



Review Article

## Physiotherapy management of children with cerebral palsy

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### ABSTRACT

Cerebral palsy (CP) is a non-progressive developmental movement and posture disorder that occurs during fetal or infant development. It results from an insult to the developing brain before birth, during delivery, or after birth. CP is regarded as the leading cause of childhood disability in all parts of the world. The hallmark of CP is a motor disability, thus, physiotherapy has long been central to the clinical management of children with this disorders. Physiotherapy intervention in the management of this condition focuses on function, movement, and optimizing the child's potential. Some of the approaches used are neurodevelopmental technique, neuromuscular electrical stimulation, exercise therapy, hydrotherapy, body weight support tread mill training, sensory integration training, and constraints induced therapy. Although, physiotherapy is generally recommended by all members of the health-care team. However, the effectiveness of physiotherapy is inconsistent. The objective of this review was to summarize the proven effectiveness of the most commonly used physiotherapy intervention in the management of children with CP.

**Keywords:** Cerebral palsy, Hippotherapy, Spasticity, Diplegia, Congenital malformations and neurodevelopmental technique

### INTRODUCTION

Cerebral palsy (CP) is the leading cause of childhood neurodisability.<sup>[1]</sup> It is the most common physical developmental disability in childhood that encompasses a group of disorders of the development of movement and posture that cause activity limitation. These are attributed to non-progressive disturbances that occur in developing infant brains.<sup>[2]</sup> The impairments in CP, including secondary impairments such as spasticity, muscle weakness, joint deformity, muscle contracture, and coordination disorders, cause activity limitation as a result of the affectation of the lower extremities. These lower extremities affectation results in deficit in walking ability and contributes to participation restriction. The variation in the level of impairment seen in children with CP can be described using the Gross Motor Function Classification System (GMFCS).<sup>[3]</sup> Although, physiotherapy is generally recommended by all members of the health-care team. However, the effectiveness of physiotherapy is inconsistent. The objective of this review was to summarize the proven effectiveness of the most commonly used intervention in the management of children with CP.

### EPIDEMIOLOGY OF CP

Population-based studies from around the world report that the prevalence estimates of CP range from 1.5 to more than 4/1000 live births or children of a defined are range.<sup>[4]</sup> It was observed

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that the prevalence of CP was lower in the developed countries than in developing countries,<sup>[5]</sup> with a prevalence of 2–2.5 cases per 1000 live birth in the United States<sup>[6]</sup> and about 3.5–4 cases per 1000 live birth in the developing countries.<sup>[7]</sup> CP is the most common motor disability in childhood.<sup>[8]</sup> Data from CP registries from Sweden showed an increasing trend in the rate of CP from the late 1960s to the mid-1980s which were 1.3 per life birth to 2.5/1000 live birth and the trend was pronounced in those children with spastic diplegia.<sup>[7]</sup> A high prevalence of CP has also been reported in the United Kingdom by Steven *et al.*<sup>[9]</sup> in the category of children having low birth weight. A prevalence of 3.8/1000 live birth was reported in Australia by Odling *et al.*<sup>[10]</sup>

### RISK FACTORS FOR CP

The exact cause of CP is not known yet; however, a group of risk factors has been identified.<sup>[11]</sup> CP can result from any event that will affect the fetal and neonatal developing brain. Congenital malformations, fetal growth restriction, multiple gestations, infection during the fetal and neonatal period, birth asphyxia, preterm delivery, untreated maternal hypothyroidism, perinatal stroke, and thrombophilia are all recognized as risk factors for CP.<sup>[12]</sup> Premature birth, especially before 28 weeks of gestation, is the leading risk factor for the development of CP.<sup>[13]</sup> The birth prevalence of CP is far higher in preterm than in term infants, increases with decreasing gestational age at delivery,<sup>[14]</sup> and can reach up to 15% among preterm neonates who were born between 24 and 27 weeks of gestation.<sup>[15]</sup> Perinatal factors that have been associated with the development of CP in premature infant include: Chorioamnionitis (intra-amniotic infection) or other evidence of perinatal inflammation, especially when sustained postnatal.<sup>[16]</sup>

### DIAGNOSIS OF CP

The diagnosis of CP is based on a clinical assessment, and not on laboratory testing or neuroimaging.<sup>[17]</sup> In clinical practice, the diagnosis of CP is typically based on observations or parent reports of unattained motor milestones, such as sitting, pulling to stand, and walking, and evaluation of posture, deep tendon reflexes, and muscle tone.<sup>[13]</sup> Therefore, Rosenbaum *et al.*<sup>[18]</sup> opined that the approach that appears to be most widely used is based on a standardized measure of motor function which is the GMFCS.

