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Physical Therapy Treatment in Children with Cerebral Palsy

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ABSTRACT

Background: Cerebral palsy is one of the most frequent disorders of the central nervous system. The various methods and techniques used by physical therapists can be very useful in treating children with cerebral palsy. The purpose of this review is to investigate the various techniques and methods used by physical therapists to improve balance, increase muscle strength, acquire and maintain agility, develop good neuromuscular coordination, improve of physical functionality and the best possible independence of children with cerebral palsy.

Methodology: The review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) reporting guidelines. A search on Pub med, Google scholar and PEDro for research articles that investigated the effectiveness of various methods/techniques used by physical therapists for the treatment program for children with CP of the last 20 years.

Results: A total of 18 articles were included in this review. The methods investigated were hippotherapy (n=3), Neurodevelopmental therapy (Bobath) (n=3), stretching (n=2), hydrotherapy (n=1), resistance and orthotics (n=3), and the parameters of classical physical therapy (n=4).

Conclusion: From the selected article it appeared that modalities such as Bobath and hippotherapy have beneficial effects on balance, static and motor control and may also have beneficial effects on gait on children with CP. Passive stretching researchers agree that there are no significant changes in reducing spasticity, while they help a lot in gaining greater range of motion as does resistance. Braces presented to be a very important tool in the hands of the physical therapist to avoid various deformities.

KEYWORDS: cerebral palsy, diplegia, physiotherapy, spasticity.

INTRODUCTION

Cerebral palsy (CP) is the most common severe motor disability in children, and its severity is demonstrated by the fact that 40% of children with the condition cannot walk independently [1-2], one-third have epilepsy [3], up to one-third are non-verbal [4-5] and about one-half have some degree of cognitive impairment. [6-8]. According to the current definition, developed by an international team of experts, cerebral palsy is a group of permanent, but not unchanging, disorders of movement and/or posture and of motor function, which are due to a non-progressive interference, lesion, or abnormality of the developing/ immature brain. [9-11] Cerebral palsy has multiple etiologies that can affect different parts of the brain, thus contributing to the broad range of clinical findings [12]. It is characterized by a limitation of the ability to move and maintain balance and posture, due to damage to areas of the brain that control muscle tone and spinal reflexes. In some cases, it can be accompanied by other non-motor problems. The damage is permanent but non-progressive and partially reversible. Depending on the size of the damage, serious functional and motor problems may occur. Thus, physical therapy is an important tool for dealing with and preventing further damage in children diagnosed with cerebral palsy. The various methods and techniques used by physical therapists can be very useful in dealing with the movement problems of children with CP. The purpose of this review is to investigate the effectiveness of various physical therapy techniques/methods used in improving balance, increasing muscle strength, acquiring and maintaining agility, developing good neuromuscular coordination, improving physical functionality and the best possible independence of children with cerebral palsy.

METHODS

Study design: The results are presented as per the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) reporting guideline (supporting checklist/diagram) [13].

Study strategy: A search on Pub med, Google scholar and PEDro for research articles that investigated the effectiveness of various methods/techniques used by physical therapists for the treatment program for children with CP.

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Inclusion criteria: The review included studies involving children with CP from infancy to 12 years of age, publication date 2000-2022, RCTs and case studies in Greek and English language.

Study selection: Eligibility screening of the studies was conducted in a blinded standardized way by two independent reviewers (Ev.T. and V.B.). Titles and abstracts were screened using and duplicate articles were excluded. After screening titles and abstracts, full paper copies were retrieved. Full text screening was also performed blinded by the same reviewers (Ev.T. and V.B.). Disagreements between authors during any stage of the screening process were resolved by consulting a third reviewer (Em.T.).

