Veena Slaich

CEREBRAL PALSY

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Cerebral Palsy

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Preface

Cerebral palsy is a very common disorder which is often come across by the occupational therapists during their clinical practice.

The disorder poses a great amount of the disabling effect to the affected child as it is a complex picture while faced by the clinical teams in various situations.

The effort in this book is made to give some key management aspects to the occupational/physiotherapists so as to keep a broad base observational management care.

The disorder is a complex which needs lots of interdisciplinary interventions. Other books may also be consulted as per the individual care requirements time to time.

The effort is made to give a wholesome idea on all aspects to be attended to in case of such disabling disorders in occupational therapy clinical practice.

The book will serve both the learners and practitioners of occupational therapy and to some extent the inquisitive parents also.

Veena Slaich

Foreword

Miss Veena Slaich, who is an experienced occupational therapist, has already written two books on the application of occupational therapy for rehabilitation of the disabled. These two books—*Occupational Therapy for Physical Injuries* and *Occupational Therapy and Rehabilitation*—are of greater importance to the occupational therapists, particularly for rehabilitation of the orthopedically handicapped. She continued with these commendable works and is now presenting the book *Cerebral Palsy* for the rehabilitation and management of cerebral palsied children, especially in relation to their therapeutic and functional rehabilitation, and their activities of daily living (ADL) planning.

There are hardly any books written in this country on cerebral palsied children and I am sure this book will go a long way to fill the gap in treating cerebral palsied children and their rehabilitation.

RK Bhargava, IAS
Ex-Secretary General
Human Right Commission
New Delhi, India

Acknowledgments

My sincere thanks to my team-mates who made my dream true in the form of the book and my students from whom I learnt a lot about management of cerebral palsy.

I am thankful to my mother who has always been my source of motivation in penning down my idea on paper.

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CHAPTER 1
Challenges for Occupational Therapists

HISTORICAL BACKGROUND

There are references in history and literature which crippled from Egypt through the darkness of middle ages, in 1843, the crippling condition being now known as Cerebral Palsy which was first described by the English surgeon, William J Little who believed that deformities in these cases were due to the nervous affections or paralysis. It was also observed that diarrhea and other internal upsets were also responsible for it—even a large proportions were in first pregnancy, and that many patients were immature/premature weighing only 40 ounces at birth. He also noticed a high degree of partial subnormality, fits and uncontrollable behavior for which he suggested massage, baths, gymnastics and manipulation as therapeutic management. The birth palsies of cerebral origin were commonly referred to as Little's disease. His description of difficult labor, premature birth, abnormal parturition and asphyxia neonatorum, on mental and physical condition of the child was in many ways in agreement with modern findings and concepts. He later defined it in the neurological classification of cerebral palsy. Dr Phelps first grasped that CP can be with normal mental status but with motor handicap.

The term cerebral palsy was very carefully designed by the Dr Phelps to dissociate feeble mindedness from motor handicap. Today, universally accepted concept is of its cerebral origin with nonprogressive origin accompanied by feeble mindedness. He also demonstrated that such children could be rehabilitated to lead useful happy life.

OCCUPATIONAL THERAPY IN THE TREATMENT OF CEREBRAL PALSY

Bower published a comprehensive review that traced the history of rehabilitation and cerebral palsy from the early 1900s to the present. She noted that Phelps was one of the first clinicians to treat patients with cerebral palsy in the 1930s, followed by Peto and Bobath, who

became interested in cerebral palsy a few years later. The major developments in use of physical therapy in the treatment of cerebral palsy, however, did not occur until the 1950s. This was largely due to the decline in the incidence of poliomyelitis after the Salk vaccine was discovered, and the shifting of research dollars and therapeutic techniques to persons with cerebral palsy.

Bower's description of the major therapeutic approaches to the treatment of cerebral palsy over the past 50 years is briefly summarized below.

Phelps, an orthopedic surgeon, recommended 5 years of institutionalized therapy from a team approach (physical, occupational, speech and other therapies). He described five different categories of cerebral palsy. His work included the use of motion pictures to describe children and evaluate the effectiveness of treatment. He also endorsed tenotomies (surgery on individual muscles). Paine researched the work of Phelps in 1962 and reported that children with mild spastic hemiplegia improved with and without treatment, and that Phelps' treatment strategies were not effective for children with athetosis. The treatment proposed by Phelps did not change whether or not a child would need surgery. The work of Rood was not based on afferent sensory stimulation, but no empirical research has ever been carried out on the efficacy of this therapy.

Vojta, a German neurologist, combined the techniques of Fay, Rood and Kabat. In 1981, research was carried out on one subject with cerebral palsy whose subluxed hip was reduced after 3 years of treatment. In 1984, Kanda looked at Vojta's work with 29 subjects with cerebral palsy. Eight were children with spastic diplegia who had gotten treatment early in their lives, and 21 children with spastic diplegia were treated several months later. All walked by the age 3. The children who were treated earlier seemed to have an improved gait pattern compared to the children treated later. Vojta also reported on his own work but there are disputes concerning how many of the 207 infants he wrote about (who supposedly became "normal" in mental and motor performance) were children with cerebral palsy.

In 1991, Mayo studied one of the most widespread therapeutic techniques used to treat children with cerebral palsy, the Bobath or neurodevelopmental approach (NDT). Started in the 1940's by Karel and Berta Bobath, this treatment was based on the view that cerebral palsy results from interference with development of normal posture against gravity. The brain lesion leads to the loss of inhibition of abnormal primitive reflexes. Mayo examined the effectiveness of NDT and did not find this technique to be any better than other forms of physical therapy. Wright and Nicholson researched Bobath's work

and concluded that there were no differences between children treated with the Bobath method compared to children who received no treatment. The one exception was the ability of children with quadriplegia to roll.

In summarising her findings, Bower noted that although each of the above methods have been used for decades in treating children with cerebral palsy, there is very little scientific evidence to prove that any one therapy is more or less effective in improving the long-term function of children with cerebral palsy, and that often therapy continues when it may no longer be needed. She noted that "research needs to be undertaken by clinical scientists to assess the relative merits of the various approaches of therapy. Research methodologies used in psychology and the social sciences may well prove to be more useful for this purpose than those used in tradititional medical research."

In 1988, a classic study by Palmer and coworkers entitled, "Effects of Physical Therapy on Cerebral Palsy, "and published in the highly respected New England Journal of Medicine, investigated two early intervention programs in 48 infants with mild to severe spastic diplegia (12 to 19 months of age). One intervention involved neuro-developmental therapy and the other intervention was a published infant stimulation program called learning games. The investigators found that there was no motor, cognitive, or social advantage for infants receiving physical therapy after six and 12 months of treatment, and that trends favored the infant stimulation program. More frequent contact between therapist and patient may have been necessary to make physical therapy more beneficial to infants with cerebral palsy, but if so, this would require higher costs. The investigators concluded with the following statement:

"This clinical trial offers no support for the idea that neurodevelop-mental physical therapy is a preferred intervention in infants with mild to severe spastic diplegia. Although it is possible that there are longer-term benefits of physical therapy or benefits in domains not reported in this study, the goal of improved motor development was not achieved in infants receiving physical therapy as compared with infants receiving infant stimulation. Furthermore, physical therapy applied earlier offered no advantage over physical therapy applied six months later. The findings underscore a fundamental issue in developmental pediatrics and public policy affecting developmentally disabled children: the immediate and long-term effectiveness of traditional interventions must be examined critically. Alternatively, less costly outcomes may improve function."

In 1995, Graves reviewed the literature on therapeutic methods for cerebral palsy and came to a similar conclusion:

"In reviewing these methods it becomes clear that while all have their zealous proponents, the methodology of evaluation studies is often flawed and the results are inconclusive. Again the call is often made for more and better studies, but the reality is that these methods have had several decades to provide proof of efficacy and none has been forthcoming. Significantly, there has been little or no attention to the negative effects of therapy."

Graves went on to say that although "…..therapy does not lead to dramatic improvements in the neurological status of children with cerebral palsy, therapists have an important role in helping families understand how to work with their children in a physical and social setting."

In an extensive review of therapeutic techniques for persons with cerebral palsy, Bleck wrote: ''After half a century of sincere and intense effort by professionals to 'treat' cerebral palsy, most now acknowledge that these remedial efforts have been unsuccessful in achieving function. Perhaps it is time to give up trying to 'cure' the neurological deficits by remedial methods, stop looking for positive studies, and get on with the task of helping children and their families."

Despite periodic calls for scientific inquiry into the effect of physical therapy in the treatment of children with cerebral palsy, there are only a handful of clinical trials in the literature that have examined the efficacy of physical therapy. As a result of small, heterogeneous samples substantial attrition among subjects, and nonrandom assignment of treatment, it is difficult to interpret what are the most effective treatment strategies for improving the motor performance in persons with cerebral palsy. Fetters and Kluzik noted that "this lack of scientific evidence of treatment effectiveness is true for many types of physical therapy for children with cerebral palsy.

This cursory review of the literature on cerebral palsy and therapeutic techniques provides a strong incentive for the Task Force develop new intervention strategies that will prove useful in the overall physical, psychological and social development of persons with cerebral palsy. Clearly, we must establish a more ecological approach to treatment and must develop safe and effective exercise guidelines for persons with cerebral palsy that can be implemented in community-based fitness settings.

HISTORY OF CEREBRAL PALSY

In the 1860s an English surgeon named William Little wrote the first medical descriptions of a puzzling disorder that struck children in the first years of life, causing stiff, spastic muscles in their legs and, to a lesser degree, their arms. These children had difficulty grasping objects, crawling, and walking. They did not get better as they grew up nor did they become worse. Their condition, which was called Little's disease for many years, is now known as spastic displegia. It is just one of several disorders that affect control of movement and are grouped together under the term cerebral palsy.

Because it seemed that many of these children were born following complicated deliveries, Little suggested their condition resulted from a lack of oxygen during birth. This oxygen shortage damaged sensitive brain tissues controlling movement. But in 1897, the famous psychiatrist Sigmund Freud disagreed. Noting that children with cerebral palsy often had other problems such as mental retardation, visual disturbances, and seizures, Freud suggested that the disorder might sometimes have roots earlier in life, during the brain's development in the womb. "Difficult birth, in certain cases," he wrote, is merely a symptom of deeper effects that influence the development of the fetus.

Despite Freud's observation, the belief that birth complications cause most cases of cerebral palsy was widespread among physicians, families, and even medical researchers until very recently. In the 1980s, however, scientists analyzed extensive data from a government study of more than 35,000 births. While they found evidence that birth trauma was the cause of thousands of cerebral palsy cases, no cause could be found in the majority of cases. These findings profoundly altered medical theories about cerebral palsy and have spurred today's researchers to explore alternative causes.

At the same time, biomedical research has also led to significant changes in understanding, diagnosing, and treating persons with cerebral palsy. Identification of infants with cerebral palsy very early in life gives youngsters the best opportunity for developing to their full capacity. Biomedical research has led to improved diagnostic techniques-such as advanced brain imaging and modern gait analysis-that are making this easier. Certain conditions known to cause cerebral palsy, such as rubella (German measles) and jaundice, can now be prevented or treated. Physical, psychological, and behavioral therapy that assist with such skills as movement and speech, and foster social and emotional development can help children who have cerebral palsy to achieve and succeed. Medications, surgery, and braces can often

improve nerve and muscle coordination, help treat associated medical problems, and either prevent or correct deformities.

Contact doctor if you have questions about your child's cerebral palsy, or if you would like to learn more about protecting your child's right to a lifetime of benefits.

DEFINITION OF CEREBRAL PALSY

Cerebral palsy is a broad term used to describe a group of chronic movement or posture disorders. "Cerebral" refers to the brain, while "palsy" refers to a physical disorder, such as a lack of muscle control. Cerebral palsy is not caused by problems with the muscles or nerves, but rather with the brain's ability to adequately control the body. Cerebral palsy can be caused by injury during birth, although sometimes it is the result of later damage to the brain. Symptoms usually appear in the first few years of life and once they appear, they generally do not worsen over time.

It comprises of those motor and other symptom complexes caused by a non-progressive brain lesion/lesions. The various types may be defined as under:

A. *Spasticity:* It is caused by lower threshold of the stretch reflex, an enlarged reflexogenic area, augmented responses with clonus and abnormal synchronization of discharge rate in various parts of the spastic muscle. The pathologic student reflex must be present to make degree of spasticity. There is a tendency to contracture due to involvement of antigravity muscles.

B. *Athetoid:* It may also be known as athetosis. It exhibits abnormal amount of involuntary type of movements, reflexes normal, E.M.G. findings are normal uncontrolled and inco-ordinate motions with varying degree of tensions.

C. *Rigidity:* It is reason of agonist and antagonist disturbances with resistance to slow passive motion of both agonist and antagonist muscles. If resistance to passive motion is continuous, then it is known as "lead-pipe" rigidity and if discontinuous, then "cog-wheel" rigidity. The more resistance is to slow than rapid motion where in spasticity, resistance is to rapid motion.

Antagonists to antigravity muscles are most involved in rigidity. Total motion may be decreased. Main features is hypertonicity, normal or diminished reflexes, no clonus, no stretch reflexes and involuntary motion.

D. *Ataxia:* Due to disturbances of the kinesthetic or/and balance areas leading to incordination. Characteristic features are disturbances of balance, equilibrium, dyssynergias, rebound phenomenon with a sterognosia. It involves the depth perception. It may show atonia and hypotonia.

E. *Tremor:* It may be intentional or nonintentional or constant, uncontrollable, involuntary motions of a rhythmic, alternating or pendular pattern due to alternate agonist and antagonist contractions.

F. *Atonia:* It is lack of tone and failure of muscle to respond to volitional stimulation. The motor system lacks firmness or turgor of normal relaxed muscles. Weak or increased deep reflexes but no involuntary motion present distinguishing from non-tension athetosis, which is rare but may be initial symptom in any cerebral palsy case. Special mention made because may be striking initial symptom in cerebral palsy which makes an outstanding symptom of a type of cerebral palsy.

G. *Mixed:* It may not need mention as the predominating symptoms describe class and type of cerebral palsy.

Cerebral Palsy is defined in number of ways by independent workers. It is a general term used to describe any paralysis, weakness and incoordination as functional deviation of the motor system resulting from an intracranial lesions. Brain being center not only of muscle control but also of intelligence, behavior, personality and many other functions. Any brain dysfunction resulting due to injury may lead to paralysis and/or convulsions, mental subnormality, personality disorder or sensory defect like visual, auditory, tactile, etc. depending on location and extent of involvement of general symptoms may be obvious clinically than mental and emotional and other associated handicap.

Cerebral palsy basically is a physical disability arising out of intracranial lesions leading to paralytic disorders, weakness, incoordination or functional deviations of the motor system. Cerebral palsy is nonprogressive.

It was also defined as "nonprogressive central nervous system lesion/lesions is present or motor dysfunction results due to this lesion' or 'sensory, motor, emotional or psychological disturbances can co-exist. It was also known earlier as "cerebral spastic paralysis" with combination of both sensory and motor involvement. While treating such children difficulties were faced only due to developmental handicap.

According to Perstein, "Cerebral palsy is generally defined as a condition characterized' by paralysis, weakness, inco-ordination or any other aberration of motor function due to pathology of the motor control centers of the brain."

Denhoff defined, "A condition in which interference with the control of the motor system arises as a result of lesions occurring from birth trauma."

Cerebral palsy is a neuromotor component of the "brain damage syndrome." It may accompany any other defects of various kinds as above. It is a nonprogressive clinical entity with a multitude of handicaps.

What is Cerebral Palsy?

Cerebral palsy is a long-term disorder causing impaired control of movement. The symptoms develop over the first few years of life, and generally do not worsen thereafter. The disorder is caused by damage to the motor control areas of the brain which disrupts the brain's ability to control movement and posture. The term cerebral refers to the brain and the term palsy refers to impaired control of body movement.

There is a spectrum of symptoms for cerebral palsy. Someone with cerebral palsy may have difficulty with fine motor tasks, such as writing; or experience trouble with main maintaining balance and walking or be affected by involuntary movements such as uncontrollable writhing motion of the hands or drooling.The symptom of life from medical disorder including epilepsy change over time. Unformtunately people with cerebral palsy are often affected by medical disorderd or mental impairment. Contrary to common belief, however, cerebral palsy does not always cause profound handicap.

Cerebral palsy is not contagious nor is it usually inherited. At this time, cerebral palsy cannot be cured, although scientific research continues to yield improved treatments.

Cerebral palsy is the commonly used name for a group of conditions characterized by motor dysfunction due to nonprogressing brain damage in early life, i.e. before brain matures. This is disorder of movement and posture.

Cerebral palsy takes many forms; in fact, no two spastic people are precisely alike. Some are so lightly affected that they have no obvious disability. Others may be much more seriously disabled. They may be clumsy in their walk, or they have difficulty with their hands or speech. Some are even unable to sit and can do little for themselves.

Sometimes, the damage involves some parts of the brain as well, leading to deafness and other difficulties of perception. Many spastic children also have special learning difficulties which make them slow to learn. Spastic people have higher than average intelligence, though they are backward because of their handicaps. They can find it hard to control their facial expression and many seem to be mentally disabled but some of those who seem to be severely disturbed are, in fact, the least affected in their intellect.

Cause of injury can be prenatal, natal or postnatal. The birth of a spastic child is the fault or either parent if Rh –ve factor is not considered before planning a child.

Inherited defects do not play a large part in cerebral palsy. The problem is of brain damage. There is no direct injury to the limbs. There are two main classifications of cerebral palsy.

- Neurological
- Orthopedic.

Damage to basal ganglia causes athetosis. The main features is frequent involuntary movement which mask and interfere with the normal movement of the whole body.

Damage to cerebellum interferes with the coordination of movement, posture and balancing. The spastic child with ataxia caused by injury to the cerebellum has an unsteady gain and difficulty in balancing.

The source of problem is not in the affected limbs but in the cells of the brain. Correct treatment given early enough in life can often bring great benefit though not an absolute cure. No way has been found to repair the damage done to the brain cells, themselves. The damage does not spread but without skilled treatment the effect of that damage does become more serious. Thus, early recognition that something is wrong needs to be followed by speedy and skillful assessment of the child's needs by specialists, followed by whatever treatment is needed. Spastic boys and girls deserve the best standard of care and love that modern knowledge can give, and in recent years, there has been wonderful progress in providing the special services which can bring about the greatest possible benefit to spastics and help them to make the very most of what they have.

Although the majority of spastics should be capable of earning their living in the right occupation with the necessary training and guidance, a large proportion do not find work. Hundreds of them are unemployed because there are not enough special work facilities available and too many older spastics who are today in institutions or mental hospitals are only because they lacked the proper early treatment and training that could have helped them to useful living

spastic people. They do not want to be a life long burden either to their families or to the community but they need expert help at right time.

To establish a department general survey should be made according to which one can know a workable plan. A general survey is conducted to:

1. Assess the magnitude of problem,
2. To study accessiblities of services,
3. To identify problems encountered by people in obtaining services.

The survey can be based on the interview, security or extension type. The survey can be simple, and in the form of a national survey.

PATHOGENESIS

Cerebral palsy forms the major cause of crippling in children, perhaps next to poliomyelitis. This is increasing day by day with increasing magnitude of the problems. This may pose a great challenge to the rehabilitation experts in the rehabilitation of these cases.

ETIOLOGY

There are various factors responsible for the causes of cerebral palsy. Some have indicated that multiple factors are involved in causation of the cerebral palsy. Many studies show that neonatal, prenatal and natal abnormalities may cause it alongwith the abnormal symptoms in the newborn period. Neonatal abnormalities may cause cerebral insult.

Causes of Cerebral Palsy

During Birth

Cerebral palsy is not one disease with a single origin, like chicken-pox or measles. It is a group of disorders that are related but probably stem from a number of different causes. When physicians diagnose cerebral palsy in an individual child, they look at risk factors, the symptoms, the mother's and child's medical history, and the onset of the disorder.

About 10 or 20 person of children who have cerebral palsy acquire the disorder after birth, while many more cases are caused by an incident that occurs during pregnancy or birth. Acquired cerebral palsy is the result of brain damage in the first few months or years of life. Common causes of brain damage are sickness such as bacterial meningitis, viral encephalitis, or even jaundice. Another common cause is head injury such as from a motor vehicle accident, a fall, or

child abuse. When a baby is "born" with cerebral palsy, the causes may be due to avoidable or unavoidable incidents that occurred during pregnancy or birth.

During Pregnancy

Cerebral palsy can also be caused by things that happen during pregnancy which cause permanent damage to the fetus.

1. *Prenatal Infections*

Certain bacterial and viral infections can damage the fetus during pregnancy. More commonly, untreated or maltreated maternal infections can induce premature labor and delivery. These newborn babies may suffer the consequences of brain damage from infection directly, or they may be damaged as a direct result of prematurity. Sometimes the mother can be unaware of the source of infection if it goes undetected by her health care provider. Maternal infections such as German measles (or rubella), cytomegalovirus and toxoplasmosis, can cross the placenta and infect the fetus as well, causing damage to the developing nervous system.

2. *Improper Dating of the Pregnancy*

One of the most important influences in prenatal care is the accurate dating of a pregnancy. Ultrasounds have made the estimation of due dates far more reliable. Failure to properly date the pregnancy may result in either premature delivery of post-mature delivery, both of which may be responsible for brain damage or cerebral palsy to newborn baby.

3. *Rh IncompAtibility*

In this blood condition, the mother's body produces immune cells called antibodies that destroy the fetus's blood cells, leading to a form of jaundice in the newborn. Severe, untreated jaundice can damage brain cells.

4. *Bleeding in the Brain*

Bleeding in the brain has several causes, including broken blood vessels in the brain, clogged blood vessels, or abnormal blood cells. Although bleeding in the brain(or stroke) is better known for its effects on older adults, it can also occur in the fetus during pregnancy or the newborn around the time of birth, damaging brain tissue and

causing neurological problems or cerebral palsy. Ongoing research is testing potential treatments that may one day help prevent stroke in fetuses and newborns.

Birth Injury

Sometimes cerebral palsy is the result of a birth injury that causes the infant to be traumatized or deprived of oxygen (asphyxia). A number of things can cause cerebral palsy trauma of asphyxia, including:

- Difficult forceps delivery,
- Difficult vacuum extraction delivery,
- Exceptionally long labor,
- Low amniotic fluid,
- A twisted or compressed umbilical cord,
- Macrosomia or a baby that is "large for gestational age",
- Placental abruption and
- Hemorrhage.

Most often when a baby is damaged, she is damaged late in labor from a continuous lack of oxygen and/or trauma. While a newborn/infant's blood is specially equipped to compensate for low levels of oxygen, and asphyxia (lack of oxygen caused by interruption in breathing or poor oxygen supply) is common in babies during the stresses of labor and delivery, this ability is not infinite. If asphyxia severely lowers the supply of oxygen to the infant's brain for lengthy period, the baby may develop brain damage called hypoxic-ischemic encephalopathy. A significant proportion of babies with this type of brain damage die. Others may develop cerebral palsy, which is then often accompanied by mental impairment and seizures.

During most labors, electronic fetal heart rate monitoring and fetal scalp pH sampling are used to assess fetal wellbeing and to detect fetal distress preventing cerebral palsy. Experts can preview the fetal heart monitoring strips and take appropriate action, often an emergency cesarean section.

Premature Delivery and Neonatal Intensive Care

Another major cause of cerebral palsy/mental retardation is premature birth. Premature labor can often be halted by medication, but it must be diagnosed at the earliest stage. Medication given to the mother can accelerate fetal lung development. Immature lungs at birth are a major factor in subsequent complications, including brain hemorrhage and death.

Contact doctor if you have questions about your child's cerebral palsy, or if you would like to learn more about protecting your child's right to a lifetime of benefits.

Risk Factors

Scientists have examined thousands of expectant mothers, followed them through childbirth, and monitored their children's early neurological development. As a result, they have uncovered certain characteristics, called risk factors, which increase the possibility a child will later be diagnosed with cerebral palsy.

Knowledge of these risk factors helps doctors keep a closer eye on children who may exhibit later warning signs for cerebral palsy. However, do not become too alarmed if your child has one or more of these factors. Most such children do not have and do not develop cerebral palsy.

Cerebral Palsy Risk Factors Include

- Breech presentation
- Babies with cerebral palsy are more likely to present feet first, instead of head first, at the beginning of labor.

Complicated Labor and Delivery

Problems with the baby during labor, or a long and complicated delivery may sometimes be the first sign that a baby has suffered brain damage during the pregnancy or in the early stages of birth, or that a baby's brain has not developed normally. Additionally, the complications themselves can cause permanent brain damage in an otherwise normal baby.

Birth Defects

Babies with physical birth defects such as malformation of the spinal bones, hernia (a protrusion of organs through an abnormal opening inside the body) in the groin area, or an abnormally small jaw bone-are at an increased risk for cerebral palsy.

Low Apgar Score

The apgar score (named for anesthesiologist Virginia Apgar) is a numbered rating that reflects a newborn's condition. To determine an Apgar score, doctors periodically check the baby's heart rate, breathing, muscle tone, reflexes, and skin color in the first minutes after birth. They then assign point (0-2 for each of the five areas); total scores closer to 10 are desirable. A low score at 10-20 minutes after delivery is often considered an important sign of potential problems.

Low Birthweight and Premature Birth

The risk of cerebral palsy is higher among babies who weigh less than 2500 grams (5 lbs, 7 1/2 oz) at birth and among babies who are born less than 37 weeks gestation. This risk increases as the less the baby weighs.

Multiple Births

Twins, triplets, and other multiple birth are linked to an increased risk of cerebral palsy.

Nervous System Malformations

Some babies born with cerebral palsy have visible signs of nervous system malformation, such as an abnormally small head (microcephaly). This suggests that problems occurred in the development of the nervous system while the baby was in the womb.

Maternal Bleeding or Severe Proteinuria Late in Pregnancy

Vaginal bleeding during the sixth to ninth months of pregnancy and severe proteinuria (the presence of excess proteins in the urine) are linked to a higher risk of having a baby with cerebral palsy.

Maternal Hyperthyroidism, Mental Retardation or Seizures

Mothers with any of these conditions are slightly more likely to have a child with cerebral palsy.

Seizures in the Newborn

An infant who has seizures at birth is at a higher risk of being diagnosed later in childhood with cerebral palsy.

Contact doctor if you have questions about your child's risk factor, or if you would like to learn more about protecting your child's right to a lifetime of benefits.

Warning Signs

Cerebral palsy is often suspected when a child does not achieve normal growth milestones, such as rolling over, sitting, crawling, smiling, or walking. However, more severe symptoms may also appear at birth. If you are concerned about your baby's development, you should check with your doctor. He or she can help your distinguish between normal developmental variation among children and a more significant developmental disorder.

Contact doctor if you have questions about your child's cerebral palsy, or if you would like to learn more about protecting your child's right to a lifetime of benefits. Here are some cerebral palsy signs to look for in your child.

At birth

Difficult breathing,
Trouble eating,
Trouble eliminating,
Lack of certain reflexes.

At three Months

Does not respond to you voice,
Does not follow toys with eyes,
Does not use facial expressions,
Has unusually stiff or floppy muscles,
Consistently uses one side of his body more than the other,
Does not enjoy being around people.

At Four to Five Months

Has difficulty in getting objects to his mouth,
Doesn't turn his head to locate sounds,
Doesn't smile spontaneously.

At six Months

Cannot sit without help,
Does not laugh or make sounds,
Does not actively reach for toys.

At Seven to Eight Months

Does not follow toys with both eyes at both near and far ranges,
Does not actively reach for toys,
Does not bear some weight on legs,
Does not try to attract attention through actions,
Does not babble,
Would not play games.

A Broad Spectrum of Etiology

For the purpose of study we divide all the causes of cerebral palsy under three basic groups:

a. Prenatal factors

b. Perinatal factors and
c. Postnatal factors

Prenatal Factors

It comprises causative factors from the time of conception to the onset of labor.

Hereditory

The familial diseases like familial athetosis, congenital tremors, familial spastic paraplegia, familial rigidities due to genetically transmitted developmental defects in the basal neuclei and/or in their tracts. Also certain progressive, hereditary, neurofibromatosis, tuberous sclerosis and other rare neurological conditions, etc. can cause cerebral palsy. These children suffered more of congenital malformations like extradigits, cleft palate, etc. Even premature deliveries could be the cause sometimes.

Acquired During Gestations

Irradiation: The X-ray (therapeutic irradiation of a pregnant mother) of lower abdomen may lead to cerebral damage of the fetus which may be the result of the lowest amount of exposure too. Examine mother for pregnancy before X-rays.

Even those who were within 1200 meters of the center of atomic explosions, the pregnant mothers gave birth to microcephalics and mentally deficient children.

Maternal Infection: Development to the brain in fetus reaches maximum during second and fourth months of gestation. German measles to the mother can cause infections like deafness, cataract, congenital cardiac malformations, and auditory aphasia. The above abnormalities can be developed even when mother suffers from the following:

- Toxoplasmosis,
- Mumps
- Chickenpox
- Herpeszoster
- Influenza and
- Syphilis.

Prenatal anoxia: If any interference in the oxygen exchange between placenta and fetus takes place for sufficiently long time, it can lead to premature/permanent injury to the fetal brain.

The mechanisms to produce or induce interference are:

i. *Placental abnormalities:* As abruptio placenta, placenta previa, poor development of placenta—in hyperthyroid mothers, multiple infarcts of placenta and bleeding.
ii. *Maternal anoxia*: Due to sudden atmospheric changes from low to high altitude, maternal allergies to analgesic drugs during labor, shock of trauma, spinal shock reactions and nitrous oxide anesthesia during labor for long period.
iii. *Cord anomalies:* They may collapse, kinking, knotting, compression of the cord leading to anoxia. Cord may wrap around the neck of the fetus tightly causing anoxia/asphyxia which requires immediate procedures to cut cord.
iv. *Maternal hypertension:* May be with maternal anoxia.

Hemorrahage during pregnancy: Mothers of cerebral palsy children generally give history of it. The prenatal hemorrhage in mothers resulted into quadriplegia in cerebral palsied child. Even premature separation of placenta leading to bleeding was responsible for anoxia of the fetus.

Fetal cerebral hemorrahage: It may take place within the fetal brain or on the brain surface, or may occur due to prolonged anoxia of cerebral blood vessels, or trauma to brain *in utero.* The blood vessels also may suffer damage due to toxemia or blood dyscrasias in mothers.

Kernicterus: A permanent damage of basal ganglia of brain due to mismanagement of hemolytic disease of the newborn or hyperbilirubinemia in premature babies is known as kernicterus. It may produce the following:

- Athetosis
- Deafness
- Mental retardation and
- Auditory aphasia.

Its incidence is far low nowadays to produce cerebral palsy than in the past.

Prematurity: Birth injury is more susceptible to cerbral palsy. Partial separation of placenta and other types of prenatal hemorrhages may lead to premature labor and fetal anoxemia. It even resulted into intracranial hemorrahage because of great fragility of the blood vessels in the children.

Predisposition to miscarriage: The number of miscarriage is directly proportional to the incidence of cerebral palsy.

Metabolic disturbances during pregnancy: Though exact mechanism of such children is not clear, the diabetic mothers also produce cerebral palsy who have difficulty of conceiving, overweight during pregnancy, delivering unusually large baby, who have difficulties in being revived and in postnatal management during the first 96-hour after birth.

*Maternal toxemia:*The pre-eclampsia is the main cause of cerebral palsy; in certain cases, hemiplegia, quardriplegia and athetosis. The toxemias pass through placental barriers and fetus is severely involved. Postnatal care of infant of toxic mother is most difficult. Postnatal asphyxia of infant is extremely difficult to overcome and susceptibility to infection is very high.

Perinatal Factors

Severe cerebral agenesis due to prenatal factors could very well be allied with apnea at birth distress of fetus, drowsiness, and even convulsion. It may be due to instrument delivery or some other procedures or may be due to intracranial complications by anoxemia *in utero*.

During this period causes can be best studied in two headings as:

i. Traumatic and vascular, i.e. mechanical causes, and
ii. causes producing anoxia.

Mechanical Factors

Prolonged Labor: The increased time in labor is directly proportional to the occurrence of cerebral hemorrahage due to trauma. It is 18 hours in primiparous and 12 hours in multiparous mothers respectively.

Mechanical factors depending upon the type of delivery: It has been observed that birth trauma differs from head injury which occurs later in life due to slow molding and compression of the head more frequently than to violent blows and trauma. Distortion of the fetal head may also result in the tearing of the dural septa.

Thoracic compression may be an important cause of cerebral congestion and venous extravasation. The blood is forced out of the large venous channels of the chest and abdomen into the head and neck. If this compression is severe and prolonged, traumatic asphyxia may be developed. Due to this severe cyanosis of head and neck persists for several days and may be associated with meningeal and retinal hemorrhages. Intracranial hemorrahage in cesarean section results due to fetal head being delivered through a very small incision in the uterus. Even use of forceps cause trauma to fetal head.

Physical injury may result in cerebral damage by laceration of the cortex by depressed fracture from excessive pressure by obstetrical forceps or from hemorrahage into subdural space on the hemisphere themselves. Subdural space hemorrhage is most of the time cause of death of the child. Traumatic delivery also is the cause of cerebral hemorrhage. Generally injuries like high forceps, breech delivery, mid-forceps, cesarean section, low forceps, spontaneous delivery, low forceps with episiotomy are seen.

Cesarean section is indicated when possibility of intracranial hemorrhage cannot be ruled out. Percentage trauma in CS is less than other types of deliveries. Baby thus delivered by the section is deprived of those stimuli usually received during vaginal delivery, i.e. initiation of normal respiration. Consequently, adequate and immediate resuscitation may be necessary in cesarean section if anoxia is to be prevented.

Such children, even though immediate breathing is given, tend to develop apnea. So they must be observed for next 48 hours after birth. Such children have more amniotic fluid and debris in bronchial tree than the normally delivered child and should have careful bronchial aspiration at birth to avoid hyaline membrane, atelectasis and pneumonia.

Forthcoming head in breech delivery can also produce severe anoxemia. The child is handled at room temperature and change enabling efforts aspirating large amount of debris. Child of hemorrhagic diathesis is prone to cerebral hemorrhage in addition to hemorrhage anywhere else in the body. It may not be associated with birth trauma. It may appear within 48 hours after birth.

Fetal Asphyxia

Perinatal anoxia is very common cause of cerebral palsy. Asphyxia at birth may cause several cerebral lesions found on autopsy in cerebral palsy. Undue suppression of the respiratory centers through excessive premedication of the mother or by prolonged use of the anesthetics, particularly nitrous oxide plays an important role in such patients. Prolonged delivery due to improper dilation of birth canal, deep transverse arrest, uterine inertia, excessive pressure by forceps, or holding the head back for unduly long time, are the predisposing factors of the perinatal asphyxia. They cause damage to basal ganglion and lead to athetosis. Prematurity is due to sudden changes between intrauterine pressure and atmospheric pressure.

Fetal Anoxia

It can be due to:

Mechanical respiratory obstruction: They cite asphyxia, cyanosis, atelectasis or congenital pneumonia, and hyaline membrane formation as common factor. This occurs more frequently in premature baby and cesarean sections. Frequency is related to the aspirated amniotic fluid and other debris during the delivery. Atelectasis/ bronchitis cause decrease in the functional number of alveoli.

Injudicious use of analgesics and anesthetics: Use of such drugs cause depression of the respiratory centers of the fetus lasting 4 to 36 hours after birth producing anoxia and period of apnea. Narcotised body should be observed for at least 48 hours after birth.

Use of resuscitation and oxygen must have been of considerable help in maintaining adequate cerebral oxygenation. The forced oxygenation of premature babies shall also develop retinal damage along with cerebral damage.

Perinatal causes are the biggest causes of cerebral palsy and this is the period when possibility lies a great deal in prevention of the cerebral palsy. Inadequate development of premature baby may be weak, having easily traumatised vessels, a tendency to anemia and hypoproteinemia, a lower resistance to infection and great tendency to aspirate mucus, amniotic fluid and other debris.

Postnatal Factors

These causes are numerous. The possible role of a prenatal cause for the postnatal development of cerebral palsy must not be overlooked. These causes have been classified by Russ and Soboloff as under:

1. *Traumatic injuries:* Accidents involving head and skull fracture due to automobile and contact sports producing large percent of brain injuries.
2. *Infections:* Cerebral infections are very common in children. Like encephalitis, meningitis, brain abscess are common ones. Scarlet fever may cause thrombosis of one of ascending frontal branches of the middle cerebral artery resulting into damage of motor cortex, and that otitis media may produce hemiplegic syndrome by a retrograde thrombosis of the regional veins.

Rheumatic heart disease may cause an embolism causing a focal lesion resulting in the hemiplegic state of cortical origin.

a. Pyogenic meningitis (post infection) and
b. Post immunization encephalomyelitis and other factors.

3. *Toxic factors:* They are very uncommon. Any substance, digested, inhaled or injected into the infant which causes toxic changes in the brain must be the factors precipitating cerebral palsy. A frequent postnatal cause is leading to encephalopathy.
4. *Vascular accident:* More frequent in adults. In children so called "stroke" may occur in congenital aneurysm of brain in the circle of Willis.
5. *Cerebral anoxia:* Insufficient oxygenation of brain due to carbon monoxide poisoning and high altitude anoxia can be the causes in postnatal period.
6. *Brain tumors:* Congenital or acquired are rarely the cause of cerebral palsy. It may also include brain cysts/internal hydrocephalus, etc. The residual sequela of surgical intervention and the tumor may produce the syndrome known as cerebral palsy.

APPLIED ANATOMY AND PATHOLOGICAL FINDINGS

Cerebral palsy is the result of intracranial pathology which falls in three groups:

i. Lesions of the motor cortex
ii. Lesions of the basal ganglion and
iii. Lesions of the cerebellum.

Motor cortex lesions result into the sapasticity and flaccidity of the muscles, if in the basal ganglion they cause athetosis, tremor and sometimes rigidity and lesions of the cerebellum cause ataxia and incordination and diffuse lesion of the brain produces rigidity.

Limitation of motion due to concomitant involvement of extrapyramidal system/pathways, even further control through interference with cerebellar function complications increase with diminished/loss of vision, abnormal movements due to dysfunction due to striatal and subthalamic system which may modify disability at any attempt to correct it. Gravity may increase due to loss of vision, frequent fits, hyperkinetic activity, impaired intelligence, speech and auditory disturbances, which may arise due to other cortical lesions.

