Cerebral palsy (CP) is a term used to describe a problem with movement and posture that makes certain activities difficult. Even though someone who has cerebral palsy has problems moving his or her muscles, this is not because there is something wrong with the muscles or nerves. These difficulties are caused because of problems in the brain. The patient might have had an injury to the brain, or had a brain that didn't develop properly. These problems can affect the way the brain controls movement and posture.

Simply stated, "Cerebral" refers to the brain, and "Palsy" refers to muscle weakness/poor control. Although the brain itself will not get worse, people who have cerebral palsy will usually change over time. Sometimes they will get better, and some patients will stay the same. Occasionally they will get worse, usually because of contracture of the joints or changes in the muscle tone;

There is currently no cure for cerebral palsy. but, there are different treatment options for people who have cerebral palsy. These options include therapy, medications, surgery, education and support. By taking advantage of one or more of these options, people with cerebral palsy can learn to improve their function and the quality of their lives.

**Who Does Cerebral Palsy Affect?**

It is estimated that two out of every 1,000 newborn children will develop cerebral palsy. And approximately 40% of those born with cerebral palsy will have a severe case. Right now, about 10,000 babies and infants are diagnosed with the condition each year. In 2002, the number of cerebral palsy cases in 8-year-old children was found to be one in 278. It is the most common motor disorder in children and is second only to autism as the most common disability in children.

**What Causes Cerebral Palsy?**

Cerebral Palsy does not have a single cause like chicken pox or measles. There are many reasons why someone might have cerebral palsy. An unborn child might have suffered a brain injury, an infection, or abnormal development of the brain tissue. These are called "prenatal"causes, meaning they happened before birth. These causes are responsible for about 70% of the cases of cerebral palsy. Another 20% of cerebral palsy cases are caused by a brain injury that takes place during the birthing process. In the United States, about 10% of children who have cerebral palsy got it after they were born. This is called "acquired cerebral palsy."(The figures are higher in underdeveloped countries.) Acquired cerebral palsy happens when there is brain damage during the first few months or years of life. This damage can be caused by brain infections, like bacterial meningitis or viral encephalitis. It can also be caused by a head injury -- usually from a motor vehicle accident, a fall, or child abuse during the first few years of life when the brain development is still taking place.
Most of the time the actual cause of cerebral palsy is not known. And, although there may have been a brain injury or a development problem, the problem may not be noticed for months.

**What Puts A Child At Risk For Developing Cerebral Palsy?**

There are many risk factors for cerebral palsy. They can include:

- Premature (early) birth
- Low birth weight
- Blood clotting problems
- Inability of the placenta to provide the developing fetus with oxygen and nutrients
- RH or A-B-O blood type incompatibility between mother and infant
- Infection of the mother with German measles or other viral diseases in early pregnancy
- Bacterial infection of the mother, fetus or infant that directly or indirectly attack the infant's central nervous system
- Prolonged loss of oxygen during the birthing process
- Severe jaundice shortly after birth

It is important to understand that even if a child does have a risk factor it does not mean that the child will definitely get cerebral palsy. It just means that the chance of a child getting cerebral palsy is increased. Just because a risk factor is there does not mean cerebral palsy WILL occur. Or, if a risk factor is not there, it doesn't mean that cerebral palsy will NOT occur. If a risk factor is present, it simply serves to alert parents and physicians to be even more observant to the infant's development.

**How Is Cerebral Palsy Diagnosed?**

Parents are often the first to notice that their infant is not developing normally. Infants with cerebral palsy are often slow to roll over, sit, crawl, or walk. When an infant develops more slowly than usual it is called *developmental delay*.

Some of the skills that infants should have include:

- Holding own head up when lying flat in a bed at 3 months
- Sitting and rolling over by 6 months
- Walking by 12-18 months
- Speaking simple sentences by 24 months

Most children with cerebral palsy are diagnosed by the time they are two years old. But if a child’s symptoms are mild, it can be hard for a doctor to make a true diagnosis before the child is four or five years old. If the doctor thinks a child has cerebral palsy, he or she will probably schedule an appointment to see the child and talk to the parents about their child’s physical and behavioral development.
Doctors diagnose cerebral palsy by obtaining a complete medical history of development and examining the child, paying special attention to the child’s movements. In addition to checking for the most common symptoms -- such as slow development, abnormal muscle tone, and unusual posture -- a doctor also has to make sure the child doesn’t have something else that could cause similar symptoms.

Some children have hypotonia, which means that their muscles are too relaxed. In this case, the baby may seem floppy. Other children have hypertonia which makes their muscles seems stiff. Sometimes a child can have hypotonia that later become hypertonia two to 24 months after birth. Children may also have unusual posture or favor one side of their body.

What’s most important to the doctor is making sure that the child's condition is not getting worse. Although cerebral palsy symptoms may change over time, children with cerebral palsy do not usually lose function. That means, if a child does seem to be losing motor skills, the problem is probably not cerebral palsy. It more likely a genetic or muscle disease, a metabolism disorder, or tumors in the nervous system. A complete medical history, special medical tests, and, in some cases, repeated check-ups can help confirm whether or not the child has cerebral palsy for certain.