RESULTS

Priscilla Lightsey et al. [14] pilot study examined the interaction between horses and children with CP during physical therapy sessions where equine movement was used. Four children with CP participated in eight physical therapy sessions incorporating hippotherapy as a therapeutic intervention. Functional mobility was assessed using the Timed-Up Go or the 10-minute Walk Test. Inertial measuring units, sensors, adapted to children and horses, recorded movements and monitored the body's acceleration, angular velocity and orientation. Functional tests improved moderately over time. For participants 1–3 on average, the times taken to finish the TUG decreased by 18.3% and 27.5% for session 4 and session 8 compared to session 1, respectively. The TUG results were more variable after the HPOT sessions (s.d.: 4.17) than before (s.d.: 3.56). Specifically, variability drastically reduced during sessions 4 and 8 for Pre-HPOT whereas variability remained relatively constant throughout the sessions for Post-HPOT. For participant 4 on average, the times taken to fnish the 10mWT decreased by 36.6% and 37.1% for session 4 and session 8 compared to session 1, respectively. Children's movements (quantified in frequency and time domains) are increasingly synchronized with the vertical movement of the horse's gait, evidenced by reduced frequency errors and increased correlation. The maximum correlation between the reference signal (i.e., ACCz from horse's back) and ACCz from rider's head increased 84.7% for session 8 compared to session 1. Similarly, the time shift also decreased 23.3% and 23.3% for session 4 and session 8, respectively, compared to session 1. Findings suggest that as sessions progressed, participants appeared to become more familiar with horse movement.

SW McCoy et al. [15] in their multicenter study aimed to describe the relationship between the amount, focus, and family focus of treatment services, the extent to which services meet children's needs, and the developmental outcomes, expressed as clinically significant changes in percentile rank balance and walking endurance, and frequency of participation in family/recreational activities over 1 year. A total of 656 children (287 female, 369 male) with CP aged 1 year 6 months to 11 years 11 months at the time of recruitment (mean [SD] 6y [2y 8mo]) were recruited. Their families were enrolled in the On Track Study (2012–2017), an international (Canada and USA), prospective, multisite cohort study. The primary goal of the On Track study was to create longitudinal developmental trajectories and centimeter charts of children's developmental changes over time in various body functions, self-care performance, and participation. Comparisons between Canadian and US participants showed that there were no significant differences between the two groups regarding children's age, GMFCS level, and gender. Results showed that the number of physical therapy programs increased as functional limitations increased, ranging from 2 to 30 therapy sessions per year for children at GMFCS level I to 31 to 52 therapy sessions per year for children at GMFCS level V in self-care activities, with scores corresponding to a "small degree" (mean=2.1–2.9). The highest focus of treatment ratings was in the area of body structure/function (stretching of tight muscles, muscle strengthening and/or activities to increase fitness, mean=3.8–4.0). Family focus was rated similarly across children at each GMFCS level and clustered around the moderate level (mean=3.4–3.5). Our findings from a prospective cohort study of 656 participants indicate that the amount of treatment children with CP received was primarily related to their level of functional ability. The hypotheses that children with optimal change would have services with a greater focus on practicing specific tasks (focus on structured play/recreational activities) and parents reporting that their children's needs were largely met by rehabilitation services were moderately supported for the result of our participation. The results showed clinically significant results for beneficial associations of health/wellness focus with higher growth in participating in family/recreational activities and performing self-care activities.

TT Koca and H Ataseven [16] through their research investigated the effect of hippotherapy on gross motor functions and functional performance in children with CP (15 male and 19 female children, aged 3–12 years). The interventions were applyed twice a week for 8 weeks with a session duration of 45 minutes and the measurements were based on the GMFM-66, and -88 and the PEDI-FSS. Parameters before hippotherapy were comparable between groups. At the end of the study the mean GMFM-66 and -88 scores were significantly improved in the hippotherapy group. Compared to the control group, PEDI-FSS scores improved more in the hippotherapy group.

In JB Christy et al. [17] research the effect of an intensive physical therapy intervention on macro motor function, community walking and participation in children with CP was examined. Seventeen subjects (8 males and 9 females) with CP between 4 years and 12 years (mean age = 7,6 ± 2,9 years). Children were categorized into GMFCS levels I and II (n = 3 each level) and GMFCS level III (n = 11). Tone description included spastic (n = 12), hypotonic (n = 3), athetoid (n = 1), and ataxic (n =1). The anatomical distribution included diplegia (n = 8), quadriplegia (n = 7) and triplegia (n= 2). Reliability of outcome measures ranged from ICC = 0,60 to 0,94, indicating a positive outcome. The GMFM-66 improved by 2,5 points ($p < 0,001$) at post-test 1 and this improvement was maintained at post-test 2 ($p = 0,01$). COPM-p improved by an average of 3,1 points at post-test 1 and 2,7 points at post-test 2. COPM-p improved by an average of 4,2 points at post-test 1 and 3,2 points at post-test 2 ($p < 0,001$ at any time points). The PODCI-gf improved by 5,6 points at posttest 1 ($p = 0,001$), and this improvement was the same at the 3-month follow-up. Although PODCI scores remained elevated from baseline to post-test 2, the differences did not reach the level of statistical significance ($p = 0,13$). This is due to the increased variability for the post-test 2 data. For example, one of the subjects had a baseline value of 54 and a post-test 1 value of 69. The value at post-test 2 was 33. The percent active time was same at post-test 1, but improved by 5,1% (not statistically significant) at post-test. The mean percentage of time the child walked at moderate or high activity levels improved by 2,2% at posttest 1 and by 1,6% three months later (no statistically significant difference). This study showed that an intensive physical therapy program for three weeks improved gross motor function (GMFM-66), overall perception of general health (PODCI-gf), and performance and satisfaction of major activities (COPM) in children with CP. The only outcome that did not improve statistically was walking.