APPLIED ANATOMY AND PHYSIOLOGY

Pyramidal Motor Pathways

Pyramidal system has its origin in the large pyramidal cells of the precentral gyrus as area 4 in the cellular elements of giants cells of Betz. Area 4 is the transmitter for accomplishing voluntary movement where intent purpose of the same origins in cerebral context lying anterior to it. The tracts of the pyramidal system join with the lower

motor neuron in the nuclear masses of brainstem and in the anterior horn cells of the spinal gray matter which is eventually completed through series of the internuncial elements serving as distributors of the impulses to the parts responsible for motor activity.

The complex arrangement as follows: any effective treatment of spasticity, at present this field appears but in its infancy must take into account the neurologic features as:

i. The spinal stretch reflex.
ii. Central inhibitory influence which reduces it.
iii. Central facilitatory influence which reduces it, so

(i) – (ii) + (iii) = Spasticity.

Spastic paralysis develops due to pyramidal system damage, flaccid paralysis develops when area 4 of motor area is damaged or when pyramidal system/tract is interrupted in the medulla where only motor fibers are present.

Though cerebral palsy involves rarely (cerebral) motor cortex lesion—a flaccid paralysis is very rare. Extrapyramidal influences when modified give rise to spastic paralysis which is an accessory system associated with pyramidal pathways in controlling motor activity.

Cortical representation of this accessory factor is in the postfrontal areas lying just anterior to motor strip. This is area 6. So like area 4 is suppressor area and 6 as the cortical zone in which gross muscle movements of the trunk, upper extremity and lower extremity have their origin.

This shows that spasticity of cerebral origin is due to lesion in this accessory extrapyramidal system tracts from here terminate in *corpus striatum* and *substantia nigra* and red nucleus in upper part of the brain. These nuclear centers exert their influence on internuncial fibers of the cord, acting by suppression mechanism within the spinal segments which make for spasticity. There is another mechanism—reticulofacilitatory system exerting influence on the stretch reflexes of cord producing hyper-reflexia of spasticity.

This is removal of suppression exerted by the accessory areas of 4 and 6, result of which is modified by reflex facilitatory mechanism in the brainstem on reflex connections on the spinal cord through the reflex spinal pathways.

When complex syndrome of spasticity of rigidity is seen may not be infrequently involuntary motions—may result due to cellular lesions in basal ganglion and their connecting fiber tracts. Ganglionic elements of the extrapyramidal involuntary movement patterns in the forms of tremor, athetosis, dystonia, etc. Peculiar torsion movements of dystonia may be due to lesion of subthalamic nucleus of Luys.

Tremors result due to abnormal discharge of impulses descending in the reticulospinal bundle leading to synchrosed motor firing in the spinal cord.

Cerebellar Elements

Ataxia and dysmetria may arise due to cerebellar lesions keeping to the definition of cerebral palsy as paralysis of cerebral origin. Cerebellum exerts a controlling influence on the motor system by maintaining muscle tone, by checking movements which make precise actions possible, by integration of individual movements to have complicated movements without breaking down to separate elements. So cerebellar lesions result into muscle tone alteration, difficulty in limitation of a motion, and decomposition of a movement.

Congenital Deformities

Congenital brain defect may not lead to cerebral palsy. Congenital abnormalities of individual convolution, or focal regions of the cortex (tuberous sclerosis). Vascular defects of congenital origin, may produce motor disability.

Traumatic Lesions

Cranial fractures when compress underlying brain which may often due to depression of the fragments. Laceration of meninges may be accompanied by extradural and subdural hemorrhage which may be in meninges than in brain substance. Brain may be injured due to compression resulting into hematoma.

A linear scar of the brain may result from a curved depressed fracture resulting from excessive compression of obstetrical forceps. Many children do not survive this.

The depressed fracture of cranial vault due to traffic accidents or falls may result in bruising/laceration of the brain of child survives-scar remains with an ingrowth of connective tissue. Residual hemiplegia may be complicated due to conseizures.

SCLEROSING ATROPHY OF THE BRAIN

Generally in cerebral palsy, there is irregular nodular shrinkage of cerebral convolutions. This can be minor affecting only a portion of a gyrus or localized gyri. They may be associated with perinatal anoxia and other causing ischemia of the brain due to vascular spasm, inflammation and embolus.

Diffuse Degeneration of the Cerebral Cortex and Basal Ganglion

It results into diffuse alteration of the gray matter of cerebral cortex, the basal ganglion, sometimes motor nuclear masses of brainstem and cerebellum. This may be associated with some familial diseases or degenerative disorders.

Subdural Hematoma of Infants

This lesion may be due to subdural (hematoma) bleeding at the time of birth, with symptomless effusion. Hematoma becomes encapsulated-acting as semipermeable membrane permitting the passage of fluid from subarachnoid space into the clot, which enlarges hematoma compressing the cerebral cortex-leading to ischemia.

CLASSIFICATION AND DIAGNOSIS OF CEREBRAL PALSY

Classification of Phelps

There is standardization of the prevalent types of cerebral palsy which can be mentioned (as Phelps described):

1. Flaccid paralysis
2. Spasticity
3. Rigidity
4. Tremors
5. Athetosis and
6. Ataxia.

This is based on clinical manifestations of cerebral palsy which is useful for both the medical and rehabilitation team members. It was even classified as:

a. Spastic and
b. Extrapyramidal.

It has been common experience that true cerebral monoplegia is extremely rare. In spastic hemiplagia arm involvement is invariably recognised before by and most of the cases supposed of monoplegia turn out of hemiplegia. Large cases of spastic tetraplegia developed extrapyramidal features and became true mixed palsies.

Athetosis

An impairment of motion in which attempted activity results in a succession of slow involuntary movements which are smooth riding in character on close observation involving instability of opposing postures such as flexion and extension or pronation on supination, involving the distal musculature. It was said that athetosis is present during sleep and disappeares if patient is completely secure posturally or otherwise and is not attempting any activity.

Chorea

It is fully or largely involuntary irregular, spasmodic contracture of individual muscle/muscles or muscle groups of extremities or of the face with muscular weakness or ineffectiveness in attempted activity.

Dystonia

It is a disorder of the movement producing rhythmic and to a large extent, involuntary twisting, distortion and changes of tone mainly of the trunk musculature and proximal parts of the limb.

Ballismus

A coarse, large scale, involuntary jerking or flinging motion of an extremity. They also emphasized that the disorder of movements in patient in the extrapyramidal group usually changing with the advancing age.

Classification of Brenda

Cerebral palsy is divided as under:

A. Little's spastic rigidity (decerebrate rigidity).
B. Pyramidal Type (mono-, hemi-, di- and paraplegias).
C. The mixed extrapyramidal-pyramidal type (paraplegias with athetosis).
D. The ataxic atonic-cerebellar type.

Nowadays the clinicians have accepted motor classification of the cerebral palsy in planning their treatment program. It should be recognized that so-called motor classification which is a descriptive or symptomatic classification is based on neurological signs and symptoms which undergo changes as nervous system matures and it cannot be finally diagnosed in the childhood only.

After nervous system matures the symptomatology becomes static and standardised. Therefore, we must follow changing neurological patterns in childhood. Motor changes may be made as symptomatologic changes.

When child is followed through early infancy through school age, we will find neurological symptomatology changes and child shows athetosis or spasticity. Therefore, motor classification of childhood is only tentative classification.

GENERAL CLASSIFICATION OF CEREBRAL PALSY

1. *Physiological (motor)*
   a. Spastic
   b. Athetosis: Tension, non-tension, dystonic, tremor
   c. Rigidity
   d. Ataxic
   e. Tremor
   f. Atonic (rare)
   g. Mixed
   h. Unclassified.
2. *Topographical*
   a. Monoplegia: One limb affected, rare, close check for eliminating hemi/paraplegia.
   b. Paraplegia: Both legs, generally spastic or rigidity types.
   c. Hemiplegia: One-half affected, usually spastic but athetoid hemi, also seen as like rigidity, hemiplegias, sensory involvement in proprioception, aphasias in right sided acquired lesions.
   d. Triplegia: Three limbs affected (2 legs + 1 arm), usually spastic, may be hemi plus paraplegia or incomplete quadriplegia. In latter both arms, equal or hemi equal but in former involved arm is short.
   e. Quadriplegia: All four limbs affected, legs greatly affected and are spastic, patients with greatest arm involvements usually ideokinetic including athetoid.
   f. Diplegia: Spasm used paralysis affecting like parts on either side of the body, bilateral paralysis.
   g. Double hemiplegia: Arms more involved than legs, usually are spastic.
3. *Etiological:*
   (a) Prenatal
      i. Hereditary
      ii. Acquired *in utero*
   (b) Natal and
   (c) Postnatal.
4. *Supplemental*
   a. *Psychological evaluation:* For IQ for mental relationship,
   b. *Physical status:* Physical growth evaluation, developed levels prone age, contractures,
   c. Convulsive seizures,
   d. Posture and locomotor behavioral pattern.

e. *Eye-hand behavior patterns:*
   - Eye-dominance,
   - Eye movements,
   - Eye-postures,
   - Fixations,
   - Convergence,
   - Presensory approach,
   - Grasp,
   - Manipulation and
   - Hand dominance.

f. *Visual status*
   i. Sensory-amblyopia
      – Field defects
   ii. Motor
      – Conjugate deviation
      – Fixation defect
      – Spasmus fixus (1%)
      – Esotropia (5%)
      – Exotropia
      – Hypertropia
      – Hypotropia
      – Nystagmus
      – Pseudopalsy of externi.

g. *Auditory status* – Pitch range loss
   – Decibel loss

h. Speech disturbances.

5. *Functional capacity (degree of severity)*
   Class I: Patient with CP with no practical limitation of activity.
   Class II: Patient with CP with slight to moderate form of limitation of activity.
   Class III: Patients with CP with moderate to great limitation of activity.
   Class IV: Patients with CP unable to carry on any useful physical activity.

6. *Therapeutic*
   Class A: Patients with CP requiring no treatment
   Class B: Patients with CP requiring minimal bracing and terminal therapy.
   Class C: Patient with CP who need bracing and apparatus and series of CP team.
   Class D: Patient with CP limited to such a degree that they require long term institutionlisation and treatment.

TYPES OF CEREBRAL PALSY

There are four types of cerebral palsy:

- Spastic cerebral palsy (difficult or stiff movement)
- Ataxic cerebral palsy (loss of depth perception and balance)
- Athetoid cerebral palsy (uncontrolled or involuntary movements)
- Mixed cerebral palsy (a mix of two or more of the above).

Spastic Cerebral Palsy

Spastic cerebral palsy affects around 70 percent of children with cerebral palsy. In this form a child's muscles are stiffly and permanently contracted, limiting their range of motion and causing jerky, unpredictable movements. Often a child has trouble holding or letting go of objects or moving from position to position. Based on the particular areas of the body that are affected, spastic cerebral palsy has several typical manifestations. When both legs are affected, they often turn in and cross at the knees, causing an awkward and stiff walk with a characteristic rhythm, known as the scissors gait. Children may also experience uncontrollable shaking (or tremors) of the limbs on one side of their body. This is known as spastic hemiparesis and, if severe, may seriously impair movement.

Ataxic Cerebral Palsy

This rare form of cerebral palsy effects around 5 to 10 percent children. Impacting a child's sense of balance and depth perception, children with this type of cerebral palsy often have poor coordination, an unsteady or wide-based gait (placing their feet unusually far apart), and experience difficulty when attempting quick or precise movements (such as writing or buttoning a shirt). These children may also suffer from intention tremors. This form of tremor begins with a voluntary movement, such as reaching for a book, and causes a trembling that affects the body part being used. The tremor worsens as the individual gets nearer to the desired object.

Athetoid Cerebral Palsy

This form of cerebral palsy is characterized by uncontrolled, slow, writhing movements. These abnormal movements usually affect the hands, feet, arms, or legs and, in some cases, the muscles of the face and tongue, causing grimacing or drooling. The movements often increase during periods of emotional stress and disappear, during sleep. Children may also have problems in coordinating the muscle movements needed for speech, a condition known as dysarthria. Athetoid cerebral palsy affects about 10 to 20 percent of patients.

Mixed Cerebral Palsy

As many as 10 percent of children with cerebral palsy have symptoms of more than one of the forms of cerebral palsy. The most common mixed form includes spastic and athetoid movements but other combinations are also possible.

SYMPTOMS OF CEREBRAL PALSY

Symptoms of cerebral palsy can range from mild to severe. They differ from person to person, depending on the type of cerebral palsy the person has, and may even change over time as the child grows. Some children with cerebral palsy have difficulty with fine motor tasks, such as writhing or cutting with scissors, while others experience trouble balancing and walking. Still others are affected by involuntary movements, such as uncontrollable writhing motions of the hands or drooling. Other disorders often accompany cerebral palsy, including seizures or mental impairment. Cerebral palsy is not contagious, nor is it inherited from one generation to the next. At this time, it cannot be cured, although scientific research continues to make advances in treatments and methods of prevention.

Contrary to common belief, cerebral palsy does not always cause profound handicaps. While one child with severe cerebral palsy might need extensive, lifelong care, another child with mild cerebral palsy might require no special assistance at all.

Contact doctor if you have question about your child's symptoms, or if you would like to learn more about protecting your child's right to a lifetime of benefits.

2 CHAPTER

Diagnosis of Cerebral Palsy

The diagnosis of cerebral palsy is not made immediately in postnatal period. The history of difficult birth, cyanosis, convulsions and rigidity should make the team members suspicious of brain damage. Child may be listless, have periods of apnea, may have feeble or high pitched cry, and may have nursing difficulty. Fontanel buldging may indicate increased intracranial pressure which may be due to cerebral edema or due to hemorrhage in the cranial cavity. CSF may show traces of blood in that case which cannot be ruled out otherwise. Brain lesion clinical symptoms may not appear for weeks/months after birth since voluntary motor centers of the infant do not or in little way exert influence on muscles of swallowing, sucking and crying which are in main reflex activities. Inadequacies appear on skilled controlled movements leading to diagnosis as cerebral palsy. Hence diagnosis of cerebral palsy commands objectivity of evidence of impaired motor system. Rigidity and listless may be seen in the extremities in the first and second months of life. Motor skill tested in this infant by his/her holding head up. If normal infant of ten weeks of age is slowly pulled by hands to the sitting position, he/she will usually hold head/support head in line with the body whereas head falls backwards in cerebral palsy child and even may not accomplish head support later on in life. Also compare growth development of sitting, standing, locomotion, hand manipulation and speech.

The variations at average age normal child who turns himself over at 5-6 months of age:

- Sits unsupported at seven months,
- Pulls himself to standing position at 9-10 months,
- Stands alone at 14 months,
- Walk unassisted at 16 months, will show interference of diagnostic of cerebral palsy.

Similarly in the mental activity:

- The child will grasp objects within reach at 3 months
- Will reach for nearly objects at 6 months

- Handles simple objects freely at 7 months of age
- Babbling sounds at the age of first 12 months of life and
- Forms words at 14-18 months,
- Words strung together in some fashion between the ages of 18-24 months and well developed speech for understanding by 3 years.

Failure to complete the normal tones above shows the failure of growth of motor system which is confirmed clinically by hyper-irritability of muscles, clonus, increased tendon reflexes.

EXAMINATION IN DETAIL ON

- Length of labor,
- Condition of the mother,
- Type of delivery,
- Condition of baby at birth,
- Presence of cyanosis or jaundice,
- Presence of convulsions,
- Resuscitation at birth,
- O_2 therapy used,
- Ability of baby to feed,
- Any evidence of apathy and
- Hyperirritability postnatally.

WHAT ARE THE EARLY SIGNS OF CEREBRAL PALSY?

Babies with cerebral palsy are frequently slow to reach developmental milestones, such as learning to roll over, sit crawl, smile or walk. This is sometimes called 'developmental delay'.

Some affected babies have abnormal muscle tone. Decreased muscle tone is called hypotonia: the baby may seem flaccid and relaxed, even floppy. Increased muscle tone is called hypertonia, and the baby may seem stiff or rigid. In some cases, the baby has an early period of hypotonia that progresses to hypertonia after the first two to three months of life. Affected babies may also have unusual posture or favour one side of their body.

Parents who are concerned about their baby's development for any reason should contact their doctor, who can help distinguish normal variation in development from a developmental disorder.

Signs among Children

The following suspicious signs can be cited as indications of the early signs of cerebral palsy:

The Infant

A. Poor neck control at four weeks,
B. Unable to resist a slow pull from supine to a sitting position,
C. Refusal to suckle,
D. Difficulty in swallowing or suckling,
E. Excessive crying,
F. Excessive vomiting,
G. Fisted hands after 4 months and
H. Presence of tonic neck reflex after 6 months.

The Young Child

A. Convulsions,
B. Hyperactivity, hyperirritability,
C. Retarded developmental progress, especially noted when the child fails to sit up, crawl, and walk by one year and
D. Hypotonicity of muscles.

The Older Child

A. Convulsions,
B. Short attention span,
C. Marked retarded development progress,
D. Speech defects,
E. Auditory difficulties,
F. Ophthalmic defects and
G. Flaccidity.

HOW IS CEREBRAL PALSY DIAGNOSED?

Doctors diagnose cerebral palsy by testing a child's motor skills and looking carefully at the child's medical history. In addition to checking or slow development, abnormal muscle tone, and unusual posture—a doctor also tests the child's reflexes and looks for early development of hand preference.

Reflexes are movements that the body makes automatically in response to a specific cue. For example, if a newborn baby is held on its back and tilted so the legs are above its head, the baby will automatically extend its arms in a gesture, called the Moro reflex, that look like an embrace. Babies normally lose this reflex after they reach 6 months, but those with cerebral palsy may retain it for abnormally long periods. This is just one of several reflexes that a doctor can check.

Doctors can also look for hand preference—a tendency to use either the right or left hand more often. When the doctor holds an object in front and to the side of the child, a child with hand preference will use the favoured hand to reach for the object, even when it is held closer to the opposite hand. During the first year, babies do not usually show hand preference. But babies with spastic hemiplegia, in particular, may develop a preference much earlier, since the hand on the unaffected side of their body is stronger and more useful.

The next step in diagnosing cerebral palsy is to rule out other disorders that can cause movement problems. Most important, doctors must determine that the child's condition is not getting worse. Although its symptoms may change over time, cerebral palsy is not progressive. If a child is continuously losing motor skills, the problem is more likely to be genetic diseases, muscle diseases, disorders of metabolism, or tumors in the nervous system. The child's medical history, special diagnostic tests, and, in some cases, repeated check-ups can help confirm that other disorders are not at fault.

The doctor may also order specialized scan of the brain, including CT (computerized tomography), MRI (magnetic resonance imaging), EEG (electroencephalogram), or ultrasound, to learn more about the possible cause of cerebral palsy.

Finally, doctors may want to look for other conditions that are linked to cerebral palsy, including epilepsy, mental impairment, and vision or hearing problems.

Diagnostic Procedures

The various diagnostic procedures are as follows:

- EEG,
- Psychometric evaluation,
- Audiometric examination and
- Ophthalmological examination.

Fruguson stated that all such children must be diagnosed by 6 months. The signs observed are: stiffness in limbs, failure to sit and to hold neck up, over-reactivity of sudden stimulus as clapping of hands, a tendency of hyperextending neck, facial grimaces, tongue rolling, inability to shake extremity in a flopping accompaniment of the shake in a short period, lack of balance due to failure in holding neck up, or inability to extend spine.

The most frequently sign seen was athetosis resulting in habitual distorted positions, uncontrolled motions, excessive activity, and purposeless motions.

Tension develops to control these motions but reflexes do not increase, the plantar responses are negative,muscle power throughout is good, and atonic musculature is not found.

Patients with spasticity exhibit increased reflex activity, positive plantars and stretch reflexes in the musculatures. Weak, atonic or inactive musculatures are frequently seen in the same extremity. Rigidity may be seen through resistance throughout full arc of motion unlike spasticity at a fixed point. Resistance felt in reversing motion or previously flexed limb.

Diagnostic Features by Illingworth

Illingworth highlighted diagnostic features of cerebral palsy as follows:

Diagnostic Features at Any Age

Prenatal and natural history may show features of predominance in cerebral palsy than in the normal population. They include prematurity, antepartum hemorrhage, multiple pregnancies, toxemia, family history of cerebral palsy, hemolytic disease of the newborn and other conditions likely to lead to fetal anoxia. Postnatally child may have poor condition, cyanotic attack or convulsion, was excessively drowsy or irritable, had severe sucking difficulties, known cerebral hemorrhage or buldging fontanel.

History of jaundice beginning very early, i.e. on first day or beginning later but being usually severe a long lasting, a history of hyperbilirubinemia associated with prematurity and admiration of excessive doses of vitamin K, may suggest of athetosis even anoxia at birth is another important forerunner of athetosis. Sometimes such babies treated carefully do not turn to be cerebral palsied.

A full developmental history not only helps to know IQ but also to differentiate mental retardation from cerebral palsy or from combined cerebral palsy with mental subnormality. All normal milestones and motor development are seen.

The mother may notice abnormalities both developmental and motor. She may ask querries. In case of hemiplegia, she may notice that one hand was clenched long after the other opened, in quadriplegia both hands were kept tight, at the age of 4-5 months, or even later, normally at 2-3 months. She may notice stiffness of limbs in bathing child, occasional tension spasms or episthotonus attacks in the athetoid baby.

PHYSICAL INSPECTION

General Inspections of the Child

History of hydrocephalus or microcephalus, none is associated with spasticity, at least in early months, expressionless faces, paucity of movement of child with severe quadriplegics. Moro reflex or tonic neck reflex even after 3-4 months be present. Children normally loose their primitive reflexes by age of 3 months; reciprocal kick disappears in displeasure when learns to walk may be absent; absent only in very severe forms of cerebral palsy. Abnormal posture in first eight weeks of child indicates motor retardation when held in ventral suspension. Arms and legs hang lifelessly down whereas in normal child of 6 months elbows flexed and hips partly extended.

Spastic Form

The earliest sign of spastic form is likely to be delayed in motor development. By the age of six weeks, the normal child when held in vertical suspension should be able to hold his head at least momentarily in the same plane as the rest of his body. Severe head lag, at this age would suggest delayed motor development. It is confirmed by placing the child in the prone position by six weeks of the pelvis should be lower than what it is was two or three weeks of age, and legs should be intermittently extended. If at 6 weeks while awake he lays in the fetal position with the knees drawn up under the abdomen, one would suspected delayed motor development.

Next, to test knee jerks. Brisk response when the dorsum of the foot is tapped strongly suggests spasticity. Such pyramidal tract late developments are occasional in some children and disappearance of such signs as time passes by. Test ankle clonus only. It is often not present but its presence does confirm the pyramidal disease. Plantar response is useless for diagnosis purposes.

Primitive reflexes are persistent which is demonstrated by grasp reflex obtained by sliding ones finger on to the palm of the child. This should disappear in 3rd month but persists in spastic cerebral palsy varying with the severity of the condition.

Test for adductor spasm in the legs-thigh muscles. This is present in early infancy, only found in severe cases of spasticity, developing later in the milder form. The spastic muscle can be moved through full arc of motion if moved slowly. If speed is increased a point reaches at which resistance is encountered. If passive movement is rapid it is quickly halted by a strong muscle contraction.

This stretch reflex is encountered in the adductors of the hips, the triceps and the quadriceps. This spasm increases as child grows and

abduction of the hips is progressively decreased. A hand tightly closed and thumb held in adduction across palm suggests spasticity. In holding the child under axilla, the hips, knees extended, ankles held in equinus, legs in internal rotation due to adductor spasm the legs may cross. In normal child hip and knees flex. When held in standing, stands on toes due to tendoAchilles spasm. It is detected that it may offer resistance to flexion-extension-rotation of the feet on the passive movement.

In older child above 2 years, the cardinal sign of pyramidal tract disease is the plantar response.

Athetoid Form

The diagnosis of such case is difficult unless the characteristic movements are seen. Retarded motor development may be suspected in cases of history of hemolytic disease of the newborn, hyperbilirubinemia, or history of severe asphyxia at birth.

The signs of "disassociation" of his development of motor system appear; for instance, speech development at the level of an 18 months old child in presence of motor development of a 9 months old child. If intelligence is good then it is not necessarily an abnormality of motor development in the early week. As soon as athetosis is suspected, a repetitive observations be made especially when given to hold a rattle or a brick. Abnormal movements may or may not be spontaneous—in the early stages they will be elicited by voluntary motion. Hand movement will be different than of a spastic child when attempted to grasp an object, in that splaying out of the hand is less marked but writhing movements are seen.

Perlstein and Bernett say that if the arm is shaken, if it will begin to flail then athetosis and if it is tense then spastic.

Rigidity

Rigid child will offer resistance through full range of passive motion. Stretch reflex absent, jerks normal. May be overcome by rapid movment unlike pyramidal tract findings, in which rapid movements bring, stretch reflext into play. The rigidity is due to combined resistance of agonists and antagonists muscles.

Ataxia

To detect ataxia, the child should be old enough to grasp objects delibrately (average 5 months). All children in early stages of grasping show ataxia, asynergia and hypermetria but these disappear as soon as child can grasp sufficiently large objects while (s)he is about 6-7

months old. Persistence shall denote ataxic cerebral palsy which later may rise to ataxic gait.

Tremor

Tremor involves whole body which may be detected in early infancy. There are constant rhythmic and pendular movements involving whole body resulting due to alternate contractions of agonist and antagonist muscles.

Mixed Types

Pathological lesions may give rise to mixed types of the cerebral palsy which are common. Such forms are rare if clear neurological signs are carefully observed. Laboratory investigations are of very little value in cerebral palsy. This may be complicated or confused with the following:

1. Normal variations in normal children,
2. Mental deficiency,
3. Unsteadiness of gait,
4. Voluntary resistance to passive movement,
5. Normal movements of arms and legs,
6. Congenital dislocation of hip,
7. Congenital shortening of tendo-Achilles,
8. Weakness or wasting of the limb for other reasons,
9. Myopathies,
10. Hypotonic conditions,
11. Other types of voluntary movements,
12. Degenerative diseases of the nervous system,
13. Toxoplasmosis,
14. Puncturate epiphyseal dysplasia,
15. Maldevelopment of the spinal cord,
16. Cleidocranial dysostosis,
17. Platybasia in allied conditions and
18. Phenyl pyruvic oligophrenia.

MODALITIES OF THE TREATMENT

The treatment of cerebral palsy is the multifacet problem, i.e. treatment of general nature of cerebral palsy and general physical condition of the patient, understanding patient and parents, speech and mental defects and motor disability of the child.

Proper care and training along with adequate treatment program do improve physically, mentally and socially. Of course nerve damage-nerve tissue damage is irreversible and permanent.

Since the varied nature of the handicaps is involved in the treatment of the cerebral palsy therefore, team approach is required. This was started by Phelps who initiated such approach. From the orthopedic point of view the overcoming of the motor disability is of primary importance.

Russ and Soboloff suggested that cerebral palsy team should comprise of:

a. Medical or diagnostic group,
b. Professional or treating group,

Diagnostic medical group includes the following:

i. Orthopedist concerned with surgical procedures and bracing if necessary and OT/PT rehabilitation of the patient.
ii. The pediatrician concerned with the general physical health of the child evaluates the various types of therapy depending upon the patient's ability to cooperate with such form of the treatment.
iii. Physiatrist who is concerned with the actual techniques of PT and OT used for rehabilitation of the cerebral palsy child.
iv. Panel of diagnostic consultants consists of neurologists concerned with the neurological diagnosis and drug therapy programs which may be required. Psychiatrist concerned with emotional problems of the child relating to the patients as well.
   - Clinical psychologist is required for assessing the handicapped cerebral palsy for his IQ and behavioral understanding.
   - Ophthalmologist required for sight problems, if any.
   - Otolaryngologist who is of benefit in the diagnosis and treatment of hearing defects which is frequently associated handicap with cerebral palsy particularly athetoid type.

How is Cerebral Palsy Managed?

Cerebral palsy can not be cured, but treatment can often improve a child's capabilities. There is no standard therapy that works for all patients. Instead, the doctor must work with a team of health care professionals, first to identify a child's unique needs and impairments, and then to create an individual treatment plan that addresses these.

Some approaches that can be included in this plan are drugs to control fits and muscle spasms, special braces to compensate for muscle imbalance, surgery, mechanical aids to help overcome impairments, counseling for emotional and psychological needs, and

physical, occupational, speech, and behavioural therapy. In general, the earlier treatment begins, the better chance a child had of overcoming developmental disabilities or leaning new ways to accomplish difficult tasks.

The members of the treatment team for a child with cerebral palsy should be knowledgeable professionals with a wide range of specialities. A typical treatment team might include.

- A doctor, such as a pediatrician, a pediatric neurologist, or a pediatric psychiatrist, trained to help developmentally disabled children. This doctor, often the leader of the treatment team, work to synthesise the professional advice of all team members into a comprehensive treatment plan, implements treatments, and follows the patient's progress over a number of years.
- an orthopaedist, a surgeon who specializes in treating the bones, muscles tendons, and other parts of the body's skeletal system. An orthopaedist might be called on to predict, diagnose, or treat muscle problems associated with cerebral palsy.
- A physical therapist, who designs and implements special exercise programes to improve movement and strength.
- An occupational therapist, who can help patients learn skills for day-to-day living, school, and work for complete functional freedom.
- A speech and language therapist, who specializes in diagnosing and treating communication problems.
- A social worker, who can help patients and their families locate community assistance and education programs.
- A psychologist, who helps patients and their families cope with the special stresses and demands of cerebral palsy. In some cases, psychologists, may also oversee therapy to modify unhelpful or destructive behaviors or habits.
- An educator, who may play an especially important role when mental impairment or learning disabilities present a challenge to education.

The children who have cerebral palsy and their family or caregivers are also key members of the treatment team, and they should be closely involved in all steps of planning, making decisions, and applying treatments. Studies have shown that family support and personal determination are two of the most important predictors of which children with cerebral palsy will achieve long-term goals.

Too often, however, doctors and parents may focus primarily on an individual symptom-especially the inability to walk. While mastering specific skills is an import focus of treatment on a day-to-day

basis, the ultimate goal is to help individuals grow to adulthood and have maximum independence in society.

Physical, Behavioral and Other Therapies

Therapy-whether for movement, speech, or practical task is the cornerstone of cerebral palsy treatment. Physical therapy should begin as soon as the diagnosis is made. Physical therapy programs use specific sets of exercises to work towards two important goals: preventing the weakening the deterioration of muscles that can follow lack of use (called disuse atrophy) and avoiding contracture, in which muscles become fixed in a rigid, abnormal position while occupational therapy is carried out simultaneously by an occupational therapist also.

Contracture is one of most common and serious complications of cerebral palsy. Normally, a child whose bones are showing stretches the body's muscles and tendons through running and walking and other daily activities. This ensures that muscles will grow at the same rate. But in children with spastic cerebral palsy, the spasticity prevents this stretching and, as a result, muscles do not grow fast enough to keep up with lengthening bones. The resulting contracture can disrupt balance and trigger loss of previous abilities. Occupational therapy alone, or in combination with special braces, works to prevent this complication by stretching spastic muscles. For example, if a child has spastic hamstrings (the tendons located behind the knee), the therapist and parents should encourage the child to sit with the legs extended to stretch them in activities in OT department.

A third goal of occupational therapy programs is to improve the child's motor development. A widespread program of occupational therapy that works toward this goal is the Bobath technique, named after a husband and wife team who pioneered this approach in the UK. This program is based on the idea that the primitive reflexes retained by many children with cerebral palsy present major roadblocks to learning voluntary control. A therapist using the Bobath technique tries to counteract these reflexes by positioning the child in an opposing movement. So, for example, if a child with cerebral palsy normally keeps his arm flexed, the therapist would repeatedly extend it.

A second approach to occupational therapy is "patterning," which is based on the principle that motor skills should be taught in more or less the same sequence that they develop normally. In this controversial approach, the therapist guides the child with movement problems along the path of normal motor development. For example,

the child is first taught elementary movements like pulling himself to a standing position and crawling before he is taught to walk-regardless of his age. Some experts, have expressed strong reservations about the patterning approach, because studies have not established its value.

Occupational therapy is usually just one element of a development program that should include efforts to provide a varied and stimulating environment. Like all children, the child with cerebral palsy needs new experiences and intractions with the world around him in order to learn. Stimulation programs can bring this valuable experience to the child who is physically unable to explore.

As the child with cerebral palsy approaches school age, the emphasis of therapy shifts away from early motor development. Efforts now focus on preparing the child for the classroom, helping the child master activities of daily living, and maximising the child's ability to communicate.

Occupational therapy can now help the child with cerebral palsy prepare for the classroom by improving his or her ability to sit, move independently or in a wheelchair, or perform precise tasks, such as writing. In occupational therapy, the therapist works with the child to develop such skills as feeding, dressing, or toilet. This can help reduce demands on caregivers and boost self-reliance and self-esteem. For the many children who have difficulty communicating, speech therapy works to identify specific difficulties and overcome them through a program of exercises. Speech therapy can also work to help the child learn to use special communication devices, such as a computer with voice synthesisers.

Behavioural therapy provides yet another avenue to increase a child's abilities. This therapy, which uses psychological theory and techniques, can complement physical, speech, or occupational therapy. For example, behavioral therapy might include hiding a toy inside a box to reward a child for leaning to reach into the box with his weaker hand. In other cases, therapists may try to discourage unhelpful or destructive behaviors, such as hair-pulling or biting, by selectively presenting a child with rewards and praise during other, more positive activities.

As the child with cerebral palsy grows older, the need for and types of therapy and other support services will continue to change. Continuing physical therapy addresses movement problems and is supplemented by vocational training, recreation and leisure programs, and special education when necessary. Counseling for emotional and psychological challenges my be needed at any age, but is often most critical during adolescence.

Ultimately, depending on their physical and intellectual abilities, adults with cerebral palsy may need attendant care, living accommodations, transportion, or employment opportunities.

Regardless of the patient's age and which forms of therapy are used, treatment does not end when the patient leaves the treatment center—most of the work is often done at home. The therapist function is as a coach, providing parents and patient with the strategy and drills that can help improve performance at home, at school, and in the world. As research continues, doctors and parents can expect new forms of therapy and better information about which forms of therapy are most effective for individuals with cerebral palsy.

Drug Therapy

Drugs are also sometimes used to control spasticity, particularly following surgery. The three medications that are used most often are diazepam, which acts as a general relaxant of the brain and body; baclofen, which blocks signals sent from the spinal cord to contract the muscles; and dentrolene, which interferes with the process of muscle contraction. Given by mouth these drugs can reduce spasticity for short periods, but their value for long-term control of spasticity has not been clearly demonstrated. They may also trigger significant side effects, such as drowsiness, and their long-term effects on the developing nervous system are largely unknown. One possible solution to avoid such side effects may lie in current research to explore new routes for delivering these drugs. Patients with athetoid cerebral palsy may sometimes be given drugs that help reduce abnormal movements. Most often, the prescribed drug belongs to a group of chemicals called anticholinergics that work by reducing the activity of acetylcholine. Acetylcholine is a chemical messenger that helps some brain cells communicate and that triggers muscle contraction. Anticholinergic drugs include trihexyphenidyl, benztropine, and procyclidine hydrochloride. We can use Indian drugs as per physician/surgeon's advice.

Occasionally, doctors may use alcohol "wishes"– or injections of alcohol into a muscle –to reduce spasticity for a short period. This technique is most often used when doctors want to correct a developing contracture. Injecting alcohol into a muscle that is too short weakens the muscle for several weeks and gives doctors time to work on lengthening the muscle through bracing, therapy, or casts. In come cases, if the contracture is detected early enough, this technique may avert the need for surgery.

Surgery

Surgery is often recommended when contractures are severe enough to cause movement problems. In the operating room, surgeons can lengthen muscles and tendons that are proportionately too short. First, however, they must determine the exact muscles at fault, since lengthening the wrong muscle could make the problem worse.

Finding problem muscles that need correction can be a difficult task. To walk two strides with a normal gait requires more than 30 major muscles working at exactly the right time and exactly the right force. Furthermore, the natural adjustments the body makes to compensate for muscle problems can be misleading. A new tool that enables doctors to spot gait abnormalities, pinpoint problem muscles, and separate real problems from compensation is called gait analysis. Gait analysis combines cameras that record the patient while walking, computers that analyse each portion of the patient's gait, force plates that detect when feet touch the ground, and a special recording technique that detects when feet touch the ground, and a special recording technique that detects muscle activity (electromyography).

Because lengthening a muscle makes it weaker, surgery for contractures is usually followed by months of recovery. For this reason, doctors, try to fix all of the affected muscles at once when it is possible or, if more than one surgical procedure is unavoidable, they may try to schedule operations close together.

A second surgical technique, known as selective dorsal root rhizotomy, aims to reduce spasticity in the legs by reducing the amount of stimulation that reaches leg muscles via nerves. In the procedures, doctors try to locate and selective sever over activated nerves controlling leg muscles. Although there is scientific controversy over how selective this technique actually is, recent research results suggest it can reduce spasticity in some patients, particularly those who have spastic diplegia. Experimental surgical techniques include chronic cerebellar stimulation and stereotaxic thalamotomy. In chronic cerebellar stimulation, electrodes are implanted on the surface of the cerebellum—the part of the brain responsible for coordinating movement—and are used to stimulate certain cerebellar nerves. While it was hoped that this technique would decrease spasticity and improve motor function, results of this invasive procedure have been mixed. Some studies have reported improvements in spasticity and function, others have not.

Stereotaxic thalamotomy involves precise cutting of parts of the thalamus, which serves as the brain's relay station for messages from the muscles and sensory organs. This has been shown effective only for reducing hemiparetic tremors (see Glossary).

Mechanical Aids

Whether they are as humble as Velcro shoes or as advanced as computerised communication devices, special machines and gadgets in the home, school, and workplace can help the child or adult with cerebral palsy overcome the limitations of computer is probably the most dramatic example of a new device that can make a difference in the lives of those with cerebral palsy. For example, a child who is unable to speak or write but can make head movements may be able to learn to control a computer using a special light pointer that attaches to a headband. Equipped with a computer and voice synthesizer, this child could communicate with others. In other cases, technology has led to new versions of old devices, such as the traditional wheel-chair and its modern offspring that runs on electricity (Fig. 2.1).

Occupational Therapy

Occupational therapy is the evaluation and treatment of physical and psychiatric conditions through selected activities in order to enable people of all ages to function as effectively as possible in daily life, the goal of occupational therapy is to help people learn physical skills they need to function and become as independent as possible. Occupational therapy uses people's strengths to help them cope with their disabilities.