Once the diagnosis of cerebral palsy has been made based on medical history and physical examination, your doctor may order tests to try to figure out the cause of the cerebral palsy (Ashwal et al., 2004). Tests (like MRI scans), that allow doctors to look into the brain, can find problems that may be able to be treated. If it is cerebral palsy, an MRI scan can also show a doctor the location and type of injury to the brain.

Some other tests a doctor might order include:

- **Cranial ultrasound.** This test is used for high-risk premature infants because it is the least intrusive of the imaging techniques. However, it is not as effective as the two methods described below at seeing small changes in “white matter” – which is the type of brain tissue that is effected in cerebral palsy.
- **Computed tomography (CT) scan.** This technique creates images that shows brain injury.
- **Magnetic resonance imaging (MRI) scan.** This test uses a computer, a magnetic field, and radio waves to create a picture of the brain’s tissues and structures. Doctors prefer MRI imaging because it offers better detail and does not involve radiation.

**Metabolic Disorders**

On rare occasions, metabolic disorders can be mistaken as cerebral palsy and some children will require additional tests to rule them out.

**Specialized Knowledge and Training**

To confirm a diagnosis of cerebral palsy, a doctor may send a child to other doctors who have specialized knowledge and training or to specialty clinics where these doctors work with a team of health professionals who specialize in working with children with cerebral palsy and other developmental delays. These doctors
might be child neurologists, developmental pediatricians, ophthalmologists (eye doctors), or otologists (ear doctors). Additional observations by these specialists can help the doctors make a more accurate diagnosis and begin to develop a specific plan for treatment.

What Is The Classification System, And How Is It Used For Cerebral Palsy?

Once the diagnosis has been made on the basis of medical history and a physical examination, the person will be classified for ease of communication among health professionals as well as affording a prognosis and treatment.

The classification system is a clinical one based on the physiology of the motor dysfunction, the number of limbs involved and the functional status of the child. The system establishes an orderly approach to describing a patient's disability but does not afford insight into the etiology or pathology.

What are the Different Types of Cerebral Palsy?

Physiological Grouping

Spasticity

Spasticity is defined as a velocity-dependent increased muscle tone, determined by passively flexing and extending muscle groups across a joint. A satisfactory, reproducible system of grading muscle tone has never been developed, although the Ashworth and Tardieu scales are commonly used in research. Most physicians describe the tone as being normal, increased or decreased. Associated with spasticity are enhanced deep tendon reflexes, usually associated with clonus and extensor plantar responses. However, the latter are sometimes difficult to elicit in the infant and even in the older child with spastic CP.

Dyskinesia

· Dyskinesia is defined as abnormal motor movements that become obvious when the patient initiates a movement. When the patient is totally relaxed, usually in the supine position, a full range of motion and decreased muscle tone may be found. Dyskinetic patients are subdivided into two subgroups.

· The hyperkinetic or choreo-athetoid children show purposeless, often massive involuntary movements with motor overflow, that is, the initiation of a movement of one extremity leads to movement of other muscle groups.

· The dystonic group manifest abnormal shifts of general muscle tone induced by movement. Typically, these children assume and retain abnormal and distorted postures in a stereotyped pattern. Both types of dyskinesia may occur in the same patient. Simply stated, spasticity you feel; dystonia you see.
Ataxias

Patients with ataxias have a disturbance of the coordination of voluntary movements due to muscle dyssynergia. These patients may be hypotonic during the first two or three years of life. They commonly walk with a wide-based gait and have a mild intention tremor (dysmetria).

Mixed Group

The fourth category that is commonly used in the physiologic and motor classification is the mixed group. Patients in this category commonly have mild spasticity, dystonia, and/or athetoid movements. Ataxia may also be a component of the motoric dysfunction in patients placed in this group.

Anatomic Grouping

Diplegia

Diplegia refers to involvement predominantly of the legs.

Quadriplegia

Quadriplegia refers to dysfunction of all four extremities; in some children one upper extremity might be less involved; the term triplegia then would be substituted.

Hemiplegia

Hemiplegia refers to individuals with unilateral motor dysfunction; and in most children the upper extremity is more severely involved than the lower. Finally, an unusual situation may occur where the upper extremities are much more involved than the lowers; the term double hemiplegia is applied to this group of patients.
What are the Functional Classifications of Cerebral Palsy?

**Level 1: Clumsy Child**
- Uses no assistive devices (such as crutches)
- Can walk indoors and outdoors and climb stairs no limits.
- Can perform usual activities such as running and jumping
- Has decreased speed, balance and coordination

**Level 2: Walks Independently**
- Is limited in outdoor activities
- Has the ability to walk indoors and outdoors and climb stairs with a railing
- Has difficulty with uneven surfaces, inclines or in crowds.
- Has minimal ability to run or jump.