M Shamir et al. [18] in their controlled pilot study evaluated the acquisition of sitting and gross mobility in infants with CP treated with intermittent intensive physical therapy compared to a matched group treated with a standard physical therapy regimen. A randomized controlled crossover study was conducted in 10 infants aged 12-22 months with CP. Five were assigned to the intensive intermittent treatment group and the other 5 to the control group. After 4 weeks of initial intervention, the intervention program was administered to the experimental group for 8 weeks and the regular weekly program to the comparison group, aimed at addressing sitting. Then the comparison group did the opposite. The results showed that intermittent vigorous physical therapy yielded an average improvement of 7,8% compared to 1,2% for standard treatment. These results were attributed only to infants with a low functional level ($P < 0,01$). Intensive intermittent physical therapy could be beneficial in infants with a low functional level.

C Van den Broeck et al. study [19] examined the effectiveness of an individualized physical therapy program on the function and gait pattern of 16 children with diplegia (aged 3-12 years, GMFCS I-II). A baseline assessment was followed by a six-week general education program. The training period was evaluated over a 4-week period with usual physical therapy. A second training period was implemented for another 6 weeks during which the children received an individualized training program. All children were reassessed after this training program. The program consisted of non-specific exercises including stretching and mobilization, muscle strengthening and functional exercises. Stride length, stride length, gait cadence and speed improved significantly after the personalized training program. On clinical examination only hip extension ROM and ankle dorsiflexion with the knee at 90 was significantly altered. The GMFM-88 total score showed a trend they increase during the periods between the three assessments. Median GMFM-88 total score was 94% at baseline, 88% after general training program and 96% after individual training program. This increase was not found to be significant. Total GAS per child showed that after the training program, 6.7% achieved the treatment goal, 33.3% remained the same and 60% worsened. After the individualized educational program, 40% of the children achieved the therapeutic goal, 33.3% remained same and 26.6% worsened. The results give an indication that the individual training program provides better functional results than a general training program. The GMFM-88 improved more after the individually defined training program compared to the general training program. After the individually determined training program several parameters of the clinical examination and gait analysis changed significantly. Considering the nature of the objectives and the result, it can be concluded that a quantified result is manifested by the application of an individually determined training program over a period of six weeks.

The purpose of E Muñoz-Blanco et al. study [20] was to describe the experience of children with CP participating in a therapeutic water program in a special education school, as well as that of their parents and education and treatment professionals. Twenty-seven participants (11 students observed, 3 students interviewed, 8 parents in focus groups, 3 health professionals, and 2 teachers

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interviewed) participated in this study. The mean age of the children was 10.99 years (SD ± 3.77), the mean duration of schooling was 5.90 years (SD ± 3.91), and the mean number of years receiving Aquatic Therapy (AT) was 4.45 years (SD ± 3.20). The most dominant mixed GMFCS level was V (42.8%). The present study highlights the use of AT as an alternative therapeutic approach that can be implemented in these schools. The children and parents in this study found these AT sessions helpful, making the children feel happy and calm, as well as allowing them to participate in further activities for the rest of the school day.