An occupational therapist may work within the community, the hospital, school or a special unit. Within local authority social services departments, occupational therapist are responsible for the assessment and provision of suitable equipment and for major adaptations to an existing or new environment at home, school or work to enable an individual to be as functionally independent as possible.

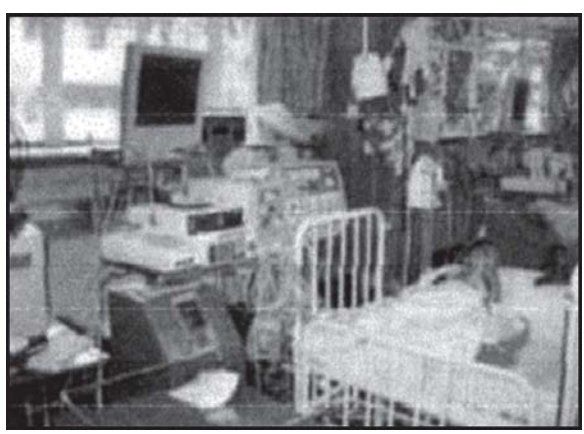


Fig. 2.1: Occupational aids

Occupational therapy plays a large role in the development of a child with cerebral palsy. The job of an occupational therapist is to teach the ability of the fine-motor skills and small muscles, which include:

- Hands,
- Feet,
- Mouth,
- Fingers, and
- Toes.

These therapists also teach daily living skills such as:

- Dressing,
- Eating, and
- Everyday mobility including use of mobility aids and transportation.

It is also one of their jobs to make sure children are properly positioned in wheelchairs, standing frames, etc. to maximise benefit and minimize positions that could contribute to more spasm or other uncontrolled movements. They may also teach child better of easier ways to:

- Write,
- Draw,
- Cut with scissors, and
- Brush their teeth.

Occupational therapists will also help child find the right special equipment to make everyday jobs a little easier, such as:

- Modified spoons and cups for easier feeding,
- Toys that are easily held and that will help the development of motor skills, and
- Seats,
- Wheelchairs,
- Pushchairs,
- Standing frames,
- Walking frames, and
- Side lying boards that will help improve child's mobility, posture, etc.

The occupational therapist may try to develop certain physical and learning skills using special play equipment and advise on equipment to help mobility such as tricycles and trolleys.

It is also the job of an occupational therapist to help make home and community accessible to child. Many adaptations may need to be accommodated in order for child to reach his maximum level of independence. For instance, because children with cerebral palsy often

have problems with their posture and muscle tension, a chair may need to be adapted with creative use of foam in order for the child to sit comfortably. Things such as a Rifton Corner Seat aid in a child's ability to sit on the floor while playing, without stressing the leg muscles and while keeping the child's posture upright.

Occupational therapists will look at the best posture and seating for the child. When occupational therapists are considering child's seating needs, it is important to obtain a clear idea of what final outcome you are looking to achieve. "Some seating is very bulky. Many special seats have trays in front of them, which means that the child is unable to join the rest of the family at the dinner table. Many chairs available on the market depend on numerous straps to hold the child in place. I don't think I would have been very comfortable as a child if several parts of my body were strapped down every time I sat in a chair. On the other hand, chairs that do not rely on straps probably require the child to put in some effort to keep their posture correct. Thus, sitting down becomes an activity rather than an act of relaxation. If your child clearly needs special seating it might be worth considering the option of more than one chair, perhaps one for relaxing and one for active sitting."

In addition to helping child find comfortable seating, depending on the degree or percentage disability of the child, the therapist may be interested in the walking pattern, or "gait," of the child. Even if the child cannot walk or stand or stand on her own, it is important that child stand for a portion of the day. While movement is necessary to stop muscles from becoming atrophied (the shrinking in size of a muscle, usually due to injury, disease, or lack of use), for children with cerebral palsy standing takes the weight from the hips to the feet, allowing the hip joint to develop more regularly, hip dislocation is a common problem in children with cerebral palsy, and allowing the joint to develop sufficient strength will help to avoid such dislocations. If a child is unable to stand on his own, there are many standing frames available. If child is not able to stand on his own but can manage with the help of an adult, purchasing a standing frame may not be necessary. Activities such as holding child's hips and supporting him in a standing position while he leans against a sofa or low table can be just as effective is allowing your child's joints to grow healthfully. Toilet seats can be specialized to help children with cerebral palsy develop this independent function without the need of assistance.

In instances where mobility is very limited, special computers that can be used by touching the screen, speaking the commands, or other modifications that make it possible for individuals with cerebral palsy

to accomplish tasks that they otherwise wouldn't be able to do by themselves. For example, computers can help people turn on a light switch with the blink of an eye or open a door with a nod of the head. 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, which means the ability to evaluate the relative importance of all sensory inputs acting on the body, on the basis of:

- A child's current posture and
- Previous movement abilities, and movement goals.

A child with cerebral palsy may experience sensory integration dysfunction (not being able to decide which sensory input, or the information coming in through senses, is compared to the others, more important) as a result of central nervous system damage (damage to the brain or spinal chord). Sensory integration dysfunction might also develop as a result of the limited sensory experience that these children have a result of their limited motor abilities.

What Occupational Therapists Cannot Do

Therapists cannot cure cerebral palsy; they can only help reduce disabling effects. Through therapy, disabled people can achieve improvement in communication and movement, and can become more independent. Every person with cerebral palsy is different, however, and not everyone will achieve the same results. An occupational therapist will likely advise you and child on easier methods of feeding, dressing and every day mobility. They will also help you find the specialized equipment the child needs to help him in every day activities.

Occupational therapists are also trained to evaluate the child's sensory system to determine whether a primary sensory deficit 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 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 experience that these children have as a result of their limited motor abilities. Occupational therapy will help determine child's abilities and will help to form reasonable goals to help your child reach (Figs 2.2 to 2.11; Tables 2.1 and 2.2).

Fig. 2.2: There is pleasurable interaction between the father and his child as the child's postural control with hand function is being developed. Father choses to use his feet to assist his child in symmetrical weight bearing from side to side or forwards and backwards during play

Fig. 2.3: Learning early balance on one foot during dressing, undressing, washing or drying with body closeness between mother and child

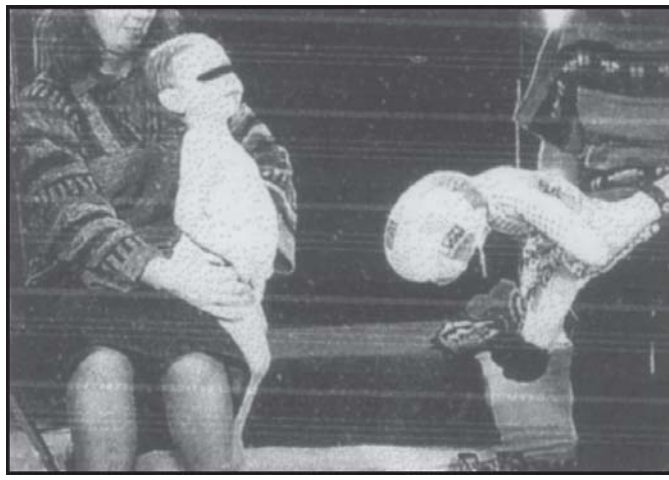


Fig. 2.4: Therapist showing tilt reaction facilitation on a doll so that the mother can interact with her child on her lap playing a 'see-saw' game. The position of the adult's hands on the child's hip rather than on the trunk is important

Fig. 2.5: A child developing postural control on her father's shoulder in playful activity

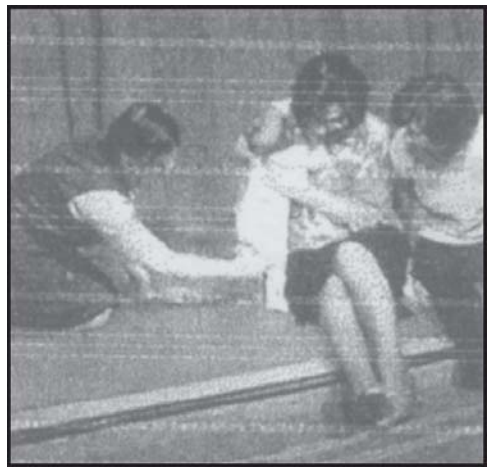


Fig. 2.6: Therapist enabling a mother and her key person to learn how to activate early standing with close body contact as support

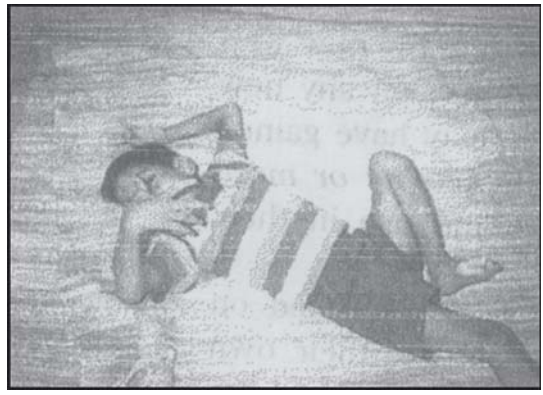


Fig. 2.7: Child with athetoid quadriplegia in supine

Fig. 2.8: Parent and child interact, promoting symmetrical standing leaning on both arms and so enabling the child to master his symptoms

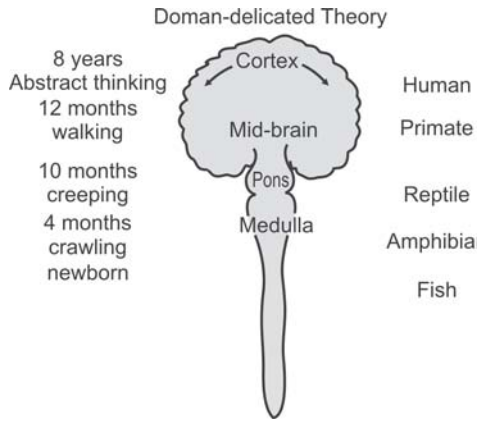


Fig. 2.9: Comparable locomotor activities of the developing human infant and representatives of evolutionary progress are depicted in successive strata of central nervous system organization. According to this theory, abstract thinking present only in human, is dependent upon hemispheric dominance

Table 2.1: The table helps a great deal to an occupational therapist in synergy management activities in OT department

Flexor synergy	*Arm extensor synergy*
Shoulder retraction	Shoulder protraction
Arm abduction	Arm adduction
Arm external rotation	Arm internal rotation
Elbow flexion	Elbow extension
Forarm supination	Forarm pronation
Wrist flexion	Wrist extension
Wrist radial deviation	Wrist ulnar deviation
Digit flexion	Digit flexion
Flexor synergy	*Leg extensor synergy*
Hip flexion	Hip extension
Thigh abduction	Thigh adduction
Thigh external rotation	Thigh internal rotation
Knee flexion	Knee extension
Ankle dorsiflexion	Ankle plantar flexion
Ankle supination	Ankle pronation
Digit extension	Digit flexion

Table 2.2: Limb synergies

	Flexion	*Extension*
Arm	Shoulder retraction and elevation, external rotation, abduction Elbow flexion, supination Wrist flexion Hand response variable	shoulder protraction, internal rotation, adduction Elbow extension, pronation Wrist extension Hand response variable
Leg	Hip abduction, flexion, external rotation Knee flexion Ankle and toe dorsiflexion	Hip adduction, extension, internal rotation Knee extension Ankle and toe plantar flexion

Emphasis is placed upon equalizing distribution of comparative strength, developing extensors of the upper extremity and flexors of the lower extremity, through facilitation of the following reflex responses (Figs 2.3 to 2.5):

ATTITUDINAL OR POSTURAL REFLEXES

Tonic Neck Reflexes

With neck rotated, flexion of the limbs on the skull side is facilitated (Fencer's stance)

Tonic Lumbar Reflexes

With lumbar spine rotated, upper limb flexes, lower limb extends, on side towards which chest rotates (ball-throwing stance)

Labyrithiner Reflexes

Facilitation of flexor synergies in upper most limbs with patient in side-lying position.

Righting Reflexes

Posture adjustment to disturbed sitting, kneeling, standing.

Associated Reactions

Contralateral synkinesis in the involved flaccid or spastic limb may be produced by forceful voluntary effort of the sound limb in the desired synkinetic pattern.

Homolateral synkinesis is produced by resisted voluntary synkinetic motion of either upper of lower limb on the same side.

Hand Reactions

Stretch of any flexor muscle of upper limb produces contraction of all flexor groups of the hand.

Elevation of the arm produces finger extension.

Grasp reflex is elicited by distally directed stimulation of the thenar area and the flexor surfaces of the fingers.

Hyperextension of the thumb produces relaxation of the finger flexors.

Table 2.3: Facilitation used in systems of therapy

	Phelps	*Deaver*	*Brunnstrom*	*Fay-Doman*	*PNF*	*Bobath*	*Rood*
Stimulus	°		°		°	°	°°
Labyrinthine reflexes	°		°			°	°
Tonic neck reflexes	°		°			°	
Righting reflexes	°		°		°	°	°
Postural reflexes	°		°	°	°	°°	°
Synergic patterns	°		°°				
Orientation	°		°		°	°	°
Strength	°	°			°°		
Range of motion	°	°			°		
Ontogenetic patterns	°				°	°	°
Phylogenetic patterns				°°			
Bracing	°	°°	°				

°° Major facilitation mechanism
° Contributory facilitation mechanism

Table 2.4: Characteristics of skeletal muscle

Light work muscles	*Heavy work muscles*
Superficial	Deep
Pale	Dark
Long	Short and thick
Cross two joints	Cross one joint
Distal insertion	Proximal insertion
Lateral origin	Medial origin
Tendinous origin	Fibrous origin
Oppose postural surfaces	Approximate postural surfaces
Suited to range and speed	Suited to stabilization
Stimulated through extroceptive receptors	Stimulated through introceptive receptors

Table 2.5: Characteristics of receptors

Exteroceptors		*Interoceptors*
	Types	
Heat Cold		Position sense Labyrinthine reflex Kinesthesia
Light touch Sight Hearing		Stretch Stretch reflex Inhibitory reflex
Taste Smell		Pressure
	Location	
Integument		Muscles Tendons
Organs of special sense		Joints
	Effect	
Awareness Muscle contraction Reciprocal inhibition		Stabilization Holding Direct contraction
	Response	
Slow-15 seconds Long after-discharge		Fast–5 seconds Short after-discharge
	Distribution	
Diffuse over dermatone		Localized to individual muscle
	Indication	
Light work muscle action for movement		Heavy work muscle action for stabilization

Tonic Labyrinthine Reflexes (Fig. 2.10)

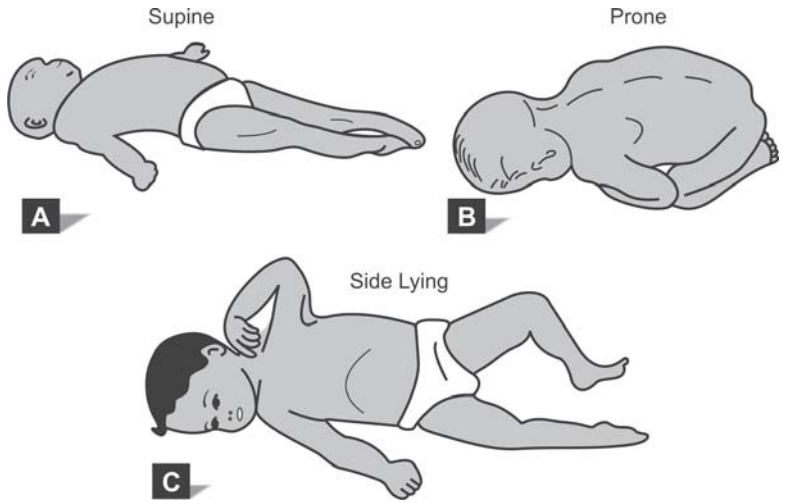


Fig. 2.10: Tone distribution regulated by the position of the head in space. (A) Supine: relative hypertonus throughout extensor groups; (B) Prone: relative hypertonus through out flexor groups; (C) Side-lying: relative hypertonus in flexors of upper most extremities and trunk, in extensors of lower-most extremities and trunk

Tonic Neck Reflexes (Fig. 2.11)

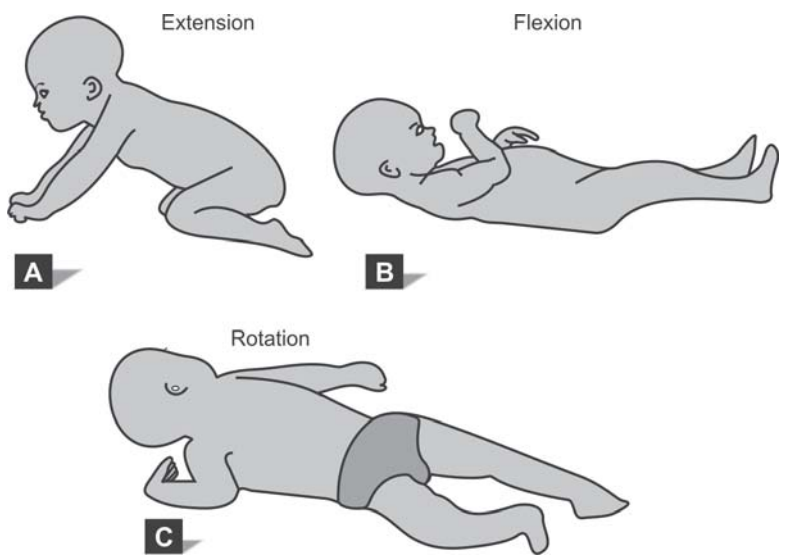


Fig. 2.11: Tone distribution regulated by the position of the cervical spine segments. (A) Neck extended: relative hypertonus in arm and upper trunk extensors, in leg and lower trunk flexors (B) Neck flexed: relative hypertonus in arm and upper trunk flexor, in leg and lower trunk extensors; (C) Neck rotated relative hypertonus in flexors of skull limbs and trunk, in extensors of face, limbs and trunk

Tonic Lumbar Reflexes (Fig. 2.12)

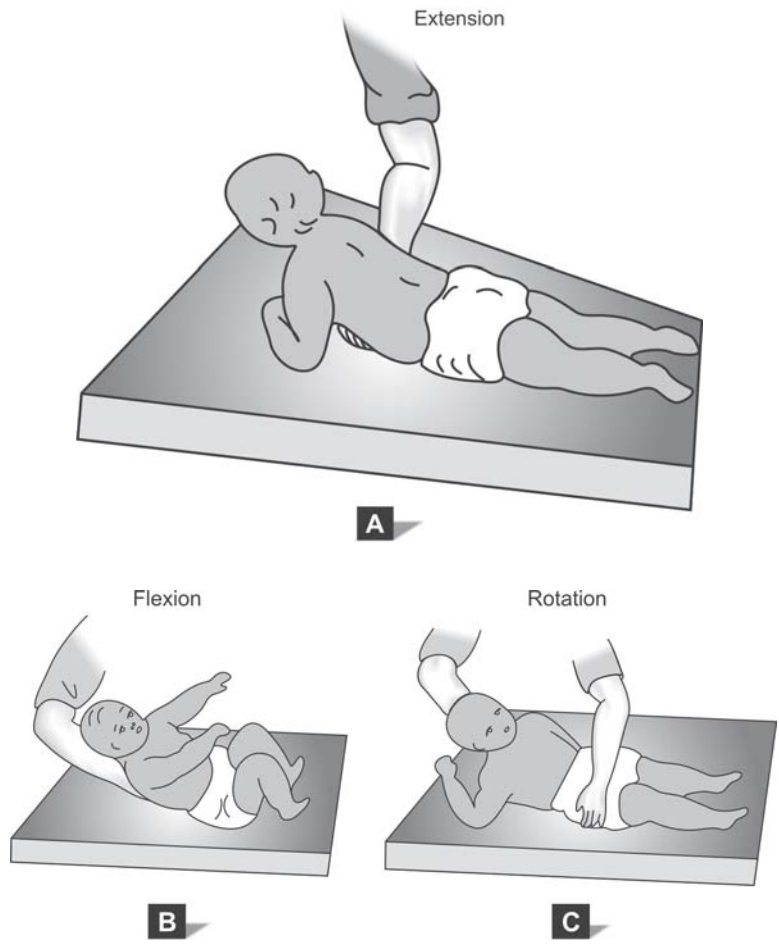


Fig. 2.12: Tone distribution regulated by the position of the lumbar spine segments. (A) Lumbar spine extended: relative hypertonus in flexors of arms and upper trunk, in extensors of legs and lower trunk: (B) Lumbar spine flexed: relative hyper tonus in extensors pf arms and upper trunk, in flexors of legs and lower trunk. (C) Lumbar spine rotated: relative hypertonus in flexors of arms and extensors of leg on side toward which the chest rotates

Righting Reflexes

Shifting of tone by interaction between muscle groups produces a complex movement of body parts which results in alignment segments into postures which adapt the individual to space. These chains of reflex actions may be observed when a cat dropped from a height,

limbs upper most, rotates the body in a caudal direction, and lands on its feet, or when a quadruped rises from a side-lying position, spiraling the body in a head-to-tail direction. The chain of reflex righting postures can be elicited in an infant or a brain-damaged adult by activating a succession of reflex movement (Fig. 2.13).

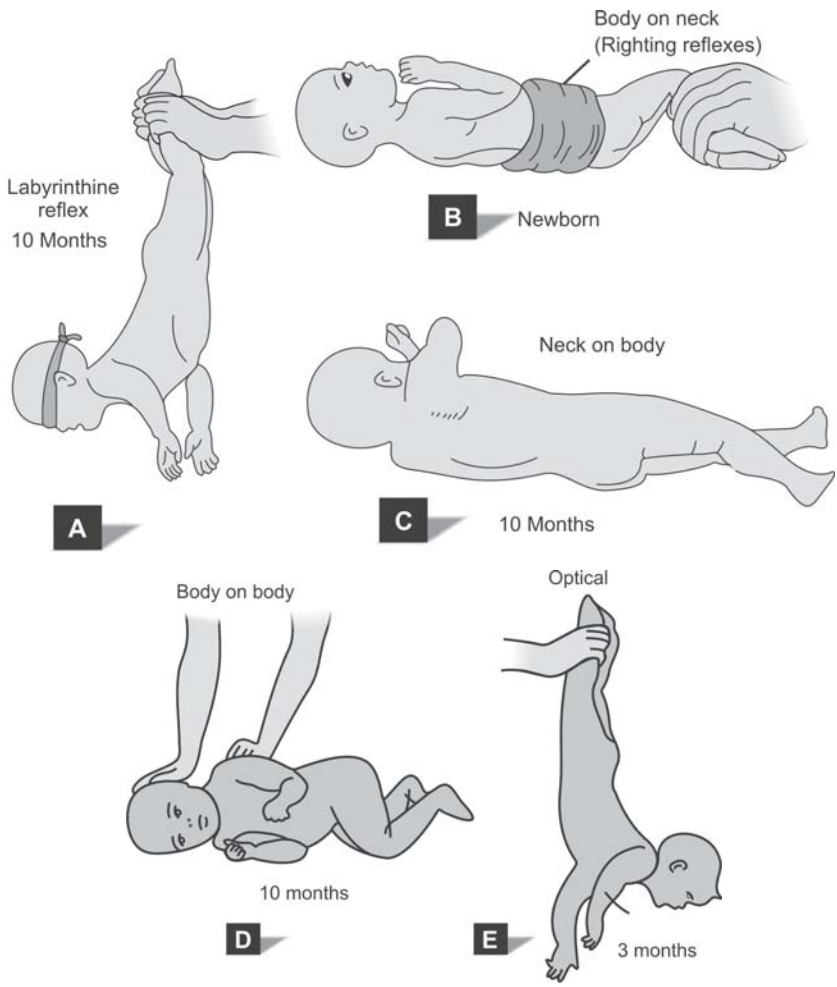


Fig. 2.13: Various stimuli initiate successions of reflex muscle responses which align body segments into anti-gravity position appropriate to state of maturation. (A) At 10 months, labyrinthine stimulation produces head erection in absence of visual cues. (B) Asymmetric stimulation of trunk results in derotation of head. If both sides of trunk are stimulated, head is oriented into neutral alignment; (C) Rotation of neck is followed by rotation of upper trunk, then lower trunk, maintaining neutral alignment (D) Asymmetric stimulation of trunk with upper portion stabilized is followed by alignment of lower segment into erect stance appropriate for the stage of maturation; (E) At 3 months, when labyrinthine righting reflexes have not developed, visual stimuli produce head erection

POSTURAL REACTIONS

Positive Supporting Responses (Fig. 2.14)

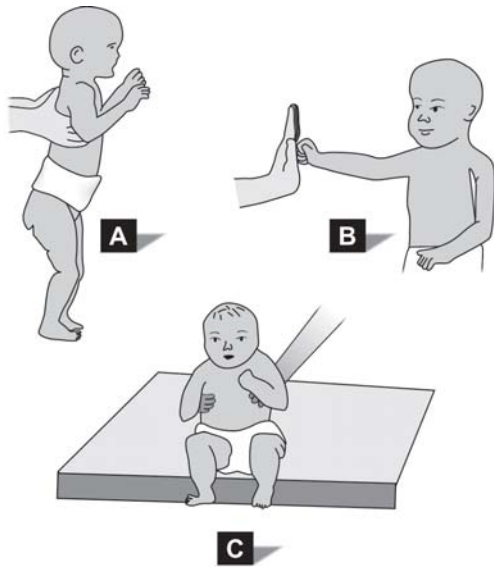


Fig. 2.14: Chains of reflex muscle contractions which adapt the body segments to gravity are initiated by both interoceptive are exteroceptive stimuli. They serve to support, stabilize, protect or act in locomotion. Pressure upon a weight-bearing surface produces simultaneous contraction of all muscle groups throughout the segment. (A) Plantar area pressed upon a flat surface produces hip and knee extension. In the newborn or some cerebral palsied, extension is incomplete. (B) The primitive weight bearing surface of the upper extremity is the dorsum of fingers. Pressure here produces wrist and elbow extension and shoulder stabilization. (C) Neck and trunk are stabilized with pressure upon buttocks

Crossed Extension Reaction

Flexion of one limb in response to a stimulus may be accompanied by extension of one or both contralateral limbs. This extensor response often alternates rhythmically from extension to flexion (Figs 2.15 to 2.17)

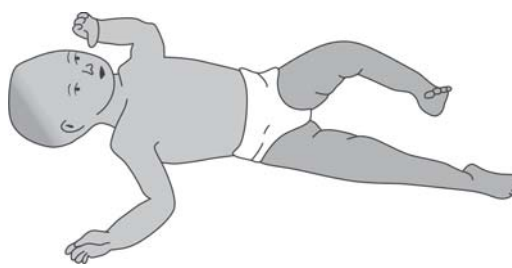


Fig. 2.15: Flexion of one extremity results in extension of the contralateral extremity

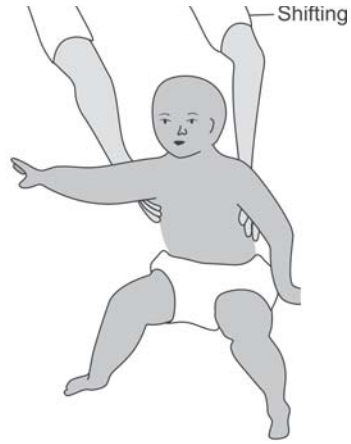
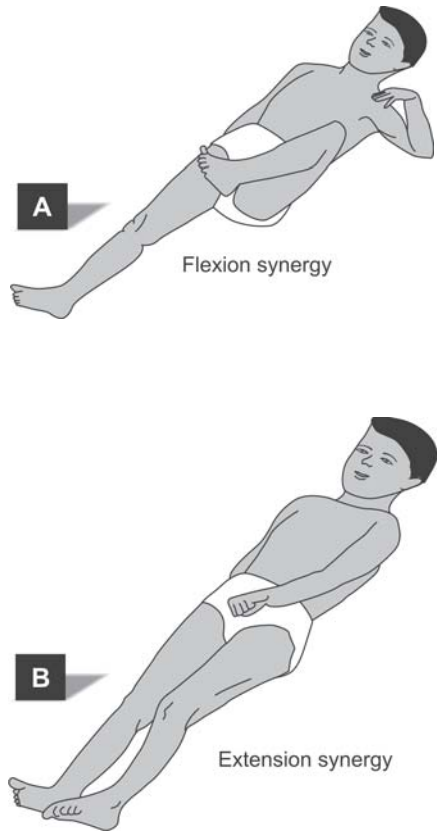


Fig. 2.16: Displacement of the body weight over a flexion produces extension of that leg and arm



Figs 2.17A and B: Flexion pattern response in arm and leg

Orientation (Figs 2.18 and 2.19)

Fig. 2.18: Visual and kinesthetic stimuli provide cues for spatial discrimination. Distorded interpretation of stimuli in inappropriate responses

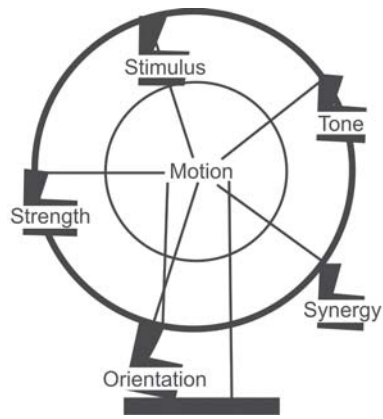


Fig. 2.19: Perfect balance of all parts, proper timing adjustment to environmental changes are necessary for efficient movement

Professional Therapeutic Team

1. OT for gaining head control, sitting balance and gait, exercises of muscles, train child to learn proper neuromuscular co-ordination. Rehabilitation of the child in all the self care activities and other upper extremity activities and educational training of the child.
2. Speech therapist for speech training.
3. Nursery or pre-school teacher to train child for the school and training for the peer group. The retardation may be due to lack of communication with same age group, i.e. "retardation due to or by deprivation."

4. Special education teacher in hospital school treatment center, to educate whatever the skills child has to achieve to peak of his/her mental abilities.
5. Vocational rehabilitation worker is concerned with child once he has reached the maximum result of therapy and has reached intellectual maturity. Occupational therapist may train the child in sheltered workshop or in an industry where he is able to use skills even though may be limited. Hence cerebral palsied has to be made self sufficient and independent to the maximum of his school physical disability.
6. Medical social worker is concerned about the child, his parents, his school surroundings and his home.
7. Public health nurse, aids in carrying out the prescribed orders at home in assisting the child and parents in home treatment. The nurse is often much closer to the environmental situation than any other member of the team if available around.
8. The administrator or co-ordinator of the treatment unit: who is concerned with the co-ordinating of the problems of cerebral palsied child and the team members.

General plan of treatment of cerebral palsied child is to aid the child in reaching a position as close to normal as possible, to make the individual a useful member of society, useful to himself and a happier existence of being handicapped.

Plan treatment in such a way that will be help in rehabilitation after 10 years of the child of that age. Study degree and severity of the handicap before planning the treatment. Cerebral palsied child has five extremities—two arms, two legs and speech which may or may not be involved.

Use special educational method as he reaches school age. His physical progress will so much increase if his mental progress is developed at the same rate.

First make accurate diagnosis, classify according to the type, evaluate his neuromuscular picture. While assessing extremities, assess speech, hearing and vision also.

Speech defect in cerebral palsy (spastic defect) is due to the spasticity of the muscles of the larynx, pharynx, tongue and lips. In athetoid patients, involuntary movements of the diaphragm which interfere with breath control add to the speech handicap.

Hearing defects in athetoid are often selective impairments for certain ranges of pitch and require special management. Visual defects not only affect vision but also extraocular muscles resulting into conversion squint and often in nystagmus. Seizures both grand mal

and petit mal occur more frequently in these patients in the normal child and must be controlled.

During physical evaluation, the mental abilities must also be evaluated. Clinical psychologist knowing in advance visual, hearing and speech handicaps evaluates child with standard tests.

Most tests of grading intelligence assume that a normal motor mechanism exists and score depends on rapidity of the motor response and communication facilities. Evaluation of the mental ability (motor response) of the child who has no rapid response, who is unable to talk, write or use his hand in any co-ordinated manner, is a difficult task. In addition to lack of speech and motor co-ordination, they also suffer from lack of environmental stimulation necessary to normal development leading to mental subnormality. This holds true for all "shut in or home bound" children. The social maturation level and emotional background of the child must also be evaluated by the psychologist for the complete observation. Each child should be first evaluated. Each child has an individual problem and each problem occurs in infinite variation. It is only after these preliminary screenings wherein clinical diagnosis of the neuromuscular picture, assessment of the associated handicaps, the psychological examinations are completed, one can map out an effective plan of treatment.

The aims of the treatment in the cerebral palsy rehabilitation revolve around five main areas:

1. Locomotion
2. Speech
3. Self help (arm skills)
4. Education and
5. Social maturation.

The first is in aiding the child to overcome motor disability by teaching child to walk. Pohl said that the treatment of cerebral palsy is mainly training the patient in developing voluntary control of the musculature. The lesion in the brain cannot be cured by any therapy but experience shows the functioning of undamaged portion of the brain can be improved by intelligent treatment. Cerebral palsy child cannot discover his own motor handicap. The disturbed performance of his musculature furnishes the child with no accurate information through which he can (control), train or direct corrective motor impulsives. He does not know what is wrong with him, how can he use his musculature but requires to be shown precisely what to do.

The effective training aims at to require physical and mental patterns of corrective activity be constantly imposed upon the developing nervous system by repetition.

Start treatment at the earliest to avoid the natural tendency to stimulate his own motor patterns which would prove to be grossly inadequate and may become fixed with the passing of time.

Pohl and others have described three principles as basis of treatment of motor disability of cerebral palsy.

1. To secure muscular relaxation
2. To train voluntary muscular control and
3. To train developmental pattern.

   Thus, tension is eliminated, involuntary activity is eliminated and individual muscle can be brought under the control of voluntary motor center. Then consolidate these activities so that muscular contractions can be channeled into useful and practical activities.

This relaxation is an important endeavor in treatment to reduce excess tension and involuntary activity of the muscles. These involuntary activities may be evident at birth as motor area of brain of the infant is inactive. The increasing demand for skilled activities and the disorder of the lack of inhibition of volitional activity becomes more apparent and involuntary motions appear with greater frequency. Relaxation depends on voluntary control and requires patient to be conscious of his disorder. Voluntary control of the muscles means bringing separate muscles under the willful control of the motor area of the brain.

The awareness of musculature may be developed by (training program for establishing) way of sensory nervous system; this being followed by training program for establishing motor pathways to the individual muscle. So that muscle consciousness must be established to insure muscle action under willful (activity) control and co-ordination. This muscle action guides streams of neurological impulses to specific muscle elements for the purpose of securing contraction of the individual muscle into a harmonious action of all motions entering into a joint activity.

Once it is established the individual muscle contractions and joint motions are brought into activity pattern, lower extremity and trunk are trained for independent balance and walking. Reach and grasp and other primary activities of the upper extremities are designed to aid in feeding and self care and eventually to lead to occupational training. Braces are used to support weak muscles to prevent contractures and chiefly to overcome the pull of undesired muscle contractions or joint motions.

Many children have no concept of the walking process; the reciprocal patterns take months of training for cerebral palsy child.

This is achieved by conditioning exercises such as in playing piano. Once the automatic phase is learnt, train the child to improvise, that is, to walk without braces or crutches. Various equipments can be used to train the child to walk without support. Pattern the training method after maturation process of a normal child, who usually pulls up at 3-6 months, sits up at 6 months, crawls at nine months, walks at 12 months, talks at 18 months. Follow the pattern for cerebral palsy child as first to train to sit, then to kneel, then to stand and finally to walk.

Occupational therapist teaches the child the skilled arm and hand movements necessary for feeding, dressing, general self-sufficiency. Speech therapy by specially trained therapists who train the muscles of the diaphragm, tongue, larynx, pharynx, lips with special skilled activities.

CHAPTER 3
Orthopedic Surgery of the Upper Extremity

GENERAL CONSIDERATIONS

Cerebral palsy poses complex clinical problems and therefore treatment also poses problems. The most commonly bothering problem is of surgery in cerebral palsy. The treatment of cerebral palsy was entrusted to the orthopedic surgery. This was natural development since the first surgical approach to the treatment of cerebral palsy was made at the suggestion of Little which attributed later one to lengthening of his own tendo-Achilles lengthening.
The facets of the comprehensive treatment:

i. Psychologic treatment
ii. The educational and
iii. The social restoration of the child as for his physical rehabilitation.

The surgery in palsied child is duly useful when he himself has the full knowledge of fundamentals of this complex entity. Nowadays emphasis is on treatment by occupational therapy, physiotherapy and braces also. Lack of knowledge of basics of this complex entity and improper selection of cases for surgical procedures lead to no faith in surgery for cerebral palsy cases. Area of orthopedic surgery in cerebral palsy is a narrow aspect in a very broad program of care. The set generalizations are follows:

1. Consistency like other conditions does not apply to the area of surgery in cerebral palsy. In cerebral palsy there is enormous variation in both form and degree of findings.
2. Bulk of surgery is reparative than curative, if such a distinction can be made. It concerns to correction of deformities which cause hinderance in functioning and training.
3. Surgery is only used in spastic cerebral palsy and not in other forms usually.
4. Surgical results are better in lower extremities than in upper extremities where the requirements are more exact and function is more involved.

5. Surgical treatment is reserved for those with sufficient mentality to employ its benefits. It should be performed where other measures fail, where it is preparatory to develop function and to release contractures effectively. General rehabilitation requires general restoration of muscle balance, the realignment of weight bearing joints and establishment of correct posture with normal relationship to the line of gravity. Spastic contractures arise from innervational overload, or imbalance and thus are far more amenable to passive correction than contractures from other causes. This is because the resistance of spastic muscles stretch may be gradually diminished rather than increased as proper corrective measures are carried out. Many spastic contractures which appear resistant at first to conservative corrections are correctible with relative ease without resort to surgery.

Surgery in athetoid may not be good but can harm by worsening the condition. Since athetosis is an attempt by the patient to get the extremities in a distorted position, no matter what muscle or group of muscles used to bring about this distortion, surgery under these circumstances would result in the uncontrollable use of the other muscle to bring about same deformity; such as in tendon transfers. Arthrodesis is done in some athetoids than tendon transfer or tendon lengthening.

