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The term cerebral palsy refers to any one of a number of neurological disorders that appear in infancy or early childhood and permanently affect body movement and muscle coordination but don't worsen over time.

History:-

The first documented history of cerebral palsy dates back to the 1860's. It was when an English surgeon named William Little came across a puzzling condition that affected young children. He wrote the first medical descriptions detailing a disorder that caused stiff, spastic muscles in their legs, as well as slightly in their arms. It was more difficult for these children to accomplish tasks that other children found rather easy, such as grasping objects, crawling, and walking. Oddly enough, these conditions did not change, for better or worse, as they got older. What was originally named Little's disease is now known as spastic diplegia cerebral palsy. Little found that most of these children were born following premature or complicated deliveries. He reasoned that extended time in the birth canal resulted in a lack of oxygen, causing their condition. Little felt that this oxygen shortage damaged sensitive brain tissues responsible for controlling movement.

Introduction

Cerebral Palsy is one of the most important cause of disability and morbidity in paediatric age group in India. If diagnosed at early age, the prognosis and overall outcome is much better. But unfortunately due to lack of awareness regarding early intervention and various therapies amongst the society and health care professionals, many cases are diagnosed late leading to morbidity and permanent disability.

Cerebral palsy (CP) is a group of permanent movement problems that do not get worse over time. Although it has historically been considered a static encephalopathy, this term is not entirely accurate because of the recognition that neurologic features of CP often change or progress over time. They cause physical disability, mainly in the areas of body movement.

Cerebral palsy is defined as "a group of permanent disorders of the development of movement and posture, causing activity limitation, that are attributed to non-progressive disturbances that occurred in the developing fetal or infant brain." While the central feature of CP is a disorder with movement, difficulties with thinking, learning,

feeling, communication and behavior often occur along with cerebral palsy. Of those with CP, 28% have epilepsy, 58% have difficulties with communication, at least 42% have problems with their vision, and 23–56% have learning disabilities.

Cerebral palsy is caused by damage to the motor control centers of the developing brain and can occur during pregnancy, during childbirth, or after birth up to about age three. About 2% of all cerebral palsy cases are believed to be due to a genetic cause. Cerebral Palsy is a term commonly referred to as CP and described by loss or impaired motor function. Basic cause of CP is brain damage that occurs in a developing brain. CP is not life threatening condition but it is permanent. Though it is not completely treatable, it is manageable. CP is neither contagious nor communicable.

The brain damage and injury to brain in CP is permanent as the brain does not heal like other parts of the body might heal.

Causes of cerebral palsy:

1. **Congenital** i.e. these children are born with CP at birth due to brain damage to a developing fetal brain. It is present at birth although it may not be detected for months. It is responsible for CP in about 70% of children. An additional 20% are diagnosed with congenital cerebral palsy due to a brain injury during the birthing process. [7]

2. **Acquired** i.e. Acquired after birth due to brain damage occurring in first few months or years of life e.g. bacterial meningitis or viral encephalitis.

Apart from developmental injuries (insults) to brain
Other causes of CP are

1. Genetic
2. Metabolic
3. Ischemic
4. Infections

All these causes will produce similar neurological picture.

Causes of congenital cerebral palsy:

1. Infections during pregnancy that may cause damage to developing CNS of foetus e.g. rubella, toxoplasmosis, cytomegalo virus etc.
2. Severe jaundice in neonatal period, due to RH incompatibility between mother and baby, which can damage brain cells.
3. Severe oxygen deprivation to the brain during labour.

Some conditions which can lead to possibility of CP in a child are as follows:

1. Breech presentation during delivery
2. Apgar score low at 10 minutes after delivery.
3. Low birth weight.
4. Premature babies.
5. Seizures shortly after birth
6. Congenital nervous system malformations like microcephaly

All children exposed to these risk factors may not develop CP but treating doctor and parents should be aware of this possibility.

Screening of such babies in high risk baby clinic is a absolute must to detect signs of early CP and treat them.

Classification of Cerebral Palsy:

Depending upon the etiology and involvement of various parts of the body Cerebral Palsy is classified into 4 major groups:

1. Spastic diplegia
2. Spastic hemiplegia
3. Spastic Quadriplegia
4. Extra Pyramidal (Athetoid or dyskinetic)

In all spastic cases, damage to brain is in motor cortex area.

1. Spastic Diplegia :

- In this type, both lower limbs are predominantly involved.
- This is the commonest type. Basic pathology in this type is peri-ventricular-leucomalaysia(PVL).
- Important causes of this are:
- Prematurity, Ischemia, Infections

2. Spastic Hemiplegia:

- Usually, upper arm is involved with mild involvement of lower limb.
- Causes are infections, genetic and developmental.

3. Spastic Quadriplegia:

- All four limbs are involved in this type. This is most severe form of CP. Pathology is PVL
- Causes are ischemia, infections & genetic.

4. Extra Pyramidal(Athetoid or dyskinetic):

- Characterized by involuntary, slow writhing movements. In some cases trunk movements are affected more.
- Pathology is in basal ganglia
- **main causes** are:
 - Kernicterus,
 - metabolic and
 - genetic.

Signs & Symptoms :

Cerebral palsy is characterized by abnormal muscle tone, reflexes, or motor development and coordination. There can be joint and bone deformities and contractures (permanently fixed, tight muscles and joints).

The classical symptoms are spasticity, spasms, other involuntary movements (e.g., facial gestures), unsteady gait and problems with balance.

Scissor walking (where the knees come in and cross) due to adductor spasm and toe walking due to spasm in lower limb.

But overall symptomatology in cerebral palsy cases is variable & diverse. At one end of spectrum, we have children who have only slight clumsiness and at other end we have children with severe impairment of movement in which co-ordinated movements are almost impossible. Some children will have severe paralysis of muscles which requires custodial care while some with very less involvement can be managed effectively with therapies and adaptive devices. Associated problems like epilepsy and intellectual impairment are also important factors in

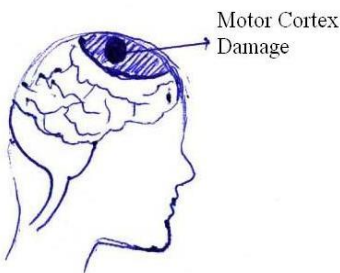
prognosis or overall outcome of that child. Depending upon the damage to the brain there may be other conditions like visual impairment, hearing impairment, abnormalities of intellect and speech.

Once the functional capacity in terms of gross motor and fine motors skills is known other associated problems are evaluated, action plan is prepared for that individual child

A baby / child of cerebral palsy will generally show symptoms during the first three years of life. May have some of the signs & symptoms as below:

1. Developmental delay - achieves mile stones later than his peers.
2. Can be easily startled.
3. Has feeding and sucking swallowing problem..
4. Crawls in a different way.
5. Has abnormal muscle tone leading to different posture and movement problems.
6. Uses one side of the body over the other.
7. Has problems in coordination and balancing body.
8. Has hearing problem.
9. Has problem with eye sight.
10. Can have seizures.