**Level 3: Uses Assistive Mobility Devices**
- Walks with assistive mobility devices indoors and outdoors on level surfaces
- May be able to climb stairs using a railing
- May propel a manual wheelchair (with assistance needed for long distances or uneven surfaces)

**Level 4: Severely Limited**
- Self-mobility severely limited even with assistive devices
- Uses wheelchairs most of the time and may propel their own power wheelchair

**Level 5: No Self-Mobility**
- Has physical impairments that restrict voluntary control of movement and the ability to maintain head and neck position against gravity
- Is impaired in all areas of motor function.
- Cannot sit or stand on their own even with equipment.
- Cannot do independent mobility, though may be able to use a power

What Can Prevent Cerebral Palsy?

Certain medical advances (such as vaccines) as well as better prenatal (before birth) care and nutrition, have lowered the numbers of babies born with CP in poorer countries. However, in developed countries (like the United States) the number of babies with CP has remained much the same over the last 50 years (Nelson, 2003).
Today, more can be done to prevent CP than ever before:

**Rh Factor Test**

Pregnant women can be tested routinely for the Rh factor. If a woman is found to be Rh negative, she can be immunized within 72 hours after the birth (or after the pregnancy terminates) to help reduce the risk of CP. If the woman who is Rh negative has not been immunized, and has a baby, the newborn can be given a transfusion to help prevent blood incompatibilities. If a newborn baby has jaundice he or she can be treated with phototherapy (light therapy) in the hospital nursery.

**Immunizations**

Immunization against measles for at-risk women who might get pregnant

**Prenatal Care**

It’s also important for women to get proper prenatal care prior to conception, and for infants to receive adequate protection from accidents or injury. Except for prematurity (being born too soon), birth asphyxia (not being able to breathe properly) is the most common risk factor associated with the development of CP.

(Prevention)

Taking steps to help prevent premature births such as:

- Reducing exposure of pregnant women to virus and other infections
- Recognizing and treating bacterial infection of the reproductive and urinary tracts
- Avoiding unnecessary exposure to X-rays, drugs and medications
- Controlling diabetes, anemia and getting proper nutrition

**Common Health Problems Associated With Cerebral Palsy**

Health problems may exist in persons with cerebral palsy that are uncommon in people without cerebral palsy.

**Drooling**

Drooling can cause severe skin irritations, which can change the child’s appearance. Caring for a child who is drooling should be openly discussed with a doctor as part of routine cerebral palsy management (Dunn et al., 1987; Rapp, 1980; Sochaniwskyj et al., 1986).

Excessive drooling can make it hard for a child to swallow (Senner et al., 2004) and treating this problem can be difficult (Blasco, 2002). Medication can help but unfortunately the side effects of medicine can be significant. Surgery may be an option and Botox therapy may also offer relief (Suskind and Tilton, 2002; Van der Burg et al., 2006).
**Nutrition**

Poor nutrition is also associated with serious health problems in children with cerebral palsy (Patrick et al., 1986; Shapiro et al., 1986; Waterman et al., 1992). Chewing difficulties, which occur in about one-third of all cases, are most responsible for the problem. And unfortunately, few medical treatments have been proven to be effective. (Rogers, 2004). However, feeding through the stomach has lead to significant improvements in height and weight. This type of treatment can potentially cause problems if the child becomes overweight. It’s important to note that there is no evidence that shows that improving nutrition improves the child’s function. (Calis EAC et al., 2007).

**Bladder dysfunction**

Bladder dysfunction can also be a serious health problem for children with cerebral palsy. and may require treatment from a physician who specializes in these conditions. Bed wetting, stress incontinence and dribbling are all associated with this condition. (McNeal et al., 1983).

**Constipation**

Constipation is a common condition that must be monitored by a doctor. This problem happens because the child with cerebral palsy is unable to control the abdominal muscles that push stool out of the body. Medical treatment may be needed to help with constipation.

**Puberty**

A survey of 207 people with cerebral palsy, who have trouble walking or are not able to walk (GMCS 3,4 or 5) showed that puberty begins earlier in people with cerebral palsy compared to people who don’t have the disorder. This same survey showed that puberty ended later for people with cerebral palsy compared to those who don’t have the disorder. (Worley et al., 2002) . In addition, menstruation occurs later in girls with cerebral palsy.

**Pain and cerebral palsy**

Hip pain in children with cerebral palsy is a very common problem. (Hodgkinson et al., 2001). Only recently has general pain in children with cerebral palsy been recognized and studied. It is difficult to tell when children with cerebral palsy are in pain because many have limited or no communication skills (Nolan et al., 2000).

When a child can’t communicate well, there are other ways to tell if a child is in pain. (Hadden and von Baeyer, 2002). According to a questionnaire two-thirds of the parents felt that their children experienced pain for at least several days during the month before the completion of the questionnaire. Unfortunately, there is very little information available on how to manage pain in children with cerebral palsy who are non-verbal.
Other Problems

In addition to the aforementioned problems, patients with cerebral palsy often have other health problems including:

- Muscle and skeletal problems
- Behavior difficulties
- Seizures
- Feeding, bladder and bowel control problems
- Epilepsy
- Sight, hearing or speech problems
- Breathing problems
- Skin disorders from pressure sores
- Learning disabilities

What Other Diagnoses Are Similar to Cerebral Palsy?