Anne-Louise Brunner et al. study [21] aimed to compare the effects of the blocks of physical therapy versus regular physical therapy on motor skills in children with CP. Thirty-nine institutionalized children with CP and clinically similar syndromes (6–16 years, GMFCS II–IV) were included. In the first school year, group A received normal physiotherapy, group B block physiotherapy and vice versa in the second year. Thirteen children (33%) did not complete the study and reasons for discontinuation were: clinical deterioration (five parents felt their child was deteriorating), changed institution (three children), incomplete study protocol (two children), surgery (two children) and a big change in the form of physiotherapy (one child). GMFM-66 scores for both groups improved (Group A rated A1–A3 (p ¼ 0.022, 95% CI: 2.69–4.31, d ¼ 0.27) and Group B vs B1–B3 (p ¼ 0.039, 95% CI: 2.03–3.21, d ¼ 0.15). Regular physiotherapy was more effective than GMFM-66-based physiotherapy blocks for children at GMFCS levels II–IV.

The purpose of E Matusiak-Wieczorek et al. study [22] was to evaluate the effect of hippotherapy on the child's posture and individual body functions, depending on the type of CP, the GMFCS level and the child's age. Forty-five children aged 6–12 years with spastic diplegia or hemiplegia, classified as GMFCS level I or II were included. Participants were randomly divided into three groups: study group I (n = 15), study group II (n = 15), and control group (n = 15). Children from the study groups participated in 30-minute hippotherapy sessions twice (study group I) or once (study group II) per week for 12 consecutive weeks. When comparing the results from the SAS scale obtained at the first and last examination, it was observed that the children from study group I improved in almost every category (except foot control). Statistically significant differences were noted in the evaluation of head position control, arm function (both cases, $p = 0.012$) and trunk control ($p = 0.005$). At the end of the study, more than half of the children showed good control of head position, less than 50% had good control of arm function, and more than 70% gained three or four points for trunk control. In study group II, improvement was observed in all categories assessed. However, statistically significant differences were noted only in trunk control assessment ($p = 0.028$). More than half of the children tested showed very good control of trunk position. In the control group, improvement was observed only in control of trunk position and hand function. However, these differences were not statistically significant. During the 12 weeks of the study, an improvement in posture was observed more often in study group I, among children with hemiplegia. In study group II and the control group, the improvement was not as visible, both in diplegia and hemiplegic children. Statistically significant differences were only seen when comparing the postural assessment between study group I and the control group ($p = 0.001$) and study group II and the control group ($p = 0.051$), in the children with hemiplegia. During the 12 weeks of the study, an improvement in posture was observed more often in study group I, among children aged 6-7 years. Statistically significant differences were observed between study group I and the control group ($p = 0.000$) and between study group II and the control group ($p = 0.022$), when comparing the assessment of body posture in the younger children (6-7 years).

T Ustad et al. [23] designed their study to examine the effects of blocks of daily physical therapy in 5 infants with CP. The intervention consisted of two periods of 4 weeks of daily physical therapy, interspersed with 8 weeks of physical therapy as usual. Children were assessed every 4 weeks using the GMFM. Results were visually analyzed and statistical significance of the GMFM-66 scores was established by the 2 SD band methods. Compliance was high. All infants showed gross motor improvement compared to baseline, but the discriminating effect of daily physiotherapy from physiotherapy as usual was unclear. The parents preferred the alternative of intensive care.

The aim of M Drużbicki et al. study [24] was to assess balance abilities in children with spastic diplegia CP who were rehabilitated using the active Lokomat orthosis. The experimental group included children with CP, aged 6-14 years, independent posture, level II-III according to the GMFCS classification. The cohort was randomly divided into two groups. The experimental group was given a rehabilitation program using an active Lokomat orthosis. A statistically significant improvement in balance was found in the experimental group. However, in the control group the improvement was also visible, but not at a statistically significant level. Comparing the results of both groups, significantly greater improvement was achieved by children in the experimental group.

In El-Kafy's [25] randomized controlled trial the effectiveness of a static grounding ankle orthosis and straps in improving gait parameters in children with spastic diplegia was evaluated. The study included 57 children of both sexes, aged 6 to 8 years. Participants in all groups received a traditional Neurodevelopmental Physical Therapy program that included walking exercises with braces. Children in group A performed the training program without orthotic management, while in group B with the TheraTogs strap system and in group C with the TheraTogs strap system and static ground reaction in the ankle orthosis. The children were treated for two hours every day, except on weekends, for twelve consecutive weeks. Primary measures were gait speed, cadence, stride length, and mid-stance hip and knee flexion angles assessed before and after treatment using a 3D motion analysis system. Statistically significant differences were recorded between the three groups after treatment in walking speed, cadence and stride length. The P values for these variable differences were 0, 03, 0,011, and 0,001, respectively. Significant post-treatment differences were also recorded for bilateral hip and knee flexion angles. For all measured parameters, significant results were better recorded for group C than for the other groups.