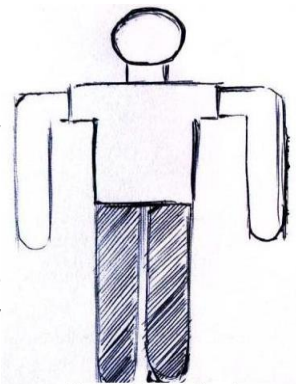
Spastic Diplegia:



Spastic

As shown in figure, the site of damage is in motor cortex, & there is involvement of both lower limbs.

In this type child's lower limbs are affected. There is bilateral spasticity of the legs, upper limbs are not involved or there may be little spasticity in upper limbs. When the child is hold upright there is crossing of the legs called as scissoring.



Spastic Diplegia

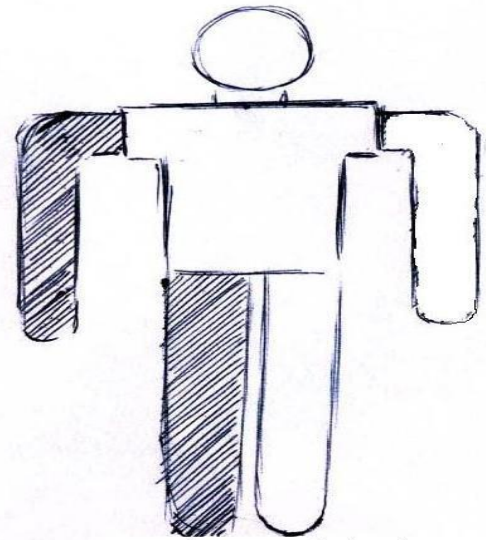
The first sign is often noted when infant begins to crawl. He crawls in a different manner, as he uses upper limbs in a normal fashion but drags the lower limbs & crawls like a commando. Because of excessive spasm and scissoring, application of diaper can be difficult.

Examination of this child shows spasticity in lower limbs with brisk DTR, ankle clonus. Walking is significantly delayed and the child walks on tip toe due to spasticity. In this type because of less use of lower extremities, there is disuse atrophy and upper portion of the body develop in a routine manner. In this children, chances of getting convulsions are less and intellectual development is excellent.

Spastic Hemiplegia :

In this type child will have spasticity on one side of the body, usually a hand and arm but may also involve a leg. Affected side may not develop properly. Some children can have seizures,. In most of the case, intellect is normal.

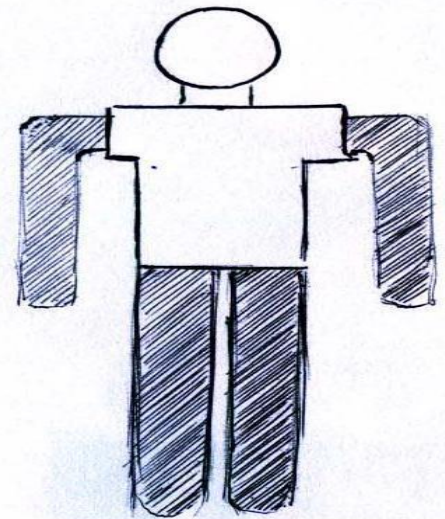
Infants with this type have decreased movements on affected side and show hand preference at a very early age as against normal children who are ambidextrous till the age of 1 to 1.5 years. Walking is usually delayed. Affected Child often walks on tiptoe because of increase tone and affected upper extremity develops a dystonic posture



Spastic Hemiplegia

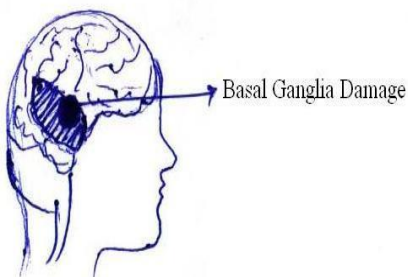
Spastic Quadriplegia :

This is most severe form of cerebral palsy due to involvement of all extremities and association with mental retardation and seizures. Contractures of knees and elbows are often present by late childhood. Walking and talking will be difficult. Speech and visual problems are prevalent in this type. Swallowing difficulties are common and sometimes led to aspiration pneumonia. They also have element of athetosis and may be labeled as mixed cerebral palsy.



Spastic Quadriplegia

Athetoid Cerebral Palsy :



Dyskinetic/Athetoid

As shown in figure, site of damage in Athetoid / Dyskinetic cerebral palsy is basal ganglia.

This type is also called as choreoathetoid or extra pyramidal cerebral palsy. It is less common form of cerebral palsy. Athetoid CP is marked by involuntary, slow, writhing movements.

Infants of this type are hypotonic with poor head control in contrast to other varieties where they have early head control due to spasticity. Feeding

may be difficult and drooling may be present. Speech is affected. Muscle tone is weak or tight leading to random and uncontrolled body movements. Due to this, child will have problem with sitting, walking, maintaining posture. Athetoid cerebral palsy can also be caused by kernicterus secondary to high level of bilirubin. This form of cerebral palsy is called as dyskinetic cerebral palsy in Europe.

Diagnosis :

Diagnosis of cerebral palsy is very simple in severe & classical forms. But if the child has a mild form of cerebral palsy, it may take longer time for diagnosis as one has to rule out other type of movement disorder. Real difficulty arises when signs and symptoms are mild & mimic certain other conditions. In differential diagnosis, one has to consider genetic, degenerative disorders, myopathies, spinal cord tumors & congenital CNS malformations.

For correct diagnosis, a thorough history taking including details of maternal problems, antenatal history, intrapartum and postpartum events is essential.

Details regarding NICU stay must be asked regarding History of convulsions, infections, hypoglycemia, hyperbilirubinemia and overall course of the baby in NICU. Also other history must be looked carefully as to when the baby was shifted with mother, whether baby had any feeding problems, choking episodes or abnormal movements and convulsions in the neonatal period .

Developmental history in detail including motor mile stones, hearing, vision and speech, should be taken.

On physical examination, look for the various muscle groups and extremities involved and pay special attention to the child's movement and muscle tone. Some children may have very relaxed, floppy muscles, while others will have stiff, tight muscle, Also look for any unusual postures or if the child favors one side over the other, the brisk DTR and positive Babinski signs, evidence for contractures, shortening of limbs, visual and hearing impairment.

While diagnosing cerebral palsy one has to rule out other conditions of CNS including degenerative diseases, spinal cord tumors, metabolic and genetic disorders and muscular dystrophy.

For this, radio – imaging in the form of MRI, Scan of the brain is indicated. This will help to determine the location and extent of the lesions in brain and associated congenital malformations if present.

MRI scan of spinal cord may be required if possibility of tumour in cordis thought of. Additional tests like Bera Test to detect any associated hearing problem. Complete ophthalmic check-up is essential to diagnose associated vision problems which can also be a clue to some genetic or metabolic problems if present. EEG is important for diagnosing associated seizure disorder. Developmental assessment is done for knowing the developmental quotient in younger children and Intelligence Quotient in older children. This will help in diagnosing other behavioral and psychological problems if they are there. With these tests one can know the functional capacity of that individual and plan individual training and educational programme (IEP).

