Cerebral Palsy: Physical Therapy Techniques in Greece

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The concept of cerebral palsy

Cerebral palsy refers to a group of permanent, unchanging disorders of the developing brain that affect both postural control and movement progression. It is the most common childhood disability.

The disorder results in motor limitations attributed to non-developing changes in the fetal brain. Cerebral palsy occurs at a frequency of more than 3 newborns per 1000 births in non-developing countries

(McIntyre et al 2022)

The concept of cerebral palsy

Often, a consequence of the disorder is:

- a reduced ability to maintain balance, both while Standing and Dynamic
- insufficient or absent of head and body control against gravity

- **the neonatologist,**
- **the pediatric neurologist,**
- **the pediatric orthopedist,**
- **the pediatric physical therapist,**
- **the speech therapist,**
- **the occupational therapist,**
- **the child psychologist,**
- **and the active participation of the family**

(Zhang, 2017)

The role of physical therapy in CP is believed to be a major challenge, as designing effective therapeutic interventions is a **complex process**.

The classic therapeutic approaches that have been applied over the years are changed, renewed, abolished or even new ones emerge.

The goal of all is early intervention, management and improvement of children with CP, with the subsequent achievement of a **better quality of life**

(Verschuren et al., 2008; Martin et al., 2010).

Physiotherapists utilize a wide variety of therapeutic interventions to enhance autonomy, strength and coordination of patients' voluntary movements. The set of interventions has developed rapidly in recent years. Some of the most well-known approaches are:

- **Neurodevelopmental treatment (Bobath)**
- **Vojta method,**
- **Proprioceptive Neuromuscular Facilitation (PNF),**
- **Sensory integration and**
- **Dynamic Movement Intervention (DMI)**

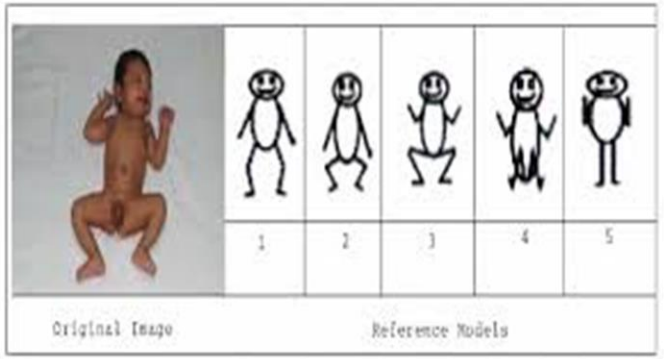
(Levitt, 2014; Cha et al. al., 2017; Ganesh & Das, 2019)

Clinical diagnosis of cerebral palsy

3 useful tools have been identified, which are valid reliable and sensitive, to predict the development of the disease early:

- the use of the neonatal **MRI** with 86%-89% sensitivity
- **Prechtl Qualitative Assessment of General Movements (GMs)** with 98% sensitivity and
- **the Hammersmith Infant Neurological Examination (HINE)** scale with 90% sensitivity

(Romeo et al 2013).



EPIDEMIOLOGICAL FACTS AND PATHOGENESIS

The incidence of CP varies between **1.5 and 3.0 per 1,000 births**, which however varies with the presence of various risk factors. Systematic reviews that have dealt extensively with the average incidence of cerebral palsy as early as 1980 to 1990, later in 1996 and finally from 1990 to 2005 have reached important conclusions.

In particular, the data collected allowed one of the studies to report that the probability of CP in infants with a birth weight of **less than 1.500 grams was more than 70 times higher than in infants with a birth weight of 2.500 grams or more.**

(Vitrikas et al. , 2020).

EPIDEMIOLOGICAL FACTS AND PATHOGENESIS

More specifically, they showed that prenatal factors appear to be responsible for almost 75% of the risk, because most of the damage can occur during **the second half of pregnancy, a critical period for fetal brain development.**

The highest index was noted for infants born **before the 28th week** of gestation with a birth weight of **1,000 to 1,500 grams**.

(Vitrikas et al., 2020; Sadowska et al., 2020).

CLASSIFICATION OF CEREBRAL PALSY TYPES AND TOPOGRAPHY

The clinical presentation of cerebral palsy varies, as does the classification given to the different groups of movement disorders affecting this population.