Because of the many origins of cerebral palsy it can be confused with other distinct diagnoses. It is especially important to consider other potentially treatable causes. Distinguishing features of these “other” diagnoses often includes the history there is an absence of difficulties at or around the time of birth that can account for the developmental motor and associated abnormalities. Additionally, the progressive impairment is not simply a change over time in the existing motor problems e.g. due to contracture formation. It is instead a distinctive deterioration in the patient with changes in one or more of the following: movement disorder, intellectual ability, and increase in tone.

One of the diagnoses that should be taken into account is a progressive movement disorder called Dopa responsive dystonia (DYT5). This rare genetic disorder that occurs due to a metabolic problem with the enzyme that converts normal products into an important neurochemical called DOPA. This results in a progressive increase in tone and physical limitations that resemble cerebral palsy. These patients are classically of normal intelligence in spite of progressive and severe spasticity or dystonia. A large number of these individuals also have variation in their tone during the day. Important is the responsiveness to therapy. These children and adults often respond to very low dose DOPA supplement and have significant improvement in their symptoms.

Another genetic disorder that is confused early in the course of the disorder is Glutaric aciduria type 1. The distinguishing feature is the progression of the movement disorder where the child demonstrates significant chorea (rapid random movements). Also imaging of the brain reveals a distinctive pattern of abnormalities in the temporal area. While reversal of the symptoms is not anticipated the people do need to have specific interventions to attempt to stop the progression.

Instability of the spinal column is also an important consideration. This possibility should be strongly considered if an individual has progressive spasticity, deterioration of motor function, sensory changes, and progressive bowel and bladder abnormalities. The spinal cord can be injured directly by the increased
movement of the boney vertebra. This may be as high as the cervical area or at any point along the spine. Intervention to stabilize the spine is critical to stop the progression. Reversal of the new neurological finding is frequently not possible but again the intervention may stop the deterioration.

Other slowly progressive disorders are occasionally misdiagnosed as cerebral palsy. These are predominantly rare diagnoses that have other symptoms that help separate them from individuals with cerebral palsy. For example, several have an associated loss of cognitive skills. These patients do not have a stable, predominantly motor problem but instead deteriorate across several domains e.g. cognitive, behavioral, fine and gross motor. Imaging (MRI preferably) may reveal changes that are consistent with the diagnosis. Examples of such diagnoses include:

- Metachromatic Leukodystrophy
- Pelizaeus-Merzbacher disease.
- Rett’s Syndrome should be considered when the symptoms of motor delay and spasticity are combined with autistic features and non-purposeful hand movements.

**Cerebral Palsy Treatment**

Although cerebral palsy cannot be cured, treatment will often improve a child’s capabilities. Many children with cerebral palsy go on to enjoy productive adult lives if their disabilities are properly managed. In general, the earlier that treatment begins the better chance the child has to learn new ways to accomplish the tasks that challenge them.

There is no single therapy that works for every child who has cerebral palsy. A team of healthcare professionals and community-based providers can help identify specific needs and develop a plan to help improve your child’s quality of life.

**Who is on the team?**

Doctors may include:

- Neonatologists
- Pediatricians
- Developmental Pediatricians
- Neurologists
- Orthopedists
- Physiatrists (Physical Medicine and Rehabilitation)
- Ophthalmologists
- Neurosurgeons
- Gastroenterologists
- Urologists
- Otolaryngologists (Ear Nose and Throat physicians)
Other health care professionals may include:

- Physical Therapists
- Occupational Therapists
- Speech Language Pathologists
- Social Workers
- Nurses
- Audiologists
- Psychologists
- Nutritionists/Dietitians

What are some therapy options?

Therapy Services

Children may receive specialized evaluations or assessments to help determine prognosis or need for treatment. These assessments may be performed by therapists in a clinic or hospital and include measurement of range of motion, strength, motor control, balance, coordination, functional skills, endurance and mobility, including walking (gait). Following medical or surgical treatment, therapy can enhance motor function and speed recovery. This may include instruction in methods to transfer in and out of bed, use of equipment such as braces, splints, wheelchairs, walkers, and exercises for stretching, strengthening and improving function.

Children with cerebral palsy are delayed in acquisition of motor skills to varying degrees, but usually reach their maximum potential for independent mobility by age 6. The focus of therapy changes from development of motor skills to promotion of health and achievement of independence with adaptations as needed. Short term intensive therapy is often used to address specific issues such as self care and use of technology. As children grow and develop, the need for individual therapy is reduced. They become more responsible for performing individual exercises and recreational activities to increase strength and endurance. PTs and OTs can design a home exercise program and help to adapt recreational and sport programs. Activities should be enjoyable and lay the foundation for lifelong practice to promote heart and lung fitness, protect and strengthen muscles, bones, and joints and promote overall health and well-being. It is important to realize that the therapist should be considered a ‘coach,’ continued work at home will lead to the best result.