Once diagnosed as cerebral palsy, management strategies for these children should be planned. While planning the management, the basic functional capacity of these children in term of gross motor and fine motor skills should be known. The impact of cerebral palsy in terms of motor ability or function is commonly described by –It's impact on gross motor skills and fine motor skills.

The gross motor skills of cerebral palsy can be categorized into 5 different levels using a tool called the Gross Motor Function Classification system (GMFCS).

GMFCS levels are as follows :

Level – I :

- Walks without limitations.
- uses no assistive devices.
- Has decreased speed, balance and co-ordinations.

Level – II :

- Walks with limitations.
- Walks independently but has difficulty with uneven surfaces, inclines or in crowds. Has minimal ability to run or jump.

Level – III :

- Walks using a hand held mobility device.
- Uses assistive mobility devices.
- May be able to climb stairs using a railing.

Level – IV :

- Self mobility with limitations. May use powered mobility.
- Self mobility severely limited even with assistive devices.
- Uses wheel chairs most of the time and may propel their own power wheel chair.

Level – V :

- Transported in a manual wheelchair.
- No self mobility.
- Impaired in all areas of motor function.
- Can't independently mobilise though may be able to use powered mobility.

Impact on fine motor skills.

The ability of children with cerebral palsy to handle objects in everyday activities can be categorized into 5 levels using the manual ability classification system (MACS).

Level – I:

Handles objects easily and successfully.

Level – II:

Children in level II perform almost the same activities as children in level-I but the quality of performance is decreased or performance is slower. They commonly try to simplify handling of objects.

Level – III:

Handles objects with difficulty, needs help to prepare and / or modify activities.

Level – IV:

Handles a limited selection of easily managed objects in adapted situations.

Level – V:

Doesn't handle objects and has severely limited ability to perform even simple actions.

Management Control

Once the functional capacity in terms of gross motor and fine motors skills is known other associated problems are evaluated, action plan is prepared for that individual child.

Risk Group :

The Indian Cerebral Palsy Register report 2009 identified four groups that statically have a greater risk of cerebral palsy.

1. **Males** – Males are at greater risk of having cerebral palsy.
2. **Premature babies** – Prematurity is associated with higher rates of cerebral palsy 42% of children with cerebral palsy are born prematurely, compared to 8% of the Indian Population.
3. **Small babies** – Low birth weight is associated with higher rates of cerebral palsy 43% of children with cerebral palsy had low birth weight compared to just over 6% of the Indian population.
4. **Twins / Triplets and higher multiple births** – 11% of children with cerebral palsy were from a multiple births, whereas the rates of multiple births are only 1.7% in the Indian population. [8]

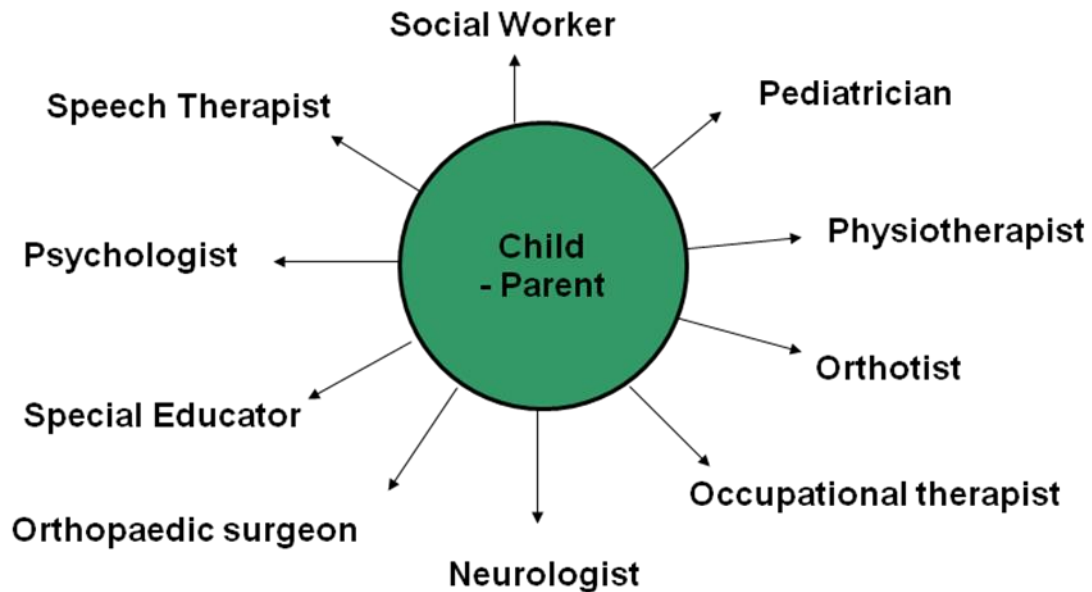
Management of Cerebral Palsy:

There is no complete cure for CP; but various treatment options are available. These options need to be tailor made depending upon the need & requirement of patient.

Various therapies like occupational therapy or physiotherapy will neither prevent development of CP in high risk group nor correct the neurological deficits. But, these therapies will optimize the function of children to achieve their potential.

Main aim of treatment is:

1. Try to make the child as independent as possible
2. To bring the child in main stream society



Treatment for CP usually involves a team of health professionals who are experts in different areas.

Team may include:

- Social Worker
- Pediatrician
- Physiotherapist
- Speech & language therapist
- Occupational therapist
- Clinical psychologist
- Special educator
- Orthotist
- Orthopaedic Surgeon
- Neurologist

Working with all experts together helps to give a insight to the child's needs and helps to make maximum use of abilities & strengths of children with cerebral palsy, thus prevent complications and improve quality of their lives.

Overall treatment consists of

1. Medications
2. Various therapies like physiotherapy, speech therapy etc.
3. Use of adoptive equipments such as walkers, frames etc.
4. Surgical interventions

Medications will be required for following problems:

1. **Stiff & painful muscles** which restricts child's mobility and prevents him from doing routine tasks. This can be treated with drugs like Diazepam. Diazepam is used for short term treatment. It has side effects like drowsiness, clumsiness & forgetfulness.

If it does not work other muscles relaxant like Dantrolene can be used. These have similar side effects like Diazepam.

For long term treatment a drug called Baclofen can be used which can be taken in liquid or tablet form. Side effects of Baclofen are drowsiness, confusion, clumsiness, constipation or diarrhea.

Another option is injection of Botulinum Toxin is available. This is injected in specific affected muscle or group of muscles. This will decrease the stiffness for 3 to 6 months. The treatment is most effective when physiotherapy follows the injection.

2. Drooling & feeding problems:

Drooling can cause irritation to the skin and infections in that area. This can be treated with anti-cholinergic drugs which reduces the production of saliva.

Injection of Botulinum Toxin into salivary glands can also be used temporarily.

Feeding problems can lead to aspiration pneumonia. To avoid this feeding through nasogastric tube is suggested.

