

Cerebral Palsy



Common Symptoms in Children With Cerebral Palsy

1. Posture, Postural Control, and Movement

- The term posture describes the alignment of the body's parts in relation to each other and the environment. The ability to develop a large repertoire of postures and change them easily during an activity depends on the integration of automatic, involuntary movement actions referred to as the postural mechanism. The postural mechanism includes several strategic components:
 - Muscle and postural tone
 - Emergence of righting, equilibrium, and protective extension reactions.
 - Developmental integration of early, primitive reflex movement patterns.
 - Intentional, voluntary movements against the forces of gravity.
 - The ability to combine movement patterns in the performance of functional activities.

- Righting reactions and equilibrium reactions allow individuals to maintain upright posture with dynamic stability. When the head is out of alignment with the body, righting reactions realign the head with the body. An individual uses equilibrium reactions or balance reactions when the body's centre of gravity is moved over the base of support. Equilibrium reactions are coordinated responses of trunk, neck, and extremities as the individual moves in and out of different postures. When righting and equilibrium reactions are not sufficient to regain an upright posture, individuals use a protective extension reaction (i.e., they automatically reach outward from their bodies to catch themselves or prevent a fall). A protective response requires the motor ability to quickly extend an extremity (i.e., arm or leg)



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Atypical movement patterns

- Children who have CP demonstrate difficulty achieving and maintaining stable posture while lying down, sitting, and standing because of impaired patterns of muscle activation. Poor postural alignment and stability result from the CNS' decreased ability to control coactivation and reciprocal innervation of select muscle groups. Coactivation of muscle, or simultaneous contraction of agonist and antagonist muscle groups, provides stability around a joint and stability of body posture. Reciprocal innervation in muscle groups occurs when excitatory input directs the agonist muscle to contract while inhibitory input directs the antagonist muscle to remain inactive

- Children who have CP may develop abnormal movement compensations and body postures as they try to overcome these motor deficits to function within their environments.
- Over time, movement compensations and atypical motor patterns create barriers to ongoing motor skill development. Instead of freely moving and exploring the world, as children with a normally developing sensorimotor system do, children who have CP may rely on primitive and automatic reflex movement patterns as their primary means of mobility.

- Muscle tone is the force with which a muscle resists being lengthened; it can also be defined as the muscle's resting stiffness. It is tested by an occupational therapist's passive stretch of the muscle from the shortened to the lengthened state as the occupational therapist feels the resistance offered by the muscle to the stretch. A child's ability to perform sequential movements is supported by muscle tension (stiffness) and elasticity during the movements. Muscles must have enough tone to move against gravity in a smooth, coordinated motion. Emotions and mental state, including levels of alertness, fatigue, and excitement, can also influence muscle tone.

- Normal muscle tone develops along a continuum, with some variability among members of the typical population. The muscle's qualities of contractility and elasticity are necessary for immediate, consistent responses to the elongation and contraction experienced during movement, such as during coactivation. Muscle tone allows muscles to adapt readily to the changing sensory stimuli during functional activities. Decreased muscle tone, or hypotonia, can make a child appear relaxed and even “floppy.” Increased muscle tone, or hypertonia, can make a child appear stiff or rigid. In some cases of CP, an infant may initially appear hypotonic, but the muscle tone may change to hypertonia at 6 or 7 months.

- Sensorimotor Problems in Children With Cerebral Palsy

1. Abnormal muscle tone

- Hypertonicity: increase in resting state of muscle
- Spasticity: velocity-dependent increase in muscle tone (occurs with active or passive movement)
- Hypotonicity: decrease in resting state of muscle
- Fluctuating: muscle tone changes between hypertonic and hypotonic

2. Persistence of atypical and abnormal primitive reflexes

3. Atypical righting, equilibrium, and protective responses

4. Poor sensory processing

- Decreased processing of vestibular, visual, and proprioceptive information
- Limited body awareness and body scheme

5. Joint hypermobility or joint stiffness

- Reduced limb stability and poor cocontraction across joints
- Reduced joint movement

6. Muscle weakness and poor muscle coactivation

7. Delays in typical progressing of motor movement and motor skills affecting adaptive function



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Distribution and classification of muscle tone

- Monoplegia refers to the involvement of one extremity.
- Hemiplegia refers to involvement of upper and lower extremities on one side of the body.
- Paraplegia means that both lower extremities experience atypical tone, and quadriplegia refers to the involvement of all limbs.
- If all limbs and the head/neck experience atypical tone, this is referred to as tetraplegia.