### CLASSIFICATION OF CP

CP has traditionally been described based on the kind of damage (spasticity, dyskinesia, and ataxic) and its location, or topography (hemiplegia, diplegia, and tetraplegia).<sup>[19]</sup> Until recently, there were not standardized methods to classify CP

in relation to subtypes and severity of motor impairments.<sup>[20]</sup> There is a substantial overlap of the affected areas. In the most studies, diplegia is the most common form (30–40%); hemiplegia is 20–30% and quadriplegia account for 10–15%. In an analysis of 1000 cases of CP from India, it was found that spastic quadriplegia constitutes 61% of cases following by diplegia 22%.<sup>[21]</sup> Conventionally, CP can be classified according to the motor type, topographical distribution, and functional severity.<sup>[22]</sup>

The topography or the body parts affected the type of motor impairment involved and the severity of the disorder can also be used to classify CP. Using classification based on topography, hemiplegia, for example, refers to the unilateral impairment of the arm and leg on the same side; diplegia describes motor impairment primarily of the legs (usually with some relatively limited involvement of arms); paraplegia indicates an involvement of the lower extremities while quadriplegia involves the four limbs and is said to be the commonest type.<sup>[23]</sup>

### MANAGEMENT OF CP

Management of children with CP starts with very early assessment, diagnosis, and treatment. This is because a very early treatment will give quicker and better result as the abnormality/impairment has not fully manifest in the child therefore has little experience.<sup>[24]</sup> It must be individualized based on the child's clinical presentation, and it requires a multidisciplinary approach that provides a combination of interventions.<sup>[11]</sup> It has been shown by Taylor<sup>[25]</sup> that children with CP that receives early and intensive management have best clinical outcomes.

Rehabilitation programs for children with CP should be appropriate for the age and functional status of the patients. The aim of CP rehabilitation should be to minimize disability and to promote independence and social participation.<sup>[26]</sup> The approach to management of children with CP is to use appropriate combinations of intervention (multidisciplinary), including development, physical, medical, surgical, pharmacological, and technical modalities to promote function, prevent secondary impairments (for example, musculoskeletal adaptation), and the most important is to increase the child's developmental capabilities to promote his or her societal participation. This is in keeping with the World Health Organization's model of health and disease which focuses on function and participation.<sup>[27]</sup> Systematic review focusing on interventions, such as constrained-induced movement therapy (CIMT),<sup>[28]</sup> postural control,<sup>[28]</sup> passive stretching,<sup>[29]</sup> hydrotherapy,<sup>[30]</sup> hippotherapy,<sup>[31]</sup> and orthotic devices,<sup>[32]</sup> has been carried out. Findings from those reviews indicated that the effectiveness and efficacy of therapeutic interventions for children with CP has been difficult to determine due to the lack of the high-quality research.

## PHYSIOTHERAPY MANAGEMENT OF CHILDREN WITH CP

Physiotherapist as an expert in the management of impairments seen in CP use different approaches as identified by Patel.<sup>[33]</sup> Some of the approaches used are; neurodevelopmental technique (NDT), neuromuscular electrical stimulation, exercise therapy, hydrotherapy, body weight support treadmill training, patterning, conductive education, constraints induced therapy, Vojta method, and suit therapy. The previous reviews have addressed the effectiveness of PT interventions for children with CP focusing on NDT,<sup>[34]</sup> conductive education,<sup>[35]</sup> various physiotherapy interventions,<sup>[36]</sup> or orthotic devices.<sup>[37]</sup> Some of these approaches are highlighted below:

