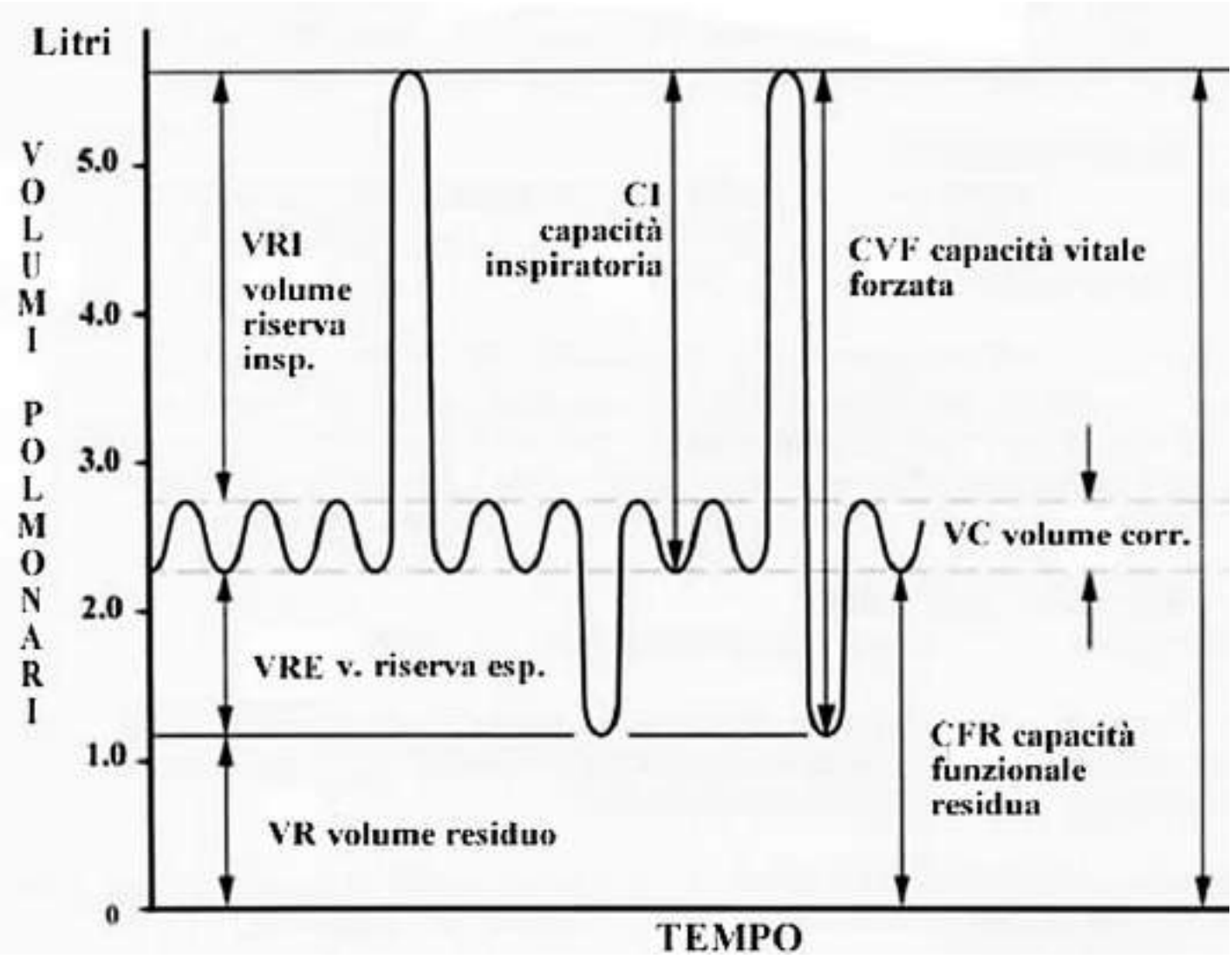
- Lung volumes are distinguished in directly explorable with oral measurements and in explorable only with indirect analysis methods. Furthermore, they are divided into static volumes and dynamic volumes, the latter evaluated on the basis of the time in which they can be mobilized by the subject usually during maximal forced maneuvers.

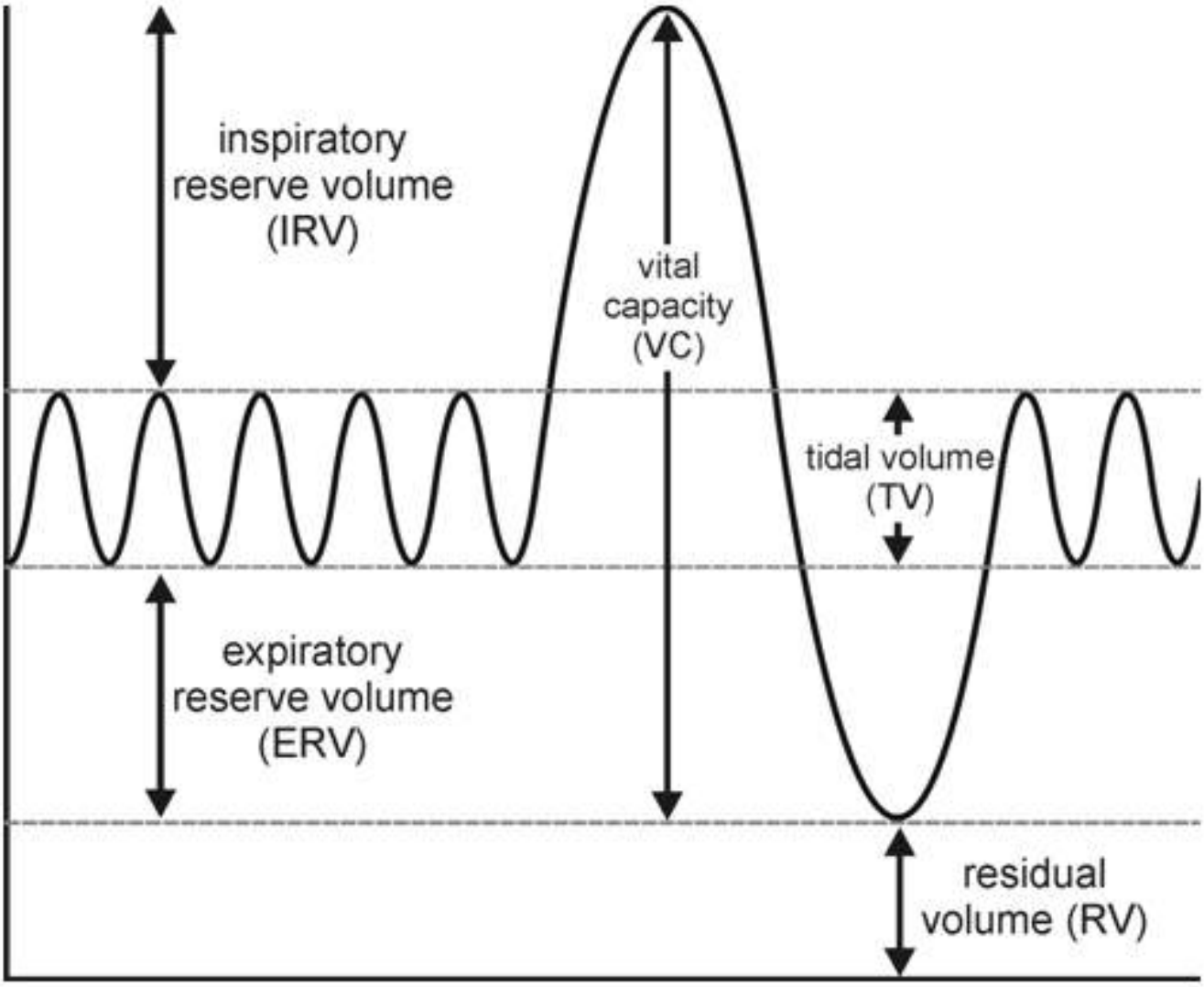
Spirometry

- The most useful spirometric index for evaluating the function of the respiratory muscles is the slow vital capacity (VC); the weakness of the inspiratory muscles reduces the inspiratory capacity and the weakness of the expiratory muscles reduces the volume of expiratory reserve.
- In case of suspected diaphragm weakness it is useful to measure the CV in a sitting and supine position. In healthy subjects, the CV in the supine position is 5-10% lower than the measurement in the sitting position.
- In the presence of severe diaphragm weakness the difference is greater than 30%.

Spirometry

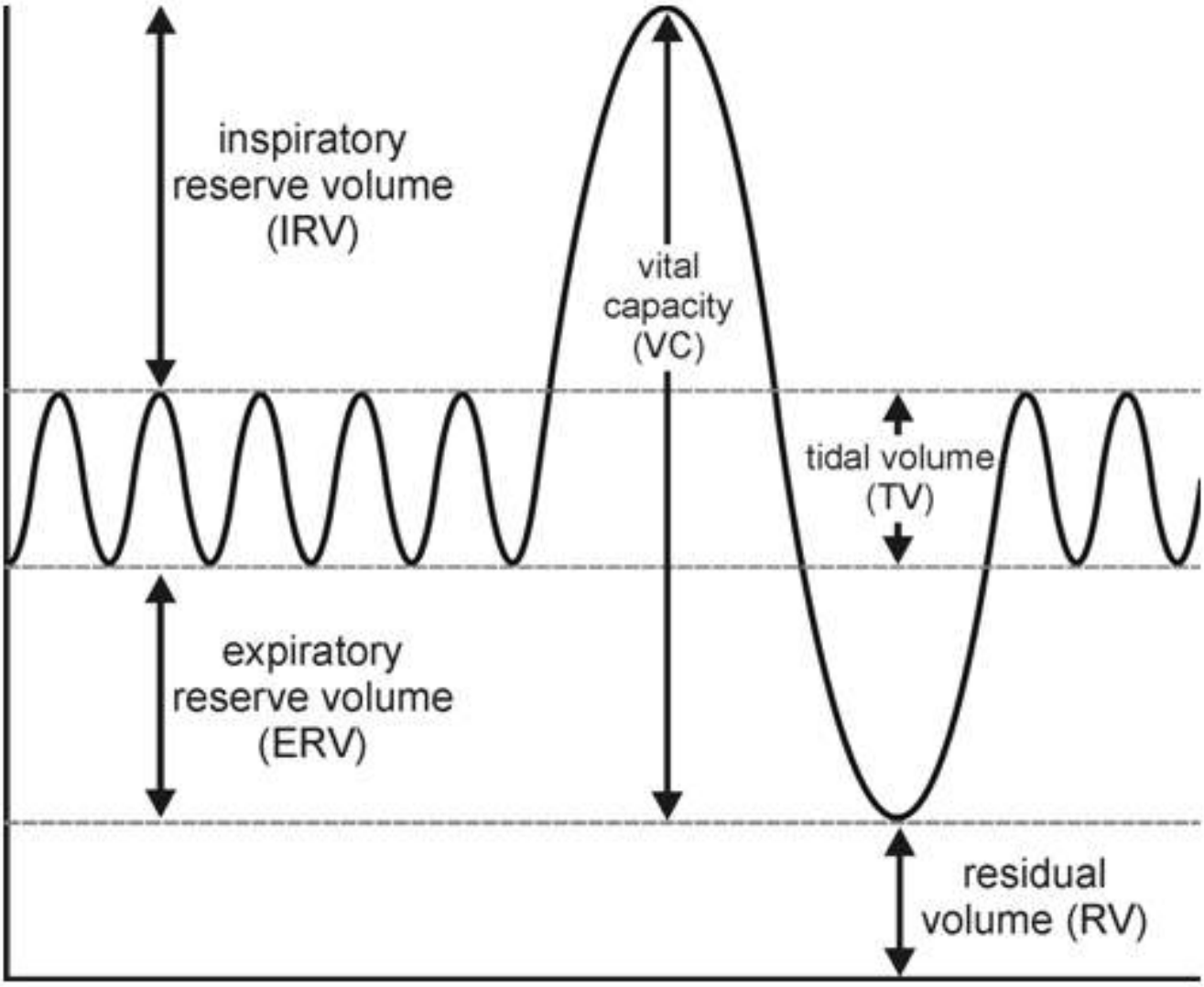
- The measurement of Current Volume has the advantage of being simple and repeatable, while the limit is given by the fact that the maneuver is voluntary and requires collaboration and coordination on the part of the patient.
- Furthermore, the test is neither sensitive nor specific.
- Because relatively low pressures are required to fully expand the respiratory system, Current Volume remains within the normal range in the case of mild or moderate weakness of the respiratory muscles.
- Conversely, a reduction in Current Volume may be due to respiratory diseases such as obstructive pulmonary-interstitial syndromes, chest wall deformity and obesity in the absence of respiratory muscle weakness.


Litri
VOLUMI POLMONARI
5.0
4.0
3.0
2.0
1.0
0
VRI
volume
riserva
insp.
CI
capacità
inspiratoria
CVF capacità vitale
forzata
VC volume corr.
VRE v. riserva esp.
CFR capacità
funzionale
residua
VR volume residuo
TEMPO


inspiratory
reserve volume
(IRV)
vital
capacity
(VC)
tidal volume
(TV)
expiratory
reserve volume
(ERV)
residual
volume (RV)

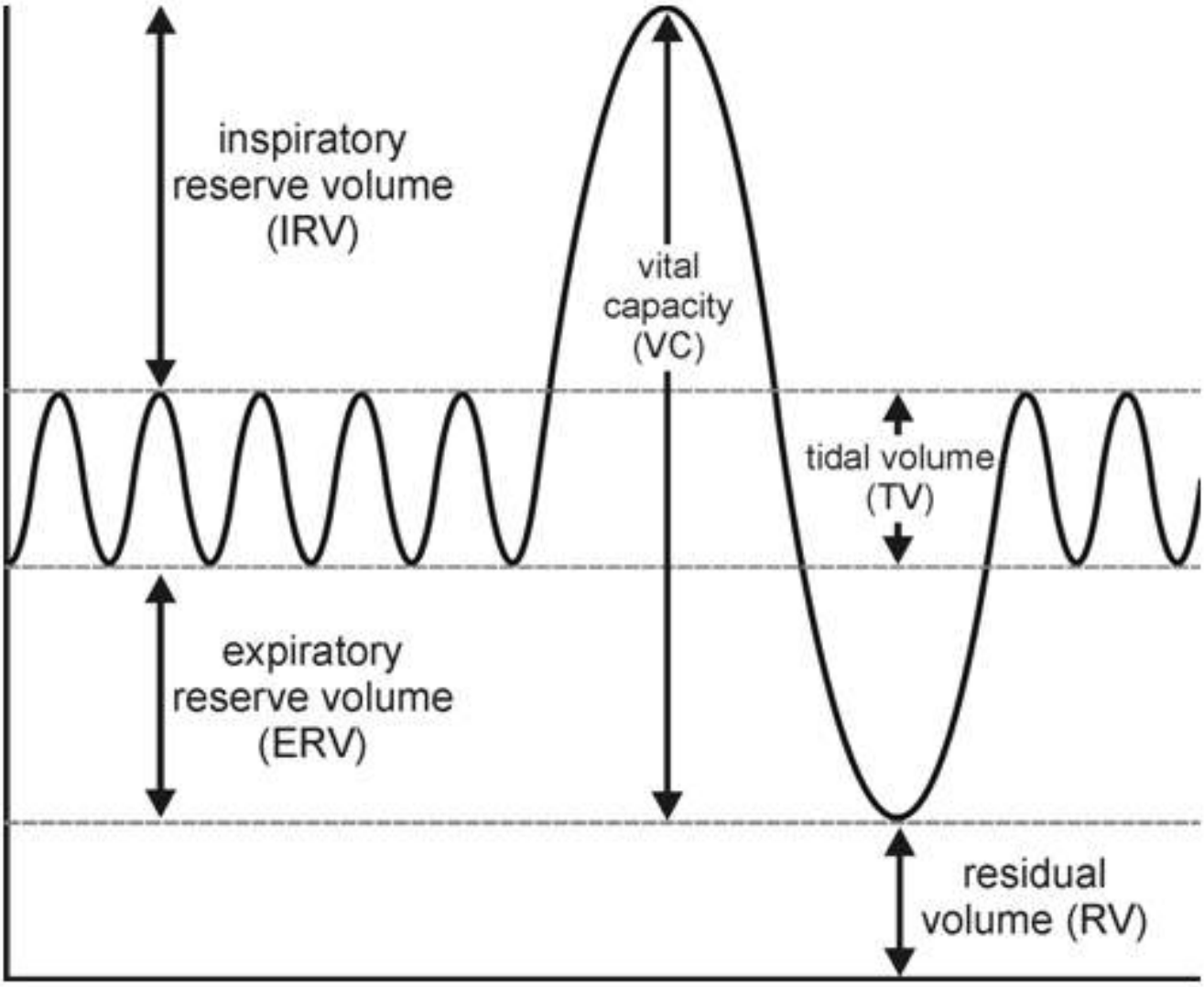
Corrent (Tidal) Volume (CV)

- *Corrent volume (CV): the volume of air mobilized to the mouth during quiet breathing*


inspiratory
reserve volume
(IRV)
vital
capacity
(VC)
tidal volume
(TV)
expiratory
reserve volume
(ERV)
residual
volume (RV)

Vital Capacity (VC)

- Vital capacity (CV): that is the maximum volume of air that can be mobilized to the mouth by the subject between the position of complete inspiration and that of complete expiration (expiratory CV) or vice versa (inspiratory CV)

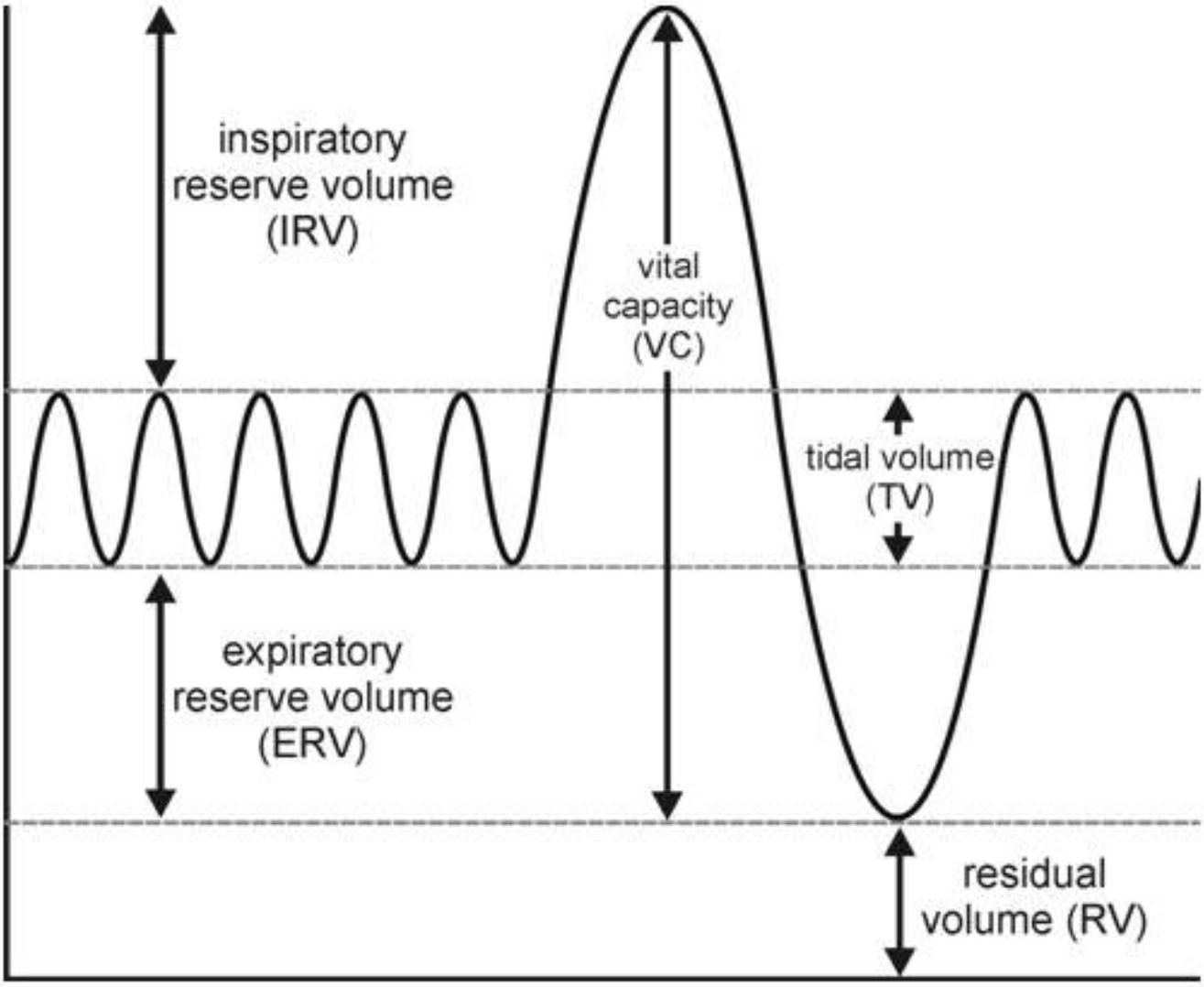

inspiratory
reserve volume
(IRV)
vital
capacity
(VC)
tidal volume
(TV)
expiratory
reserve volume
(ERV)
residual
volume (RV)

Forced vital capacity (FVC)

- Forced Vital Capacity (FVC): the volume of air that the subject is able to exhale in a full maximal exhalation performed in the shortest possible time with an explosive maneuver

Inspiratory Reserve Volume (IRV)

- Inspiratory Reserve Volume (IRV): the volume between the end of the quiet inspiration and a full maximal inspiration;


inspiratory
reserve volume
(IRV)
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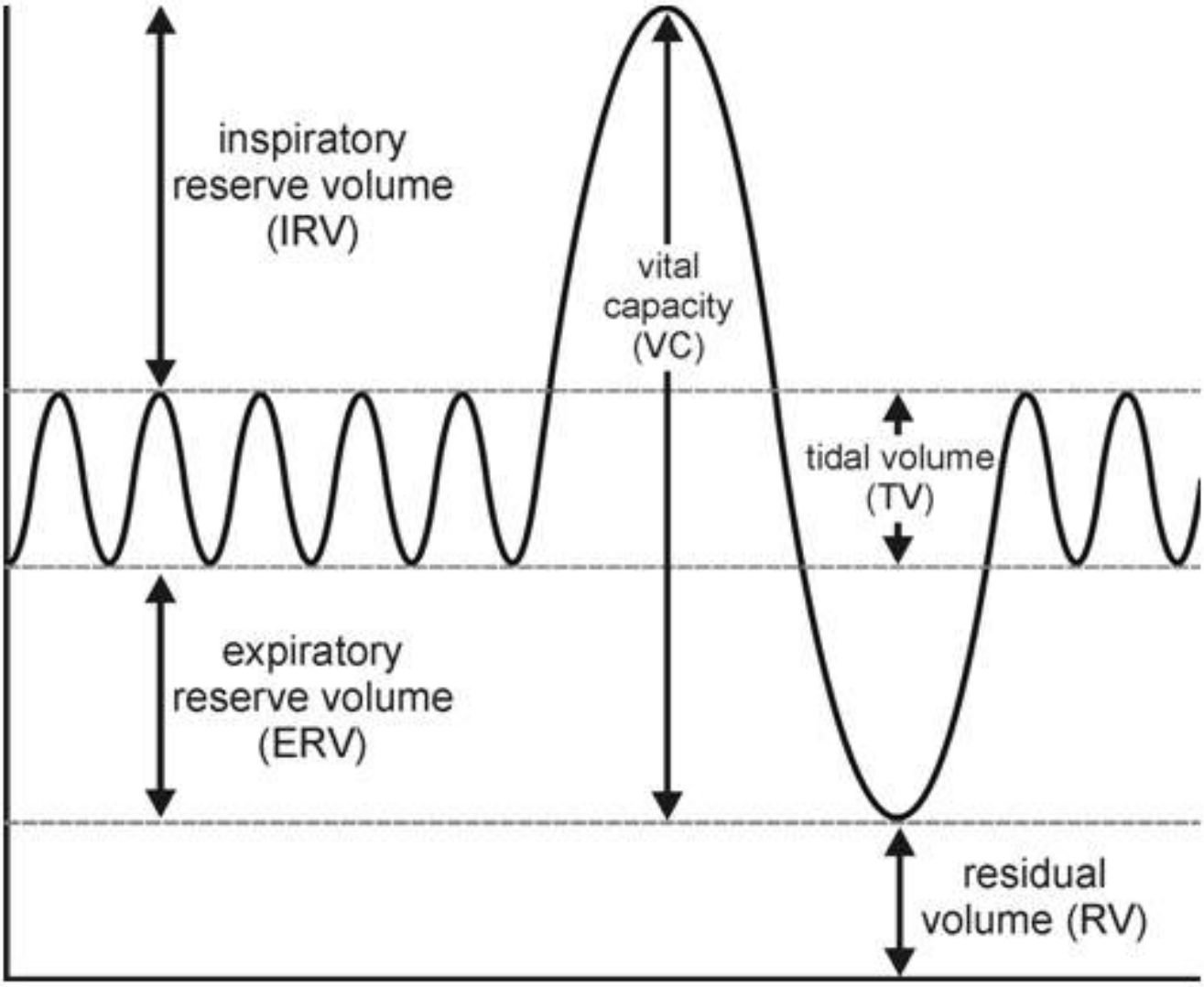
capacity
(VC)
tidal volume
(TV)
expiratory
reserve volume
(ERV)
residual
volume (RV)

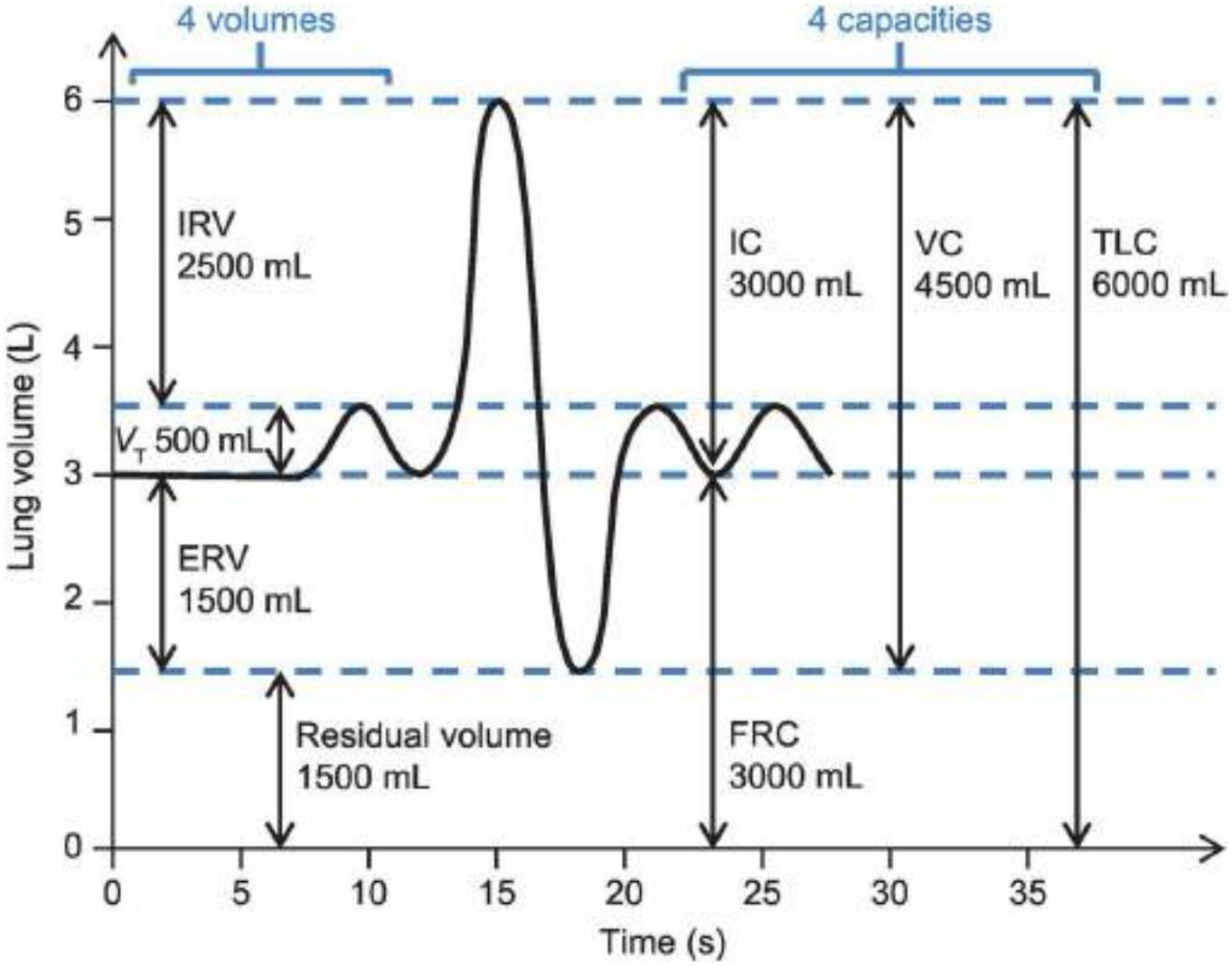
Expiratory Reserve Volume (ERV)

- Expiratory Reserve Volume (ERV): the volume between the end of the quiet exhalation and a maximum full exhalation;


inspiratory
reserve volume
(IRV)
vital
capacity
(VC)
tidal volume
(TV)
expiratory
reserve volume
(ERV)
residual
volume (RV)

Inspiratory capacity (IC)

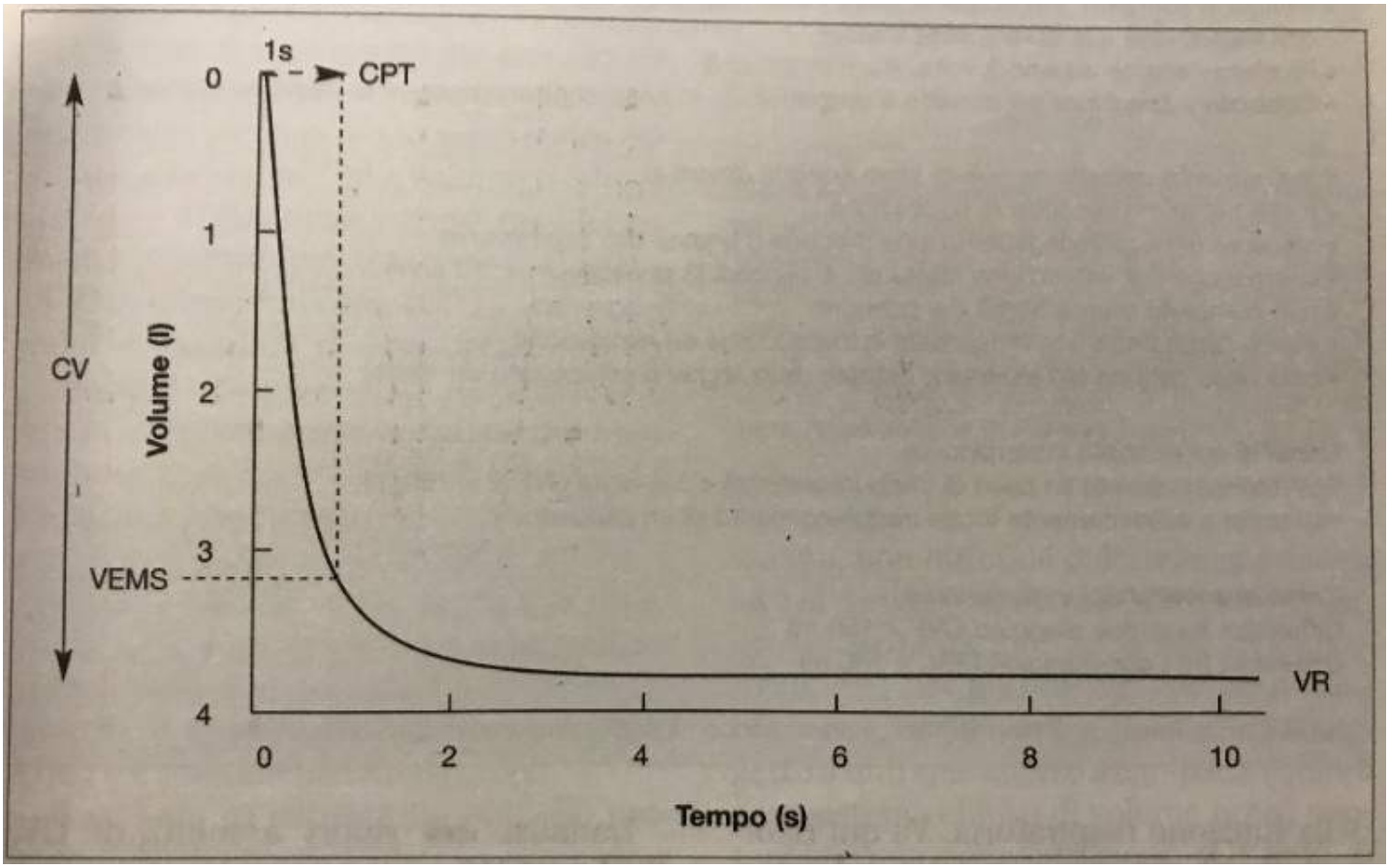
- Inspiratory Capacity (CI): the modification of volume in a full inhalation from the end-exhalation position during quiet breathing at rest to a maximal inspiration.