Surgery:

Orthopedic surgeries may sometimes be required in following conditions:

- Release of contractures i.e. lengthening any muscles & tendons that are too short and causing problems.

Other surgical interventions which are required to treat other problems like scoliosis and urinary incontinence.

Selective Dorsal Rhizotomy: It is a surgical procedure which involves cutting some of the nerves in the lower spinal column, which can help to relieve leg stiffness. But even after this extensive, physiotherapy is must.

Physical therapy:-

Physical therapy is one of the most important aspects of cerebral palsy therapy. The referral to the physical therapist is often the first referral made in child's treatment. The job of the physical therapist is to help a child's mobility to develop and to carry out and teach exercises designed to avoid contractures, bone deformity and

unwanted movement. In general, they are trained to work with child to enable him or her to obtain maximum physical function. Parents follow physical therapy more as it shows results faster and helps to obtain maximum benefit of given muscle tone.



Physical therapists tend to focus mainly on activities involving the legs, such as walking, braces, using crutches and trunk balance. A patient's physical therapy treatment program should be for lifetime to avoid contractures and deformities which would cause discomfort

Physical therapist works in collaboration with orthopedic surgeon and orthotist and suggests various assistive devices like Braces, also referred to as orthoses, help children with cerebral palsy by stretching muscles that are usually over-flexed, and can be invaluable in aiding a child's mobility and ability. Ankle-foot orthoses, or AFOs, are very common in children with cerebral palsy. It is worn for the purpose of stretching the Achilles tendon. . Children who wear AFOs should wear them during the day as they would their shoes. While walking barefoot after a bath or in the evening can do no harm, you might consider having the child wear them at night, even while sleeping, for stretching particularly tight muscles. Use of various crutches walkers standing board is done for kids with cerebral palsy.

Occupational therapy:-

Occupational therapy plays a large role in the development of a child with Cerebral Palsy. The job of an occupational therapist is to hone the ability of the fine-motor skills and small muscles, which include hands, feet, mouth, fingers and toes. An occupational therapist is likely to advice on easier methods of feeding, dressing and everyday mobility. They will also help you find the specialized equipment your child needs to help him/her in everyday activities, such as modified spoons and cups for easier feeding, toys that will help the development of motor skills and seats, wheelchairs, pushchairs, standing frames, walking frames and side lying boards that will help improve your child's mobility, posture, etc.



It is also the job of an occupational therapist to help make your home and community accessible to your child. Many adaptations may need to be accommodated in order for your child to reach his maximum level of independence.

Occupational Therapists are also trained to evaluate the child's sensory system to determine whether a primary sensory deficit is present or whether a child has difficulty processing sensory information. Sensory Integration refers to the ability to evaluate the relative importance of all sensory inputs acting on the body, on the basis of a child's current posture, previous movement experiences and movement expectations. A child with Cerebral Palsy may experience sensory integration dysfunction as a result of central nervous system damage, or sensory integration dysfunction might develop secondary to the limited sensory experiences that these children have as a result of their limited motor abilities

Speech and Language Therapist:-

Speech and language therapists frequently help the child and his or her family to establish normal speech and feeding patterns, Even if a child with cerebral palsy is able to speak well, a speech and language therapist can assist them by helping to make speech clearer and easier to understand, or on building their language skills by

expanding their vocabulary, learning to speak in sentences, or improving their listening skills.



For the child who is more challenged in his or her speech ability, the speech and language therapist can be hugely supportive in helping them to communicate in teaching them sign language, giving them picture boards with basic pictures that a child can point out to express their desires or equipping them with a communication device, which would generally be computer-based and could immensely help a child's communication ability. These sophisticated electronic communication aids are especially important to the child who is cognitively able to communicate but has a communication disability.

Music and Dance Therapy:-

Music and dance can have a profound effect on anyone, but the benefits of exposing a child with cerebral palsy to music and dance can be huge. Both of these artistic media are enjoyable to children and both can be used to support a child's development in a number of ways. Through music and dance, a child can express her emotions, develop a sense of rhythm (which will in turn support their physical development), develop their communication skills, benefit from auditory and tactile stimulation (through the vibrations of the music) and relax.



Dance therapy is especially helpful in development of coordination in children with cerebral palsy. It also helps in sensory integration as it involves different parts of the child's body and the coordination of moving those parts with the rhythm of the music, it also helps in stretching and makes walking easier.

Hippotherapy



Hippo therapy is a form of physical, occupational and speech therapy that uses equine (horse) movement to develop and enhance neurological and physical functioning by channeling the movement of the horse. Hippo therapy is built on the concept that the individual's neuromuscular development is enhanced when their body makes adjustments to the gait, tempo, rhythm, repetition and cadence of a horse's movement. Horseback riding



triggers a series of complex physical and mental reactions; such as making physical adjustments to maintain proper alignment on the horse. Riders must also plan

movements to maintain balance on the horse, and be able to interact with the animal. Hippo therapy can help children with cerebral palsy on several fronts.

Nutrition and Diet Counselling

With the majority of individuals with cerebral palsy reporting feeding or digestive difficulties, a dietary counseling program can be highly beneficial. The majority of individuals with cerebral palsy, 93%, will experience feeding difficulties. Since cerebral palsy results in impairment of muscle groups, facial muscles can be affected. The facial muscles are one of the strongest muscle groups in the body. With the majority of individuals with cerebral palsy reporting feeding or digestive difficulties, a dietary counseling program can be highly beneficial. Most dietary concerns for those with cerebral palsy focus on how to prepare food, what to feed, how to feed, and when to feed. Depending on the severity level of the individual's cerebral palsy, his or her digestive challenges and the ability to properly chew, swallow, and self-feed, effective dietary therapy can be devised to meet the individual's unique needs

Play Therapy

Play therapy incorporates the child's physical abilities, cognitive functioning levels and emotional needs in a safe, supportive environment. It is a therapeutic and psychological intervention that uses play to help children with cerebral palsy develop a better sense of inclusion using both directed and non-directed play. It builds self-confidence, interaction, and sense of self. Playing is the activity that brings the most joy into the young lives of children; play therapy capitalizes on that interest to help a child function.



Play therapy is a therapeutic and psychological intervention that uses play to help children with cerebral palsy develop a better sense of inclusion using both directed and non-directed play. This allows children to not only learn how to interact with others and develop relationships; it also provides physical strategies children can use to perform. Play therapy incorporates the child's physical abilities, cognitive functioning levels and emotional needs in a safe, supportive environment.

Play therapy helps children with cerebral palsy express themselves. Therapy gives children a voice they might not be able to express in words, and therefore, provides valuable insight into a child's emotional state. During therapy, children will learn how to take part in the physical aspects of play by using altered toys adaptive equipment, and modified techniques, like:

- **Soft clay**
- **Pencils, markers, crayons and paint brushes with a foam grip**
- **Costumes with Velcro closures**
- **Large beads and course string**
- **Sand trays**
- **Textured toys**
- **Brightly-colored games**
- **Simple musical instruments and bells**

Methods beyond child-safe measures, that can be used to make a space safe and conducive to play for those with impairment include:

- **Strategically-placed wedge pillows**
- **Large stuffed animals**
- **Soft carpet**
- **Permanently stabilized stationary toys and dollhouses**
- **Bright lighting**
- **Safe play surfaces**

Aqua Therapy

Aqua therapy provides deep, intense exercise within a soothing and comforting environment. This form of therapy promotes physical functioning with the aid of water's restorative and detoxifying properties. Water buoyancy makes aerobic and anaerobic exercises safe and effective by allowing an individual to ambulate freely.