### The NDT approach

This approach was developed by mere personal observations of two individual Berta and Karel while managing children with CP.<sup>[38]</sup> This technique was based on the assumption of Bobath that the motor abnormalities in children with CP are as a result of delayed milestones or abnormal development of postural control and reflexes because of the nervous system dysfunction.<sup>[39]</sup> As such, the approach aiming at training appropriate and age related milestones, facilitate normal motor development and function and to prevent secondary musculoskeletal adaptation. Therefore, following the Bobath approach which focuses on using different techniques to inhibit and control the abnormal tone and reflexes,<sup>[40]</sup> the NDT was postulated to facilitate normal postural and righting reflexes and movement patterns. Bobath concept helps to improve postural alignment and inhibit abnormal reflex with child's active participation and practice of functional skills. Using handlings, it is possible to conduct movements, influence muscle tone, and improve postural alignment and postural self-organization.<sup>[41]</sup>

### Body weight support treadmill training

This technique works primarily on eliciting and improving the stepping movement that is normally present in newborn and infant even before the infant starts to bear weight, stand, or walk as the child attempts to walk on a slowly moving treadmill with close monitoring and support.<sup>[42]</sup> Other studies have shown the positive impact of body weight support treadmill training on the lower extremity mobility and gait pattern in children with CP.<sup>[43]</sup> Furthermore, treadmill has been proven to improve balance and build strength in the lower limbs of children with CP so they could walk earlier and more efficiently than those who did not receive treadmill training.<sup>[44]</sup> It is suggested that treadmill training may favor proprioceptive feedback, leading to adjustments for adequate postural balance and functional performance.<sup>[45]</sup> Backward

treadmill training has also been reported to help children with CP (most especially the spastic type) to improve walking capacity and decrease standing asymmetry of body weight distribution.<sup>[46]</sup>

### Conventional exercise therapy

This encompasses the treatment regimen which includes passive movement, progressive resisted exercises, passive stretching, weight bearing exercises, and progressive habilitation exercises. The studies have shown the effectiveness of the conventional exercise therapy on muscle strength, local muscular endurance, and overall joint range of motion.<sup>[39]</sup> In the past, strength training was considered contraindicated in children with CP because it was thought to increase muscle stiffness and result in an increase in spasticity. However, authors have found no change in spasticity during or after training, which support the present belief that strength training for persons with spasticity is not contraindicated.<sup>[47]</sup> Barber<sup>[48]</sup> also noted that there are strong indications that strength training programs play an important role in the habilitation of individuals with CP.

### Sensory integration training

Sensory integration was developed by an occupational therapist, Jean Ayres, in the 1960s.<sup>[49]</sup> In this concept, difficulties in planning and organizing behavior are attributed to problems of processing sensory inputs within the central nervous system, including vestibular, proprioceptive, tactile, visual, and auditory. A significant number of children with CP has sensory impairments and sensory integration may help processing and integration of this sensory information, thereby enhancing the child's acquisition of function.<sup>[48]</sup> It was concluded that sensory integration training in children with CP will be applied to combined programs and the relationship with individual and group treatments developed.<sup>[50]</sup> Schaaf and Miller,<sup>[49]</sup> however, concluded in a separate review of literature that efficacy of this treatment approach is equivocal.

### CIMT

This is specifically used to improve the upper limb function in children with hemiplegic type of CP and the sub-type that account for approximately 30% of all children with CP.<sup>[19]</sup> The CIMT aims to increase spontaneous use of the impaired arm by forcing the child to use it by restraining the other one, and it is characterized by restraining of the unaffected side, concentrated and intensive practice, and shaping activities.<sup>[51]</sup> One potential advantage of CIMT is that the restraint allows the therapist administering the intervention to focus solely on the more-affected arm.<sup>[52]</sup> Some clinical trials show that

this modified CIMT significantly improves movement efficiency and bimanual arm use in hemiplegic children.<sup>[53]</sup>

## CONCLUSION

The hallmark of CP is a motor disability and physiotherapy has long been central to the clinical management of children with this disorders. Although, some authors find the outcome of physiotherapy intervention to be inconsistent. However, this review summarizes some interventions that their effectiveness has been proven in the management of children with CP.

## Declaration of patient consent

Patient's consent not required as there are no patients in this study.

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## Conflicts of interest

There are no conflicts of interest.

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