Selective myotomy, tenotomy or neurectomy may reduce tension in some athetoids as in mixed of athetosis with spasticity of the calf musculature with clonus without any fixed deformity since there is no constant spasm in athetosis, so no contractures develop. Arthrodesis of a joint prevent involuntary movements or dispensing with braces in deformity cases of the foot.

In cerebral spastic extremity, the procedure of choice will depend upon a careful muscle evaluation of the extremity. The same extremity not only truly spastic muscles but normal and flaccid or (zero cerebral) muscles may also exhibit. The spastic group of cerebral palsy is charactersied by cerebral spastic muscle in the extremity—this is the muscle exhibiting phenomenon (the stretch muscle reflex). Stretch reflex being the ability of a muscle to contract to maximum on being stretched, that is, the contraction of the antagonistic, i.e. hamstrings flexing the knee joint, will produce a stretching of the hypercontractile and hyperirritable spastic muscle (quads in this case) causing qauds to contract and block voluntary motion in knee flexion. Quadriceps is then said to be cerebral spastic muscle. The success of surgery will depend upon accuracy of appraisal of normal, spastic, zero cerebral muscle in an extremity. The intelligence is also an important factor

while considering surgery in a patient. Motivational status of the patient and his parents also to be considered. Before planning surgery, observe occupational therapy/physiotherapy and bracing for quite some time to finalise choice of surgery which may follow intensive treatment of occupational therapy/physiotherapy and bracing.

Even after careful and adequate care, recurrences following surgery in cerebral palsy may develop due to longitudinal bone growth especially below 14 years which occur due to alteration in muscle length and continuous bone growth in the presence of muscle imbalance have led to recurrences of deformity when balance was corrected.

Pollock and Sharrard stated, "It is likely that the deformity will progress to a greater degree still in a growing child if nothing is done." Phelps emphasize that it is not sufficient to correct a deformity contracture alone but that the muscle imbalance of the extremity must be corrected by surgery and proper postoperative splinting and occupational therapy/physiotherapy must be maintained until the end of the longitudinal growth period.

Evolve criteria as:

1. Did the surgery adequately correct the deformity?
2. Was muscle function and skill improved?
3. Was the course of therapy facilitated or improved?
4. Were braces and crutch reports eliminated?
5. Was the total effect considered worth while by the patients and his parents?

Surgery is performed first to restore muscle balance in the evolved extremity, to assure proper alignment of the joints concerned with weight bearing and to establish correct posture.

SURGERY OF THE PERIPHERAL NERVOUS SYSTEM

Procedures followed in the past for peripheral nervous systems (PNS) have been of posterior root resection, sympathetic remisection, neurectomy of the perepharal nerves, etc. First two have been abandoned completely. Neurectomy of peripheral nerves appeared to be the most direct means of attacking the innervational overload to the musculature by approaching it directly through the interruption of the nerve pathways. Principle being to weaken the spastic muscle power to that of the antagonists by all or part of the resection of the nerves. This is most hazardous way of restoring muscle balance. Extensive resection of the nerve may produce deformity in the opposite direction. It is a destructive operation which can be returned. Exceptional transaction is done in anterior division of the obturator

nerve to the time of adductor gracilis tenotomy for the relief of adduction contracture of the hips.

Neurectomies for relief of the persistent clonus may be present as a result of spasticity of calf muscles are not necessary. Clonus can be checked by stretching the points of stretch reflex or by bracing or both. This conservative method may restore muscle balance in the extremity without influencing or creating further damage to the peripheral nervous system in as much as there is already motor origin damage of these nerves in the motor centers of the brain.

Neurectomies are abandoned due to:

1. Failure to obtain postoperative occupational therapy/physiotherapy.
2. Failure to recognize existence of fixed deformity.
3. The evil and irrecoverable effects of over extensive muscle denervation especially in the presence of unsuspected strong antagonistic muscles.
4. The recovery of function of nerves after 5 years or more.

SURGERY OF THE UPPER EXTREMITY

General Considerations

The results of surgery are more gratifying in lower than in upper extremity. The reason being that the functional requirements of upper limb demand that the principal goal be mobility as in lower extremity where painless stability is desired. Involvement is more disfused in upper extremity than in lower extremity where isolated muscle groups are more frequently involved.

Common deformities in upper extremity are:

a. Flexion of the fingers
b. Flexion of the thumb with adduction into the palm
c. Flexion of the wrist
d. Pronation of the forearm
e. Flexion of elbow and
f. Adduction and internal rotation at shoulder.

Surgery does provide function and co-ordination. It is designed for upper extremity to obtain a functioning position for the arm and forearm so that patient can extend fingers and wrists and retain active use of flexion of fingers for grasp. Shoulder contractures and flexion at elbow usually do not warrant surgery. Resection neurectomy in upper extremity is seldom used. Tendon transfers at wrist offer opportunity for achieving functional improvements when carefully selected. Arthrodesis of the wrist alone or in combination with

transference of tendons, will provide stabilizing factor to improve grasp, and enhance appearance and eliminate unsightly deformity as a cosmesis.

Stabilization of forearm by fusion of the distal radioulnar joints as per Caroll and Craig does not appear to be worth while. Fusion of 1st to 2nd metacarpal by means of a bone graft does not enhance function or correct deformity.

Only one procedure well-planned relieves deformity, i.e. transfer of flexor carpiulnaris to the extensors of the wrist, the extensor carpiradialis brevis and longus will produce functional hand with greater certainty than any other procedures applied to poorly functioning hand.

The Shoulder

General deformity due to spasticity is adduction and internal rotation at shoulder. Surgery is rarely indicated. If applied then:

a. Pair hand-sever operation which is applied to obstetrical paralysis.
b. Rotational osteotomy of humerus for fixed internal rotation contracture.

The osteotomy is usually performed at the level of the deltoid tubercle and division of the insertion of pectoralis major and latissimus dorsi muscle may be necessary. Cosmesis appears to be the main indication for any surgical correction at shoulder level.

The Elbow and Forearm

Elbow contracture and pronation contracture is usual deformity at elbow in spastic paralysis. Since slight flexion at elbow enhances the function of elbow joint, it is rare that tendon lengthening of biceps is attempted. With growth this tendon continues to contract.

Surgery may be used to correct pronation contracture by tendon transfer and neurectomy. Tendon transfers are more useful than neurectomies of median and ulnar nerves. Pronator teres may be transferred into the extensor carpi radialis longus and brevis muscles. It lessens pronation contracture and enhances the extensor action of the wrist by equalizing power of antagonistic muscles. It is supplemented by the simultaneous transplantation of flexor carpi radialis to the extensor carpi radialis longus muscle. Steindler has modified this procedure by mobilizing the flexor carpi ulnaris and anchoring the tendon after it passes over the dorsal surface of forearm into the lateral aspect of the lower end of the radius.

Green modified this further by transferring the tendon of flexor carpi ulnaris into the extensor carpi radialis longus tendon, with the forearm in supination and wrist in dorsi flexion.

Occasionally, pronation contracture may be associated with subluxation of the head of the radius in long standing cases and an alteration of the relationship of the shaft of the radius to that of ulna.

Pollock and Sharrard have suggested a long oblique osteotomy of the shaft of the radius followed by rotation of the forearm to one hundred eighty degrees to overcome this deformity.

In a case of painful subluxation of head of the radius due to spastic pronation deformity of the forearm of long standing by resection of the head of the radius.

Most flexion deformities of pronation of elbow and the forearm still provide sufficient function for useful function of the wrist and the hand without surgery.

Deformities of the Wrist, Hand and Fingers

The treatment of cerebral palsy poses many problems; among them being selection and application of the surgical procedures. It has been seen that some of the orthopedic operations if skillfully performed with proper postoperative care can help patients which other therapies cannot achieve and create improvement in shorter time than any other single conservative modality. The procedures used on hand proved highly satisfactory for treatment of paralysis of the hand resulting from infection or trauma may not be as satisfactory as when used in the presence of spasticity, flaccidity or athetosis of the upper extremities.

By catagorically denying surgery to an intelligent cerebral palsy child with a spastic hand by prolonging conservative treatment with stretching, splinting, muscles re-education, co-ordinational aids, alone without making surgery available, is to overlook certain procedures, particularly since the work of Goldner, resulted into satisfactory results rendering improvement in others.

Careful surgery in selected cases with splinting, muscle re-education, co-ordinational aids will give benefits in short time. Operative procedures should be limited to spastic cerebral palsied only than any other type.

The functions of the hand primarily are grasp, release and reach. Surgery in cerebral palsy hand does not initiate the voluntary movement, does not reduce involuntary motion or inco-ordination. The clinical indications of restorative surgery will vary and the choice of surgical procedure will require realistic understanding of cerebral palsy problems. Poor result neither does harm to the patient nor aggravate the deformity. Surgery is used to improve function and cosmesis in hand of cerebral palsy child.

PRINCIPAL AIMS OF TREATMENT

Pollock and Sharrard have indicated four principal aims of treatment:

1. To try to improve function by conservative as well as by active surgical means.
2. To try to prevent deformity.
3. If deformity develops or has developed already, to attempt to correct or relieve it.
4. To achieve as fully a degree of habilitation or rehabilitation as possible and active cooperation with colleagues in education, physiotherapy, occupational therapy and speech therapy. With all this in mind the program may be planned to restore the functions of cerebral palsy child for which the screening as under may be done.

The age of the patient: Co-operation of the patient of normal mentality with treatment is of utmost importance.

This is particularly true with reference to brace and splint tolerance, motivation, co-operation in the important postoperative therapy programme. A successful metacarpophalangeal joint arthrodesis of the thumb at 4 years with particularly good results in improving hand function.

The type of cerebral palsy: Reserve surgery for those falling out of extrapyramidal dyskinesia, involuntary movements, as in athetoid and the tremors, i.e. for spastics only. Wrist arthrodesis is occasionally necessary in athetoid hand, where instability of wrist joint is a disturbing factors to the general wellbeing and the emotional status of the patient.

The degree of involvement and the appearance of the hand: Is whole of the upper extremity is week or part of it? Does the hand have any grasp and release phenomenon? Is there any evidence of stabilizing of the wrist would either interfere with opening or closing of the fingers? Is there any adduction deformity of the thumb with a "thumb-in-palm" deformity? Or contracture? Is there complete lack of cerebral control muscle? Does he have excessive hypermobility of the joints of the hand? Those are some of the major factors that must be considered in evaluating the degree of involvement.

Sensory appreciation of the hand: Perform tests for sensory appreciation of the hand such as form, size, shape discrimination, two point discrimination, touch and pain sensation.

Existing functional condition of the hand: What is the status of hand after long period of occupational therapy, bracing and splinting, and

careful follow-up and observation. Is there any improvement in function, does it warrant surgical intervention, etc.?

Evaluation of intelligence and motivation: Perform surgery on intelligent patients to follow re-educational and retraining programme, who have enough motivation and initiative to take advantage of the anatomical improvement anticipated by surgical treatment.

The degree of involvement of the other extremities: Mostly surgery is performed on hemiplegics, who have least motor involvement of all cerebral palsy children and the best prognosis. A quadriplegic who has no hope of walking and using upper extremity for any serious functional activity is not the type of the case for hand surgery. At occasions hands may restore grasp and release with surgery to hold crutches necessary for walking. Mainly the restorative surgery is performed on hand of hemiplegic child.

Psychological attitudes of parents and child: The retraining programs are very important and hence motivational attitudes of the both parents and child be made. Does child take full advantage of occupational therapy? Is the parent co-operative in the home care program?

What has been the experience with earlier treatment of the hand: If the hand has not responded to intensive occupational therapy, splinting, bracing, co-ordinational aids, or even to other surgical attempts, further surgery may not be indicated.

In evaluating the patient, many observations can be made during the preliminary training and occupational therapy program: Is the hand used for holding, helping, transferring, eating, dressing, playing, assisting the dominant hand or is it completely ignored? This is index too of patient's intelligence, cooperation, independence and motivation. Judge motivation in activities of daily living (ADL), progress noted during the course of treatment, not only in occupational therapy.

INDICATIONS FOR SURGERY OF THE HAND

Functional Classification

The factors to be considered are (i) extent of ability to grasp and release, (ii) degree of control of wrist and fingers, (iii) the position of hand in grasp and release, (iv) the degree of spasticity, (v) the evaluation of motor activity in the flexors and extensors of both the wrists and the fingers and the degree of voluntary control of the rest of the upper extremity and (vi) observe for joint stability, position of

upper extremity in walking, sitting and standing, as well as shoulder and elbow joints.

General Considerations for Hand Surgery

The screening for this purpose is evaluation, the study of the patient, individual attitudes, experiences, capabilities of the surgeons, surgery not indicated in:

a. When there is generalized flaccidity of the muscles of the upper extremity with no available motions for adding strength.
b. When patient has adequate grasp and release mechanism, and there was ample evidence after bracing and splinting, that stabilization of the wrist would interfere with either the grasp or release mechanism in opening or closing the fingers, when there was lack of voluntary control of the muscles usually in a patient with flaccid upper extremity particularly in those patients with considerable involuntary motion as in severe athetotics: when the joints were excessively hypermobile in hand, when activities of daily living ability with hand is as good as estimated after surgery.

The specific surgical procedures are:

a. Arthrodesis of the wrist joint.
b. Arthrodesis of the metacarpophalangeal joint of thumb.
c. Rerouting of extensor pollicis longus.
d. Transfer of wrist flexors to the extensors of the wrist.
e. Opening of the thumb web.
f. Opponens transfer.
g. Arthrodesis of interphalangeal joints.
h. Transfer of flexors digitorum profundi to the flexors digitorum sublimis, section of the lateral bands (index finger).
i. Replacement for weakness of the intrinsic muscles to the index fingers.

Goldener has further broken down the specific operative procedure utilized for the correction of deformities of the hand in the cerebral palsy child to:

- *Tendon Transfers through and around:* The transfer of the flexor carpi ulnaris to the extensor carpi radialis brevis, flexor carpi ulanaris to the extensor digitorum communis, flexor carpiradialis to the extensor digitorum communis, flexor carpiradialis to the extensor pollicis longus, flexor digitorum sublimis to the extensor pollicis longus, flexor digitorum sublimis to extensor digitorum communis, flexor digitorum profundus to the flexor digitorum sublimis, the extensor carpi radialis longus to the extensor digitorum communis, extensor carpi radialis longus to the extensor pollicis longus, rerouting of the extensor pollicis longus.

- *Release Tendon Contracture or Tighten Joints:* Includes tendon lengthening of the sublimis, tendon lengthening of profundi, tenodesis of sublimis at the interphalangeal joints, advance of retinaculum for interphalangeal joint hyperextension, release of the lateral band mechanism for contracture of the intrinsics, pronator tenotomy, biceps and brachialis myotomy.
- *Joint Stabilization:* This includes the fusion of the metacarpophalangeal joints of the thumb, fusion of the radius to the carpals/metacarpals, fusion of radius to the proximal carpals, fusion of the distal phalangeal joints occasionally.

General Plan for Surgical Treatment

Preparatory Treatment

Patients with cerebral palsy of upper extremity should undergo observation to indicate what stretching can accomplish, the wearing of rigid splints or plaster bivalves at night, or on part time basis during the daytime.

Use bracing for flexed wrist to achieve the dorsiflexed position in spastic hand which is very common, aiding strength of the grasp and enabling patient to extend fingers more effectively.

Young child should be given sandwich type of splint in which the wrist and the joints of the fingers are maintained in the neutral position, to avoid overstretching of the extensors and shortening of the flexors of the wrist and fingers. Supervised occupational therapy/physiotherapy treatment should be carried out. Parents co-operation and understanding problems are essential. Active therapy period before surgery helps the surgeon/therapist to motivate the patient psychologically and their willingness of patient and parents to co-operate in post-surgical treatment program.

While indicating the stabilization procedures, splinting of the hand in the desired position of stabilization by a brace or cast, will show whether stabilisation particularly of wrist joint, will improve function of the hand or not. It may also indicate arthrodesis of wrist should be performed in neutral position as far as dorsi and palmar flexion are concerned, whether wrist should be in ulnar deviation or in neutral position. This improves hand function specially of finger, to correct deformity of the wrist, and to give stability after tendon transfers.

Outline of Surgical Protocol

Treatment be planned after screening hand for general factors and complete evaluation for motor strength, motor deficiency, and for contractures of the joints .

Wrist arthrodesis is the most useful procedure in the selected cases. Neurectomies are never indicated in cerebral palsy cases at all whether upper extremity or lower extremity.

Postoperative Treatment

Follow up period is not stressed—may consist of observation of casts, checking of braces. It should include occupational therapy/physiotherapy regardless of length, effort and time required. Mostly cerebral palsy patients and their parents are cooperative in this critical period.

Specific Procedures Recommended

The three recommended procedures are:

i. *Transfer of flexor carpi ulnaris* to the extensor digitorum communis or to the extensor carpi radialis brevis for improving wrist dorsiflexion.
ii. *Stripping of the first dorsal interossei muscle* from the metacarpal of the thumb and tenotomy of the adductor pollicis muscle and transfer of flexor carpi radialis tendon to the tendons of the adductor and short extensor tendons of the thumb for correction of thumb-in-palm deformity
iii. *Arthrodesis of the wrist:* For the correction of the deformity and stabilization of the wrist joint.

Transfer of Flexor Carpi Ulnaris

The extensor digitorum communis or extensor carpi radialis brevis: Such a hand has moderate spasticity in flexor of fingers and there is flexion deformity at wrist, which is usually not a fixed deformity. Wrist extends when fingers flexed, with fingers tightly clenched in the palm, with or without the ability to extend the fingers, or hand is unable to extend the fingers, except in full wrist flexion. Such hand usually does not have active extension, and has fair sensation.

Pronation deformities do not call for correction generally because such a position in forearm is desired in many hand activities. They are not even corrected with plaster immobilizations and exercises and surgical results are also uncertain. Extensive stretching should be in preoperative period. Stretching pronators at very early age prevents pronator deformities, if any.

Such hand benefits from by transfer of deforming factor, usually strong flexor carpi ulnaris, to the dorsal extensors of the wrist providing stabilization of wrist and better finger function and very frequently enables thumb to come out of the palm to open and close hand effectively and also improving supination of the forearm.

Transfer of flexor carpi ulnaris is multipurpose in that

- It removes the deforming force which pulls the hand into ulnar deviation and flexion, and at the same time provide active motor to promote dorsiflexion of the wrist and supination of the forearm.
- It also improves rigidly flexed digits in the clenched finger-in-palm position to the dorsal cock-up position where release of the fingers is possible.

The direction of flexor carpi ulnaris tendon is usually done through a subcutaneous tunnel about ulnar or medial aspects of the forearm. The direction of the transfer about the ulnar aspects of the forearm and wrist provides a satisfactory supinator action as well as assisting dorsiflexion of the wrist. If there is no deformity, hand and wrist can be placed in supination and dorsiflexion. This transfer alone has excellent results in improving functions provided patient has some motor control of his fingers.

Flexor carpi ulnaris tendon after being detached from its insersion, is freed up to the proximal third of the forearm not farther than the point of entrance of nerve into the muscle belly and pulled through proximal forearm incision. It is brought around then on ulnar aspect of the forearm through a subcutaneous channel and sutured into either the extensor digitorum communis or the extensor carpi radialis brevis. Tendon of extensor carpi radialis brevis is usually utilised because brevis gives a more central action in dorsiflexion of the wrist.

Green and Banks recommended the suturing of the flexor carpi ulnaris to the tendon of the extensor carpi radialis longus because it gives a better direction of pull for supinator action and a better correction of the ulnar deviation.

The actual technique of the tendon transfer depends upon the individual experience and cast must be provided accordingly. The majority of the patients appear to need no active splinting during the day after the cast is removed at the end of the six weeks postoperative period.

"Thumb-in-palm" Deformity

This deformity develops in spastic hand only. This consists of first interosseous muscle stripping from the metacarpal of the thumb, a tenotomy of the tendon of adductor pollicis, and transfer of flexor carpi radialis tendon to the tendons of the adductor and short extensors of the thumb. This is most disabling deformity. It interferes with grasp but also sometimes serves as a stimulus to set up hyperirritability of the fingers flexors and seems to excite the fingers into the flexed position in the palm. Many cerebral palsy hands with

mild hand deformities have active use of the fingers, and by ulnar deviation of the hand at the wrist increase the tension of the extensor and adductor mechanisms of the thumb, pulling the thumb phalanges and the first metacarpal towards the radial side and thus removing the thumb from the palm of the hand. In more disabled hand, where there is severe (deformity) ulnar deviation of the hand at the wrist and where arthrodesis of the wrist joint is contemplated.

Cooper suggested that it would be wise to place the hand in a position of moderate ulnar deviation at the time of the arthrodesis of the wrist, thus being effective in pulling thumb out of palm.

The carpal metacarpal joints of the thumb aid in the function of apposition, pinch and grasp. Therefore stability of the thumb is a very vital factor in hand function and recommends fusion of the metacarpophalangeal joints of the thumb and rerouting the extensor policis longus volarwards, thus internally rotating and abducting the thumb at the same time. This is intended in rerouting the pollicis longus tendon is to aid in stabilizing the loose carpal-metacarpal joint and assist in function of pinch. It is also recommend that if the extensor mechanism of thumb is inactive or weak, transfer of the extensor carpi radialis longus to the extensor pollicis longus tendon should be performed.

Opponens transfer has been recommended by some, if there is a paralysis or weakness of the opponens pollicis and other intrinsic muscles of the thumb, as well as spasticity of the finger flexors.

Restoration of the thumb movements are of little use if other fingers are not able to function. The stripping of the contracted web of the thumb and the transfer of the flexor carpi radialis is usually performed after a flexor carpi ulnaris transfer to the dorsum of the wrist. Both procedures are not done at the same time but watch for six months after flexor carpi ulnaris transfer.

Arthrodesis of the Wrist

This is performed to improve/correct control of wirst (function) flexion deformity and function of the fingers. Decision for this will depend on ability of the patient to perform grasp and release when wrist is stabilized by cast on splint in the position of the function. If extension, actively at wrist cannot be performed due to weakness of the extensors, then arthrodesis cannot be performed. Transfer wrist flexors to the dorsal wrist and fingers extensors instead. It is reserved for true cerebral spasticity involving upper extremity as opposed to those patients with athetosis, ataxia, tremor and rigidity. Before stabilising hand, consider body function as a whole. It may cause

loss in moving wheelchairs, thus not enabling ambulation. In crutch bound patients, flexible wrist is useful in weight transfer and shifting body weight.

Arthodesis of wrist is postponed as long as possible until all soft tissue surgery has been performed and adolescence is reached. Observe the patient in waiting period till adolescence after transfers of the tendons. Best position of function of the wrist is determined by splints for arthodesis during that time.

Ideally, arthrodesis include radius, the carpal bones and 2nd and 3rd metacarpals. Usual dorsiflexion in wrists of 20-25° for arthrodesis, advocated for other wrist cases is not true in cerebral palsy. In most cerebral palsy hands active extension of the fingers is more difficult with the hand in even a slight of dorsiflexion.Wrist arthrodesed in 5-10° of dorsiflexion permits the function of grasp and release with least amount of effort.

Whether to place the hand in ulnar deviation at the time of the arthrodesis will depend upon a careful evaluation of the functional status of the thumb. The fusion of radius, the carpal bones, 2nd and 3rd metacarpal is in the very spastic hand. The distal radioulnar joint is left intact in order to maintain pronation and supination.

Hand is dependent on wrist for opening and closing fingers/ digits, or in those hands where extensors are weak, arthrodesis may be carried out between the radius and the proximal carpal bones, thus leaving the distal joints intact permitting few degrees of flexion and extension. The arthrodesis will not improve function if the digit motors are extremely weak. Cosmetic arthrodesis is useful in adolescent hemiplegic female where severe wrist deformity in flexion may cause irritation and embarrassment. If done in fixed contractures, it will be necessary to improve proximal carpal row, navicular and lunate, to permit extension of the wrist to the desired position.

4 CHAPTER Orthopedic Surgery of the Lower Extremity

DEFORMITIES OF THE HIP JOINT

Flexion-adduction Deformities of the Hip

Mostly the flexion adduction and flexion internal rotation deformities are seen in the cerebral palsied children. Next to the equinus deformity of the foot, adduction flexion contracture of the hip is encountered frequently in cerebral palsied. Adduction deformity can be corrected by the tenotomy of the adductor longus and the adductor brevis and the gracilis muscle and selective resection of the anterior obturator nerve. This is recommended for spastic cerebral palsies. While evaluating the affected extremities, the potentialities of the individual muscle must be assessed in the light of the total condition of the patient. Rehabilitation of the patient depends also on the alignment of the joints and not only on restoration of the muscle balance in the extremities, in weight bearing and establishing correct posture.

Adduction deformity of hip may be caused by:

i. Spasticity of the adductors combined with flaccidity of the abductors.
ii. Spasticity of the adductors combined with overstretching or weakness of the abductors.
iii. Spasticity of abductors and internal rotators.
iv. Spasticity of the gracilis.

Detailed muscle evaluation should precede every surgical procedure, especially in scissors type deformity. In pure adductor spasticity, when patient in suspine, the internal rotation does not take place when forcibly abducted. When adductor deformity is due to spasticity of the internal rotation then it is usually combined with either a flexion or an internal rotation deformity. Scissors gait most often develops due to hip flexion-internal rotation deformity in which tensor fascia lata is major deforming factor. In pure adductor spasticity, the limbs will be brought together but will not cross unless hip flexors are involved.

Most long-standing adduction deformities are due to a combination of contracture of the involved muscle and their sheaths and an innervational overload resulting in spasticity of the involved muscles. This combined mechanism does not allow either adductor tenotomy or obturator neurectomy alone than combination of the two will be necessary.

Repeated testing of gluteus medius will often demonstrate voluntary power in the abductors, particularly after the wearing of braces that overcome the stretching of the abductors by the spastic antagonist adductor muscles. Scissors deformity may be the result of an attempt by the patient with weak or flaccid glutei medii to stabilize the lower extremity. In such a situation, adductor tenotomy will correct the deformity along with obturator neurectomy the adductor deformity at expense of eliminating the one stabilizing factor available to the patient for walking and standing. It is certainly better for patient to walk with adductor deformities than not to walk at all.

This combined operation is contraindicated in the persistent flaccidity of the abductors of the hips.

Frequently gracilis muscle contributes to the adduction deformity. This is true in cases with adductor deformity at hip and flexion deformity of knee. Gracilis not only adducts thigh but flexes leg and after it is flexed assists in the medial rotation. This is innervated by branch of obturator nerve. Test gracilis-place patient in prone positition with legs flexed and the thigh widely abducted. As the legs are gradually extended, adduction of thighs will occur if the gracilis muscles are spastic or contracted. In combined operation tenotomy of the gracilis is performed at the same time as the tenotomy of adductor longus and adductor bravis muscle. Gracilis spasticity also may cause coxa valga deformity of femoral neck particularly in severely involved spastic child who is delayed in standing and walking. This deformity may produce subluxation of the femoral head. Mostly benefiting are spastic para-and quadriplegics, a bilateral technology is utilized. This may be used in unilateral adductor contractures associated with progressive subluxation and dislocation of the hip.

Flexion Deformity of the Hip

Hip flexion deformity has considerable influence on gait and posture in cerebral palsy child. This develops as primary deformity due to overaction of spastic hip flexor muscle and secondarily in response to flexion deformity at knee. Most flexion hip deformities are corrected by braces and by persistent standing in braces and assuming

a correct posture in sitting or avoiding sitting and kneeling positions as much as possible. Hip flexion deformity causes increased lumbar lordosis and crouch posture. The iliopsoas tenotomy (like adductor gracilis tenotomy) may be performed.

Contractures of rectus femoris also may play a great deal in hip and knee flexion contractures. Release of pelvic origin of rectus femoris may often improve knee extension as well as reducing lumbar lordosis and hip flexion deformity. In more resistant cases, the tensor facialata, the sartorius and the rectus femoris muscles can be separated from their attachments to the ilium. Abductor power of hip may be increased in suturing the tensor facialata to the tendinous origin of the gluteus medius posteriorly on the ilium to convert its action into that of an abductor and external rotator.

Internal Rotation Deformity at the Hip

Internal rotation deformity along with adduction deformity is very frequent. The procedure–division of glutei, a method employed to reduce the internal rotation deformity at hip weakens the abduction power so important for lateral stability. Such deformities can be corrected by strengthening of the glutei by intensive program of therapy, later provided with braces—long leg with rotation strap. More severe cases are corrected by derotation osteotomy of the femur. When fixed internal rotation deformity then femoral rotation osteotomy either at subtrochanteric level or in the superacondylar region will prove useful. Correction occurs by simply rotating the distal fragments so that the patella and the foot are in the proper alignment with pelvis, the proximal fragment being maintained at internal rotation in full. Necessary strengthening of the muscles accordingly should be carried out.

In subtrochanteric derotation osteotomy it is necessary to do an iliopsoas tenotomy first to avoid acute flexion of the proximal fragments and subsequent malalignment of the fragments.

Derangements of the Hip Joint

Severely involved patient with spasticity and rigidity where adductors, flexors, internal rotators are all involved, subluxation or dislocation of hip may occur. Congenital hip dislocation is rare in cerebral palsied but dislocation of hip may occur early in these children resulting in the failure of the acetabulum to develop normally in depth.

Paralytic hip dislocations are primarily due to the overactive adductors and hip flexors with weakness or paralysis of antagonist glutei.

Valgus deformity of formal neck produces subluxation and dislocation of hips. Every severe dislocation can be due to severe spasm and contractures.

Most subluxation/dislocations can be cured in younger patients by hip spica or by gradual abduction and traction on a frame.

Varus osteotomy to correct valgus deformity of femoral neck for avoiding acquired subluxation of the hip joint in the presence of coxa valga has shown good results.

Coxa valga deformity and acetabular changes in cerebral palsy can be prevented by as early as two years with full control braces, if necessary. Phelps had advocated early stand up table to prevent coxa valga deformity at hip joint in children with delayed walking and standing. Distal tenotomy of gracilis and medial hamstrings has reduced coxa valga deformity.

DEFORMITIES AT THE KNEE JOINT

Most common in cerebral palsy spastic children are equinus deformity of the ankle, adductor flexor contracture of hip and flexion deformity of the knee.

Flexion deformity in knee in cerebral palsy can be due to various deforming factors. It may be due to overactive spastic knee flexors and associated weakness of knee extensor muscles. It may accompany occasionally, the adductor flexor deformity of hip or overactivity of spastic gastrocnemius muscle. It may develop secondary to flexion deformity at hip or spastic equinus deformity of ankle. It may be purely postural, the patient failing to lock his knees, in full extension when standing or may be the result of prolonged sitting with flexed knees. Definite treatment can be on the primary source of the deformity and individual potentialities of the muscle involved in extremities. Best is bracing, physiotherapy and occupathonal therapy program found useful. Mostly knee flexion deformities were in children due to spasticity of hamstrings especially the medial hamstring group.

Equinus deformity of foot eliminated with foot drop splint and night splint or by lengthening tendo-Achiles. Flexion deformity at hip and knee can be modified by the transfer of hamstring supplemented with release of retinacula of the extension mechanism of the knee. In knee flexion deformities, the surgery is most useful in cerebral palsies. The careful muscle charting of the involved extremities is very useful in such cases. The problem is not of balancing the agonist and antagonist function, the presence of the two joint muscle spanning the knee, hip and ankle joint seriously implicate the problems.

The biarthrodial nature of the rectus femoris, the gracilis, the biceps femoris, the semitendinosus, the semimembranosus and the gastrocnemius increases the difficulty of understanding mechanics of the knee joint by bringing into picture deformity and function of the adjacent joint. It may be complicated further by deformity of posture or fixed deformities of hip and ankle joint as well as by the presence of spastic, weak of normal muscle of the lower extremity in variable degrees.

Understand gait also prior to operation as well as status of the hip and ankle joint. The "jump or crouch" position of walking often originates in disturbances of function at hip and ankle joint rather than in the knee joints. Factors contributing to crouch or jump position of knee in walking must be observed and corrected before attempting to correct knee deformity.

In lieu of the transferring the ischial origin of the hamstring distally the tendons of insertions of the hamstrings be transferred into the femoral condyles posteriorly. It was also recommended sometimes that spasticity of the hamstring muscles resulting in an imbalance in the flexors and extensors of the knee could be reduced by partial neurectomy of the branches of the sciatic nerve which innervates those muscles. It was also proposed that the division of iliotibial band in conjunction with lengthening of the hamstring and in addition a division of the tendons of the origin of the heads of the gastrocnemius. Also proposed fractional lengthening of the biceps femoris and semimembranosus in flexion contractures of the knee joint. If desirable at later stage, the hamstring tendon may be detached from their femoral condylar origin and reattached to the tibia.

It was also suggested that the supracondylar osteotomy for relieving gross flexion deformity of the knee not completely correctable by division or transference of the soft tissues. It has not proven necessary to correct valgus or varus or flexion deformity at knee joint.

In cerebral palsy hamstrings during erect walking (maintain) hold the knee in flexion, and to maintain balance, the patient must flex his hips to compensate for the knee flexion. For correction of the situation both hip and knee need reinforcement. This can be accomplished by transference of the hamstrings to the posterior aspects of the femoral condyles. When this is done, the contraction of the transplanted hamstrings muscle extends hip directly and knee indirectly; the spastic hamstring muscle no longer flex the tibia at the knee joint and the patient is not required to alter the phase of any spastic muscles because the flexors continue to function in flexion and extensor mechanism in extension. When the deformity is primary at the hips, due to spasticity

of the strong hip flexors, the increased power of active extension at the hip joint caused by transfer of the hamstring tendons may produce considerable dimunition of hip flexion deformity.

Relief of flexion contracture at the knee however is not complete unless there is full active knee extension. In most patients with cerebral spastic muscle paralysis involving the lower extremities the quads mechanism is greatly weakened. This may be due to overactivity of the knee flexors and to stretching of the patellar tendons, the result of persistent knee flexion in the sitting and standing positions. After transfer of the insertions of the hamstrings tendons to the femoral condyles, active knee extention may be possible to only 160 or 170° whereas in supine lying, passing knee extension is possible to 180°. To obtain complete active extension, the patella which now lies opposite the lower shaft of the femur proximally to its normal (functional) anatomical position, may be advanced surgically at a later stage/date to a lower level. This provides a normal leverage provided by the patella, permitting the quads to extend the knee joints actively to 180°. Release of retinacula of the knee may also accomplish this.

DEFORMITIES OF ANKLE AND FOOT

Deformities amenable to surgical corrections in cerebral palsy are of foot. The commonly associated with spasticity are equinus deformities of the foot. Howover valgus deformities, varus, calcaneous and spastic-intrinsic-muscles imbalance deformities may be found on rare occasions.

Equinus Deformities of the Foot

Most commonly requiring surgical correction in cerebral palsy is talipes equinus. Before planning surgery in lower extremity, first complete muscle charting should be done in reference to the function of the antagonistic muscle. It is also to be differentiated that whether equinus is due to tight tendo-Achilles or due to contracted gastrocnemius tendons. The equinus deformity of foot which can be corrected passively when the knee is flexed must be due to gastrocemius involvement; when it is due to contracture of tendoAchilles or spastic to muscle, the equinus will persist whether knee flexed or extended. Two additional factors to equinus deformity are:

i. Capsular contracture posterior to the ankle and subtalar joints and secondly in long-standing cases.
ii. A thickening of the anterior portion of the talus which has moved forward the ankle joint mortise sufficiently to prevent its return between the ankle maleoli or the dorsiflexion of the foot.

In most of such situations, division of posterior capsule of the ankle and subtalor joints will allow full correction. When talus is also affected then division of anterior and posterior tibial-fibular ligaments is advised.

The muscular imbalance situations resulting into equinus of foot and ankle are as follow:

i. Spastic triceps surae groups vs spastic dorsiflexors,
ii. Spastic triceps surae group vs normal-dorsiflexors,
iii. Spastic triceps surae group vs flaccid dorsiflexors,
iv. Normal triceps surae group vs flaccid dorsiflexors, and
v. flaccid triceps group vs flaccid dorsiflexors.

This shows procedure depends on the particular muscle imbalance present. Surgery may be postponed till growth period is over.

If equinus due to tight tendo-Achilles then lengthen it openly till foot comes to right angle. Overcorrection in strong dorsiflexor muscles will result in a development of talipes calcaneus which is much more crippling. If equinus is due to tight gastrocnemius muscle then G-slide operation gives more satisfactory results. It preserves shape of calf better than in tendo-Achilles lengthening.

Tightness of gastrocnemius can be corrected manually by exercises during day and by bracing at night. Soleus appears to be involved in almost all contractures of the tendocalcaneus since it is most powerful muscle in the triceps surae group and muscle having most of the innervational load.

Many foot and ankle deformities in children are corrected due to occupathonal therapy exercise with activities by strengthening weak muscles of the foot particularly antitibial, persistent stretching of heel cord by therapists and parents and by wearing night braces. These braces may be given during the day to afford stability to the child during walking with broad base.

In severe equinus deformity in children which does not respond to conservative treatment above then tendocalaneous lenghthening is done. Lengthening of tendocalcaneous does not loose strength of the muscles. The popliteal neurectomy or any procedure on gastrocnemius and the body of the soleus will materially affect the strength of the triceps surae group which is so important or ankle and foot stability in developing walking pattern. In older children even after tendocalcaneus lengthening too, the posterior portion of the capsule and the interosseous membrane are contracted and that frequently a posterior capsulotomy of ankle joint is necessary to permit the foot to come up to a 90° angle. In older children, it is also seen that the plantaris tendon is extremely hypertrophied as compared to that of normal child. Now in all tendocalcaneus lengthening, the

plantaris tendon is also resected to avoid the hypertrophy of this tendon as a substitute for the contracted (tendocalcaneus) heel cord. Those who continued exercises and bracing till tibial growth (14-16 yr) did not develop equinus deformity.

Tendocalcaneus is lengthened by Z-plasty procedure, the plantaris is resected and posterior capsulotomy of the ankle joint is performed. It is lengthened to bring foot to 90° and knee fully extended. Full length plaster cast is applied for 3 weeks and windowed to remove stiches and dressing purposes. Cast is in full knee extension maintaining surgical correction in the length of tendocalcaneous. After 3 weeks full weight bearing is allowed. Followed by strengthening of anterior tibial muscle—the dorsiflexors of foot—is begun with short night caliper keeping foot at right angle. If tendocaleaneus lengthening performed early in resistant cases then requires later bony surgery like talectomy or triple arthrodesis in adolescent growth period may be averted. Failure of tendocalcaneous lengthening is due to excessive lengthening or correction not maintaining by post-splinting until longitudinal bone length has ceased. Inept strengthening of weak dorsiflexors of the foot will also cause failures.