4 volumes
4 capacities
IRV
2500 mL
V_T 500 mL
ERV
1500 mL
Residual volume
1500 mL
IC
3000 mL
VC
4500 mL
TLC
6000 mL
FRC
3000 mL
Lung volume (L)
Time (s)
0
1
2
3
4
5
6
0
5
10
15
20
25
30
35

Forced expiration curve

- The measurement of the volumes that can be directly explored, which can also be performed with the simplest instruments, therefore allows an initial evaluation of the respiratory patient.
- To perform a forced expiration curve, the subject, with the nose clip positioned, performs a rapid maximal inhalation and, after a pause of less than 1 second, performs a forced exhalation until he is no longer able to exhale.
- The minimum duration of exhalation should be 6 seconds for adults and 3 seconds for children.
- In addition, the exhalation should be prolonged until the volume change in the unit of time falls below 25 ml / s

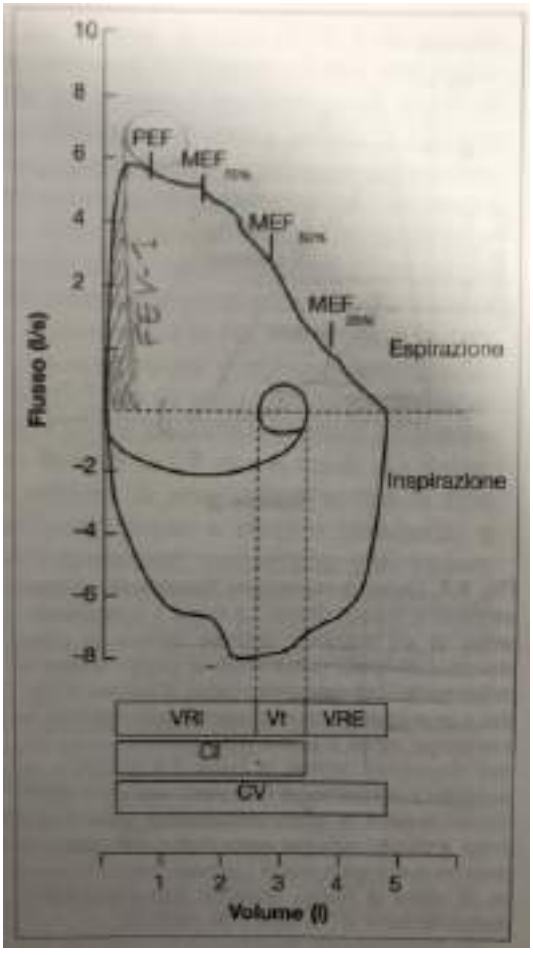
Forced expiration curve



Forced expiration curve

- On a forced expiration curve it is possible to measure two fundamental parameters in the interpretation of the spirometric picture of a subject: the vital capacity and the maximum expiratory volume in the first second of forced expiration (FEV1) allow an initial evaluation of the respiratory function .
- The analysis of the absolute values of CV, CVF and FEV1, as well as the FEV1 / CV% ratio (Tiffeneau index) allows an orientation, and in some cases the diagnosis, on the state of the patient's respiratory function.

Volume flow curve



Volume flow curve

The following can be measured on the flow / volume curve:

- the Expiratory Flow Peak (EFP), that is the maximum flow value developed during a maximal exhalation starting from vital capacity (obtained in the first 10-15% of the Forced Vital Capacity),
- the Maximum Expiratory Flows at 75, 50 and 25% of vital capacity (MEF75%, MEF50% and MEF25% respectively), i.e. the expiratory flow values obtained at the different vital capacity levels during forced expiration.

Other parameters

- At the end of a maximal exhalation, a certain volume of air remains in the lung which in no way can be measured in the mouth. This volume, Residual Volume (RV), must necessarily be measured to obtain the Total Lung Capacity (TLC), that is the maximum volume of air contained by the lungs.
- In respiratory physiopathology, one operates by determining the Residual Functional Capacity (RFC), that is the volume of air that remains in the lungs at the end of the quiet expiration, and which is composed of Expiratory Reserve Volume and Residual Volume.

Diagnosis of obstruction and restriction

- In clinical practice it is obviously necessary to distinguish between "normal" and "pathological" values. To this end, for spirometry, it is generally accepted that a value that falls below the 5th percentile is considered to be below the "expected" range, and, therefore, pathological.

Diagnosis of obstruction and restriction

- The spirometric test allows the distinction between normality pictures of respiratory function and pathological pictures, defined as "disventilators". The main distinction occurs between obstructive and restrictive frameworks, a combination of the two being also possible (mixed type deficit).

Obstructive deficit

- The obstructive dysventilatory deficit is characterized by a disproportionate reduction in the maximum expiratory flows generated by the subject compared to the Vital Capacity
- It assumes a narrowing of the airways during exhalation and is defined by a reduction in the FEV1 / Vital Capacity ratio below the 5th percentile of the predicted value.
- Total Lung Capacity may be normal or increased (depending on the clinical picture in which the obstructive syndrome develops) and the Residual Volume / Total Lung Capacity in percentage ratio tends to be increased (lung hyperinflation).

Restrictive deficit

- The restrictive type deficit is characterized by a reduction in Total Lung Capacity below the 5th percentile of the theoretical value with a normal FEV1 / Vital Capacity ratio.
- The presence of a restrictive deficit may be suspected when the Vital Capacity is reduced and the FEV1 /Vital Capacity is normal or slightly increased, while the flow / volume curve shows a convex trend.
- Since such a picture can be generated by a non-maximal exhalation maneuver, a reduced Vital Capacity does not, in itself, prove a restrictive ventilatory defect.
- It is obvious that, in the latter form, smaller volumes will also correspond to proportionately smaller flows (in-and expiratory).
- In the restrictive forms, the Total Lung Capacity will obviously be reduced, and the Residual Volume / Total Lung Capacity in percentage usually normal, as the Residual Volume will tend to be reduced homogeneously to that of Vital Capacity and Total Lung Capacity .

Flow /volume curve and deficit

- The flow / volume curve presents, in the expiratory phase, a phase of rapid ascent to the PEF, and therefore a progressive reduction of the expiratory flow values as the exhalation proceeds and approaches the level of VR.
- In the obstructed subject, on the other hand, in addition to a lower Expiratory Flow Peak , the descending phase of the curve will be characteristically concave upwards for a more rapid reduction of expiratory flows during exhalation.
- The morphology of the narrow flow / volume curve, on the other hand, is very similar to that of the normal one (sometimes with an accentuation of the convexity of the descending phase), but with lower volume values and expiratory flows.

Flow /volume curve and deficit

- The two main deficits can be variously associated with producing a mixed deficit, characterized, in fact, by the simultaneous coexistence of obstruction and restriction, and defined when both the Total Lung Capacity and the FEV1 / Vital Capacity ratio are below the 5th percentile of their respective theoretical values.
- Since Vital Capacity can be reduced in both obstructive and restrictive deficits, the presence of a restrictive share in an obstructed patient cannot be inferred from the simple measurement of FEV1 and Vital Capacity. Therefore, the measurement of Residual Volume and Total Lung Capacity is absolutely necessary to define the picture.

Severity of the obstructive deficit

Normality: a test in which both the CV and the FEV1 / Vital Capacity in percentage ratio is within the normal range is defined as normal	
Obstructive deficit: is defined when the FEV1 /Vital Capacity in percentage ratio is below the normal range. Severity is defined as follows:	
FEV1/ Vital Capacity in percentage ratio below normal is	
FEV1≥100% of theoretical	Possible physiological variable
FEV1 <100% and ≥70% of theoretical	Mild
FEV1 <70 and ≥60% of theoretical	Moderate
FEV1 <60% and ≥50% of predicted	Moderate-severe
FEV1 <50% and ≥34%	Severe
FEV1 <34%	Very severe

Severity of the restrictive deficit

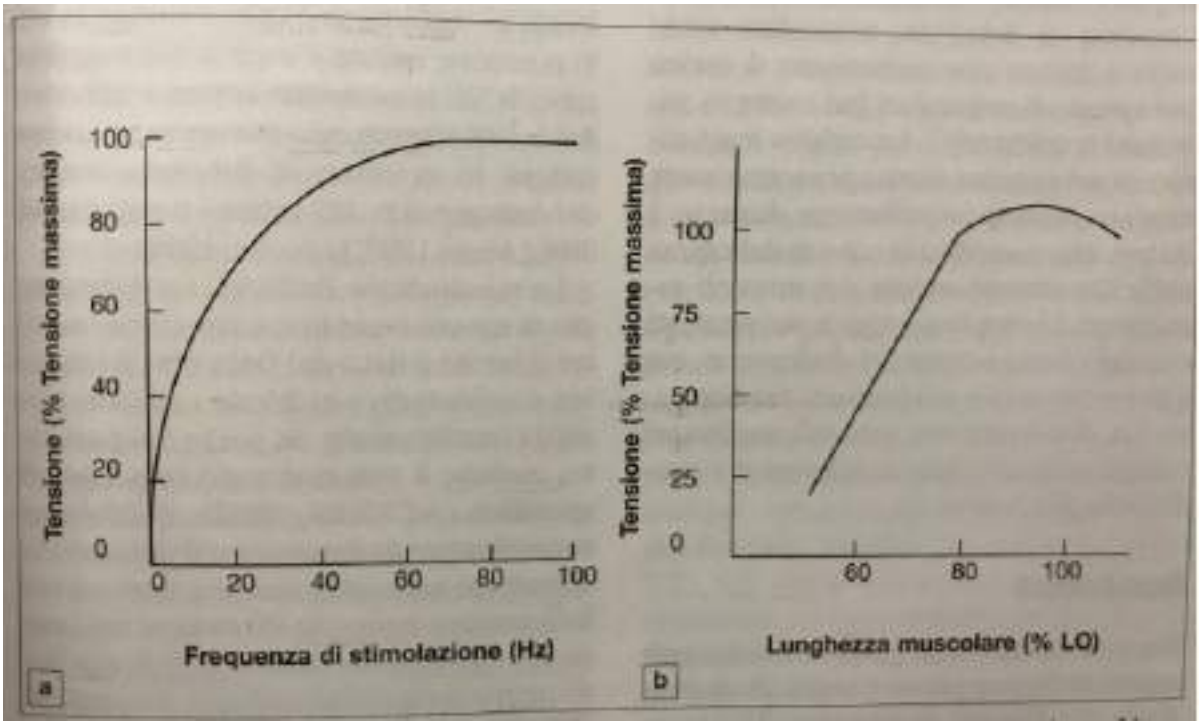
Restrictive deficit: defined on the CPT when the VEMS / Vital Capacity in percentage ratio is not reduced	
Restrictive deficit: defined on the CPT when the VEMS / Vital Capacity in percentage ratio is not reduced	
Vital Capacity <LLN but> 100% of theoretical	Mild
Vital Capacity <70 and ≥60% of theoretical	Moderate
Vital Capacity <60%	Severe
LLN (lower limit of normality) = theoretical value - 1.645 for standard error of the estimate	

Assessment of the strength of the respiratory muscles

- The assessment of the strength of the respiratory muscles is based on several elements
  - Anamnesis
  - Physical examination
  - Spirometry (Current Volume in standing and supine position)
  - Respiratory muscle strength test
  - Non-invasive voluntary tests
    - Maximal mouth pressures (MIP, MEP)
    - Nasal sniff test
  - Invasive voluntary tests
    - Esophageal sniff test
    - Transdiaphragmatic sniff test
    - Maximal transdiaphragmatic pressure
    - Gastric pressure when coughing
  - Non-voluntary testing
    - Twitch Pdi with electrical stimulation
    - Twitch Pdi with magnetic stimulation

Assessment of the strength of the respiratory muscles

- The strength-to-length relationship is of critical relevance to understanding muscle strength testing



Assessment of the strength of the respiratory muscles

- The strength-to-length relationship is of critical relevance to understanding muscle strength testing
- With the same nerve stimulation, the tension developed by the skeletal muscles during an isometric contraction is a function of the length of the muscle fibers at the time of contraction.
- The developed tension is maximal when the muscle the muscle contracts from a certain length (optimal length) and is reduced when the muscle contracts from a certain length (optimal length) and is reduced when the muscle contracts to start from a shorter or longer than optimal length.

Assessment of the strength of the respiratory muscles

- As for the respiratory muscles, the length depends on the volume of the respiratory system: the inspiratory muscles, especially the diaphragm, have an optimal length at low volumes (close to residual volume), while the expiratory muscles have an optimal length at high volumes (close to total lung capacity)

Anamnesis

- Symptoms that may be associated with respiratory muscle weakness are dyspnea, orthopnea, morning headache, daytime sleepiness and ineffective cough.
- Dyspnea occurs in severe weakness of the respiratory muscles, or in the presence of muscle weakness associated with factors that increase the load on the respiratory muscles (for example, respiratory infections).
- Morning headache and daytime sleepiness can be caused by hypoventilation during sleep, which occurs in cases of sufficiently severe weakness of the respiratory muscles. Orthopnea is typical of patients with severe diaphragm weakness, but is also present in heart patients. Weakness of the expiratory muscles compromises the effectiveness of coughing and predisposes to pneumonia.

Clinical examination

- Clinical examination of the chest wall may be helpful in detecting signs of respiratory muscle dysfunction:
  - paradoxical abdominal breathing on inspiration: it is typical of severe weakness of the diaphragm and is more easily evident in the supine position;
  - Hoover's sign: the re-entry of the last intercostal spaces on inspiration is typical of the shortening and altered conformation of the diaphragm associated with pulmonary hyperinsufflation;
  - recruitment of the accessory muscles of respiration: the sternocleidomastoid muscles are recruited on inhalation, while the abdominal ones on exhalation in case of severe weakness of the diaphragm or excessive load on the ventilatory pump;
  - rapid and shallow breathing.

Respiratory muscle strength test

- When history, physical examination, or spirometry suggests the possibility of muscle weakness, it becomes important to specifically measure the strength of the inspiratory and expiratory muscles.

Non-invasive voluntary tests

- The most widely used non-invasive tests to globally assess inspiratory and expiratory muscle strength are maximal pressures measured at the mouth during maximal inspiratory and expiratory efforts with occluded airways (Maximal Inspiratory Pressure (MIP) and Maximal Expiratory Pressure (MEP) at the mouth).
- MIP and MEP depend on age, sex, the volume of the respiratory system at which they are measured, and the degree of cooperation and coordination of the subject.

Non-invasive voluntary tests

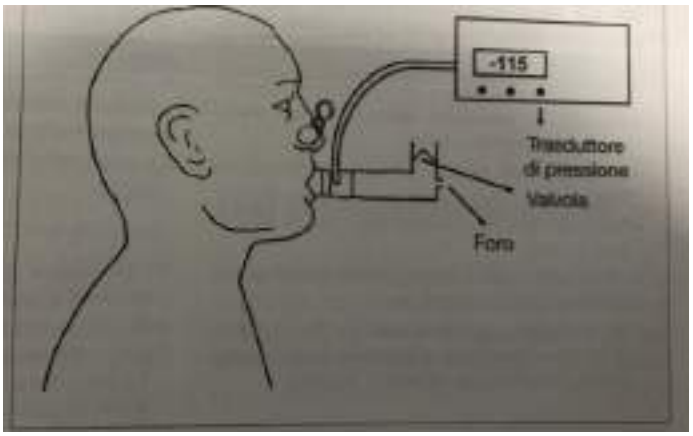
- The maximum value of MIP is obtained at residual volume and that of MEP at total lung capacity due to the length-tension relationship of the respiratory muscles and the elastic return of the respiratory system.
- The inspiratory muscles, particularly the diaphragm, have the best length-to-tension ratio at low lung volumes; moreover, the elastic return of the respiratory system at residual volume is about -30 cmH20 and contributes significantly (about 30% in the normal subject) to the MIP.
- Conversely, the expiratory muscles are in a favorable position on the length-tension curve at high lung volumes; in addition, the elastic return of the respiratory system to total lung capacity is about 40 crnH2O.
- The pressure developed during the MIP and MEP maneuvers and the normal reference values are therefore the result of the pressure developed by the muscles and the elastic return pressure of the respiratory system.
- When MIP and MEP are measured at residual functional capacity they depend only on the pressure developed by the respiratory muscles, since the respiratory system is in conditions of elastic equilibrium.

MIP & MEP

- Maximal voluntary inspiratory (PImax) and expiratory (PEmax) pressures (or MIP and MEP) are probably the most frequently reported noninvasive estimates of respiratory muscle force.
- Ever since Black and Hyatt reported this noninvasive technique in the late 1960s (21) it has been widely used in patients, healthy control subjects across all ages, and athletes.

MIP & MEP - Method of execution

- The technique of execution is critical and differences in methodology contribute to the variability of the normal values of MIP and MEP reported in the literature



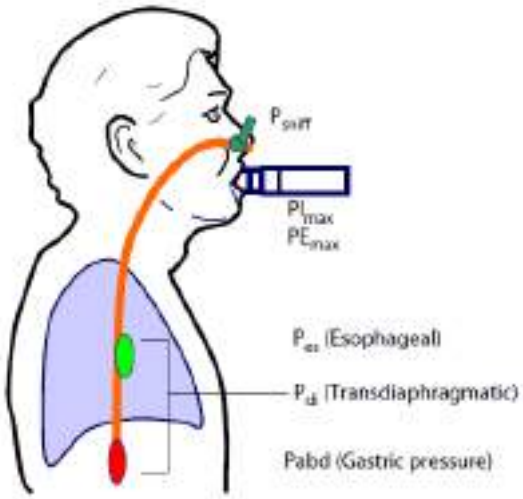


Figure 9.2 Respiratory muscle strength can be measured at the nose (inspiratory muscles), at the mouth, in the oesophagus, or in the stomach.

MIP & MEP

- Pressure is recorded at the mouth during a quasi-static short (few seconds) maximal inspiration (Müller manoeuvre) or expiration (Valsalva manoeuvre). The manoeuvre is generally performed at residual volume (RV) for PImax, and at total lung capacity (TLC) for PEmax .
- Measurements at functional residual capacity would theoretically be more appropriate and the pressure theoretically would better reflect the tension developed by the respiratory muscles (Pmus).
- Nevertheless, patients find it easier and more straightforward to perform the manoeuvres from RV and TLC.

MIP & MEP - contraindication

- Only few contraindications exist for these measurements, and these can be summarized as pathological conditions where relatively large pressure swings in the thorax or abdomen should be avoided.

Table 9.3 Some relative or absolute contraindications for measurements of maximal respiratory muscle strength

(Relative) Contraindications for measurement of respiratory muscle strength
• Unstable cardiac disease
• Uncontrolled hypertension
• Hernia inguinalis
• Aneurism of the aorta
• Recent pneumothorax
• Recent abdominal or thoracic surgery (not consolidated)
• Conditions in which pain precludes a maximal effort
• Any disease with significant loss in the bone mineral content (multiple myeloma or bone metastases, very severe osteoporosis)

MIP & MEP

- Although the technique appears simple and hard- and software became available to make these measurements easily accessible in the pulmonary function laboratory, there are some technical pitfalls that influence the obtained results and make the results more variable than most other lung function measurements

MIP & MEP - Method of execution

- The use of a soft flanged mouthpiece, commonly available in respiratory pathophysiology laboratories, is advisable because it is easier for patients to use, even if trained subjects get higher MIP and MEP values using a rigid mouthpiece.
- The mouthpiece is connected to a short tube connected to a pressure transducer and equipped with a valve system that allows you to breathe quietly and perform maximal inspiratory and expiratory maneuvers against the occluded airway.

MIP & MEP - Method of execution

- The occlusion system must have a small hole (2 mm in diameter) in order to prevent closure of the glottis and involuntary use of the orofacial muscles during maneuvers.
- Maximal inspiratory and expiratory efforts must be sustained for at least 1.5 seconds in such a way as to allow measurement of the maximum sustained pressure for one second.
- The test should be performed by an experienced operator who can adequately instruct, encourage and motivate the patient.
- The operator must help keep the lips closed around the mouthpiece in case of leakage and support the patient's cheeks during exhalation efforts.
- The maneuvers must be repeated until a variability of less than 20% is obtained and the highest value obtained is recorded.

MIP - Summary

- Patient in a sitting position, trunk upright or completely supine *
- The nose must be closed with a nose plug
- There must be a small hole in the mouthpiece (2 mm)
- The execution must be preceded by some learning maneuvers
- The subject is asked to exhale fully (at Residual Volume) and to inhale as forcefully as possible for at least 3 seconds
- He is advised that no air will arrive during inspiration because the path is blocked and that this will allow us to measure the force developed by his inspiratory muscles
- The subject must be urged vigorously
- Check that the subject is not using the bucco-facial muscles (sucking activity)
- Check that there are no air leaks from the mouth
- The maneuver must be repeated at least 5 times and in any case until a variability of less than 20% is obtained
- It may be useful to use visual feedback
- Only maneuvers with inspiratory effort maintained for more than 1 second are considered valid
- The best result is chosen from the valid maneuvers performed

MEP - Summary

- Patient in a sitting position, trunk upright or completely supine
- The nose must be closed with a nose plug
- The execution must be preceded by some learning maneuvers
- The subject is asked to inhale until full (at Total Lung Capacity) and to exhale as forcefully as possible for at least 3 seconds
- He is warned that during exhalation he will not be able to expel air because the way is blocked and that this will allow us to measure the force developed by his exhaled muscles
- The subject must be urged vigorously
- Compress the cheeks during the exhalation effort to prevent them from swelling
- Check that there are no air leaks from the mouth•
- The maneuver must be repeated at least 5 times and in any case until a variability of less than 20% is obtained
- It may be useful to use visual feedback•
- Only maneuvers with expiratory effort maintained for more than 1 second are considered valid
- The best result is chosen from the valid maneuvers performed•

MIP & MEP - Advantages

- It is an intuitive and easy maneuver to perform with little practice. It is relatively reproducible and has a narrower range of normal values than MIP. Additionally, it is particularly useful in patients who have difficulty performing the MIP maneuver.

MIP & MEP - Disadvantages

- There is a tendency for muscle strength to be underestimated in COPD patients.
- The sniff test is difficult or even impossible if there is an anatomical alteration of the upper airway or if the nose is completely blocked. Like all voluntary maneuvers, poor motivation can make performance submaximal

MIP & MEP – Interpretation of results

- The pressure values obtained with the nasal sniff test should be compared with the reference values.
- It is very useful to perform this type of examination in subjects who have a low MIP value. In fact, some subjects who fail to perform the MIP maneuver correctly are able to obtain normal pressure values with the sniff test, allowing to exclude the presence of muscle weakness.
- In clinical practice, an inspiratory pressure with nasal sniff test of at least -70 cmH2O in males and -60 cmH20 in females allows to exclude clinically relevant weakness of the inspiratory muscles.

Voluntary Invasive Tests - Esophageal pressure and transdiaphragmatic pressure

- These tests are necessary when, after completing the simpler tests, it is not possible to be certain about the real presence of respiratory muscle weakness, when it is useful to specifically evaluate the function of the diaphragm or for research purposes.
- They require placement of catheter-balloon systems at the esophageal level (to estimate pleural pressure) and at the gastric level (to estimate abdominal pressure).
- The difference between the variation of gastric pressure (Pga) and esophageal (Pes) during the contraction of the diaphragm allows to directly measure the pressure developed by the diaphragm (transdiaphragmatic pressure, Pdi).
- Pes and Pdi can be measured during maximal static inspiratory efforts or during sniffing maneuvers.
- Pes and Pdi measured during sniff maneuvers (sniff-Pes and sniff-Pdi) have a narrower normal range than the MIP and a lower coefficient of variation. A substantial number of subjects with low MIP values are able to obtain normal sniff-Pes values.

Voluntary Invasive Tests - Esophageal pressure and transdiaphragmatic pressure

- In clinical practice, the sniff-Pes and the sniff-Pdi are the most accurate and reproducible voluntary tests currently available to assess the overall strength of the inspiratory and diaphragm muscles, respectively.
- Sniff-Pes of at least -80 cmH2O in males and -70 cmH20 in females allow to exclude inspiratory muscle weakness.
- Normal sniff-Pdi values are at least -100 cmH20 in males and -80 cmH20 in females.

Voluntary Invasive Tests - Gastric pressure during coughing

- The measurement of the Pga during coughing allows to estimate the strength of the abdominal muscles, which are the main expiratory muscles.
- Coughing is a more natural maneuver to perform than MEP, and many patients with low MEP values actually have normal expiratory muscle strength when measuring Pga during coughing.
- Further studies are needed to obtain normal values in sufficiently large populations of subjects.

Conclusions

- In many patients, the clinical suspicion of clinically significant respiratory muscle weakness can be confirmed or ruled out using simple tests available to many respiratory physiopathology laboratories, although, in some cases, complex tests available to specialized laboratories are indispensable.
- A sequential approach, starting from the simplest tests to get to the more complex ones, allows to resolve the clinical suspicion of respiratory muscle weakness with efficiency and accuracy.
- Once muscle weakness is diagnosed, the use of invasive tests may be necessary to establish its severity. The Pdi measurement allows you to specifically evaluate the strength of the diaphragm.

Evaluation of gas exchanges: invasive and non-invasive

- In addition to the common assessments, subjects who have to undergo a respiratory physiotherapy program must also be carefully examined on the respiratory side. Only with a careful examination, in fact, it is possible to prepare a "tailor-made" respiratory rehabilitation program.
- A cornerstone of the respiratory evaluation is certainly represented by the examination of the adequacy of gas exchanges.
- The reference measure that evaluates the gas exchange is the Arterial Blood Gas Analysis (EGA). With this test it is possible to measure, in arterial blood, the partial pressure of oxygen (PO2), carbon dioxide (PCO2) and the degree of acidity (pH).
- The evaluation of these haematological parameters is of crucial importance to define the adequacy of the "ventilation, oxygenation and acid-base state of the organism.

ARTERIAL BLOOD GAS ANALYSIS

- Arterial blood gas analysis is a minimally invasive measure. In adults it is performed, in most cases, through a blood sample from the radial artery of the wrist, less frequently from the brachial or femoral artery. It is a non-continuous procedure and its detection requires qualified personnel and expensive equipment. A syringe with anticoagulant, usually heparin, is used for sampling.
- When evaluating arterial blood sampling, it must also be remembered that blood gas parameters are influenced by other factors: body temperature, hemoglobin level (Hb), inspiratory Fi02 (21% if the blood sample is taken in air / room).

Partial Arterial Pressure 02 (PaO2)

- It is an age-dependent parameter, which is reduced by about 20 mmHg from 14 to 84 years. It indicates the efficiency of the gas exchange only if the inspiratory fraction of 02 is constant.
- A healthy 20-year-old adult has a Pa02 of about 90-100 mmHg.

PaO_2

- In healthy subjects there is an inverse correlation between Pa02 values and age and that this parameter remains above 60 mmHg at any age.
- Hypoxemia is therefore defined as a reduction in Pa02 below the expected value for age
- The finding of a value below 60 mmHg also implies a reduction in the arterial oxygen content and leads to the diagnosis of hypoxemic respiratory insufficiency.
- Hypoxia is not synonymous with hypoxemia and instead indicates a condition of reduced oxygen supply to the tissues.

Partial Blood Pressure C02 (PaCO2)

- In normal subjects the PaC02 remains constant at any age between 40 ± 5 mmHg.
- The importance of this parameter lies in the fact that it is inversely correlated with alveolar ventilation.
- The increase of this gas in the arterial blood is called hypercapnia and leads to the diagnosis of ventilatory failure.
- In this context, it must be remembered that the increase in PaC02, consequent to alveolar hypoventilation, also involves a consensual reduction of PaO2 and, therefore, in the long run, the development of hypoxemic-hypercapnic respiratory insufficiency.

$PaC0_2$

- Alveolar hyperventilation, on the other hand, results in a reduction of PaC02 below the normal range and is instead referred to as hypocapnia. Finally, it should be remembered that the most common cause of hyperventilation

Arterial pH

- Arterial pH represents the main parameter of acid-base balance detected in arterial blood.
- It is slightly alkaline, with a narrow range of variation in the normal subject, between 7.40 ± 0.05.
- Most of the vital functions of the organism require a strict control of this value

Saturation of 0_2

- The EGA report also shows other parameters. The most important of these is arterial oxygen saturation (Sa02) expressed as a percentage value.

Blood gas analysis

- EGA is not a practical method of patient monitoring. It is therefore necessary to search for other useful exams to carry out monitoring and use the EGA as a quality benchmark.

MONITORING OF OXYGENATION: PULSE OXIMETRY

- Pulse oximetry (Sp02) is a relatively recent but now widespread method, suitable both for the evaluation of the critically ill patient and for the follow-up of the chronically ill patient.
- This low-cost and non-invasive method allows continuous monitoring of the patient's oxygenation status through a skin sensor.
- It is also widely used in subjects undergoing respiratory rehabilitation and in the follow-up of patients in Long-Term Home Oxygen Therapy (LTOT).
- Finally, it allows the recognition of pathologies that can be associated with acute respiratory failure, a condition characterized by hypoxemia and / or decompensated respiratory acidosis.

SpO_2

- The saturation of 02, like any measure, has a variable error percentage between 2-4%, for values of Sp02 in the normal range. This percentage of error then increases significantly as the detected value is reduced.

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

Respiratory functional assessment

Exercise assessment

- Exercise intolerance and functional impairment are common consequences of chronic respiratory disease.
- The distinctive characteristics of exercise intolerance in this population include dyspnea, muscle fatigue, hypoxia, bronchospasm, and fear and anxiety surrounding activity. Patients with chronic respiratory disease spend significantly less time walking and standing and more time sitting and lying in daily life when compared to sedentary, healthy age-matched individuals

Exercise assessment

- Exercise assessment of the patient with chronic pulmonary disease may be used to do the following:
  - Quantify exercise capacity before beginning a program
  - Establish a baseline for outcome documentation
  - Help establish patient-specific goals
  - Assist in formulating an exercise prescription for exercise training

Exercise assessment

- Exercise assessment of the patient with chronic pulmonary disease may be used to do the following:
  - Detect exercise-induced hypoxemia and aid with titrating supplemental oxygen therapy
  - Evaluate nonpulmonary limitations to exercise (e.g., musculoskeletal problems)
  - Help detect underlying cardiac abnormalities
  - Screen for exercise-induced bronchospasm

Exercise assesment - Contraindication

- For most respiratory patients without known or suspected cardiac problems, exercise testing, even to maximal levels, is relatively safe.
- Contraindications to exercise testing in this setting are relatively few.
- Standard lists of absolute and relative contraindications are concerned primarily with patients with known or suspected cardiovascular abnormalities

Exercise assesment

Figure 4.1 Contraindications and precautions to exercise testing

Absolute Contraindications

- A recent significant change in the resting ECG suggesting significant ischemia, recent myocardial infarction (within 2 days), or other acute cardiac event
- Unstable angina
- Uncontrolled cardiac arrhythmias causing symptoms or hemodynamic compromise
- Severe symptomatic aortic stenosis
- Uncontrolled symptomatic heart failure
- Acute pulmonary embolus or pulmonary infarction
- Acute myocarditis or pericarditis
- Suspected or known dissecting aneurysm
- Acute infections

Relative Contraindications†

- Left main coronary artery stenosis
- Moderate stenotic valvular heart disease
- Electrolyte abnormalities (e.g., hypokalemia, hypomagnesemia)
- Severe arterial hypertension (i.e., systolic BP of >200 mmHg or diastolic BP of >110 mmHg) at rest
- Tachyarrhythmias or bradyarrhythmias
- Hypertrophic cardiomyopathy and other forms of outflow tract obstruction
- Neuromuscular, musculoskeletal, or rheumatoid disorders that are exacerbated by exercise
- High-degree atrioventricular block
- Ventricular aneurysm
- Uncontrolled metabolic disease (e.g., diabetes, thyrotoxicosis, or myxedema)
- Chronic infectious disease (e.g., mononucleosis, hepatitis, AIDS)

†Relative contraindications can be superseded if benefits outweigh the risks of exercise. In some instances, these people can exercise with caution or using low-level exercise, especially if they are asymptomatic at rest.

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Absolute Precautions

- Unstable angina* or myocardial infarction during the previous month
- Resting pulse oximetry (SpO_2)% < 88% on room air or while breathing the prescribed level of supplemental oxygen. The referring doctor should be notified and exercise assessment should not proceed.
- Physical disability preventing safe performance

Relative Precautions

- Resting heart rate >125 beats/min after 10 minutes rest
- Systolic blood pressure >200 mmHg ± diastolic blood pressure >110/100 mmHg

Exercise Test Termination Criteria

- Onset of angina or angina-like symptoms
- Signs of poor perfusion including lightheadedness, confusion, ataxia, pallor, central cyanosis, nausea, cold clammy skin, sweating
- Patient requests to terminate test (e.g., intolerable dyspnea which is not relieved by rest and causes patient distress)
- Physical or verbal manifestations of severe fatigue
- Development of an abnormal gait pattern (e.g., leg cramps, staggering)
- Tachycardia (i.e., heart rate >220 – age)
- SpO_2 < 88% on room air**
- Failure of heart rate to increase with exercise (unless the patient has a fixed rate pacemaker)

*Stable exertional angina is not an absolute contraindication to exercise, but the test should be performed after administration of anti-angina medication and with rescue nitrate available.

**Alternatively, consider repeating the test with supplemental oxygen.

Adapted from Pulmonary Rehabilitation Toolkit.

Exercise assesment

- General safety considerations when performing exercise testing are as follows:
  - All test administrators must be trained in cardiopulmonary resuscitation.
  - Oxygen and emergency equipment should be in close proximity to the testing site.
  - If testing is not performed in a hospital environment, adequate emergency procedures must be in place.
  - If the patient is on long-term oxygen therapy, the exercise test should usually be carried out using the prescribed level of oxygen. An exception might be the evaluation of a patient who may no longer need supplemental oxygen.

Exercise assesment

- General safety considerations when performing exercise testing are as follows:
  - At a minimum, pulse oximetry should be used to measure heart rate (HR) and oxygen saturation to monitor the patient's physiological response to exercise.
  - Dyspnea and exertion scales should be used to measure the patient's perceived shortness of breath and effort during the test (use the modified Borg perceived exertion chart).

Exercise assessment

- In the pulmonary patient, formal exercise testing is generally of two types: walk distance tests (WDTs) and incremental maximal exercise tests (IMETs).
- WDTs are easier to perform, the results correlate well with functional status, and they can identify the need for supplemental oxygen
- In contrast, IMETs are more complex to perform, but they stress the cardiopulmonary system maximally and better define the absolute limits of a patient (including supplemental oxygen needs and the propensity for exercise bronchospasm).

Field test

- Gait tests are becoming increasingly important in clinical practice, not only for the greater accessibility and for the information they can add about adaptation to effort in the diagnostic process of pulmonary and heart disease, but also for the prognostic value of some parameters measured during these tests.

Walk Distance Tests (WDTs)

- Timed walking tests are clinically favored because they are functional and do not require extensive or expensive equipment. These tests are easily administered with a very debilitated patient population, but do not offer comprehensive physiological monitoring.