The widely accepted pathophysiological classification of CP by the European Committee for the Registration of Children is distinguished into 3 types:

a) spastic type,

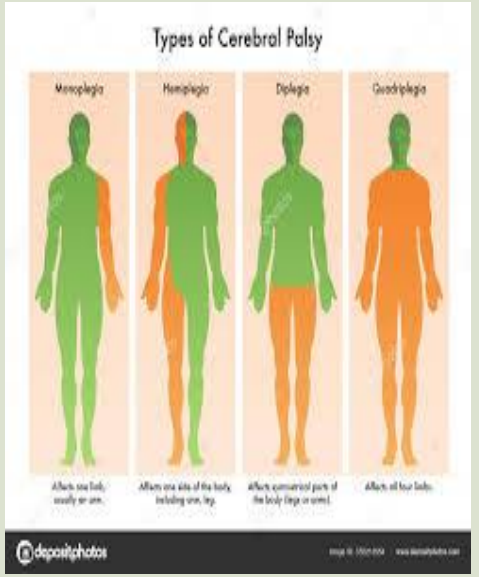
b) dyskinetic type,

c) ataxic type and

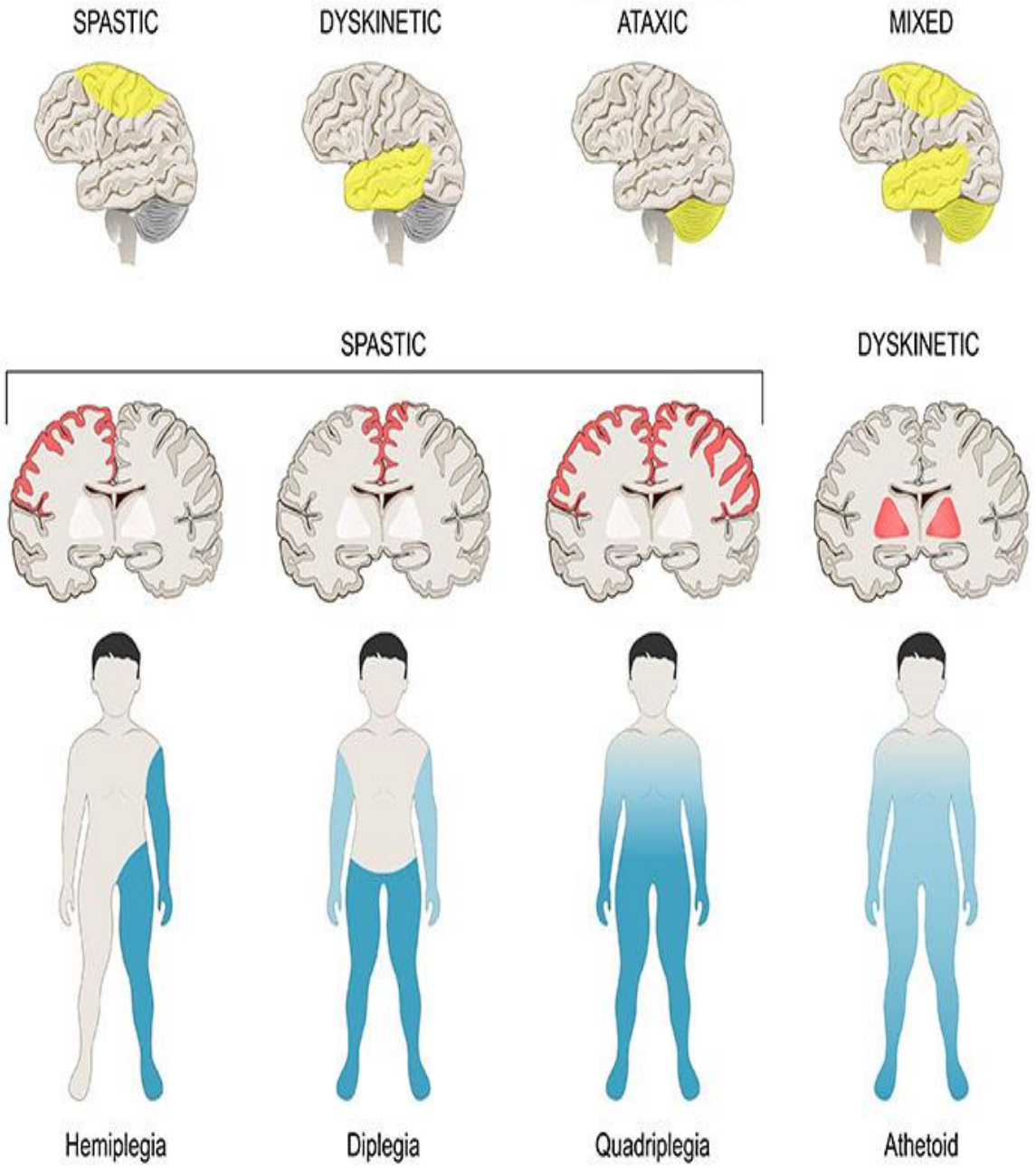
d) Mixed type

In all types, motor impairment ranges from <u>mild, moderate or severe</u>

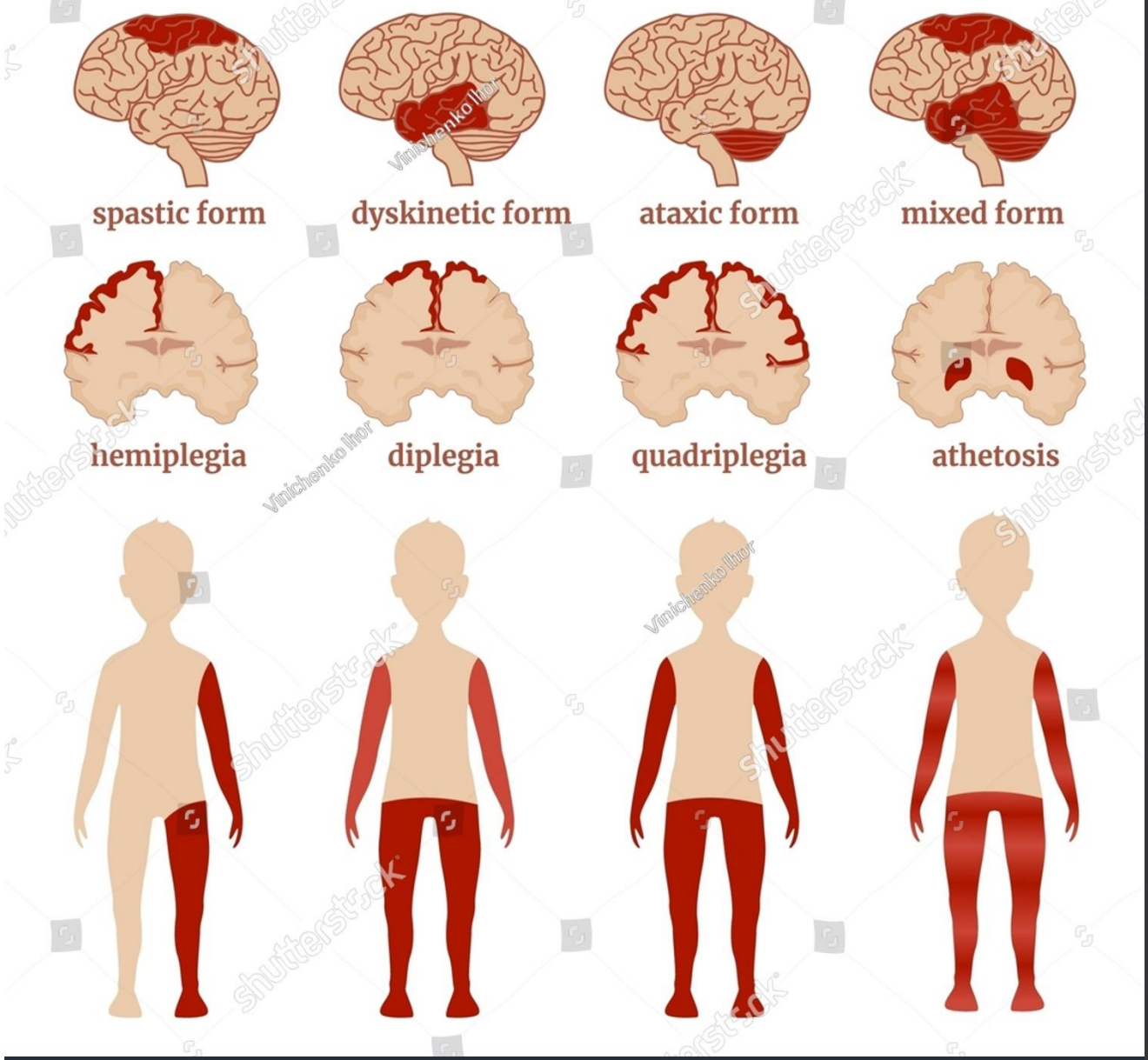
(Cans, 2007)