It is accepted by the medical community as a method to rehabilitate, or re-educate, the human body. For children with cerebral palsy, water can be a healing force. Aqua therapy is one of the best environments for a child with cerebral palsy to improve physical functioning in the water – which in and of itself is known for restorative and detoxifying properties – provides buoyancy that makes aerobic and anaerobic exercises easy to perform effectively, and safely

Behaviour Therapy

Behavioral therapy, also known as cognitive behavioral therapy, is rooted in the belief that emotional challenges and unproductive behaviors are learned and can, therefore, be changed. In behavioral therapy, troubling situations are identified, and thoughts, emotions and beliefs about those situations are explored, challenged and ultimately altered. Behavioral therapy empowers the individual to respond to challenging situations in a more effective and acceptable manner. Behavioral therapy has a positive influence

not only on the quality-of-life for the child with impairment, but also on those who support and care for the child. Behavioral therapy helps an individual develop life skills

Recreational Therapy

Recreational therapy is a treatment service designed to restore, remediate and rehabilitate a person's level of functioning and independence in life activities, to promote health and wellness as well as reduce or eliminate the activity limitations and restrictions to participation in life situations caused by an illness or disabling condition.

Recreational therapists work with clients to restore motor, social and cognitive functioning, build confidence, develop coping skills, and integrate skills learned in treatment settings into community settings. Intervention areas vary widely and are based upon client interests.

Examples of intervention modalities include creative arts (e.g., crafts, music, dance, drama, among others), sports, adventure programming, dance/movement, and leisure education.



Assistive devices

Physical Therapy

Ankle Foot Orthosis (AFO):- An ankle-foot orthosis (AFO) is an orthosis or brace that encumbers the ankle and foot. AFOs are externally applied and intended to control position and motion of the ankle, compensate for weakness, or correct deformities. AFOs can be used to support weak limbs, or to position a limb with contracted muscles into a more normal position. Ankle-foot orthoses are the most commonly used orthoses for kids with cerebral palsy,



Knee Splint:-

A knee orthosis (KO) or knee brace is a brace that extends above and below the knee joint and is generally worn to support or align the knee. In the case of diseases causing neurological or muscular impairment of muscles surrounding the knee, a KO can prevent flexion or extension instability of the knee.



Walker(Zimmer Frame) :-A walker or walking frame is a tool for children with cerebral palsy who need additional support to maintain balance or stability while walking.



Cane:-

The cane or walking stick is the simplest form of walking aid. It is held in the hand and transmits loads to the floor through a shaft. The load which can be applied through a cane is transmitted through the user's hands and wrists

Crutches

A crutch also transmits loads to the ground through a shaft, but has two points of contact with the arm, at the hand and either below the elbow or below the armpit. This allows significantly greater loads to be exerted through a crutch in comparison with a cane



Wheelchairs

An individual with spastic CP may have difficulty in walking because of the tight muscles in the hips and legs. A wheelchair is a popular device for mobility and accessibility. There are variety of wheelchairs available in market example their chair with 30-fixed tilt, headrest, and h-harness are suited for someone with weak trunk muscles, and needs assistance to sit upright.



Adaptive Tricycle (for therapeutic cycling)

An adaptive tricycle, therapeutic cycling can improve respiration, swallowing and the development of head and trunk control while strengthening anti-gravity muscles, improving eye-hand coordination and self-esteem. This tricycle can be used for recreational purpose.



Standing Equipment

Depending on your child's life stage and ability, there are products developed for assisting with movement while promoting stability or when difficulty holding themselves in an upright position.



Communication Devices

Some individuals with CP have speech problems and are not able to speak due to the muscle spasms in their mouth, throat and tongue. Augmentative Alternative Communication (AAC) **devices** allow individuals the ability to communicate in different ways, specialized to their needs, such as signs, letters, pictures, and even a voice.



Commode and Bath Chairs



The ability to use the toilet may be very empowering for an individual with CP however; they may need modifications in order to remain safe and hygienic. Bath chairs are also helpful in providing a safe and stress-free bathing experience. Railings help to maintain balance and reduce fear of falling down



Writing tools



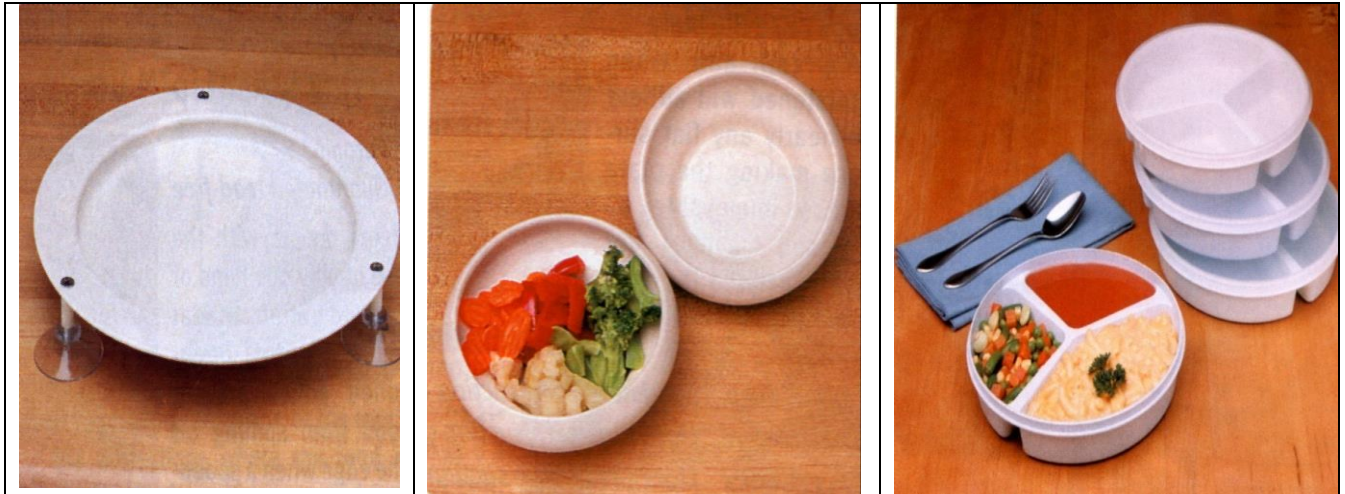
There are numerous devices to aid a student with CP in writing. For example, a child with spastic CP may find it easier to use large markers or paint brushes, as they are easier to grip, they can also make use of grippers and pointers can be of valuable help to use computer