Walk Distance Tests

Exercise tests	Equipment needed*	Advantages	Disadvantages
6-minute walk test (6MWT)	Pulse oximeter, sphygmomanometer, stethoscope, stopwatch or timer, track or hallway (measured distance), supplemental oxygen, and Borg scale chart	Correlates with quality of life measures and measures of function; strong correlation with max VO_2 and maximum work capacity (Wmax); uniform instructions and encouragement have been defined	Does not evaluate mechanism or cause of exercise limitations; correlations with spirometry lack agreement; inconsistent correlations with dyspnea
Shuttle-walking test Types: 1)Incremental 2)Endurance	Pulse oximeter, sphygmomanometer, stethoscope, timer, 10m course, supplemental oxygen, Borg scale chart, and audible walking pacer; incremental test developed as a functional capacity measure for COPD patients; endurance test developed to assess endurance in COPD patients	Significant correlation to 6MWT; correlates with max VO_2; endurance test type assesses endurance more than 6MWT; found 85% maximal intensity most suitable endurance intensity	Less validation than 6MWT; less widespread; more potential for cardiovascular problems

6 MINUTE WALKING TEST

- The timed 6-minute WDT is a widely reported outcome measure for pulmonary rehabilitation.
- The test is safe, is easy to administer, involves the use of minimal technical resources, is well tolerated, and accurately reflects a familiar activity of daily living.
- The 6-minute walk distance test (6MWDT) measures the total distance walked over 6 minutes.
- To obtain valid and reliable results, it is essential to standardize the test procedure (e.g., number of tests at baseline, patient instructions, reinforcement during testing, use of supplemental oxygen).
- Directions on performing the 6-minute walk test are given in this list.

6 minute walk test (6MWT)

- The 6MWT is a simple and reproducible test, which does not require special equipment or specialized technical personnel.
- It measures the distance a subject can cover in 6 minutes, walking in a corridor, but without running.
- Unlike the cardiopulmonary test, which allows an objective determination of the functional capacity and the quantification of the limitation to exercise in relation to any pathophysiological mechanisms, the 6MWT does not provide specific information on the functionality of the individual systems, but evaluates the functional capacity at submaximal levels.
- The 6MWT is therefore to be considered a complementary test to the Cardiopulomnary Test and not an alternative.
- However, assuming that many of the activities of daily living are performed at submaximal intensity, the 6MWT would seem to better reflect the functional level of exercise in daily physical activities.
- The main indication for 6MWT is given by the evaluation of the effectiveness of rehabilitation interventions in elderly subjects with various types of pathologies.

6 minute walk test (6MWT)

Comparison between baseline and post treatment	Functional evaluation	Predictor of mortality and morbidity
Lung transplant Pulmonary resection Lung volume reduction Respiratory rehabilitation Chronic Obstructive Pulmonary Disease (COPD) pulmonary hypertension Elderly subjects	Chronic Obstructive Pulmonary Disease (COPD) Cystic fibrosis Heart attack Peripheral vascular diseases Fibromyalgia Elderly subjects	Heart attack COPD Primary pulmonary hypertension

Before the test

- Standardize the shape of the walking course: straight versus continuous circle, oval, or Square.
- A medical history for the patient has been reviewed and any precautions or contraindications to exercise testing have been taken into account.
- Instruct the patient to dress comfortably, wear appropriate footwear, and avoid eating or drinking for at least two hours before the test (when possible or appropriate).
- Prescribed inhaled bronchodilator medications should be taken within one hour of testing or when the patient arrives for testing.
- Rest for at least 10 minutes before beginning the test.
- Record blood pressure, heart rate, oxygen saturation, and dyspnea score while patient is sitting or standing.

During the test

- A straight walking course should be more than 30 meters (100 feet) long.
- The subject should be asked to walk as fast as he or she can in six minutes.
- Standardized encouragement and notification of time elapsed should be given at specific intervals.
- Rests are allowed and included in the total time.
- The total distance covered is recorded.
- The subject is asked to rate dyspnea and effort using the Borg scale.
- The patient should walk alone; staff, other patients, or family should not walk with the patient performing the test.
- Do not assist the patient in carrying or pulling his supplemental oxygen.
- Count laps with a lap counter.
- The patient may use an ambulatory assistive device; make note of which device (e.g., single-point cane, rollator walker, standard walker) is used and why.
- A comfortable ambient temperature and humidity should be maintained for all tests.
- Monitor the patient for untoward signs and symptoms.

Ending the test

- The six minutes are completed.
- Note if the patient exhibits any untoward signs and symptoms.
- Immediately record oxygen saturation, heart rate, and dyspnea rating while patient is sitting or standing (measurements taken before and after the test should be done with the patient in the same position).
- Record the distance completed in feet or meters.

6 MINUTE WALKING TEST

- The distance walked (in feet or meters) is recorded as well as the number of times the patient stopped to rest and the total time spent resting.
- If applicable, note the ambulatory assistive device, the number of rest stops, and the total time spent resting.
- It may also be useful to periodically monitor pulse oximetry and heart rate during the test.

6 MINUTE WALKING TEST

- The 6-minute WDT can be affected by multiple factors, including motivation and encouragement, learning effect, and physical course layout.
- Standardized encouragement must be given. There is a learning effect in performing successive 6-minute WDTs, and distances may increase by 5.8 to 14.9% on subsequent tests.
- If two tests are performed, the recommendation is to wait at least 30 minutes, up to the next day, to repeat the second test and that the larger of the two values be reported.

Technical aspects (6MWT)

- The test should be performed indoors in a flat, straight corridor with no large traffic of people.
- Under optimal weather and environmental conditions, the test can also be carried out outdoors.

Technical aspects (6MWT)

- The route should be at least 30 meters long to be marked every 3 meters. The two starting and ending points must be marked with two cones.
- These indications derive from the fact that with shorter corridors the subjects would be forced to numerous changes of direction, consequently decreasing the walking speed and therefore the total distance covered.

Technical aspects (6MWT)

To perform the test you need:

- • a stopwatch to determine the duration of the test;
- • a card for recording data (Fig. 11.10);
- • two small cones to mark the path • one
- chair easily transportable along the route;
- • a sphygmomanometer;
- • a heart rate monitor and possibly an oximeter (oxyhemoglobin saturation meter);
- • the scales for assessing dyspnea and muscle fatigue (Borg, VAS). For people with respiratory diseases it is preferable to have a source of oxygen available.

Technical aspects (6MWT)

- The patient will have to regularly take any medical therapy, will be able to eat a light meal before the test and will have to abstain from intense physical activity for at least 2 hours. During the test you will have to wear comfortable clothes and sneakers and you can use any walking aids (cane, walker, etc.).
- A warm-up period is not necessary before starting: the patient should sit at rest for 10 minutes near the starting point of the course; in this period of time any contraindications should be sought (see TCP), blood pressure and heart rate measured, the degree of dyspnea and muscle fatigue at rest evaluated. If available, the SpCO2 measurement can be integrated. The patient should also be instructed to walk with the aim of walking the greatest distance in 6 minutes, but without running. It is advisable to standardize the instructions given to the patient in order to minimize intraoperative variability. During the test, the patient can slow down, stop and rest.

Procedure for performing the 6-minute walk test

- Make sure the patient is in LTOT and the flow to use during exercise
- Measure and record at rest: HR, HR, Sp02, BP, dyspnea and muscle fatigue
- Read the standardized test explanation to the patient *
- Position the patient at the start and start the test. Do not follow the patient during the test. If necessary, walk behind the patient
- Encourage the patient every minute with phrases: "He is doing well" or "He is sustaining a good pace", and inform the patient of the time elapsed
- If the maximum HR or an Sp02 below 80-85% is reached, stop the test
- Record the meters traveled and any stops
- At the end, repeat the parameter readings
- Repeat the test at least 2 times
- Between one test and the next, allow at least 1 hour to fully recover from the baseline condition
- Calculate the total distance traveled
- Calculate the predicted meters using the reference equations

Procedure for performing the 6-minute walk test

- • "The goal of this test is to walk the greatest distance in 6 minutes. You will have to walk back and forth along this corridor. 6 minutes of walking will be long so you will have to strain. You will probably be out of breath during the test He will feel exhausted. During the test he can slow down, stop and rest when he needs it. He can also lean against the wall, but he will have to walk again as soon as possible. He will have to walk back and forth around the pins. He should go around the pins quickly and start again. to walk without hesitation.
- Here now I show you how to do it, I will count the paths it will complete. Remember: the goal is to cover as much distance as possible in 6 minutes by walking without running. Leave when you want ".

Technical aspects (6MWT)

- During the test, the patient can slow down, stop and rest. The patient should be informed every minute of the remaining time and prompted with the following standardized phrases recommended by current guidelines (ATS Statement, 2002):
- • 1st minute: "It's going well. There are 5 minutes left";
- • Second minute: "He is maintaining a good rhythm. There are 4 minutes left";
- • III minute: "It's going well. We're halfway there";
- • IV minute: "He is sustaining a good rhythm. There are only 2 minutes left";
- • 5th minute: "It's going well. Only 1 minute to go";
- • 15 seconds from the end of the test: "I'm about to tell you to stop. When I do, stop where you are."

Technical aspects (6MWT)

- If the patient reports an intention to stop the test early, note the distance traveled, the time elapsed and the reason for the interruption. In case of a rest break during the walk, do not stop the stopwatch and inform the patient saying: "You can also lean against the wall to rest, but as soon as you can start walking again"
- At the end of the test, dyspnea, muscle fatigue, if possible the Sp02 and the number of laps covered with the maximum distance covered will be recorded.
- It is advisable to repeat the test at least twice to avoid the patient's learning effect and to have a more reliable assessment. Furthermore, to minimize intra-day variability, the test should be repeated at the same time if possible.

Technical aspects (6MWT)

- As already mentioned, the main value of the test is given by the evaluation after therapeutic intervention. There are in the literature reference equations relating to healthy subjects; each of these analyzes populations with different anthropometric characteristics: the reference to one equation with respect to another should be agreed considering both the age of the patient and the method of execution of the test (one or more tests). A study of 117 healthy men and 173 healthy women reported an average distance at 6MWT of 580 and 500 meters, respectively. Another study conducted on a smaller population reported an average distance of 630 meters. However, further studies are needed to reduce the bias due to the inhomogeneity of the populations studied. Increasing importance is given instead to walking tests with regard to
- prognostic stratification of patients with cardiorespiratory pathology. Recently the distance to 6MWT has been integrated into a scoring system called BODE (Body Mass Index, Aìrflow Obstruction, Dyspnea, Exercise Capacity) in order to classify patients with COPD and predict their mortality.

Shuttle walking test (Maximum tolerance)

- Despite the considerable functional and prognostic value of 6MWT, this remains strongly dependent on the patient's motivation, for which walking tests with greater repeatability have been devised; among these, the most used test is
- The shuttle walking test. It is an incremental maximal test, in which both the description of the test and the walking speed are guided by a pre-recorded audio cassette.

Shuttle Walk Distance Tests

- There are two types of shuttle walk distance tests: the incremental and the endurance.
- The incremental shuttle WDT (ISWT) measures a symptom limited walking distance over a marked walking course of usually 10 meters (33 feet).
- This distance correlates well with maximal oxygen uptake.
- The incremental shuttle utilizes an audible pacing timer to incrementally increase pacing frequency .
- The subjects walk according to the pacing timer frequency until they are too breathless to continue or cannot keep pace with the external pacing signal.
- Like the timed WDT, the primary test result of the shuttle WDT is the total distance walked.

Shuttle Walk Distance Tests

- The endurance shuttle WDT (ESWT) is a standardized, externally controlled, constant-paced walking test for the assessment of endurance capacity.
- The ISWT is initially performed to determine exercise capacity, and then a paced walk speed corresponding to 85% of capacity is used to determine the walking speed for the ESWT

Shuttle Walk Distance Tests

- When compared to a self-paced 6-minute WDT, proponents argue that the shuttle WDT is less affected by motivation or pacing, correlates better with exercise capacity in patients with chronic lung disease, and may be a more sensitive indicator of functional change with rehabilitation or other therapies.

Technical aspects

- The protocol for the execution requires the patient to walk along a path of 10 meters delimited by 2 cones placed 0.5 meters from each end, to avoid sudden changes in direction.
- The test starts at a walking speed of 30 meters x minute1 and is increased by 10/20 meters x minute1 for each level.
- The speed at which the patient walks is controlled with the aid of an acoustic signal, which indicates when the patient must be at one end of the path.
- For the first minute the physiotherapist is expected to accompany the patient, so that he adapts to the initial speed. There are 12 levels at increasing speeds and each level change (speed) is signaled by a triple beep.
- All information needed by the patient is recorded on tape.

Before the test

- A medical history for the patient has been reviewed and any precautions or contraindications to exercise testing have been taken into account.
- Instruct the patient to dress comfortably, wear appropriate footwear, and avoid eating or drinking for at least two hours before the test (when possible or appropriate).
- Prescribed inhaled bronchodilator medications should be taken within one hour of testing or when the patient arrives for testing.
- Two cones are set 9m apart. The distance walked around the cones is 10m.
- Rest for at least 10 minutes before beginning the test.
- Record blood pressure, heart rate, oxygen saturation, and dyspnea score while the patient is sitting or standing.

During the test

- Standardized instructions should be used on the tape or CD.
- No encouragement should be given throughout the test.
- Record each shuttle that is completed on the recording sheet.
- The subject is asked to rate dyspnea and effort using the Borg scale.
- The patient should walk alone; staff, other patients, or family should not walk with the patient performing the test.
- Do not assist the patient in carrying or pulling his supplemental oxygen.
- The patient may use an ambulatory assistive device; make note of which device (e.g., single-point cane, rollator walker, standard walker) is used and why.
- A comfortable ambient temperature and humidity should be maintained for all tests.
- Monitor the patient for untoward signs and symptoms.

Ending the test

- The patient is more than 0.5 m (1.6 ft) away from the cone when the beep sounds (allow one lap to catch up).
- The patient determines that they are too breathless to continue.
- For the endurance shuttle WDT: The patient reaches 85% of predicted maximum heart rate.
- The patient exhibits any untoward signs and symptoms.
- Immediately record oxygen saturation, heart rate, and dyspnea rating while the patient is sitting or standing (measurements taken before and after the test should be done with the patient in the same position).
- Record the total number of shuttles completed.
- Record the reason for terminating the test.

Technical aspects

The protocol provides for:

- explanation of the test via audio cassette;
- monitoring of respiratory rate, heart rate, oxyhemoglobin saturation, assessment of dyspnoea and muscle fatigue
- using the Borg scale or Visual Analog Scale;
- absence of patient encouragement from the performing physiotherapist;
- interruption of the test when the patient cannot maintain the required speed. To establish this inability, the patient must be more than 50 cm away from the cone at the time of the acoustic signal. In the event that the patient is at a distance of less than 50 cm from the cone, he can continue with the test along a further path, in order to recover; if it fails, the test is stopped;
- calculation of completed levels and total distance traveled.

Procedure for carrying out the shuttle walking test.

- Check the operation of the cassette player by inserting the audio cassette and testing the speed of the tape reading
- Determine if the patient is in LTOT and which flow to use during exertion. Measure and record at rest: HR, HR, Sp02, BP, dyspnea and muscle fatigue
- Connect the pulse oximeter to the patient preferably in a wearable carrying case over the shoulder. Turn on the tape deck and follow the directions
- for the first minute of the test the physiotherapist must walk with the patient to set the speed of the first level
- If the maximum HR or a Sp03 lower than 80-85% is reached, stop the test
- At the end, repeat the measurements of the parameters: HR, HR, SpOj, BP, dyspnea and muscle fatigue, Record the number of levels and courses completed referring to the instruction table
- Calculate the meters traveled and identify the maximum speed reached by the patient (speed of the last completed level)

Incremental Maximal Exercise Tests

- Maximal exercise tolerance is typically measured with an IMET performed on a treadmill or stationary bicycle in a laboratory.
- Arm ergometry may be substituted for those patients who are unable to perform lower-extremity exercises.

Incremental Maximal Exercise Tests

- The IMET provides either ramped or incremental increases in exercise load (e.g., 15 to 25 watts/ minute) until patients reach a symptom-limited maximum.
- Physiological responses to this graded exercise are commonly evaluated with ECG monitoring, blood pressure determinations, pulse oximetry, and ratings of perceived symptoms of breathlessness and muscle fatigue.
- Symptoms can be rated by using the Borg category scale of breathlessness or a visual analog scale

Incremental Maximal Exercise Tests

- With the addition of expired gas analysis to the IMET, it is possible to evaluate oxygen consumption, carbon dioxide production, and anaerobic threshold (when reached).
- The addition of arterial blood gas analysis allows for the most accurate assessment of arterial oxygenation (i.e., alveolar–arterial oxygen gradient), carbon dioxide levels, dead space/tidal volume ratio (V*D/VT), and* acid–base balance measurements.

Submaximal Exercise Test

- Although less commonly used in pulmonary rehabilitation programs, submaximal steadystate exercise testing can be performed to assess supplemental oxygen requirements for activities of daily living (ADLs).
- In this situation the test is conducted at a work rate that approximates those encountered during normal living conditions.
- A submaximal exercise test may also be conducted with patients with severe pulmonary hypertension or congestive heart failure, for whom maximal stress testing may be contraindicated. Symptoms can be rated by using the Borg or visual analog scales.

Exercise Assessment Equipment

- ***WDTs***
- A measured walking distance with minimal traffic used for timed walk distance tests (at least 30 meters [100 feet] for timed WDTs or 10 meters [33 feet] plus two cones for shuttle WDTs)
- Manual blood pressure measurement equipment
- Stethoscope
- Cutaneous pulse oximeter
- Supplemental oxygen source
- Stopwatch
- Lap counter (6MWT)
- Borg scale chart or visual analog chart
- Walker, cart, or wheelchair
- Emergency plan and supplies (refer to your hospital's or facility's policy; should include
- Bronchodilators)
- Audible walking pacer (shuttle WDT)
- Test-site personnel trained in basic life support techniques

Exercise Assessment Equipment

- ***Additional equipment for IMETs***
- Calibrated cycle ergometer or motorized treadmill
- Equipment to monitor EKG during exercise testing
- Defibrillator and crash cart
- Access to a laboratory for arterial blood gas analysis
- Equipment for expired gas analysis to measure VO2 (oxygen uptake), VCO2 (carbon dioxide elimination), minute ventilation, and various derived variables
- Spirometry equipment for use in assessing dynamic hyperinflation and exercise-induced bronchospasm

Functional Performance Assessment

- In addition to formal exercise testing, patients should be assessed by questioning and physical assessment regarding functional performance status.
- This should include evaluation of respiratory muscle function, breathing mechanics, and thoracic mobility (e.g., diaphragmatic excursion, accessory breathing patterns, and rib cage flexibility).
- Equally important is the evaluation of balance, fall risk, and any orthopedic or musculoskeletal limitations; for example, the patient's gait should be evaluated for abnormalities that may require individualized alterations to the exercise plan and ambulatory assistive devices.

Functional Performance Assessment

- Musculoskeletal problems are especially prominent in the pulmonary rehabilitation population.
- It is important to make a thorough assessment of the patient's baseline levels of strength, range of motion, posture, orthopedic limitations, and simple activities of daily living (e.g., lying to standing, dressing, climbing steps).

DYSPPNEA AND REDUCED TOLERANCE TO EXERCISE IN RESPIRATORY DISEASES

- Patients with chronic respiratory disease characteristically present with a progressive reduction in exercise tolerance associated with an increase in the sensation of dyspnea. To determine the onset of these symptoms are mostly the progressive reduction of lung ventilatory capacity, but also alterations in the skeletal muscles, such as malnutrition and reduction of muscle strength, secondary to the systemic involvement of the disease. It is known that the degree of exercise tolerance in patients with pulmonary and heart disease cannot be adequately predicted from functional tests performed at rest (e.g. spirometry, echocardiography).

DYSPPNEA AND REDUCED TOLERANCE TO EXERCISE IN RESPIRATORY DISEASES

- Hence the need to measure, in the laboratory or "in the field", exercise tolerance which in clinical practice has a high prognostic value and which is increasingly used in the evaluation of the response to therapeutic interventions (bronchodilators, rehabilitation). Impaired exercise tolerance can be defined as

Reduced effort tolerance

- Impaired exercise tolerance can be defined as the inability to perform certain muscular work, for example brisk walking uphill, which is usually well tolerated by a "normal" subject of comparable age, sex and anthropometric characteristics.
- It is believed that the reduction of exercise tolerance occurs when the metabolic demands, and in particular the availability of O2 to the skeletal muscle, necessary to guarantee the correct production of energy (adenosine triphosphate, ATP) for muscle contraction exceed the capacity of the respiratory, cardiac and muscular systems to ensure an adequate supply of oxygen and elimination of C02 at the tissue level.

Reduced effort tolerance

- As is known, these systems work in an integrated way, interfaced with each other at the level of the pulmonary capillary circulation (respiratory-cardio-circulatory system) and at the level of the peripheral capillary circulation (circulatory-muscular system).
- Clinically, the imbalance between the demand and availability of energy substrates results in the appearance of muscle fatigue and exhaustion due to the accumulation of toxic metabolites in the muscle.

EVALUATION OF MUSCULAR STRENGTH AND NUTRITIONAL STATE

- In patients with chronic respiratory diseases, muscle strength and nutritional status are of particular importance as they can significantly influence exercise tolerance and quality of life.
- The evaluation of the patient with chronic lung disease must therefore also include an accurate assessment of mass (nutritional status and body composition) and muscle function (strength and endurance).

Nutritional evaluation

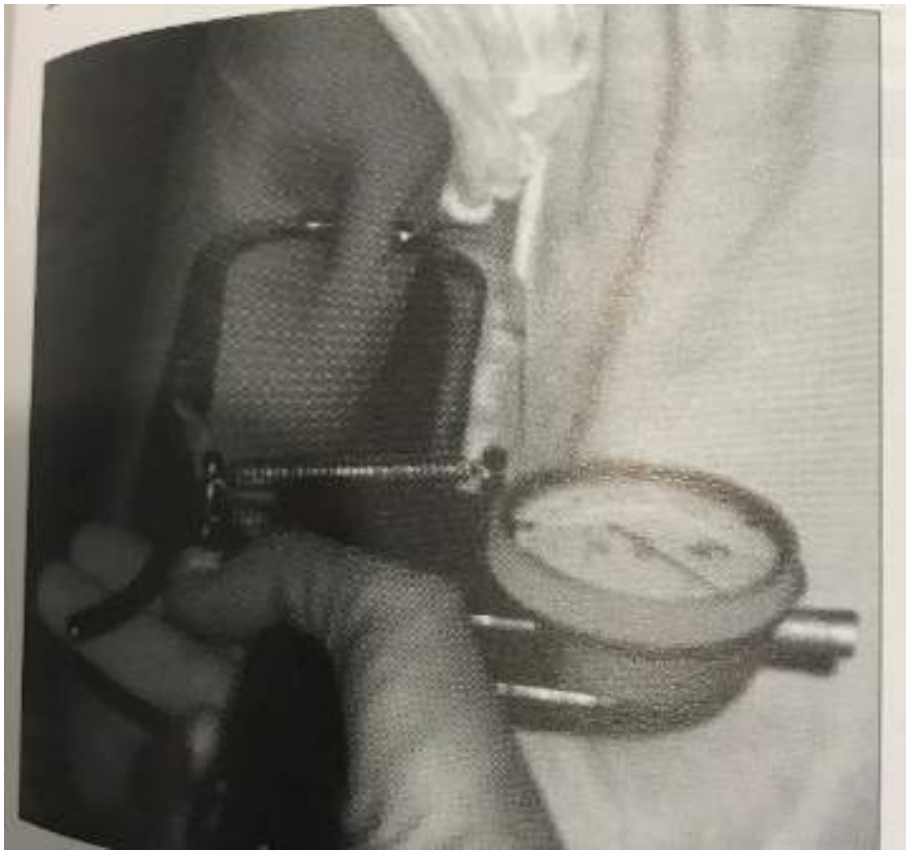
- Nutritional evaluation is now an integral part of the evaluation of the patient with chronic respiratory disease; some studies have shown that low body weight and weight loss are negative prognostic factors, regardless of lung function.
- The most used methods in order to assess the nutritional status are the body weight relative to the Ideal Body Weight (DBW) and the Body Mass Index (BMI).

Nutritional evaluation

- By evaluating the body composition, it is possible to obtain qualitative information about the body tissues (percentage of lean mass and fat mass), indispensable in order to plan an individualized workout and to monitor its effects over time.
- Body composition can be investigated with instrumental techniques, more or less invasive, or with anthropometric methods.
- Anthropometry allows to evaluate the body composition of a subject through simple and non-invasive procedures. The most commonly used method for this purpose is skin plicometry.

Plicometry

- Among the various methods for measuring the percentage of body fat, skinfolding is one of the simplest, most precise and, moreover, with low instrumentation costs. However, it requires accuracy and expert personnel.



Plicometry

- The technique is based on the assumption that the thickness of the subcutaneous adipose tissue (fold) is proportional to the total body fat.
- Folds are obtained by lifting the skin and subcutis in order to loosen these two layers from the underlying muscle tissue. To carry out the measurement, the plicometer (spring caliper) is used, which provides values expressed in millimeters.
- The instrument must be subject to regular calibrations and the measurement technique must be standardized.
- Once the skin folds in different sites have been detected, they must be added up, using mathematical equations, from which the body density and the percentage of fat mass are obtained.

Muscle strength assessment

- As already mentioned, the reduced exercise tolerance in the patient with chronic respiratory disease cannot be attributed solely to the ventilatory alterations linked to the underlying disease, but other factors, such as peripheral and respiratory muscle weakness and deconditioning, must be called into question. .
- A high mortality has also been observed in patients presenting with a severe reduction in muscle strength.
- The evaluation of the musculoskeletal system must therefore be an integral part of the evaluation of the patient with pulmonary pathology in order to guide specific rehabilitation interventions.

Incremental Repetition Test for Isotonic Muscle Strength: 1-Repetition Maximum (1-RM)

- It is a field test that allows you to know the maximum dynamic force value of the muscle or muscle group concerned.
- After a warm-up phase, an incremental pyramid type test is performed in order to identify the weight that allows only one movement, defined as maximum repetition.
- It is necessary to have a barbell and dumbbells with pieces of various weights or a machine dedicated to the movement to be investigated.

Incremental Repetition Test for Isotonic Muscle Strength: 1-Repetition Maximum (1-RM)

- The load increases between one series and another depend on the type of exercise (1-2 kg for upper limbs or single muscles, even 5 kg for lower limbs).
- For the purposes of a correct application of the test it is advisable that the first series do not lead to muscle exhaustion and that there can be room for complete recovery between the series.
- It should also be kept in mind that the test is sensitive to learning, so the subjects examined must know the required exercises and know how to perform them correctly.
- It is therefore necessary that at least 2 sessions are foreseen, prior to the test, which allow the subjects to be instructed in the use of submaximal loads and which allow the examiner to approximately identify the theoretical maximum: the load that can be lifted 10 times corresponds to the 70% of the maximum strength, the one that allows 6-7 repetitions corresponds to 80%, the one that allows 4-5 repetitions to 85% and the one that allows 2-3 repetitions to 90%.

Incremental Repetition Test for Isotonic Muscle Strength: 1-Repetition Maximum (1-RM)

- Finally, it is essential to pay attention to the number of loads necessary to reach the maximum, as an excessive number of attempts could distort the measurement of the ceiling; if they are higher than 5 it is necessary to repeat the test.
- For a correct evaluation it is essential to remember that adequate safety measures must be observed, especially if the test is performed with free weights.
- To avoid the onset of pathologies due to exertion, in subjects not very accustomed to the use of weights or particularly deconditioned, the maximum strength can be extrapolated by stopping the test before reaching the maximum repetition.

Incremental Repetition Test for Isotonic Muscle Strength: 1-Repetition Maximum (1-RM)

- There are different equations which, taking into account the subject's body weight, allow to estimate the 1-RM on the basis of submaximal repetitions.
- In the elderly, 1-RM can be calculated from submaximal efforts according to the following formulas:
- 1-RM (kg) = 1554 x (weight at 7-10RM, kg) -5181 (sedentary subjects)
- 1-RM (kg) = 1172 x (weight at 7-10RM, kg) + 7704 (trained subjects). 1-RM (kg) = 1172 x (weight at 7-10RM, kg) + 7704 (trained subjects).

Procedure for calculating the maximal force (1-RM)

- Warm-up with stretching and light weights
- First series of 10 repetitions at 40% of the theoretical maximum
- Pause for a few minutes (2-5)
- Second series of 5-6 repetitions at 50-60% of the theoretical maximum
- Pause for a few minutes (2-5)
- Third series of 2-3 repetitions at 80% of the theoretical maximum
- Pause for a few minutes (2-5)
- One repetition at 90% of the theoretical ceiling
- Successive series of attempts in search of 100% with one repetition

Upper Limb Strength Test (Arm Curl)

- This is a very simple assessment that allows you to identify the strength of the muscles involved in the flexion-extension movement of the elbow.
- The subject is seated, trunk erect and feet resting on the ground, the dominant hand holds a weight of 2.27 kg (woman) or 3.63 kg (man).
- At the beginning of the test the elbow is extended and supinated, the upper limb is perpendicular to the ground.
- It records how many times the elbow flexion and extension is performed in 30 seconds.
- Normality parameters have been established for the population over 60 years of age.

Manual dynamometers

- Manual dynamometers, or myometers, are instruments that, through different devices (spring, electromechanical), are able to quantify the force delivered by the subject examined.
- They are placed on the distal part of the segment to be examined and held by the examiner during muscle contraction, usually isometric.

Manual dynamometers

- The hydraulic handgrip (Jamar) is inexpensive, simple to use, versatile, accurate, reproducible and reference values are available for interpretation of results.
- The disadvantages are represented by the difficulty of stabilizing the device during the examination, of reproducing exactly the position of the patient, the examiner and the segment to be examined.
- Portable electronic transducers that can be connected to a personal computer have been developed to study the strength of the upper and lower limbs.

Manual dynamometers

- Two isometric tests are mostly used: the make-test and the break-test.
- In the first, the maximum strength of the subject is equal to that of the observer; in the second, the examiner's strength is slightly greater than that of the patient.
- Both are reproducible, although the break-test would tend to overestimate muscle strength.
- Portable dynamometers are a useful alternative to more expensive electronic meters, provided that the examiner's strength is greater than that of the muscle group of the test subject.
- There are reference values, even for elderly subjects and this method has been applied for the assessment of muscle strength in patients with COPD

Isokinetic dynamometers

- One of the most common laboratory methods for evaluating the maximal and resistant strength of a muscle or muscle group is dynamometry.
- The isokinetic dynamometer is a tool that allows you to perform muscle contractions at a known and constant speed.
- The subject must move with all possible force a lever whose maximum rotation speed is predetermined.
- Once the set speed has been reached or exceeded, the machine will oppose a resistance of equal and opposite intensity to keep the speed constant.

Isokinetic dynamometers

- Low angular speeds (60-90 ° / sec.) And few repetitions (4-6) are used for the evaluation of maximal muscle strength.
- The isokinetic instrument is computerized and allows the collection, processing and display of data to measure various parameters: angular position, maximum moment produced (peak moment of force, PMF), power (moment x angular velocity) and work (subtended area from the moment / time curve).

Isokinetic dynamometers

- The main isokinetic dynamometers used in muscle assessment have been shown to be reliable, but the presence of expert personnel is essential.
- The main limitations of isokinetic machines are given by the fact that it is possible to easily analyze only single-joint movements and only some joints due to difficulty in positioning the lever and / or the patient; furthermore, test execution takes a long time and equipment costs are high.

Muscle endurance assessment

- Evaluation of peripheral muscle function in COPD patients has often focused solely on muscle strength.
- However, histological studies of lower limb muscles have shown a reduction in slow muscle fibers and oxidative enzymes.
- These data suggest an impairment of muscle endurance in COPD patients, as demonstrated by some authors.
- However, the data in the literature are not unique.
- There are several methods for measuring the resistance of a muscle or muscle group.

Constant load test

- To perform this test it is necessary to know the maximal strength values obtained with the incremental repetition test. A submaximal load is chosen (30-60% of .1-Rm) and the subject is asked to perform the exercise until muscle exhaustion: the duration of the exercise defines the resistance

Constant rhythm testing

- It is similar to the previous one, from which it differs in that, once the load with respect to the ceiling has been chosen, the subject is asked to perform the exercise following the rhythm provided by a metronome.
- When the rhythm is no longer maintained, the exercise is stopped; also in this case it is the duration of the exercise that gives the measure of muscle resistance.

30 seconds chair stand test

- Evaluate the strength of the lower limb muscles
- You need a chair without armrests (the seat of which must be 43.2 cm above the ground) and a stopwatch.
- The subject is asked to get up and sit down from the chair repeatedly for 30 seconds.
- It measures how many times the gesture is performed.
- During the test the subject does not have to help himself with the upper limbs that are crossed over the chest.
- The test can be completed by evaluating the symptoms of dyspnea and muscle fatigue.
- For safety reasons it is recommended to lean the back of the chair against a wall.
- Normality parameters have been established for the population over 60 years of age.
- This test is particularly useful in the most compromised patients such as, for example, those who have been bedridden for a long time, who may not yet be able to perform other assessments such as the 6MWT (6 Minute Walking Test).

Unsupported upper limb tests

- In such tests, activities of daily living are reproduced and, therefore, are recommended in patients with chronic respiratory disease. The patient is seated with the trunk straight and the feet flat on the ground:

Unsupported upper limb tests

- in the ring test introduced by Celli (1986), the patient is seated in front of a vertical surface where two pegs 10 cm apart (vertically) are anchored; the lowest peg is placed at the height of the subject's shoulders.
- The test consists in moving rings from one peg to another over 6 minutes: it can be interrupted due to muscle exhaustion or dyspnea and the score is given by the number of rings moved in 6 minutes;

Unsupported upper limb tests

- In the incremental test proposed by Takahashi (2003), the subject is seated in front of a poster (0.84 x 1.20 m) where 8 colored and numbered strips are drawn 15 cm apart. The first level, the lowest, is positioned at the height of the knees.
- The patient holds a stick in both hands which he must move to the first level during the first minute and from level zero to the second level during the second minute and so on until the last level reached.
- At this point the stick is weighted by 500 g every minute remaining at the highest level until exhaustion.
- The highest level that the subject can reach is recorded and, at the same time, the symptoms of dyspnea and muscle fatigue are detected;

Unsupported upper limb tests

- in the endurance test with a wooden stick, the patient must repeatedly bring the cane over the head while keeping the elbows extended by flexing and extending the shoulders.
- Exercise duration time, dyspnea and muscle fatigue are recorded.