Cerebral palsy



cerebral palsy



CLASSIFICATION OF CEREBRAL PALSY

A. Spastic CP, which is the most frequently occurring type (70%) has some motor characteristics. The most important of these is **spasticity**, which is considered responsible for the limited range of motion of the joints, muscle weakness and motor impairment of the child.

The movement pattern differs from normal children, with the co-contraction of agonists and antagonists influencing the motor response.

Pathological posture is another motor characteristic of them, as there is a delayed development of the mechanisms of postural stability and postural adaptation of the head and trunk.

(Krigger, 2006; Levitt, 2014; Logothetis, 2016).

CLASSIFICATION OF CEREBRAL PALSY

B. The second type of CP, dyskinesia is an indication of basal ganglia involvement.

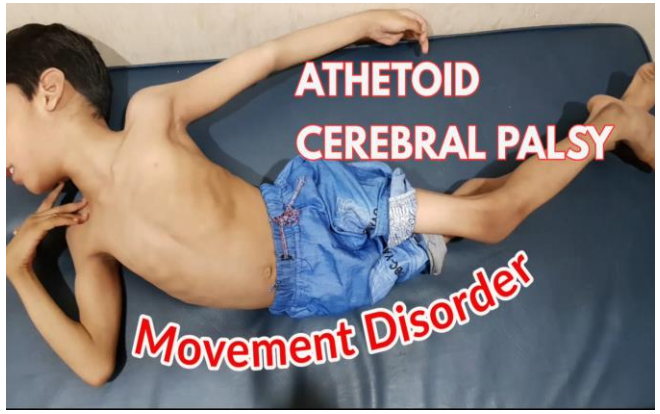
Dyskinetic CP, which occurs in 20% of children, can be distinguished into athetosic and dystonic subtypes.

Athetosis is characterized by slow, continuous rotational movements that do not allow maintaining a stable position.

Dystonia is characterized by involuntary prolonged or intermittent muscle contraction with repetitive and abnormal postures

Involuntary movements disrupt balance, and compensatory adoption of a pathological backward-leaning posture with hip extension, lordosis, and kyphosis is observed.

(Krigger, 2006; Levitt, 2014; Logothetis, 2016).



CLASSIFICATION OF CEREBRAL PALSY

C. Finally, the rarest form of CP is the ataxic type (10%), which is due to cerebellar damage children are unable to produce normal voluntary movement. It is characterized as a rare form as it seems to affect only 5 to 10% of the total number of children born with CP worldwide.

Clinically there is generalized unsteadiness, abnormal postural patterns and lack of rhythmically coordinated movements. In ataxia, muscle tone is reduced and children experience floppy baby syndrome. Both the ability to maintain posture and walking are delayed, while tremors in the extremities are also common

(Krigger, 2006; Levitt, 2014; Logothetis, 2016).

CLASSIFICATION OF CEREBRAL PALSY

D. Brief reference is also made to the hypotonic and mixed CP. Hypotonic CP usually develops into an athetic or spastic type and may not represent a specific type of CP. Hypotonia has not been associated with specific nerve damage and is characterized by reduced muscle tone and impaired postural functions.

Finally, the mixed form of CP is used to describe the clinical picture of a child that combines a multitude of deficits of the above CP forms, such as the presence of spasticity and dyskinesia

(Tecklin J.S., 2007; Wright & Palisano, 2021).

TOPOGRAPHIC CLASSIFICATION OF CP

Children with CP are grouped based on the topographical distribution of the lesion into categories. **Hemiplegia, diplegia and tetraplegia are the main types of spastic CP**

(Graham et al., 2016)

The mildest form of **CP is hemiplegia,** where one hemisphere of the body is affected. Clinically, there is a lack of fine movements in the affected upper limb, adduction, medial rotation and flexion of the lower limb, and trunk involvement is also not excluded. The developmental path of a child with hemiplegia is quite favorable if there are no accompanying cognitive-perceptual-sensory disorders, as he is able to walk independently and perform functional activities.