Picciolini et al. [26] in their study analyzed the way musculoskeletal disorders and hip deformity play a key role in the future development of motor and adaptive functions in children with CP. Lateral migration of the femoral head increases by an average of 7.7% per year and may develop in association with acetabular dysplasia in hip dislocation. Conservative maintenance of muscle length and balance can prevent or reduce femoral head migration and acetabular dysplasia. Prone, seated and standing equipment is an established method of maintaining muscle length and joint range. The French approach (LeMétayeretal) involves the use of a custom orthosis cast, for sitting and standing, called siège moulé and gouttière, adapted to the child's musculoskeletal characteristics and motor abilities. Hips with clinical and radiographic evidence of displacement unresponsive to pharmacological and surgical therapy were treated with rational management. The two cases showed in this paper underwent a physical therapy program (Neurodevelopmental therapy) twice a week from a sitting position 5 hours a day with the siège moulé. Hip radiographs were measured with the migration percentage (MP) described by Reimers. Follow-up measurements showed a progressive reduction in MP values of the treated hip, confirming the significant benefit of the combined nonsurgical approach. The study supports the evidence that conservative treatment of hip deformity with siège moulé can be successful if applied before the development of hip dysplasia.

The purpose of NF Taylor et al. study [27] was to investigate whether individualized resistance training improves physical mobility in youth with CP. Forty-eight participants with spastic diplegia CP (26 males, 22 females, mean age 18 years 1 month, SD 1 y 11 months) classified as Level II or III on the GMFCS were randomly assigned to progressive resistance training or habitual control. Resistance training was completed twice a week for 12 weeks in a community gym under the supervision of a physical therapist. Exercises were based on instrumented gait analysis and targeted muscles that contribute to gait difficulties. Target muscle strength increased by 27% (95% CI 8–46%) compared to the control group. There were no between-group differences in any objective measure of mobility at 12 weeks (6-min walk test: mean difference 0.1 m, 95% CI −21 to 21 m) or 24 weeks. Participant-rated mobility improved (5-meter Functional Mobility Scale: mean 0.6 points, 95% CI 0.1–1.1 points, Functional Assessment Questionnaire: 0.8 points, 95% CI 0.1– 1.6 points) compared to the control group at 1 weeks.

AS Papavasiliou research [28] aimed to analyze the effectiveness of therapeutic rehabilitation, orthosis, oral medications and botulinum toxin, and intrathecal baclofen, complementary or alternative therapies, and guidelines for a goal-oriented approach will be discussed. Despite the underreporting of trials, physical therapy has shifted from traditional to goal-oriented approaches based on the principles of motor learning, strengthening, and fitness training. Emphasis is placed on the correct choice and use of a splint. Pharmacologic treatments of spasticity (oral agents, allantotoxin, and intrathecal baclofen) may be alternatives or adjuncts to orthopedic surgery. There is evidence that botulinum toxin combined with conservative treatments reduces the number of complex orthopedic interventions. Intrathecal baclofen effectively reduces spasticity. The use of complementary or alternative therapy is widespread. Research needs to determine what factors make these modalities desirable and effective in cerebral palsy. It is concluded that the introduction of new treatments facilitates an individualized management plan. Multimodal treatment is optimized with a multidisciplinary team. Measurement of the result according to the World Health Organization. concluded that until now there is no specific treatment for the brain lesions that lead to motor dysfunction in cerebral palsy. The available symptomatic treatment options place CP among the costliest chronic childhood conditions. Therefore, it is essential to make well-informed decisions in an effort to balance cost-effectiveness with patient and family needs.

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L Wiart et al. study [29] aimed examine the muscle contraction mechanisms in CP, the effectiveness of stretching and the current practice of physical therapy stretching. Children with a diagnosis of CP, aged 6-13 years, participated. The researchers could not draw strong conclusions about the effects of passive stretching, active stretching, or therapeutic positioning on joint range of motion in people with CP from this body of research. Additional research is therefore needed to investigate the structural changes that occur in the short muscles of children with CP and the effects of practical stretches used in pediatric physical therapy.