8. Feeding Tools

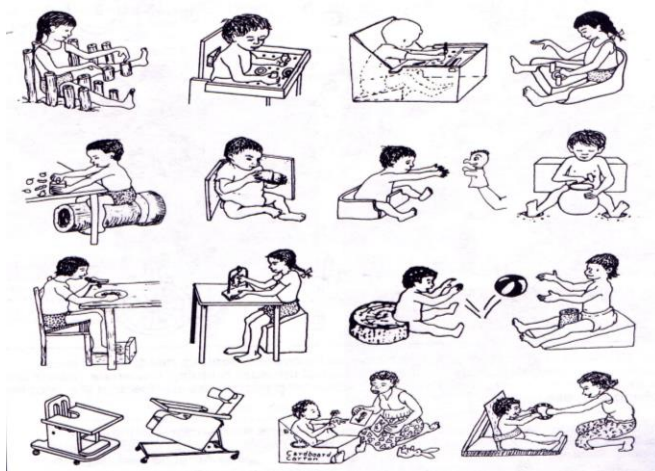
There are numerous feeding tools available in market with broader grip, suction plate, compartment plates and specialized handle for spoons, specialized straws, cups, bowls and bottles.





Various Feeding Tools

9.Seating Aids :- There are various seating aids available in market such as CP chair, corner seats, car seat



Education for children with cerebral palsy depends on vast issues In India generally they are advised special schools as they are given the certificate of Mental Retardation and main stress is seen in improving their ADL activities but this thought needs to change now as these kids can do functional academics and can learn in inclusive atmosphere.

Inclusive Education:-

Inclusive Education means a child with disability is provided all support services within the regular classroom. One of the main features of inclusive education is the

development of the capability of the regular education system to meet the needs of the children with any kind of impairment.

Inclusive Education is possible for children with cerebral palsy with little efforts from the school and parent as the variation amongst those with cerebral palsy (CP) is vast. Therefore strategies for teaching are going to look differently based on the severity of individual students' symptoms and needs. Following points should be kept in mind while teaching children with cerebral palsy .They are dependent on individual assistance

- They need
 - help to get his/her books out of the bag
 - get in and out of the classroom
 - visit the toilet
 - a slower rate of progression than others,
 - special material,
 - extra explanations, etc
- The process of Learning has to be *modified* and may in many cases take more time.
- A plan or strategy for each child must be prepared based on a detailed assessment of the child's
 - Possible learning difficulties
 - Physical premises
 - Communicative form and abilities
 - Intellectual level
 - Some children may also have mild or severe sensory dysfunctions.
- It is important for these children *to use as many senses and body parts as possible*.
- The child must *learn to look, listen, touch and feel the objects* which supply meaning and sense to various concepts.
- If possible, the child should also handle these objects, or at least watch others handling them.

- A structured programme can make the child may feel secure, knowing exactly what is going to happen at all times.
- Similarly, may enjoy getting short, clearly defined exercises or tasks, particularly where the result is immediately apparent
- E.g. One arithmetic problem at a time, written on an individual card
- Teaching based on the pupil's level of development
- Adjust speed
- If the child experiences problems in relating to his own body, activities to enhance this should be pursued, e.g.:
 - Playtime activities focusing on the body,
 - Songs and dances with body movements,
 - Copying postures, positions and movements.
- Repetition of already acquired skills
 - Use of proper aids and appliances should be done in class e.g. Pointer ,weighted cuffs etc
 - Educational material can be reduced in size. enabling the child to reach a larger number of words or pictures without moving the hand.
 - Educational material can be enlarged, or words and pictures moved further apart to facilitate pointing (should the child suffer from exaggerated involuntary movements).
 - Small, metallic objects (e.g. paper clips) can be fastened to word pictures, numbers or objects, enabling the pupil to lift them with the aid of a magnet attached to the hand or other parts of the body.
 - The best possible working posture will greatly enhance the functions.
 - To reduce the impact of motor skills problems it is important to find the best possible working position for the pupil.
 - Good planning on the teacher's part may be necessary to find pleasant and meaningful ways to make these experiences available for these children. E.g. picture books, role playing, films and educational documentaries etc.

- To compensate for visual-motor co-ordination problems a multitude of sensory stimulants should be employed:
 - - Forming letters/numbers in sand
 - - Tracing in sand
 - - Writing blindfolded etc.
- A possible and sensible solution is to employ letter stamps, or a computer at a relatively early stage.

Vocational Counseling

Vocational counseling assesses an individual's intelligence, aptitude, interests, abilities and skill levels in order to path a career. For people with cerebral palsy, achieving a vocation and securing employment can be a challenge. Vocational counseling, also known as vocational rehabilitation, is a program that prepares people with cerebral palsy and other physical and cognitive impairments for the workplace. It gives

- **Independence**
- **Economic self-sufficiency**
- **Self-esteem through occupational practice**

Vocational counseling is often part of a special education initiative to transition the child into adulthood. Often vocational counseling is initiated within the school's IEP program to assist the child to achieve optimal independence. This typically occurs after a student has benefited by other therapies such as physical or occupational therapy designed to maximize their ability to function.

Because no two cases of cerebral palsy are the same, approaches to vocational counseling will vary significantly. Some individuals need only minimal assistance in terms of reaching their professional goals, but others will need a more intensive intervention.

Parents support group

Parents play an important role in shaping life of a child with cerebral palsy A barrage of emotions ranging from sadness to guilt to anger to acceptance typically occurs after a child is diagnosed with cerebral palsy. Suddenly, all of the hopes parents had for their child – everything they planned for their child – suddenly come into question. . Parents of children with disabilities know that their child is often times struggling with basic tasks; seeing the big picture can be a challenge. But once a parent is able to learn more about



their child's condition and bond with their child, new hopes and possibilities emerge. Acceptance of the child is the key point for the parent to lead a normal life. Disability should always be kept secondary and child's progress and independence should be the first preference. Creating a parent support group will help in getting emotional and guidance as lot of exchange of views and knowledge can be done in this support group. Cerebral palsy is a lifelong battle which the child and entire family should fight with determination.



References

1. Cerebral Palsy Page number 2494, Textbook of Nelson volume 2.18th edition.
2. Rosenbaum, P; Paneth, N; Leviton, A; Goldstein, M; Bax, M; Damiano, D; Dan, B; Jacobsson, B (2007). "A report: The definition and classification of cerebral palsy April 2006". *Developmental Medicine & Child Neurology* 49: 8–14. [doi:10.1111/j.1469-8749.2007.tb12610.x](https://doi.org/10.1111/j.1469-8749.2007.tb12610.x). PMID 17370477.; Corrected in Rosenbaum, P; Paneth, N; Leviton, A; Goldstein, M; Bax, M; Damiano, D; Dan, B; Jacobsson, B (2007). "A report: The definition and classification of cerebral palsy April 2006". *Developmental medicine and child neurology. Supplement* 109: 8–14. [doi:10.1111/j.1469-8749.2007.tb12610.x](https://doi.org/10.1111/j.1469-8749.2007.tb12610.x). PMID 17370477.
3. Beukelman, David R.; Mirenda, Pat (1999). *Augmentative and Alternative Communication: Management of severe communication disorders in children and adults* (2nd ed.). Baltimore: Paul H Brookes Publishing Co. pp. 246–249. ISBN 1-55766-333-5.
4. Kent, Ruth (2013). "Chapter 38: Cerebral Palsy". In Barnes MP, Good DC. *Handbook of Clinical Neurology*. 3 110. Elsevier. pp. 443–459. ISBN 978-0444529015.
5. "Cerebral Palsy – Topic Overview". Retrieved 2008-02-06.