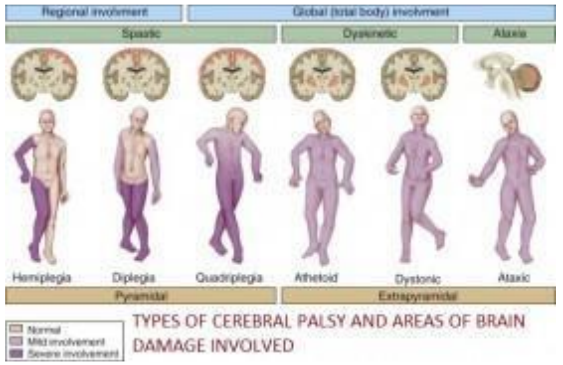
(Levitt, 2014; Logothetis, 2016)

TOPOGRAPHIC CLASSIFICATION OF CP

Diplegia is characterized as a more difficult form of CP, as more than 50% of these children have bilateral spasticity in the lower limbs, making independent control of their standing and movement very challenging.

Clinically, in both standing and walking the lower extremities are in adduction, flexion and medial rotation. Also, the sitting position is the same as that of children with quadriplegia, known as the "W" position. However, despite the severe involvement of the lower limbs, the pathological muscle tone and motor limitations involve to a milder degree the upper limbs as well as the trunk.

(Levitt, 2014; Logothetis, 2016).



TOPOGRAPHIC CLASSIFICATION OF CP

The most severe form with significant motor deficit in both upper limbs, trunk and lower limbs, is **Quadriplegia.** It is often accompanied by cognitive and perceptual deficits.

Following the limited mobility of these children is the presence of atrophies, fractures and osteoporosis due to insufficient loading of the limbs, respiratory, cardiovascular and circulatory complications.

(Levitt, 2014; Logothetis, 2016).

The concept of cerebral palsy

Physiotherapy assessment of children with CP aims to:

- determine participation abilities and limitations,
- activity limitations,
- deficits in body structures and functions,
- as well as personal and environmental factors.

The purpose of ongoing assessments is to provide systematic feedback to therapists, children, and families about the child's progress and weaknesses.

(Panteliadis et al., 1998; Aroojis et al., 2019).

SYNDROME DEFICIENTS OF CEREBRAL PALSY

CP in this population as mentioned earlier significantly impairs their mobility, soon leading them to functional incapacity.

- **reduced voluntary motor weakness,**
- **pathological muscle tone,**
- **coordination problems,**
- **lack of separation and**
- **involuntary movements**

Secondary problems

- **structural changes in the muscle,**
- **stiffness,**
- **atrophy,**
- **contractures,**
- **osteoporosis**
- **degenerative arthropathy, deformations of the Spine etc.**
- **Sensory deficits related to proprioception**
- **Stereotype behavior**
- **epilepsy**
- **and pain**

(Pruszczynski et al., 2016; Vitrikas et al., 2020)

CLASSIFICATION OF FUNCTIONALITY USING RATING SCALES

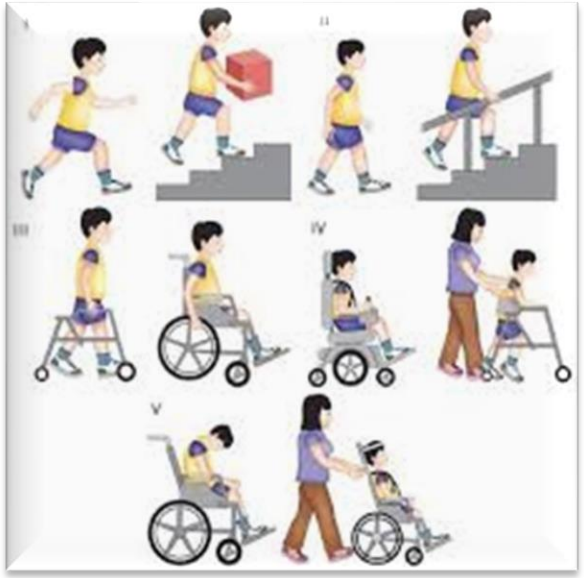
Some of the most well-known and reliable tools used mainly in children with CP, up to the age of 18, are:

- **the Gross Motor Function Classification System (GMFCS),**
- **the Manual Ability Classification System (MACS),**
- **the Bimanual Fine Motor Function (BFMF),**
- **the Communication Functional Classification System (CFCS),**
- **the Eating and Drinking Abilities Assessment System (EDACS),**
- **the Pediatric Evaluation of Disability Inventory (PEDI), and**
- **the Pediatric Balance Scale (PBS)**

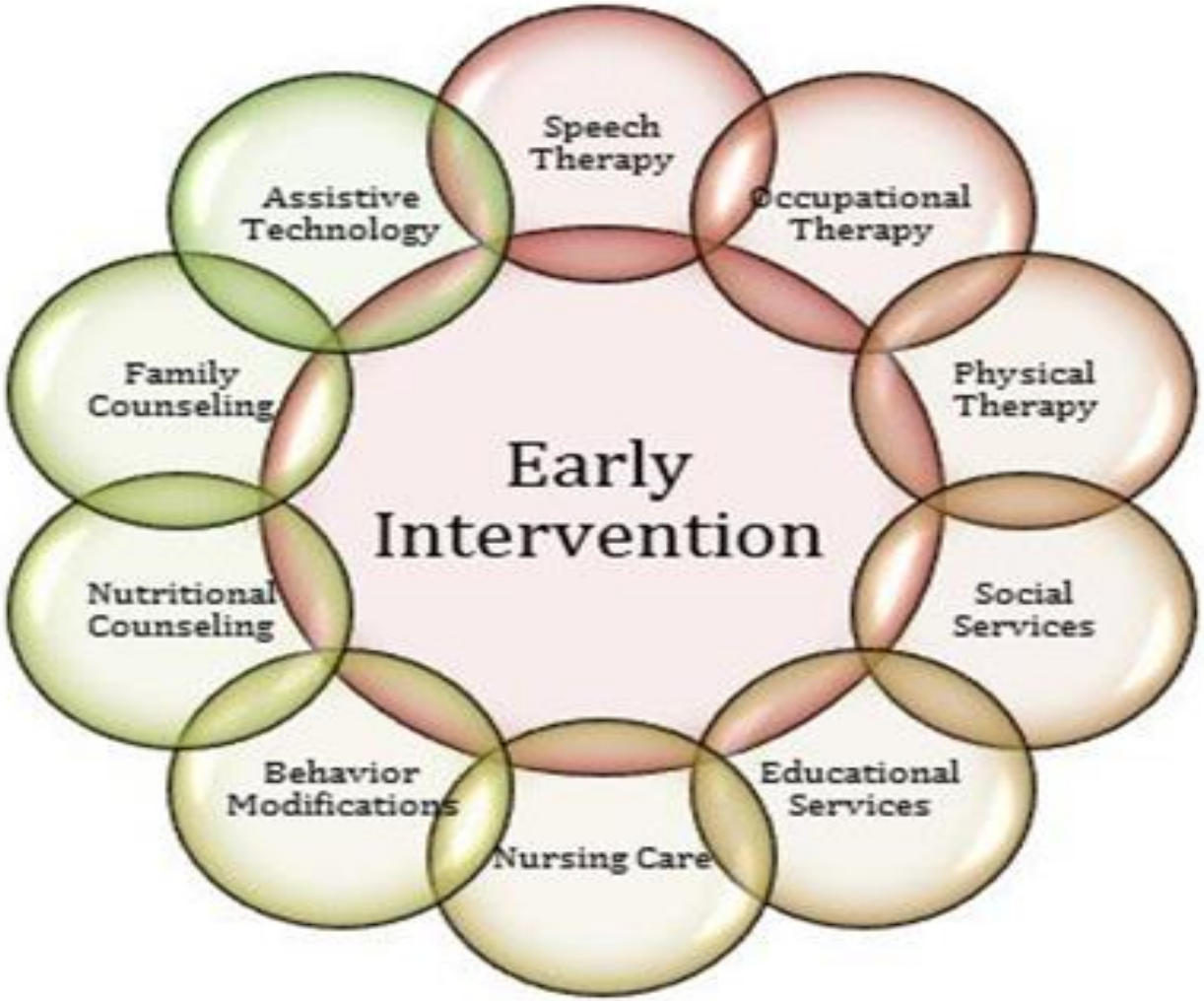
(Cans et al., 2007; Ohrvall et al., 2014; Wright & Palisano, 2021).

