

Children with Cerebral Palsy: Importance of Physical Therapy or Physiotherapy

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Introduction

Cerebral palsy is a group of lifelong disorders affecting movement and posture, leading to activity limitations. These disorders are due to non-progressive disturbances that occurred in the developing brain of a fetus or infant. Motor disorders associated with cerebral palsy are often accompanied by issues in sensation, perception, cognition, communication and behaviour (Rosenbaum *et al.* 2007).

Cerebral palsy is the most common motor disorder diagnosed in children (Damiano *et al.* 2021) and has the highest global disease burden among all non-communicable chronic diseases evaluated in rehabilitation as of the 2030 WHO conference (WHO, 2019). This is due to its high prevalence, early onset in life, and significant severity.

Intervention

Intervention involves deliberately engaging in a challenging situation to improve it or prevent it from worsening (dictionary.cambridge.org). In the context of cerebral palsy, an intervention is a service designed to enhance the condition and daily life of those affected by it (cparf.org).

The incidence of cerebral palsy in India is approximately 3 cases per 1,000 live births, with 2011 statistics showing around 2.5 million children affected by CP in the country (Das, S.P., and Ganesh, G.S., 2019). While cerebral palsy is a lifelong condition, various interventions are available to help reduce its effects on the body and improve the individual's quality of life.

Physical Therapy or Physiotherapy

Physiotherapy helps children with cerebral palsy reach their highest potential for physical independence and fitness, enhancing the quality of life for both the children and their families by reducing the impact of physical impairments (Das, S.P., and Ganesh, G.S., 2019).

The goals of physiotherapy are to support the participation needs of children with cerebral palsy and to reduce the physical impairments associated with their symptoms.

There are many types of Physical therapy as follows: Approaches without equipment's

- ✚ **Bobath concept:** The Bobath approach also called Neurodevelopmental Treatment (NDT), was created by Dr. Karel Bobath and Berta Bobath in the 1940s. this concept originated from their observations of how abnormal muscle tone affected a child's ability to develop functional skills (Balçı, N. Ç. 2016). The Bobath concept emphasizes that a normal quality of muscle tone is essential for effective movement. Therapists using the bobath approach apply specialized handling techniques to improve muscle tone and support movement patterns needed for daily activities. The child's active participation is encouraged throughout treatment, with a specific focus on controlling movement during activities (Bobath, B. 1967). The purpose of this approach is to adjust abnormal postural tone and promote more typical movement patterns for completing daily activities seeks to normalize muscle tone, suppress primitive and abnormal reflexes, and encourage normal movement patterns. The Bobath concept focuses on improving postural alignment and reducing abnormal reflexes through the child's active participation and practice of functional skills.



- ✚ **Goal attainment therapy:** Goal Attainment Scaling (GAS) is a personalized, criterion-referenced measurement tool that assesses the achievement of treatment or intervention goals for various types of treatment issues. The aim is to support the child's participation in daily activities, such as communicating with parents, siblings, and peers; moving from place to place; dressing and undressing ; eating and playing. Therapy goals are chosen based on several factors, including the child's interests, the family's preferences, the community and environment in which the family lives, and the child's level of disability. Over time, there has been a shift in therapy approaches. Today, children are encouraged to be active problem solver within their daily environments,

rather than passive recipients of treatment as in the past. This treatment method, known as the ‘task-oriented’ approach is based on motor control theories. In this approach, therapy goals are established in close collaboration with the child’s family and at times, the child. The goals, along with their step-by-step grading, create a personalized plan to help the child learn specific activities and achieve the desired outcomes (Carlberg, E. B., & Löwing, K. 2010).



✚ **Conductive Education:** Conductive Education (CE) is an integrated educational and task-oriented approach designed for children with cerebral palsy. specially trained “conductors” provide instruction to groups of children with similar motor disorders. Movement challenges faced by children with cerebral palsy are regarded as fundamental learning process difficulties. Training occurs in an educational environment, where conductors, trained in all aspects of motor and cognitive development, structure activities, particularly those related to self-care. Group work plays a key role as a source of motivation, and significant emphasis is placed on anticipation, forward planning of activities, and voluntary control in developing new skills. The Conductive Education (CE) approach aims to teach individuals with physical disabilities to gain new experiences and skills in activities of daily living (ADLs). This approach focuses on teaching the child how to utilize their abilities to perform active movements and apply this learning across various life situations. The Conductive Education (CE) approach is particularly effective in enhancing social interactions and relationships compared to other methods. Additionally, educational programs for parents can improve the quality of life for children with cerebral palsy, especially in activities like eating and managing bowel and bladder control.