Calcaneus Deformity

Spastic talipes calcaneus is encountered infrequently. When present it is due to over-lengthening of tendocalcaneus in presence of spastic dorsi flexors of the foot. Surgery is not satisfactory entirely. The tendocalcaneus may be shortened by overlapping procedure or the tendon of the flexor hallucis longus or flexor digitorum longus may be transferred into the tendocalcaneus or into the oscalcis separately to further strengthen the plantar flexion of the foot.

This may be an early finding in atonic child and may be braced. Retraining program for restoring muscle balance in foot and bracing is usually sufficient to correct the deformity. As child grows, atonic muscles usually develop greater tonicity, and that this deformity disappears without surgery.

Inverter-everter Imbalance of the Foot

Varus Deformity of the Foot

The post tibial muscle frequently shows hyperirritability in younger children and an innervational overload resulting in an inversion of the heel, overcoming by stretching and by the application of a night brace with an inside bar and the T-strap applied to place foot in an overcorrected valgus position at night. Supplement by extensive

muscle strengthening of the peroneal muscles in the treatment program. In resistant cases of varus due to hyperirritability of posterior tibial muscle, later can be removed as a deforming factor, and can be utilized as a motor to assist the weak dorsiflexors of the foot and the peronei. Posterior tibial tendon is detached and transferred subcutaneously over the anterior aspect of ankle joint to the cuboid bone or to the lateral cuneiform. This helps restoration of muscle balance in foot especially in those with weak or flaccid peronei.

Many a times stabilizing procedures on the foot have been avoided by transfer of the posterior tibial tendon supplemented by intensive muscle training.

Valgus Deformity of the Foot

These are extremely common in young children and common in athetoid and spastics both when peronei are spastic or contracted, in the presence of weak dorsiflexors of the foot. It is also quite often accompanied by a tendocalcaneous. To know length of heel cord—dorsiflex foot to maximum with foot in neutral position and not in valgus position. Persistent valgus deformity of foot will lead to deformities of talus and the oscalcis. As valgus foot gives broad base for standing, and walking balance it leads to deformed and painful foot. Valgus of heel cord contracture can be corrected by night brace. Logitudinal arch of rubber scaphoid pad and an inner border heel wedge to support longitudinal arch in day shoes.

The extra-articular arthrodesis of the subtalar joint also helps to cure valgus deformity. It may be done before bony growth ceases-8-12 years. Start retraining much earlier to improve muscular balance avoiding triple arthrodesis. Later is most called for, in adult children, to avoid/correct inverter–everter muscle imbalance of the foot.

Popliteal and soleus neurectomies add problems than solving them. They give temporary results and later tendon lengthening transfers and stabilization procedures may be required.

The intrinsic-muscle-imbalance has been seen not infrequently in foot deformities in severe tension athetoids with relaxation and bracing this pattern can be broken up.

5 CHAPTER Occupational Therapy Intervention

INTRODUCTION

The crafts are not the media used in treatment of the cerebral palsy child as is generally the one for other physical disabilities. There is little use of crafts but training is on practical everyday type of activity to make child self sufficient as much as possible. There are varied ranges of cerebral palsy children, no two are alike as treatment plan for spastic cerebral palsy is different from that of a athetoid. The therapist job is on diagnosis and his/her own knowledge of the medical background of the patient. This is translated in a therapy program as age, diagnosis, handicap, mental ability are all the part of the treatment plan. Therapist works on bringing about the maximum independence of the individual child. The treatment program is comprehensive but not therapist standing alone but cohesive team approach to rehabilitate whole child. For cerebral palsy, habilitation is more correct word/term in most cases, not restoring what damaged brain never had but finding ways to circumvent the damage, and training new pathways for functional activity.

The training in activities of daily living has to be repeated with cerebral palsy child again and again, over a long period of time, with different ranging results, based on his diagnosis, mental and physical activity ability.

There are feeding activities: sucking, chewing, swallowing, holding utensils, getting hand to mouth pattern.

Dressing activities: buttons, laces, bows, braces and buckles, zippers, getting clothes off and on.

Bathroom activities: brushing teeth, washing hands and face, toileting.

Pre-school and school activities: writing, typing and visual motor co-ordination, handedness testing to determine the child's dominance.

The making of splints and treatment of postoperative hand surgery.

Play activities using games and toys for definite purpose, and basic fundamentals of reach, grasp, release, placement, gross and fine co-ordination of the upper extremities.

Tables and chairs required should allow good sitting positions, adequate supports and restraints for the child who cannot balance himself, standing positions for those who can do work in that position on standing table more easily.

Graded activities—from simple to complex, from gross to fine co-ordination. Consider the developmental pattern in planning occupathonal therapy program. What child should do first and be able to reach for some thing else. Integration of the motor and sensory system results in a normal growth process of child. In brain damage these are interrupted resulting into abnormal or limited motor responses. Co-ordination results from the normal integration of motor and sensory developmental patterns and occurs automatically as a normal process growth.

Normal human being is highly integrated organism, all parts are mutually dependent and functions interrelated. With interruption of these pathways the approach to training must vary from that approach of the individual with perfect integration. Learning may go back to basic level of conditioned reflex, i.e. repetition of a particular sensory stimulus to lay down a motor-sensory pathways, since the early stages of learning are accomplished primarily by conditioning, the more advanced stages are the result of perceptual processes in which previously conditioned patterns are developed into more complex patterns. When motor-sensory pathways are faulty the individual cannot form a plan of movement to accomplish skilled, purposeful activity, and thus require therapy to train him to accomplish many purposeful activities.

Motor control is normally gained from the proximal to the distal, i.e. neck and trunk before the extremities; so therefore, if the patient does not have fair sitting balance and reasonable head control one will find difficulty in working with the extremities.

Timing and co-ordination of movement are normally distal to proximal, as in feeding. To achieve fine performance like feeding before that basic controls must be there.

There may be a child who will never have head control and sitting balance. It does not mean we forget him but teach him to accomplish whatever he can do. The motivation helps continue learning. Motivation is personal achievement depending on therapist/child relationship, but sometimes child does not respond. Many cerebral palsy children please therapists in a way when respond after being approached.

Reach child at his level of interest. The first impression is very important and after wining confidence of the child, you may alter your approach the way you want it to be as the needs are. Everything you do is motivation and response is reflexion of your attitude. You get what you give. Develop his sense of "wanting to do" and lack of motivation may make development of his potentials difficult. Give him authority and direction to develop security. He needs love and affection of his accomplishments and efforts which helps him to adjust to himself and others.

The occupathonal therapy methods are on the whole general and can be made specific depending upon individual requirements of the case.

Spasticity

This variety of cerebral palsy has problem of muscular imbalance. The basic principle is to re-educate the muscle to equalize that imbalance. Occupathonal therapy adapts handicap to a skill rather than developing muscle re-education as fundamental prior to the attainment of skill. Occupathonal therapy is also concerned about small muscle of the hand which cannot be tested individually muscle by muscle for spasticity, and equally difficult to treat muscle by muscle.

Accept the patient at his level, provide self help aids, encourage him to develop greatest skill possible within his limits of handicaps. Strengthen weak muscles to overcome imbalance, protecting and re-educating the zero cerebral muscle and cutting down power of hyperactive muscles.

Athetosis

Teach relaxation and increase or decrease on his voluntary control is the basis of treatment of the athetoid. Once relaxation is achieved then basic motion may be started. The motion may be carried through to completion like follow through in sports, thus differing from limited range in spasticity. Single motion precedes combine motion, thus gross shoulder control precedes grasp.

Smaller the muscle group, smaller the pace required as often loses accuracy when speed increases. Steady gain is obtained when can pause between movements/motions, particulary when learning combined motions of feeding, grasp spoon-pause-fill the spoon-pauses-flex the elbow-pause-insert spoon-pause-return-pause. This avoids build up of tension.

Ataxia

The fundamental principle is developing compensatory mechanisms to substitute for cerebellar dysfunction. If balance loss, increase use of kinetic senses through developing awareness through weight distribution and in absence of nystagmus, the development of visual accommodation to interpret environmental levels are two compensatory techniques.

When kinesthetic senses are lost then development of balance sense should be emphasized and kinesthetic senses exaggerated where motivation is contributing factor. Conditioning helps develop basic patterns for motions like grasp, release, reach and return but only successful, if done in functional position. Teach eye-hand coordination to avoid subnausea condition of many ataxics. The look away technique is best, as prolonged fixation on a small area may make the patient uncomfortable.

Rigidity

Rigidities respond to the techniques used for spasticity or for athetosis according to their etiology. However, the fundamental principle in rigidity is the development of speed of muscle contraction and release. It is accomplished through repetitive motion, usually passive at first, then assistive and active.

To determine rate of speed, it is wise to push the rigidity to a rate slightly faster than that which the patient chooses to use; hence the rate is accelerated deliberately and differs from the caution used in selecting the rate of speed for a spastic muscle where there is danger of arousing stretch reflex.

Tremor

Requests for treatment of tremors are rare. Relaxation, use of weights to reduce amplitude of the tremor, and progression from gross to small motions are the principles to be considered.

TREATMENT

After referral, child must be evaluated first to give therapist a working knowledge of the child's potential.

First 2-3 sittings to know the child, to observe behavior, attitude, motivation, level of development, handedness, degree of handicap, motor skills, head balance, sitting balance, hand skills, etc and self help skills. Record on treatment sheets as quick recording can be made and concrete records are with the therapists of what child can accomplish.

The therapist can forecast what child can be capable of doing and treatment laid down accordingly.

Seat child securely and comfortably. Adjustable cut-out table is advised, chair to fit the cerebral palsy child is satisfactory. May use restrainer and a foot block to keep feet in position.

Rapport established by motivating him to use toys to arouse his interest of varying degree of difficulty. Many children love to play and go along with therapists wishes if told to do so. What the child does and how does he respond to it will determine child's potential.

With very young or very handicapped, the toys are used for grasp, release and release only in primary needs. They can be used to teach color size, shape, texture while he is playing as a part of fundamental training in learning.

Pass on finner skills from gross motions, activities of daily living so necessary part of every child's daily life.

Establish good eating habits as early as possible, even if unable to handle utensils and feed himself. Do work with lip closure, sucking, chewing and swallowing. Parents have to carry out most of it at home and carry out therapists plan.

Feeding training begins with mother feeding the baby. Hold up right in lap with as little support from parent as possible. Therapist to insist to sit on straight chair with cut-out table as early as possible.

Lip closure, sucking, chewing, swallowing should first be established as adequately as possible. If child can feed himself but lacks any one of these essentials, it can be done alone but not during mealtime but can when he feeds himself.

When severely handicapped gets to feeding himself, he has to control his head, neck, shoulder arm control for long hours. Let child drink with plastic straw towards independent. Dispensor bottle with screw top and plastic bottle is generally used. Top small hole may accommodate straw and flow regulated with squeeze of the bottle.

Lip closure and sucking can be taught by asking child to "kiss" the straw. Raise fluid by squeezing bottle the child gets some liquid which is the incentive to the child.

Stimulate chewing by using any substance which will dissolve easily in the mouth of the child such as crakers, cookies and small candies. Child opens wide mouth and place food using tongue depressor well back to the side between with molars, move jaw up and down in chewing motion, greatly push the tongue into position with tongue depressor. Many children chew by pushing food to the roof of the mouth rather using the teeth or they extend tongue pushing food out of mouth entirely.

Hold jaw closed and stimulate swallowing by stroking the throat slightly. Encourage feeding by himself even if early skills are not established. If everything for them then they do not try to do things. Use toys and games for pre-feeding motions but better to use actual food. If no grasp then give lollipop tap to the hand. Without having to think about maintaining grasp he can work on the flexors, extensors pattern of elbow. Spoon or fork bent as per needs of the child. Spoon bent at acute angle and held in primitive manner and grasp little motion, other than elbow flexion and extension are needed to stab food and get it to the mouth. Adopt utensils as per needs of the child but keep program as near a normal as possible unless cannot be done otherwise.

Use dishes which are not too deep with raised side in half of the plate so that food is not spilled around. Anchor dishes to table with suction cups, modeling clay rubermat or any other device, holding plate in place. In the beginning, give weighted cups for beginners, double handles, plastic top, progress to the top, a regular plastic cup, small plastic glass to regular glass. Adopt any method with individual child as per his needs.

Writing

Foundation begins much before child holds pencil and draws letters. Early play activities are such eventually leading to enable him read and write. He should recognize, reproduce form, to interpret meaningfully that which he sees and to this end puzzles, block forms, games, toys demanding various forms being recognized.

As soon as child is able, mentally and physically and shows desire, he should be allowed to handle tools of writing, crayons, pencils, etc. Use fat crayons for severely affected and very small child padded pencils for good grasp, pencil in pencil holder when grip cannot be maintained.

Take up writing step by step. Time spent on each step depends on each child. Beginning with vertical lines with downward stroke as that can be controlled easily, proper habit to be formed to begin lines as to the direction and circles in writing.

Let child write in between lines to mark good fence, dots used to mark fence line, if needed. Then horizontal lines made in between dots of one or two colors and from left to right as in writing. Then combination of the two to form squares, thus basis for many printed letters. Of course, "O" is the first form recognized by the child, it is not as easily produced by many children so it ranks 2nd in learning of letters. Circles can be drawn by drawing squares first and rounding

off corners-gradually dispensing with squares and straight drawing circles. Direction is important counterclockwise. This will eliminate future problems when it comes to cursive writing as the child who has formed the habit of clockwise. Circle has much trouble reversing this procedure for the counterclockwise motion or cursive writing.

When these two forms are mastered then move to triangles, the last recognised of these basic forms and most difficult to reproduce because of the diagonal lines, involved in its construction.

Again lines and dots are useful to establish the pattern; one diagonal at a time, right to left is easier for the right handed child, and left to right for left handed child.

After mastering this then start to writing letters. Let him write each word in a predrawn square which helps to keep in straight lines to go from left to right and to space the letters.

Tilt writing surface with athetoids reducing pressure in trying to control pencil and in right-athetoid especially eliminating the necessity of getting on top of his work to see what he is doing.

Children with perceptual disorder find difficulty to put on paper what they have learnt visually.

For spastic quadriplegia who was through that cannot learn writing, a procedure was deviced as under:

A program was get up to appeal other senses and not only visual and motor.

A pad modeling clay was affixed to a sheet of heavy cardboard, slim colored pegs were laid on to the clay (keeping always same color in same position). A wooden stylus was given to the child (sharp dowel stick) and set to tracing a line at a time, repetitiously getting the re-enforcement of the resistance of the clay and the stimulus of the color.

This line was reproduced using pencil and paper.

Line by line, color by color the child progressed to the mastery of letters.

Cursive writing is based on a flowing, circular motion and appears most easily, learned by tracing and repetitive exercises, starting with most easily produced forms. Certain basic forms will produce most of the cursive letters, the I and e forms being good ones with which to start and leading to the b, h, k, f, i and t. Similarly the C form leads to the a, d, g, q, o and so on.

Size and space again controlled by rhythm and guiding lines can be enhanced by the use of the metronome.

Left handed child will pose more problem than the right handed one. True in a child with mild right handicap who has switched to the left hand because of the handicap.

The left handed child that tends to back hand writing is to mark the writing area on the desk with a bright red paint which will show through the paper, divide paper with a line down the middle and have him more the paper so that the writing area is always over the marked spot. Also draw angles to show the angle at which the paper should be slanted, as paper moves he has the red mark, and the guidelines to keep his hand in proper position.

Adaptations are needed but discarded soon so that child does not become too dependent on them.

Typing

Starting in those who cannot develop writing at all or who lack speed and control of work demanded at school. For such cerebral palsy children it is essential. Use method on child's abilities and convenience.

Most satisfactory is electric type-writer. Give supports to the levels to enable use key boards. Typing stick may be used if finger control is less or not existing. Typing stick can be grasped and then used to strike letters.

For athetoids, key shield can be used across key board of the typewriter with keys beneath each hole and removed when not required.

Most of the children become one-handed typists but any combination of fingers may be used. Typewriter can be adapted to one hand use only.

Touch typing has proved very beneficial and useful with different key colors. Corresponding chart is made for each child giving only the letters on which he is working and adding new letters as old one are mastered. Let child develop habit of good fingering and accuracy before attempting speed. And given regular drill like in any typing class.

If child has poor memory then each finger nail is pasted with colored tape helping him to use the key board accordingly. Metronome develops rhythm. Child not needing color cues, cover key with white tape, just central line of keys covered with red tape to mark where one hand stops, and other takes over.

If one-handed then row of keys is controlled by little finger. First or second grade child can master the method of typing when learned his letters and has started to read he should have no problem with typing.

Postoperative Therapy

When surgery performed on hemiplegics then occupational therapist is called on to set up the postoperative treatment program.

Regular exercise with activities plays biggest part in the program; general strengthening of wrist and hand, adduction, abduction, flexion and extension of fingers and thumb opposition, dorsiflexion of the wrist, supination and pronation and elbow extension. Facilitation techniques, confusion patterns and co-contraction appear to work on the transferred muscles as they do on the muscles which normally perform these actions. Games and toys can be used to augument the routine exercises and activities to make it more interesting for the child.

The Dominance Theory

Handedness Testing

Brunyate proposes that "the use of hand dominance principles in the treatment of cerebral palsy has long been a controversial subject and field is divided sharply between those who use them and those who ignore them completely. Those who use handedness principle believe that they would be accepted more generally if they were understood more widely. The application of the principle and adherance to them develops concentration, in motivation, in correction of the bizarre behavior and in avoidance of fits or stuttering. Handedness is important when lesion is cortical brain area or an asymmetric involvement of upper extremity. Some refer to the theory of laterality, others to theory of dominance. According to dominance theory an individual is born with two thinking brain areas, two speech areas, two eyes, two feet and two hands, each with the same potential of output or leadership. He also inherits drive or a tendency to use one of each and through habit and growth develops the exclusive use of unilateral brain areas and the master lead of one hand, one eye and one foot.

This right handed uses the intelligence and speech areas on the left side of the brain and becomes either left or right footed and right or left eyed. The inner desire of inherited drive varies from one individual to another; some show strong right handedness, others a moderate degree and still others ambilateral. The actual skill and physical skill does not have any co-relation with degree of dominance drive.

Some develop dominance at age of 2 or 3 years and others not even early school years. It is apparently due to degree of drive and not an index of ultimate motor or mental skill. Child failing to develop

mental and manual dominance does exhibit limited mental and manual acquity. Once it establishes dominance then it does not shift.

Hand dominance can shift without corresponding area used. A shift in hand use prior to the establishment of brain dominance may result in a shift of brain areas, thus a resultant speech and mental acquity problem arises. A shift in use or loss of an extremity after dominance has been achieved does not cause a corresponding shift in the brain laterality.

Loss of dominant brain areas will create acquity problems but a loss or damage to a subdominant brain area will not.

Occupational Therapy

Occupational therapy is the evaluation and treatment of physical and psychiatric conditions through selected activities in order to enable people of all ages to function as effectively as possible in daily life, the goal of occupational therapy is to help people learn physical skills they need to function and become a independent as possible. Occupational therapy uses people's strengths to help them cope with their disabilities.

An occupational therapist may work within the community, the hospital, school or a special unit. Within local authority, social services departments, occupational therapist are responsible for the assessment and provision of suitable equipment and for major adaptations to an existing or new environment at home, school or work to enable an individual to be as functionally independent as possible.

Occupational therapy plays a large role in the development of a child with cerebral palsy. The job of an occupational therapist is to create the ability of the fine-motor skills and small muscles, which include:

- Hands
- Feet
- Mouth
- Fingers, and
- Toes

These therapists also teach daily living skills such as:

- Dressing
- Eating, and
- Everyday mobility including use of mobility aids and transportation.

It is also one of their jobs to make sure children are properly positioned in wheelchairs, standing frames, etc. to maximise benefit and minimize positions that could contribute to more spasm or other

uncontrolled movements. They may also teach child better of easier ways to:

- Write
- Draw
- Cut with scissors, and
- Brush their teeth.

Occupational therapists will also help child find the right special equipment to make everyday jobs a little easier, such as:

- Modified spoons and cups for easier feeding.
- Toys that are easily held and that will help the development of motor skills, and
- Seats
- Wheelchairs
- Pushchairs
- Standing frames
- Walking frames, and
- Side lying boards that will help improve child's mobility, posture, etc.

The occupational therapist may try to develop certain physical and learning skills using special play equipment and advise on equipment to help mobility such as tricycles and trolleys.

It is also the job of an occupational therapist to help make home and community accessible to child. Many adaptations may need to be accommodated in order for child to reach his maximum level of independence. For instance, because children with cerebral palsy often have problems with their posture and muscle tension, a chair may need to be adapted with creative use of foam in order for the child to sit comfortably. Things such as a Rifton Corner Seat aid in a child's ability to sit on the floor while playing, without stressing the leg muscles and while keeping the child's posture upright.

Occupational therapists will look at the best posture and seating for the child. When occupational therapist are considering child's seating needs, it is important to obtain a clear idea of what final outcome you are looking to achieve. "Some seating is very bulky. Many special seats have trays in front of them, which means that the child is unable to join the rest of the family at the dinner table. Many chairs available on the market depend on numerous straps to hold the child in place. I do not think I would have been very comfortable as a child if several parts of my body were strapped down every time I sat in a chair. On the other hand, chairs that do not rely on straps probably require the child to put in some effort to keep their posture correct. Thus, sitting down becomes an activity rather than

an act of relaxation. If your child clearly needs special seating it might be worth considering the option of more than one chair, perhaps one for relaxing and one for active sitting.

In addition to helping child find comfortable seating, depending on the degree % disability of the child, the therapist may be interested in the walking pattern, or "gait," of the child. Even if the child cannot walk or stand or stand on her own, it is important that child stand for a portion of the day. While movement is necessary to stop muscles from becoming atrophied (the shrinking in size of a muscle, usually due to injury, disease, or lack of use), for children with cerebral palsy standing takes the weight from the hips to the feet, allowing the hip joint to develop more regularly, hip dislocation is a common problem in children with cerebral palsy, and allowing the joint to develop sufficient strength will help to avoid such dislocations. If a child is unable to stand on his own, there are many standing frames available. If child is not able to stand on his own but can manage with the help of an adult, purchasing a standing frame may not be necessary. Activities such as holding child's hips and supporting him in a standing position while he leans against a sofa or low table can be just as effective is allowing your child's joints to grow healthfully. Toilet seats can be specialized to help children with cerebral palsy develop this independent function without the need of assistance.

In instances where mobility is very limited, special computers that can be used by touching the screen, speaking the commands, or other modifications that make it possible for individuals with cerebral palsy to accomplish tasks that they otherwise would not be able to do by themselves. For example, computers can help people turn on a light switch with the blink of an eye or open a door with a nod of the head. 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, which means 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 abilities, and movement goals.

A child with cerebral palsy may experience sensory integration dysfunction (not being able to decide which sensory input, or the information coming in through senses, is compared to the others, more important) as a result of central nervous system damage (damage to the brain or spinal chord). Sensory integration dysfunction might also develop as a result of the limited sensory experience that these children have a result of their limited motor abilities.

Occupational therapy will help determine your child's abilities and will help to form reasonable goals to help child reach.

What Occupational Therapists cannot Do

Therapists cannot cure cerebral palsy; they can only help reduce disabling effects. Through therapy, disabled people can achieve improvement in communication and movement, and can become more independent. Every person with cerebral palsy is different, however, and not everyone will achieve the same results. 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 will likely advise you and child on easier methods of feeding, dressing and everyday mobility. They will also help you find the specialized equipment the child needs to help him in every day 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 needs to be accommodated in order for the child to reach his maximum level of independence. For instance, because children with cerebral palsy often have problems with their posture and muscle tension, a chair may need to be adapted with creative use of foam in order for the child to sit comfortably. Things such as the Rifton corner seat aid in a child's ability to sit on the floor while playing, without stressing the leg muscles and while keeping the child's posture upright.

When you and your occupational therapist are considering your child's seating needs, it is important to obtain a clear idea of what final outcome you are looking to achieve, "some seating is very bulky. Many special seats have trays in front of them, which means that the child is unable to join the rest of the family at the dinner table. Many chairs available on the market depend on numerous straps to hold the child in place. I do not think I would have been very comfortable as a child if several parts of my body were strapped down to every time I sat in a chair. On the other hand, chairs which do not rely on straps probably require the child to put in some effort to keep their posture correct. Thus, sitting down becomes an activity rather than an act of relaxation. If child clearly needs special seating it might be worth considering the option of more than one chair, perhaps one for relaxing and one for active sitting."

In addition to helping your child find comfortable seating, it is important that the child stands for a portion of the day. While movement is necessary to stop muscles from becoming atrophied, for children with cerebral palsy standing takes the weight from the hips to the feet, allowing the hip joint to develop more regularly. Hip dislocation is a common problem in children with cerebral palsy, and allowing the joint to develop adequate strength will help to avoid such dislocations. If a child is unable to stand on his own, there are many standing frames available. If a child is able to stand on his own but can manage with an adult's assistance, purchasing a standing frame may not be necessary. Activities such as holding your child's hips and supporting him in a standing position while he leans against a sofa or low table can be just as effective in allowing your child's joints to grow healthfully. Toilet seats can be specialized to help children with cerebral palsy develop this independent function without the need of assistance.

Occupational therapists are also trained to evaluate the child's sensory system to determine whether a primary sensory deficit 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 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 experience that these children have as a result of their limited motor abilities. Occupational therapy will help determine your child's abilities and will help form reasonable goals to help your child reach. (Refer to Figs 2.1 to 2.19 and Tables 2.1 to 2.5).

EQUIPMENTS IN OCCUPATIONAL THERAPY (FIGS 5.1 TO 5.25)

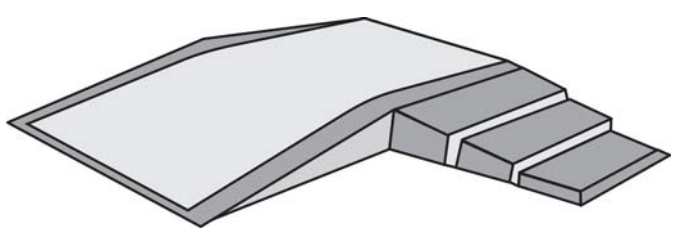


Fig. 5.1: Ramp and steps walking trainer

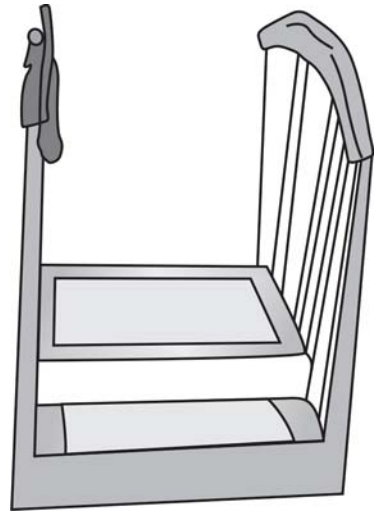


Fig. 5.2: Steps siderails support trainer

Fig. 5.3: Ramp and steps walking trrainer

Fig. 5.4: Side lying wedge for CP child

Fig. 5.5: Modified wheel chair with head and feet supports for cerebral palsied child

Fig. 5.6: Child in triangular corner seat

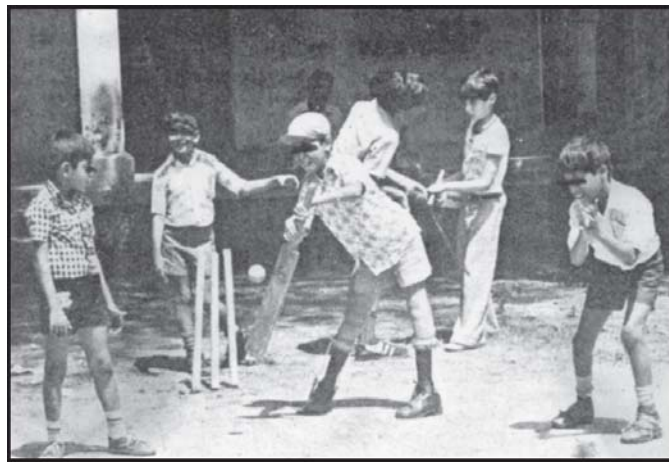


Fig. 5.7: Playing in a group of children

Fig. 5.8: After pearning balance enabling to walk

Fig. 5.9: Learn crutches balance

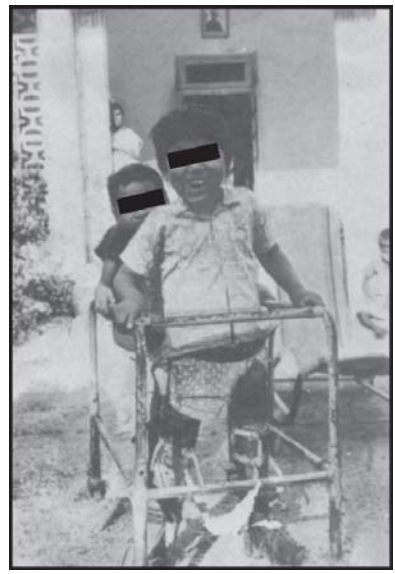


Fig. 5.10: Walker use to iniate standing balance

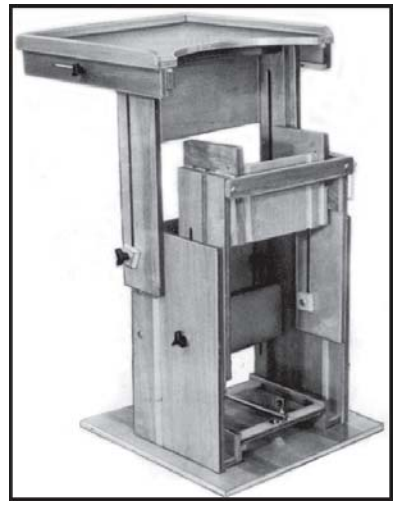


Fig. 5.11: CP table for developing standing balance

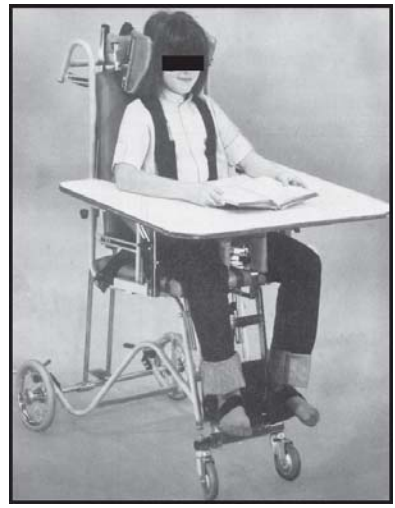


Fig. 5.12: Modified CP chair with work table

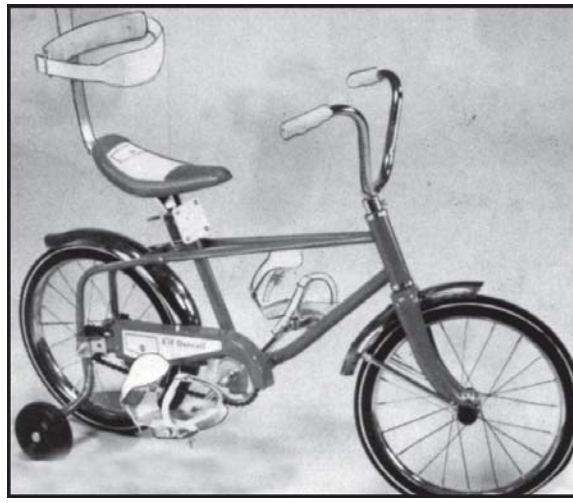


Fig. 5.13: Trainer bicycle with trunk and pedal supports

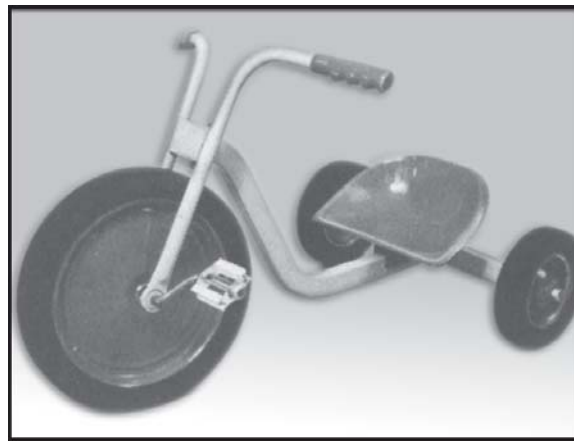


Fig. 5.14: Lowseat for early postural training to a CP child

Fig. 5.15: Rish mail to develop posture in activity of cycling

Fig. 5.16: Star car for transportation of a CP child

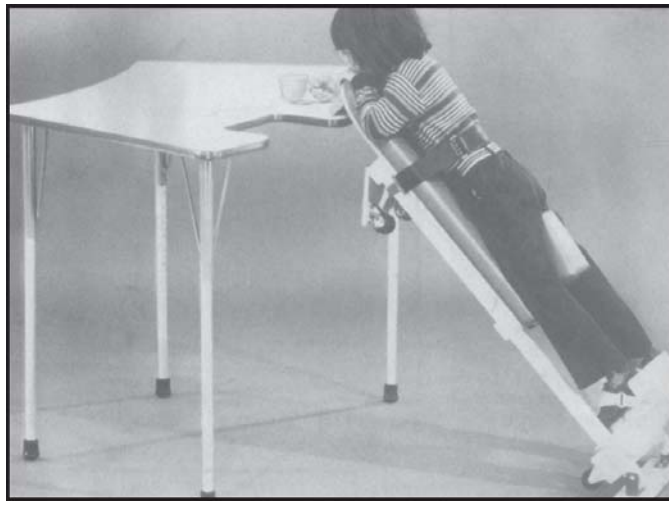


Fig. 5.17: Prone scooter to facilitate activity by CP child

Fig. 5.18: Mustang scooter to prevent adductor contractures.

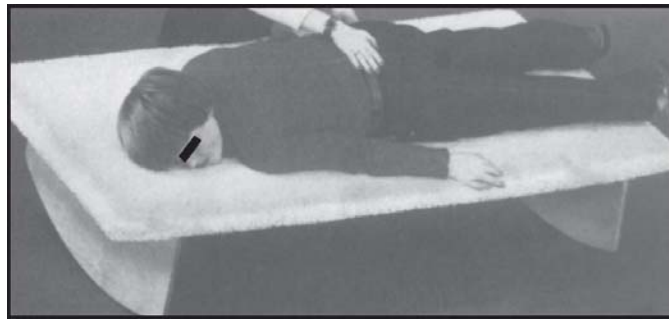


Fig. 5.19: Vestibular board to facilitate vertibular functions in a CP child

Fig. 5.20: Delux floor sitter for developing posture in relaxed sitting

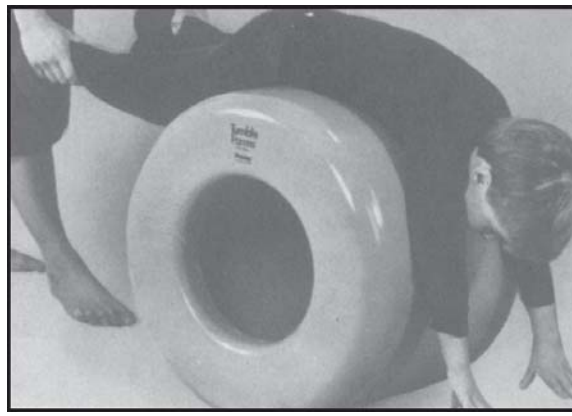


Fig. 5.21: Tumble forms barrel roll to develop reflexes

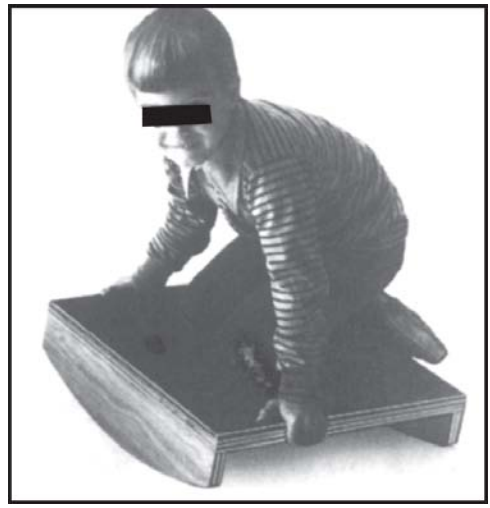


Fig. 5.22: Rocker balance square to develop equilibrium

Fig. 5.23: Delux floor sitter for smaller child

Fig. 5.24: Saucer twirl for CP children

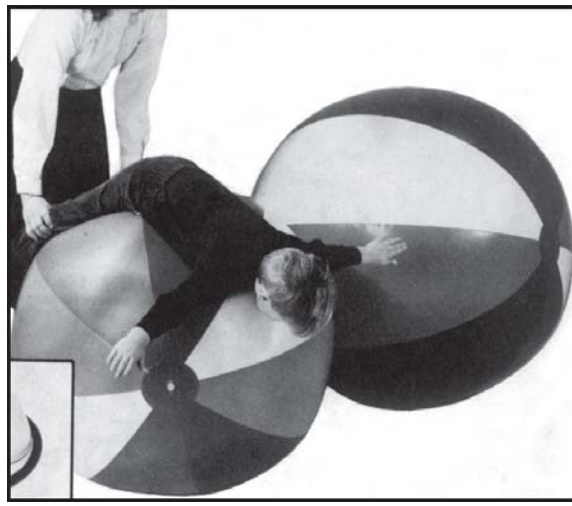


Fig. 5.25: Reflex developmental beach ball

DIFFERENTIATION OF DOMINANCE PROBLEMS

It may be remembered that normal pattern of development may not be always distorted in cerebral palsy child. The children whose arm is severely handicapped and could not develop arm skill have never dominance problems for which they automatically develop/establish brain dominance on the inherited side and since the development of arm skill comes long after they have fixed dominance, either hand could become the leading hand. Persistence of tonic neck reflex does not distort dominance either, for here again inherited dominant brain area is fixed prior to the establishment of handedness. Whenever extremity interference is equal and severe in both arms, the establishment of dominance usually is not disturbed, for neither hand is given preference.