Upper limb test with hand crank ergometer

- This test can be used both in incremental mode and at constant load.
- The patient is seated with the trunk erect, the ergometer is placed on a table or in any case in a position such that the rod of the crank is at the height of the glenohumeral joint.
- In the incremental mode the patient must maintain a constant speed of 60-70 rpm and the load is increased) every 1, 2 or 3 minutes from 5 to 25 watts.
- The endurance test is performed at a constant load, between 160 and 75% of the maximum load reached during the incremental test. The test is continued until exhaustion.

EVALUATION OF EXERCISE CAPACITY

In general, the indications for the Cardiopulmonary Stress Test in respiratory diseases can be summarized as follows:

- diagnostic evaluation of dyspnea and impaired exercise tolerance;
- functional evaluation of the patient with chronic respiratory disease;
- prognostic evaluation and evaluation of any therapeutic, pharmacological, surgical, rehabilitative interventions

EVALUATION OF EXERCISE CAPACITY

- Precisely in the context of therapeutic and prognostic interventions, the "constant load test" is becoming more and more frequent, performed at a high workload (for example, 80% of the ceiling) until muscle exhaustion or the appearance of symptoms limiting; this test has proved more sensitive than the incremental test and the maximal parameters it provides, in identifying patients with lung disease who benefit from certain therapeutic interventions, such as training

EVALUATION OF EXERCISE CAPACITY

Alongside laboratory tests (incremental ceiling and endurance tests), walking tests are increasingly being used, both timed (6-12 Minute Walking Test, 6-12MWT) and incremental (Shuttle Walking Test, SWT), especially if associated to the evaluation of functional parameters such as SpO2 and HR.

Cardio-pulmonary exercise test

- The gold standard for measuring the degree of tolerance to effort and identifying any limiting factors, cardiovascular, respiratory or muscular is the Cardiopulmonary Stress Test (CST), with an incremental maximal protocol (or ramp) on a cycle ergometer or on a treadmill, which is capable of inducing considerable muscular, ventilatory and cardiovascular stress.
- It is based on the performance of incremental "symptom-limited" exercise, usually associated with the "breath-by-breath" measurement of cardiopulmonary variables, such as oxygen consumption (V'02) at the peak of exercise, the production of carbon dioxide (V'C02), ventilation (V'E) and heart rate (HR). Other important ones

Cardiopulmonary Stress Test

- The main chronic respiratory diseases in which the execution of TCP is indicated are COPD, Exercise-Induced Bronchoconstriction, Cystic Fibrosis, Interstitial Pulmonary Disease and Pulmonary Vascular Disease

Indications for cardiopulmonary testing

Comparison between baseline and post treatment	Functional evaluation	Predictor of mortality and morbidity
Lung transplant Pulmonary resection Lung volume reduction Respiratory rehabilitation Chronic Obstructive Pulmonary Disease (COPD) pulmonary hypertension	Dyspnea from exertion Exercise-induced desaturation Bronchostruction Exercise induced COPD Cystic fibrosis Interstitial Pulmonary Disease Pulmonary Vascular Disease Chronic heart failure Elderly subjects	COPD Cystic fibrosis Pulmonary Vascular Disease Chronic heart failure

Cardiopulmonary Stress Test

- Absolute contraindications to the test include unstable angina or recent myocardial infarction. Relative contraindications include resting HR> 120, systolic blood pressure> 180 mmHg and diastolic> 100 mmHg.
- Stable exertional angina is not an absolute contraindication; the only precaution is to perform the test after the administration of the antianginal drug and to have first aid medicines (nitrates) available.

Cardiopulmonary Stress Test

- Criteria for immediate termination of the test include chest pain, unbearable dyspnea, muscle cramps in the lower limbs, dizziness, diaphoresis, and sudden paleness.
- The operator performing the test should be trained to recognize these symptoms and cope with them.
- In the event of an interruption for any of the above reasons, the patient must be able to sit or lie down, depending on the severity of the event, and it is necessary that the technician performing the test can measure blood pressure, heart rate and oxyhemoglobin saturation.

Cardiopulmonary Stress Test

- For the purpose of clinical evaluation, 2 types of protocols are used: maximal incremental tests, indicated for the evaluation of maximum exercise tolerance and any "cardiopulmonary" causes of reduced tolerance, and constant workload tests, which allow to highlight the contribution of any peripheral limitations (myopathies, vasculopathy) to the exercise.

Incremental protocol for Cardiopulmunary Stress Test

- Although there are numerous tests available that can evaluate each specific pathophysiological component involved in the performance of physical exercise under stress, the incremental cardiopulmonary stress test is the one that best studies the integrated physiological response of the various systems.

Cardiopulmonary Stress Test Procedure - Incremental Protocol.

- Physical examination (with assessment of weight, height, heart rate, and blood pressure)
- Spirometry
- ECG; Echocardium (useful but optional)

- Perform a complete calibration of the apparatus for breath-by-breath recording of gas exchanges (gas analyzers and turbine)
- Find the rate of increase in the workload
- Instruct the patient on how to exercise (reaching the maximum sustainable load while maintaining a pedaling frequency between 50 and 60 rpm)
- Apply electrodes for continuous 12-lead ECG recording
- Adjust the seat height of the cycle ergometer
- Choose the right face mask for the patient

Cardiopulmonary Stress Test Procedure - Incremental Protocol.

- Place the blood pressure cuff on the blood pressure monitor
- Position the sensor for oximetry
- Instruct the patient that during the test he will not be able to speak, but will be able to signal (thumbs down) any symptoms that may appear
- Put on the face mask and connect the turbine and the gas sampling tube
- Before starting the recording, view on the PC the main parameters (FC, Ve, V'02, V'C02) that will be monitored during the test
- Perform 2-3 minutes of data acquisition at rest
- This is followed by a 2-3 minute warm-up in which the patient reaches the optimal pedaling rate
- Begin the incremental or ramp test
- Monitor BP, Sp02, the sensation of dyspnea and muscle fatigue by means of visual scales
- At the end of each workload, ask the patient about any symptoms
- At the end of the effort, allow the patient to continue pedaling, without load, for 2 minutes

Technical aspects

- Prior to the Cardiopulmonary Stress Test, the patient's medical history, physical examination, respiratory and cardiovascular function tests obtained at rest, as well as his informed consent to perform the test should be collected.
- The patient must take all medications required by therapy, including inhaled bronchodilators.
- In the two hours preceding the test, no one should eat, smoke or drink coffee; the patient must present himself for the examination wearing a tracksuit.
- Your weight, height, heart rate and blood pressure should be measured upon arrival in the laboratory.
- In more severe pulmonary patients, a new measurement of FEV1 and arterial gases should be performed to verify clinical stability. Before starting the test, the patient should be instructed on how to exercise and the possible complications.

Technical aspects

- If the cycle ergometer is used, the patient must maintain a pedaling frequency of 50-60 revolutions per minute. If the exercise is performed on a treadmill, a short test session will be required, during which the patient will become familiar with the instrument.
- Electrodes are then applied for monitoring the HR and ECG (12 leads); blood pressure is measured with each new workload.

Technical aspects

- Generally it is preferred to choose a rate of increase of the workload such as to allow the patient to reach his tolerance limit in about 10 minutes, sufficient time to discriminate the response profiles to the effort.
- For a young adult, 15-20 W / min increments are usually used; for a cardiopathic or pulmonary patient, increases <5 W / min can be reached, depending on the severity of the disease.
- In these patients FEV1 can be used as a guide: FEV1 <75% of predicted = 15 W; FEV1 <50% predicted = 10W; FEV, <35% predicted = 5W.

Technical aspects

- Immediately before the start of the test, the patient is instructed to report ("thumbs down") any discomfort or pain affecting the chest and / or legs, also indicating the location of said symptoms (heart, chest, legs). Finally, the mask (or mouthpiece) is placed for measuring ventilation and exhaled gases.
- At the end of each workload and before applying the next load, the patient should be questioned about the possible appearance of ailments or pain in the chest and / or legs.
- During the recovery phase, it is advisable to allow the patient to continue pedaling in the absence of a load for at least 2 minutes to facilitate faster removal of the lactate produced with effort.
- At the end of the test, after removing the mask, the patient is asked to quantify the intensity of dyspnea and / or muscle fatigue felt at the peak of the effort, using a visual scale such as Borg's.
- If from a preliminary analysis of the data it should be evident the early interruption of the test due to lack of patient commitment, the TCP can be repeated one hour later.

The parameters that are taken into account in the maximal effort test are:

- VO2 at peak. It is the highest value obtained during the incremental or high intensity test, conducted up to the patient's tolerance limit.
- If the subject performs an adequate effort, that is, right at the limit of his maximum tolerance, the VO2 at peak can be considered a good approximation of the VO2 maximum, the gold standard among the indices of tolerance (or intolerance) to exercise.
- The approximation of VO2 maximum to VO2 at peak depends on whether or not VO2 stunted growth is observed despite continuing to increase the workload.

VO2 at peak

- This index reflects the achievement of a limitation in one or more points of the path that from the lungs carries oxygen up to the respiratory chain at the mitochondrial level. In evaluating the V'O2, the age, sex and build of the subject must be taken into account, so it is useful to express the value obtained during the test as a percentage of the predicted value based on the patient's data or normalize it for body weight (V'O2 / kg).
- A peak V'O2 <10 ml / min / kg, 0 a PaO2 / V'O2 ratio with a slope <80 mmHg / L / min is associated with a high risk of mortality in COPD patients, with a survival of 5 years <20%. A peak V'O2 <15ml / min / kg indicates a high risk of perioperative complications after lung volume reduction surgery.

VO2 at peak

- A lower peak VO of 10.4 ml / min / kg in patients with primary pulmonary hypertension indicates a mortality risk of 50% at 1 year, and 85% at 2 years.
- Another important measurable parameter during an incremental test is the anaerobic threshold, expressed by the maximum value of VO2 reached without an increase in blood lactate, produced by anaerobic glycolysis, indicating that below this threshold the metabolic demand for the execution of the effort is entirely satisfied by metabolic processes of aerobic type.
- As with VO2, it can be normalized for weight. Normally the threshold appears between 40 and 80% of the VO2

The parameters that are taken into account in the maximal effort test are:

- V'O2 / Watt During the test: the V'O2 increases linearly with the workload and the relation V'O2 / Watt, normally equal to 9-13 ml / min / Watt, can be used as an estimate of the efficiency of the system

The parameters that are taken into account in the maximal effort test are:

- V'E / V'CO2. Ventilation is a fundamental function for the regulation of PaCO2 and pH. During exercise, the ventilatory response is a linear function of VCO2, with a slope of 25 for normal subjects.
- The VE / V'C02 relationship can be used for the non-invasive measurement of ventilatory efficiency. In hyperventilation conditions, such as in the case of hypoxia or metabolic acidosis, the increase in VE / V'C02 reflects the increased ventilatory demand to ensure control of PaC02;

The parameters that are taken into account in the maximal effort test are:

- Respiratory Reserve. Respiratory reserve is an index of how much the level of ventilation achieved during exercise actually approaches the limit of tolerable maximum ventilation (VEmax).
- It can be expressed in m ventilation terms as a fraction of the maximum voluntary ventilation, V'E/MVV, or in absolute value as the difference between the maximum ventilation and the peak ventilation, MVV-VE. A severely reduced or zero respiratory reserve indicates ventilatory limitation.

Constant load protocol for the Cardiopulmonary Stress Test

- Initially this test was introduced mainly for research purposes, for the evaluation of cardiovascular and ventilatory adaptation to exercise (kinetics of ventilation and gas exchange).
- In clinical practice it was then used to study severely compromised patients who could not withstand a maximal test.

Constant load protocol for the Cardiopulmonary Stress Test

- It allows the evaluation of the efficiency of work and the use of energy substrates, the aerobic capacity of the peripheral muscle component and respiratory mechanics indices.
- In addition, the constant load test is a useful guide for prescribing a rehabilitation program.

Constant load protocol for the Cardiopulmonary Stress Test

- The duration of the exercise is 6 minutes. The workload greatly influences the ventilatory response; for moderate workloads, that is below the anaerobic threshold, a state of equilibrium of the variables under examination is achieved after a few minutes of exercise; these loads are generally well tolerated and can be maintained for a prolonged time.
- For loads of high intensity, i.e. above the anaerobic threshold, it is not possible to reach a state of equilibrium and, consequently, these loads can only be maintained for short periods of time.
- The trend of the various variables during exercise is characterized, for workloads below the anaerobic threshold, in 3 phases : a first rapid phase (15-20 sec), in which we witness the sudden increase in ventilation and gas exchange of O2 and CO2.
- It would result from nerve stimuli coming from the moving limbs with a consequent increase in ventilation even before the activation of the chemoreceptors by the metabolites produced by the muscles in activity.

Constant load protocol for the Cardiopulmonary Stress Test

- A second phase of growth of the variables follows, slower but of greater amplitude, according to an exponential trend described by a time constant (0, defined as the time required to reach 63% of the response to equilibrium.
- This phase reflects the delay in the adaptation of the lung-heart muscle system to the level of exercise to which the subject is subjected.
- In normal subjects, the V'O2 value is 30-40 sec; in elderly patients or with cardio-pulmonary pathology it can lengthen by 2-3 times. However, this slowdown is partly reversible after a rehabilitation program.

Constant load protocol for the Cardiopulmonary Stress Test

- The third phase is characterized by the achievement of a VO2 plateau in which the metabolic demands for the execution of the exercise are completely satisfied by the aerobic processes.
- For workloads above the anaerobic threshold, this third phase is described by a second exponential curve, with t higher than the second (slow phase of VO2 kinetics), in which VO2 will never reach equilibrium but will continue to grow, while a portion of the energy necessary to carry out the effort will continue to be provided by the anaerobic metabolism.

Constant load protocol for the Cardiopulmonary Stress Test

- Alongside the fixed-time constant load test, we find endurance tests, in which the patient exerts an effort at a certain fraction of the maximum load sustained during an incremental test, usually 80-90%, up to the limit of tolerance.
- These are increasingly used in the evaluation of therapeutic interventions as they allow the variables of the response to effort to be compared against a standardized point (isotime), generally the time when the test was stopped before the therapeutic intervention.

Constant load protocol for the Cardiopulmonary Stress Test

- Another particular application of the constant load test is in the diagnosis of exercise-induced asthma. The test should be performed in ambient air at a temperature of 20-22 ° C, with a relative humidity of 40%. The choice of the load is essential to obtain a good provocation; the ATS guidelines recommend a very high workload, equal to 80-90% of the calculated ceiling.
- The ideal test duration to achieve a significant drop in FEV is 6-8 minutes.
- The exercise test has a high specificity for exercise-induced asthma, but a low sensitivity compared to chemical challenge tests; however, the sensitivity of the stress test can be increased by adding other factors stimulating bronchial reactivity, such as, for example, the inhalation of cold air.

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Assessment of the effectiveness of cough

Cough

Cough is a defense mechanism of the respiratory system that has the function of cleaning and keeping the airways open in case of inhalation of foreign material, of abundant quantities of mucus due to hypersecretion or alterations of mucociliary clearance, and pathological secretions , such as purulent ones secondary to inflammatory processes of bacterial origin and transudates and exudates resulting from pulmonary edema.

Cough physiology

Cough is commonly described as a succession of three phases:

- Inspiratory phase
- Compression stage
- Expulsion phase

Inspiratory phase

- During the inspiratory phase a deep inspiration is performed, not necessarily forced, which brings the lung volume to values close to 90% of the Total Lung Capacity. In this phase the vocal cords are abducted and the glottis is therefore open.
- The inspired (pretussive) volume of air is one of the determinants of the air flow expelled during cough, measured as peak expiratory flow during cough, in English Peak Cough Expiratory Flow (PCEF)
- Furthermore, the expansion of the chest produces a lengthening of the fibers of the expiratory muscles, optimizing the tension-length ratio and promoting, with the same activation, the production of higher intrathoracic pressures.
- Finally, it should be remembered that a high lung volume corresponds to a greater elastic return pressure of the thoraco-pulmonary system, which is added to the intrathoracic pressure generated by the contraction of the expiratory muscles.

Compression stage

- Lasting about 200 msec, it is characterized by the closure of the glottis by the adductor muscles of the arytenoid cartilages and by the contraction of the expiratory muscles.
- Closing the glottis causes the expiratory muscles to contract isometrically while maintaining the advantageous tension-length ratio secondary to thoracic expansion for longer.
- In this phase, the intrathoracic pressures can reach 300 cmH2O, far exceeding [from 30% to 180% in the various studies] the values observed, with the same lung volumes, during forced expiration with open glottis

Expulsion phase

- t is characterized by the sudden opening of the glottis and the concomitant elevation of the soft palate, while the expiratory muscles maintain the contraction.
- The combination of a high pretussive volume and a high intrathoracic pressure determines, at the opening of the glottis, a rapid and transient increase in the expiratory flow (730-50 ms), characterized on the flow-volume curve by the presence of a spike, which correspond PCEF values that in adults can exceed 12 l / s.
- The expiratory flow during the expulsion phase can be interrupted several times by a succession of rapid closing of the glottis, to which equally rapid expiratory efforts correspond.

Ineffective cough

- Coughing is effective when the linear velocity of the air inside the airways is such as to allow adequate interaction between air and mucus and, therefore, to allow the transfer of kinetic energy from the air to the secretions.

PHYSIOPATHOLOGY OF INEFFECTIVE COUGH

- The effectiveness of the cough can be compromised by problems inherent in one or more phases of inspiration, compression and expulsion.
- The inhalation phase can be limited by a restrictive deficit, which determines a reduction in the volume of inhaled air, due to reduced compliance of the respiratory system or to a lack of strength of the inspiratory muscles

PHYSIOPATHOLOGY OF INEFFECTIVE COUGH

- The compression phase, on the other hand, may be inadequate due to the reduction in the ability of the expiratory muscles to generate force ", as indicated by reduced values of Maximum Expiratory Pressure (MEP), or a glottic dysfunction, secondary to neurological problems, which prevents beyond a certain pressure, the complete closure of the glottis The presence of an artificial airway inhibits (cuffed tracheal prosthesis) or limits (uncuffed tracheal prosthesis) the compression phase.

PHYSIOPATHOLOGY OF INEFFECTIVE COUGH

- Finally, the expulsion phase may be insufficient as a consequence of the deficit of one or both of the previous phases or, as occurs in functional alterations of an obstructive type, due to pathological events that alter the normal structure of the airways and parenchyma pulmonary.
- In obstructive diseases, in fact due to the compromised elastic properties of the lung parenchyma (emphysema), the destruction of the supporting tissue of the airways (bronchiectasis and cystic fibrosis), the presence of edema, bronchospasm and bronchial hypersecretion (chronic bronchitis and asthma), there is a limitation of the expiratory flow secondary to a shift of the Equal Pressure Point during the cough towards the airways of a smaller caliber.

INDICATIONS FOR THE EVALUATION OF COUGH

- The accumulation of tracheo-bronchial secretions is linked to the imbalance between production and elimination of the same. While hypersecretion requires a pharmacological approach, the reduced elimination of secretions benefits from physiotherapeutic techniques designed to facilitate mobilization and / or to allow their expulsion.

INDICATIONS FOR THE EVALUATION OF COUGH

- To direct physiotherapy treatment in one direction or another it is important to differentiate between difficulty in mobilizing secretions and inability to expectorate them. It should be emphasized, however, that it is not uncommon for an inadequate cough to be associated with a deficit in the mobilization of secretions and how, therefore, it is always necessary to evaluate whether the patient is able to expectorate validly, under penalty of encumbrance of the trachea and of the large bronchi by the mobilized secretions.

METHOD OF EVALUATION

To obtain a correct clinical-functional classification of the patient with expectoration deficit and consequently set up an adequate treatment, one cannot ignore an accurate assessment focused on punctual and reproducible measures. In addition to a general clinical evaluation, the following evaluations are required to determine cough efficacy:

- Respiratory function tests;
- Maximum Expiratory Pressure (MEP);
- Peak of Expiratory Flow (PEF) and Peak of Expiratory Flow during cough (PCEF);
- Relationship between PEF and PCEF.

Respiratory function tests

- Vital Capacity (CV) is the total volume of air expelled with a slow exhalation performed up to the Residual Volume, starting from a maximal inhalation. In clinical pictures characterized by restrictive dysventilatory syndromes, secondary to insufficient strength of the inspiratory muscles or to reduced compliance of the lung and / or chest wall, the decrease in the pretussive volume can lead to a reduction in the efficacy of cough.
- Furthermore, as already mentioned, an adequate pretussive volume also indirectly allows to improve the performance of the expiratory muscles which, at Total Lung Capacity, are in advantageous mechanical conditions and are therefore able to develop greater pressure, improving the effectiveness of coughing.

Measurement of Maximum Expiratory Pressure (MEP)

- The ability of the expiratory muscles to generate force is indirectly assessed through the determination of the MEP, which is implemented by measuring the pressure developed within the occluded airway during a forced expiration. during a forced exhalation
- Since the weakness of the expiratory muscles reduces the effectiveness of cough by limiting the dynamic compression exerted on the airways by the increased intrathoracic pressure, the measurement of MEP represents an essential step in the evaluation of the patient with ineffective cough.

Peak Expiratory Flow (PEF) and Peak Expiratory Flow during Cough (PCEF)

- PEF is the peak flow that can be measured during a forced exhalation maneuver performed with the glottis open. The normal value of PEF for the healthy adult is between 400 and 1200 l / min, varying in relation to age, sex and height. According to Boezen and co-workers, the average PEF value is just under 600 l / min

Peak Expiratory Flow (PEF) and Peak Expiratory Flow during Cough (PCEF)

- PCEF is the peak flow that is measured during a cough. The PCEF reference values are also correlated with the anthropometric characteristics of the subject. Even if theoretical reference values are not available, in normal conditions the PCEF must be higher than the PEF.
- Since it is the result of the three phases of cough, that is the phase of inspiration, compression and expulsion, the PCEF is conditioned by alterations that compromise in some way any of these three phases. Although PEF has also been used in this sense, several studies have recently suggested that PCEF represents the best physiological indicator of cough effectiveness.

Peak Expiratory Flow (PEF) and Peak Expiratory Flow during Cough (PCEF)

- PEF and PCEF can be measured using a pneumotachometer, spirometer or peak flow meter, connected to the patient via a face mask or mouthpiece.
- The Peak Flow Meter consists of a cylindrical tube in which the air exhaled by the patient moves a piston connected to a spring, which in turn moves a cursor on a graduated scale. When the patient performs a forced exhalation with open glottis (PEF) or a cough (PCEF), the exhaled air flow moves the cursor which is positioned on the highest value reached

PEF / PCEF ratio

- Since they contract with the glottis closed, during cough the expiratory muscles produce intrathoracic pressure values that far exceed those observed, with the same lung volume, during a maneuver performed with the glottis open. Therefore, in normal conditions the PCEF is greater than the PEF. A PEF / PCEF ratio> 1 indicates adequate glottic function

EVALUATION OF COUGH AND CHOICE OF TREATMENT TECHNIQUE

- Being influenced by alterations in any of the phases of inspiration, compression and expulsion, the PCEF is the most appropriate index to evaluate the overall effectiveness of cough. However, the PCEF does not help to highlight the causes of impaired cough effectiveness and, therefore, to orient the treatment towards the most appropriate forms of assistance. Therefore, every time the PCEF is <270 l / min, it is necessary to carry out an accurate evaluation of the elements that characterize each of the three phases of cough, in order to identify the pathophysiological mechanism that causes its compromise.

EVALUATION OF COUGH AND CHOICE OF TREATMENT TECHNIQUE

- The techniques that can be used to increase the efficacy of cough can be grouped into two major categories: techniques that increase the pretussive volume (air stacking, mechanical insufflation with Ambu bag or with ventilator); techniques that increase intrathoracic pressure during the compression and expulsion phases (manual cough assistance)

EVALUATION OF COUGH AND CHOICE OF TREATMENT TECHNIQUE

- It should also be emphasized that it is not uncommon for patients to present deficits at the level of more than one single phase of cough; therefore, often, the different techniques must be used in association with each other. In this context, it is useful to remember the devices designed to mechanically assist coughs.
- Through these devices, the pretussive volume is first increased through the application of positive pressure to the airways and, subsequently, in the exsufflation phase a subatmospheric pressure is applied to the airways. The increased pressure gradient between inspiration and expiration thus determines an increase in expiratory flow.
- The finding of an altered PEF / PCEF ratio can help to recognize a glottic dysfunction, which in itself excludes the use of those physiotherapy techniques that require the competence of the glottis as an indispensable condition.

CONCLUSIONS

- The evaluation of the efficacy of cough cannot be separated from precise measurements that make it possible to have a correct clinical-functional classification and, consequently, to set up an adequate treatment. Coughing can be altered in one or more phases of inhalation, compression and expulsion.
- The PCEF represents the best index for evaluating the effectiveness of cough because it is influenced by alterations in any of the three phases. However, PCEF does not help define the causes and mechanisms that lead to ineffective cough and must therefore be accompanied by other physiological indices, such as CV, MEP, PEF / PCEF, in order to obtain a complete and clinically useful evaluation.

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Assessment of dyspnea

Introduction

- Dyspnea is a general term used to characterize a subjective experience of respiratory distress, which consists of qualitatively distinct sensations of varying intensity.
- These experiences derive from the interaction between different factors: physiological, psychological, social, environmental and cultural, which can induce secondary physiological and behavioral responses.
- Dyspnea is a "technical" term, but generic; the patient presents with wheezing, shortness of breath, difficulty and difficulty in breathing, heavy breathing, etc. For simplicity, we will only use the term dyspnea in this slides

Introduction

- Besides being a symptom, dyspnea is a sensation, perceived according to the same processes involved in the perception of external stimuli.
- As a sensation, dyspnea can be compared to a painful sensation and, like pain, varies in multiple dimensions

Introduction

- Intensity is not the only dimension that characterizes dyspnea (as well as pain), but also associated qualitative aspects have fundamental value.
- Much of the clinical and research work on dyspnea has equated dyspnea with a sense of increased respiratory "strain" or a perception of increased ventilation.

Introduction

- Many studies have shown that the respiratory effort correlates with the perception of dyspnoea. Maximum Inspiratory Pressure MIP) (Pes / MIP).
- It is therefore understandable that the greater the maximum available force, the lower the value of the ratio and, therefore, the sense of effort, just as it is clear that the more a muscle is weak or fatigued, the greater the value of the ratio and, therefore, the sense of respiratory effort

Introduction

- Since many patients who complain of dyspnea are forced to breathe under conditions of increased mechanical load, the term "effort" is a dominant feature of the sensation reported by the patient.
- There are other circumstances that cause dyspnoea, clinical or experimental (acute hypoxia, pulmonary embolism, breathing of hypercapnic mixtures), not characterized by mechanical alterations for which the term effort may not be adequate.

Introduction

- Dyspnea therefore refers not to a specific sensation that varies only in intensity, but to a multiple variety of qualities gathered under a single label. In some studies using questionnaires on dyspnea in patients with different cardiopulmonary diseases, some authors have shown that individuals with presumed different physiological causes for their sensation of respiratory distress, as well as normal subjects made dyspnoea by different activities, employ qualitatively different descriptors to describe their feeling of difficulty

Introduction

- While the sense of increased exertion or work of breathing is common in conditions of increased mechanical load, such as COPD, interstitial disease and neuromuscular disease, patients with congestive heart failure describe a feeling of lack of air or choking and dyspnoea of asthma it is characterized by a sensation of chest tightness.
- The consistency of these observations in a large group of patients from different cultures suggests that these qualities of dyspnea do not merely reflect variations in individual experience or culture, but are inherent in differences in the pathophysiological mechanisms underlying the sensations themselves.

Introduction

- The use of verbal descriptors of dyspnea can therefore contribute to the understanding of the pathophysiological mechanism and help in the identification or presumption of a specific diagnosis.
- Standardized descriptors were grouped into distinct clusters, with a high discriminatory value between different pathological pictures.
- The dyspnea clusters most frequently selected by patients with respiratory diseases are chest tightness, exertion / work, unsatisfactory inspiration, rapid breathing and lack of air.
- Different pathophysiological mechanisms can be recognized at the base of the single clusters.

IMPACT OF DYSPNOEA IN PATIENTS WHO HAVE RESPIRATORY DISEASE

- About 30% of presumably healthy individuals 65 years of age or older report breathlessness while walking on a level or up an incline.
- It is likely that the 30% prevalence of dyspnoea in the elderly is multifactorial, including possible undiagnosed cardiac or respiratory disease, decreased physical activity with low fitness levels and increased body mass index.
- Breathing difficulty is a strong predictor of mortality in the elderly who have no known cardiorespiratory disease, in those with COPD independently of their FEV1 and in those admitted to chest pain units for suspected acute coronary syndrome .

DESCRIPTORS OF DYSPNOEA

- Although individuals may find it difficult to explain what their 'dyspnoea' feels like, patients with various cardiorespiratory diseases are generally able to select relevant descriptive statements about the experience of dyspnoea.

DESCRIPTORS OF DYSPNOEA

- The major qualities of dyspnoea are summarized in the Table.
- For example, ‘work and effort’ associated with breathing is common to cardiorespiratory diseases. This quality reflects the role of the respiratory muscles in the perception of breathing discomfort regardless of the underlying disease.
- Another feature is ‘chest tightness’ which appears to be unique for those with asthma.
- A third quality is ‘unsatisfied inspiration’ which is dominant at the end of an exercise test. The descriptor ‘air hunger’ associated with breathing high levels of carbon dioxide is thought to be similar to ‘unsatisfied inspiration’.

Table 12.1 Qualities of dyspnoea

Work/effort
1. ‘Work/effort’ descriptors of breathing are selected by patients with various cardiorespiratory diseases
2. This quality reflects the role of the respiratory muscles in the perception of dyspnoea
3. ‘Work/effort’ quality likely originates from respiratory muscle afferents and/or perceived cortical motor command
Chest tightness
1. Due to constriction of airways and typically experienced in the upper anterior chest
2. Endorsed by ~50% of outpatients with asthma
3. Is not generally reported by patients with other cardiorespiratory conditions
Unsatisfied inspiration
1. Mainly selected by patients with respiratory disease at the end of exercise
2. May overlap with sensation of ‘air hunger’ produced by increased respiratory drive due to breathing carbon dioxide

Clusters

- A feeling of "chest tightness" is frequently reported by asthmatic patients. It may result from the stimulation of sensory receptors located within the lungs via vagal and autonomic pathways: slow adaptive receptors excited by the contraction of the muscle fibers of the airways, irritation (fast adaptive) receptors and C fibers, which may respond to local inflammation of the airways.
- "Increased work or respiratory effort" includes descriptors that are frequently selected as common in most diagnoses.

Clusters

- The "unsatisfactory inspiration" cluster refers to the disparity between central respiratory output and mechanical response of the respiratory system and is believed to play an important role in the increased perception of dyspnea during exercise in COPD and interstitial disease patients.
- The perception of this disparity is possible due to the fact that the central motor command to the sensitive cortex (corollary discharge) is modulated by a series of peripheral mechanoreceptors, which provide precise information on the displacement of the inspiratory muscles, the tension produced, the variations in flow and volume produced and on the caliber of the airways.
- The disparity between this sensory feedback and the degree of respiratory effort would be at the basis of a pathogenetic mechanism of dyspnea recently proposed and defined as "neuroventilatory dissociation", which implements the old pathogenetic theory of length / tension inappropriateness.

Clusters

- Rapid or shallow breathing is the descriptor reported by normal subjects who breathe during exercise with an external thoracic restriction. Rapid breathing also characterizes the exercise response of patients with interstitial diseases.
- Increased respiratory drive results in an increase in respiratory rate due to reduced pulmonary distensibility, while vagal receptors may be potentially involved.

