INTERNATIONAL JOURNAL OF
PHYSICAL THERAPY RESEARCH & PRACTICE
AN OFFICIAL JOURNAL OF SAUDI PHYSICAL THERAPY ASSOCIATION

Review Article

Role of Physical Therapy in Postural Management to Prevent Hip Dislocation in Children with Spastic Cerebral Palsy

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Article info

Received : Oct. 18, 2025
Accepted : Nov. 19, 2025
Published : Nov. 29, 2025

To Cite: Alamri SA et al. Role of Physical Therapy in Postural Management to Prevent Hip Dislocation in Children with Spastic Cerebral Palsy. (n.d.). *International Journal of Physical Therapy Research & Practice*, 485-497. https://doi.org/10.62464/ykxpkv10

Abstract

Background: Cerebral palsy (CP) is a neurological disorder characterized by motor impairments stemming from non-progressive brain anomalies. A primary concern in children with spastic CP is hip migration, which can progress to subluxation or dislocation, particularly in non-ambulatory patients. **Objective:** This narrative review explores the efficacy of physical therapy approaches within postural management programs in preventing hip dislocation in children with spastic CP. **Methods:** Literature published between 1990 and 2022 is reviewed across databases—namely, PubMed, EDLINE, CINAHL, AMED and Google Scholar. **Results:** The review highlights diverse interventions, including passive stretching, weight-bearing exercises, standing devices, orthotic aids and the Vojta method, that underestimate the importance of early, individualized and multidisciplinary management in children with spastic CP. While some conservative strategies show promising outcomes, the evidence remains limited and of variable quality. Moreover, the studies have been heterogeneous in design, outcome measures and intervention protocols. Overall, the review indicates the need for tailored programs early in life, especially for children whose motor function is classified as Gross Motor Function Classification System levels IV and V, emphasizing the essential role of physiotherapists in preventive care. **Conclusion:** Early, tailored physiotherapy and postural management programs play a critical role in mitigating hip displacement in children with spastic CP. Strengthening interdisciplinary collaboration and standardizing intervention protocols are essential to both improving clinical outcomes and advancing the evidence base for conservative management strategies.

Keywords: Cerebral palsy; Hip dislocation; Postural management; Physical therapy; Gross Motor Function Classification System.

Introduction

Cerebral palsy (CP) encompasses a range of non-progressive brain lesions or anomalies that emerge in early development, leading to secondary motor impairment syndromes (Mutch et al., 1992). While these brain lesions or anomalies remain stable in patients with CP, the outward manifestation of their symptoms exhibits variability over time. The characteristics of CP may include spasticity,

secondary alterations in the musculoskeletal system (e.g. diminished muscle strength, joint tightness, contractures) and abnormalities in bone structure, leading to a decline in patients' mobility (Graham & Selber, 2003). Children with CP subluxation or dislocation (Rodby-Bousquet et al., 2013).

Children with CP typically exhibit normal hip alignment at an early age; however, various factors that occur during growth can disrupt their hip development. The primary contributors to hip migration include a lack of weight-bearing capacity and spasticity (Connelly et al., 2009). Notably, the age at which a child begins to stand independently is a critical factor affecting hip migration. Another important contributing factor is the muscle tone imbalance commonly seen in children with CP, whereby strong hip flexors and adductors oppose weaker hip extensors and abductors (Connelly et al., 2009), potentially leading to reduced femoral head contact with the acetabulum. This disruption may lead to a limited range of motion and bone deformities such as coxa valga, femoral anteversion and acetabular dysplasia/migration.

Research gap

Despite the strong theoretical rationale and increasing clinical use of physiotherapy-led postural management strategies in children with CP, the evidence base remains limited by heterogeneous intervention designs, inconsistent outcome measures and lack of high-quality trials. Prior studies seldom examined physiotherapy within a 24-hour postural management framework, meaning that it remains unclear how specific physiotherapy approaches contribute to preventing hip migration across different Gross Motor Function Classification System (GMFCS) levels. Thus, the role and effectiveness of physiotherapy within

commonly experience progressive musculoskeletal issues, such as scoliosis, pelvic obliquity and windswept hip deformity, with the associated hip migration potentially leading to

structured postural management programmes in preventing hip dislocation in children with spastic CP remain insufficiently synthesised.