Real difficulty comes when the handicap involves one extremity more severely than the other, thus diminishing the effectiveness of the inherited drive and "equalizing" the hand so that one does not become a leading hand. If both hands are involved equally, the inherited drive still tends to give one hand the advantage over the other, and likelihood of dominance difficulties is not so great. If inherited dominant hand is involved more severely than the inherited subdominant hand, again the skills are equalized and the patient has the equivalent of two assisting hands and becomes mixed dominant. If only one hand is involved and that on inherited dominant side a problem arises unless the handicap is so severe that the extremity is useless, in which case the child will shift automatically to using the

other hand and other brain area. If only one hand is involved, and that on inherited subdominant side, no problem will present itself unless the assisting hand receives such repetitive exercise that it begins to compete with the leading hand.

Most dominance problems occur in spastics, hemiplegics and ataxics. Restraint for the purpose of shifting handedness is not often used but frequently the handicap itself and the brace used for its deformity help restrain and shift handedness. If restraint is ordered then denim sleeve is worn under clothing for 18 months for all waking hours. After this time, free use of both hands is allowed, but leading hand is always emphasized. Use of subdominant hand can be begun in child who has been restrained or in any child whose dominance is apparent as long as the leading hand is kept in the lead and the subdominant hand does not give in competition. Compare the hand writing of hemiplegic with his subdominant work, with his classmates. If all are of equal caliber there can be little doubt that the patient has achieved dominance.

Testing handedness is a part of the occupational therapy program. When two things, in an outpatients being tested, the parents can be helpful in doing two things, the preference tests, and observation of daily, everyday activities.

Preference testing should be done without knowing the child that you are doing, let him seated at a table and placing objects, one at a time in the centre of the table, asking him to pick up the object. Record the hand used, if transfers hands, do not count it.

A few minutes each day is enough for this activity. For the activities preference the child should be observed doing any of his everyday activities, feeding, brushing teeth, turning on a light or TV, throwing a ball, etc. The date and total activities for each day should be noted, and the list returned to the therapist at the end of testing period to be incorporated in her total testing material.

Treatment Techniques

Various treatment techniques have been devised for use with the cerebral palsy as stated by Brunyate.

Phelps

Theory: The use of conditioning based on the Pavlovian theory and in compliance with Sherrington's law of reciprocal innervation and relaxation and motion from the relaxed position derived from Jacobson's principles.

Technique: The 12 modalities massage, passive motion, assistive motion rest, relaxation, motion from the relaxed position, balance, reciprocation, reach, grasp, release, skills.

Application: Use of modalities singly or in combination according to the level (Gesell) of the patient, place the arm in a relaxed position (use a brace to hold it if necessary) use conditioned motion, and passive motion to encourage the development of grasp.

Fay

Theory: The training of basic patterns of movement paralleling the evolution from fish to amphibian to reptile and to anthropoid.

Technique: The patterning of exercise to develop first the motions of swimming then crawling, then balance and antigravity factors.

Application: Place the arm at right angle to the body with the thumb towards the mouth to obtain an open hand position and abduction of the thumb prior to the development of grasp.

Kabat

Theory: The maximal activation of neuromuscular mechanisms to bring into use dormant pathways and to develop new pathways, the utilization of reinforcement through resistance, reflexes and mass movement patterns.

Technique: Heavy resistance exercises through the use of pulleys, weights, and manual resistance, work against gravity and friction to increase awareness of contraction first in elementary motions, then combined motion and skilled activity.

Application: The use of glove reinforced with bands of dental dam in such a fashion as to provide resistance to the thumb and the fingers for the development of voluntary grasp.

Bobath

Theory: The inhibition of exaggerated tonic reflexes and the facilitation of balance reflexes, the reversal of abnormal position to enhance development of automatic posture and movement, the normalizing of muscle tone, the reduction of steadying of tone by the inhibition of reflexes.

Technique: The use of reflex inhibiting postures devised in sequence, graded and adjusted to the patient's tolerance, the placement of the

patient in a position which encourages the motion to facilitate righting and equilibrium reaction.

Application: The placement of the patient in a position of complete reversal of tonic neck reflex and the maintenance of that position by the therapist's holding to gain spontaneous opening of the hand and fingers preliminary to the development of the grasp.

Rood

Theory: The bombardment of the sensory motor system with more efferent impulses than normal in order to facilitate motor response, stimulation to cause the contraction of a muscle and the inhibition of its antagonist (Sherrington) to bring about motion, or the contraction of a muscle and the simultaneous contraction of its antagonists for holding a part.

Technique: Stimulus in the form of stroking, squeezing, pressure, pounding, application of cold, discretely and judiciously applied to various receptors and used only until the patient has regained sufficient voluntary control.

Application: Stroke the radial sensory area for finger extension, the short abductor of the thumb for abduction, the palm of the hand and apply pressure on the ulnar side or have the patient squeeze, to bring in lumbricals and interossei for improvement of hand function ultimately for grasp.

Knott

Theory: Proprioceptive neuromuscular facilitation to stimulate and strengthen the response of the neuromuscular mechanism. Reinforcement and repetition to develop endurance, change in activity to overcome fatigue, proximal stimulation first, the use of strong areas as reinforcement for weak ones.

Technique: Resistance is isotonic contractions of antagonists and agonist, the use of patterns of motion, particularly a spiral and diagonal to accelerate learning and to improve strength and balance.

Application: Optimum pattern for long and short finger flexors, flexion-adduction-external rotation, with the elbow held in flexion to improve strength and to speed the control of the fingers preliminary to the improvement of grasp.

Each of these methods is useful and should be used as per needs of the particular case of cerebral palsy. Daily records must be

maintained for each patient for treatment purposes along with progress notes if any for the purposes of follow-up and details of the progress made by the each case.

Bracing

It is an important modality in cerebral palsy in modern days. Splinting and bracing are essential auxiliary in the treatment approaches to cerebral palsy child. Support and stabilization are essential; hence bracing is necessity for prevention and correction of deformities. They maintain correction after surgery.

It is preventive and corrective in spastics where it is a contrast in post-polio residual paralysis bracing where they are used as substitute to support weak muscles, or for limiting joint motion, as in foot drop.

Bracing in athetoid is used not only for support but for direct control of the co-ordinated joint movement and the elimination of involuntary motion.

Associated deformity in spastics is pes equinus. Therefore, bracing at night may also be advised in severe deformity cases. This is in addition to correction of pes equinus but for stretching tendo-Achilles and muscle sheath caused by the spasticity of the gastrocnemius-soleus group of muscle. Operation can be avoided in lengthening heel cord by night bracing. Stretching by splint is the best produced in cerebral palsy. Quite frequently after wearing foot brace during the day are nullified when child sleeps in prone position foot going to planter flexion and heel cord shortens forcing foot into further equinus. Quite frequently the child with the contractures of the heel cord due to spasticity of the calf muscles will be able to discard the braces during the day.

Night braces are high quarter shoes with laces, above the ankles, to which is attached a single bar caliper with padded leather cuff below knee at right angles stop fixed to the sole of the shoe. The caliper bar can be bent as dorsiflexion continues to increase. The shoes must be worn first so that bar and padded band does not slip. It is suggested that toe cap may be removed so that the toes which may be under the influence of spastic flexor muscle are not curled up under the foot. Wear foot brace till longitudinal growth of tibia has grown, i.e. up to 16 years.

In varus deformity associated with equinus, the bar in caliper is on the medial aspect of shoes, an outside or lateral T-strap is attached passing over bar and pulling the foot toward bar, correcting varus deformity.

Equinovarus deformities of the foot and varus deformity should be corrected first, as in correction of club foot before obtaining dorsi flexion by stretching heel cord.

Equinus deformities are associated with valgus. Place caliper bar on lateral aspect of the shoe and T-strap on medial side. Spastic equinus is corrected like this and prevention of fixed equinus also.

Contracture of heel cord due to marked spasticity of gastrocnemius is corrected by long leg brace with double bar, brace keeping knee in full extension and foot dorsiflexed and those who cannot wear it at night may wear during the day. The standing tables may prove useful in such cases in school and at home when engaged in a purposeful activity.

Overactivity of spastic gracilis muscle results in knee flexion and adduction contractures, corrected by lower leg brace and spreader bar fixed above or below knee when knee locked in full extension.

Adduction contractures cause is first tried to be known and then braces for scissors gait are advised. This results due to spasticity of the adductor muscles. The minute examination shows that this scissors gait is due to internal rotation and flexors spasticity at hip. They are very close muscle and patient can stand with abducted legs and flexion tries to produce internal rotation leading to scissors gait. Overactivity of hip flexors and internal rotators, it becomes necessary to attach long leg brace to pelvic band.

Twisters may be used in cases of weak internal rotation or external rotation of legs, due not to spasticity of rotator muscles of hips but imbalance of zero cerebral muscles or weak antagonists muscles of elastic or elastic straps. Tie on the canvas belt and get attached on shoes. Do not use twisters in spastic hip as the stretch will overactivate such muscles to increase deformity and even contraindicated when there is flexion of knees tendency.

In tension athetosis, there is excessive movement in the extremities involving joints so braces are not supportive. Splinting in this case is purely to control joints and must control involuntary movements which interfere with direct pyramidal tract control of volitional muscles. These purposeless motions inhibit directional motion to have coordinated joint motion. Unwanted motion interfere in walking, eliminate these extranuous motions in athetoids by relaxation and the training patterns of joint motions from the relaxed status.

The braces by blocking involuntary movements to develop purposeful joint which by constant repetition become automatic. These then become conscious voluntary patterns necessary for functional activities of daily life.

Develop brace tolerance in very young children and not fearful of braces. Let child wear shoes or braces for some days. Apply braces loosely and removed immediately for the first day. Then use them on standing table. Small children use them all the day long, they play, walk freely in parallel bars with braces and with help of crutches also. After tolerance developed then let him stand with stabilizers in hip-knee extended. Basic reciprocal fashion developed on table is projected to up right position. Constant practice above will lead to walking with braces alone. The gait pattern approximates with brace pattern. Such braces are called "athetoid control" braces of stronger metal. Due to unusual strength and over activity of the muscle in athetoid the standard type of joint will shear off quickly laterally and torsional strain.

Relaxation and active motion from the relaxed state is learned more quickly. Develop desirable control of athetoid over braces.

Full athetoid control brace is with spinal straps to spinal supports, pelvic band, hip, knee joints and full shoes. Springs and elastics increase involuntary movements in athetoids. While teaching automatic walking patterns keep knees locked in extension for greater security in walking. Emphasize balance training more with locked knee position in gait training. Since greater balance security can be achieved with slight knee flexion. Straight knee avoids knee contractures and over stretching of the patellar tendon.

The back brace to be attached to pelvic band, basic issue is presence or absence of athetosis in erector spinae muscle. In most athetoids back is weak, and steel uprights will strengthen the tone of erector spinae. Back brace attached to pelvic bands, the hip joints should be stopped at 180° and slip locks should be attached for standing purposes.

Spoon splint extending to the forearm may be used to prevent wrist flexion associated with finger flexion. Leather thumb loop may or may not be necessary to maintain thumb adduction.

In others, flat hand splint with thumb plateform and soft dorsal hand pad-hand sandwich brace may be used at night to avoid over stretching of wrist and fingers extensors.

Some may require full supinated or mid-supinated position of the forearm. A transverse bar to prevent rotation of the hand through the wrist should be attached-permitting flexion and extension at elbow joint with the forearm and hand in a position of mid supination.

Associate Handicaps

Visual Defects

Cerebral palsy children show a high degree of visual abnormalities. Most of them are neurological abnormalities related to cerebral pathology and include:

a. Defective eye movements,
b. Blindness or impaired vision, and
c. Other field of vision abnormalities.

The frequency of refractive errors, internal strabismus and athetosis due to kernicterus with palsy especially up going. Nystagmus along with visual perceptual error-depth, form and shape perception.

Ocular difficulties gave rise to the loss of depth perception and space perception with frequent falls in ataxic child and could also lead to involuntary movements of the body.

In many children eye movements improve with increased control of involuntary movements. Athetoids with pitch of deafness showed upward movement of eyeballs. In spastic paraplegics movements showed internal strabismus.

Muscular Imbalance of the Eye: This is commonly seen in spastics, athetoids and ataxics. Spastic para- and quadriplegias have bilateral internal strabismus which is related to adduction or scissoring of the lower extremities. Premature paraplegic birth shows high degree of eye defects. The eyes deviate to the strongest side of tonic neck reflex in athetoids. Athetoids and spastics improve as control of extremities also improves. Some show strong defective eye movements leading to become fixed. The child persists looking sideways and may also move head to that way.

Eye movements can be corrected by training to avoid permanent strabismus and defective vision. Ataxic group child cannot maintain conjugate deviation.

They have difficulty in scanning a line of print which should be cured to avoid difficulty in reading at school.

Impaired Vision: It may occur with all types of motor handicap in cerebral palsy child. Pale disc in newborn shows optic atrophy and to be followed in the development phase of growth. Observations show that impaired vision is cerebral and not ocular in origin; hence most are cortical in origin. This may be cortical defect of visual imagery which prevents child recordings what he sees. May not perceive three dimensional (vision) field leading to visual confusion markedly. Visual agnosia should be diagnosed at the earliest so that can perceive special training in use of sight and opportunities to play and experiment with materials.

Field of Vision Defect: The defects were more in acquired hemiplegics and that was homonymous field visual defect due to lesion in optic radiation passing posterior into the confines of parietal and temporal lobes to occipital lobes due to the vascular lesion of middle or posterior cerebral artery.

Eye Dominance: Dominant eye is on the side of the dominant hand but cross laterality may occur between 37 to 46% of the norms. When occurs it is minor disability but hampers early achievement in learning to read. Normal IQ child can overcome the handicap. It can become additional factor in brain injured child in hampering in educational training, right hemiplegia shows left eyedness where left hemiplegia shows right eyedness. This shows the damage to normally dominant hemisphere the minor or subdominant hemisphere takes over both eye and hand, and presumable speech control.

Bobath indicated that left handedness is due to a stronger tonic neck reflex on normally dominant right side, forcing the child to use his left hand. However, role of dominance of eye has not been established clearly in cerebral palsy.

Therefore, a thorough examination by ophthalmologist is indicated when child shows difficulty in reading at school.

Seizures

Incidence: Is frequent in cerebral palsy. This common problem causes anxiety in rehabilitation program. Fits in cerebral palsy hemiplegia were not severe like idiopathic fits, aura occurs but patient does not fall, no initial cry, tongue bitting and sphincter continence were rare, stutter was brief and attack is without post-epileptic coma. High frequency in hemiplegics than in tetra- and quadriplegics severely handicapped is due to the degree injury producing fits as well as motor systems is less likely to be comparable with survival if bilateral. Cerebral palsy hemiplegias were more prone to injuries of cortical origins/epileptic origins than complex forms of cerebral injuries in spastic quadriplegics.

Psychological Evaluation of Children with Cerebral Palsy

This is related to a need, a problem. As motivation and closely related emotional life are most important background factors for adjustment of the child's adjustment. The educators at school evaluate the children on the basis of learning ability, etc. The psychologist studies the development of each child and plans program accordingly. He will evaluate the intellectual capacity of the child in the primary place.

The parents are advised to treat the child as advised by the psychologist.

Hearing Defects

They are severe as affect the communication with the child badly. Deafness in cerebral palsy is cortical deafness or auditory agnosia.

They are of two kinds:
a. High frequency deafness and
b. Auditory agnosia.

High frequency deafness is more common with athetoid with ataxic combination showing defective upward gaze movement of the eyes. This is due to cochlear nuclei. They are partial hearing defects usually, rarely complete. The high frequency loss described by Phelps as pitch-cut-off deaf athetoid. Such children show more upper extremity involvement, head and neck. Often learn to walk and achieve balance soon. Some may with severe losses of having develop little or no speech.

Sensory Defects

These are often seen as cerebral palsy is neurological disturbance. They may affect education and use of intelligence tests also. If arm was less affected, there were more chances of sensory defects developing. The lack of use of the affected limb was also attributed to sensory defects which were due to parietal lobe injuries. The sensory tests were for pain, touch, temperature, vibration, two-points discrimination, sense of position, and steriognosis.

Many children who did have minor limb involvement, no sensory defect, mild spasticity but still refused to use the limb but showed marked loss of body image and movement defect.

They become additional problems in cerebral palsy. Sensory loss may be in nature of cortical defect, since learning difficulties which some children experience are suggestive of the sensory and perceptual difficulties associated with parietal lobe damage.

Laterality

Dominance difficulties in hemiplegics may be common cause for lack of speech or delayed speech. When hand dominance is lacking, speech is not only the problem. Greater incidence of reading and writing problems are seen in cerebral palsy of left handedness and certain other educational problems which are associated with left eyedness. Further investigation is desired to determine significance of laterality

with regard to speech difficulty as well as advisability of treating the affected limb in hemiplegia.

The frequent occurrences of mental retardation, speech disorders, seizures, behavior disturbances, etc. are not often recongnised in cerebral palsy children.

A vigorous treatment is given to affected hemiplegic's arm without knowing the harm being done to the inherited dominant side—true in acquired hemiplegic at birth, during infancy and in preschool period.

Before starting treatment on affected arm-determine first if it is inherited dominant handedness side or on sub-dominant side. Since many believe "handedness" is inherited factor, then first know it in grand parents, parents and children, etc. also.

Hemiplegics with inherited dominance side are complicated cases than subdominant handedness. First kind of cerebral hemiplegics may have associated with speech, mental retardation, seizures and behavior disturbances also. Complete shift of subdominant hand takes place very early in childhood that dominant arm was so severely affected that he did not use it at all. Such shift rarely have speech problems, seizures and mental retardation. If handicap is mild then shift is delayed tendency due to urge to use inherited dominant hand despite its handicap.

When hemiplegic child develops seizures, mental retardation, speech disturbance or behavior disturbances, an incomplete shift is in progress-then effort is made to complete shift to the sub-dominant hand as early as possible. By avoiding treatment on affected arm then concentrate on unaffected arm to use it as skillfully as possible. Occasionally to complete shift put affected arm in a sling and immobilized.

6
CHAPTER

Cerebral Palsy Gait

INTRODUCTION

There are many definitions of walking. For the purpose of understanding and analysis of the gait, it is to be considerd as a sequence of standing postures which advance the body while continuously retaining balance, stability and security. Two basic requirements are:

a. A stable standing posture and
b. Ability to accomplish an effective stride.

Even slight abnormality of posture or stride will lead to inefficient or less efficient walking. The later may completely be impossible where there is severe deformity. Thus one needs not to be perfect physically for effective walking, whereas basic requirements must be met. The errors so related to clinical abnormalities lead to corrective measures both for functional and cosmetic improvement.

In most of the disabilities there is a correlation of physical finding and observed gait. Local joint trauma or arthritis can be accurately forecasted. Therefore, the functional muscle loss can be predicted in polio, muscular dystrophy, peripheral nerve injuries, etc. However, such predictions in cerebral palsy cannot be made. The reasons are many, such as:

i. Lesions causing motor dysfunction are hidden in the control centres of brain (cerebral cortex) and spinal cord.
ii. Motion is controlled by a hierarchy of numerous sensory-motor exchange centres.
iii. Disruption of this hierarchy through brain damage has diverse effects.

Neurological Control Mechanisms: The type definable of motor activity are voluntary selective motor patterns, primitive locomotor patterns, mass limb reflexes, erect postural responses and spasticity. They represent five levels of sensory-motor exchange with in the neurological system. As no motion occurs without a stimulus, the nature of sensory functions at each particular level determines the type of motor action that will ensue.

Spasticity: This is unmoderated display of a simplest form of a motion. The muscle directly responds to stretch stimulus, requiring a single arc of a spinal segment represents the lowest level of motor control hierarchy. EMG analysis shows two types of responses: sustained action and clonus.

Sustained response is recorded with a low stretch or as a continuation of the earlier clonic reaction. Distribution pattern of spasticity shows the exaggeration of the ordinary bipedal posture.

Mass Limb reflexes: Present in lower extremity and represent the postural relationship between the hip, knee and ankle. Through intrasegmental connections within the spinal cord, the position of one of these joints influences that of the others. In most of their primitive forms (in spinal cord injuries) the limb reflexes are exhibited as flexor withdrawl to a noxious stimulus and extensor thrust response to the firm plantar pressure. Cerebral palsy exhibits more substle relationship between these joints postures and muscles action. Grossly 45° of hip and knee divides the flexion and extension synergistic responses.

Either hip or knee but knee more in particular may influence the activity in ankle and foot muscle and hence joint (muscles) posture. With flexion at hip or knee, the plantar flexors are relaxed and foot is easily dorsiflexed and vice versa when hip and knee extended.

Using stretch as muscle tension, the change in muscle tone between two positions may be exhibited by difference in duration of the clonus. So therefore, Silferskiold test deployed to differentiate between contracture of gastrocnemius and soleus is invalid, if the neurological lesion has exposed his mass limb reflexes. This means there will be active ankle plantar flexion when child contracts both soleus and gastrocnemius muscles when extends his knee. This can be clearly demonstrated in cerebral palsy hemiplegia. Similar mass limb reflexes occur in upper extremity also.

Erect Postural Tone: It is mediated through vestibular system within the lower brainstem. In response to vestibular stimulation (there are tracts extending from the brainstem to the spinal cord segments), extensor tone in lower extremity is increased when patient is erect. In upper extremity, it is the flexors which become hypertonic. Spastic response is increased by induced tone. Hence examination is to be done for this in standing as in lying it will be revealed.

Primitive Locomotor Patterns: In primitive locomotor patterns, the mass limb reflexes are used for locomotion. Stimulated by the desire of the patient to walk, this control center in midbrain subthalamic area initiates the flexor synergy (to take a step) and the extensor pattern (to provide limb support).

The three joints respond in a stereotype fashion which cannot be modified by the patient. However, there are variations in patients as to the strength and the completeness of the patterns.

Selective Control

This is the normal way to move. Emanating from cerebral cortex, this permits to move any one joint or muscle independently, or to combine various actions as desired, either sequentially or simultaneously. Velocity and strength can be modified at will. These characteristics are used to attain smoothness and efficiency in normal walking that makes this complex task so easy.

Sensory motor control is essential for manual muscle testing as isolation is prime requisite to determine strength. Manual muscle testing is accurate in polio, muscular dystrophy, peripheral neuritis, nerve injury or in persons of localized joint pathology. Patients as such can control muscle efficiently, failure to perform as instructed or display of weakness is straight evidence that the peripheral structures tested are deficient. But in cerebral palsy the situation is just reversed. His peripheral system is intact but cannot control accurately. So responses to muscle testing may be inconclusive, incomplete and highly misleading whenever joints and body postures have active influences though it is not true in all the cases.

A typical cerebral palsy exhibits all these types of motions when the patient walks. Spasticity is induced by body and limb weight stretching the muscle. Major changes of joint positions alter muscle tone through the mass limb reflexes. General character of gait is determined by relative amounts of patterned and selective control available to initiate walking act. Both standing and stride characteristics are influenced by level of the control.

Stationary Standing Posture

The quiet standing posture gives an idea of the alignment available to the patient walking. Automatic stability ensures as feet are flat on the ground-floor, knees and hips are slightly hyperextended, trunk erect and centered over feet as above. Any deviations from this alignment due to deformity or muscle imbalance, indicate need for active support for the malaligned joints which may have compensatory adaptation of the adjacent segments if the patient is to stand independently. The trunk must be centered, regardless of individual joint postures, over the supporting base afforded by the feet contacting floor. Cerebral palsy does have denervated type of weakness. So stabilization of malaligned joints is seldom a problem, though compensatory alignment is attained soon and is frequent. To obtain this

spontaneous alignment, the crutches or any kinds of external supports are desired and needed.

The apparent weakness in cerebral palsy is attributed to failure of cerebral control mechanism to initiate action at right proper time or to an adequate extent. This will also lead to strength loss due to disuse. The mechanical cause of additional weakness may be due to chronic overstretching of the hyperactive antagonists.

Malalignment of one, influences the stability of the other; hence examine each anatomical part individually.

The trunk: It is large influential mass comprising 50% of the body weight. Head and arms each represents 10% each, so a total load of 70% of body weight has to be balanced by the lower extremity. Normally movements of head and trunk are slight and directed towards counteracting those at pelvis. Scoliosis deforms trunk into an asymmetrical mass and tend to pull the patient off balance. With 70% of body weight can cause inormous problems to the extremities which are having poor control. Loss of alignment, lessens the patient ability to use trunk in maneuvers to counteract balance hip, knee or ankle alignment difficulties.

The hips: Spastic or contractural hip deformity prevents the patient aligning his trunk over his feet unless there is lordosis or the knees are flexed. Lordotic substitution in cerebral palsy is minimal as their spine is not hypermobile in the lumbar region. If excessive knee flexion is corrected operatively without simultaneous hip flexion correction, trunk lies anterior to its support needing crutches postoperatively even though the child was independent before.

Similarly lateral alignment problems arise due to adduction and abduction at the hip.

The knees: Both reflect and dictate the posture of the hips and ankles during stance. When erect, the knee flexion so tilts femur that hip also flexes. Converse may occur if hip is extended freely, but spasticity of the hip flexor reflects the postural change to the trunk. Hip and knee represent two ends of a common bone (the femur) hence these joints can be treated as functional couple-always planning for them together. This relationship is enhanced by the erect posture (Figs 6.1 to 6.4).

A second functional couple is formed by the knee and ankle. If knee is flexed either the ankle must dorsiflex comparable amount or patient is obliged to stand on toes. To correct toe-stance without attention to knee can lead to surgical lengthening of tendo-Achilles. The complications after tendo-Achilles lengthening is the nature of

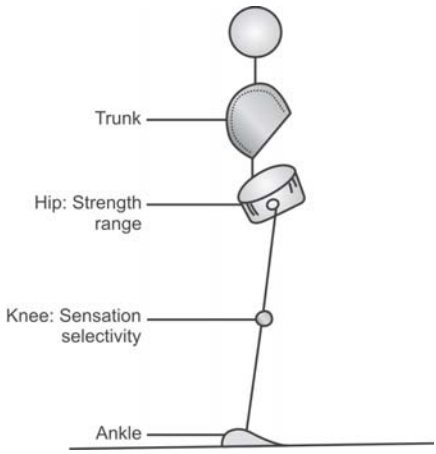


Fig. 6.1: Stationary standing posture

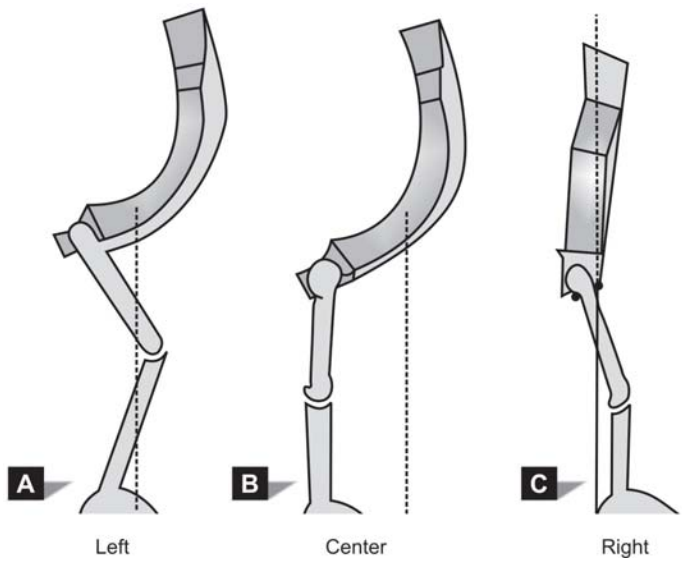


Fig. 6.2

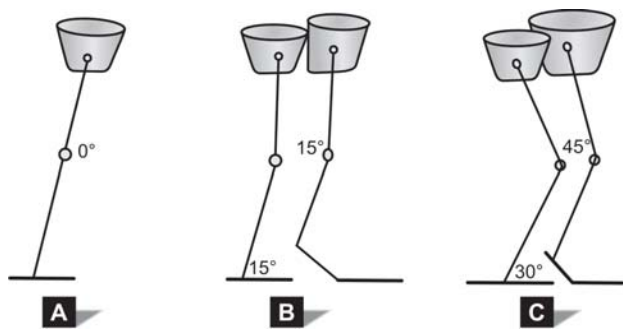
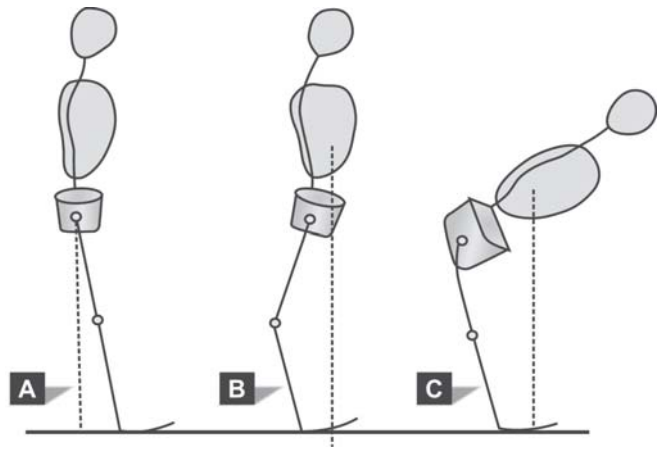


Fig. 6.3



Figs 6.2 to 6.4: Balance between hip and knee joints during walking

the ankle joint. There extreme intrinsic stability when ankle is in plantar flexion.

Body mass of the patient, body through posteriorly angled tibial is an added restraint to ankle movement, so no extrinsic force required to lock the joint when the patient is standing with ankles plantar flexed. However, once travel is initiated the ankle moves through full range of motion with ease. Body weight locking mechanism is immediately lost as the tibia advances across the ankle. Falling forward of tibia is restrained by considerable muscle force. Knee locking becomes difficult in the absence of the ankle stability, as its inferior segment is mobile (the tibia).

With dependence on primitive patterns of locomotion, the cerebral palsy cannot modify his plantar flexor force according to the situation. Slight plantar flexion response is inadequate to control tibia as it moves forward over the highly mobile ankle joint. The resulting posture is dorsi flexion at foot with tendo-Achilles stretched to maximum length and corresponding degree of knee flexion to keep the patient erect.

Functional coupling between ankle plantar flexion and knee hyperextension is well known but its need is seldom appreciated. Just 15° of plantar flexion of the ankle places the trunk behind the supporting foot, unless there is hyperextension at the knee flexion or a 2" heel on the shoe. Only on these combinations of compensations can the patient stand erect. Co-existing knee flexion of 15° so exaggerates the posterior position of the trunk, that not even 45° of hip flexion or a 3" heel will restore trunk foot alignment. Therefore, independent standing balance is lost.

Standing Stability during Walking

Walking dynamics presents two further challenges to the patient standing stability. He should be able to support trunk on one limb, and abrupt motion changes which follow floor contact must be controlled.

Lateral balance is desired on supporting body on one leg in addition to sagittal alignment.

This shifts body by 2 cm on the side of the supporting limb and pelvis level is maintained by strong abductor contraction of hip. Body schema timely functions for timely shift of one body and gets disturbed in brain damage. Awareness of body segment is lost, and does not account for their weight while balancing on one leg, one falls on the unsupported leg side without trying to catch himself—body image is impaired. This should be differentiated from Trendelenburg test which indicates weak hip abductors. In later case, the pelvis falls/drops on the unsupported side and the trunk falls to that side but body as a whole does not. Patient also moves promptly to catch himself and is aware of unsafe plight.

Hip abductors do not form part of primitive locomotor patterns, so support thus provided is lacking in pattern-dependent cases. Such patients will show Trendelenburg drop during single limb support, unless they have sufficient proprioceptive awareness and selective control to compensate by leaning over the supporting limb.

During gait, when swinging limb contacts floor—momentum is abruptly interrupted. Foot acts as a rocker while heel contacts floor-perpetuating forward motion efficiently.

Tibia advances rapidly continuously, if this advance is not controlled—leads to excessive knee flexion and sense of instability. In patients dependent on primitive locomotor patterns, the patterned activation of ankle plantar flexors checks tibial advance that accompanies the knee extension during late swing. If surgery has overlengthened the tendo-Achilles to provide good range of dorsi-flexion the tibial advance will not be controlled as the patient is dependent on primitive locomotor patterns cannot selectively increase the action of his plantar flexors to meet this increased demand. Spastic quadriceps if present, will react and provide necessary stability. The observed action will be brief knee flexion thrust and quick retraction. Attention is focused on knee but the seat of undesired function at the moment of the floor contact is the ankle, with its plantar flexors providing sufficient restraint.

When strong triceps surae keeps the ankle in plantar flexion, then knee stability is no problem but curtail seriously the advancement of

the body. The stereotyped muscle action, correction of equinus must be a compromise between the need for stance stability and need for adequate stride length.

Gait Characteristics

Postural stability and stepping ahead requirements vary during the course of a stride, several phases of action are defined. The basic ones being:

a. Stance and
b. Swing.

These terms are used to distinguish between limbs weight bearing period and its interval of free advancement. Further subdivisions are defined to differentiate event occurring within these broad categories.

Customary terminology used to describe normal function has been modified to accommodate variations seen in the paralytic gait.

Sub-phases are as under:

a. Floor contact-heel strike
b. Contact response,
c. Mid stance,
d. Terminal stance (push off),
e. Preswing (follow-up of push up),
f. Pick-up (early swing) and
g. Reach (late swing)
   - — Floor contact describes phase during which previously freely moving (swinging) limb becomes a stable weight bearing member.
   - — Mid stance is-interval during which trunk advances over a stationary foot.
   - — Terminal stance is subsequent period when foot alters its position on the floor.
   - — Prewing is the moment when knee flexes in preparation for pick-up.
   - — Pick-up is initial mechanics of advancing the unloaded limb, while, reach identifies the motion complex of gaining the final length of stride.

Stride Length

The distance one spans with each stride is attributed solely to the efficiency of the swinging limb. Such is not the case. 60% of the stride length is achieved only as a result of postural modifications by the

stance limb. Thus actions of the both limbs must be considered when assessing this aspect of gait.

Floor contact and contact response: Trunk advancement is uninterrupted when floor contact is made with the heel, as the forward motion is perpetuated by a rocker like response in the foot and knee. The normal response to heel contact is a rapid but controlled drop to a flat foot position accompanied by moderate advancement of tibia.

Normal heel strike is dependent, not ankle being at 90° but also on full knee extension and on hip flexion of 30°. Failure to achieve any of these three positions causes the toe to approach the floor. Result is either a flat foot or toe-contact, depending on degree of position loss. In cerebral palsy flexed knee and equinus ankle are often seen. When two occur together, the floor contact is made with the toe. Bracing the ankle to restore 90° posture converts this contact to a flat foot alignment, but does not give heel stride. Only by restoring also full knee extension will later be accomplished.

When toe contact is due to sustained ankle plantar flexion (active or contractual) the effect of weight bearing is to produce a backward thrust of tibia as the body weight pushes the whole foot on the floor. This prevents advancement of the limb; in fact, its course of motion is reversed. Trunk advancement is also halted momentarily. Toe contact also creates a rapid stretch on the tense plantar flexor causing increased spasticity.

If the foot is in such severe equinus that the weight is borne only on the most anterior area of the metatarsal heads, the foot serves as a small rocker and forward momentum is not interrupted.

Mid Stance

During this single support period, foot is stationary and is normally flat on the floor. Advancement of the trunk over this stationary foot is continued by momentum and as a result the knee is dorsiflexed. Progression from original 15° of plantar flexion to about 10° of dorsiflexion (at which point heel rises) is gradual under the control of soleus. Both soleus and gastrocnemius which joins it a bit later, undergoes a yielding contraction as they restrain tibia from advancing too fast, yet do not restrain it completely.

Such graduated muscle action is not available to the patient dependent of primitive locomotor patterns and subject to vestibular, extensor tone and spasticity, instead plantar flexor muscle remains strongly contracted at one position, thereby excessively restraining tibia and perpetuating the plantar flexion posture at the ankle.

Hyperextension thrust is created on the knee while momentum continues to carry trunk forward. If knee does not yield, the force is reflected upwards to the hip causing it to flex. Stride length at this moment is limited to the amount of advancement permitted at the ankle, knee and hip. The short swing of other limb visualises the effect. If hip and knee yield sufficiently to place body weight over the most anterior portions of the forefoot, a rocker is created that lets the trunk advance smoothly. However, lack of terminal stance, hip extension or knee flexion severely limits advancement of trunk, and contralateral swing is shortened. If the mechanism causing the sustained plantar flexion is spasticity superimposed on selective control, tendo-Achilles lengthening is effective way of gaining ankle mobility during midstance phase. The stretch response is thereby avoided. Post-surgical gain is less evident if the patterned muscle action is prominent as the patient still lacks the ability to graduate his muscle action.

If soleus overactivity (patterned or spastic) the need to place trunk ahead of the supporting foot as one walks leads to progressive genu recurvatum. The rapidly growing tissues in a young child are most susceptible.

A weak soleus leads to a flexed knee stance and reduction in stride length, cause being either excessive surgical lengthening of tendo-Achilles or poor spontaneous activity. Lacking soleus restraint the tibia falls forward in response to the foot contacting floor. As femur and trunk are advancing less rapidly, knee flexion results. Loss in stride length corresponds to failure of the trunk to advance beyond the flexed knee.

Terminal stance: This phase of gait is the final period of single support. In normal gait, the onset of "terminal stance" is when the heel rises from the floor as the trunk passes over the toe. The strong triceps surae action stabilizing the ankle at neutral, body weight is progressively transferred to more anterior parts of the forefoot. By the end of this phase, the trunk has well moved ahead of the foot, so increasing length of the stride by about 20% because during terminal stance there is increased pressure against the floor followed by rapid planterflexion of the ankle, this was initially called "push off". More recent analysis deny any actual push. Instead foot action during this final period of single support should be considered as a rocker action to further advance the trunk.

The cerebral palsy is denied this rocker action by his fixed plantar flexion. The posteriorly aligned tibia and foot become one lever which is too long to roll over unless forward momentum is sufficient to

produce the necessary marked elevation of the trunk. Therefore, trunk advancement is curtailed. In this situation, the knee tends to lock and the foot is prevented from being lifted until weight has been transferred to the other foot.

Weak planterflexor muscles deny the sufficient ankle stability for heel rise. Hence position characteristic of terminal stance is lacking. Instead limb is lifted in toto after weight is on the other foot, with a corresponding loss in stride length and momentum.