Clusters

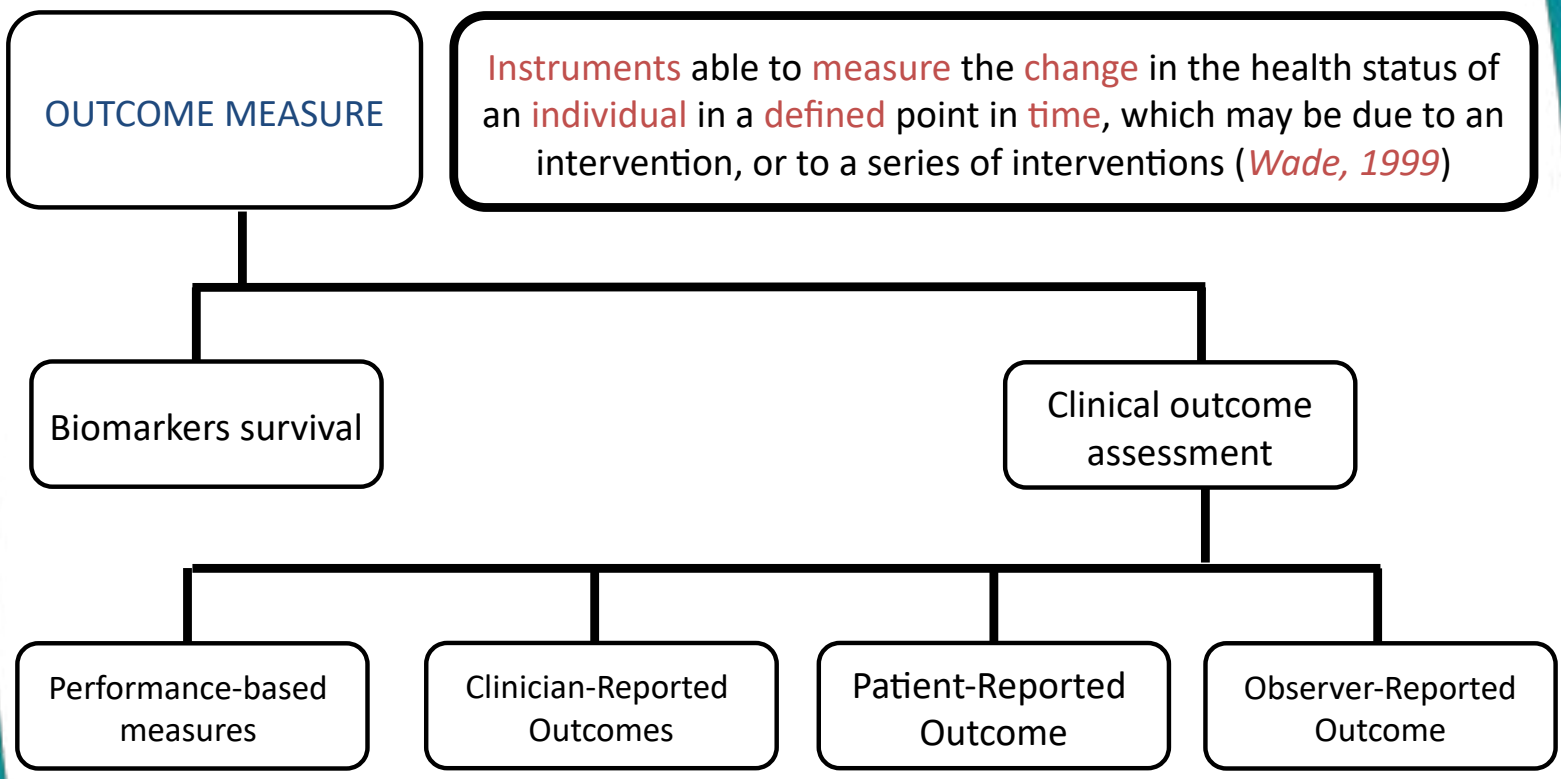
- "Hunger for air" is a cluster that tends to be associated with conditions resulting in increased respiratory drive, usually with increased ventilation: exercise, congestive heart failure, pregnancy, COPD.
- The sensation of air hunger is likely to result from an increased urge to breathe and is not directly related to the activation of the respiratory muscles or to an increase in ventilation. In fact, in subjects with high cervical lesion in mechanical ventilation, the addition of C02 to the inspired gas produces a feeling of difficulty in breathing characterized as "air hunger", despite the ventilation being kept constant
- Since dyspnea is a key part of the patient's medical history, physiotherapists and doctors should familiarize themselves with the language used. The attempt to measure the sensation of dyspnea is part of this path of understanding the symptom and approaching the real difficulties of the patient with dyspnea.

Method of evaluation

- The evaluation of a symptom implies the possibility of translating a subjective experience into a numerical parameter. Measuring the sensation of dyspnea is important for many reasons: first, it is the symptom most frequently reported by patients with chronic respiratory diseases; moreover, dyspnoea represents a unique dimension of respiratory disease that cannot be derived indirectly from other measures (for example, evaluation of respiratory function), so it can only be evaluated through a direct measurement

Method of evaluation

- The measurement of the intensity of the sensation is also important to evaluate the response to a therapeutic intervention (pharmacological, rehabilitative), and can therefore be used as an outcome measure.
- In addition, in patients undergoing a training program, the assessment of dyspnea during an exercise conducted initially offers the possibility to prescribe a training program based on the intensity of the measured sensation.
- Currently there are different types of scales for the evaluation of dyspnea, developed starting from laboratory studies with psychophysical methods up to clinical scales.
- These instruments are classified in various ways.


OUTCOME MEASURE
Instruments able to measure the change in the health status of an individual in a defined point in time, which may be due to an intervention, or to a series of interventions (*Wade, 1999*)
Biomarkers survival
Clinical outcome assessment
Performance-based measures
Clinician-Reported Outcomes
Patient-Reported Outcome
Observer-Reported Outcome

Method of evaluation

- The scales can, in fact, be distinguished into discriminative (which differentiate populations of subjects with greater dyspnea compared to the population of subjects with less dyspnea) or evaluative (which identify changes with respect to a baseline condition).
- Apart from this general distinction, there are many other ways to characterize and classify the tools used to measure dyspnea: there are categorical scales (the score is represented by categories, for example, mild, moderate dyspnea) or analog (for example, the Visual Analogue Scale, VAS, where the signal is analog).
- A distinction can be made between direct scales (which directly investigate the extent of the perceived symptom) and indirect (when evaluating the activities that dyspnea hinders in everyday life).

Method of evaluation

- Depending on whether the instrument identifies one or more dimensions of sensation, we will distinguish one-dimensional or multi-dimensional scales (if they take into account, for example, only the type of activity that causes dyspnea, or also other dimensions such as functional alteration, the magnitude of the task that evokes the symptom and the magnitude of the effort associated with the sensation).
- For practical purposes it is also possible to distinguish the scales in clinics (used in the clinic, during the routine anamnestic collection) and psychophysical (to evaluate the intensity of the symptom in response to a stimulus, such as physical exercise, bronchospasm or pharmacologically induced bronchodilation, application of mechanical ventilation, exposure to respiratory loads).

Method of evaluation

- In the next slides where the tools in use to quantify the sensation of dyspnea will be presented, we will follow the ideal path of the patient who refers to a rehabilitation facility and whose dyspnea is initially assessed by clinical scales, which provide a measure of the degree of functional impairment and are therefore able to place the patient in a severity class. Next, we will discuss the tools used to quantify the intensity of sensation in response to specific tests in use for assessing exercise tolerance and exercise capacity.

Rating scale

- Much of the content of the interview with the cardiopulmonary patient revolves around dyspnea.
- Spontaneously he will report about the extent of the symptom and the activities during which the trouble appears in everyday life.
- During follow-up visits or meetings that follow one another during the re-training program, the worsening or improvement of the state of health will spontaneously refer to the reduction or increase in dyspnea related to daily activities.
- The two most popular tools that allow us to measure dyspnea in this context are the Medical Research Council scale and the Baseline Transitional Dyspnea Index.

Scala Medical Research Council

- In 1959, on behalf of the Medicai Research Council, Fletcher et al. (1959) developed a 5-point scale based on the patient's sensation of dyspnea during daily activities.
- It is the first clinical scale for the evaluation of dyspnea.
- Grade 0 represents the least severity and grade 4 the most compromised situation.
- For grades 0 and 1 it is considered a symptomatic scale since the effort that produces the symptom is indicated, while grades 2, 3 and 4 give indications on ability and social impact

Scala Medical Research Council

- It has been used mainly for discriminatory purposes to characterize the study population or to stratify patient populations with different functional impairment.
- Its diffusion level is very high, so much so that a patient with chronic obstruction is currently described using the MRC grade together with FÉV1.
- You can show the scale or read the levels directly to the patient.
- With the MRC it may be difficult to highlight medium-sized changes induced by a therapeutic or rehabilitative intervention because the scale is insensitive.
- The threshold activity capable of evoking the sensation of dyspnea is considered, but not the way in which the task is performed, nor the effort or time needed to complete it.

MRC dyspnoea scale(Medical Research Council)

- 0 I am out of breath from intense efforts
- 1 I only get out of breath if I run flat or take a gentle climb
- 2 I walk slower than people of my age when I go flat, or I have to stop to breathe when I walk at my standard pace
- 3 I have to stop to breathe after I have walked on level ground for about 100 meters or a few minutes
- 4 I am too short of breath to leave the house or I am out of breath when dressing and undressing

Scala Baseline/Transitional Dyspnea Index

- The scale consists of two tools: the Baseline Dyspnea Index (BDI) and the Transitional Dyspnea Index (TDI).
- The BDI constitutes the initial assessment and represents the discriminatory tool, while the TDI is administered after a certain period of time during which a therapeutic intervention has been performed.
- There is an Italian version of this tool.
- The BDI is made up of 3 components: functional limitation, extent of activity and extent of effort.
- In the BDI each category has 5 grades from 0 to 4, where 0 corresponds to the most serious situation. The scores in each category are added together and the smaller the total, the worse the clinical situation will be. 12 is the maximum score obtainable and corresponds to the patient's lowest effort.

Functional limitation

- In this area, the loss of function is investigated in the context of both daily life and work activities. As for the work activity, the patient may have been forced to stop completely or to reduce the activity.

Entity of the activity

- This area investigates what everyday activities cause dyspnea. In the 5 levels some activities with increasing work intensity are listed. Level 0 (the most severe) indicates dyspnea at rest, sitting or lying down. As you progress, the activity becomes increasingly heavy.

Extent of effort

- It is the effort to evoke dyspnea. This area is probably the most distinctive aspect of the staircase. It is in this context that patients differ who, while carrying out the same activities, make extremely different efforts. The variable "time" needed to complete the activity is taken into consideration, combined with the type of activity more or less demanding.

Extent of effort

- In the BDI there are 3 categories (W, X, Y) if the information is not sufficient or available to identify the degree of limitation caused by dyspnea or the patient's abilities are compromised by causes other than dyspnea.
- When the TDI is administered (the part of the instrument that evaluates the response in terms of dyspnea to a therapeutic intervention or even the variation over time with respect to the basic condition investigated with the BDI), the patient is questioned about the change that has occurred compared to baseline.
- The patient can choose the score 0, which corresponds to no change, or a slight, moderate or marked change, m worse or better, then 3 levels above and 3 below 0.
- This is the characteristic that gives a great sensitivity to the scale. The scores of the 3 categories are added together to obtain the transitory score which can range from -9 to +9.

Scala Baseline/Transitional Dyspnea Index

- According to the author, some limitations of existing methods for the assessment of dyspnea can be overcome with this index; in fact, it is possible to discriminate patients who make a very different effort in carrying out the same activity.
- The TDI allows detection of even small changes in the extent of dyspnea and the Minimum Significant Difference has been identified for this instrument, which corresponds to one unit.

Scala Baseline/Transitional Dyspnea Index

- The Author found a good agreement in the scores obtained when the scale was administered by different operators and, in addition, a good correlation of BDI and TDI with the 12-minute walk test, while there was a weaker correlation with FVCeFEV1.
- The scale provides for informal administration performed during the routine collection of the anamnesis by the doctor, nurse or physiotherapist in a time ranging from 4 to 5 minutes.

Scala Baseline/Transitional Dyspnea Index

- A computerized version of the BDI has recently been introduced to compare the scores obtained by two different interviewers (Mahler, 2003). However, the author suggests some questions that can help in conducting the interview and in choosing grades. For example, for the BDI, category / activity, the patient can be asked whether he has had to interrupt any activity of daily living due to breathlessness.
- For the administration of the TDI it is necessary to refer to the scores of the BDI and remind the patient of his comments and the choices made during the initial interview, asking if there are any changes compared to the basal condition, of what type and of what extent.

CONTRIBUTION OF PSYCHOPHYSICS TO THE EVALUATION OF DYSPNEA

- Dyspnea must be carefully assessed during physical exercise represented by laboratory tests (cardiopulmonary exercise test), field tests (6 MWT and shuttle WT) and training sessions. For this purpose, psychophysical scales are used.
- The psychophysical approach has made an important contribution to the quantification of dyspnea. Psychophysics is a branch of psychology that studies the laws that regulate the perception of sensations as the stimulus varies.

Borg Rating of Perceived Exertion

- The RPE is a categorical scale with "verbal anchors" associated with numbers for the gradation of perceived exertion.
- Borg built the scale to overcome the limitations of the scales that did not allow the possibility of comparing the score between different individuals.
- In fact, with the same numerical score attributed to a sensation, it is not possible to affirm that for two different subjects the sensation is superimposable, and therefore it is not possible to compare the score.

Borg Rating of Perceived Exertion

- The scale consists of 15 levels ranging from 6 to 20. During exercise there is a linear relationship between Heart Rate (HR) and intensity of perceived exertion. In a normal subject, the score 6 corresponds to 60 beats / minute, considered an average HR at rest, and the score 20 at the other end corresponds to 200 beats / minute, considered the maximum HR that can be reached at peak exercise.

Scale RPE *(Rating of Perceived Exertion)* of Borg.

- 6 No effort
- 7 Extremely light
- 8 9 Very light
- 10
- 11 Light
- 12
- 13 A little heavy
- 14
- 15 Heavy
- 16
- 17 Very heavy
- 18
- 19 Extremely heavy
- 20 Maximum effort

Borg scale CR10

- The CR10 (Borg, 1982) is a categorical scale with relationship properties created to evaluate a symptom and used for the quantification of dyspnea, but also of pain, effort during exercise and muscle fatigue.

Borg scale CR10

- The scale grades the sensation of breathlessness from 0 to 10, where 0 corresponds to the sensation of normal breathing (absent dyspnea), while 10 corresponds to the maximum sensation of breathlessness that the subject has ever perceived.
- Some values are linked to a verbal descriptor, called "anchor", chosen from commonly used words.
- Verbal anchors create categories of sensation in which subjects are easily recognized: "moderate intensity" is placed in the center of the scale, "strong" and "weak" symmetrically above and below.
- In addition to the value 10 it is still possible to place further choices, which allow the patient to define his own sensation with greater precision. For this reason the stair is defined open.

Borg scale CR10

0 Absolutely nothing

0.5 Extremely weak

1 Very weak

1.5

2 Weak

2.5

3 Moderate

4

5 Strong

6

7 Very strong

8

9

10 Extremely strong

11 Absolute maximum

Borg scale CR10

- The version currently used in the respiratory patient is the one modified by Mahler and Horowitz in 1994 and defined precisely as modified Borg scale.
- The two authors published a review of the works that concerned the most commonly used dyspnea scales during exercise.

Modified Borg scale

- In this scale, the verbal descriptors of CR10 were changed to fit the description of dyspnea: weak was changed to slight and strong to severe.
- The modified Borg scale is widely used to assess dyspnea and muscle fatigue during exercise and as a tool for prescribing the intensity of the workload during the training session.
- Mahler and Horowitz (1998) demonstrated the ability of a group of 13 patients with moderate and severe COPD to accurately reproduce on a treadmill the exercise intensity achieved on a cycle ergometer during the incremental test, using the CR10 score.
- According to the authors, this possibility would allow translating a workload from one exercise mode (cycle ergometer on which the incremental test was performed) to another (walking on a treadmill, on which the training is performed).

Modified Borg scale

- 0 Absolutely nothing
- 0.5 Extremely mild
- 1 Very mild
- 1.5
- 2 Mild
- 2.5
- 3 Moderate
- 4
- 5 Intense
- 6
- 7 Very intense
- 8
- 9
- 10 Extremely intense
- 11 Absolute maximum

Administration of Borg scales

- The administration of the scales takes time and patience
- The operator must establish a good communication relationship with the subject examined and be sure that the patient has understood precisely that we are dealing with "his sensation", therefore with the perception of his symptom and that the operator has no tools to judge whether the choice made does not correspond to the truth.

Administration of Borg scales

- It must be made clear that there is no right or wrong answer, but simply a choice determined by the patient's judgment of his own perception.
- It may be necessary to recall exertion experiences made during daily activities or refer to the intensity felt during other sensory experiences, such as the sourness of a lemon, the pain of a wound, etc.

Administration of Borg scales

- It should be borne in mind that the patient's emotional state could lead to an underestimation or overestimation of the symptom. These are aspects to be considered, taking care not to interfere in the patient's choice of score.
- Borg himself in the presentation of his scales (Borg, 1998) pays much attention to the mode of administration for which it is necessary to follow a rigorous procedure

Method of administration of the Borg scales.

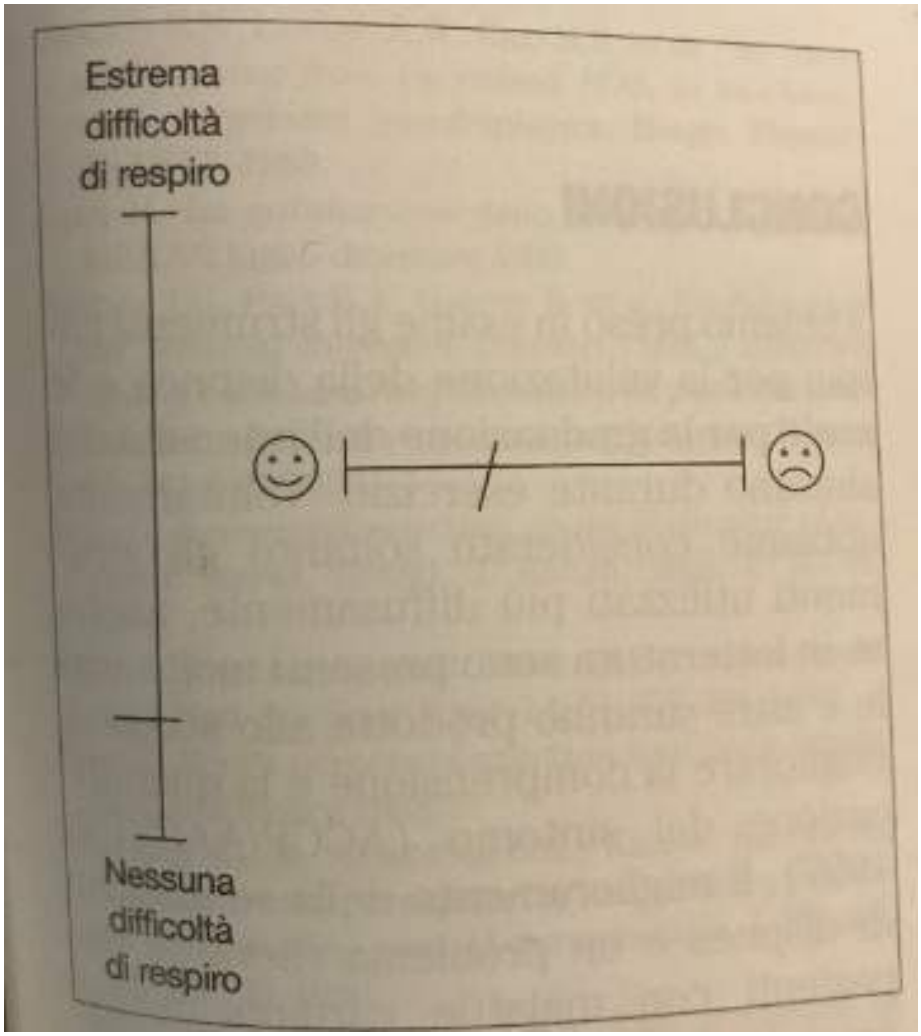
- Explain to the patient what we are trying to evaluate, that we are interested in what he feels
- Explain to the patient why we need information about their sensation during the test
- The place and time of administration must be chosen carefully to avoid possible interference
- Show the scale to the patient and explain exactly how it is constructed and the meaning of all corresponding adjectives and numbers. For example: "The scale you see is used to evaluate the sensation of wheezing, shortness of breath or labored breathing. We need to understand if, and how intense is your feeling of breathing badly at this moment"
- Explain to the patient that not all numbers correspond to a descriptor and this to leave the possibility to choose, for example, an intermediate definition between intense (5) and very intense (7) dyspnea

Method of administration of the Borg scales.

- Show the extremes of the scale and explain the meaning of the numbers. For example: "10 corresponds to the worst feeling of breathlessness I have ever perceived. He may also experience, during the exercise, a new sensation, even higher than 10, in which case he can choose even a greater number"
- Give the patient written instructions to standardize administration and allow the subject to become familiar with the scale
- Make sure the patient understands the meaning of the extremes
- Ask that adjectives be considered first and then the corresponding numbers

Visual Analogue Scale (VAS)

- VAS was described by Aitken (1969) for the evaluation of sensations and later used for the measurement of dyspnea.
- It consists of a vertical or horizontal line usually 10 cm long, delimited by two dashes which correspond to 2 images or verbal descriptors, one representing the maximum intensity of sensation and the other the absence of perception of the sensation
- The instrument is analogue because the line corresponds to the continuity of perception.
- The patient is asked to place a vertical mark at the point on the scale where the perceived symptom is placed.


Estrema
difficoltà
di respiro
Nessuna
difficoltà
di respiro

Visual Analogue Scale (VAS)

- The tool is simple and cheap, but the mental operation that is required of the subject is certainly complex and requires good abstraction skills.
- The administration of the VAS also takes time and patience
- The optimal length is between 10 and 20 cm. Another aspect to consider is the orientation of the vertical or horizontal line. There are no clear indications in the literature, the only observation is the possible association, in the vertical scales, between high and greater intensity of perception.

Visual Analogue Scale (VAS)

- The two dashes at the end of the line delimit the scale, preventing you from choosing beyond the borders. This is why the VAS is considered a closed scale. The quantification of the symptom corresponds to the distance from the 0 point expressed as a percentage of the total length of the scale.
- The choice of words or phrases at either end represents a problem to be carefully considered. And the term "unbearable" could acquire a more absolute meaning than "maximum", and in any case it is necessary to consider the semantic value that each descriptor can have for the individual.

Visual Analogue Scale (VAS)

- The VAS is a scale that directly assesses the symptom and is used during exercise or to assess changes from a baseline condition. The complexity of the thought abstraction operations that require understanding the tool makes it unsuitable for people over 75 or children up to 11.
- Other authors have compared the VAS to the Borg scale, studying the time necessary for the explanation and the sensitivity of the instrument and concluded that with the same sensitivity, the VAS takes twice as long to be explained to the patient.

Method of administration of the VAS

- Make it clear what we want to evaluate and why
- Show the scale and describe it accurately to the patient, making sure that he has understood the meaning of the extremes (verbal or iconographic)
- Define the moment to which we refer
- To make sure he understands it, one might ask where he would put the mark if dyspnea was absent
- Ask the patient to focus on their sensation and indicate its intensity by placing the sign corresponding to the perceived intensity
- If the patient has difficulty in understanding the use of the scale, you can use the example of the thermometer and assimilate the VAS line to this instrument

CONCLUSIONS

- We examined the clinical tools for assessing dyspnea and scales for grading symptom intensity during exercise.
- We have deliberately considered only the most widely used tools, even if in the literature there are many scales and others will be produced in order to improve the understanding and quantification of the symptom.
- Improving the sensation of dyspnoea is a significant problem for patients with chronic cardiopulmonary diseases and often the only result obtainable with treatment.
- In this sense, the measurement of dyspnea becomes an important outcome measure and the routine application of specific tools for the assessment of the sensation of dyspnea therefore assumes a fundamental importance in the treatment of these patients.

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PRACTICAL TEACHINGS FOR THE REHABILITATION PHYSIOTHERAPIST

Assessment of Daily Life Activities

Introduction

- One of the primary objectives of rehabilitation is to promote the independence of individuals in carrying out daily life activities
- The term ADL means the activities of personal care and home care and the ability to enjoy the basic freedoms inside and outside it in full autonomy

Introduction

- ADLs can be divided into two main categories: basic or primary ADL (BADL) and instrumental or secondary ADL (IADL).
- When an individual needs the help of others to satisfy the primary care functions of his person, or biological needs such as eating, washing, dressing or moving around his home, it is said that this individual is no longer completely independent in the BADL. Similar situations occur repeatedly in very elderly and institutionalized patients.
- The IADLs, on the other hand, are represented by application activities that often involve the sphere of participation in social life. In this sphere there are shortcomings on the part of a larger share of the population residing in the community.

Introduction

- The limited ability to fulfill primary or secondary ADL autonomous marines triggers processes of limitation to participation in social life and deterioration of the individual's quality of life.
- In order to capture a precise image of the residual functional ability of the individual, a broad-spectrum evaluation of the functions performed in these areas is therefore recommended.

ADL IN PATIENTS WITH CHRONIC DISEASES OF THE RESPIRATORY SYSTEM

- Patients suffering from chronic diseases of the respiratory system manifest impaired lung function with symptoms (dyspnea and fatigue) that interfere with many aspects of daily life, progressively limiting their ability to work, participate in relational and recreational activities and fulfillment of domestic duties.
- In more advanced cases it is not uncommon to see the ability to perform basic ADLs also impaired. In this population of individuals, particularly among those suffering from Chronic Obstructive Pulmonary Disease (COPD), and even more so among those with chronic respiratory insufficiency who have to resort to home oxygen therapy (OLT), common life activities are a source of severe fatigue.

ADL IN PATIENTS WITH CHRONIC DISEASES OF THE RESPIRATORY SYSTEM

- This phenomenon is justified by at least two factors: the severity of the symptoms due to the underlying respiratory disease, more or less associated with a tendency to chronic hypoxemia; and the limitations of motor activities resulting from the use of OLT equipment.
- Such a clinical picture induces a gradual abstention even from basic life activities by the patients concerned, activities which are progressively abandoned and delegated to other members of the family group.

ADL IN PATIENTS WITH CHRONIC DISEASES OF THE RESPIRATORY SYSTEM

- Typically, the first level of functions to be progressively abandoned is that of occupations performed outside one's home, which often include recreational and social activities.
- In the specific case of COPD patients, there are at least three characteristic patterns of disability, which are expressed with the loss of some selected BADL and IADL of different content in terms of psychophysical demand for the individual.
- The first pattern is characterized by the loss of the skills to travel, handle money, take drugs, go up and down stairs and walk for medium to long distances, but also more simply to bathe or shower and take care of one's feet.
- A second pattern is characterized by the inability to perform housework of varying heaviness, including washing laundry, shopping and preparing meals.
- The third pattern, peculiar to the most compromised subjects, is characterized by the inability to fulfill all the basic ADLs and also affects the ability to telephone and move in the immediate vicinity of the home.

ADL IN PATIENTS WITH CHRONIC DISEASES OF THE RESPIRATORY SYSTEM

- The progressive abandonment of ADL, in addition to negatively impacting the level of physical conditioning, leads to an increase in the level of anxiety and depression due to the growing isolation from social life.
- The objective deterioration of the level of physical and psychosocial well-being described can, however, further contribute to worsening the patient's level of dyspnea and quality of life.

ADL IN PATIENTS WITH CHRONIC DISEASES OF THE RESPIRATORY SYSTEM

- Since, in COPD patients, fatigue is one of the symptoms that characterize the pathological picture, in the course of the disease patients must necessarily acquire specific energy conservation techniques, which allow them to continue to carry out ADL with the maximum autonomy granted to them.
- This is a critical step for the physiotherapist, in charge of both evaluating the problem and educating the patient and the family on how to properly manage efforts and recovery times, making them accept the concept of the decline in psychophysical performance, consequent to the progression of the disease.

MEASURES OF ADL IN RESPIRATORY REHABILITATION

- Although the subject suffering from chronic respiratory disease easily encounters limitations in the fulfillment of their IADL and BADL and despite a recent increase in the attention of clinicians to characteristic aspects of the quality of life of patients suffering from irreversible diseases, the availability of simple and precise measuring tools that provide an estimate of the limitations in peculiar functional abilities in such patients is still quite limited.
- The first studies aimed at analyzing ADL in COPD patients date back to the late 1980s; a subsequent development took place with the identification of a suitable tool to assess the limitations in the life activities of patients with mild and moderate COPD, while neglecting the most compromised patients.

MEASURES OF ADL IN RESPIRATORY REHABILITATION

- In the light of the more modern interpretation of the concept of residual ability and social participation, the general principle underlying the assessment of ADL is that, within the context represented by their lifestyle and living environment, patients with chronic diseases of the advanced respiratory system benefit from an in-depth and individualized assessment of their residual functional capacity.
- The professional must then evaluate, together with the patient, which personal and home care activities and / or which daily activities of specific interest are the cause of a feeling of dyspnea or fatigue in compliance with the maxim that functional capacity is not absolute, rather it relates to the patient's expectations, priorities and goals, as well as the social support he enjoys.

MEASURES OF ADL IN RESPIRATORY REHABILITATION

- The realization of this statement takes the concrete form of an assessment centered on the needs and motivations of the individual that includes elements of both subjective and objective analysis; the former can emerge through interviews and be collected with the help of more or less structured tools, while the latter should emerge from an assessment made through validated measurement scales and should always include a precise assessment of the functional state and the living environment individual.

MEASURES OF ADL IN RESPIRATORY REHABILITATION

These are the most useful functional assessment measures applicable to patients with respiratory pathology and reduced ability to perform ADL

- Self-administered questionnaires
  - Canadian Occupational Performance Measure (COPM)
  - Nottingham Extended Activities of Daily Living Index (EADL)
  - Pulmonary Functional Status and Dyspnea Questionnaire (PFSDQ)
  - Chronic Respiratory Disease Questionnaire (CRQ)
  - St. George's Respiratory Questio nnaire (SGRQ)
  - London Chest Activity of Daily Living Scale (LCADL)
  - Oxygen Cost Diagram (OCD)
- Measures for estimating residual ability
  - Indice di Barthel (Bl)Indice di Barthel (Bl)
  - Basic Activity Daily Living Scale (BADL)Basic Activity Daily Living Scale (BADL)
  - Baseline Dyspnea Index (BDI)Baseline Dyspnea Index (BDI)
  - Modified Borg Modified Borg Scale (BORG)Scale (BORG)
  - Medicai Research Council Dyspnea Scale (MRC)
  - Medicai Research Council Dyspnea Scale (MRC)
  - Instrumental Activity Daily Living Scale (IADL)
  - Instrumental Activity Daily Living Scale (IADL)
  - Transitional Dyspnea Index (TDI)
  - Transitional Dyspnea Index (TDI)

Subjective elements of evaluation: interview

- Through conversation with the individual and their family members, the physiotherapist, or other competent health professional, can begin to identify the elements necessary for a thorough assessment of the impact that the disease process has on the patient's life.
- He can also compare this impact with the residual resources of the individual, expressed in terms of positive coping with his own pathological condition.
- The interview should be extended to the spouse and / or other family members ("resource persons") who have close relationships with the person concerned, in order to draw a more complete and detailed picture of the "challenges" that the patient is facing daily basis. Furthermore, family members or close friends can help the professional to grasp the changes induced by the evolution of the pathology in the energy level patterns that characterize the patient during the performance of common activities; not to be underestimated, then, the importance assumed by the presence of a support person in the patient's home for the expression of his residual abilities of positive coping.

Subjective elements of evaluation: interview

- In the initial interview it is of fundamental importance to understand what social support the individual enjoys, both inside and outside his home. Further fields worthy of exploration are represented by the emotional state, by the level of subjective motivation, as well as by the coping mechanisms that the individual typically uses.

Subjective elements of evaluation: interview

Other important considerations include aspects related to:

place and type of home, including the crucial aspects relating to the accessibility criteria of the same in terms of both natural and architectural barriers;

- need to travel outside the home in order to meet their needs when necessary (supermarkets, bank, doctor, etc.);
- accessibility to a suitable means of transport, which includes the possibility to drive a car and, in this case, to use an accessible garage the possibility of being able to count on a willing and reliable person to act as a driver, to take advantage of financial resources sufficient to deal with the necessary travel by taxi, accessibility to public transport and the possibility of fully satisfying individual needs through their use.

Depending on the circumstances, which differ for each subject, all the factors listed may play an important role in the deterioration of the individual's energy reserves.

Subjective elements of evaluation: self-evaluation questionnaires

- Self-assessment responds to the need to grasp the quality with which the individual perceives his or her ability to meet the individual needs for personal care and home care, as well as the need to carry out physical and recreational activities.
- There are relatively few valid tools, designed to measure in a simple and objective way (direct or indirect) the limitations in the functional abilities of the individual. For this reason, many programs, aimed at preserving the subjective abilities of ADL fulfillment of individuals suffering from disabling diseases, have used specific tools aimed at exploring the perception that the individual has about the impact of the pathological condition on their functionality, in particular to understand the specific consequences that dyspnea and fatigue have on the patient's ADL.

Canadian Occupational Performance Measure (COPM)

- The conceptual foundations of COPM place it among the occupational performance measures of use preferred by the competent therapist, where occupational performance is understood to be the product of the interaction between the person, his environment and the activity in progress. Published for the first time in the 1930s, the COPM was tested on groups of adult patients undergoing rehabilitation, people with disabilities of developmental age (where it is administered by the parents), individuals enrolled in a pain management program and patients with depressive disorders
- Today it is used in more than 35 countries around the world and is translated into over 20 languages, including Italian. A recent systematic review of the literature, with the aim of summarizing the available knowledge on the use of COPM and evaluating its effects on research and clinical practice in occupational therapy, underlines the validity, reliability, responsiveness and psychometric properties of this This tool is therefore useful in clinical practice and research in the field of occupational therapy on a wide range of patients and clinical conditions. The sensitivity to changes in functional status also makes it a useful tool for evaluating the effects of a rehabilitation intervention.

Nottingham Extended Activities of Daily Living Index (EADL)

- The EADL was originally designed as a questionnaire to be mailed to community-resident stroke patients to assess their ability to perform instrumental ADLs. It evaluates 21 activities belonging to 4 categories: mobility, cooking activities, domestic activities and leisure activities. It is a simple tool, the self-administration of which takes about 10 minutes.
- In COPD patients, EADL has been shown to be sensitive in distinguishing disabilities of various levels and able to correlate well with the severity of the underlying disease. Although useful in the initial characterization of the patient, the EADL has however shown limits in the possibility of being used as an outcome measure, as it is unable to grasp the variations in the ability to perform ADL following a respiratory rehabilitation program; consequently, its use in the areas of research and clinical practice is still scarce.

London Chest Activity of Daily Living Scale (LCADL)

- The LCADL is a standardized, easy-to-administer scale specific to individuals with severe COPD. The purpose of the scale is to offer a measure of the patient's ability to perform ADL through an estimate of the degree of dyspnea perceived during the performance of the activities investigated.
- The conceptual basis on which this tool is based is based on the hypothesis that dyspnea, during the patient's common activities, induces a condition of significant limitation in the individual ability with limitation to social participation. The scale investigates the degree of disability induced by dyspnea associated with 15 common activities, divided into 4 areas (personal care, domestic activities, physical and social activities) which mainly take place at home, on a daily basis and represent basic functional activities.

London Chest Activity of Daily Living Scale (LCADL)

- Recent studies have shown that, in a COPD patient population, the LCADL is a reliable tool in assessing dyspnea during daily activities; with the sole exception of the household component, it is also responsive to changes following participation in a respiratory rehabilitation program, which supports its use as an outcome measure after similar therapeutic interventions have been performed in the population of 'interest.