Pathophysiology of primary brain lesions and functional consequences

CP arises from insults to one or more motor system structures in the immature brain (e.g. corticospinal tracts, basal ganglia, cerebellum, thalamocortical systems). The timing, location and mechanism of injury (hypoxic–ischemic events, intraventricular haemorrhage, periventricular leukomalacia, infection, bilirubin toxicity, congenital malformation) determine the clinical motor syndrome (e.g. spastic, dyskinetic, ataxic) and the distribution of motor impairments (hemiplegia, diplegia, quadriplegia). Periventricular white matter injury (periventricular leukomalacia [PVL]) is strongly associated with the spastic diplegic phenotype typical of preterm survivors, whereas basal ganglia injury (e.g. kernicterus) predisposes patients to dyskinetic presentations. These central lesions result in altered motor unit recruitment, impaired selective motor control, abnormal muscle tone and strength deficits that limit voluntary movement and adaptive postural control (Ahya & Suryawanshi, 2018).

Secondary pathophysiology of the musculoskeletal cascade

As the neural lesions seen in a child with CP remain static but the child in question grows, an evolving cascade of secondary musculoskeletal problems commonly develops. More specifically, persistent or asymmetric tone, reduced spontaneous

movement, loss of reciprocal inhibition and reduced motor variability all lead to muscle tendon shortening, joint contracture, bony torsional deformities (e.g. femoral anteversion, tibial torsion), spinal deformity and joint subluxation/dislocation (notably of the hip). These secondary changes amplify functional impairments, pain levels and limitations in Moreover, the complications seen in CP may culminate in subluxation or dislocation, which is particularly prevalent in children with CP whose age-related motor function is classified as GMFCS levels III and IV. Figure 1 presents the five-level GMFCS, originally developed by Palisano et al. (1997) as a reliable and valid method for classifying gross motor function in children with CP. The GMFCS categorises children according to their self-initiated movement capabilities, including sitting, walking and use of mobility aids, with an emphasis on typical functional performance in home, school and community settings. The levels progress from level I, which represents the highest functional mobility, to level V, which reflects profound limitations in self-mobility despite the use of assistive technology.

In the Figure 1, the illustrations accompanying each level depict the characteristic mobility patterns. Level I shows a child who walks indoors and outdoors independently, climbs stairs without support and performs gross motor skills such as running and jumping, although mild balance or coordination impairments may be present. Level II illustrates a child who walks independently but requires support (e.g. using a railing on stairs) and demonstrates limitations on uneven terrain or in crowded spaces. Level III depicts a child who ambulates on level surfaces using an assistive mobility device and may rely on a manual wheelchair for travelling longer distances or outdoor mobility. Level IV shows a child with limited participation in the activities of daily living. Importantly, many secondary outcomes (e.g. progressive hip migration) are not related to the movement disorder per se but to the level of gross motor function and prolonged exposure to asymmetric postures and deforming forces (Graham et al., 2016; Terjesen & Horn, 2022).

self-mobility who may use a walker for moving short indoor distances but primarily depends on powered or assisted wheeled mobility in most environments. Level V presents a child with severe motor impairment who has markedly restricted voluntary movement and requires full assistance for mobility and positioning, including using wheeled transportation for all functional activities. Together, the visual and textual descriptions in the figure highlight the functional distinctions across GMFCS levels I–V and underscore the increasing dependence of children with CP on assistive devices and caregiver support as their gross motor impairment becomes more pronounced.

Notably, no child classified as GMFCS level I develops hip dislocations with a migration percentage exceeding 40%. In contrast, 10% of level II children, 18% of level III children, 45% of level IV children and 64% of level V children develop severe hip dislocations. Moreover, windswept hip deformities are absent among children classified as levels I and II, discernible in children classified as level III and observed in 52% of level V children (Hägglund et al., 2016; Hägglund et al., 2007).