Pre-swing: This is an internal of double support during which the trailing limb maintains floor contact while the leading limb is accepting body weight. Of prime importance is the 35° or 40° of knee flexion occurring during final moments of toe contact. It prepares the limb for further knee flexion needed for easy toe clearance during early swing. The rapid knee flexion mechanism seem to be the considerable forward alignment of the trunk mass unlocking the previous extensor alignment. An additional factor by abrupt unloading of the previously taut gastrocnemius, as there is an associated ankle plantar flexion and virtual cessation of weight bearing and continued floor contact and knee stability are maintained by slight quadriceps activity.

Like the terminal stance, the pre-swing phase is denied to cerebral palsy slight rather than full tension of quadriceps is not available with patterned action. Also approach into flexion creates a stretch on tense muscle, inducing spastic response that adds further tension. Hence an extended rather than flexed knee is the final posture. This does not occur if knee flexion and ankle plantar flexion are so severe that weight is borne only on the more anterior part of the forefoot.

Swing: With body weight entirely on other limb, the trailing extremity is free to swing forward for the next stride. Differences in knee motion divide the swing phase into two separate tasks: "pick-up" and "reach."

Initial Swing (Pick-up)

"Toe off" is a common designation for the onset of the swing phase of the gait. The dominant action at this time is knee flexion. The postural relationship between the limb and the trunk at the end of stance places the limb behind the body with the toe pointing down, i.e. there is a natural equinus. To knee is in about 35° of flexion as a result of the pre-swing stance action. To avoid dragging the toe while the limb advances, the knee must flex an additional 35°. The hip need flex only half this amount. Following a brief continuation of plantar flexion rebound seen during last movements of stance, the ankle progressively dorsiflexes.

By the time the foot passes the supporting limb, the previous position of 20° of plantar flexion has been recovered.

In cerebral palsy toe clearance is difficult to achieve, and limb appears stiff. The pre-swing knee flexion of terminal stance is lacking. In fact, because at the end of "stance" the hip is in extension, knee flexion at this time is likely to provoke a spastic reaction of quadriceps and in particular, of rectus femoris. In patterned gait, dependence on the flexor withdrawl reflex means that flexion of the knee is always accompanied by roughly an equal amount of hip flexion.

Yet for normal gait the knee should proceed twice as fast. One advantage of the patterned gait is that knee flexion is accompanied by simultaneous dorsiflexion of the foot. A second advantage is the relative shortness of the stride which lessens the obstacles created by the training position.

The advantages thus partly balance the disadvantages, and permit minimal toe-clearance, but with a stiff-looking limb.

Terminal swing (Reach): With the foot now ahead of the body, the need for knee flexion to avoid a dragging toe no longer exists. Now the objective is to extend the knee for maximum stride length. During the first part of this knee extension period, the hip and ankle continue to flex until hip flexion of 30° and neutral ankle alignment are attained. These positions are then maintained, while the knee continues to extend during the rest of the reach phase.

Knee extension is primarily a passive pendulum like motion. After pick-up, the knee flexors-short biceps and gracilis-relax and the limb swings forward.

The functional requirements for an effective "reach" seem simple, but have provoked to be complex neurologically. Only the patient with unfettered selective control can fully accomplish the necessary mixture of motions—the cerebral palsy patient with his spasticity and dependence on primitive locomotor patterns cannot.

Poor reach due to incomplete knee extension may be caused by hamstring spasticity. Delay in the relaxation of the knee flexors following "pick-up" subjects them to the pendulum like swing of the shank (tibia).

These hypersensitive muscle are stretched leading to a spastic restraint of knee extension.

Dependence of patterned locomotor control permits use of the flexor or extensor limb synergies, but not mixture of the two. Thus, while the hip is held in flexion, the knee automatically flexes an equal amount. The result is a vertical shank (tibia) with foot parallel to the floor and short strode. Efforts to extend the knee initiate the extensor

synergy, and hip flexion is lost. This causes general retraction of the limb. Many cerebral palsies have selective control and are able to partially escape the restraints of purely patterned gait.

Foot posture is similarly influenced by patterned action. As the knee is extended to reach forward, the triceps surae is also activated, causing a plantar flexion at the ankle. A combination of increasing flexion of ankle, a loss of hip flexion and incomplete knee extension results in a "toe down" foot position. The anterior tibialis commonly exhibits a spastic response which is detectable on electromyography but is too weak to hold up the foot. It must be recalled that the gastrosoleus muscle mass is five times greater than that of the anterior tibialis, so the odds favor equinus posture.

Because of cerebral palsy limited ability to modify his responses, correction of postural irregularities must be planned so as not to deprive him of his ability to move. The basic requirements during standing are a stable base, centering of the trunk over this base (the feet), and sufficient latitude is alignment for the patient to be able to move without falling. To take a step he must be able to pick-up the limb sufficiently to clear his toe and to advance it a useful amount.

Management of cerebral palsy gait is a compromise between the need for standing stability and the need to be able to take a step. The more a patient is dependent on patterned control for walking, the less opportunity therapists and surgeons have to improve his gait.

7 CHAPTER Spinal Deformities in Cerebral Palsy

DEFORMITIES OF THE SPINE AND PELVIS

Since mostly people concentrate on locomotion and limbs, the spine and pelvis are neglected often. This demands subdivision into other facets which demands view. These pelvic and spinal deformities can be classified as under:

A. Spinal deformities:
   1. Scoliosis,
   2. Thoracic kyphosis,
   3. Lumbar lordosis,
   4. Degenerative disc diseases
B. Pelvic deformities:
   1. Increased posterior inclination,
   2. Increased interior inclination,
   3. Rotation,
   4. Obliquity,

Scoliosis

The location of the curve is as follows.

Thoracic curve: T_5 to L_1 with apex at T_9 or T_{10}
Lumbar curve: T_{12} TO L_5
Thoraco lumbar curve: T_8 to L_4
Double main curve (primary curve)
T_5 to T_{11} and T_{12} to L_5

Etiology: Due to marked differences in ambulatory and nonambulatory cerebral palsies with scoliosis, the etiology will be discussed separately.

Scoliosis in Non-ambulatory CP

The spinal curvature in non-ambulatory patient appears to be of a similar type to that found in patients with other paralytic diseases such as polio, muscular dystrophy, etc. Some biopsy of sacrospinalis muscle has shown neurogenic atrophy.

The other cause being asymmetrical persistence of the infantile incurvatum reflex—Galant's reflex—may be of prediction of scoliosis in cerebral palsy. "Stroking the flank results in convex curvature of the spine away from the side stroked, with wind blowing of the hips towards the concavity of the curve."

This elicited by stroking the dorsal skin alongside the vertebral column, so that the trunk curves with the concavity on the stimulated side. It is present in all newborn babies and disappears by 9th day. Whether test is +ve or –ve, the followup studies continue in cerebral palsy.

Scoliosis in the Ambulatory Cerebral Palsy

The spinal curves are not so distinct in ambulatory patients than in non-ambulatory patients:

a. S is higher in this category.
b. S is mostly in cerebral palsy ataxic type.
c. Spinal curvature associated with ataxic cerebral palsy is similar to idiopathic.
d. Scoliosis is present in Friedriech's ataxia.
e. Sensory defects exist in scoliosis.
f. Brain changes—enlargement of 3rd ventricle are seen in scoliosis.
g. Lesions of caudate nucleus have developed scoliosis convex to the side of the lesion: destruction of the opposite caudate nucleus has straightened the spine.
h. Abnormalities of the postural tone.

Non-ambulatory cerebral palsy has lack of normal postural control is clear. The absence of equilibrium reactions differentiate between ambulatory and non-ambulatory cerebral palsied which appear in 6 months old infant. Those with borderline equilibrium reactions resume crutches. Both the types of cerebral palsies have varying degrees of deficiency of equilibrium reactions.

Treatment: Preventive measures first and find out the same by early clinical and radiological examination. Scoliosis appears mostly in non-ambulatory cerebral palsy.

Milwaukee has not been used for scoliosis in spastic and athetoids as it is not tolerated easily. This provides excellent head and neck control in cerebral palsies who cannot sit otherwise alone. The neck gets compressed on side bars as they consistently lean to one side. The large ring may be used to connect chin and occiput support which relieves discomfort.

At the age of 10 years when spine is flexible then, spinal fusion can be performed with fairly good results. Severely spastic post-

operatively can be given halo-femoral traction. Plaster casts are not tolerated. Some athetoids are treated without casts and bed rest for six months have been advised.

Ataxic can be allowed to move in plaster jacket after three months of bed rest after spinal fusion. Extra-weight of cast make top weight of ataxic heavy, he may need a cane or walker during 3 months of postoperative ambulation in the plaster jacket.

Thoracic Kyphosis

Many children when sit up have it but without structural changes. Bobath explained the kyphosis as a compensatory mechanism, to bring the trunk over pelvis when the child has insufficient flexion of the hips due to extensor hypertonus.

Fixed thoracic kyphosis has been observed in spastic cases with ectodermal dysplasia. Those patients had contracted hamstring muscles but lengthening of hamstring tendons did not affect kyphosis and only caused lumbar lordosis more and can be managed better with Milwaukee brace with a posterior pressure pad over the thoracic spine. The thoracic scoliosis has developed occasionally in ambulatory patients who have excessive lumbar lordosis.

Early correction of lumbar lordosis by iliopsoas recession may obviate this compensatory kyphosis. Those who use crutches have forward shoulder couping and concomitantly high thoracic kyphosis in spastics. Attempts to stretch the shoulder girdle into extension have not been successful.

Early release of pectoralis minor muscle in young patient before fixed changes occur does seem to be a promising method of correcting the forward couping of the shoulders.

Lumbar Lordosis and Pelvic Inclination

They are intimately linked in cerebral palsy patient and hence discussed together.

Biomechanical analysis: The degree of lumbar lordosis in cerebral palsy is dependent upon the degree and direction of pelvic inclination. Pelvic inclination is dependent on the degree of hip flexion deformity. With a hip flexion deformity, weight bearing makes the lumbar spine and pelvis conform to the hip flexion deformity. The position of knee decides the ultimate posture.

In spastic children two different compensatory mechanisms to the hip flexion deformity, with two different spastic patterns can be observed. One is spastic quadriceps with a hip flexion deformity. In this pattern the pelvis is inclined anteriorly, the lumbar spine becomes lordotic and the knees are extended.

In second pattern the patient has spastic hamstrings and a hip flexion deformity. The pelvis is inclined posteriorly to the patient where it is finally checked by the anterior ligaments of the hip. The lumbar spine becomes flat and the knees flexed. These patients are sitting down when standing up. Patients with hip flexion/knee flexion patterns, forced extension of the knees, by bracing or by sectioning, lengthening and transferring the hamstring tendons, tend to increase disability, by forcing the pelvis to rotate into excessive anterior inclination and so producing lumbar lordosis. The range of extension of the lumbar spine in such patients is limited, so many lean forward to maintain center of gravity over their feet.

Symptoms: Old cerebral palsied complain of low back pain associated with severe lumbar lordosis.

Treatment: Lumbar lordosis in spastic patients responds neither to exercises nor to corsets on braces. Mostly recession or lengthening of iliopsoas will decrease lordosis.

Iliopsoas tenotomy as a means of correcting lumbar (spine) lordosis which should permanently severe loss of hip flexion which is a severe additional loss to a patient who never walked with crutches. Therefore, iliopsoas recession or lengthening is advisable.

Excessive lumbar lordosis in the spastic patient is a postural adaptation to the hip flexion deformity. Existing muscles balance is best possible and that since correction of the lordosis will result in some weakness of hip flexion it is not with doing.

Pelvic Obliquity

Etiology: may be due to muscle contractures above and or below the iliac crest. Mostly due to adduction contracture of one hip. The mechanics of adduction contracture with apparent shortening of the involved extremity. Most of these pelvic obliquities are seen in spastics or tension athetoid quadriplegic patients. In these patients muscle spasms and contractures occur above the iliac crest, and pelvic obliquity is a part of the scoliosis.

Treatment

In the non-ambulatory patient who has a pelvic obliquity and no scoliosis other than reversible compensatory lateral curve of lumbar spine, the adduction contracture of the hip can be relieved with adductor myotomy and anterior branch obturator neurectomy.

In the non-ambulatory patient in whom the pelvis is involved in scoliosis, skeletal femoral traction, in addition to release of hip contractures may be necessary to level the pelvis. Fusion of spine should extend into sacrum to keep pelvis level. Surgical release of quadratus lumborum and the sacrospinalis muscle on the high side of the pelvis has not been rewarding as a procedure for correcting flexed pelvic obliquity.

Pelvic rotation

Clinical observation

Lateral (external) rotation of the pelvis has been noted in the patients with spastic paralytic dislocations of the hip, the pelvis being rotated laterally on the side of the dislocation.

Some spastic ambulatory patients who have asymmetrical involvement or hemiplegia have a persistent medial (internal) rotation of the pelvis. In such cases entire trunk or shoulder girdle rotate forward or have hip flexion deformity and limited external rotation of the hip.

Symmetrically involved ambulatory spastic diplegic or paraplegic patients exhibit a gait similar to that of patients who have had an arthrodesis of the hip.

These patient may show pelvic-femoral fixation due to a flexion deformity of the hip. This mechanism can be best shown by having the patient hold on to a table, stand on one leg, and let the other swing back and forth, as the femur flexes and extends, the pelvic roll can be seen. When these patients with partly fixed hips walk, the pelvis rotates medially and then laterally in order to swing the limb through.

Biomechanical analysis: When the foot is fixed, as in standing or in the stance phase of gait, the pelvis rotates about the head of the femur. The internal rotation of the pelvis in this situation is equivalent to external rotation of the hip. If the hip is limited in external rotation, the pelvis cannot rotate internally and stays behind so that the opposite side of the pelvis is persistently rotated forward. Persistent unilateral internal pelvic rotation can also occur after too much correction of medial formal torsion by derotation femoral osteotomy. It is better to leave about 20° of internal hip rotation when performing a derotation femoral osteotomy.

In order to correct persistent medial rotation of the pelvis, iliopsoas recession also helps. Postoperatively no significant change in the position of the pelvis occurs. In such cases, spastic rotation of the

entire trunk precludes further corrective surgery. Iliopsoas recession reduces degree of pelvic-femoral fixation and pelvic rotation in hip flexion deformities.

Degenerative Arthritis of the Spine

The constant head and neck motion in athetoids over years causes neck pain. Narrow intervertebral disc spaces and spurring at the edges of contiguous vertebrae were often seen radiographically. Immobilization due to cervical spondylitis helped. But in few the spinal compression was seen due to cervical spondylitis.

8 CHAPTER Treatment Approaches in Cerebral Palsy

QUTLINE OF TREATMENT APPROACHES

There are many systems of treatment for cerebral palsy.

Muscle Education and Braces

Phelps combined occupathonal therapy, physiotherapy and speech therapy together to form rehabilitation teams. The main points of this treatment approach were:

a. Specific diagnostic classification to plan treatment of cerebral palsy child.
b. Fifteen modalities were used to treat cerebral palsy with specific combinations, for specific type of cerebral palsy.

The modalities were:-

1. Massage: for hypotonic muscles, contraindicated in spastics and athetoid.
2. Passive motion through joint range for mobilizing joints and demonstrating to child the movement desired. Speed is slow for spastics and rapid for rigidity.
3. Active assisted motion.
4. Active motion.
5. Resisted motion followed according to the capability of the child.
6. Conditioned motion is recommended for babies, young children and mentally retarded.
7. Confused motion or synergic motion which involves resistance to a muscle group in order to contract an inactive muscle group in the same synergy. Mass movement as in extensor thrust or the flexion withdrawl reflex are usually used, e.g. using hip knee flexion dorsiflexion synergy, inactive dorsiflexors are stimulated by resistance given to hip flexors.
8. Combined motion is training motion of more than one joint such as a shoulder and elbow flexion using modalities 2, 3, 4, 5 above.
9. Relaxation techniques used are those Fink's conscious "letting

go" of the body and its parts and Jacobson's method of tensing and relaxing parts of the body.

These are mainly used for athetoids. They attempt to lie still or relaxed or use contract-relax relaxation for grimacing and other voluntary motion.

10. Movement from relaxation is conscious control of movements once relaxation has been achieved. It is used to control involuntary movements in children.
11. Rest: Rest periods suggested for athetoids and spastics.
12. Reciprocation is training movement of one leg after the other in a bicycling pattern in lying, crawling, knee walking and stepping.
13. Balance: Training of sitting balance and standing in braces.
14. Reach, grasp and release used for training of hand functions.
15. Skills of daily living such as feeding dressing, washing and toileting.

Braces or Calipers

Phelps advised special braces to correct deformities to obtain the upright position and to control athetosis. Bracing is extensive and worn for many years. The children are taught to step and walk with braces with pelvic bands and back supports or with spinal braces sometimes. After progress back supports are removed, then pelvic belt and finally only below knee brace. The control on locks can also be taught.

Muscle Education

Spastics are given muscle re-education based on an analysis of whether muscles are atonic, week, normal spastic muscle to obtain balance between the two. Teach attetoids to control simple joint motion and do not have muscle education. Strengthening activities to ataxics to strengthen muscles.

Others like Deaver, Pohl, Plum, Rood, Tardieu have developed ideas on bracing and muscle education.

Deaver uses braces for ambulation, eliminating brace elements as the child's control improves-concentrates on self care or activities of daily living particularly the independent use of wheel chairs.

Pohl focuses the child's attention on individuals muscle for training movement. Progress is made to movements of the limb and body.

Plum stresses strengthening spastic muscles as well as their antagonists. He exercised them in their outer ranges as muscles are usually shortened, whereas antagonists are exercised in their middle and inner ranges.

Tardieu in their "factorial analysis" identifies the specific problems in the muscles which gives rise to abnormal movements or deformities.

Alcohol injections are used to reduce spasticity, muscle education, specific bracing and a preference for early orthopedic surgery are recommended. Tardieu covers the neurodevelopmental approaches and studies.

Progressive Pattern Movements

Temple fay: A neurosurgeon in Philadelphia, recommends that cerebral palsy be taught motion according to its development in evolution. He regards ontogenic development (in man) as a recapitulation of phylogenetic development (in the evolution of the species). This meant development of motion from reptilian squirming to amphibian creeping, through mammalian reciprocal motion "on all fours" to the primate erect walking.

As lower animals carry out early movements of progression with simple nervous system, they can be similarly carried out in human beings also in absence of normal cerebral cortex.

The midbrain, pons and medulla could be involved in the stimulation of primitive (fashion) patterns of movements and primitive reflexes which activate the handicapped parts of the body.

He also described "unlocking reflexes" which reduce hypertonus. On these ideas, he based the progressive pattern movements consisting of five stages:

Stage I: Prone lying—Head and trunk rotation from side to side.

Stage II: Homolateral stage—Prone lying, head turned to side. Arm on the face side in abduction-external-rotation, elbow semiflexed, hand open thumb out towards the mouth. Leg on face side in abduction, knee flexion opposite stomach, foot dorsiflexion. Arm on occiput side extended, internally rotated, hand open at the side of the child or on the lumbar area of his back. Leg on occiput side extended movement involves head turning from side to side with the face, arm and leg sweeping down to the extended position and the opposite occiput arm and leg flexing upto the position near the face as the head turns round.

Stage III: Contralateral stage—Prone lying, head turned to side, arm on the face side as in stage 2. Leg on face side is extended. Other leg on the side of the occiput is flexed. As head turns this contralateral pattern changes from side to side.

Stage IV: On hand and knees reciprocal crawling and on hands and feet stepping in the bear walk or elephant walk.

Stage V: Walking pattern—This is a "sailor's walk" called by "Fay" reciprocal progression on lower extremity synchronized with the contralateral swing of the arms and trunk. A wide base is used and the child flexes one hip and knee into external rotation. As the foot is being placed on the ground, the opposite arm and shoulder are rotating towards it. As weight is taken on the straight leg, the other leg flexes up.

The Doman-Delacato system which follows the basic tenets postulated by Fay also recommends periods of CO_2 inhalation from a breathing sack, restriction of fluid intake and development of cerebral hemispheric dominance. Cerebral dominance is attempted by principal use of dominant eye, hand, foot and arm and other methods. Child is hung upside down and whirled around to stimulate the vestibular apparatus. They are also asked to hand and 'walk' their hands along a horizontal ladder as observed in apes.

These progressive pattern movements are practiced for 5 minutes passively at least five times daily. One person turns the head, other person moves the arms and leg on one side, and other person the arm and leg on the other side.

Locomotion beyond the stage of the child's patterning level is not permitted. A non-proficient child in cross pattern creeping is prevented from walking.

Neurological organization is considered possible if each developmental level is established before going to the next level.

Synergistic Movement Patterns

Signe Brunnstrom, a physiotherapist produces motion by provoking primitive movement patterns on synergistic movement patterns which are observed in fetal life or immediately after pyramidal tract image. The main features are as follows:

Reflex Response

Reflex response is used initially and later voluntary control of this reflex patterns is trained. Most of it has been on hemiplegics in relation to the studies on the stages of the recovery of flexion and extension limb synergies leading to isolated motion.

Control of head and trunk is attempted with stimulation of attitudinal reflexes. This is followed by stimulation of various reflexes and later balance training.

Associated reactions are used as well as "hand reactions", e.g. hyper-extension of the thumb produces relaxation of the finger flexors.

Brunnstorm used proprioceptive and other sensory stimulation in the training program for adult hemiplegics.

Proprioceptive Neuromuscular Facilitation Techniques

Herman Kahat: A neurophysiologist and psychiatrist in USA discussed various neurophysiological mechanism which could be used in therapeutic exercises. Occupational therapists use in the form of therapeutic activities.

With Margrent Knott and Dorothy Voss, he developed a system of movement facilitation techniques and methods for the inhibition of hypertonus. Main features of these methods are the use of the following:

Movement Patterns: called mass movement patterns based on pattern observed within functional activities such as feeding, walking, playing tennis, golf or football. These are spiral patterns, i.e rotational and diagonal with synergy of muscle groups. These movement patterns consist of following components.

1. Flexion or extension,
2. Abduction or external rotation, and
3. Internal or external rotation.

Sensory (afferent) stimuli are skillfully applied to facilitate movement. Stimuli used are touch and pressure, traction and compression, stretch, the proprioceptive effect of muscle contracting against resistance and auditory and visual stimuli.

Resistance to motion is used to facilitate the action of the muscle which form the components of the movement patterns.

Special Techniques

1. *Irradiation:* This is predictable overflow of action from one muscle group to another within a synergy or movement pattern or by reinforcement of action of one part of the body stimulating action in another part of the body.
2. *Rhythmic stabilization:* which use stimuli alternating from the agonist to its antagonist in isometric muscle work.
3. *Stimulation of reflexes:* such as mass flexion and extension.
4. Repeated contractions of one pattern using any joint as a pivot.
5. Reversals from one pattern to its antagonist and other reversals based on the physiological principles of successive induction.
6. Relaxation techniques such as contract relax and hold-relax. Ice

treatments are used for relaxation of hypertonus. There are various combinations of techniques.

Functional work or 'mat work' involves the use of various methods mentioned above in training rolling, creeping, walking and various balance positions of sitting, kneeling and standing.

Neuromotor Development

Eirene Collis, a therapist and a pioneer in cerebral palsy in England stressed neuromotor development as a basis for assessment and treatment. Her main points were:

- The mental capacity of the child would determine the results.
- Early treatment was advocated.

MANAGEMENT

The word 'treatment' was considered misleading in that besides the Physiotherapy session there should be management of the child throughout the day. The feeding, dressing, toileting and other activities of the day should be planned.

Strict Developmental Sequence

The child was not permitted to use motor skills beyond his level of development. If child was learning to roll he was not allowed to crawl or if crawling he was not allowed to walk. At all the times child was given picture of correct normal movement and as posture and tone are interwoven. Collis placed the child in "normal postures" in order to stimulate "normal tone".

Once postural surety was obtained achievements were facilitated and developmental sequences were followed throughout this training.

She evolved the idea of cerebral palsy therapist than separately occupathonal therapy, physiotherapy and speech therapists.

Neurodevelopmental Treatment with Reflex Inhibition and Facilitation

Karl Bobath, a neuropsychiatrist and Berta Bobath, a physiotherapist, based assessment and treatment on the premise that the fundamental difficulty in cerebral palsy is lack of inhibition of reflex patterns of posture and movement.

The Bobath, associate these abnormal patterns with abnormal tone due to overaction of tonic reflex activity. These tonic reflexes such as the TL reflex, STN reflex, ASTNR, have to be inhibited.

In addition, various primitive reflexes of infancy should also be inhibited. Once abnormal tone and reflex patterns have been inhibited there should be facilitation of more mature postural reflexes. All this is carried out in a developmental context. Main features are: "reflex inhibitory patterns" specifically selected to inhibit abnormal tone associate with abnormal movement patterns and abnormal posture.

Sensorimotor Experience

The reversal or 'break down' of these abnormalities gives the child the sensation of more normal tone and movements. This sensory experience is believed to feedback and guide more normal motion. Sensory stimuli are also used for inhibition and facilitation and voluntary movement.

Facilitation techniques for mature postural reflexes:

- "*Key points of control*" are used by the therapist for inhibition or facilitation.
- *Development sequence* is followed and adapted to each child.
- *All day management* should supplement treatment session, parents and other are advised on daily management and trained to treat the children.

Sensory Stimulation for Activation and Inhibition

Margret Rood: Physiotherapy and occupathonal therapy based her approach on many neurophysiological theories and experiments. The main features of her approach are:

Afferent stimuli: The various nerves and sensory receptors are described and classified into types, location, effect, response, distribution and indication. The stimulation techniques such as stroking, brushing (tactile) icing, heating (temp.), pressure, bone pounding, slow and quick muscle stretch, joint retraction and approximation, muscle contractions (proprioception) are used to activate, facilitate or inhibit motor response.

Muscles are classified according to various physiological data, including whether they are for light work muscle action" or "heavy work muscle action". Appropriate stimuli for their actions are suggested.

Reflexes other than the above are used in therapy, e.g. TL reflexes, tonic neck, vestibular reflexes, withdrawl patterns, etc.

Ontogenetic developmental sequence is outlined and strictly followed in the application of stimuli:

1. Total flexion or withdrawl pattern (in supine).

2. Roll over (flexion of arm and leg on the same and roll over),
3. Pivot prone (prone with hyperextension of head, trunk and legs),
4. Co-contraction neck (prone head over edge for co-contraction of vertebral muscles),
5. On elbows (prone and push backwards),
6. All fours (static, weight shift and crawl),
7. Standing upright (static, weight shifts), and
8. Walking (stance, push off, pick up, heel strike).

Vital fuction: A developmental sequence of respiration, sucking, swallowing, phonation, chewing and speech is followed. Techniques of brushing, icing and pressure are used.

Reflex Creeping and Other Reflex Reactions

Vaslav Vojta, a neurologist working in Czechoslovakia, developed his approach from Temple Fay and Kabat. Main features being as follows:

Reflex Creeping

The creeping patterns involving head, trunk and limbs are facilitated at various "trigger" points or "reflex zones". The creeping is an active response to the appropriate triggering from the zones with sensory stimuli. The muscle work used in the normal creeping patterns or "creeping complex" have been fully analysed. The occupational therapist must be skillful in the facilitation of these normal patterns and not provoke "pathological patterns".

Reflex rollings: Also used with special methods of triggering.

Sensory stimulation: Touch, pressure, stretch and muscle action against resistance are used in many of the triggering mechanisms or in facilitation of creeping therough various activities also.

Resistance is recommended for action of muscles. Various specific techniques are used to apply the resistance so that either a tonic or a phasic muscle action is provoked. The phasic action (through range) may be provoked on, say, a movement of a limb creeping up or downwards. The tonic action, or stabilizing action, is obtained if a phasic movement is prevented by full resistance given by the therapist. Therefore, the static muscle action of stability occurs if resistance is applied so that it prevents any movement through range. Rising reactions are also provoked using resistance and all the methods above.

Conductive Education

Andras Peto in Budapest, Hungry, originated conductive education.

The main features are:
The integration of therapy and education by having:

A conductor: acting as mother, nurse, teacher and therapist. She is specially trained in the rehabilitation of motor disabled children in a specialized course. She may have one or two assistants/helpers.

- The group of children: About 15-20, work together. The groups are fundamental in this training system.
- An all day program: A fixed time table is planned to include getting out of bed in the morning, dressing, feeding, toileting, movement training, speech, reading, writing and other school work.
- The movements: Sessions of movements take place mainly on and beside slatted plinths (table/beds) and with ladder baked chairs. The movements are devised in such a way that they form the elements of a task or motor skill. The tasks are carefully analysed for each group of children. The task are the activities of daily living, motor skills including hand function, balance and locomotion. The purpose of each movement is explained to the children. The movements are repeated, not only in the movement sessions of say the "hand therapy class" or "plinth work", but also in various contexts throughout the day. The children are shown in practice how their exercises contribute to daily activities.

Rhythmic intension: The technique used for training the elements or movements in "rhythmic intention", the conductor and the children state the intended motion: "I touch my mouth with my hands". This motion is then attempted together with their slow, rhythmic counts of one to five. Motion is also carried out to an operative word such as "up, up, up" repeated in a rhythm slow enough for the children's active movement ability. Speech and active motion reinforce each other.

Individual session: may be used for some children to help them participate more adequately in the work of the group.

Learning principles: These are basic to the program. Conditioning techniques and group dynamics are among the mechanisms of training discussed.

Cortical or conscious participation is stressed, as opposed to involuntary and unconscious reflex therapy.

Synthesis of Treatment Systems

While treating cerebral palsies the following aspects are kept into considerations:

1. The postural mechanisms.
2. Voluntary motion.
3. Perceptual motor function.

The Postural Mechanisms

In outline they consist of:

a. *Antigravity mechanism:* On the mechanism which helps support the weight of the body against gravity. It is also known as supporting reaction in infants by straightening reflex or "positive statz reaction".
b. *The postural fixation of parts of the body:* Head on trunk, trunk on pelvis and fixation of the shoulder girdle and pelvic girdle and the lower jaw, pharynx and tongue. Postural fixation of the body as a whole. Terminologies also used for this are "stability". "heavy work", "tonic activity".

Counterpoising mechanisms are associated with postural fixation. They are adjustments of the trunk and other parts of the body so that a movement can be made whilst the person maintains posture or equilibrium. The movements of the limbs or head provoke these adjustments of equilibrium.

Terminologies also used are "balance during motion", "weight shifts" "sway" and various "balance exercises" and movements superimposed on co-contraction.

Righting or rising reactions: The reactions make it possible for the person to rise from lying to standing, or sitting to standing or many other changes of position. Rising into position as well as returning to the original position are both part of these reactions. Other terminologies used are "assumption of posture", "moving into position" and movement patterns. The later is confusing as there are also movement patterns which are voluntary movements and different to these automatic change of posture. "Righting" is also used meaning either "sway" or "tilt" reactions and is not sense in which commonly used.

Tilt reaction when a person is tilted well off the horizontal plane and he adjusts his trunk so that he preserves his balance.

Reaction to falling or saving from falling: These are various reactions in the limbs which prevent the person from falling over, if the tilt reactions cannot preserve balance. These reactions do not occur on their own, stop falling over completely. For example, the arms may be thrown out to save the person from falling forward, sideways,

backwards and in more complicated patterns. If person is falling over from the standing position he may stagger, hop or quickly place a foot out to stop the fall. In sitting, kneeling and other positions the legs also move in order to save the person from falling from these positions.

Other terminologies are for these reactions "protective response". Particular arm saving reactions are also called" parachute reactions", saving and propping on the hands, "protective extension," "arm balance responses", "precipitation reaction" or "head protective response".

"Equilibrium reactions" or balance reactions" are also terms used which mean a combination of tilt and the limb reactions. These terms are confusing as all the postural reactions above are involved with equilibrium or balance. Maintaining a posture is synonymous with maintaining balance. Also lack of tilt reaction seems to augment limb saving reactions and vice versa. This is seen in ataxic and athetoid children.

In addition to above reactions there are also:

- Locomotive reactions which serve to initiate stepping, continue stepping and stop stepping.
- Occular postural reflexes and also control of facial musculature are also interwoven with the postural mechanisms.

These reactions can be stimulated within developmental training, using methods drawn from different systems of treatment. It is useful to follow motor development levels, for as the child acquires, the motor abilities in these sequences, he is acquiring these neurological mechanism. However, sequence may vary in normal and abnormal children.

Voluntary Motion

Which is purposeful, conscious, willed motion is sometimes confused with active automatic movements which occur in the postural mechanisms such as rising or saving from falling. Since some of the automatic movement synergies are also seen in voluntary movement, stimulation of the automatic patterns only corrects abnormal postures and movements but does not contribute enough to training of the voluntary motion. Voluntary motion uses many different synergies and there may be a great variety of synergies in any one child for a same task.

In time he chooses the most effective pattern. Voluntary motion is also bound up with postural mechanisms in that they help create stable postures so that limbs can be accurately used. Arm and hand

functions require postural fixation and counter poising of the trunk and shoulder girdle for co-ordination. Voluntary motion far more complex in that it is involved with perceptual, praxic and cognitive function.

Perceptual Motor Function

This is contributed to develop and stimulation of all the senses, linking of sensations, sensory discrimination, developing body image, body schema, spatial relationships and direction and other aspects relating to perceptual motor function.

Neuromuscular techniques in the various therapy systems may be integrated with the perceptual motor function.

Neuromuscular techniques in the various therapy systems may be integrated with the perceptual motor training.

Treatment Principles for a Synthesis of Therapy Systems

The common ground between different systems forms the principles of treatment.

General Principles of Treatment

They can be listed as follows:

1. Team work,
2. Early treatment,
3. Repetition of motor activity, whether it is neuromuscular techniques in treatment sessions or in the motor activity during all day management,
4. Sensory motor experience,
5. Motivation of the child.

Specific Principles of Treatment

They are as follows:

a. Developmental training,
b. Treatment of abnormal tone,
c. Training of movement patterns,
d. Use of afferent stimuli,
e. Use of active movements,
f. Facilitation, abnormal and normal "overflow", and
g. Prevention of deformity.

Most systems of treatment suggest following the normal developmental sequences of child development which is, however seems very superficial. The views differ whether to them strictly or

modify them. The views also differ as to whether to train total motor function such as rolling, crawling, standing or walking or to break each for the purpose of training. Many therapists prefer to train elements developing and build up motor function as well as train the total function—differing view on what these elements are. Some talk of muscle tone, different reflexes, different muscle work and other ideas-in addition basic motor patterns recommended as the basic abilities which underlie many motor functions on the developmental scales.

Bobath suggests training the fundamental motor patterns of head and trunk control, symmetry, extensor activity, rotation arm support and equilibrium reactions.

Rood suggests muscle work in main stages on ontogenic developmental sequence.

Vojta uses the basic creeping complex from which stabilization and rising are facilitated.

Fay uses levels of creeping, crawling and only prone development.

Cotton recommends symmetry, grasp elbow extension, hip flexion and mobility as fundamental in cerebral palsy. It is possible to contain all these view points in recognizing that:

Training postural reactions and locomotive reactions, described above, as well as movement patterns of voluntary motions include all these elements. Look at the postural reactions in each part of the body, i.e. head, shoulder girdle.

9 CHAPTER

Conductive and Special Education

PURPOSE OF EDUCATION

Education is meant for oneself to lead socially and economically purposeful life. It is not necessary that education should be concerned only with intellectual persuits but also for moral virtues. The word education is derived from the word educare, i.e. to lead out or to draw out and place the emphasis on development of potentialities of the individual and to train or mould towards the desired ideal.

SPECIAL EDUCATION

The relationship between a physical disability and mental deficiency has long been a subject of controversy and has been engaging the attention of many a educationist and psychologist from time to time. The educational development of the orthopedically disabled children is restricted by their disability. Special education methods are necessary for them. Education is a link between medical and vocational rehabilitation of the handicapped. It is a valuable tool with which the handicap can be conquered to eliminate disability. Many disabled are called stupid simply because their intellectual capacity has not had a chance of expressing itself to the fullest by means of usual modes of expression. The child who is orthopedically handicapped in early life and who has spent his previous years of school in bed or in hospital will have lesser opportunity to develop his mental abilities. Unless a special effort is made to provide appropriate education for him, he has no opportunity of mixing with others of his own age or to explore his environment owing to his physical limitations.

This training takes away the time which the usual children use for learning other things. Naturally, therefore, such children develop a narrow outlook on life and a narrow range of interest, unless they are given timely help to broaden them. Human growth is a physio-biological process in which emotions and intellectual elements are as important as physical ones. Anything, therefore, that interferes with

this process is likely to retard his growth. For example, learning to walk is an accomplishment of body but even more important is the sense of independence it imparts to the individual. The handicapped child continuously restricts his experience and therefore, shapes his mental, emotional and social growth subnormally. Ultimately, they are prone to frustration and likely to develop escapist tendency. The education of the disabled child must follow the law of compensation, i.e. the development of intellectual abilities to compensate for physical inadequacy.

Special Education and Its Relation to Normal Education

Handicapped children should be given education in accordance with the abilities and needs of the individual child and not by a set formula by way of fitting the individual child into a mould devised without reference to his special circumstances.

Special school like normal education is based on taking into consideration the whole child. Education must develop the talent, abilities whether physical, mental or moral. Education plays a vital role in building up of the individual and social health. Modern education is the technique that accounts for the interest in a particular child. It is not the educator who puts new facilities into man and imparts to him the breath of life. He only takes care that no untoward influence will disturb natural march of development. The moral intellectual and practical power of man must be nurtured within himself and not from artificial substitutes.

Type of Special Education Facilities

Different types of educational facilities are provided to suit different types of handicapped children and different stages of their illness:

1. House teaching,
2. Hospital schools,
3. Day and boarding special schools,
4. Special arrangements in ordinary schools, and
5. Correspondence school arrangement.

Components of a Special Education Program

The scope of the special educational programs vary with the economic resources of a community. However there are certain basic features which are common every where. They are (i) remedial treatment including intensified and specialised medical supervision of an occupational therapist when needed; (ii) suitable housing and special

equipment; (iii) special curriculum; (iv) transportation; (v) special guidance for child and parents; and (vi) recreational amenities.

Remedial treatment: A correct diagnosis is the first step in any school service for orthopedically handicapped. Treatment must proceed side by side with education. Medical care and occupational therapy are the integral part of education framing without maximum physical ability and co-ordination. The child is unable to take advantage of education likewise a child cannot benefit fully from medical care and treatment unless he is mentally stimulated by educational occupational therapy provided in school premises so that treatment may proceed side by side with education.