MA Zanon et al. review [30] investigated the effects of neurodevelopmental treatment (Bobath) in children with CP. Only randomized clinical trials with parallel programming, focusing on children and adolescents (under 18 years) with a clinical diagnosis of CP, regardless of the presence of comorbidity, who underwent neurodevelopmental therapy compared to no therapy. Three studies, which met the selection criteria (2 published and 1 ongoing studies) were included in the review. Two small randomized clinical trials were underpowered inference information to practice about neurodevelopmental treatment approaches for children with brain paralysis. No difference between neurodevelopmental treatment and conventional physical therapy was found for gross motor function (mean difference 1.40; 95% confidence interval -5.47 to 8.27, low certainty evidence). The effects of neurodevelopmental treatment for children with cerebral palsy presented to be uncertain

Hilde Tinderholt Myrhaug et al. [31] in their systematic review and meta-analysis, which aimed to describe and categorize intensive motor function and functional skills training in young children with CP and to summarize the outcomes of these interventions, included 38 studies from Asia (n = 12), Australia (n = 3), Europe (n = 11) and North America (n = 12) . The 38 studies selected included 1407 children with all levels of gross and fine motor function. 31 assessment tools were used in the studies. Studies that targeted gross motor function were fewer, older and with lower frequency of training sessions over longer training periods than studies that targeted hand function. Home training was most common in studies on hand function and functional skills, and often increased the amount of training. The effects of constraint induced movement therapy (CIMT) on hand function and functional skills were summarised in six meta-analyses, which supported the existing evidence of CIMT. In a majority of the included studies, equal improvements were identified between intensive intervention and conventional therapy or between two different intensive interventions. Different types of training and different intensities aimed at fine motor function suggest that they may help, but this requires more research.

Table 1. Studies included in the review

Authors	Sample	Assessment	Results
Priscilla Lightsey et al.	N= 4 children with CP that underwent 8 hippotherapy sessions.	Timed Up Go, velocity and sensors measuring acceleration, angular velocity and orientation of the body.	On average, the times taken to finish the TUG decreased by 18.3% and 27.5% for session 4 and 8 compared to the first session. Functional tests improved moderately over time. Children's movements are increasingly synchronized with the vertical movement of the horse's gait, evidenced by reduced frequency errors and increased correlation.
Hilde Tinderholt Myrhaug et al.	38 studies involving children under 7 years of age with cerebral palsy who underwent intensive motor function and functional skills training.	Studies were assessed with the Risk of Bias Tool (RoB) and categorized by intensity and interventions.	Different types of training and different intensities aimed at fine motor function suggest that they may help, but this requires more research.
Sarah Westcott McCoy et al.	656 children with CP (average age 6 years,	Children were assessed two to five times over a 2-year period by therapists using	The number of physical therapy services increased as functional limitations increased, ranging from 2 to 30 therapy sessions per year