The treatment objectives when averting hip dysplasia/migration in children with CP are contingent upon the individual child's functional status. For non-ambulatory children, the goal is to establish a pain-free hip that facilitates stable sitting, proper positioning and enhanced personal hygiene. Conversely, the treatment for ambulatory

children is intended to enable walking without groin or hip pain. In cases of subluxation, surgical intervention is primarily aimed at preventing dislocation, which necessitates the identification of hips that are prone to such a risk (Eldessouky & Smeda, 2016; Wynter et al., 2014).

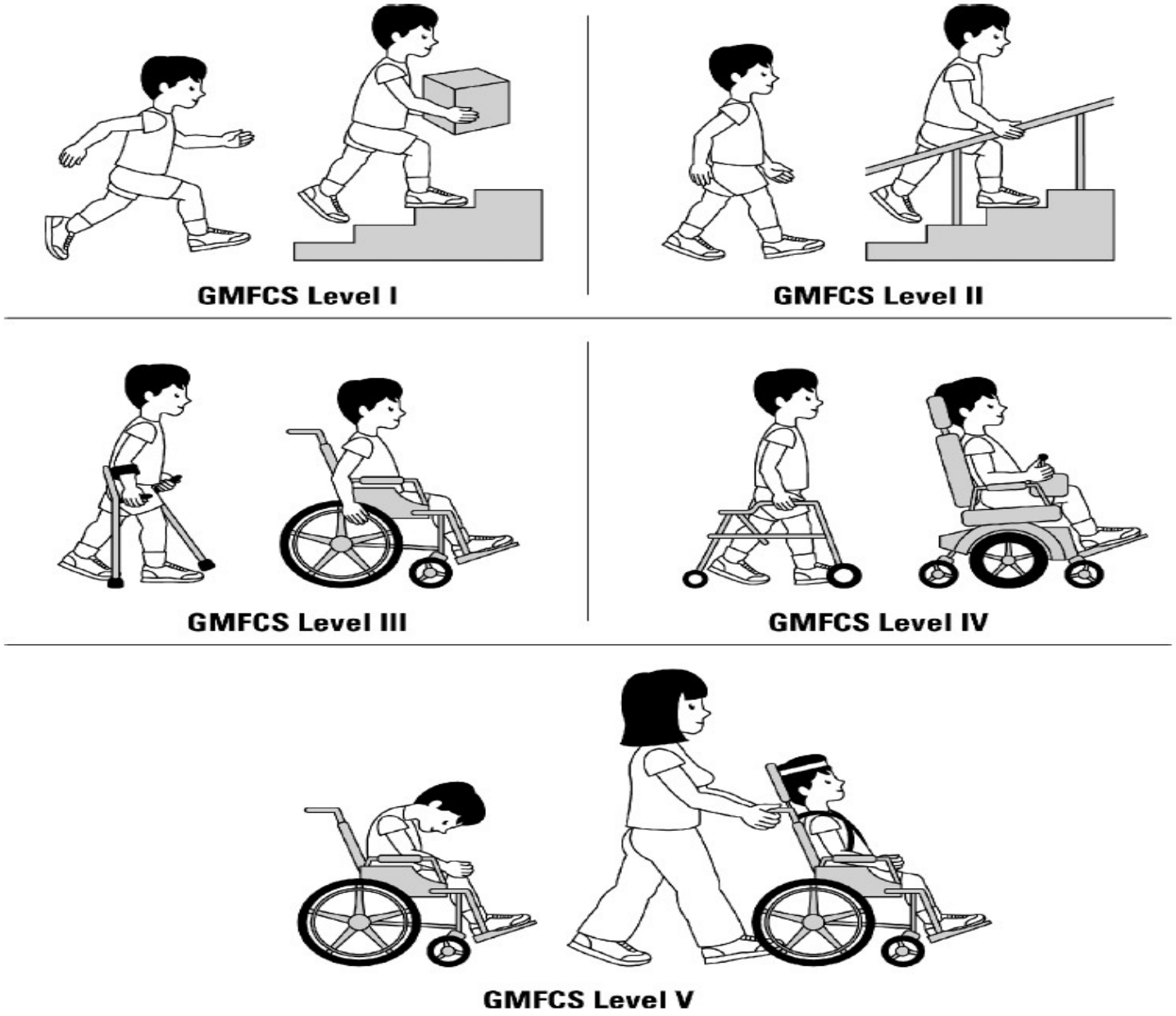

Figure 1. Gross Function Classification System for children with cerebral palsy (ages 6–12 years) (Palisano et al., 1997).