6. WebMD Medical Reference from Healthwise.
7. Online 'Mendelian Inheritance in Man' (OMIM) Cerebral palsy, spastic, symmetric, autosomal recessive -603513
8. Understanding Cerebral Palsy-- the Basics
9. WebMD Medical Reference.
10. <http://www.webmd.com/brain/understanding-cerebral-palsy-basic-information>
11. Indian Institute of Cerebral Palsy, Kolkata
12. <http://www.iicpindia.org/PDF/What%20is%20Cerebral%20Palsy.pdf>
13. Alberta Education. (2010). Making a difference: Meeting the diverse learning needs with differentiated instruction. Curriculum Sector: Alberta, Canada.
14. Bachrach,S,MD.,(2012).CerebralPalsy.Retrieved from http://kidshealth.org/kid/health_problems/brain/cerebral_palsy.html
15. Cerebral Palsy & Education. ((n.d.)). In Cerebral palsy world. Retrieved February 2, 2013, from
16. http://cerebralpalsyworld.com/cp_education.aspx#Top
17. Cerebral Palsy (2012). In Physical as anything. Retrieved January 28, 2013, from
18. http://www.physicalasanything.com.au/lo/cerebralPalsy_011/cerebralPalsy_03.html
19. www.cerebralpalsy.org
20. www.spasticinfo.com
21. "Cerebral Palsy: Hope Through Research".<http://www.ninds.nih.gov>. February 2, 2015. Retrieved 4 March2015.
22. "<http://www.nichd.nih.gov/>". *Cerebral Palsy: Overview*. 09/05/2014. Retrieved 4 March 2015.
23. "CEREBRAL PALSY, SPASTIC QUADRIPLAGIC, 1; CPSQ1".<https://omim.org>. 11/13/2012. Retrieved 4 March 2015.
24. "How many people are affected?". <http://www.nichd.nih.gov>. 09/05/2014. Retrieved 4 March 2015.
25. Oskoui, M; Coutinho, F; Dykeman, J; Jetté, N; Pringsheim, T (Jun 2013). "An update on the prevalence of cerebral palsy: a systematic review and meta-analysis.". *Developmental medicine and child neurology* **55** (6): 509–19. doi:10.1111/dmcn.12080.PMID 23346889.
26. Panteliadis, C; Panteliadis, P; Vassilyadi, F (Apr 2013). "Hallmarks in the history of cerebral palsy: from antiquity to mid-20th century.". *Brain & development* **35** (4): 285–92.doi:10.1016/j.braindev.2012.05.003. PMID 22658818.
27. Rosenbaum, P; Paneth, N; Leviton, A; Goldstein, M; Bax, M; Damiano, D; Dan, B; Jacobsson, B (2007). "A report: The definition and classification of cerebral palsy April 2006". *Developmental Medicine & Child Neurology* **49**: 8–14. doi:10.1111/j.1469-8749.2007.tb12610.x. PMID 17370477.; Corrected in Rosenbaum, P; Paneth, N; Leviton, A; Goldstein, M; Bax, M; Damiano, D; Dan, B; Jacobsson, B (2007). "A report: The definition and

classification of cerebral palsy April 2006". *Developmental medicine and child neurology*. Supplement **109**: 8–14. doi:[10.1111/j.1469-8749.2007.tb12610.x](https://doi.org/10.1111/j.1469-8749.2007.tb12610.x). PMID [17370477](https://pubmed.ncbi.nlm.nih.gov/17370477/).

28. Kent, Ruth (2013). "Chapter 38: Cerebral Palsy". In Barnes MP, Good DC. *Handbook of Clinical Neurology*. 3 **110**. Elsevier. pp. 443–459. ISBN [978-0444529015](https://www.isbn-international.org/product/978-0-444-52901-5).
29. Hirsh, Adam T., Juan C. Gallegos, Kevin J. Gertz, Joyce M. Engel, and Mark P. Jensen. "Symptom Burden in Individuals with Cerebral Palsy." *Journal of Rehabilitation Research & Development* 47.9 (2010): 863-67. Academic Search Premier. Web. 13 Mar. 2013
30. Beukelman, David R.; Mirenda, Pat (1999). *Augmentative and Alternative Communication: Management of severe communication disorders in children and adults* (2nd ed.). Baltimore: Paul H Brookes Publishing Co. pp. 246–249. ISBN [1-55766-333-5](https://www.isbn-international.org/product/1-55766-333-5).
31. McKearnan K.A., Kieckhefer G.M., Engel J.M., Jensen M.P., Labyak S. (2004). "Pain in children with cerebral palsy: A review". *Journal of Neuroscience Nursing* **26** (5): 252–259. doi:[10.1097/01376517-200410000-00004](https://doi.org/10.1097/01376517-200410000-00004).
32. Newman C.J., O'Regan M., Hensey O. (2006). "Sleep disorders in children with cerebral palsy". *Developmental Medicine and Child Neurology* **48** (7): 564–8. doi:[10.1017/S0012162206001198](https://doi.org/10.1017/S0012162206001198). PMID [16780625](https://pubmed.ncbi.nlm.nih.gov/16780625/).
33. ^b Klingels, K.; De Cock, P.; Molenaers, G.; Desloovere, K.; Huenaerts, C.; Jaspers, E.; Feys, H. (2010). "Upper limb motor and sensory impairments in children with hemiplegic cerebral palsy. Can they be measured reliably?". *Disability & Rehabilitation* **32** (5): 409–416. doi:[10.3109/09638280903171469](https://doi.org/10.3109/09638280903171469). PMID [20095955](https://pubmed.ncbi.nlm.nih.gov/20095955/).
34. Donkervoort, M.; Roebroek, M.; Wiegerink, D.; Van der Heijden-Maessen, H.; Stam, H.; The Transition Research Group South (2007). "Determinants of functioning of adolescents and young adults with cerebral palsy". *Disability & Rehabilitation* **29** (6): 453–463. doi:[10.1080/09638280600836018](https://doi.org/10.1080/09638280600836018). PMID [17364800](https://pubmed.ncbi.nlm.nih.gov/17364800/).
35. William B. Carey, ed. (2009). *Developmental-behavioral pediatrics* (4th ed. ed.). Philadelphia, PA: Saunders/Elsevier. p. 264. ISBN [9781416033707](https://www.isbn-international.org/product/9781416033707).
36. Saunders, NR; Hellmann, J; Farine, D (Oct 2011). "Cerebral palsy and assisted conception.". *Journal of obstetrics and gynaecology Canada : JOGC = Journal d'obstetrique et gynecologie du Canada : JOGC* **33** (10): 1038–43. PMID [22014781](https://pubmed.ncbi.nlm.nih.gov/22014781/).
37. McIntyre, S; Taitz, D; Keogh, J; Goldsmith, S; Badawi, N; Blair, E (Jun 2013). "A systematic review of risk factors for cerebral palsy in children born at term in developed countries.". *Developmental medicine and child neurology* **55** (6): 499–508. doi:[10.1111/dmcn.12017](https://doi.org/10.1111/dmcn.12017). PMID [23181910](https://pubmed.ncbi.nlm.nih.gov/23181910/).
38. Ellenberg, JH; Nelson, KB (Mar 2013). "The association of cerebral palsy with birth asphyxia: a definitional quagmire.". *Developmental medicine and child neurology* **55** (3): 210–6. doi:[10.1111/dmcn.12016](https://doi.org/10.1111/dmcn.12016). PMID [23121164](https://pubmed.ncbi.nlm.nih.gov/23121164/).
39. "Cerebral Palsy: Hope Through Research". National Institute of Neurological Disorders and Stroke (U.S.). NIH Publication No. 13-159. August 2013. Retrieved 2014-01-23.
40. Teng, J; Chang, T; Reyes, C; Nelson, KB (Oct 2012). "Placental weight and neurologic outcome in the infant: a review.". *The journal of maternal-fetal & neonatal medicine : the official journal of*