- CP is also classified by the nature of the movement disorder according to four main types: (1) spastic, (2) dyskinetic, (3) ataxic, and (4) mixed.
- Children with spastic CP demonstrate hypertonia and muscle spasticity. Spasticity is defined as a velocity-dependent resistance to stretch. It is characterized by an excessive stiffness in the muscles when the child attempts to move or maintain a posture against gravity. Resistance to range of motion will either increase with speed of force or will increase with quick movement. The effects of spasticity are often associated with clonus, an extensor plantar response, and persistent primitive reflexes.

- As a child with spastic CP attempts to move, muscle tone increases and then rapidly releases, triggering a hyperactive stretch reflex in the muscle. Spasticity can vary according to the child's state of alertness, emotions, activity, posture, or presence of pain. Spasticity is associated with poor control of voluntary movement and limited ability to regulate force of movement. Distribution of spasticity can be monoplegia (rare), diplegia, hemiplegia, quadriplegia, or tetraplegia.
- In dyskinetic CP, movement patterns are classified as athetoid, choreoathetoid, and dystonic, which generally affect the entire body. A child with dyskinesia exhibits excessive and abnormal movement, and often when initiating movement in one extremity, atypical and unintentional movements in other extremities result. The child with athetosis exhibits slow, writhing, involuntary motor movements in combination with abrupt, irregular, and jerky movements.

- Athetosis is made worse by attempts to move; however, it may also be present at rest and is distinguished from dystonia by the lack of sustained postures, and from chorea by the lack of identifiable movement fragments. Children with pure athetosis demonstrate a fluctuation of muscle tone from low to normal with little or no spasticity and poor coactivation of muscle flexors and extensors.

Classification of Cerebral Palsy

Type of Movement Disorder	Area of Body Involved	Prevalence
Spastic	Diplegic: legs > arms	32%
	Quadriplegic: all four extremities	24%
	Hemiplegic: one-sided involvement, arm > leg	29%
	Double hemiplegic: both sides; one greater than other, arms > legs	24%
Dyskinetic	Choreoathetoid	14%
	Dystonic Athetosis	
Ataxic		<1%
Mixed (percentages included above)		

- Children with choreoathetosis have constant fluctuations from low to high with jerky involuntary movement that may be seen more proximal to distal. These movements are sustained twisted postures that are absent at rest and triggered by movement (action). Chorea is distinguished from dystonia by the apparently random, unpredictable, and continuously ongoing nature of the movements, compared with the more predictable and stereotyped movements or postures of dystonia. The movements of chorea often appear more rapid than those associated with dystonia. Although chorea may be worsened by movement, attempts at movement, or stress, specific movements are not triggered by voluntary attempts with the same degree of temporal specificity as in dystonia

- The third type of CP, ataxia, is characterized by poor balance and coordination. Children who have ataxia may show shifts in muscle tone, with quadriplegic distribution, but to a lesser degree than those with dyskinesia. Children with ataxic type CP are more successful in directing voluntary movements but appear clumsy and show involuntary tremor. They have considerable difficulty with balance, coordination, and maintenance of stable alignment of the head, trunk, shoulders, and pelvis. These children may have poorly developed equilibrium responses and lack proximal stability in the trunk to assist with control of hand and leg movements.

- Children with CP who often show combinations of high and low muscle tone problems are classified as the mixed type. When children have a diagnosis of CP where there is more than one motor type (i.e., spasticity and dystonia), usually one motor type will appear dominant. The distribution for mixed type CP is typically quadriplegic.