Non-operative treatments designed to mitigate hip dislocation are primarily preventive in nature. For instance, an integrated approach to averting hip-related problems may involve various interventions, including postural management, physiotherapy programmes, botulinum toxin injections and orthotic devices. Among these interventions, physiotherapy stands out as a widely utilised and universally recommended non-operative treatment. Its effectiveness stems from the diverse range of available therapeutic interventions, which employ various exercises and

techniques such as neurodevelopmental treatment (NDT). This approach significantly contributes to enhancing the physiological and functional outcomes in children with CP. Indeed, physiotherapy plays a pivotal role in postural correction and alignment systems. The focus is on maintaining adequate hip abduction and counteracting the progression of muscle contractures, safeguarding against potential hip joint issues (Picciolini et al., 2009; Das & Shankar Ganesh, 2019).

Conservative strategies for addressing hip migration in children with CP have gained prominence over the past decade, with a notable emphasis on postural management programmes. Postural management encompasses a range of nonsurgical methodologies, including the use of specialised equipment such as standing devices or lying systems, as well as orthotic interventions and tailored physiotherapy sessions (Gough, 2009).

Benefits of physiotherapy

Physiotherapy (PT) in children with CP targets the interface between the static neurological lesions and the dynamic musculoskeletal and functional outcomes. There are a number of complementary mechanistic and evidence-based reasons why PT should be central to CP care:

- Neuroplasticity and motor learning: Task-specific, repetitive and progressively challenging practice can promote experience-dependent plasticity in developing motor systems. Early and intensive physiotherapy enhances the recruitment of alternative neural pathways, refines motor patterns and improves functional motor outcomes (Graham et al., 2016).
- Direct prevention of secondary impairments: PT techniques (range-of-motion programmes, stretching, strengthening, task-specific training, orthotic prescription, gait training) are designed to maintain muscle length, reduce the contracture risk, preserve joint alignment and maximise functional mobility, thereby interrupting the pathway to deformity (Liang et al., 2021).
- Improving participation and quality of life: Beyond reducing impairment, goal-directed PT and activity-based interventions offer benefits in terms of gait speed, balance, strength and participation metrics in children and adolescents with CP. These outcomes translate into greater independence and reduced caregiver burden. Recent systematic reviews and randomised controlled trials (RCTs) report positive effects on the part of several PT modalities (treadmill training, goal-directed training, action observation, strength training), although the effect size varies by the intervention type and GMFCS level (Liang et al., 2021).

Postural management must be emphasised within physiotherapy

In the PT field, postural management—that is, a coordinated programme of 24-hour positioning, supported standing, individualised seating systems and orthotic/assistive device use (Gericke, 2006)—merits particular emphasis for three main reasons:

- Continuous mechanical influence: Unlike episodic therapy sessions, posturing and positioning determine the child's mechanical environment for most of the day and night. Both protracted asymmetric loading and sustained shortened positions (e.g. adduction–flexion posture of the hip) create chronic deforming forces that drive bony remodelling, hip migration and scoliosis. Hence, interventions that modify these continuous forces (e.g. sitting posture, supported standing, night-time positioning) address the principal drivers of many secondary musculoskeletal pathologies (Paleg & Livingstone, 2022).
- Prevention of hip displacement and role of surveillance: Hip migration and dislocation are

both common in children with higher GMFCS levels. Thus, evidence and professional guidelines emphasise the importance of hip surveillance and early postural/orthotic strategies as preventive measures. A sitting posture that centres the femoral heads and supported standing (when tolerated) reduce the asymmetric loads on the hip and are associated with slower migration percentage progression (Martinsson & Himmelmann, 2021). National and regional hip surveillance programmes recommend early, risk-stratified radiographic monitoring and integration of postural management into routine care (AACPDM Hip Surveillance Care Pathway Team).