Pulmonary Functional Status and Dyspnea Questionnaire (PFSDQ)

- The PFSDQ is a self-administered questionnaire consisting of 164 questions aimed at capturing the functional status and the level of dyspnea of the individual during the performance of activities divided into 6 categories: personal care, mobility, home management, nutrition, recreational activities and activities social. Although it has been specifically designed to be used in a population of subjects suffering from respiratory diseases, its use is not widespread.

Pulmonary Functional Status and Dyspnea Questionnaire (PFSDQ)

- The resistance to its use is probably due to the fact that many items among those tested are not applicable to patients suffering from respiratory diseases of high severity; moreover, its widespread and extensive use would be very expensive in terms of time.
- In 1998 the reliability, validity and practicability of a modified version of this scale, reduced to 40 items, were tested on a population of patients with severe COPD; the introduction of this shortened version produced positive results, also due to the reduction of the administration time to just 7 minutes.

Oxygen Cost Diagram (OCD)

- The Oxygen Cost Diagram (OCD) is a self-assessment tool designed to provide an estimate of exercise limitation in patients with respiratory diseases. It is a linear scale consisting of a 10 cm long vertical line which lists some common ADLs on both sides.
- The arrangement of these ADLs is made in such a way as to bring the activity with the lowest oxygen expenditure, or sleep, back to the lower end of the line. Going up along the line vertically, physical activities with increasing energy expenditure are listed, in ascending order, up to the upper end, at which we find the fast uphill walk. The subjects are asked to indicate with a dashed line on the line the point corresponding to the physical task that causes them a feeling of dyspnea such as to require the suspension of the activity.

Oxygen Cost Diagram (OCD)

- The administration of the OCD takes only 1-2 minutes to complete; the score, as for the more common Visual Analogue Scale (VAS), is calculated with the aid of a millimeter ruler. The scale was designed to obtain an assessment of the self-reported exercise limitation as an estimate of physical performance. Validation studies of the instrument were carried out in patients suffering from both restrictive and obstructive chronic respiratory disease of varying degrees.
- In patients with obstructive respiratory disease, OCD has been shown to be able to clearly distinguish between different degrees of disease severity; however, longitudinal studies conducted to test the sensitivity of the instrument with respect to variations in the physical condition of individuals have indicated a low propensity to perceive both the deterioration and the improvement resulting from a respiratory rehabilitation program.

Self-assessment questionnaires

- Other very popular tools, specific for the indirect assessment of the ability to perform ADL in patients with chronic respiratory diseases, are the Chronic Respiratory Disease Questionnaire (CRQ) and the St. George's Respiratory Questionnaire (SGRQ).
- In fact, these are tools conceived for the self-assessment of the individual quality of life related to health status (HRQoL), but they include sessions dedicated to understanding the deterioration of the level of well-being due, among other aspects, to the ability to effectively fulfill the ADL.

Chronic Respiratory Disease Questionnaire (CRQ)

- The CRQ is a tool specifically designed to evaluate different aspects of HRQoL in patients with chronic airflow limitations. In one of the 4 components, it focuses on the specific dimension of fatigue related to the performance of common life activities. Subjects are asked to answer 20 questions using a modified 7-point Likert scale; the 20 questions derive from a wide range of questions classified as the most important problems capable of conditioning the psychophysical state of individuals affected by Chronic Airflow Limitations.
- Upon completion of the questionnaire, a global score and partial scores are obtained for the 2 domains of physical function and for the 2 domains of emotional function. The domain of dyspnea is individualized, allowing the individual patient to identify the most relevant activities for their health and to provide an estimate of the degree of dyspnea perceived during their performance. A recent version of the tool also provides for the standardization of this domain.

Chronic Respiratory Disease Questionnaire (CRQ)

- Conceptually, the CRQ was designed to assess the changes occurring in HRQoL level over time in various types of patients (mainly COPD but also cystic fibrosis and asthmatics with allergic rhinitis).
- In the literature there are some studies conducted to test their reliability and validity.
- The Italian version, used long ago, has been translated and culturally adapted, but never formally validated. Currently, 2 versions of the CRQ are used, one of which is self-administered and the second is administered by the interviewer, both of which can be completed in about 20 minutes.

St. George's Respiratory Questionnaire (SGRQ)

- The SGRQ is a self-assessment questionnaire (but it can also be completed through an interview if the patient's cultural level makes reading and interpretation burdensome) aimed at measuring the HRQoL and its variations over time, specific for affected adults. from COPD of varying degrees, asthma and / or bronchiectasis.
- It consists of 50 items divided into 3 components: frequency and duration of symptoms in the last year, physical activities that cause or are negatively affected by dyspnea, psychosocial disorders attributable to the underlying respiratory disease.

St. George's Respiratory Questionnaire (SGRQ)

- The score related to the symptomatology component, consequent to the morbid condition, is attributed on the basis of a Likert scale; to 4 or 5 points. In the remaining 2 components, the score is instead attributed according to a true / false format.
- Upon completion of the questionnaire, a global score and partial scores are obtained for each of its 3 components.
- Each specific aspect of the questionnaire has a specific weight derived empirically in order to provide an estimate of the level of difficulty associated with the symptom or condition described.

St. George's Respiratory Questionnaire (SGRQ)

- Authors suggest the validity of the SGRQ in measuring the unfavorable consequences on living conditions, health and the level of well-being perceived by individuals affected by diseases of the respiratory system. The SGRQ is validated in patients with COPD, asthma and bronchiectasis, but also in patients who are candidates for lung transplantation and with idiopathic pulmonary fibrosis or respiratory failure syndrome.
- Most individuals can complete their compilation in 15 minutes.

Objective evaluation elements Scales for estimating residual ability

- There are no scales for the objective assessment in the field of limitations to the performance of ADL specifically created for patients with chronic diseases of the respiratory system. To be useful in clinical practice, an ADL scale must be tested for its reproducibility, validity and sensitivity, it must be easy to use and well accepted by patients and professionals, as well as sensitive to clinical or environmental variations.
- Among the objective estimation scales of residual functional ability most used also in the population of individuals suffering from chronic respiratory diseases we remember the Barthel Index (BI), the Basic Activity Daily Living Scale by Katz (BADL) and the Instrumental Activity Daily Living Scale by Katz (IADL).

Barthel Index

- The Barthel Index (BI) represents one of the best known tools for evaluating functionality in the rehabilitation field. The tool is based on the evaluation of the patient's performance in the execution of 10 primary ADLs - nutrition, dressing, personal hygiene management, use of toilets, moving from bed to chair and vice versa, walking on level ground, climbing and descending stairs , bladder and alvo control.
- The total score varies from a number of 0 to a maximum of 100 and is made up of variable scores assigned to the individual activities (from 0 to 5, from 0 to 10, from 0 to 15, where the maximum score always corresponds to maximum autonomy) , in relation to the specific weight that each of them reflects in terms of assistance required. However, the maximum score does not want

Barthel Index

- However, the maximum score does not mean that the patient is able to live alone without any support, nor does it certify autonomy in carrying out instrumental ADLs (such as cooking or cleaning one's home). in the clinic and in the community, it takes 20 minutes if the examiner attends the performance of the various activities, and only 5 if the information is obtained verbally from the patient
- The tool was designed to contribute to the need to assess the rability of personal care by the patient suffering from neuromuscular or musculoskeletal pathology (spinal cord pathologies, stroke neurological pathologies worsening rheumatoid arthritis, amputations) in burn victims, carriers of heart diseases and in subjects Senior citizens. In these areas, an instrument of documented reliability and validity appears.
- The use of BI instead in patients suffering from COPD and other respiratory diseases dates back only to the last ten years, but specific validation studies are lacking.

Basic Activity Daily Living Scale di Katz (BADL) and the Instrumental Activity Daily Living Scale di Katz (IADL)

- BADL and IADL, proposed since the 1960s, are among the most used tools in this field.
- The BADL is a scale whose score reflects different levels of autonomy possessed by the individual in 6 human functions of primary importance (dressing, using the toilet, taking care of personal hygiene, moving from bed to chair and vice versa, controlling sphincters, feed).
- The IADL is a scale used to estimate the ability to perform activities that are normally also carried out by elderly people or individuals with limitations of ability and considered necessary for the maintenance of their independence. They are two valid objective tools for classifying heterogeneous groups of people suffering from chronic diseases with levels of residual ability and similar health needs. The scores assigned to each activity tested are dichotomous (1 = independent; 0 = dependent).

Basic Activity Daily Living Scale di Katz (BADL) and the Instrumental Activity Daily Living Scale di Katz (IADL)

- The administration of the BADL, possible both in the clinic and in the community, takes 20 minutes if the examiner attends the performance of the various activities, and only 5 if the information is obtained verbally from the patient.
- Administration of IADL in a clinical setting is generally possible based only on information obtained from the patient, as some activities are only feasible in the community.
- In the face of a lower flexibility demonstrated compared to BI, from the clinical point of view BADL and IADL represented the attempt to build 2 scales capable of defining, for each activity, significant differences associated with the score, whose intrinsic hierarchy makes it possible to classify the global functional status of large populations of individuals (adults or children, physically or mentally disabled, institutionalized or not).

Basic Activity Daily Living Scale di Katz (BADL) and the Instrumental Activity Daily Living Scale di Katz (IADL)

- his feature makes these tools effective in comparing groups and evaluating longitudinal studies, identifying long-term variations in the level of residual ability; less fruitful is their use to estimate the response to rehabilitation or assistance interventions in the short-medium term.
- Screening and investigation tools are also considered, helping to define the health needs of the elderly and / or disabled population and to assess their satisfaction; in this perspective the BADL, in particular, appears to be a useful tool for defining strategic objectives of a health or social service, for the management and planning of interventions, for research and teaching in the socio-health sector.

Monitored functional assessment tools

- From the point of view of the healthcare professional, in addition to having a measure of the patient's basic functional capacity, it is also essential to be able to observe the techniques adopted spontaneously by the individual to cope with the stress associated with the various activities. These objectives can be achieved by monitoring some significant parameters during the performance of one or more activities identified by the individual as problematic.

Monitored functional assessment tools

- Parameters that can be easily monitored during the performance of a specific activity aimed at a functional assessment of the patient should always include heart rate and respiratory rate, oxygen saturation, the amount and duration of interruptions made necessary during the assessment. and the recovery time n required to return to resting values
- Particularly useful are the individual estimates of dyspnea and fatigue, which can be obtained through scales designed to assess the extent of these symptoms at a precise moment and possibly after some time, in order to denote the variations in measurement in these parameters. with respect to the basic condition.
- The most common tools that can be used for this "objective are the Baseline / Transitianal Dyspnea Index (TDI) and the Borg scale, both tools have been validated and are currently adopted in the evaluation of subjects suffering from morbid conditions affecting the respiratory system.

Modified Medical Research Council Dyspnea Scale

- The level of physical activity necessary to exacerbate the sensation of dyspnea is instead the goal of the Modified Medical Research Council Dyspnea Scale (MRC), which is part of my larger tool designed for epidemiological purposes.
- This scale, self-administered by the patient, is also validated in individuals suffering from various respiratory diseases.

Monitored functional assessment tools

- Additional evaluations, although very useful, that can be carried out by the rehabilitation professional include observation of the patient's characteristic breathing pattern, the type of posture maintained, the mechanics of movement and the spontaneous rhythm with which the activity is carried out (pacing), as well as the emotional state possibly exhibited by the patient.
- Other components of complementary assessment are then muscle strength, the ability to express aerobic work and the range of motion of some parts of the body particularly involved in activities deemed problematic by the individual.

Monitored functional assessment tools

In general, all monitored functional assessments highlight the patient's monitored difficulties and help identify the need for one or more of the following interventions useful for relieving individual discomfort:

Acquisition of an alternative technique for carrying out the problematic activity (for example, through a more efficient use of body districts, cheaper breathing, pacing more suited to individual characteristics),

Adaptation of tools in use or adoption of specific aids;

Prescription of long-term treatments (for example, OLT);

Recourse to the assistance of a "resource" person.

ASSESSMENT OF DOMESTIC ENVIRONMENTS

- The evaluation of domestic environments has the general objective of evaluating the accessibility to environmental units and the usability of the environments in which primary and secondary ADLs of specific interest to the individual take place mainly.
- An exhaustive analysis of this aspect requires specific technical skills which, in the Italian cultural model, are often not the patrimony of most of the healthcare personnel involved in the treatment of patients with respiratory diseases, if only for the fact that the concepts of accessibility and usability of the environments have developed having as a reference motor disabilities with different characteristics than those presented by the patient who complains of dyspnea and fatigue as symptoms of limitation for their activities.

ASSESSMENT OF DOMESTIC ENVIRONMENTS

- The presence of an architectural barrier in the living environment therefore prevents the possibility of accessing that minimum ceiling of unconditional mobility which is meaning, if not a symbol of life itself. On the contrary, the elimination of existing barriers creates an increase in the quality of life for the whole community, as well as for those who live with permanent limitations of their autonomy, which is accompanied by the advantage of being able to have facilities for individuals affected by temporary disabilities.

ASSESSMENT OF DOMESTIC ENVIRONMENTS

- The general criterion of accessibility in domestic environments is therefore to design spaces, paths and aids calibrated to offer greater autonomy of movement to a particular user, but also with favorable repercussions on the quality of life of an enlarged user. The backbone of the legislation in this sector is represented by two legal texts (D.M.n.236-1989; D.P.R.n.5031996), from which it is also possible to draw some explanations about the terminology in common use in this area.
- The term accessibility means the possibility, even for people with reduced or impeded motor or sensory ability, to reach a building in its individual real estate and environmental units, to enter it easily and use its spaces and equipment in conditions of adequate safety and autonomy.

ASSESSMENT OF DOMESTIC ENVIRONMENTS

- By visitability we mean the possibility, for the same people, to access the relationship spaces (the living room of an accommodation and the workplaces) and to at least one toilet in each real estate unit.
- The term adaptability means the possibility of modifying the built space over time at limited costs, in order to make it completely and easily usable also by these same individuals. Therefore, if accessibility expresses the highest level of adaptation, visitability represents a level of accessibility limited to a more or less extended part of the building and adaptability appears instead as deferred accessibility.

ASSESSMENT OF DOMESTIC ENVIRONMENTS

- The aforementioned regulations detail the minimum requirements indispensable in order to decree the accessibility of a building; they have been conceived keeping in mind an enlarged user which contemplates, although not limited to them, the needs of people with limitations of the abilities consequent to cardio-respiratone pathologies.
- Specific reference must be made to these regulations each time the living, working and leisure environments of subjects suffering from chronic respiratory limitations are evaluated, in order to adapt to the needs of the individual.

CONCLUSIONS

- The use of tools for assessing the specific disability referred to the activities of daily life seems to us a question of doubtful question in the general panorama of rehabilitation. The tools available, both subjective and objective, appear to be indispensable for a careful identification of the patient's residual resources and deficits, but also for the identification of individual needs.
- This process represents the first step through which to arrive at the development of a treatment plan (rehabilitation) that is truly calibrated on the priority needs of the individual.

CONCLUSIONS

- This peculiar interest in the assessment of ADL is now spreading in the respiratory rehabilitation sector. Although the studies are still limited and of preliminary value, they suggest at least the inclusion of specific assessments to identify the difficulties in performing ADL in the chronic respiratory patient population, in order to evaluate the appropriateness of a specific program aimed at this. functional recovery.

CONCLUSIONS

- Finally, the application of this type of intervention could provide patients with specific and fundamental tools to optimize the self-management of their disease, not only during the treatment period, but also and above all within the home environment: result which could also translate into an improvement in the individual psychophysical condition, in the reinforcement of self-esteem and, therefore, in a global benefit on one's quality of life.

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Assessment of Quality of Life

Patient-Reported Outcomes: A Long Tradition in Pulmonary Rehabilitation

- A patient-reported outcome (PRO) is “any report of the status of a patient’s health condition that comes directly from the patient, without interpretation of the patient’s response by a clinician or anyone else”
- There is a wide range of PROs from single questions on specific symptoms (e.g. shortness of breath) to multi-item questionnaires that capture aspects of health that influence a person’s quality of life (i.e. health-related quality of life). PROs have a long tradition in the evaluation of pulmonary rehabilitation, and they have been used for years before they entered research in other clinical areas such as cardiovascular medicine, cancer or diabetes

PROMs

- There are a number of purposes to use PROs.
- The most common use in the context of pulmonary rehabilitation is to assess the difference between the beginning and the end of the rehabilitation program in order to quantify its effects (“evaluative” purpose). For evaluative purpose, PRO instruments need to yield reproducible scores (i.e. good test-retest reliability) and be able to pick up the change between the beginning and end of pulmonary rehabilitation (i.e. be responsive).

PROMs

- PRO instruments vary widely with respect to their responsiveness, and it is of great importance to choose a responsive instrument to avoid false-negative results because the instrument was not able to pick up change.
- PROs may also be used to predict the probability of success of pulmonary rehabilitation or to predict outcomes of patients with COPD (e.g. exacerbations, mortality) more generally ("predictive" purpose). While the evidence is not strong to support the use of PROs to predict the success of pulmonary rehabilitation and identify individuals who may benefit most, some PROs (e.g. dyspnoea, physical activity or symptoms of anxiety or depression) are predictors of outcomes and have been included in prognostic scores

PROMs

- Virtually all PRO instruments used in the context of pulmonary rehabilitation and clinical research in general are fully structured questionnaires, i.e. with predefined questions and answer options. Most of them can be completed by patients themselves, while some require an interviewer
- They range from specific symptoms in specific situations (e.g. shortness of breath when walking) up to constructs like disease-specific or generic (i.e. not disease-specific) health-related quality of life.
- Single items (i.e. individual questions and its predefined answer options) can be used to address specific symptoms such as the modified Medical Research Council (MRC) dyspnoea scale.
- However, many symptoms (e.g. shortness of breath or fatigue) are multifaceted so that a certain number of items are necessary to capture them and express the extent of those symptoms by domain scores.

PROMs

- However, many symptoms (e.g. shortness of breath or fatigue) are multifaceted so that a certain number of items are necessary to capture them and express the extent of those symptoms by domain scores.
- As more symptoms or limitations are addressed, more items are needed that are typically summarized in separate domain scores (e.g. symptoms activity and impact domains of the SGRQ) or in a ore inclusive score (e.g. physical functioning of the Short Form Health Survey 36 [SF-36] or SGRQ total score).

PROMs

- The latter reflects more abstract concepts such as health-related quality of life that are not directly measured but that reflect the patients' perception of the physical, psychological and social burden associated with a specific disease (i.e. disease-specific healthrelated quality of life) or health (i.e. generic health-related quality of life) more generally.
- It is important to remember though that most instruments ask about specific symptoms or limitations and not about these more abstract constructs directly, which are difficult to assess in a standardized way across patients.

Introduction

- In recent years, an interest in everything related to Quality of Life (QoL) has gradually developed. In the medical field, scientific interest has been directed towards those pathologies which, due to their severity or chronicity, not only have effects on the functionality of a specific organ, but also on the activities of daily life and on the perception of health: ultimately on those pathologies that appeared to deteriorate patients' QoL the most.
- In the pulmonology field, studies have focused mainly on COPD. This is due to the fact that it is a chronic and "incurable" pathology: consequently, the effectiveness of the treatment must be seen as an improvement in the level of disease, rather than as a degree of real curability.

Introduction

- The treatment of these patients should then be directed towards the prevention of symptoms and exacerbations, minimizing the effect of the disease on the patient's overall health status, ultimately determining the objective improvement of QoL, or at least avoiding its worsening.
- Moreover, with the progressive increase of the average life span, currently there are more and more elderly patients, who tend to be affected by more than one pathology and present increasingly marked degrees of disease. In particular, when FEV1 falls below one liter, there is a rapid increase in the impact of the disease on the patient's daily life and well-being with a reduction in normal activities.

Introduction

- As a consequence, over time the concept of "rehabilitation" has become increasingly popular, the aim of which is essentially to improve the state of health of patients. From this point of view, the effect of therapy on the patient's well-being and daily life represents the most important subjective result of the treatment. However, the measurements normally used as an index of functional damage correlate poorly with QoL and therefore provide an incomplete picture of health status.

Definition of the QoL

- The terms "Quality of Life" and "State of Health" are often used interchangeably. In fact, the difficulty of researchers in characterizing the quality of life is evident, as each could theoretically give its own definition.
- The simplest approach is to define it as the gap between what is desired and what is achievable. However, each of us has unfulfilled desires, especially when a chronic disease such as COPD is present, so that, in the context of medicine, the term "health-related quality of life" is used to indicate the distance between what is desired. and what is possible to achieve due to limited health. However, even this definition is too general, since one patient's wishes may differ from those of another.

Definition of the QoL

- A more practical definition is that which sees quality of life as "quantifying the impact of the disease on everyday life and well-being, in a formal and standardized way".
- This definition underlines the importance of having "standardized" questionnaires.
- However, since the subjects are not all the same, it may be difficult, or even impossible, to quantify QoL in a standardized way, so the term "Quality of Life" should be reserved for individual case discussion.
- On the contrary, what can be provided is a reliable measurement in the specific patient population to which the subjects belong, which can best be defined as the "Measure of Health Status". In current practice, however, the expression "Quality of Life" has prevailed in the meaning of "Measurement of the State of Health".

Questionnaires on Quality of Life

- The QoL questionnaires essentially consist of a series of questions or statements (items) that are self-administered by the patient himself or collected by an interviewer directly or by telephone.
- Responses can be dichotomous (for example, the patient chooses between true and false), or expressed on an Analog-Visual Scale (VAS), or on Likert-like scales, generally at 3-5 intervals (for example, absolutely true, true, indifferent, false, absolutely false).
- Basically, the groups of questionnaires that can be used in the assessment of quality are due, the generic ones and those specific for pathology.

Questionnaires on Quality of Life

A questionnaire, be it generic or specific for a given pathology, must have certain properties. In particular it must:

- measure health;
- being able to differentiate between different levels of health in different patients;
- be repeatable;
- be sensitive to clinically significant changes in the health of the same subject;
- be relatively short and simple;
- be validated.

Generic questionnaires

- Generic questionnaires measure health disorders without taking into account the causes. These questionnaires have the advantage that their reproducibility and validity have been verified in different pathologies
- However, they have not been specifically designed for COPD patients and are therefore not adequately sensitive to clinically significant changes in health resulting from treatment.

Sickness Impact Profile

- I Sickness Impact Profile (SIP) - of which there is an Italian version - contains 136 items divided into 12 categories, from which 3 different scores can be generated: total, physical activity, psychosocial activity.
- There are 3 categories that make up the physical dimension, while 4 make up the psychosocial one. All 12 categories together produce a total score, which is transformed into a scale from 0 to 100: the highest score indicates a worse state of health.
- SIP represents a valid measure of general health impairment in chronic airflow limitation, especially in patients with an FEV1 <50% predicted.

Short Form 36

- Another generic health questionnaire is SF-36 (Short Form of the Medical Outcome Study, MOS).
- Its 36 items are divided into 8 dimensions: physical activity, role limitation due to physical problems, physical pain, general health, vitality, social activity, role limitation due to emotional state, mental health, plus a single question on whether change in health status in the past year.
- Each dimension is then calculated separately and then transformed into a scale from 0 to 100, where the lowest score indicates a poorer level of health. In addition, the categories for the physical and mental components are then calculated separately to produce two "super scores": the Total Physical Component Summary (PCS,) and the Total Mental Component (Meritai Component Summary, MCS).
- The SF-36 is easier to use than the SIP, although it requires a computerized scoring program. It was originally validated in 11,186 subjects and was shown to be a valid measure of health status in COPD patients. There is also an Italian version of this questionnaire.

EuroQol-5D

- Another measure that has entered the respiratory field quite recently is the EuroQol-5D, a questionnaire that has two components, a visual scale and a self-administering questionnaire (The EuroQol Group, 1990).
- The questionnaire covers 5 dimensions: mobility, selfcare, usual activities, pain / discomfort, anxiety / depression. On the visual scale, various health states can be self-rated from best (I-one) to worst (0 zero) health.

Specific questionnaires

- However, the generic questionnaires are not very sensitive and precise. To increase sensitivity, disease-specific questionnaires were created.

Chronic Respiratory Questionnaire

- The first specific questionnaire for COPD patients was the Chronic Respiratory Questionnaire (CRQ)
- The CRQ is for COPD patients only. It has 4 categories of items: shortness of breath (patients choose 5 items that determine dyspnea from a list of 26 activities), fatigue (4 items), emotional function (7 items), mastery or sense of control over the disease (4 items) .
- The questionnaire is administered by an interviewer and takes approximately 20 minutes to complete. Patients respond to each item using a 7-point Likert-type scale, where the highest score indicates better health.
- This questionnaire has been shown to be reliable, that is, to be able to differentiate between different levels of health in different patients, and to be sensitive to changes in health related to therapy.
- The CRQ has been used extensively in the respiratory rehabilitation field.

St. George's Respiratory Questionnaire (SGRQ)

- The St. George's Respiratory Questionnaire (SGRQ) was created specifically with the aim of having a more sensitive measure of health for use in respiratory conditions, both asthma and COPD.
- It is applicable in clinical and pharmacological trials and, generally, in long-term studies.
- The SGRQ is completely standardized. It is made up of 50 items (with 72 possible weighted responses) divided into 3 sections: symptoms (8 items), or clinical symptoms; activity (16 items), which concerns the activities that cause or are limited by dyspnea; impact (26 items), a measure of the subjective consequences of respiratory disease on daily life and well-being.
- In addition to a score for each component, there is also a total score for assessing the patient's overall respiratory health: their range is from 0 (best level of health) to 100% (lowest level of health). A change in score over time of at least 4 points is considered clinically significant

St. George's Respiratory Questionnaire (SGRQ)

- The SGRQ is self-administering or administrable by telephone interview and takes about 15 minutes to complete. LI SGRQ exhibits good repeatability and sensitivity: it was twice as sensitive as SIP in measuring the types of response to differences in disease activity among patients.
- It is available throughout Europe, in North and South America, in some countries of Eastern Europe and the Far East. Obviously there is also a standardized Italian version.
- The SGRQ has two main differences with the CRQ: it is applicable to both asthmatic and COPD patients and does not use a Likert-type scale for the item score.
- Conversely, patients are forced to decide between true and false in most responses. In this way, the problem of any semantic differences was solved.

Maugeri Foundation Respiratory Failure Questionnaire

- The Maugeri Foundation Respiratory Failure Questionnaire (MRF-28) is a 28-item questionnaire.
- It was created to measure the impairment of health status in patients with Chronic Respiratory Failure (CRF), without reference to the underlying disease (COPD or kyphoscoliosis), treatment (oxygen therapy or long-term mechanical ventilation), age or gender.
- It is made up of 3 specific factors. The first 'daily activity' factor is associated with disability due to shortness of breath in everyday life, a common element of QoL questionnaires for 'and respiratory diseases.
- The other 2 factors represent the unique feature of MRF-28: "cognitive function", which correlates with the effects of impaired cognitive function on daily life and "disability", which is related to the patient's inability to make efforts, to the experience of social isolation or dependence on others.

Maugeri Foundation Respiratory Failure Questionnaire

- MRF-28 appears to be able to discriminate between different levels of health impairment better than existing questionnaires. In particular, the distribution of its score is wider than that of the SGRQ or SIP.
- The properties of MRF28 measures suggest that it may be a more discriminatory tool for CRF patients than existing measures.

Meaning of "clinically significant change"

- In assessing the health status and impact of various therapeutic interventions, it is very important to know the clinically significant threshold or the minimum clinically significant difference.
- These two concepts reflect the judgment of physicians and patients and have more practical significance than statistically significant variation.
- Current studies have shown that a difference of 4 units for the SGRQ and 0.5 units for the CRQ can be considered clinically meaningful minimal difference.

HOW TO CHOOSE A QUESTIONNAIRE OF QoL

- Whenever you feel the need to use a QoL questionnaire in your patients, you need to know which is the most suitable tool to use. Consequently, you need to know or inquire about the characteristics of the tools available There are several characteristics to take into consideration.
- Once we have verified that the tool we intend to use has been validated, we only need to make sure that the validation has also been cross-cultural, i.e. that the questionnaire has been correctly adapted to the Italian situation.

HOW TO CHOOSE A QUESTIONNAIRE OF QoL

- The choice between generic questionnaires and specific questionnaires is related to the purpose of measuring the QoL. In general, if you want to compare different pathologies or if the purpose is to evaluate the general health status of a population, perhaps comparing it with that of "healthy" subjects, then a generic questionnaire may be sufficient.
- On the contrary, if the main purpose is to evaluate how the state of health is altered by a specific pathology or if a particular therapy or treatment is able to modify the QoL, then it will be necessary to use specific tools. In our practice, however, we prefer to use an association between the two types of questionnaire

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PRACTICAL TEACHINGS FOR THE
REHABILITATION PHYSIOTHERAPIST

Treatment techniques in respiratory physiotherapy

Introduction

- The literature on the efficacy of respiratory physiotherapy is richer and more detailed than one might believe, but the studies are small, they proceed in no particular order with little overlap of the drawings.
- Some techniques have passed the test of their effectiveness (Postieaux ELTGOL, Chevaillier Autogenic Drainage), i.e. they do what they say and say what they do, but almost all of them are difficult to test in serious studies, not least for the fact that they do not it is ethical to treat someone with physiotherapy alone and someone with drugs alone.
- In the international guidelines you will see that respiratory physiotherapy appears in many integrated pathways among non-pharmacological interventions even if few with level A evidence, such as COPD, Cystic Fibrosis, Medullary Injury, Burns, Cardiothoracic Surgery, and others .

Introduction

- This is inevitable because the functional component of the state of health (i.e. the endurance capacity of daily activities) is directly proportional to the ability to nourish the organs in terms of oxygen.
- If we consider the technical components as lego bricks, respiratory physiotherapy uses very few of them, probably not reaching 10 manual techniques and 10 standardized instrumental techniques; however, it is essential to use and combine these elements in a reasoned way, based on the physiological mechanism and natural history of the disease, to put it with a teacher, Jean Roesler of the University of Leuven "Respiratory physiotherapy requires a" clinical wisdom "that rarely uses difficult, however, the choice of technique and its adaptation from time to time to the condition of the patient require knowledge, know-how and know-how to be very extensive and precise ".

Manual respiratory physiotherapy

- By "breathing exercises" we mean the set of interventions that make up "manual respiratory physiotherapy": breathing with parted lips, active exhalation, slow and deep breathing, relaxation techniques, adapted body positions, for example the modified quadruped (forward leaning), inspiratory and expiratory training and diaphragmatic breathing.
- The purpose of all these exercises varies considerably from one to the other and may concern: increased ventilation (loco-regional) and gas exchange, reduction of dynamic hyperinflation, improvement of respiratory muscle performance, reduction of dyspnea, increase of tolerance to exercise and improve the quality of life. Physiotherapy also employs a number of techniques to increase mucus drainage in the airways, including assisted cough and forced exhalation, manual thoracoabdominal compression, postural drainage, manual or mechanical percussion / vibration of the chest, positive pressure breathing and positive pressure. oscillating "

Manual respiratory physiotherapy

- The previous definition is very broad and very dispersive but well reflects the "state of the art" of non-instrumental respiratory physiotherapy. In fact, each of us learns and applies holds, pushes, compressions and sequences of procedures that derive from a light scientific smattering and from a substantial "professional" experience that is transmitted from teacher to student in a little or very little codified way.

Manual respiratory physiotherapy

- Respiratory physiotherapy was born in the United Kingdom after World War II and established itself very quickly in the healthcare environment, given the clinical weight of respiratory complications in every area and age group; becomes the "disciplinary sector" of physiotherapy with Postural Drainage, born in Chelsea Royal Brompton Hospital by the legendary Jennifer Pryor and Barbara Webber. Yet, despite its age, Postural Drainage has only been examined in a "scientific" way in recent years.

Manual respiratory physiotherapy

- The Anglo-Saxon environment remained faithful to itself, continuing to affirm the role of "Chest Physiotherapy", which in fact is much more present in the literature than the Francophone techniques, but developed in "mixed" directions, whose main product is the Active Cycle of Breathing Tecniques (ACBT) born again at Brompton Hospital by Jennifer Pryor.

Respiratory physiotherapy

- In the meantime, instrumental respiratory physiotherapy was already a health reality thanks to the PEP Mask and the results of the trials on unblocking in Cystic Fibrosis. With the introduction of the concept of Expiratory Pressure in all its variables of application (and the observation that nature has already predisposed this same mechanism as compensation for chronic bronchial obstruction), physiotherapy followed the treatment of respiratory insufficiency and entered in health teams of increasingly acute conditions, up to the Intensive Care Unit, around 2000.

Respiratory physiotherapy

- In 1996 a book by the American physiopathologist John Bach was published which profoundly revolutionized respiratory physiotherapy by introducing "the search for the defect" in the chain of events that constitutes the natural history of the disease: in fact, up to that moment, respiratory physiotherapy was only concerned with diseases obstructive (COPD and Cystic Fibrosis) by transferring the same techniques to all other conditions, obstructive or not. Bach, in collaboration with the Belgian Philippe Soudon, proposes pathophysiology as a basis for elaborating the treatment and attributes to hypoventilation disease (in particular of neuromuscular origin) its separate dignity and an Evidence Based approach

Respiratory physiotherapy

- In the new millennium the combination of manual and instrumental treatment, the contribution of the best knowledge of the physiology of ventilation and the "functional" approach introduced by Bach in mechanical ventilation gain the physiotherapist the field of neuromuscular respiratory insufficiency, which also inaugurates the path " chronic ”of the patient ventilated at home.

Respiratory physiotherapy

- In the general confusion of schools and theories, the Consensus Conference on Manual Respiratory Physiotherapy, which took place in Lyon in November 1994, tried to offer a common basis, codifying the interventions and techniques according to the main physiological and pathological mechanisms underlying them. This flow chart based on the “chain of defect” is still considered valid today

Respiratory physiotherapy

- A similar Conference, held the following year, set itself the purpose of coding the instrumental treatment means, bringing each device back to its basic physiological principle. The most useful result was the interpretation in a physiotherapeutic sense of clinical data hitherto of exclusive medical prerogative, such as the measurement of PEF for the efficacy of cough or the interpretation of arterial blood gas analysis to distinguish the components of ventilation and exchange. in the treatment of respiratory failure.