Options that may be considered for treating cerebral palsy include physical therapy, occupational therapy and speech therapy.

Physical therapy:

A physical therapist will focus on helping children with strength, balance, flexibility and coordination required for motor skills and functional mobility including rolling, sitting, crawling, and walking. They also select, fabricate, modify, and train children and families in the use of adaptive equipment.
Occupational therapy:

Occupational therapists focus on the development of fine motor skills and on optimizing upper body function and improving posture. An occupational therapist helps a child master the basic activities of daily living, such as eating, dressing, and using the bathroom alone. Fostering this kind of independence boosts self-reliance and self-esteem, and also helps reduce demands on parents and caregivers. They can also address difficulties with feeding and swallowing. They will use exercise, facilitated practice, alternative strategies and adaptive equipment to promote independence.

Speech and language:

Speech and language therapists (also known as speech therapists or speech-language pathologists) observe, diagnose, and treat the communication disorders associated with CP. They use a program of exercises to teach children how to overcome specific communication difficulties. A speech therapist works with your child on the receptive (understanding) part of speech and language as well as the expressive part (talking). Speech therapist help improve your child’s ability to speak clearly or communicate using alternative means such as an augmentative communication devise or sign language. They may also help with difficulties related to feeding and swallowing. Speech interventions often use a child’s family members and friends to reinforce the lessons learned in a therapeutic setting. This kind of indirect therapy encourages people who are in close daily contact with a child to create opportunities for him or her to use their new skills in conversation, learning and play.

Psychology:

Psychologists can help children and families cope with the special stresses and demands of CP. In some cases, psychologist may also oversee therapy to address unhelpful or destructive behaviors.

Vision and hearing aids:

Depending on how your child’s eyes are affected, he or she may need eyeglasses to correct vision or surgery to correct a vision problem. Hearing aids may help correct hearing problems.

Orthotics:

A variety of orthotics, braces or splints, may be recommended for your child to correct muscle abnormalities. These may be used on your child’s legs, arms, hands or trunk. Some of these supports are used to help function, such as improved walking, sitting or standing. The purpose of other types of orthotics is for additional stretching or positioning of a joint.
Assistive Technology:

Assistive technology means “any equipment purchased ....off the shelf or custom made, that is used to improve function in persons with disabilities” (Technology-Related Assistance for Individuals with Disabilities Act of 1988). Simple technology can be used to assist with skills (modified eating utensils). Complex technology can substitute or replace abilities that do not exist (power chairs for walking, electronic speech aids for talking). Learning to use the equipment may include education from a therapist or teacher, depending on the technology.

Assistive Technology describes devices that help children move more easily and communicate successfully at home, at school and in community with family and friends. These are devices that assist a child to overcome physical and communication limitations. There are a number of devices that help children stand straight and walk, such as postural supports or seating systems, open front-walkers, quadrapedal canes. It can also include more high tech equipment like customized wheelchairs and electric wheelchairs that let children move more freely.

As individuals mature, they may require support services such as personal assistance services, continuing therapy, educational and vocational training, independent living services, counseling, transportation, recreation/leisure programs, and employment opportunities, all essential to the developing adult. People with CP can go to school, have jobs, get married, raise families, and live in homes of their own. Most of all people with CP need the opportunity for independence and full inclusion in our society.

Computers

The computer is probably the most dramatic example of a communication device that can make a big difference in the lives of children with cerebral palsy. If a child has a computer and a voice synthesizer, a child can communicate successfully with others. Communication for a child with cerebral palsy is essential. Some children may use sign language, some use picture books and some will use computerized software programs to communicate and learn.

Assistive Technology Options

- Braces (orthotics) and Splints
- Mobility Devices
- Canes
- Walkers
- Wheelchairs: manual or powered
- Powered scooters
- Positioning Devices
- Seats
- Standers
- Sidelyers
• Wedges
• Adapted eating equipment
• Bath chairs
• Speech aids
• Computer software or hardware
• Electronic home aids (door openers, devices to turn on lights)
• Vision aids (magnifiers, large text print books)
• Hearing aids (telephone amplifiers)

Additional Support Services

• Personal assistance such as in-home nursing care or aides
• Educational and vocational training
• Independent living services
• Counseling
• Transportation
• Recreation/leisure programs

Employment opportunities and support

• Where are services provided?
• Inpatient and Outpatient services:
  • hospitals
  • special clinics or outpatient offices
  • may be affiliated with hospitals or may be private or free-standing
• Early Intervention services (birth to three years)
• Homes
• Community locations
• Day care settings
• Other settings or programs when participating along with peers
• School-based services (three through age 21 years)
• Public schools

What are some muscle tone management options for Cerebral Palsy?

There is no one therapy that works for every child who has cerebral palsy. If your doctors have decided that your child does have cerebral palsy, a team of health care professionals can help identify specific needs and then develop a treatment plan to help improve your child’s quality of life.