- ✚ **Sensory Integration Training:** Sensory integration, developed by occupational therapist Jean Ayres in the 1960s, attributes difficulties in planning and organizing behaviour to challenges in processing sensory inputs within the central nervous system. These inputs include vestibular, proprioceptive (related to the perception of body position and movement), tactile, visual, and auditory stimuli. Sensory integration therapy is founded on the concept that some children experience “sensory overload”, making them overly sensitive to specific types of stimuli. In cases of sensory overload, the brain struggles to process or filter multiple sensations simultaneously. Conversely, some children are under sensitive to certain types of stimulation. Children who are under sensitive may process sensory information slowly to inefficiently, often appearing disconnected from their surroundings. Children with sensory integration challenges have difficulty organizing, interpreting, and responding to sensory information from their environment. Sensory integration therapy provides structured, repetitive exposure to sensory stimuli. The goal of this approach is to help the brain adapt over time, enabling children to process and respond to sensory input more effectively.



- ✚ **Constraint-induced movement therapy (CIMT):** Constraint-induced movement therapy (CIMT) is a specialized approach designed to enhance upper limb function in children with hemiplegia, a condition affecting approximately 30% of children with cerebral palsy. Constraint-induced movement therapy (CIMT) aims to promote spontaneous use of the impaired arm by encouraging the child to rely on it through the restraint of the unaffected arm. Congenital hemiplegia, the most common form of

unilateral cerebral palsy, affects approximately 1 in 1,300 live births. It causes movement and/or sensory impairments on one side of the body, often leading to challenges with daily activities. These sensory and motor impairments frequently result in “developmental disuse” where the child avoids using the affected limb, preventing it from developing properly. CIMT involves key components such as restraining the unaffected side, intensive and focused practice (typically over 2-3 weeks, with therapy conducted 6-7 days a week, during which the unaffected hand is restrained for 90% of waking hours), and shaping activities. This is often followed by a 10-day, 6-hour daily intensive program. CIMT enhances movement efficiency, performance, and the perceived use of the affected upper extremity, with these improvements lasting for up to 6 months. Its effectiveness is not dependent on age. While the concept behind CIMT is not new, its application in hemiplegic CP remains experimental.



- ✚ **Bimanual training:** Bimanual training (BIT) focuses on enhancing the coordination of both arms through structured tasks, incorporating bimanual play and functional activities with intensive practice. Previously, therapists utilized a bimanual approach to manage motor dysfunction in children with hemiplegia. However, only recently has an intensive bimanual training program, known as Hand-Arm Bimanual Intensive Training (HABIT), been introduced with evidence supporting its effectiveness. This approach is grounded in motor learning theory, emphasizing practice specificity, types of practice, and feedback. It also leverages neuroplasticity, highlighting the brain’s ability to adapt through repetition, increasing movement complexity, motivation, and reward. The focus is on promoting equal use of both arms during bimanual tasks. Intensive Bimanual Training (BIT), such as HABIT, was developed with the understanding that achieving greater functional independence in a child’s environment requires the coordinated use of both hands. BIT emerged as a response to the limitations

of CIMT, aiming to address bimanual coordination while preserving the benefits of intensive training for the impaired arm. It emphasizes enhancing the coordination of both hands through structured task practice, integrated into bimanual plan and functional activities.



Approaches with using equipment's

- ✚ **Treadmill training:** Around 41% of children with cerebral palsy have limited walking ability. Traditionally, gait training has been conducted overground using assistive devices or parallel bars. Recently, treadmills have gained attention as a tool for gait training and assessment, offering several advantages over conventional methods. Treadmills offer clinicians practical solution for gait evaluation by addressing space constraints, reducing physical strain, and providing a convenient setup. Treadmill training is commonly used for children with cerebral palsy to improve balance and strengthen their lower limbs, enabling them to walk earlier and more efficiently compared to children who do not undergo treadmill training. Recently, there has been growing interest in Partial Body Weight-Supported Treadmill Training (PBWSTT). In this approach, the child wears a harness that supports their body weight, reducing the effort needed to walk on the treadmill. Treadmill gait training enables children to perform task-focused activities repetitively while walking, helping them regulate speed and develop a proper walking pattern through repeated sensory inputs. This approach effectively strengthens the knee extensors and flexors while enhancing balance skills, playing a crucial role in improving functional activities for children with cerebral palsy. Increased lower limb strength helps adjust posture, enhance dynamic postural stability, and ultimately improved walking. Additionally, the combination of improved walking endurance and muscle strength leads to better gait performance following treadmill training (Olama, K. A. 2011).