- Clinical feasibility and broad impact: Postural interventions (e.g. appropriate seating, individualised standing frames, sleep supports) are practicable in both home and school settings. Moreover, they are often deliverable by physiotherapists and therapists and can improve the patient's comfort, ease of caregiving pressure distribution, respiratory mechanics and participation. While high-quality RCT evidence is limited by the heterogeneity of prior interventions and outcomes, scoping and systematic reviews support the clinical value of 24-hour postural approaches and highlight the need for standardised protocols and measurements (Angsupaisal et al., 2015). To extend the literature in this regard, the present narrative review aims to synthesise the existing evidence on the role of PT interventions within postural management programmes in preventing hip dislocation in children with spastic CP.

Methodology

Study Design and Setting

The research question addressed in this narrative review is as follows: Do PT approaches play a role in postural management to prevent hip dislocation in children with spastic CP? Answering this question is important because the role of PT programmes in posture management remains unclear due to the scarcity of evidence related to the prevent of hip dislocation in children with CP. This narrative review involved literature searches conducted in PubMed, MEDLINE, CINAHL, AMED and Google Scholar spanning the years 1990 to 2022. The searches focused on articles containing the keywords 'posture management', 'physiotherapy', exercises', 'NDT', 'hip migration', 'displacement', 'subluxation', 'dislocation' and 'cerebral palsy' in their titles. The review encompassed various study types, including RCTs, systematic reviews, meta-analyses and pilot studies.

A total of 49 records were initially identified via database searching. After the removal of any duplicates, all of the records underwent title and abstract screening based on predefined key terms ('cerebral palsy', 'hip migration', 'postural management' and 'physiotherapy'). During this stage, 25 records were excluded from the analysis because they did not meet the following eligibility criteria: (1) population: children or adolescents diagnosed with CP, regardless of CP subtype or GMFCS level; (2) conceptual focus: investigations examining hip migration or displacement, postural management strategies and/or physiotherapy or rehabilitation interventions; (3) availability and language: full-text articles published in English; and (4) study design: empirical research using quantitative, qualitative or mixed-methods approaches, including RCTs, quasi-experimental studies, cohort studies, observational studies, case series and systematic or scoping reviews. Eligible studies were also required to report outcomes pertaining to hip displacement (e.g.

migration percentage), postural alignment, musculoskeletal function, motor performance or PT-related management.

Moreover, studies were excluded from the analysis if they (1) did not involve populations with CP or did not address hip migration/displacement, postural management or physiotherapy interventions; (2) were published in a language other than English; (3) lacked full-text availability; (4) constituted non-peer-reviewed publications, including conference abstracts, letters, commentaries, editorials or opinion pieces; (5) focused exclusively on adults with CP; or (6) demonstrated insufficient methodological rigour or failed to report adequate data to support interpretation of the outcomes of interest.

A total of 24 full-text articles were found to meet the inclusion criteria and, therefore, were included in the final qualitative synthesis. No additional records were identified via hand-searching or reference list screening. The literature search strategy applied in this review is illustrated in Figure 2.