Although cerebral palsy cannot be cured, treatment will often improve a child’s capabilities. Many children with cerebral palsy go on to enjoy near normal adult lives if their disabilities are properly managed. In general, the earlier that treatment begins the better chance the child has of overcoming developmental disabilities, or of learning new ways to accomplish the tasks that challenge them.
**Muscle Tone Management:**

- Oral medications
- Botulinum toxin injections
- Cutting some of the roots of the spinal nerves (Rhizotomy)
- Injection of medicine into the fluid around the spine (intrathecal delivery of medication via an implanted pump)

Your doctor will determine which, if any, these treatments might be appropriate for your child.

Abnormal muscle tone that is strongly influenced by body posture and/or position and/or movement:

**Oral medications:**

Medications are usually used as the first line of treatment to relax stiff, contracted or overactive muscles. These drugs are easy to use and appropriate for children who may need only mild reduction in muscle tone or who have widespread spasticity. The use of oral medication for the management of abnormal tone has been disappointing. For spasticity, dantrolene, baclofen, diazepam and tizanidine have been used. Other medications such as Artane have been used for dystonia and there are some preliminary reports of success with modafinil. Medications for the dyskinesias, including dystonia, athetosis, and hemiballismus have been equally disappointing. (Pranzatelli, 1996).

**Botulinum toxin:**

Botulinum toxin A therapy (Botox, Allergan, Corporation, Irvine, CA) is FDA approved for strabismus, hemifacial spasm, cervical dystonia, severe primary axillary hyperhydrosis and for cosmesis (wrinkles). Although approved throughout the world for treatment of spasticity in children with cerebral palsy, it is not approved by the FDA in for this use in the United States. It has been used as an off label drug for this indication since the late 1980’s. There are other preparations on the market including Dysport which is used in Europe and Myobloc, which is Botulinum Toxin B which acts through a different mechanism than Botulinum toxin A.

Extensive literature exists to show to show that botox is effective for children and adults who have spasticity and/or dystonia. A combination of muscle weakening and strengthening of the antagonist muscle may minimize or prevent contracture development with bone growth. This type of intervention is used when a limited number of muscles are causing deformities such as spasticity of the gastrocnemius muscle causing a child to walk on their toes or hamstring spasticity being responsible for a crouch gait. Recovery of the muscle tone occurs because of the sprouting of the nerve terminals, a process which peaks at approximately 60 days (Cosgrove et al., 1994).

Botox use in the upper extremity spasticity has been shown to improve cosmesis and function (Fehlings et al., 2000; Yang et al., 2003). Although the evidence is not conclusive, it is not uncommonly performed.
Selective dorsal rhizotomy

Selective dorsal rhizotomy (SDR) involves the cutting of approximately 50% of the dorsal sensory roots from the spinal cord, thereby decreasing the muscle tone in the lower extremities (Abbott, 1996). As a result of the decrease in the muscle tone, discomfort or pain may be alleviated, and sitting posture and/or gait may improve. The ideal candidate is a child who has normal or near normal strength in the lower extremities, has good trunk strength, who has not developed fixed contractures and whose alteration of tone will lead to the desired improvements in function. Combining the data from 3 separate studies that compared physical therapy with SDR plus physical therapy revealed a direct relationship between percentage of dorsal root tissue transected and functional improvement. SDR+PT is efficacious in reducing spasticity in children with spastic diplegia and has a small positive effect on gross motor function (McLaughlin et al., 2002).

Intrathecal Baclofen Infusion (ITB)

Baclofen, a GABA agonist, administered intrathecally (next to the spinal cord) via an implanted pump (ITB) has been helpful to patients whose muscle tone is more generalized and, whose muscle tone in interfering with function (Albright, 1996). As Baclofen dose not cross the blood-brain barrier very effectively, large doses must be used orally to achieve success compared to administering baclofen intrathecally. Often, the patient on oral medication becomes lethargic. The candidates for this intervention can be divided into 2 groups. The first group includes the patients whose gait is adversely affected by the muscle tone and who have some underlying muscle weakness. SDR in these patients is contraindicated as the procedure will cause additional muscle weakness, possibly causing an ambulatory patient to become non-ambulatory. A second group of patients are those whose generalized tone interferes with activities such as hygiene, transferring from a chair to a bed or just maintaining a safe upright position. Although the complication rate, including infection and baclofen withdrawal symptoms, occurring as a result of catheter breakage or leakage, is about 50%, parent satisfaction is extremely high with this type of intervention. Once the complication is corrected, over 90% of the parents/caretakers/patients request that the pump be reimplanted or the catheter be replaced (Albright and Ferson, 2006; Gooch et al., 2004).

What are the surgical options?