- ✚ **Robot-assisted therapy:** Robot-assisted therapy (RAT) utilizes robotic devices to help patients perform specific limb movements. One of its key advantages is enabling patients to complete a high volume of movements within a limited timeframe. The engaging human-machine interface motivates children to participate in therapy through interactive activities, such as car racing games or exercises that simulate activities of daily living (ADLs). Additionally, robotic devices provide visual, auditory, or sensory feedback and offer performance-based assistance tailored to the patient's progress. Robotic devices provide children with an enjoyable and intensive rehabilitation experience that goes beyond what a human therapist alone can offer. These robots can be seamlessly incorporated as a valuable complement to traditional therapy in clinical settings.



- ✚ **Virtual reality:** Virtual reality is defined as the use of computer-generated interactive simulations to immerse users in virtual environments that resemble real-world objects and events in appearance, sound, and feel. The therapeutic purpose of virtual reality and interactive computer play extends beyond mere entertainment. In paediatric rehabilitation, virtual reality leverages its unique features to create realistic, engaging opportunities for active learning. These experiences are motivating, enjoyable,

challenging, and safe. Children with cerebral palsy often face mobility and manual ability limitations, reducing their opportunities for free play. Without the chance for self-initiated, spontaneous play, they may develop learned helplessness, believing they cannot perform tasks despite having the physical ability to do so. Virtual reality can enhance patient's motivation and performance in activities of daily living (ADLs).



- ✚ **Cardiorespiratory endurance training:** Many children, adolescents, and adults with cerebral palsy (CP) experience reduced cardiorespiratory endurance- the ability to perform physical activities primarily reliant on aerobic energy systems-as well as decreased muscle strength and participation in regular physical activity. Both diminished endurance and muscular weakness significantly increase the risk of negative health outcomes, including early cardiovascular and all-cause mortality. Due to their lower levels of muscle strength and cardiorespiratory fitness, individuals with CP face a heightened risk of developing cardiovascular diseases. This is evidenced by elevated cardiometabolic risk factors in adults with cerebral palsy (CP), including hypertension, cholesterol imbalances, low HDL-C, visceral adipose tissue accumulation, and obesity. Additionally, adults with CP exhibit significantly higher rates of chronic diseases such as diabetes, asthma, hypertension, cardiovascular conditions, stroke, joint pain, and arthritis. Cardiorespiratory training has been shown to effectively improve cardiorespiratory endurance in children and young adults with cerebral palsy (CP). An exercise program for individuals with CP should include the following guidelines: 1. A frequency of at least 2-3 sessions per week. 2. An intensity level of 60-95% of peak heart rate, 40-80% of heart rate reserve (HRR), or 50-65% of VO₂ peak. 3. A minimum duration of 20 minutes per session for at least 8 consecutive weeks (when training 3 times per week) or 16 consecutive weeks (when training 2 times per week).



- ✚ **Hippotherapy:** Hippotherapy, a rehabilitation technique involving therapy with a moving horse, has shown promise in enhancing mobility in children with cerebral palsy (CP). This therapy aims to improve motor function and movement quality in children with CP. The horse's warmth, body shape, and rhythmic, three-dimensional motion during riding contribute to improved flexibility, posture, balance, and mobility for the rider. Hippotherapy is characterized as a treatment approach with low frequency but high repetition. Muscle contractions and postural adjustments are essential for responding to the horse's movements during hippotherapy. A full-sized horse walking transfers approximately 110 multidimensional swinging motions to the rider every minute. In a 30-minute session, a horse walking at a pace of 100 steps per minute generates over 3,000 steps, requiring the child to actively engage their trunk muscles to maintain vertical alignment and respond to these postural challenges. During sessions, the child often assumes various positions, such as forward sitting, side sitting, and backward sitting, to enhance motor engagement and adaptability. During hippotherapy sessions, a therapist and a trained side walker assist the child on the horse, providing support and facilitating movement opportunities. This therapy helps reduce abnormal muscle tone, enhances motor performance, promotes symmetrical alignment, and improves postural awareness, gait and mobility. It serves as an upper-body walking exercise that does not rely on the use of the legs.



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