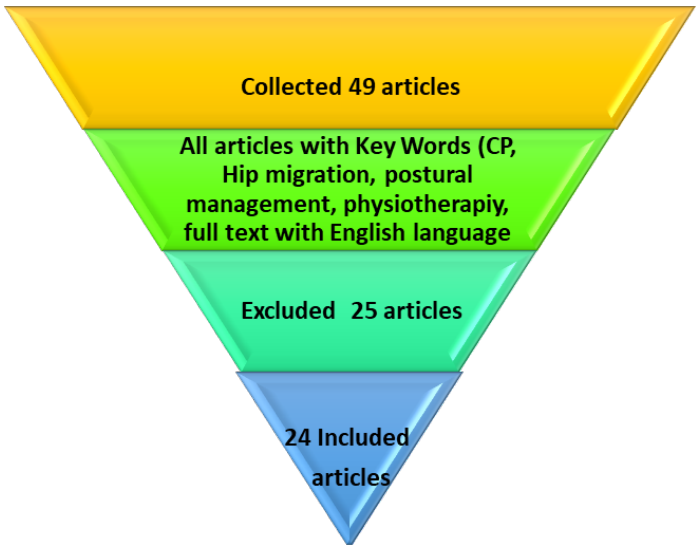

Figure 2. Literature search strategy

Ethical Approval Statement

This study was based entirely on previously published literature and did not involve human participants or identifiable personal data; therefore, ethical approval and informed consent were not required. The review was conducted in accordance with the principles of research integrity and transparent reporting. As this review involved no human participants or identifiable data, informed consent was also not required.

Results and Discussion

There are numerous variations in clinical practice regarding the utilisation of passive stretching exercises, orthosis and postural management programmes aimed at preventing deformities in children with CP; however, there remains a lack of published guidelines regarding the optimal usage of such interventions. Notably, there is a lack of evidence supporting the effectiveness of passive stretching exercises. While such exercises may result in short-term improvements in the child's passive range, potentially due to a decrease in muscle tone, these improvements appear to be transient. In contrast, as physical postural management programmes are extensively employed, the use of stretching over longer durations of postural management programmes has been proposed (Gough, 2009).

Gericke (2006) reported on a Mac Keith Multidisciplinary Meeting that produced a consensus statement on postural management in children with CP. The statement conceptualises postural management as 'a planned approach encompassing all activities and interventions which impact on an individual's posture and function', a definition grounded in both clinical expertise and scientific literature. Central to this framework is the individualisation of programmes in an effort to meet each child's unique needs, incorporating elements such as specialised seating

systems, nocturnal positioning supports, standing frames, active exercise regimens, orthotic devices, surgical interventions and tailored therapeutic sessions. For children classified as GMFCS level III, the early implementation of postural activities is advocated. In contrast, for children classified as GMFCS levels IV and V, the initiation of a comprehensive 24-hour postural management programme is recommended from birth, beginning with lying programmes, progressing to sitting programmes at approximately six months of age, and advancing to standing programmes at around 12 months. Additionally, the consensus statement recommends that any child who is unable to take more than 10 independent steps by 30 months of age should undergo radiographic assessment of both hips to determine the migration percentage, with follow-up evaluations performed every 6–12 months until the child is seven years of age (Gericke, 2006).

In a pilot study by Hankinson and Morton (2002), participants who could tolerate the lying system, which comprises a modular mattress adapted to specific body contours and equipped with cushioned supports to maintain proper trunk, hip and leg positioning, exhibited favourable results. This system offers effective positional control and can be conveniently adjusted while the child is using it. It promotes hip abduction and some hip flexion, facilitates side lying and enables personalised contouring for supine back support. The study revealed noteworthy improvements in participants' seating and toileting positions, as evidenced by parental questionnaire responses. Surprisingly, within the limited study timeframe, a significant improvement in the hip migration percentage was observed on one side (right), whereas the other side (left) demonstrated no substantial change. Potential for achieving greater hip stability over an extended period is indicated; however, the extent to which this might enable joint remodelling and an improved acetabular index remains to be seen.

A study by Martinsson and Himmelmann (2011) involved 205 children with CP who were categorised as GMFCS levels III, IV and V. Each child engaged in straddled weight-bearing using the Gazelle standing aid, maintaining the maximum tolerated hip abduction and hip and knee extension. While standing upright at 0–10 degrees of forward tilt for at least one hour per day over the course of one year, the children were supervised by their parents at home, and their progress was documented in a logbook. The outcomes demonstrated a reduction in hip migration and preservation of the range of movement, whether or not surgery was pursued. Moreover, positive outcomes were observed with 60 and 90 minutes of supported standing per day, whereas no significant changes were noted with 30 minutes of daily standing.