Respiratory physiotherapy

- With the spread of physiotherapy in the Critical Area, Europe increases its distance from the United States, regaining the overall vision of the patient and, reshaping the distinction "Physiotherapist" / "Respiratory Therapist", arrives at the Consensus Conference for Adult with Critical Illness in 2009 promoting this flow chart on bronchial clearing.
- In the foreground there is the global care of the patient: traditional global treatments (positioning and mobilization), respiratory instrumentation of all kinds - from the simplest (Positive Expiratory Pressure - PEP) to the most complex (Intrapulmonary Percussive Ventilation - IPV, High Frequency Compression - HFC) - and the set of manual techniques in a reasoned guide that completely incorporates the concept of choosing the intervention based on the underlying deficit.

Respiratory physiotherapy

- Respiratory physiotherapy is now recognized as one of the non-pharmacological treatments recommended in a wide variety of acute and chronic diseases, and is the subject of many clinical studies around the world.
- However, the variety of names and descriptions of the applied techniques makes it difficult to identify the sources and superimpose the study designs, just as the means to measure the effect and the way in which this measure is reported are far from each other. Despite the more than 4000 items found in a systematic search, the incipit that is most frequently encountered in discussions remains "There is a lack of evidence ....."

Respiratory pathologies

They can be divided into two different types.

- Restrictive whereby the lung is unable to expand normally due to anatomical or functional impairment of the rib cage or pleural cavity. The main causes are: respiratory paralysis, thoracic trauma, congenital or acquired skeletal malformations, pleural adhesions, pneumothorax.
- Obstructive characterized by a reduction in ventilation caused by an obstacle that prevents the entry of air into the lungs, as in the case of the presence of foreign bodies or due to tumors or other diseases such as bronchitis, pneumonia and bronchial asthma.

Obstructive pathologies

- Obstructive diseases (or chronic obstructive pulmonary diseases - COPD) are chronic diseases that cause, as the name suggests, an obstruction of the airways. This obstruction usually results from irreversible damage to the pulmonary acini (the structures of the lungs in which respiratory exchanges take place) or to the bronchioles (the last branches of the bronchial tree).
- Contrary to restrictive pathologies, chronic obstructive diseases increase distensibility and reduce lung elasticity. For this reason, the difficulty does not concern the inspiratory phase, but the expiratory one.
- Expiratory difficulty and the formation of a barrel chest are the classic symptoms of obstructive pathologies. The so-called "barrel chest" is an alteration of the structure of the rib cage characterized by an increase in the transverse diameter and the anterior-posterior diameter.
- The main diseases of this type include asthma, bronchiectasis, bronchiolitis, chronic bronchitis, chronic obstructive pulmonary disease (COPD) and pulmonary emphysema. Some cancers can also lead to chronic obstructive lung disease.

Restrictive pathology

- Restrictive lung diseases reduce the distensibility of the lungs, compromising lung expansion and thus causing fatigue and a reduction in lung volume.
- Furthermore, restrictive pathologies lead to an increase in elasticity and inspiratory difficulties.
- Symptoms vary depending on the specific pathology. However, dyspnea is one of the most common symptoms. Dry cough, chest pain, muscle weakness, fatigue, wheezing or traces of blood in the phlegm are some of the signs that may indicate the onset of a restrictive lung disease.
- Among the restrictive diseases and other diseases that can lead to restrictive lung disorders, we remember: asbestosis, kyphosis, pleural fibrosis, pulmonary fibrosis, fibrothorax, myositis, obesity, neuromuscular diseases of the respiratory muscles (see also respiratory disease in neuromuscular and osteoarticular), pneumonia, scoliosis, silicosis, respiratory distress syndrome, ankylosing spondylitis, tuberculosis.

Description of Mucus Clearance Techniques

- More recent mucus clearance techniques are based on the observation of the physiology and pathophysiology of the respiratory system and use physical principles aiming to change rheological proprieties of mucus, to splint open (or re-open) airways to gain volume, to vary gas flow modulating pulmonary pressures, lung volumes and compressive forces.
- In fact, the rhythmic ciliary metachronism slowly moves the mucus in a cephalad direction and its action is higher in the peripheral airways, while expiratory airflow exerts shear forces on the air–liquid interface between airflow and the mucus layer (two-phase gas–liquid transport) resulting from the combination of the above factors promoting higher displacement of secretions in the central airways

Description of Mucus Clearance Techniques

- In general, each intervention to help airway clearance aims to collect and mobilize mucus in a cephalad direction and to facilitate elimination by cough, or forced expiration (huff) or suctioning.
- Depending on the aim of the study or review, authors classify mucus clearance techniques by principles of action (positive pressure, percussion, vibration…) or by the use of devices or not.
- However, a functional classification by “level of action” could be more useful to guide the selection of mucus clearance technique in clinical practice: those promoting the recruitment of lung volume, those supporting the mobilization of mucus from peripheral to upper airways, and those facilitating the elimination of mucus from upper airways by expectoration or deglutition

DRAINAGE TECHNIQUES: TRACHEAL CLEANING

- In a restrictive patient with bronchial stagnation, the first therapeutic step is the emptying of the trachea. Then, if it remains cluttered, peripheral drainage techniques are used followed in turn by a new tracheal cleaning. This logical approach, which distinguishes tracheal cleaning and peripheral drainage - distinct but chronologically complementary techniques - is of essential interest in restrictive patients.
- Obstructive patients (COPD, mucoviscidosis) have normal strength. Their effective cough promotes both tracheal cleansing and peripheral drainage, making it unnecessary and sometimes obscure to distinguish between these two actions. On the other hand, in severe restrictive secretions, secretions stagnate at the base of the trachea where they induce a cough reflex, but the insufficiency of the cough itself causes the secretions to flow towards the glottis but cannot go beyond it and eventually fall back towards the keel.

TRACHEAL CLEANING

- This cough - completely ineffective - makes the patient very tired. Some very bulky patients are even prescribed mucolytics which, paradoxically but logically, still increase the amount of secretions and therefore the bulk.
- In neuro-restrictive patients, the absence of cough must therefore be replaced by an active tracheal emptying, regardless of any complementary distal actions.

TRACHEAL CLEANING

- There are many techniques that have in common the aim of emptying the proximal bronchopulmonary area, that is, the space between the lower face of the glottis and the first bronchial divisions. The diameter of these bronchi is such that the vibratory cilia no longer have any mechanical activity and therefore only the active cough allows the propulsion of secretions to overcome the glottic barrier.
- Tracheal cleaning is essential for patient comfort but also to avoid desaturation linked to obstruction of the large bronchi. Since the patient is almost totally passive, techniques based on the help of the therapist and his material will be preferred.

Methods that are unsuitable or not always available:

- Obtaining the cough reflex by digital stimulation of the suprasternal fork is a common method in neurology and, more generally, in the child. In restrictive patients (even in pediatrics) this is completely useless because there is no deficit of the cough reflex, and moreover it is contraindicated because the cough produced is ineffective, tiring and only manages to concentrate large quantities of secretions in the trachea. , favoring important desaturations.
  It may be tempting to use general mucolytics to thin the mucus and promote expectoration. In practice, however, the only effect will be to increase secretions which, in the absence of other active unblocking techniques, will jeopardize the restrictive that is unable to cough.

Methods that are unsuitable or not always available:

- A method of increasing the inspired volume, the Frog (or batrachian breathing) is based on the possibility that some people have - such as frogs - to actively push the air towards the trachea with small repeated movements of the mouth. If the maneuver is fast enough they are able to fill the lungs by several centiliters and thus generate an acceptable tidal volume. It is a very useful feature in respirator-dependent patients in the event of a sudden failure. While the ability to convey air into the stomach and release it in a more or less modulated way (the esophageal voice of laryngectomees) is quite common, there are few people who know how to spontaneously convey air into the trachea. So it is a technique that requires learning, and some therapists are able to teach it. Although this technique is interesting for reinforcing the safety of ventilator-dependent patients, we place it here because unfortunately it is not practicable by everyone.

Methods that are unsuitable or not always available:

- The Coflator is a device that performs a passive and massive mechanical aspiration of the trachea. In the first phase, the machine supplies a pretussive volume to the patient who is allowed to insufflate. Then it produces a very strong depression in a very short time: it generates an expiratory flow up to peaks of 400 l / min which ensures tracheal emptying. The pressures generated before and during aspiration are adjustable to avoid an unpleasant massive collapse of the trachea. Many authors confirm the clinical interest of the Coflator.

Assisted cough

- in literature “Manually Assisted Cough” (MAC) or “Enhanced
- Cough ". It consists of a very energetic and medium-amplitude thoracic or thoracic-abdominal compression that aims to increase the intrathoracic pressure to obtain a cough-like flow, therefore a peak expiratory flow (PEF) greater than 270 liters / minute (it is physiological beyond 400 liters / minute).
- It is always a bilateral maneuver and can be practiced by one or two operators depending on the anthropometric relationship between therapist and patient. It is the preferred technique to compensate for the strength deficit as long as the patient has normal functioning larynx and vocal cords, otherwise the combination with instrumental unblocking must be envisaged.

Assisted cough

- Starting from the principle that the efficacy of cough is linked overall to a sufficient peak of expiratory flow, the aim we want to achieve is to accelerate the speed of the air exhaled to the mouth to the maximum. The techniques that can be used can be grouped into two broad categories: those that increase the flow by increasing the pretussive inspired volume (forced insufflation) and those that increase the flow by facilitating the exit of air (assisted exhalation)

Assisted cough

- Help in inhalation ("air stacking") When the MEP falls below 50 cm H2O, the expiratory flow depends only on the maximum inspired volume and therefore the technique is based on allowing the patient to inhale as much air as possible before coughing .

a) Without positive pressure. It is an old-fashioned method made obsolete by the advent of the BIRD but always useful when there are no other possibilities. It is a four-step ventilation that requires a very cooperative patient because it requires a rather long inspiratory apnea:

* maximal inspiration in dorsal decubitus

* apnea at the end of expiration

* complementary thoracic expansion with closed glottis with further short inhalation accompanied by the therapist with abdominal compression in the distal direction

* active exhalation or cough with chest and abdominal compression

Assisted cough

b) With ambu balloon insufflation by insufflating the patient with an additional volume towards the end of his spontaneous inspiration. The same thing can be done with any positive pressure device as long as the pressure is close to 30 cm H2O. The expiratory phase will be reinforced by manual help. Fig. 6 shows the increase in PEF with the administration of insufflation: in healthy subjects by increasing the inspired volume from 2100 to 3470 ml, the PEF goes from 288 l / min to 477 l / min. In Duchenne, increasing the inspired volume from 500 to 1200 ml brings the PEF from 108 l / min (ineffective cough) to 246 l / min (weak but functional cough). Furthermore, the increase in PEF is also due to the "free" elastic retraction pressure that we provided to the patient

Assisted cough

c) With mechanical insufflation (ventilator) In patients ventilated non-invasively by tracheostomy with volumetric ventilator, it is possible to teach to breathe several consecutive volumes of air without exhaling to have a large volume of air on exhalation; all without having to change the fan setting.

Assisted cough

- Help on exhalation

There are several studies showing that the effective cough limit is around 50 cm H2O of MEP, so manual compression must develop a force equal to the amount of pressure the patient needs to reach this threshold. A well done, synchronized, and cooperative patient compression can easily double the PEF and achieve effective unblocking. We have already seen that strength is not the only component: for example, in a complete obstruction of the trachea or the large bronchi, one can develop normal strength but have no cough due to lack of airflow. In the inspiratory aid flow is then provided, in the expiratory aid the adequate force is provided to the patient.

Assisted cough

Forced expiratory assistance can be implemented with:

a) Synchronous manual, thoracic and / or abdominal compression that we have already seen provide a noticeable increase in PEF. The limitations of the technique are the patient's lack of cooperation and the presence of pain, as well as particular conditions of thoracic trauma.

b) Tracheal pompage. It is a technique born for infants who have the trachea in an extrathoracic position, it can still be good for adolescents, it is almost useless and very

annoying for adults.

c) When patient cooperation cannot be obtained or compression does not generate sufficient flow, bronchoaspiration should be used.

Controlled cough

- In literature Toux Dirigée or Directed Cough
- The basic problem is pain and the therapist's hands "contain" the surgical wound. The patient's ventilatory behavior is guided by the therapist in a verbal (breathing control, huffing) or non-verbal way (deflation, resisted inhalation), keeping the compression as constant as possible. In some reports the Directed Cough is instead the main technique that contains the others as variants.
- A particular modality is the Cough with Variable Volumes which is based on the physiological principle of the formation of the equal pressure point at a predetermined level of the bronchial tree. In fact, a cough at high volumes will create a compression in the proximal airways, with a pretussive volume corresponding to the Residual Functional Capacity a more central compression will form and with the cough carried out in the expiratory reserve volume it will form in an even more distal compartment. Cough with variable volumes can be very tiring, it is justified only in patients with non-hypoxic hypersecretion and intact neuromuscular apparatus, for example in young bronchiectasis.

Peripheral drainage

To obtain the ascent of secretions from the periphery there are many techniques, but it should be remembered that those that use flows and force that the patient himself must generate are not applicable, while all those in which the patient's deficits can be vicariate by the therapist or by means technicians.

While in the tracheal cleaning the aim is to develop flows as high as possible, in the peripheral unblocking the aim will be to homogenize the ventilation to counteract the unventilated areas and microatelectasias and slow expiratory flows will be used in order not to cause collapse of the small airways.

Techniques not very suitable

They are the tiring ones par excellence, in particular

a) low-volume cough, which requires considerable force forced expiratory techniques (TEF) because they require a lot of force and high flows
b) postural drainage, because it is difficult to reach and maintain the indicated positions in the presence of strong deformities or serious injuries; even worse if you want to apply percussion and manual vibrations that the patients do not tolerate; It is therefore better to resort to adjustable vibration generators to gently accompany the expiratory phase.

Techniques not very suitable

c) The flutter because to enter into vibration it needs a minimum flow that is maintained for a few seconds and therefore our patient will exhaust his supply of air long before the device is useful to him. The Flutter is a device that has not obtained the CE mark and its patent has been collected from other companies that produce devices with similar characteristics but with a level of commitment

adjustable.

d) The expiratory brakes, that is the PEP, because it foresees being able to lengthen the expiratory phase (which we have seen to be very expensive!) and keep the exhalation against resistance.

Both flutter and PEP put the patient at risk of fatigue so they are not the first choice of treatment, but they can be very useful in counteracting atelecases in patients who maintain good compensation and acceptable ventilatory flows.

Adaptable techniques

- They are the ones that closely link the concepts of "drainage" and "homogeneity of ventilation"

a) Autogenic drainage. It is suitable for well-cooperating patients who maintain CV above 1.5L. The advantage is that it does not require any instrumentation, the disadvantage is instead represented by the fatigue that can involve staying in the vicinity of the residual functional capacity for a long time (in particular for patients who develop severe thoracic deformities or in which the wall becomes very rigid). In this case it is useful to use the

b) Sanglage as a means of maintaining lung deflation passively. The sanglage is useful during many treatments (Autogenic Drainage, ELTGO - that is, the impossibility of maintaining the position on the side - intrapulmonary percussion).

Adaptable techniques

c) ELTGOL. Since it is a technique that requires very low flow ventilation and passive expiratory accompaniment it is obvious that in this case it is a preferential choice.

d) Intrapulmonary percussion. It is a technique developed in the last 10 years to provide a possibility of peripheral drainage to uncooperative patients, especially burned and comatose patients. It can be applied as a mask or connected to the tracheostomy tube. It releases a series of very small volleys of very high frequency compressed air (between 80 and 240 per minute) which have the effect of causing vibro-percussion waves that spread in the bronchial tree, detaching the secretions and attracting them towards the source of the vibration . Technically, the machine modifies the rheological characteristics of the mucus (frequency from 10 to 13 Hz) and enters into resonance with the vibratile cilia (13 HZ). It transmits the vibration beyond the 8th bronchial generation

Support techniques

- Water supply. Hydration is essential for coughing, as in all patients. Additional problems can be the difficulty of drinking independently, the voluntary limitation of liquids to better control urination, the presence of total or partial mechanical ventilation.
- Caloric intake. Since the muscle glycogen stores of these subjects are
- particularly small, a general catabolic process is easily triggered which can also lead to an important acidosis.
- Mucolytics. If used well before a clearing session, they increase the water content of the mucus and facilitate expectoration. Unlike the case of the prescription to the paralyzed patient and not in conjunction with the unblocking sessions.
- Aerosol therapy. The same goes for mucolytics.
- Oxygen therapy. Sometimes we see the administration of O2 when instead it would be indicated for a mechanical assistance.

ELTGOL

- The first manual technique put to the test by health technology is Guy Postieaux's Total Slow Expiration with Open Glottis in Lateral Position (ELTGOL) (1990), which involves a physiopathologist from the Reine Fabiola hospital in Brussels in the study of air flow - labeled with radioactive isotopes - during this maneuver of his invention aimed at bronchial unblocking.
- One of the most surprising results of this study was the finding that bronchial clearance is little affected by the force of gravity and the mucus that is coughed with lateral positioning comes not from the bronchus above but from that of the lung below.
- This initial finding had a great resonance in the Francophone environment and encouraged many studies on bronchial motor skills, on the dynamic role of the wall, on the "mobile" nature of the bronchus - which is a complex organ, not a rigid tube -, on the intrinsic characteristics of mucus and the properties of mucocylar clearance.

Re-training

- Respiratory function cannot be dealt with separately from physical performance. All the scientific literature of the last twenty years strengthens this principle, so that the prognostic and therapeutic value of global physical activity supports specific techniques and cannot be considered "other". The exclusively respiratory physiotherapist, where he renounces his competence in the field of global performance, would gain a narrow field of specificity in the face of a great loss of competence.

Re-training

- As for the training of the respiratory muscles, the "breathing training" or "respiratory training" literature, the techniques fall under the common hat of "Incentive Spirometry" and therefore belong to instrumental techniques. In spite of the variety and the CE mark of the devices on the market, the results are slightly more significant than those obtained with manual treatment, except in the surgical patient.

Guided ventilation

- In literature: Directed Ventilation, Ventilation Dirigée.
- It takes place with the two components of “expiratory accompaniment” and “inspiratory flow guide”. Once a manual pressure has been exerted (which is part of the expiratory flow acceleration techniques) to bring the chest to the closed position, in addition to the volume of the Residual Functional Capacity (CFR), a "rebound" on inspiration will be obtained which exploits two principles distinct physiologicals:
  1. elastic return of the rib cage, which behaves like any musculoskeletal structure subjected to stretching;
  2. exteroceptive guidance of the therapist's hands, which attracts a greater amount of incoming flow.

Guided ventilation

- The greater flow generated in inspiration can be adjusted according to the extension of the technique, local or lateral or bilateral, with one or two therapists.
- With good synchronism, guided ventilation can be used in a completely passive way to obtain a considerable increase in the minute volume in ventilated patients (even in controlled mode) as long as the respiratory rate is not set by the machine but is marked by the rhythm of the compressions.
- In patients with curaritis or with flaccid paralysis, it may be the only external way to promote peripheral drainage of secretions.

Inspiration resisted

- In literature: Forced Thoracic Expansion.
- If resistance to inspiration is offered during guided ventilation, an increase in thoracic contraction in an expansive sense will be obtained; in fact, the Central Nervous System, responsible for the ventilation pattern, does not tolerate externally imposed limitations and increases the drive of the muscles affected by the limitation so that they are activated against unwanted resistance.
- This contraction drags the pleural space making it even more negative, which results in a massive entry of air that is directed preferably towards the compressed area (example: aspiration of the liquid with a syringe but the needle is closed; increase the traction on the plunger, the obstruction jumps suddenly and I inhale with the same force I exerted before).

Inspiration resisted

- The verification of this hypothesis was made only a few years ago. In a 2012 study Powell and Williams measured the power of the respiratory drive in the presence of a resistive load on inspiration and found that each increase in resistance corresponds to an exponential increase in the force of expansion.

EDIC (Exercise à Debit Inspiratoire Controlé)

- The English correspondent is missing.
- The patient is placed in a lateral position, the treated lung is the one above. The technique exploits the state of static hyperinflation that occurs in this position, characterized by the costal arch in inspiration; pleural pressure is more negative on this side which makes the alveoli slightly more open. On the contrary, the inlet and outlet flow is reduced due to the tension length disadvantage of the corresponding diaphragmatic dome. Therefore, a greater static volume is achieved in a prolonged time, which we have seen to be the condition for exploiting collateral ventilation and recruiting alveoli.

EDIC (Exercise à Debit Inspiratoire Controlé)

- This effect is enhanced by the controlled inhalation / exhalation exercise conducted by the therapist: with the hands in a lateral mobilization position, he accompanies the rib arch in elevation during inspiration and lowering during exhalation; the patient keeps the upper limb elevated above the head and in any case in a position that favors the inspiratory excursion.
- A volumetric inspiratory stimulator (optional) can be used which provides the patient with visual feedback of the duration and constancy of the flow of his inspiration.

Homogenization of ventilation: deflation

- We mean a maintained state of exhalation which corresponds to a volume slightly lower than the Residual Functional Capacity; it occurs naturally in the infralateral lung, ie the one below, in the position on the side.
- When the lung is compressed between the support surface and the weight of the mediastinum, it is in the same situation as the lung bases in an upright position (ie the parenchyma is "resting" on the pleura = lower pleural gradient.
- This reduced pleural negativity means that the lung structures are less stretched, with alveoli of reduced size - at the volume of the CFR or slightly less - so that the inhaled air naturally goes towards the underlying lung, exactly as in an upright position it goes towards the basics.

Homogenization of ventilation: deflation

- The lower hemithorax - we repeat: "infralateral" - has an advantageous tension length of the diaphragmatic hemicupula, precisely because it is more domed than the side above, with the smaller radius of curvature
- This length / tension advantage translates into an almost double excursion with respect to the hemicome of the lung above and in a much greater percentage change in volume. Let's clarify with an example: I have 2 half-liter bottles that contain water colored with methylene blue. From each bottle I pour a glass of colored water and return to the previous quantity by topping up tap water. I repeat this action until the water in the bottles is completely clear. Using a coffee cup for one bottle (30 cc) and a wine glass for the other (200 cc), which bottle will first contain only tap water without blue color?

Homogenization of ventilation: deflation

- In the compressed lung, the static volume is smaller and is uniform in a few seconds between the parenchyma and the airways, creating a general reduction in the caliber of the airways: remember that a reduction in caliber corresponds to an increase in air flow velocity (Poseuille's Law) .
- These three components (compliance advantage, flow acceleration, higher percentage exchange of air) greatly favor the transit of mucus and explain why in the lateral position the coughed mucus comes mainly from the underlying bronchus, despite the disadvantage of gravity

Homogenization of ventilation: deflation

- More complicated from a physiological point of view is to explain why the compression of the lung tissue results in a better air distribution with an alveolar recruitment effect. In fact this point is still to be clarified and there are many studies on the subject.
- All ICU doctors have the problem of distributing the mixture of air / oxygen that the patient needs; once the volume of gas has entered the trachea its distribution will follow the general law of best compliance, whereby the alveoli that offer less resistance to opening will be ventilated earlier and more than those that are partially closed.

Homogenization of ventilation: deflation

- With the passing of the hours the situation will be increasingly unbalanced with very open, over-stretched areas, at risk of injury (barotrauma) alternating with closed, atelectatic or even "hepatized" areas: If the pressure of the fan is increased, the bad distribution increases in its time and this positive feedback often represents the underlying mechanism of death. In this situation, the patient is severely hypoxic (because the increase in the percentage of inspired oxygen cannot compensate for the scarcity of the breathing surface) but not hypercapnic, because there is no obstacle to the passage of air in and out of the bronchial tree. .
- In general, the entire dorsal area of the lungs, including the bases, are in a "stasis lung" condition, while the exchange continues to occur only in the small area anterior to the mediastinum.

Homogenization of ventilation: deflation

- When hypoxic respiratory insufficiency is very serious, health professionals can choose to place the patient prone; the change of position moves the ventilation zone towards the dorsal part of the lungs, which is much wider in volume than the anterior part. In this case, the liquid also moves due to gravity, so pronation is the typical counter-move of the stasis lung.
- Also in this case, the inspired air is directed according to the compliance advantage whereby it reopens the small compressed alveoli of the bases (now that the liquid has moved), improving gas exchange within a few hours.

Sanglage

- A group of anesthetists from a Trauma Center in New Delhi, finding themselves unable to place a patient with very severe hypoxic respiratory insufficiency prone due to his skeletal lesions, positioned on the patient's chest, in correspondence with the costal wings (anterior angle of 9 ° 10 ° costa on the midclavicular line) two weights of 2 kilograms each (2-liter bags of saline solution) and left them in place for 12 hours. The result was a progressive and significant improvement in the ventilation / perfusion ratio, with a trend very similar to that obtained with pronation.

Sanglage

- One way to achieve deflation, even if limited to the treatment area, is the compression held with the hands for a few minutes. Deflation is also obtained with the positioning on the chest of semielastic bands (sanglage) which have the purpose of offering a lung tissue more compliant with instrumental treatments with positive or oscillating positive pressure

BRONCHIAL DESTRUCTION

- In unblocking, no action alone is effective, each technique is a collage of actions that attempt to repeat the virtuous physiological pattern that should take place like this:
- a) the passage of mucus in the very small airways starts from a uniformly ventilated alveolar area;
- b) this mucus should be scarce (about 10 ml per day overall), not very viscous, fast enough not to exclude that alveolar area from ventilation;
- c) in the middle routes the transit should be slow but constant, without interruptions in the mucus film and without areas of entrapment;
- d) in the upper airways all secretions should collect up to a critical quantity that stimulates the mucosa and triggers the cough reflex;
- e) finally, the abdominal and thoracic muscles should provide an active thrust powerful enough to speed up the glottic barrage and quickly free the larynx to avoid prolonged apneas.

BRONCHIAL DESTRUCTION

- In respiratory physiotherapy each of these steps is stimulated or facilitated by different actions that must be recombined together in a sequence that works for the patient. For example, some actions would be very effective on paper but cause such discomfort that they are not practicable, or two individuals with a theoretically similar defect need a completely different timing.
- To quote Jean Roesler, current professor of Respiratory Rehabilitation at the University of Louvain: "Respiratory physiotherapy requires" clinical wisdom "where gestures are rarely complex but their choice and their adaptation to the patient require knowledge, in knowing how to do and in knowing how to be, very broad and precise

BRONCHIAL DESTRUCTION

- Bronchial obstruction is commonly due to the presence of mucus not eliminated physiologically due to qualitative and / or quantitative alterations, but it can also be due to changes in the bronchial wall, which is not very "stable" in the presence of fast flows and variations rapid transpulmonary gradient; this is the case of asthma and bronchial malacia, in which the techniques will try to avoid the stimulus that triggers the bronchospasm.
- The "Rheology" of mucus is its ability to change its flow and deform in response to the forces applied to it. Mucus is "viscoelastic" because it simultaneously possesses the characteristics of liquid and solid; it is "viscous" because it resists the flow and absorbs energy from the particles of material flowing over it; it is "elastic" because it reacts by retransferring an energy equal and opposite to the particles themselves

BRONCHIAL DESTRUCTION

- The removal of mucus depends on the ability of the vibrating cilia to maintain a high transport speed over time and therefore it is important to understand by what means this activity can be favored. Physiologists have addressed the problem from the point of view of mucus - making it less viscous and more similar to water - and from the point of view of the cilia - which are stimulated by the speed of the air flow and above all by its variation in speed.

Postural Drainage

- It uses gravity: the sliding of the mucus is affected by the force of gravity only if the affected bronchus is of large caliber, the amount of mucus is such as to give a mechanical stimulus to the mucosa and the rheological characteristics are very close to those of water. The vision of the patient who is released in the Trendelemburg position remains valid for the rapid evacuation of a large amount of liquid, as can occur in the event of flooding of the bronchial tree or emptying of a large bronchiectasis.

Postural Drainage

- Shock waves
  - Percussion: in literature "Clapping". It consists of the fast and intermittent pressure of the cupped hand on the chest. The hand remains light, almost weightless, causing a fast intermittence of the outgoing airflow (which can occur with the corresponding intermittence of the vocal flow). The aim is to detach and fragment the secretions of the medium-small airways by exploiting the entrainment of mucus in the expiratory time.
  - Vibration: in literature "Squeezing". It consists of an expiratory accompaniment of the chest throughout its excursion by associating the pressure of the hands with a shaking effect of small amplitude and as fast as possible. A very experienced physiotherapist can reach a frequency between 3.4 and 7.9 hertz (12) compared to a certainly effective frequency between 25 and 35 Hz. However the physiologist Malcom King in 1983 found that an oscillation of 8 Hz modifies the rheological characteristics mucus reducing its viscosity, as long as it is kept for five minutes.

Postural Drainage

- Since increasing the speed of the outgoing flow is the most effective means to enhance the ciliary action, the forced exhalation associated with shock waves should theoretically accelerate the transport of mucus. The inventors of both thoracic and endobronchial oscillatory therapy devices have moved in this direction, but the effectiveness of manual treatment remains disputed: percussion and vibration remain excluded from the recommendations.

Postural Drainage

- The three previous components, gravity, percussion and vibration, constitute Postural Drainage (DP), in Chest Physiotherapy literature, which continues to be the best known technique in the Anglo-Saxon world, even if in recent years it is applied in a "modified position", that is without the Trendelemburg component.
- In many respects, the effectiveness of the DP has been questioned, but the study of the spatial relationships of the bronchial tree remains very useful, allowing for reasoned positional choices for treatment.
- Each session takes place with a change of position every 15/20 minutes with the sequence: supine, semi-flank, side, semi-prone, prone on both sides. So the overall time is huge and impractical in its entirety.

Positive Expiratory Pressure

- Positive Expiratory Pressure seeks:

a) the extension of the expiratory time,
b) the recruitment of collateral ventilation,
c) the maintenance of an endobronchial pressure regime that compensates for the loss of air content,
d) the acceleration of flow that moves a greater amount of mucus in the unit of time,
e) maintaining a volume at the end of expiration which reduces resistance to the entry of air at the time of the next inspiration

Positive Expiratory Pressure

- There are several techniques that aim to act directly on the caliber of the airways by trying to move the point of Equal Pressure towards the mouth (= the airways remain open longer, I exhale more air, move a more peripheral flow). They are instrumental techniques of exhalation against resistance or expiratory brakes (PEP bottle, PEP mask, ...), spontaneous ventilation in continuous positive pressure (Ventilation Support - VS-PEP) or CPAP of the Anglo-Saxons (Continous positive airway pressure breathing) or, more simply, pursed lips breathing. The problem with most of these techniques is that their effectiveness is limited to the time of their use.

Positive Expiratory Pressure

- At this point it would be logical to teach the auto pep directly against parted lips, since it can be used for long periods in full discretion. Some patients discover it and use it on their own in full autonomy. PEP with simple expiratory brakes finds a role in the manual flow chart because its use is so extensive and integrated into clinical practice that no technique could do without it.

Positive Expiratory Pressure

But how much pressure?

- If the pressure level is chosen in an appropriate way there are no contraindications; in auto - PEP the resistance is not controllable but probably two or three centimeters higher than the spontaneous pressure regime induced by the disease (intrinsic PEEP).

Positive Expiratory Pressure

- The PEP needs a large bottle so that the air that enters does not cause splashes at the exit and a rubber tube of 1 centimeter caliber; the tube must be 50 to 70 cm long - in the hospital the bubble tube is used, cut at the distance of two consecutive bubbles -; the water level, i.e. the resistance, ranges from 5 cm (in the case of weak and fatiguing patients), to 8 cm (standard), to 12 cm to cause a forced exhalation to stimulate cough: the patient must blow for at least 5 seconds constantly starting from the current volume. Prolonged exhalation is more strenuous, goes too close to the closing volume of the airway, and requires a longer recovery time.

Expiration Lente Total a Glotte Ouverte en décubitus Latéral (ELTGOL) – Expiration with Glottis Open in Lateral Position

- French-speaking technique that uses deflation and passive, semi-passive or active AFE in a lateral position to counteract the trapping of air and secretions in acute and chronic conditions. Born for infants with bronchiolitis, it is also well suited to the treatment of COPD.
- It is not applicable with patients who cannot assume the lateral position

ELTGOL

- ELTGOL is applied in three stages:
- 1- the hand that guides the exhalation of the infralateral lung is positioned on the anterior costal angle and starts first, bringing the rib arch (without the hand slipping) towards the navel;
- 2 - the hand that guides the exhalation of the overlying lung starts immediately after and brings the corresponding costal angle towards the navel;
- 3 - the forearm from the upper side squeezes the abdomen pushing the viscera towards the diaphragm.
- The patient is positioned with the lung to be treated down and is instructed to breathe at a tidal volume while keeping the lips parted.
- The whole maneuver takes at least 5 seconds.

Autogenic drainage

- French-speaking technique that combines very fast ventilation with very low volumes and a progressive increase in the volume of air which acts as a residual functional capacity. Born for small children with asthmatic forms, it is now also well adaptable to adults but requires a long training time and excellent learning ability.
- Not very suitable for hospitalized patients because it requires great freedom of flow modulation.

Forced Expiratory Tecniques (FET)

- Expressly Anglo-Saxon label that collects all active maneuvers to create a fast expiratory flow.
- It is performed with the mouth and glottis open so as not to impose compression of the vocal cords on the outgoing air flow. The most used variant is HUFFING which mimics cough from the point of view of strength but avoids the backlash of thoraco-abdominal co-contraction.
- We know that at medium and low lung volumes the increase in pleural pressure has no effect on the effective motive force (see flow / volume curve)
- The use of these techniques must therefore be limited to high lung volumes, in the first 20% of CPT. Despite this, even at such high volumes, forced expirations or manual thoracoabdominal compressions in COPD can decrease peak expiratory flow rather than increase it.

Augmentation du Flux Expiratoire (AFE)

- Expressly French-speaking label that collects the TEF but adds other fundamental concepts. In fact, the AFEs are not all active and fast, but also slow and passive. Modulating the flow during an active exhalation requires collaboration and the possibility to do so, which cannot be proposed, for example, in the paralyzed or ventilated patient.