GROSS MOTOR FUNCTION CLASSIFICATION SYSTEM (GMFCS)

Level I: walks without limitations.
Level II: walks with limitations. Wheeled mobility (typically self-propulsion) may be required for long distances.
Level III: walks using a hand-held mobility device. Wheeled mobility (typically self-propulsion) may be required for outdoor and community use.
Level IV: self-mobility with limitations; may use powered mobility. These children are more likely to require supported seating, are more likely to be transported (typically pushed by a caregiver) in a manual wheelchair or use powered mobility.
Level V: transported in a manual wheelchair (pushed by a caregiver). Children and youth at this level require significant postural support in seating and may only achieve self-mobility using a powered wheelchair.



Multidisciplinary approach -Cerebral Palsy



Importance of early assessment of balance

An abnormal posture accompanied by delayed motor development leads to a delay in acquiring and maintaining a sitting and standing position and a reduced ability to support the body against gravity

(Masson J 1994, cited in Mostafa S. Ali 2021)

Thus, it appears that the earlier the assessment of the functional deficit and the inclusion in a rehabilitation plan, the more likely is the achievement of a better functional goal, due to the critical period of exploiting the neuroplasticity of the child's brain

(Morgan C et al 2021)

Importance of early assessment of balance

Balance is assessed with a variety of weighted functional tests and scales that focus on specific positions such as:

- **sitting or standing,**
- **localized areas such as the head or trunk,**
- **or the whole body and address a specific range of ages,**
- **motor levels,**
- **and achievement of the child's motor milestones**

An additional modern way of assessing balance ability is the machines, such as the dynamometer and the balance platform, widely used by clinical therapists.

Modern plans for rehabilitation and treatment of cerebral palsy symptoms

To manage the symptoms of cerebral palsy there are a variety of treatment methods, which involve:

- taking medication,
- injections of toxins such as Botox
- alcohol injections and
- less often surgical interventions.

Botulinum toxin infusions are a more invasive method and are used to reduce the secondary symptoms of spasticity, such as pain and stiffness, and by extension to normalize tone.

The results of this method last for about six months.

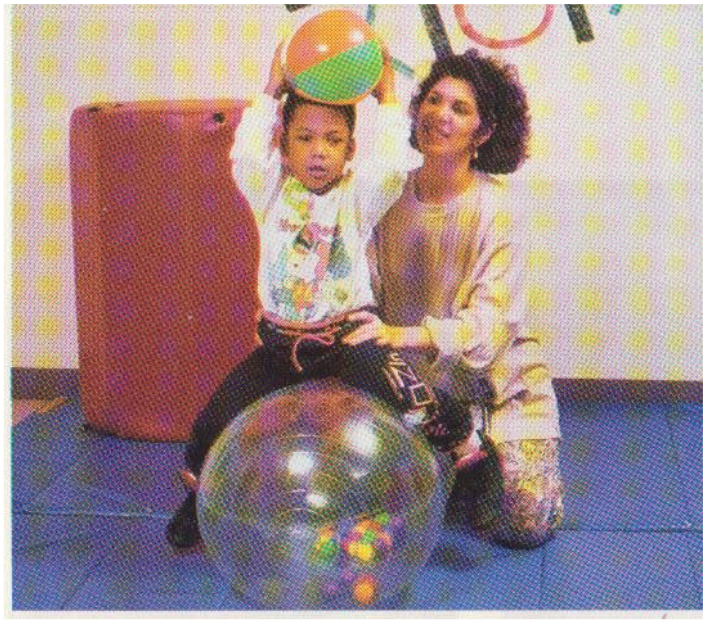
It is combined with the use of facilitation techniques by the physical therapist, exercises to acquire motor patterns and activate individual muscle groups with the use of technology, such as:

- **exoskeletons,**
- **virtual reality programs,**
- **robotic systems,**
- **orthotic adaptation and**
- **external mobility aids, are used to treat the symptoms of cerebral palsy.**

(Jackman et al 2022)

USE OF BALL

The child sits on the ball and the therapist moves right-left, back-front, diagonal movements