Orthopedic surgery is often recommended when spasticity and stiffness are severe enough to make walking and moving about difficult or painful. (Chambers, Oppenheim) The spine is monitored for scoliosis, and the hips for progressive subluxation. In younger children, lengthening or transfer of contracted tendons may suffice, supplemented by bracing to prevent early recurrences. For older children with bony deformities, corrective osteotomies (resetting of the bony alignment) may be required. If surgery becomes necessary, it is wise to do as much as possible at one setting (single event multilevel surgery (SEMLS)) both to keep multiple levels in balance as well as to avoid having to operate too frequently through childhood. Indications for surgery are generally different in ambulatory as opposed to non ambulatory children.
Ambulatory Children:

The goal here is to improve walking, though the spine and hips must still be monitored as in the non-ambulatory child. Typically the children are ambulating but with some issue such as toe walking, a poor stride length, scissoring (hips crossing over while walking), or crouching (the knees bent while walking). At times the feet may not be aligned with the way that the child is walking and there may be toeing in or toeing out. Instrumented three dimensional gait analysis may be helpful in identifying which muscles are contributing to the abnormalities, and examination can determine if there are twists in the bones that need to be addressed. Scissoring may be caused by tight adductor muscles of the hips, or flexion at the knees and internal rotation at the hips. A crouch gait may be related to simple weakness, or balance issues, or can be due to contractures of the hips and/or knees. For the ankle level the issues are tightness or weakness of the triceps surae, or both. In the past heel cords were released as necessary, but now we recognize that the gastrocnemius may be tight without the soleus being involved. The latter is important in lifting the heel at the end of stance (‘push off’) so that when possible it must be preserved. Otherwise, there is a risk of further crouching at the ankle as the child ages. The exception is for hemiplegic individuals, where toe walking may be treated (after conservative measures such as casting and or botulinum toxin) by tendon achilles lengthening without concern for later crouching which is a risk only for diplegic children with both lower extremities involved.

Nonambulatory:

The goal is to promote ease of care by preventing contractures, the development of significant scoliosis, and progressive hip subluxation,. This is done to promote useful sitting and transfers, if possible, and to prevent pain and pressure difficulties which may eventually accompany poor sitting postures, and subluxed hips,. In order to ensure good sitting height and lung development, scoliosis surgery is postponed to as late as possible by sitting modification and at times bracing. Likewise, hip abduction bracing or chair ‘pom pom’ modifications may be useful to control hip subluxations. Both of these are monitored by x-rays. Spinal fusion may be offered for curves in older children that exceed 50 degrees when sitting. The mere presence of hip and knee contractures in wheelchair dependent individuals are not in itself an indication for surgery. For progressive hip subluxation, iliopsoas release and adductor tendon lengthening may stabilize the situation, but when there is bony deformity of the hip joint itself, or when spasticity is particularly severe, proximal femoral varus osteotomy (cutting and redirecting the thigh bone) and/or acetabuloplasty (deepening or reorientation of the socket) may be necessary. For foot deformities, the goal to perform procedures to allow the child to wear comfortable shoes and to be able to place them properly in a wheelchair foot platform. This may require tendon lengthening, particularly the triceps surae (heelcord) and the posterior tibialis muscles (responsible for inverting or turning the foot in), but may require bony realignments and fusions in more severe cases.

Rotational Problems:

Although not readily apparent to the untrained eye, the position of the foot with respect to the leg is helpful in extending the knee. When distorted, this relationship is often referred to as ‘lever arm’ disease. Likewise, the position of the knee with respect to the axis of the hips is also important in gait progression so
there is not excessive ‘kneeing in.’ Why correct such deformities? Severe kneeing in or scissoring may impede one leg from moving ahead of the other. Further, if an otherwise uninvolved individual were to attempt to walk in a crouched manner, he or she would experience great fatigue in a short amount of time. Similarly, if they were to take half steps all day long, they would likewise feel very fatigued. Half steps or a shortened stride may result from tight hamstrings. Thus, correction of such abnormalities may result in a more efficient gait, with a greater stride length, greater self selected velocity, and less fatigability.

Because there can be a combination of bony deformity and soft tissue contractures, along with weakness, deciding how much and which abnormalities to address can at times be challenging. Once a decision to address a gait aberration has been made, the trend among orthopedic surgeons is to do more at a single sitting, and, not less. This discussion did not touch on some of the nuances, such as hyperextension of the knees, or patella alta, but when severe and symptomatic, these abnormalities may at times require complex reconstruction as well.

**What Happens To Someone With Cerebral Palsy Over Time?**

There is no one answer. Some children with cerebral palsy will show improvement, some will remain the same, and some will get worse.

The child’s motor (movement) abilities at age two can often predict how well the child will walk and move as he or she ages. However, since every child with cerebral palsy is different, it is not easy to make a prediction of whether or not a child will make progress.

Children with low IQs do not do as well with children with higher IQs. Children who undergo treatment often do better than children who are not treated.

It is important to keep in mind that many people who have cerebral palsy can go to school, hold jobs, get married, raise families, and live in homes of their own. Most of all people with cerebral palsy need the opportunity for independence and full inclusion in our society.

**10 Myths and Misunderstandings About Cerebral Palsy**

**My child’s future is limited.**

A child born with cerebral palsy or other disabilities has never had a more promising future. With early intervention services available from birth, and public school education in the “least restrictive environment” made mandatory, children with disabilities have the best shot ever for a quality education and greater achievement in life. But all services are not provided equally throughout the country. Parents will be the chief advocates for their child.
Caring for my child with disabilities will place enormous stress on my family.