Special housing and equipment: There are special requirements in school buildings for the handicapped. Flooring must be such that no falls or slips are caused. It must permit use of wheel chairs and crutches, elevators and ramps are needed to accommodate the handicapped with wheel chair and those who are not permitted to climbstairs, wide doors are needed.

Special curriculum: The disabled need special creative outlook and opportunity to compensate them for the various fields of life in which they cannot take part. Good reading enables them to acquire knowledge through the printed words, information which the normal child acquires through direct personal contact and observation. The radio, the photograph and the film have special importance in the education of disabled children because they bring to their experiences from which they are otherwise prevented on account of their disability. In elementary grades there should be special provisions for craft work in addition to regular curriculum so that muscular co-ordination can be improved. At the secondary stage two types of instructions are desirable. One for those who could pursue higher education and one for those who would take up jobs. Curriculum should vary according to the stages of development. Recording after a dramatic way of teaching and stimulating interest in music. New realms of science can be introduced to children through imaginative use for simple magnate bells and thermometers, chemical, gardens and seeds can awaken their interest in interest in agriculture. History can be depicted through dramas. Group projects and arts like story telling, music, singing and painting provide a good outlet for creativity.

Transportation: Many children are deprived of education simply because they cannot travel to schools by ordinary modes of transport. Special education programs for these children must therefore, include provision of suitable transport.

Counseling: The vocational guidance of the disabled children must start early and must be based on an evaluation of his physical and mental capabilities and limitation. It is sufficient to give merely the best possible education and let the future take care of itself. Education is brought to hault unless it leads forward to the choice of a right career. The function of home education is essentially to satisfy the needs of children to prepare them for adult life.

Re-creational facilities: Disabled could, like other children, need recreation. Play serves a number of useful purposes. It is spontaneous outlet for excessive energy. It is expression of joy of living. It promotes physical growth through the exercise of muscles. The play for such children must serve two purposes:

1. It must meet their emotional needs,
2. It must stimulate the use of muscles in need of exercise.

Man cannot live well without companionship. Camping, scouting and picnicking enable a disabled child to learn cooperation, tolerance and teamwork. He is socialized through recreations. The disabled scouts and guides are known as extension scouts and guides.

Teacher of the Children with Physical Disabilities

Direct attention towards the teacher who is responsible for education and training of these children. The teacher is, of course, a specially trained person—the occupational therapist and the parents.

The elements that constitute a teacher training program are as varied as the progress of the institution in which they are provided. A natural leadership document on the preparation of teacher for children with physical disability has outlined five basic elements:

1. Prescribing and counseling of candidates.
2. Interaction with community representatives, other institutes and agencies.
3. Use of program components, curriculum and method of instruction.
4. Interaction with the local university.
5. Commitment of certain ethical positions.

Four areas for which the demonstrable competencies are required include pupil, progress, program effectiveness and profession interpersonal relationships.

Disabled Related Services

The services related to the treatment and education of the child with a physical disabilities are most of them thought of in terms of the persons who offer or perform these services. These persons working

in conjunction with one another usually have their own professional interest at the center of their approach of treatment. This may lead to fragmentation of services or at least to a lack of co-ordination and a conflict of interest. Although certainly not a few concepts in its approach to management, the team approach is the only one that fully contributes to the wellbeing of interest of the child.

Role of Physician

In physical evaluation the physician takes into account the total health development, to determine strong and weak areas of functioning including the extent of disability. He can refer the cases to specialists like orthopedic surgeon, occupational therapist.

Occupational Therapy

The occupational therapist is involved in (i) assessment of an individual functional ability both in terms of physical capability, cognitive and/or perceptual abilities (ii) treatment for maintenance of acquired levels of health and physical status (iii) preventive treatment to reduce or limit the effects of a disability and its possible progression and (iv) developmental or redevelopmental treatment, learn new skills and ability to relearn skills and ability though have been lost as a result of illness or injury. Other therapies are speech therapy, psychologist, social worker, recreational therapist, etc.

As educators become aware of the role of motor, sensory and perceptual development in continuum of learning, occupational therapists are hired to work in school setting. They work with preschool and young learning disabled-children in readiness. For skills and movement explanation, occupational therapists were hired to provide treatment sequencing for perceptual, motor, psychosocial and selfcare goals.

Special schools can also be opened with the help of voluntary associations. This is a very important educational setting in the treatment program.

The Directorate of Education, Delhi has also made arrangements for the orthopedically handicapped children. Such students are given special facilities by way of providing necessary appliances and gadgets to these students. They are given special allowance for traveling by bus besides other facilities like free-ships, books and school uniform.

The main aim is to make these students self reliant, so that they are no more a burden on the society. All out-efforts are made for their proper and effective rehabilitation to make them socially useful citizens. Those students who are severally handicapped, special

schooling facilities are provided to them so that they may have their education without any difficulty. The Directorate of Social Welfare and Ministry of Social Justice and Empowerment, Govt. of India, Delhi gives financial assistance to such educational institutions.

Purpose of Social Education

The purpose of social education is to bring about a proper adjustment of the child to his social environment. Education thus plays a vital role in the building up of individual and social health. The education of the crippled child must follow the law of compensation, i.e. the development of intellectual abilities to compensate for physical inadequacy. The idea of modern infant's school is that the child's interest should be awakened and he should be awakened and he should not be taught to read; for instance, until he is ready for it. Swimming is pleasant, enjoyable and useful, but before one can swim, effort and patience are necessary. Education must include development in the youngs, the skill and understanding which will enable them to play a useful and satisfying part in the economic life of the community.

Quality of Special Education

Nowadays generally education is based upon the recognition of individual differences amongst children. Generally, modern schools provide education in a way suited to the great variety of disabilities children and to the various stages of life from early childhood to adolescence. Disabled children should be given education in accordance with the abilities and need of the individual child, and not by a set formula, without reference to his special circumstances.

Special education like normal education is based on taking into consideration the whole child. Education must develop the latent abilities whether physical, mental or moral.

Before special services for physically handicapped children are set up, two steps are necessary:

i. Locating the child and
ii. Determining their eligibility.

Locating the children: As regards location, teacher or parents are able to observe some of the more obvious defects. There is an erroneous belief on the part of parents and teachers that lesser defects should not be reported. But these also need diagnosis and physio/ occupational therapy otherwise, they may develop into serious defects. Many a hidden handicap can be found out by class-teacher

who becomes alert in recognizing deviation in activity, response or accomplishment relating to these untreated physical handicaps. Elements in the school program which are highly effective in finding out disabled children are (a) a continuous census and (b) a school health program requiring physical examination of student from time to time.

Eligibility for special education: The eligibility of disabled children is determined by an educational authority on the basis of medical information secured from the child's physician. Education of the disabled children must start earlier than education of the normal child. Early education facilities, physical improvement as well as his transference to a regular school.

PROVISION FOR SPECIAL SCHOOLS

A special type of institution should be designed to provide integrated services of rehabilitation including physical and occupational therapy service, school education and pre-vocational/social exploration. Most of the orthopedic disabilities as, for example, polio, tuberculosis of bones and traumatic injuries require long periods of hospitalization. Children suffering from these disabilities must be taught that during this time they will loose years of schooling at a time when they can benefit from it most, if children in hospital schools are generally undergoing intensive medical treatment. Education of these children must, therefore, be proper education to children not only in the three R's, i.e. reading, writing, arthmatic but also give them educational poise, by creating an information atmosphere.

The provision of special school is limited only to those children whose disabilities are so severe that they cannot benefit by education in a normal school. For many children who are handicapped in more than one way, education in the usual surroundings, means daily experiencing of failure and consequent loss of self-respect and self confidence. They must therefore, be given at least a beginning in the sheltered surroundings of special school institution. Special schools for disabled children should, however, provide facilities for frequent mixing of crippled children with normal school children at parties, picnics, outings and entertainments as well as at debates, games, etc.

Nearly two-third of disabled children are able to take advantage of ordinary school facilities. It is in the school that child first learns how to get along with others, to respect the point of view of others, to submit to authority and to measure his strength as well as his weakness against that of others. Schooling in a normal atmosphere is the best safeguard against social and emotional ill-health. The disabled

children must be given a feeling of belonging to his group in his classroom. It is, therefore, very important that normal pupils understand the problems of their disabled classmate in their right prerspective. A disabled child should not be dramatized but he should be treated as normally as possible.

TEACHERS FOR DISABLED CHILDREN

Teachers of disabled children should be selected on the basis of non-sympathy, patience and imagination. Today the importance of personal relationship between the teachers and pupils is recognized by all educationists. Teachers for exceptional/disabled children are required to have two types of training:

1. The regular course for teachers of normal children and
2. Specialized training in their particular area of teaching.

The teachers of disabled children should have capacity for self-direction. They should have patience and perseverance. It is desirable that the teachers of disabled children should be physically fit at least as regards orthopedic handicap. They should be well adjusted from a psychological point of view.

TEACHING ORTHOPEDICALLY HANDICAPPED CHILD

Many children who encounter difficulty in the classroom cannot set their own limits or functions satisfactorily in an unstructured setting. Be kind but firm and consistent. The children with orthopedically handicapping conditions can work for very very short periods of time as compared to their peers, does create a problem. Make sure the child knows what he is allowed to do when that work is completed. If he receives immediate feedback on his completion of the work and its correctness, he will gladly turn to a cushion-activity while waiting for the others to finish. Disabled children are very much like other children, they respond better to a positive approach than to a negative approach. In every way possible, treat the disabled child just as you do your other children.

COMPONENTS OF A SPECIAL THERAPY PROGRAM

The scope of the special therapy program varies with the economic resources of a community.

They are:

1. Remedial treatment including physician, occupational and physio-therapy, speech therapy, social worker, psychologist, rehabilitation counseling.

2. Special equipments.
3. Special curriculum.
4. Special guidance for children and parents, and
5. Recreational therapy.

The team approach is the only one that fully contributes to the well being and best interests of the child. The treatment team consists of several members who have different functions or tasks to carry out in the prevention of certain events and in the striving for other events to take place. The overall goal of the team involves that it has the same central feature as that of the sport team-maximum independence.

"A true treatment team is a group of professionals working together—seeing, treating, following, making mistakes by others and learning to contribute and exchange views."

Remedial Treatment

Children should be referred to special education only after adequate diagnosis of their condition has been made by an appropriate specialist. A correct diagnosis is, therefore, the first step in any school service for disabled children. Medical care and treatment as well as occupational and physiotherapy have now become an integral part of any educational program for the disabled children. Without maximum physical ability and coordination the child is unable to take advantage of education.

Role of physician: Medical specialists with whom the school personnel are most likely to come into contact, are pediatricians and orthopedists. The pediatrician, a physician whose professional concern is with the care and treatment of children may be the primary physical and the school environment and the person responsible for recommending the child for placement in the school. The school pediatrician will most often see the child after the family pediatrician has made a recommendation for placement of the disabled children in a special school besides the special medical treatment or therapy. On referral, the school pediatrician will serve as a member of the team of specialists who will act as a part of the admission discharge committee for the child. This committee, composed of the pediatrician, occupational therapist, speech therapist, teacher, social worker, psychologist, school principal and parents, will meet to evaluate the child physically and his educational characteristics. For the physical evaluation, the physician takes into account the total health development of the child, including a medical or health history and an examination to determine strong and weak areas of functioning. At this point, the physician may have recommendation for physical care, including referral for

further evaluation and treatment by the occupational therapist. The orthopedic surgeon, who specializes in the functioning of the skeletal system, may advise surgical procedure or the use of braces or other appliances for prevention of deformities or for the enhancement of motor activities. In addition to physicians, there are several other professional persons who provide services to children with physical and perceptual problems. For children with severe motor and perpetual problems there will probably be a need for atleast three other professional services those of a physical therapist, occupational therapist and speech therapist.

Occupational therapy: Occupational therapy literally means treatment by work. The AIOTA defines occupational therapy as "any activity mental or physical and by occupational therapists for its remedial value."

The occupational therapist is concerned with the evaluation and treatment of perceptual motor functioning, particularly of fine motor coordination and control. The techniques develop muscle strength as well as visual perception. The occupational therapist can assist the teacher by providing methods to assist the child in developing self-help skills, including feeding and dressing and by making adaptive devices for children with fine motor weakness. Occupational therapists have provided teachers with educationally-relevant evaluation, devices and research. Physically its function is to increase muscle strength and joint motion as well as to improve the general health. Occupational therapy functions to provide normal activity as early as possible through vocational projects. Treatment of child with physical disabilities may include any of the activities perceptual assessment and training to establish the position of body in space, gross and fine motor activities that might be used in learning finger grasping and release movements required for daily living skills. Such activities lead directly to the functioning of the child in the class and should point the way towards a cooperative effort between the occupational therapist and the special education teacher. The cooperation of the professionals in these two areas may result in a program that will meet both the medical and educational needs of the child.

Functional Training in Activities of Daily Living

Training in the basic skills of daily living goes hand in hand with education. These activities are divided into three major groups: (i) self-care; (ii) locomotion and travel with appliances and (iii) hand activities. The physically disabled child must be trained to walk and travel, to care for his daily needs, to use normal methods of transpor-

tation, to use ordinary toilet facilities, to apply and remove his own prosthetic devices, if any and to communicate either orally or in writing.

Occupational Therapy: The occupational therapist implements a training program prescribed by the physician to develop muscles or motor movements. The treatment plan is always individualized. The goal of treatment is to allow the child to function as independently and efficiently as possible. The therapist can help the classroom teacher by providing sitting or standing devices, by suggestions, for positioning the child and techniques for moving children with braces and other prosthetics. The treatment may be either active or passive. The latter form, which comprises massage, bath, electrotherapy and heat and so on precedes of alternates with active treatment which involves group gymnastics, games and competitive sports under an occupational therapist.

Speech therapy: The speech therapist's special role is to help the child communicate orally while many are now also knowledgeable about language development. The speech therapist traditionally has been concerned with the production of speech and training the mechanisms to allow the child to talk. She can be a very helpful resource person to the teacher providing suggestions for stimulating speech and techniques for use in the classroom including those for strengthening oral musculature for feeding. The speech therapist's treatment then becomes not only one of correcting faulty speech pattern, but also one involving the establishment, and in some cases the re-establishment of the concepts and conditions needed for effective communication skills.

Social workers: The social worker may, from the beginning, be involved with the family. Feeling of fear, separation and isolation by the child and family attitudes of distrust towards professionals, who push and pull at the family's physician, mental and psychological pressures, are problems, that must be dealt with by the social worker.

Psychologist: The school psychologist is often seen by the teacher as a person who administers intelligence tests as the culprit behind the involved case description that accompany a child on placement in a class. The psychologist must be aware of the type of test available, their construction, their administration requirements and their interpretations.

Rehabilitation counseling: The role of the vocational rehabilitation counselor is not only includes assessment of the vocational skills of the child and the development of work training and work experience activities, it also involves an active community based component.

Special equipment: special equipments are needed for many disabled children. They include: movable desks with adjustable seats and attachments for support of limbs and for support of books, treatment tables, devices for corrective activities and equipment for his treatment and therapy used are table, work benches, tools and equipment for occupational therapy and handicraft are also provided in schools.

Special curriculum: The curriculum for the child needs to be specially designed because of his disability, disabled children need special creative outlets and opportunities to compensate them for the fields of life in which they cannot take part. Good reading enables them to acquire through the printed words, information and knowledge concerning life situations, which the normal child acquires through direct personal contact and observation. In elementary classes, there should be special provision for craft work in addition to the regular curriculum so that muscular coordination can be improved. Group projects, and arts like storey telling, music, singing and painting provide a good outlet for creativity.

Counseling: Counseling service may be desirable in any program of education but for the handicapped it is a dire necessity. The vocational guidance of the disabled child must start early and must be based on an evaluation of his physical and mental capabilities and limitations. Education is brought to a halt unless it leads forward to the choice of a right career.

Education of Parent: The functions of home education are essentially two: (i) to satisfy the essential needs of children and (ii) to prepare them for adult life. Parents must be made to understand that the goals of education for their children are the same as those for other normal children. They must understand the disabled child needs affection rather than possession, a simple feeling of security rather than a sense of his own importance. There must be a close cooperation between the teachers and the parents throughout the education of a handicapped child.

Recreational Facilities or Play Therapy

Handicapped children like all other children need recreation. Play serves a number of useful purposes. It is a spontaneous outlet for excessive energy, it is an impression of the joy of living, it promotes physical growth through exercise of muscles and nerve cells, above all, the child at play rehearses the serious business of adult life. The

play material for crippled children must serve two purposes: (i) it must meet their emotional needs; and (ii) it must stimulate the use of muscles in need of exercise. Play material should be adapted to all types of disability. The school must arrange for providing the disabled child with enough facilities for recreation. Clay is an ideal material for giving expression to the child's imaginative genius as well as for developing his paralysed parts of his body.

10 CHAPTER Department Planning and Organization

Type of Institution

Consideration should be given to the type of institution in which the department is being established. It is a Government, Private or voluntary institution? Does it serve to a certain age group? Is it a hospital, rehabilitation center, a nursing home? all these factors relate to philosophy of the institution, overall program and will have bearing on type of occupational therapy to be offered.

Size of Institution

For planning on occupational therapy dept. in rehabilitation center, occupational therapy needs quite a large complex for setting department specially for rehabilitation of cerebral palsied.

BASIC POINTS TO BE CONSIDERED WHILE ORGANISING AN OUTPATIENT ORTHOPEDIC SERVICE FOR CHILDREN

Occupational therapy is one of the most important and integral service in any well organised orthopedic set up for children.

Its main function is to help the child to develop to his highest potential level in physical, psychological, social and vocational or avocational areas, through the use of various suitable activities guided by the qualified occupational therapist.

It will have following programs:

1. Assessment of disabilities and abilities,
2. Treatment, follow-up and parental involvement,
3. Self help activities,
4. Activities—program for severely handicapped children.
5. Physical restoration training,
6. Group therapy,
7. Cognitive-perceptual-motor training,
8. Splinting devices and toys,
9. Outdoor activity programs,

10. Home visits, and
11. Research and development programe.

Space

As the activities for the children will be both indoor and out-door the following facilities should be available.

Indoor

1. Office and assessment room 15′ and 10′,
2. Activity Room-25′ and 25′,
3. Room for C.P.:20′ and 20′,
4. Splints devices and research room: 20′ and 20′, and
5. Hobby rooms painting, clay modeling, music, etc. 15′ and 10′ each.

Notes: Minimum 1600 sq. ft. area is required or 40 sq. ft. per patient load. This does not include storage and toilet facilities.

Outdoor

1. Garden and pond,
2. Sand and water-play activity,
3. Large play ground,
4. Hobby centre, and
5. Area for wrings, jungle gymnasium, sea-saw, etc.

Furniture: Treatment plinths, chairs, table, cupboards, (wooden).

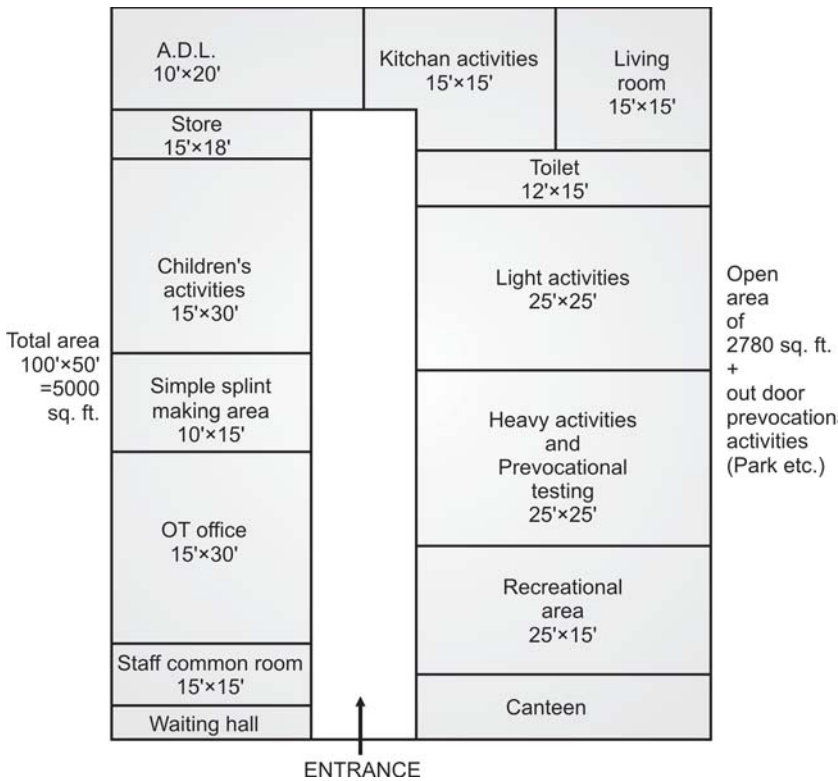
Equipment include:
- Assessment equipments,
- Diactic toys and play material,
- CP room set up,
- Devices, and
- A activities room.

Staff

1. Senior occupational therapist,
2. Staff therapist: one for 20 patients
3. one nursing and or aya.

While planning designing of interior setup including furniture, sink, work table, cup-boards, etc. all the architectural barriers for physically handicapped should be taken care of in planning to make it disable friendly as also outdoor area for better and efficient service delivery to the disabled.

LAYOUT PLAN OF
OCCUPATIONAL THERAPY DEPARTMENT
FOR
WORK LOAD OF 50-100 PATIENTS DAILY



11
CHAPTER

Miscellaneous

GLOSSARY OF COMMON CEREBRAL PALSY TERMS

- *Apgar score*—A numbered score doctors use to assess a baby's physical state at the time of birth.
- Apraxia—Impaired ability to carry out purposeful movements in an individual who does not have significant motor problems.
- *Asphyxia*—Lack of oxygen due to trouble with breathing or poor oxygen supply in the air.
- *Bile pigments*—Yellow-colored substances produced by the human body as a by-product of digestion.
- Cerebral—relating to the two hemispheres of the human brain.
- *Clonus*—An abnormality in neuromuscular activity characterized by rapidly alternating muscular contraction and relaxation.
- Computed tomography (CT)—An imaging technique that uses X-rays and a computer to create a picture of the brain's tissues and structures.
- *Congenital*—Present at birth.
- *Contracture*—A condition in which muscles become fixed in a rigid, abnormal position causing distortion or deformity.
- *Dysarthria*—Problems with speaking caused by difficulty moving or coordinating the muscles needed for speech.
- *Electroencephalogram (EEG)*—A technique for recording the pattern of electrical currents inside the brain.
- *Electromyography*—A special recording technique that detects muscle activity.
- *Failure to thrive*—A condition characterized by lag in physical growth and development.
- *Gait analysis*—A technique that uses camera recording, force plates, electromyography, and computer analysis to objectively measure and individual' pattern of walking.
- *Gastrostomy*—A surgical procedure to create an artificial opening in the stomach.

- Hemianopia—Defective vision or blindness that impairs half of the normal field of vision.
- *Hemiparetic tremors*—Uncontrollable shaking affecting the limbs on the spastic side of the body in those who have spastic hemiplegia.
- *Hypertonia*—Increased tone.
- *Hypotonia*—Decreased tone.
- *Hypoxic-ischemic encephalopathy*—Brain damage caused by poor blood flow or insufficient oxygen supply to the brain.
- *Jaundice*—A blood disorder caused by the abnormal build up of bile pigments in the bloodstream.
- Magnetic resonance imaging (MRI)—An imaging technique which uses radio waves, magnetic fields, and computer analysis to create a picture of body tissues and structures.
- *Neonatal hemorrhage*—Bleeding of brain blood vessels in the newborn.
- *Orthotic devices*—Special devices, such as splints or braces, used to treat problems of the muscles, ligaments, or bones of the skeletal system.
- *Paresis or plegia*—Weakness or paralysis. In cerebral palsy, these terms are typically combined with another phrase that describes the distribution of paralysis and weakness, e.g. paraparesis.
- *Palsy*—Paralysis or problems in the control of voluntary movement.
- *Reflexes*—Movements that the body makes automatically in response to a specific cue.
- *Rh incompatibility*—A blood condition in which antibodies in a pregnant woman's blood can attack fetal blood cells, impairing the fetus's supply of oxygen and nutrients.
- *Rubella*—Also known as German measles, rubella is a viral infection that can damage the nervous system in the developing fetus.
- *Selective dorsal root rhizotomy*—A surgical procedure in which selected nerves are severed to reduce spasticity in the legs.
- *Spastic diplegia*—A form of cerebral palsy in which both arms and both legs are affected, the legs being more severely affected.
- *Spastic hemiplegia (or hemiparesis)*—A form of cerebral palsy in which spasticity affects the arm and leg on one of the body.
- *Spastic paraplegia (or paraparesis)*—A form of cerebral palsy in which spasticity affects both legs but the arms are relatively or completely spared.
- *Spastic quadriplegia (or quadriparesis)*—A cerebral palsy in which all four limbs are affected equally.
- *Stereognosia*—Difficulty perceiving and identifying objects using the sense of touch.

- *Strabismus*— Misalignment of the eyes.
- *Ultrasonography*—A technique that bounces sound waves off of tissues and structures and uses the pattern of echoes to form an image, called a sonogram.

FREQUENTLY ASKED QUESTIONS

- Is cerebral palsy a disease or a genetic disorder?
- I've heard that cerebral palsy can be the result of a 'birth injury', but isn't that the same as a 'birth defect'?
- Is cerebral palsy preventable?
- Is cerebral palsy curable?
- What are the risk factors for cerebral palsy?
- What are the early signs of cerebral palsy?
- How is cerebral palsy diagnosed?
- How can I learn more about protecting my child's right to a lifetime of benefits?

Is cerebral Palsy a Disease or a Genetic Disorder?

Cerebral palsy is neither a disease nor a genetic disorder. Cerebral palsy is a condition with many possible causes, such as birth trauma or brain injury, but it is not contagious or inherited.

I've Heard that Cerebral Palsy can be the Result of a 'Birth Injury', but isn't that the same as a 'Birth Defect'?

A birth injury is suffered by the infant at the time of birth or soon after birth when the infant is still in the care of medical professionals. A birth defect, however, occurs during pregnancy and involves factors outside the care of professionals, such a maternal infections or genetic malformations. Cerebral palsy is often the result of a birth injury, such as when an infant's brain is damaged by lack of oxygen during birth.

Is Cerebral Palsy Preventable?

A significant number of the cerebral palsy cases that occur as the result of a birth injury can be prevented. Medical negligence, such as careless handling of the child's cranium or an undetected oxygen blockage in the child's brain, is a factor in these preventable cases. Also, as we begin to understand other risk factors, such as blood-type incompatibility, rubella (contacted during early pregnancy) and other complications, we will be able to prevent additional cases of cerebral palsy. For more information about whether your child's cerebral palsy could have been prevented please contact doctor.

Is Cerebral Palsy Curable?

Since the disorder is caused by irreversible brain damage, cerebral palsy has no cure. However, the physical effects of the brain damage can be treated. While impaired motor skills, speech, and muscle development cannot be "cured," there are an ever-growing number of management options. Early intervention if often considered the single most important factor in the disorder's treatment. If the signs and symptoms of cerebral palsy are recognized early, then therapy and special learning can keep the disability under control.

What are the Risk Factors for Cerebral Palsy?

Years of research has revealed that babies with certain risk factors are more likely to have cerebral palsy. For a list of these factors, please visit your doctor.

What are the Early Signs of Cerebral Palsy?

Most children begin to exhibit symptoms of cerebral palsy before they are three years old. Parents are often the first to suspect that their child is not developing normally. For a list of early cerebral palsy warning signs, please visit your doctor.

How is Cerebral Palsy Diagnosed?

Doctors look for a number of different indicators in order to diagnose cerebral palsy. They will also often prescribe medical tests to help them determine the exact nature of a child's problem. For more information on how doctors diagnose cerebral palsy, please visit your doctor.

SOME FACTS ABOUT CP

Hyperbaric oxygen treatments: Hyperbaric oxygen treatments are used when the child has had lack of oxygen before, during or after birth. Oxygen treatments are effective in helping children with their motor skills and are safe treatment.

Hyperbaric oxygen treatments are commonly used when you are having trouble healing quickly. When using hyperbaric oxygen treatments you are using sometimes 100% pure oxygen in an air-controlled space. High pressure, or hyperbaric treatments are used usually when treating carbon monoxide poisoning, some infectious diseases and the protect bone from radiation therapy. It is used when you have a child with developmental brain damage due to the impairments and disabilities that come along with cerebral palsy.

Oxygen treatments are the best medicine you can give your body when you are under any kind of sickness or trauma in your life.

Spastic cerebral palsy, spastic diplegia, hemiparesis. Discover the symptoms and treatments for hemiparesis or muscle tremors that are associated with spastic cerebral palsy or spastic diplegia.

Spastic cerebral palsy is the most common type of cerebral palsy. Children with spastic cerebral palsy may have one or more muscle groups that are tight, which limit the amount of movement they can do. Children with spastic cerebral palsy have stiff or jerky movements.

People with spastic cerebral palsy often find it difficult to move from one position to another. They also have a hard time letting go and holding on to objects. Spastic diplegia occurs when the patient has more injury to the lower part of their body than the upper part. Spastic diplegia affects more of the legs than the hands. The brain injury causing the leg problems may also cause difficulty in eye-hand coordination.

Hemiparesis is a weakness on one side of the body. The most common cause is due to stroke. Muscle tremors are caused by a deficiency of magnesium. An excess of thiamin may also cause you to have muscle tremors. Spastic cerebral palsy can be controlled by certain treatments that may include drugs and therapy.

If you are a parent with a special needs child, there are many resources you can get help from. You can talk to a support groups for special needs children. You can go to your local library and find books to help you along. You also can talk to your family physician to see what they might have to say.

Special needs children are precious gifts from God and they need lots of attention from their parents. For example, they need time, patience, love and dedication. Some of the special needs equipment that you might need is for their ability to hear, communicate, see, and be mobile. Hearing impairments are to help with visual signals rather than tones or spoken words. To help communicate they have communicator devices to help guide special needs children go through everyday life.

To help your special needs child to see better there are products to assist computer usage with increased text size, screen contrast, or sound. The best special needs of equipment that your special needs child will need is a mobility chair so they have the mobility to move about on third own.

Erbs Palsy Treatments Information

Discover how erbs palsy oxygen treatments can increase recovery. Contact your doctor and find out if your child can benefit from erbs palsy oxygen treatments.

Erbs palsy is caused by birth trauma when traction of the head, arm or twisting the arm or shoulder down and backward. By doing this it results in paralysis in the nerves supplying to the arm. Erbs palsy deals with the muscles of the shoulder and upper arm. It is in the cervical root of the 5th and 6th spinal nerves. The arm may hang limp and normal movement is lost. These are some common problems with erbs palsy.

Some of the erbs palsy treatments are physiotherapy, occupational therapy, hydrotherapy, nerve grafts and tendon/muscle release. Erbs palsy oxygen treatments within the first year of life can have an amazing impact in recovery. Erbs palsy oxygen treatments take place when the baby has had lack of oxygen during the birth.

If you feel that your child might be showing sign of erbs palsy then it is to recommend immediately going to the emergency room or your family physician.

Ataxic cerebral palsy, ataxic gait, ataxic dysarthria. Damage to the cerebellum can cause the ataxic gait or ataxic dysarthria associated with ataxic cerebral palsy.

Ataxic cerebral palsy means low muscle tone. Ataxic cerebral palsy affects, about 5 to 10 percent of patients. This rare form of ataxic cerebral palsy affects the sense of depth perception and balance. They normally have poor coordination. Children with ataxic cerebral palsy look unsteady and off balanced. It may take longer for a child to complete a task than for another child to do so.

Ataxic gait, or cerebellar gait, is a term for how someone walks. When a person with ataxic gait walks their feet are far apart and they find it difficult to make sharp movements. A person with ataxic gait walks in a staggered, unsteady, and irregular manner.

What causes ataxic dysarthia? Damage to the cerebellum or to the neural pathways that connect the cerebellum to the other parts of the central nervous system. This is often very difficult to correct with surgery as the results are unpredictable. Children with ataxic cerebral palsy look very unsteady and shaky.

Athetoid cerebral palsy and dyskinetic cerebral palsy treatments may include anticholinergics to relieve some symptoms.

Athetoid cerebral palasy affects about 10 percent of children with cerebral palsy. It is caused by damage to the cerebellum or basal ganglia. Damage to these areas may cause a child to have poor development in the face, arms and trunk. In addition, children with athetoid cerebral palsy often have low muscle tone and have problems in sitting and walking.

A child with dyskinetic cerebral palsy has extreme difficulty in moving. In about 15-20% of all individuals that have cerebral palsy

will have some form of dyskinetic cerebral palsy. Involuntary movements, usually chorea, athetosis, and dystonia of the limbs, trunk, face and the bulbar muscles characterize dyskinetic cerebral palsy. Anticholinergics are drugs you can take to relieve cramps or spasms in the stomach, intestines and bladder. Anticholinergics are used to treat Parkinson's disease. Some of those side effects are dry mouth, sedation, delirium, hallucination, constipation, and urinary retention. Athetoid cerebral palsy often increases in severity during periods of emotional stress and disappears during sleep.

Birth injuries attorney and, birth injuries lawyer are available in western world. If you feel that the child has been the victim of medical negligence, contact birth injuries attorney or lawyer immediately discover your options if you are in western world. In India, Consumer Protection Act is applicable in such instances.

Birth injuries are defined as damage to an infant's body at the time of birth. Some of the common birth injuries that take place are lots of bleeding, fetal distress, prolonged labor, breech pregnancy and seizures. Sometimes birth injuries occur during medical malpractices.

Of the 15 commonly known birth injuries only three of them are at a greater rate by 30 to 1000 births. These are meconium, fetal distress and breech/malpresentation. If you know that child has suffered from a serious medical condition caused by medical malpractice during birth than you are advised to call a lawyer right away. Time is very critical when it comes to bodily injury so contact a birth injuries specialist to protect your rights.

If you feel that some kind of birth injuries have happened to the child or your family you are encouraged to call a lawyer so that this does not happen to another child or family.

Tips to Help You to Care for Your Special Needs Child

You should be aware of the laws and government benefits that are available to protect your child.

The financial considerations are not just for lifetime care, but for the quality of life you want for your special needs child. There are great childcare facilities to help care for special needs children with role models that will allow them to learn new skills through imitation. They will also learn personal and social skills. There are other various types of programs to help care for a special needs child, such as, summer camps, respite care, educational classrooms, educating on living on your own.

The care for a special need child can be hard work on the parents, so you are encouraged to call your local community to find a facility that can help you and your child go through life a little easier.

Disability lawyer can prove doctors were negligent in preventing cerebral palsy and brain damage by carefully studying the medical records.

If a child suffers a period without oxygen, then this can result in fetal distress, which, if a doctor does not act quickly, it may lead to brain damage or death. You might want to get cerebral palsy lawyer if you know that any malpractice has taken place on your child and that your child has low muscle tone.

Disability lawyers specialize in helping victims of medical negligence during childbirth that resulted in cerebral palsy.

Cerebral Palsy Cause Signs

A common cerebral palsy cause results from medical mistakes. Learn the early cerebral palsy sign including contracture and slow motor skill development. If you think the your child may have suffered from medical mistakes. Contact your doctor and learn the cause.

A common cerebral palsy cause is due to a birth injury before, during or after birth. The main cause of cerebral palsy cause is the brain which has failed to develop properly. Another significant cause is neurological damage to the child's brain resulting from inappropriate medical treatment. Some of the cerebral palsy signs to look for include seizures, difficulty sucking or feeding, irregular breathing and delayed motor skills development. Other signs include smaller arms and leg development, impaired hearing or vision, uncontrollable drooling, and contractures. A contracture is a permanent tightening of the muscle, tendons, ligaments, or skin that prevents normal movement. Contractures primarily occur in the skin, underlying tissues, muscle tendons, and joint areas.

Medical mistakes occur when a physician or other provider fails to do something for you or your child that normal responsible providers would do otherwise. When a medical mistake is the cerebral palsy cause, you may be compensated for a physician's inactions in consumer court.

Many times parents think that they are to blame or medical mistakes, however, many times they are due to medical malpractice, a common cause.

Cerebral palsy symptoms may include seizures, muscle contractions, irregular breathing, mental retardation, spasticity or a limited range of motion. Many cerebral palsy symptoms differ from person to person and can range from mild to severe. Cerebral palsy symptoms may also change over time as the child grows.

The main cause is due to injury to the cerebrum, the largest part of the brain, which involves your ability for mental and muscle function. This cause can occur during birth, however, 10-20% acquire the disorder after birth. Contact your doctor for more information concerning causes.

Acquired cerebral palsy is caused from brain damage during the first few months or years of life. Acquired cerebral palsy often follows brain infections or from a head injury such as a car accident, a fall, or child abuse. Contact your doctor for more cerebral palsy information concerning acquired cerebral palsy.

For birth injury related cerebral palsy, you need a lawyer experienced with ataxic, athetoid and spastic cerebral palsy for litigation under Consumer Protection Act.

A lawyer can assist if you or a family member has suffered from a preventable birth injury. A lawyer specializes in the legal aspects of cerebral palsy caused by medical malpractice. If you feel that you child are received improper care, then contact them.

Some basic cerebral palsy symptoms to look for if you suspect that your child may have cerebral palsy include slow motor skills, difficulty in maintaining balance or walking, involuntary movement, uncontrollable writhing of hands or excessive drooling. The cerebral palsy symptoms can change as a child grows and vary from person to person and ranging from mild to severe. Cerebral palsy symptoms are often overlooked, but as the child grows parents will recognize a change the child's development.

Children with developmental delays can lead full and wonderful lives with their friends and family. Someone who has a developmental delay wants to feel human and be equal to others, not different. Low muscle tone in a child is not a disease; it is a condition, which is becoming more commonly diagnosed. Child low muscle tone is where the child is slow to develop the ability the lift and control their head. They are normally called "floppy babies."

You may have a child with severe cerebral palsy symptoms; which might need extensive care; while a child with mild cerebral palsy symptoms may need no special assistance.

Does my child have cerebral palsy? What are the early sign? What are the cerebral palsy statistics? What cerebral palsy treatments are available?

There are support groups for the parents and for the children. There are many effective cerebral palsy treatment including physical therapy, behavioral therapy, drug therapy, surgery and mechanical skills. Other cerebral palsy treatments include a neurosurgical procedure called dorsal rhizotomy, which decreases the spasticity in children.

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