The findings of Macias-Merlo et al. (2015) suggested that treatment involving the siège moulé assists in preserving hip abductor muscle flexibility, enhancing pelvic and lower extremity alignment, mitigating trunk and head weakness, facilitating comfortable sitting postures, promoting hip development and, ultimately, fostering participation and activity in children with CP. The siège moulé is a standing aid fabricated from plaster, utilising the child's body as a mould and incorporating foot orthotics when necessary for standing. The extent of the hip abduction within the standing aid was designed to be 10 degrees less than the maximum extensibility of the adductor muscles, ensuring stretch tolerance. Most utilised standing aids were configured to allow approximately 30 degrees of abduction of each leg. The standing aids effectively regulated leg and pelvic positioning, achieving proper pelvic

alignment devoid of frontal plane asymmetry or excessive sagittal plane lordosis.

The GMFCS is internationally recognised as a stable and valid tool for classifying motor function in children with CP, beginning at around the age of two. As explained above, higher GMFCS levels (i.e. IV and V) are associated with a significantly increased risk of hip displacement and so require more intensive surveillance (Howard et al., 2024). However, previous research has demonstrated the effectiveness of the siège moulé based on postural treatment, even in children with severe impairment categorised as GMFCS level V (i.e. MP ≥55%), which yielded reductions in hip subluxation (Macias-Merlo et al., 2015; Picciolini et al., 2016).

In a retrospective study by Pountney et al. (2002), conservative management utilising a 24-hour postural approach encompassing lying (prone, supine), sitting and standing with supports demonstrated the potential to curtail hip dislocation in children with bilateral CP prior to the onset of hip subluxation. This approach surpasses traditional splinting and bracing programmes, positioning children at elevated functional levels that encourage movement from symmetrical positions, thereby promoting alterations in neuronal selection and development of improved movement patterns (Pountney et al., 2002).

Kim et al. (2022) observed significant reductions in hip displacement upon applying a hip brace to 33 children classified as GMFCS levels IV and V. This brace, developed as a pair of trousers combined with outer fabric bands, is easy to use and features Velcro for fastening and unfastening. The outer fabric bands comprise three components—namely, upper, lower and thigh straps. The upper straps safeguard the hip joints against displacement, while the lower ones counteract coxa valga. Additionally, the thigh straps are designed to prevent hip adduction. During the study, all of the children wore the braces for a minimum of 12 hours daily. Follow-up evaluations were conducted 6 and 12 months after the brace was worn.

In a case report by Polczyk (2018), the utilisation of the Vojta method in two cases demonstrated its excellent potential as a complementary treatment for dislocated, unstable and dysplastic hips. The implementation of crawling and rolling reflexes had a positive impact on the hip joint development of children at risk of hip dysplasia. This was achieved by centring the femoral head within the hip joint, normalising muscle tension and expanding the range of motion within the affected joints. Vojta therapy employs two significant movement complexes—that is, the rolling reflex and the creeping reflex. Stimulating the rolling reflex from a supine position using the thoracic zone not only prompts segmental spinal extension but also triggers motor responses in the lower limbs. After achieving a stable position in terms of the back, external rotation in the spherical joint and antigravity limb processes become evident. The rolling reflex's effect on the external rotators and adductors of the lower limbs acts as a synergistic antigravity force. The lower limbs are flexed at the hip joints to 90 degrees, adducted and rotated externally. This hip position helps align the acetabulum and femoral neck axially, adjusting the hip joint surfaces. In the initial position (before thoracic zone application), the lower limbs remain extended and adducted. However, during activation, the child shifts away from this configuration and moves in the opposite direction. Implementing Vojta therapy not only reduces the treatment duration but also mitigates the effects of prolonged immobilisation of the lower limbs in orthotic devices (Kiebza, 2016; Polczyk, 2018).