Caring for a child with disabilities does place substantial stress on a family, challenging family members in every aspect of their lives. However, more and more resources exist to help reduce this stress. Most states now offer family support programs with a range of services, including respite, counseling, parent training, cash subsidy programs, and recreational and after-school activities. Government funded respite services are available in most communities, ranging from in-home assistance to overnight care. And local non-profit organizations such as United Cerebral Palsy: provide parent and sibling support groups, resources centers and learning libraries, information, referral aid, and assistive technology services. These are often in addition to concrete services which include programs for early intervention, preschool and school-age special education, adult recreation, and residential care, as well as healthcare, employment assistance, and more.

My child will never be able to walk.

When a child is very young, it is generally too soon to make a judgment about his or her long-term physical abilities. There are many complex issues that will come into play from a healthcare and rehabilitation perspective. A child’s self-motivation for physical independence also plays a key role. A parent can get connected by networking with other parents, as well as by asking their pediatrician to recommend an agency, hospital, or clinic that can provide the orthopedic evaluations comprehensive medical care, and physical therapy.

My child will never be able to communicate.

All children communicate in one from or another. Many children benefit from ongoing speech therapy. For a child who has limited speech or difficult-to-understand speech, there are an increasingly wide array or augmentative/alternative speech systems available. Young children learn with simple communication boards, basic “yes/no” switches, and sign language. As children grow older and gain the ability to operate more complex communication systems, they typically graduate to more sophisticated and high-tech electronic devices. From the parent’s perspective, it is important to find an educational program or in-house service that is savvy about speech therapy and augmentative communication systems, and introduces these services at the earliest point possible. Your local school district or county health department can direct you to speech and augmentative communication services in your community.

My child will never have friends who are non-disabled.

Throughout their lives, children with disabilities have constant, natural opportunities to interact with youngsters who are non-disabled, such as play groups and family gathering. Many preschool settings are no integrated and children who have disabilities learn side-by-side with their typically developing peers. When they graduate from preschool, they may go on to inclusionary public school settings.
My child will never hold down a job.

Your child’s future in terms of both supported and mainstream employment is brighter than ever. With the 1997 renewal of the Individuals with Disabilities Education Act (IDEA), we will continue the progress made in the educational arena guaranteeing an appropriate and inclusionary education for individuals with disabilities. Too, the widespread availability of transitional services between school and the work world increase the likelihood of success for individuals with disabilities in the workplace. The statistics speak for themselves: 20 years after IDEA, 57 percent of young people with disabilities as compared with 33 percent of older individuals with disabilities are cumulatively employed within five years of leaving school.

My child will never be able to get around the community.

The 1990 Americans with Disabilities Act (ADA) guarantees the accessibility of public systems by people with disabilities, and mandates alternative transportation systems when public transportation, such as subways, cannot be made readily accessible. And for adults who choose to live in small group programs in the community, specially trained staff provide instruction to promote independent traveling. Many programs also have accessible vans and other vehicles to assist in using community resources.

My child won’t have a normal life in the community.

Children with cerebral palsy and other disabilities have the potential for a childhood, adolescent, and adult life that is satisfying, challenging and, from almost every perspective, similar to everyone else’s. Depending on their degree of disability, they may eventually live on their own or in a small supervised group settings. They may marry have children of their own. They will face the emotional highs and lows and challenging life circumstances that every person faces at various points in their lives. Most important, they will have a choice in selecting the lifestyle and living situation that they prefer.

Society will never accept my child.

A child born with disabilities today enters a world where attitudes are light years ahead of society 20 years ago. In most communities across America, we have experienced 20 to 25 years of deinstitutionalization and community living. Individuals who have disabilities are visible everywhere-in school, in the workplace, and in every possible public venue. Most Americans have had some personal experiences with one or more persons who have disabilities- many through volunteer work and many others in every aspect of day-to-day life. Further, the ADA- which mandates physical accessibility for public buildings, public spaces, and transportation- has also served to heighten awareness of those with physical disabilities. While we do not live in a perfect world, we do live in a society which is far more accepting and in tune to the needs of those with physical and cognitive challenges.
My child will never be independent.

Today there exists an incredible variety of assistive devices and services that enhance the independence of individuals with cerebral palsy. There are also simple modifications that can be made to a person’s home, school, and work environments to facilitate independence and productivity. Lowering the clothes bar and shelves in a closet, widening doorways, and installing hand-held showers, all make it possible for a child who has cerebral palsy to actively participate in self-care activities. Adapted utensils and appliances enable a child to have access and independence in feeding and food preparations. Other assistive technology devices, ranging from alternative communication systems to computer adaptations, to adapted toys, enhance independence in all areas of a child’s life. Through the federal “Tech Act” Technology Related Assistance for Individuals with Disabilities (TRAID) Centers have been established in every state, offering free information and referral for assistive technology devices and systems.
# Cerebral Palsy Resources

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<td>National Information Center for Children and Youth With Disabilities</td>
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<td>National Institute of Neurological Disorders and Stroke</td>
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<td>MayoClinic</td>
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