the European Association of Perinatal Medicine, the Federation of Asia and Oceania Perinatal Societies, the International Society of Perinatal Obstetricians **25** (10): 2082–7. doi:[10.3109/14767058.2012.671871](https://doi.org/10.3109/14767058.2012.671871). PMID [22394270](https://pubmed.ncbi.nlm.nih.gov/22394270/).

41. Crepeau, Elizabeth Blesedell; Willard, Helen S.; Spackman, Clare S.; Neistadt, Maureen E. (1998). *Willard and Spackman's occupational therapy*. Philadelphia: Lippincott-Raven Publishers. ISBN [0-397-55192-4](https://www.isbn-international.org/product/0-397-55192-4).
42. Mulligan S, Neistadt ME. Occupational therapy evaluation for children: a pocket guide. : Lippincott Williams & Wilkins; 2003.
43. Hoare, BJ.; Wasiak, J.; Imms, C.; Carey, L. (2007). "Constraint-induced movement therapy in the treatment of the upper limb in children with hemiplegic cerebral palsy.". *Cochrane Database Syst Rev* (2): CD004149. doi:[10.1002/14651858.CD004149.pub2](https://doi.org/10.1002/14651858.CD004149.pub2). PMID [17443542](https://pubmed.ncbi.nlm.nih.gov/17443542/).
44. Heinen F, Desloovere K, Schroeder AS, et al. (January 2010). "The updated European Consensus 2009 on the use of Botulinum toxin for children with cerebral palsy". *Eur. J. Paediatr. Neurol.* **14** (1): 45–66. doi:[10.1016/j.ejpn.2009.09.005](https://doi.org/10.1016/j.ejpn.2009.09.005). PMID [19914110](https://pubmed.ncbi.nlm.nih.gov/19914110/).
45. Farmer JP, Sabbagh AJ (2007). "Selective dorsal rhizotomies in the treatment of spasticity related to cerebral palsy". *Child s Nervous System* **23** (9): 991–1002. doi:[10.1007/s00381-007-0398-2](https://doi.org/10.1007/s00381-007-0398-2). PMID [17643249](https://pubmed.ncbi.nlm.nih.gov/17643249/).
46. Carraro E, Zeme S, Ticcinelli V, Massaroni C, Santin M, Peretta P, Martinuzzi A, Trevisi E., Multidimensional outcome measure of selective dorsal rhizotomy in spastic cerebral palsy, *Eur J Paediatr Neurol.* 2014 Jun 11. pii: S1090-3798(14)00090-7. doi:[10.1016/j.ejpn.2014.06.003](https://doi.org/10.1016/j.ejpn.2014.06.003)
47. Gantasala, S.; Sullivan, PB.; Thomas, AG. (2013). "Gastrostomy feeding versus oral feeding alone for children with cerebral palsy.". *Cochrane Database Syst Rev* **7**: CD003943. doi:[10.1002/14651858.CD003943.pub3](https://doi.org/10.1002/14651858.CD003943.pub3). PMID [23900969](https://pubmed.ncbi.nlm.nih.gov/23900969/)
48. Condie DN, Meadows CB. Conclusions and recommendations. In: Condie DN, Meadows CB, eds. Report of a Consensus Conference on the Lower Limb Orthotic Management of Cerebral Palsy. Copenhagen: International Society of Prosthetics & Orthotics; 1995:15-19
49. Ross, K. and Bowers, R. (2009) A review of the effectiveness of lower limb orthoses used in cerebral palsy. In: Recent Developments in Healthcare for Cerebral Palsy: Implications and Opportunities for Orthotics. International Society for Prosthetics and Orthotics, pp. 235-297.
50. Balaban B, Yasar E, Dal U, Yazicioglu K, Mohur H, Kalyon TA (2007). "The effect of hinged ankle-foot orthosis on gait and energy expenditure in spastic hemiplegic cerebral palsy". *Disability and rehabilitation* **29** (2): 139–144.
51. American Academy of Pediatrics. Committee on Children with Disabilities (1999). "[The treatment of neurologically impaired children using patterning](#)". *Pediatrics* **104**
52. Jenks KM, de Moor J, van Lieshout EC, Maathuis KG, Keus I, Gorter JW (2007). "The effect of cerebral palsy on arithmetic accuracy is mediated by working memory, intelligence, early numeracy, and instruction time". *Dev Neuropsychol* **32**
53. Strauss D, Brooks J, Rosenbloom R, Shavelle R (2008). "Life Expectancy in cerebral palsy: an update". *Developmental Medicine & Child Neurology* **50** (7): 487–493. .

54. Van Zelst, B.; Miller, M.; Russo, R.; Murchland, S.; Crotty, M. (2006). "Activities of daily living in children with hemiplegic cerebral palsy: a cross-sectional evaluation using the Assessment of Motor and Process Skills". *Developmental Medicine & Child Neurology*
55. Nieuwenhuijsen, C.; Donkervoort, M.; Nieuwstraten, W.; Stam, H.J.; Roebroek, M.E.; Transition Research Group South West Netherlands (2009). "Experienced problems of young adults with cerebral palsy: targets for rehabilitation care". *Archives of Physical Medicine and Rehabilitation* **90** (11): 1891–1897.
56. Arnould, C.; Penta, M.; Thonnard, J. (2008). "Hand impairments and their relationship with manual ability in children with cerebral palsy". *Journal of Rehabilitation Medicine* **39** (9): 708–714.
57. Fedrizzi E, Pagliano E, Andreucci E, Oleari G. Hand function in children with hemiplegic cerebral palsy: prospective follow-up and functional outcome in adolescence. *Dev. Med. Child Neurol.* 2003 02;45(2):85-91.