Pin (2007) conducted a review of 10 articles to explore the effectiveness of static weight-bearing exercises in children with CP. Such exercises are believed to enhance antigravity muscle strength, prevent hip dislocation, improve bone mineral density, enhance self-esteem, aid in feeding, facilitate bowel and urinary functions, reduce spasticity and improve hand function. The findings provided support for the effectiveness of static weight-bearing exercises in children with CP, particularly in terms of increased bone density and temporary spasticity reduction. However, the findings did not substantiate the effectiveness of such exercises in diminishing or preventing hip dysplasia in children with CP.

Future research directions

While PT and postural management are integral components of multidisciplinary care, many studies fail to isolate the effects of PT from concurrent interventions, such as botulinum toxin injections, orthopaedic surgery or orthotic use. This complicates efforts to determine the independent effectiveness of PT-based strategies in preventing hip displacement in children with CP.

Given the clear association between the GMFCS level and the risk of hip displacement, future studies should consider performing stratified analyses to determine which interventions are most effective for high-risk groups, especially children classified as GMFCS levels IV and V (Larnert et al., 2014). Studies should also aim to define the optimal intervention parameters, including the frequency, duration and intensity of PT and supported standing, while exploring the cumulative effects of 24-hour postural management programmes .

Furthermore, the development of unified clinical guidelines and standardised protocols for postural management would improve the consistency and reproducibility of interventions across clinical environments. Advanced imaging and biomechanical modelling may also contribute to a better understanding of the mechanistic pathways linking posture, muscle imbalance and hip displacement in children with CP, thereby aiding with the design of more targeted therapeutic approaches for this patient population.

Finally, future studies should incorporate long-term follow-up to evaluate how early PT and postural interventions influence hip integrity, functional mobility, participation, pain, caregiver burden and overall quality of life throughout childhood and adolescence in children with CP. Strengthening the evidence base in these areas will support the development of early, individualised and multidisciplinary strategies that can more effectively prevent hip dislocation and the associated complications in children with spastic CP.

Conclusion

This narrative review emphasises the critical significance of early identification of children with CP who are at risk of hip subluxation or dislocation. This is important because early recognition enables proactive management to prevent such complications and, if necessary, initiate timely surgical interventions. In an attempt to guide clinicians in the rehabilitation field, the recommendations provided in a 2006 consensus statement advocate the adoption of postural management programmes (Pountney et al., 2006). Such programmes encompass lying, sitting and standing positioning, precisely timed and tailored via the use of specialised equipment, orthosis or braces. This approach is particularly pertinent in children categorised as GMFCS levels IV and V.

The role of PT within postural management extends to conducting thorough screenings and comprehensive physical and functional assessments of children with CP. This process begins as soon as referrals are made by physicians, followed by the formulation of individualised postural management programmes that integrate occupational therapy and orthotic therapy in the early stages. These programmes incorporate specialised equipment, braces or orthotic devices, along with specific exercises rooted in the Vojta method of weight-bearing exercises (Ungureanu et al., 2022), as supported by the reviewed evidence.

This narrative review highlights the challenges inherent in implementing postural management programmes, particularly regarding the cooperation and commitment of the individual child and their family. Consequently, the search for effective alternatives is imperative, whether through modifications to equipment, orthoses or braces to enhance the comfort of the child, or by adapting the timing and duration of the programme.

Regrettably, this review ultimately reveals that the body of evidence concerning the effects of alternative PT approaches, such as strengthening, stretching exercises and neurodevelopmental techniques, in preventing hip subluxation/dislocation in children with CP remains insufficient, necessitating further research in this area.

Author Contributions

All authors significantly contributed to the work reported, including conception, study design, execution, data acquisition, analysis, and interpretation. They actively participated in drafting, revising, or critically reviewing the manuscript, provided final approval of the version to be published, agreed on the journal submission, and accepted accountability for all aspects of the work.

Data Availability Statement

The authors will transparently provide the primary data underpinning the findings or conclusions of this article, without any unjustified reluctance. If need from editorial team.

Funding

The author/s have not received any funding for. This study.

Conflicts of Interest

The authors declare no potential conflicts of interest related to the research, writing, or publication of this work.

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