EXPIRATORY ACCOMPANIMENT

in literature Expiratory Rib Cage Compression (ERCC) - consists in the mobilization of the costal arches according to their physiological direction

Apical: the therapist's hands compress the chest in the cranio-caudal direction, from the shoulders or better still from the wall immediately downstream of the clavicles. It is a useful maneuver for diseases that involve a shortening of the neck muscles, for example emphysema. The Milanese colleague Andrea Bellone, in the 90s, added to this maneuver the exhalation against a small resistance of 5 cm of water and called it "Released Exhalation". Although it has disappeared from the literature, the Released Exhalation gives excellent results in dyspnoic emphysematous, as long as the exhalation time is not prohibitive (within 7 - 8 seconds);

EXPIRATORY ACCOMPANIMENT

- Medium - basal: the hands are positioned along the costal arch from column to sternum more or less at the height of 8 ° / 9 ° and move all or the "bucket handle" arch in an oblique direction; when the maneuver is bilateral, a triangle movement with apex at the navel results. It can be used as an assessment (metric eye!) Of the active expansion between hemilates or on different days with the same patient.

EXPIRATORY ACCOMPANIMENT

- Concentric: one hand above the sternal plane and one on the abdomen below the navel, the movement takes place by bringing the thumbs closer together without pressure towards the support surface.
- The maneuver can affect the entire chest or only one side. The hands of the physiotherapist act as an additional expiratory muscle whose force opposes the thoracic elastic return and is added to the pulmonary elastic return often making the intrapleural pressure positive and thus increasing the expiratory flow. It is not always possible to obtain the desired effect, especially in systems whose basic functioning has been altered for years and the defect / compensation / defect chain is not reversible.

Breathing Exercises and Mucus Clearance Techniques in Pulmonary Rehabilitation

- One of the aims of pulmonary rehabilitation is to improve respiratory muscle function and reduce dyspnoea.
- This is generally achieved via systemic endurance training, such as walking or cycling, which increases the demand on the respiratory system resulting in either a physiological training effect, improved coordination and muscular or ventilator efficiency or a desensitization to the discomforting symptom of dyspnoea.
- Another aim is to reduce the frequency of exacerbations and hospitalization. In addition to whole body exercise, specific strategies may be employed within a pulmonary rehabilitation programme to address these aims. These include breathing exercises and mucus clearance techniques, both of which will be discussed in this chapter, or specific exercises to improve the strength and endurance of the respiratory muscles

Breathing Exercises

- The majority of the pulmonary rehabilitation literature discusses breathing exercises for people with COPD with little description of how to adapt these exercises for patients with other chronic respiratory conditions. Breathing exercises can be employed on an individual basis following identification of an abnormal breathing pattern or in a generalized sense.
- Individualized instruction in breathing exercises is generally referred to as breathing retraining, the most common technique being diaphragmatic breathing, also termed abdominal breathing or breathing control.

Breathing Exercises

- Diaphragmatic breathing exercises are often prescribed in addition to whole body exercise during pulmonary rehabilitation or may be prescribed for patients who are unable to participate in the exercise component of pulmonary rehabilitation.

Breathing Exercises

- Pursed lips breathing, achieved by exhaling through the mouth against the pressure of pursed lips, is a strategy that may be adopted by patients spontaneously or may be encouraged by the pulmonary rehabilitation clinician to reduce respiratory rate and dynamic hyperinflation during exercise training with the aim of an overall increase in endurance.

Breathing Exercises

- Ventilation-feedback breathing or timed breathing during exercise training is another strategy that has been employed to increase endurance time.
- Other generalized breathing exercise strategies include coordination of breathing with movement such as pacing arm lifts during the inspiratory or expiratory phase or the use of body positioning to improve the pattern of breathing.

Diaphragmatic Breathing

- Patients are encouraged to breathe predominantly with the diaphragm while minimizing the action of accessory muscles.
- The technique is generally performed in a supported sitting position, with relaxation of the upper chest and shoulders, although several investigators have commenced instruction with patients in a supine position.

Diaphragmatic Breathing

- Tactile feedback is given with one hand of the therapist or the patient on the abdomen, with or without the other hand on the chest.
- During inspiration, patients are instructed to move the abdominal wall outward, causing the hand on the abdomen to gently rise up and out ("breathe into my/your hand") with minimal movement palpable against the hand on the chest.

Diaphragmatic Breathing

- Nasal inspiration is encouraged to facilitate recruitment of the diaphragm as well as enhancing natural humidification.
- Expiration is relaxed and passive with the hand on the abdomen returning gently to the resting position.

Diaphragmatic Breathing

- Effective technique is evidenced by an increase in abdominal tidal excursion and a reduction in rib cage excursion or upper chest movement.
- Variations on this technique include combining diaphragmatic breathing on inspiration with pursed lips breathing on expiration or active abdominal expiration.
- Patients are encouraged to practice this technique daily, ranging from 10 min to an hour per session, two to three times per day, although the optimum dosage is not clear

Breathing Control

- It is the evolution of the "diaphragmatic breathing" of the 1970s. In reality, every breath is diaphragmatic so the term "breath control" is much more correct. It consists in becoming aware of the diaphragmatic excursion that is achieved with a slow inhalation from the residual volume to the total lung capacity. In this awareness, the perceptual component of the thoracic excursion is fundamental, which is initially guided by the therapist and later will be recreated by the patient independently using his hands or, more practically, a non-elastic belt. The maximum volume causes a counter-reaction of the wall; this in turn generates a high pressure in the airways and, if the air has time to distribute itself, overcomes the resistance of the less accessible areas by exploiting collateral ventilation. For this reason, at the end of the complete excursion there is an apnea pause of at least three seconds by "checking" the diaphragm.

Breathing control

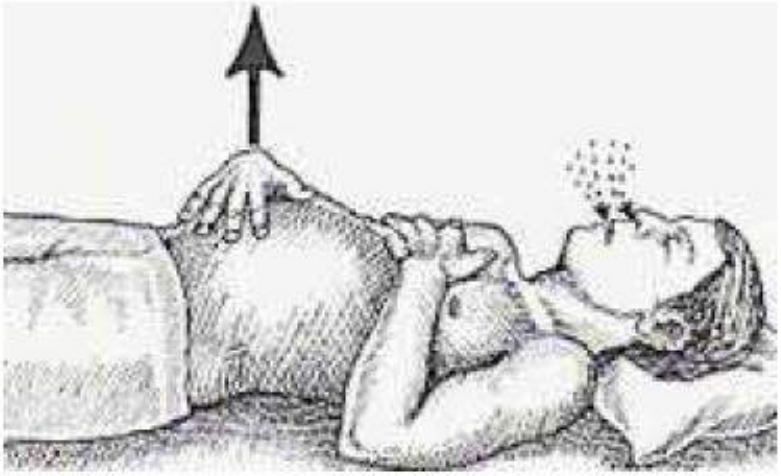

Fig 1- Breathing control

Breathing control

- The slow total excursion of the diaphragm is seen as a "relaxing" action in the healthy subject - see the association with holistic practices such as yoga and meditation - but not at all in the acute patient; in fact, the diaphragmatic activity absorbs 10 to 12% of the cardiac output and is not favored by the semi-sitting position in bed. Hemodynamic instability and low cardiac output (for example during sepsis) result in poor ventilatory autonomy and difficult weaning from mechanical ventilation.

SLOW EXPIRATION

- It is the expiratory consideration of Breathing Control.
- In slow exhalation the air flow remains constant or decelerates at the mouth, but this does not mean that it also decelerates along the bronchial tree. It can be part of many complex techniques to inhibit a cough that is too early, to control a hyperventilation syndrome, to maintain high pressure in the airways without blocking the diaphragmatic action in a state of apnea. While the use of the expiratory brakes is intended to delay the formation of the equal pressure point so that there is more time to exhale, slow active exhalation - but not forced with the glottis open achieves the diametrically opposite effect: the pressure in the proximal airways and therefore increases the endobronchial pressure loss (= the motor pressure of the air between the alveoli and the mouth is exhausted due to the lack of gradient) and therefore the EP is formed earlier, in an area of smaller caliber.

SLOW EXPIRATION

- Example: the expiratory brake - PEP - has the effect of a half-compressed tube of toothpaste in which the pressure of the fingers does not get to crush it completely, but rather the maintained compression continues to release the toothpaste for a longer time than that that is expected. Slow exhalation with an open glottis can be imagined, however, as the pressure on the tube applied to the most peripheral part and "crawled" towards the cap by a few centimeters.
- If it is possible to modulate the exhalation by reducing its speed (it is not an exercise for patients without functional reserves!) Avoiding the expiratory brake of the glottis, the caliber of the small airways gradually reduces (without causing them to collapse, pay attention to the closing volume !) causes a prolonged flow in the small passages and improves bronchial drainage.
- It is possible that this is the mechanism of action of the ELTGOL technique.

The complex techniques

- Active Cycle of Breathing Tecniques (ACBT), Jennifer Pryor - Anglo-Saxon technique derived from Chest Physiotherapy, the most cited in literature.
- It consists of a series of resting breaths followed by one or more Breathing Control carried out against a band at the base of the chest in order to combine active expansion. Breaths at rest and FET expirations follow, either free or accompanied by compression of the exhalation band

Active Cycle of Breathing Tecniques

- The sequence is completely personalized and must be guided by auscultation to move from one phase to another. The patient is usually seated with the back not supported, slightly bent forward in a position similar to that of the jockey.
- Self-treatment training is very useful for patients with chronic hypersecretion. The transition from one ventilatory behavior to another is guided by auscultation: resisted inhalation and breathing control to recruit, acts at rest and slow exhalation to initiate secretions in the small airways, collection of secretions in the upper tract with PEP or auto PEP, forced exhalation techniques for final propulsion or to replace cough. Hardly all the components are practicable in the hospitalized acute patient.

Pursed Lips Breathing

- Pursed lips breathing is performed as a nasal inspiration followed by expiratory blowing against partially closed lips, avoiding forceful exhalation.
- Some patients with COPD are observed to adopt a spontaneous pattern of pursed lips breathing at rest, during exercise or recovery from exercise or during acute illness.
- This observation has prompted many investigations into the physiological effects of pursed lips breathing and potential mechanisms of benefit in applying it as a training technique.

Pursed Lips Breathing

- Attempts have been made to train patients who do not naturally adopt pursed lips breathing, to use this technique to see if they will also benefit.
- Patients with COPD can be encouraged to trial pursed lips breathing during exercise training or recovery from exertion as well as during activities of daily living

Pursed Lips Breathing

- Various instructions can be used to further illustrate the desired technique, “expiratory blowing through pursed lips to create a slight whistle”, “imagine a small candle, make the flame flicker but don’t blow it out”.
- In patients who do not adopt pursed lips breathing spontaneously, they are able to learn how to perform it using ear oximetry for feedback with a resultant significant increase in oxygen saturation and tidal volume and reduced respiratory rate, while maintaining minute ventilation
- Effective technique is evidenced by immediate reduction in respiratory rate with prolongation of expiration and improvement in symptoms.

Asthma

- Asthma is a chronic inflammatory disorder of the airways characterized by episodic bronchoconstriction, airway hyperresponsiveness, and intermittent exacerbations of airflow obstruction.
- As in COPD, dynamic hyperinflation during exercise may occur in those with active airflow obstruction.
- The airway obstruction is more reversible than that of COPD, and patients generally have more variability in symptoms. Dyspnea Dyspnea, cough, and wheezing are common symptoms of asthma. Asthma patients vary considerably in disease severity, including lung function, and their frequency, severity, and triggers of exacerbations.

Asthma

- In general, patients with asthma tend to be less physically fit than those who are unaffected.
- Anxiety, fear of exercise, deconditioning, obesity, and steroid-induced myopathy commonly contribute to dyspnea and exercise intolerance, particularly in those with more severe disease.
- Some patients can progress to chronic airflow limitation that may become difficult to distinguish from COPD

Asthma

- General goals of asthma management include preserving normal lung function, minimizing symptoms and exacerbations, preserving physical fitness, and preventing mortality.
- These goals are realized through pharmacological management, education, and promotion of physical activity.
- Although all asthma patients stand to benefit from education and promotion of a healthy lifestyle, those with well-controlled asthma and without significant functional impairment generally do not need referral to a pulmonary rehabilitation program.
- Pulmonary rehabilitation should be considered for those who remain symptomatic with dyspnea, have individualized educational needs, or have exercise impairment despite maximal medical therapy. Documented benefits of pulmonary rehabilitation include reduced asthma symptoms, decreased breathlessness and anxiety during exercise, decreased rescue beta-agonist use, and fewer emergency department visits.

Asthma

- Some program modifications that may be necessary for patients with asthma are listed I figure

Figure 7.2 Pulmonary rehabilitation program modifications for patients with asthma

Exercise Assessment
- Cardiopulmonary exercise testing (CPET) when possible
- Evaluation for exercise-induced bronchoconstriction (EIB)

Exercise Training
- Preexercise warm-up and postexercise cool-down
- Medication before exercise to prevent EIB
- Upper- and lower-extremity strength and endurance exercise

Age-Appropriate Patient and Family Education Topics
- Recognition and avoidance of triggers
- Role of medical therapy
  - Disease-modifying versus symptom-controlling medications
  - Importance of medication compliance
- Peak expiratory flow monitoring
- Variable symptoms of an asthma exacerbation
- When to contact your care provider: developing an effective communicative relationship
- Self-management plan
  - Management of baseline symptoms
  - Management of exacerbations
  - Stress, anxiety, and coping techniques
  - Nutritional evaluation and counseling
- Dietary evaluation for patients requiring chronic systemic steroids

Asthma

- Adherence to therapy, especially regularly used controller medications such as inhaled corticosteroids, is central to asthma management; this collaborative self-management strategy must be emphasized in pulmonary rehabilitation.
- Education on the proper use of inhalers is also important. Because obesity, often resulting from inactivity or chronic systemic corticosteroid use, can also contribute to functional limitation, dietary intake should be evaluated and nutrition counseling provided.

Asthma

- People with well-controlled asthma can have normal cardiopulmonary responses to exercise. Resting lung function is a poor predictor of exercise ventilation; therefore cardiopulmonary exercise testing is particularly helpful in determining the causes of exercise intolerance and in formulating the exercise prescription for individual asthmatic patients.
- Strategies to prevent or manage exercise-induced bronchospasm must be incorporated into the rehabilitation plan.
- A preexercise warm-up program and administration of an inhaled beta-agonist is generally recommended before exercise.
- Supervised exercise training programs improve exercise tolerance in children and adults with asthma.
- Aerobic fitness training using swimming, walking, running, stair climbing, jogging, cycling, rowing, aerobics, and yoga have all been successful.

Asthma

- Similar to those without respiratory diseases, patients with asthma can increase their exercise capacity by following high-intensity training.
- Gains in exercise tolerance tend to be greatest in people with lower baseline fitness levels.
- In patients with well-controlled asthma, training intensity may be set near the anaerobic threshold or at a high percentage of the maximal heart rate or peak VO2 . Low-intensity exercise, isometric exercise, or both may be suitable for severely disabled people unable to exercise at higher intensity. Endurance training of the upper and lower extremities can promote weight loss and possibly reverse some of the muscle weakness caused by chronic steroid use.
- Strength training is also of benefit.

Asthma

- The optimal tools for detecting change in health status and quality of life after pulmonary rehabilitation for patients with asthma have not been intensively investigated. The SF-36, Juniper Asthma Quality of Life Questionnaire, Pediatric Asthma Quality of Life Questionnaire, and St. George's Respiratory Questionnaire have been used to measure health status after other therapeutic interventions in asthma.
- Age appropriate tools should be considered.

Cystic Fibrosis

- Cystic fibrosis (CF) is an autosomal recessive disorder in which abnormal epithelial ion transport leads to excessively thick, viscous mucus in the airways and impairs the secretion of pancreatic enzymes
- Nutrition depletion may result from fat malabsorption due to pancreatic insufficiency, poor dietary intake, and catabolic factors. Respiratory consequences include diffuse bronchiectasis; progressive airflow obstruction; hyperinflation; and recurrent respiratory infections characterized by increased sputum production, bronchoconstriction, and worsening functional limitation. Although the course of CF is variable, its manifestations typically begin in infancy or early childhood, and severe pulmonary function abnormalities are often present by adolescence.

Cystic Fibrosis

- Advances in medical management of CF have led to improved survival such that many patients live into adulthood.
- Nevertheless, CF leads to major morbidity, with symptoms of cough, sputum production, dyspnea, intermittent hemoptysis, exercise intolerance, functional
- impairment, and impaired quality of life.
- As the disease progresses, hospitalizations become more frequent. More than 90% of CF mortality relates to lung involvement

Cystic Fibrosis

- Exercise capacity tends to be maintained until patients have moderate to severe disease.
- Exercise tolerance is most limited during and after exacerbations.
- Airflow obstruction, hyperinflation,
- increased ventilatory requirements resulting from dead space and gas exchange disturbances, cardiocirculatory disturbances (including pulmonary hypertension), nutrition depletion, and skeletal muscle dysfunction all contribute to the exercise impairment of patients with CF.

Cystic Fibrosis

- Patients with moderate to severe CF have ventilatory limitations to exercise. Resting or exertional hypoxemia or both are common in later stages of the disease, and some patients may be affected by exerciseinduced bronchospasm.
- Similar to in COPD, leg fatigue or discomfort may be the major symptom limiting exercise for some patients.
- The cardiovascular response to exercise is normal in mild disease, but right ventricular stroke volume may be impaired once pulmonary hypertension develops as disease progresses.
- Moreover, some patients develop hypertrophic osteopathy, which may diminish joint flexibility.
- Reduced physical activity can lead to greater difficulty clearing secretions. Higher levels of aerobic fitness are associated with improved survival and
- well-being.
- Lung transplantation may be an option for CF patients with advanced disease.

Cystic Fibrosis

- Therapy for CF is individualized to the needs of the patient; interventions may include the following:
- Regular exercise and increased levels of physical activity
- Maintenance of adequate nutrition
- Pancreatic enzyme and vitamin supplementation
- Regular use of airway clearance techniques
- Inhaled DNase to decrease mucus viscosity
- Antibiotic therapy
- Bronchodilators
- Aggressive exacerbation management strategies

Cystic Fibrosis

- The need for pulmonary rehabilitation in CF increases as the disease progresses and symptoms and functional limitations become pervasive.
- Since many CF patients are now followed in specialized centers, close collaboration between the rehabilitation staff and the CF care team is essential

Cystic Fibrosis

- Exercise training and rehabilitation are highly beneficial and result in increased aerobic fitness and endurance, increased strength and muscle mass, decreased exertional breathlessness, and improved quality of life.
- Some studies, especially those including exercise training over a longer period of time (1 to 3 years), have demonstrated that exercise training is associated with better maintenance of lung function over time, although the mechanisms for the noted improvement are not clear.
- Enhanced sputum expectoration related to physical training (in conjunction with chest physical therapy) may account for some of this improvement.
- Physical training alone should not, however, be considered a replacement for conventional airway clearance measures.

Cystic Fibrosis

- Maintenance of stable pulmonary function (i.e., prevention of decline) and exercise tolerance are crucial for patients with CF to prevent long-term worsening disability.
- The long-term effects of pulmonary rehabilitation on functional status, quality of life, frequency of exacerbations, hospitalizations, prognosis, outcomes of lung transplantation, and survival are not yet known in the CF population.

Cystic Fibrosis

- Close partnering with health care providers and maintenance of regular long-term exercise are important educational topics in CF.
- Some additional areas of importance to the CF patient include the following:
  - Pacing and energy conservation
  - Pursed-lip breathing
  - Strategies to remain active in work, school, social, recreational, and sport activities
  - The role of antibiotics and other medications (such as steroids and bronchodilators) in managing infection and optimizing lung function

Cystic Fibrosis

- The rationale, importance, and techniques of airway clearance should be reinforced in CF patients.
- There are several options for airway clearance, and the technique(s) chosen should fit the patient's needs, lifestyle, and resources.
- Mechanical secretion clearance devices such as the vibration vest and positive pressure breathing devices can be used to augment manual chest physical therapy

Cystic Fibrosis

- The goals of exercise training in patients with CF are to maintain and optimize leg and arm function and minimize the decline in strength, endurance, or functional capacity. Supervised exercise training should be undertaken for at least 20 minutes, 3 to 5 days per week, for 12 to 16 weeks

Cystic Fibrosis

- The intensity of training must be tailored to disease severity and patient tolerance. For medically stable patients, moderate-intensity training (50% of maximal work rate, 65 to 85% of maximal heart rate, or a moderate perceived exertion level) is recommended.
- Those unable to exercise at this level may start at a lesser intensity or duration and increase exercise as tolerated.

Cystic Fibrosis

- The intensity of training will need to be adjusted after disease exacerbations. Symptom-limited exercise may be appropriate for patients with more severe disease.
- Warm-up and cool-down periods should be provided. When possible, the exercise program should be tailored to include activities that the patient enjoys because motivation is important in promoting adherence to exercise over the long term.
- Ventilatory muscle training (resistive or threshold, conducted 10 to 30 minutes per day for several weeks) can increase inspiratory muscle strength and endurance in patients with CF.
- The effect of ventilatory muscle training on overall endurance is inconsistent, but increased walking endurance has been noted in some patients.

Cystic Fibrosis

- Patients and staff members must pay rigorous attention to hygiene techniques during rehabilitation to avoid cross-infection of patients with bacterial pathogens that may be antibiotic resistant.
- Cross-infection of antibiotic-resistant organisms among CF patients is an extremely serious consideration that may alter the course of disease.
- Close attention must be paid to hand washing, standard precautions, and hospital-based aseptic techniques. Patients with CF should exercise at least 3 feet (1 meter) apart from one another and other patients in the program, and consideration should be given as to whether the CF patient should wear a protective mask and gloves.
- Consideration should also be given to isolating exercise equipment (such as dumbbells or elastic bands) of patients with resistant organisms.

Cystic Fibrosis

- Nutrition intervention is crucial to maintain growth and restore and maintain weight in CF patients.
- Caloric and protein intake must be adjusted to meet the increased demand posed by exercise training. Importantly, patients with CF have excess salt and fluid loss during exercise as a result of excessive sweating, yet they may not experience thirst and tend to underestimate their fluid needs.
- Therefore, close attention must be paid to maintenance of adequate fluid and salt intake. Sports drinks can be useful both to replete electrolytes and provide caloric support.

Cystic Fibrosis

- Some outcome measures typically used for COPD, such as the 6-minute walk test, shuttle walk test, and measures of dyspnea, are also appropriate for patients with CF.
- The choice of health-status measurement tool needs to be tailored to the age and concerns of the patient. Tools that address well-being, self-worth, physical appearance, and perceived competence at school, with friends, in athletics, and in romance, such as the Quality of Well-Being Scale, the Self-Perception Profile for Children, and the Beck Depression Inventory, may be particularly useful outcome measures for patients with CF.

Cystic Fibrosis

- Figure summarizes some of the issues relevant in the pulmonary rehabilitation of the CF patient.

Figure 7.3 Pulmonary rehabilitation program modifications for patients with cystic fibrosis

Exercise Assessment
- Cardiopulmonary exercise testing
- Identification of any exercise-induced bronchospasm (EIB)

Exercise Training
- Warm-up and cool-down periods
- Strength and endurance training: upper and lower extremity
- Sodium chloride and fluid replacement especially when exercising in heat
- Monitoring of oxygen saturation; maintaining S_pO_2 greater than 90%

Age-Appropriate Patient and Family Education Topics
- Basis of symptoms (cough, sputum production, and dyspnea)
- Medical therapy (antibiotics, bronchodilators, corticosteroids, vitamins, pancreatic enzymes, DNase)
- Secretion clearance techniques
  - Controlled cough
  - Postural drainage
  - Vibration vest and positive end-expiratory devices
  - Bronchodilators
- Pacing and energy conservation techniques
- Pursed-lip breathing
- Strategies to remain active in school, work, and recreational activities
- Benefits of long-term maintenance of regular exercise
- Potential role for lung transplantation in long-term disease management plan

Nutrition Evaluation and Counseling
- Weight monitoring during training
- Age-appropriate outcome measures for exercise tolerance, dyspnea, and health status

Pulmonary Rehabilitation and the Surgical Patient

- When considering major surgery for a patient with chronic lung disease, medical personnel must assess whether the patient has adequate respiratory reserve to tolerate surgery and estimate the risk of postoperative complications.
- Screening spirometry is needed for all patients with chronic respiratory disease before thoracic or upper abdominal surgery.

Pulmonary Rehabilitation and the Surgical Patient

- In general, any patient undergoing thoracic, upper abdominal, or abdominal aortic aneurysm surgery is at risk of developing postoperative pulmonary complications, particularly if the person has smoked within 2 months of surgery or has underlying chronic lung disease or poor general health status.

Pulmonary Rehabilitation and the Surgical Patient

- The following are common postoperative respiratory complications:
- Infection
- Atelectasis
- Worsened gas exchange
- Bronchoconstriction
- Thromboembolic disease
- Respiratory failure requiring prolonged mechanical ventilation

Pulmonary Rehabilitation and the Surgical Patient

- Comprehensive exercise testing may provide useful information in the preoperative assessment of patients whose pulmonary function results are marginal.
- Low exercise tolerance is associated with poor surgical outcome and reduced survival

Pulmonary Rehabilitation and the Surgical Patient

- Occasionally, pulmonary rehabilitation can lead to such an improvement in exercise capacity that patients initially considered inoperable become candidates for potentially curative surgery

Pulmonary Rehabilitation and the Surgical Patient

- Pulmonary rehabilitation can optimize the respiratory patient's medical and functional status before major surgery, help prevent postoperative complications, and speed up the restoration of functional status.
- The principles of pre- and postoperative pulmonary rehabilitation (including exercise training) for respiratory patients facing surgery are the same as for rehabilitation in general.
- However, some specific considerations apply to the patient preparing for or recovering from surgery.

Pulmonary Rehabilitation and the Surgical Patient

- When feasible (i.e., nonemergent surgery), patients should abstain from cigarette smoking for at least 2 months preoperatively; (142) a specific smoking cessation program or counseling may be necessary in this regard.
- Patients should be trained preoperatively in lung expansion and airway clearance techniques, including deep breathing, incentive spirometry, posture, splinting, and assisted coughing. (143-146) Patients should also be familiarized with the planned surgical procedure and chest tubes as well as trained in pacing, energy conservation, pain management, venous thrombosis prevention, bed mobility, and methods for performing transfers.
- Nutrition counseling and anxiety management are also important.

Pulmonary Rehabilitation and the Surgical Patient

- Exercise training duration should be based on the time frame for surgery as dictated by medical necessity. Short-duration (2 to 4 weeks) preoperative pulmonary rehabilitation for respiratory patients about to undergo major elective surgery is feasible, although its safety and benefits need confirmation in larger randomized controlled trials

Pulmonary Rehabilitation and the Surgical Patient

- Postoperatively, patients should be mobilized as early as possible. The implementation of pain control and lung expansion strategies learned before surgery is crucial to minimize atelectasis and assist in the clearance of secretions.
- Gas exchange should be monitored closely, and noninvasive positive pressure ventilation should be used, when necessary.
- Adequate nutrition should be assured.
- Stretching, range of motion, and ambulation exercises should begin as soon as is medically feasible.

Pulmonary Rehabilitation and the Surgical Patient

- After hospital discharge, exercise training can be continued in a standard outpatient pulmonary rehabilitation program.
- Uncontrolled clinical studies have demonstrated that postoperative pulmonary rehabilitation (after lung cancer resection surgery) improves walking endurance, increases peak exercise capacity, and reduces dyspnea.
- Further studies are needed to assess the impact of postoperative pulmonary rehabilitation on perioperative complications and survival

Pulmonary Rehabilitation and the Surgical Patient

Figure 7.11 Pulmonary rehabilitation program modifications for patients with lung cancer or those undergoing thoracic or upper abdominal surgery

- Exercise training to increase muscle strength and endurance
- Pulmonary rehabilitation once chemotherapy or radiation therapy is completed
- Self-management strategies
- Assessment of need for assistive equipment and services
- Psychosocial intervention: coping, stress, and anxiety management techniques
- Education
  - Breathing retraining
  - Pacing
  - Energy conservation
  - Nutrition
  - When to seek health care services

Chest Wall and Neuro muscular Disorders

- Some patients with restrictive chest wall disease or neuromuscular disease with respiratory impairment (with or without underlying lung disease) may benefit from pulmonary rehabilitation.
- The incidence, severity, and natural history of respiratory impairment in these disorders vary widely, but respiratory complications occur in the majority of people at some point in the illness.
- Many of these patients have concomitant skeletal muscle or joint dysfunction.

Chest Wall and Neuro muscular Disorders

Figure 7.9 Examples of conditions wherein pulmonary rehabilitation may be of benefit

- Restrictive chest wall disease (e.g., kyphoscoliosis, pneumoplasty)
- Neuromuscular disease with respiratory involvement
- Muscular dystrophy
- Parkinson's disease
- Multiple sclerosis
- Postpolio syndrome
- Myasthenia gravis
- Amyotrophic lateral sclerosis
- Neuromuscular disease (including stroke) and comorbid primary lung disease

Chest Wall and Neuro muscular Disorders

- People with neuromuscular disease or chest wall disease tend to have a restrictive ventilatory defect on pulmonary function testing. Many have a rapid, shallow breathing pattern, especially during exercise.
- Other physiological derangements may include respiratory muscle weakness, position-related mechanical disadvantage of the respiratory muscles, chest wall distortion, and reduced chest wall compliance (especially in kyphoscoliosis).
- Mechanical and physiological abnormalities lead to gas exchange disturbances, often with an elevated P*aCO2 (resulting from alveolar* hypoventilation) and hypoxemia (related to ventilation–perfusion mismatch or a shuntlike effect at the lung bases).

Chest Wall and Neuro muscular Disorders

- The previously noted mechanical and physiological respiratory abnormalities plus frequent concomitant peripheral muscle dysfunction lead to exercise intolerance.
- Respiratory muscle weakness or fatigue and increased oxygen consumption resulting from peripheral muscle weakness or incoordination contribute to exertional dyspnea.
- Impaired muscle function also results in a weak, impaired cough.
- Furthermore, secretion clearance may be compromised by poor lung expansion or chest wall distortion.

Chest Wall and Neuro muscular Disorders

- Some patients, especially those with degenerative neuromuscular disorders such as muscular dystrophy, amyotrophic lateral sclerosis (ALS), multiple sclerosis, and Parkinson's disease, develop swallowing dysfunction and therefore are at risk for aspiration.
- Collectively, these disturbances increase the risk of respiratory infection. Sleep-disordered breathing, including obstructive sleep apnea and the worsening of alveolar hypoventilation during sleep, is very common among people with neuromuscular and restrictive chest wall disorders, especially in the advanced stages of disease.

Chest Wall and Neuro muscular Disorders

- Supportive care, with emphasis on prevention of medical complications and maintenance of functional status, is a principal focus.
- A few small studies suggest benefits of aerobic training or pulmonary rehabilitation for patients with restrictive chest wall disease, with improvements demonstrated in walking endurance, dyspnea, and pulmonary function.
- Several small trials suggest that individualized pulmonary rehabilitation may benefit selected patients with neuromuscular disease.

Chest Wall and Neuro muscular Disorders

- The approach to pulmonary rehabilitation generally differs from that for the COPD patient. As in COPD, exercise training is undertaken in an effort to prevent or reverse deconditioning.
- Consideration must be given to avoiding excessive muscle fatigue in patients with neuromuscular disease or postpolio syndrome.
- Those with significant skeletal muscle dysfunction may benefit in particular from water-based aerobic exercise.

Chest Wall and Neuro muscular Disorders

- To date, no clear published guidelines exist regarding optimal exercise strategies for the different forms of neuromuscular disease, and further investigation is needed in this area.
- Aerobic conditioning may be helpful in maintaining mobility and reversing deconditioning. Ambulation and cycle exercise can be performed by patients who have responded to medical therapy or are in an early stage of disease. More frequent exercise sessions of shorter duration (interval training) may be used to avoid overstressing already limited capabilities

Chest Wall and Neuro muscular Disorders

- Strength training is usually included, but exercises may vary from resistive training to active range of motion.
- Those types of strength training that can induce muscle injury should be avoided.
- Other interventions that may be helpful include orthotics, airway clearance, and inspiratory muscle training.
- Physical therapy or occupational therapy consultation may be necessary to identify the potential needs for adaptive equipment or orthotics necessary to maintain independence with ADLs, work, driving, or higherorder activities such as attending school

Chest Wall and Neuro muscular Disorders

- Close attention should be given to training the patient in energy conservation and pacing techniques.
- Vocational rehabilitation may be useful for selected patients.
- Family members should be taught the basis of the patient's functional limitations and the optimal ways to provide assistance.
- Pursed-lip breathing training may not be appropriate for all people with neuromuscular disease.

Chest Wall and Neuro muscular Disorders

- Patients should also be taught strategies to assist with cough and secretion clearance such as the manually assisted cough technique.
- An insufflator–exsufflator device, vibration vest, or positive expiratory pressure device can be used where appropriate

Chest Wall and Neuro muscular Disorders

Figure 7.10 Pulmonary rehabilitation program modifications for patients with chest wall and neuromuscular disorders

Exercise Assessment

- Disease type and severity
- Individual patient needs and functional limitations
- Consultation with neurologist or physiatrist in formulating exercise prescription (appropriate type and intensity of exercise) if needed

Exercise Training

Nature and goals of training program individualized

Avoidance of excess muscle fatigue

Aerobic and strength training: ambulation, cycling, water-based exercise

More frequent, shorter-duration exercise sessions if necessary

Interval training possibly beneficial

Inspiratory muscle training for selected patients

Additional Considerations

Supplemental oxygen to keep S_pO_2 greater than 88%

Potential role for noninvasive assisted ventilation during exercise

Identification of patients who may be in need of nocturnal noninvasive assisted ventilation (CPAP or BiPAP)

Assessment of need for assistive or orthotic equipment to maintain independence with ADLs

Inpatient PR for patients with severe functional limitation or intensive nursing or medical care needs

Age-appropriate Patient and Family Education Topics

Respiratory manifestations or complications of neuromuscular or chest wall disease (tailored to the person's condition)

Secretion clearance and cough techniques

Recognizing signs of disease destabilization and infection

Rationale for and benefits of noninvasive assisted ventilation

Supplemental oxygen

Tracheostomy and mechanical ventilation

Advance directives

Community resources, skilled nursing facilities, chronic ventilator facilities

Progetto sostenuto con i fondi
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