<u>Objective</u>:
Improving trunk control, balance and cooperation of two hands

Use of balance board

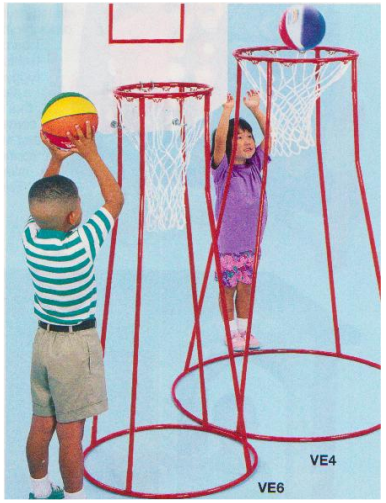
The child squats on the balance board and the Physio moves it left and right

<u>Objective:</u>

Development of balancing reactions, trunk control and stability, body sensation perception, hand-eye coordination.

Changes of the Environment

Down on the ground there are scattered “stones” in different colors



<u>Objective:</u>
Separation of the lower extremities, balance in limited space, improvement of orientation reactions, visual motor coordination and upper body strengthening extremities.

Developmental patterns of posture and movement

The Bobath method is based on Neurodevelopmental principles that see development as:

- Dynamic
- Continuous
- Cephalo-caudal
- Proximal-distal
- Automatic before Conscientious
- Customizable

Principles of the method

1) A patient who only gets feedback from his **abnormal posture and movement** only forms a "wrong" image of his body. Since everything he does seems normal to him, he has no need to correct his "mistakes".
2) So the treatment comes to give the patient the sense of movement based on **normal functional patterns.**
3) Normal movement cannot be based on a pathological posture, but needs its own, **appropriate, static background.**

Hands on!!!!!

Principles of the method

5) preventing secondary musculoskeletal injuries and **maximizing physical function**

6) promoting the cognitive, social and emotional development of children

7) the development, maintenance, and perhaps restoration of neural structures.

Hands on!!!!!

Video games and technology

Another treatment method that has evolved quite a bit in recent years is the use of video games and technology in general to treat children CP.

A systematic review by Apolo-Arenas et al., (2021) found that therapy using virtual reality and video games had better outcomes in children with various types of cerebral palsy who received the therapy compared to children who received simple conventional physical therapy.

Strengthening exercises

The study by Merino-Andrés et al (2022) states that strengthening exercises of specific muscle groups can help improve strength, balance, walking speed and gross motor function, without affecting spasticity.

However, the improvement observed was short-lived, so it is stated that the patient should continue the program to maintain the benefits derived from the treatment. Therefore, these exercises are suggested to be used in a functional-oriented intervention program.

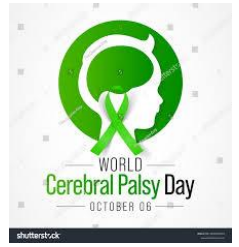
Therapeutic climbing

Therapeutic climbing began to appear in the therapeutic protocol of rehabilitation centers in the late 20th century.

This type of therapy has been shown to help improve a patient's muscle strength, endurance, flexibility, coordination and balance.

Like any therapeutic technique, therapeutic climbing has contraindications including conditions such as osteoporosis, fractures, and acute pain

(Liu et al 2022)



The complexity of neurological diseases has led to the need for an interdisciplinary team for the personalized and holistic treatment of each Child with CP.

Therapists must see the patient holistically and focus on secondary factors that may affect performance such as psychological disorder and difficulty integrating into society.

Thus, the collaboration of different specialties and regular communication between them, to create a comprehensive approach but also the participation of the family in the decision-making process, is necessary for all patients

(Schwabe 2020)

Playground activities

We encourage parents to orient their child to participate in children's group games. This has the effect of strengthening not only above goals but contributes **to socialization** and grouping of the child.

- The child calms down, acquires a sense of his strength and of freedom and uses his whole body until learn to control it.
- Through movement, muscle stimulation is achieved and acceleration of the child's bone growth.
- Physical strength and endurance is enhanced.
- The child develops his fine motor skills

- Self-confidence, independence and his self-sufficiency.
- He has better behavior, because as he plays sports
- Develops harmonious relationships
- He practices his basic skills such as running, walking, jumping etc.…


THANK YOU
THANK YOU
VERY
MUCH