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	287 girls and 369 boys) and their parents	standardized measures of balance and walking endurance. Parents completed questionnaires about rehabilitation treatments and their children's performance in self-care and participation. Children were classified into Gross Motor Function Classification System (GMFCS) levels.	for children at GMFCS level I to 31 to 52 therapy sessions per year for children at GMFCS level V. Lower treatment focus was reported that he engages in self-care activities, with scores corresponding to a “little degree” (mean=2.1–2.9). The highest focus of treatment ratings was for the subdomain of body structure/function (stretching tight muscles, muscle strengthening, and/or activities to increase fitness, mean=3.8–4.0). Family focus was rated similarly across children at each GMFCS level and clustered around the medium level (mean=3.4–3.5).
Tuba Tulay Koca et al.	Children with CP, multiple sclerosis and autism, aged 3-12.	A hippotherapy program was applied for approximately 12 weeks with a session duration of 45 minutes. Measurements were based on the GMFM-66 and 88 scales, the PEDI, and the Pediatric Statistical Balance Scale.	At the end of treatment, improvements were seen in posture (30%), coordination (80%), body balance, sociability and self-confidence (50%).
Jennifer Braswell Christy et al.	17 ambulatory children with cerebral palsy CP who participated in an intensive intervention (ie, four hours per day, five days per week for three weeks), a modified version of the Therasuit protocol.	The GMFM-66, the SAM, the COPM and the PODCI were tested twice at baseline, immediately after intervention and three months later.	Immediately after the intervention, GMFM-66, COPM and PODCI scores improved significantly ($p < 0.001$). At three months, improvements persisted for GMFM-66 and COPM ($p < 0.01$). Gait quantity or intensity (SAM) did not improve.
Malka Shamir et al.	10 infants aged 12-22 months with CP of which 5 were assigned to the intensive intermittent treatment group and 5 to the control group.	GMFM 66 and 88 were used at 4-week intervals.	The intermittent intensive program yielded an average improvement of 7,8% compared with 1,2% with standard treatment. However, these results were attributed only to infants with a low functional level ($P < 0,01$).
C Van den Broeck et al.	16 children with diplegia, aged 3-12 years, underwent an individually defined physical therapy program to improve functionality and gait pattern.	A 6-week general training program was followed by a specific training program based on individual goals determined by the results of 3D gait analyses, the GMFM-88, and a clinical assessment.	After the general training program, 6.7% of children achieved treatment goals, 33.3% remained at the same level and 60% worsened, and 40%, 33.3% and 26.6% of children respectively after the personalized training program. Improvement for GMFM-88 walking, running, and jumping was significantly greater after the individually defined program ($p < 0.05$), compared to the general training program.

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Elisa Muñoz-Blanco et al.	A qualitative descriptive case study with 27 children and youth with CP, together with their parents, special education teachers, and health professionals.	Data were collected through non-participant observation, semi-structured and informal interviews, focus groups and researcher notes. A thematic analysis was carried out which revealed the following themes: a) connection with the environment b) postural improvements and mobility c) opportunity to perform tasks d) learning and transfer.	The most dominant motor Gross Function Classification System (GMFCS) level was V (42.8%). None of the sessions had to be interrupted for safety reasons, and none of the children reported adverse effects during the sessions. A motivating environment leads to physical, cognitive and social benefits, both at school and at home. Hydrotherapy was seen as a means of learning and participation.
Márcia Andréa Zanon et al.	3 randomized clinical trials (2 published and 1 ongoing) involving 66 children.	Through a comprehensive literature search we reviewed all randomized clinical trials that compared Neurodevelopmental therapy with conventional physical therapy for children with cerebral palsy. We used the Cochrane Risk of Bias Table to assess the risk of bias of the included randomized clinical trial and the GRADE approach to assess the certainty of the body of evidence.	No difference was found between Neurodevelopmental therapy and conventional physical therapy for gross motor function (mean difference 1.40, 95% confidence interval –5.47 to 8.27, low-certainty evidence). The results of Neurodevelopmental therapy for children with cerebral palsy are still uncertain. Further studies are needed to evaluate the efficacy and safety of Neurodevelopmental therapy.
Anne-Louise Brunner et al.	39 children with CP and clinically similar syndromes (6–16 years, GMFCS II–IV) were included.	During the first school year, group A received regular physical therapy while group B received intermittent physical therapy and vice versa in the second year. Gross Motor Functioning Measure 66 (GMFM-66) was the outcome measure.	Thirteen children from each group completed the study. GMFM-66 improved ($p < 0.05$) over the study period in both groups. Changes ($p < 0.05$) were observed only in dimension D (group B) and E (both groups) during regular treatment.
Ewelina Matusiak-Wieczorek et al.	A case-control study included 45 children aged 6–12 years, classified as GMFCS level I or II, with spastic diplegia or hemiplegia. Participants were randomly divided into three groups: study I (n = 15), study II (n = 15), and control (n = 15).	Children from the study groups attended 30-minute hippotherapy sessions for 12 consecutive weeks, twice (study group I) and once (study group II) per week. The Sitting Assessment Scale (SAS) was used. A comparison of the SAS showed improvement in almost all categories assessed	In study group I there were statistically significant differences in the evaluation of head position control, arm function (both cases, $p = 0.012$) and trunk control ($p = 0.005$). At the end of the study, more than half of the children showed good control of head position, less than 50% had good control of arm function, and more than 70% gained three or four points for trunk control. In study group II statistically significant differences were noted only in trunk control assessment ($p = 0.028$). At the end of the study, more than half of the children tested

		among children who participated in hippotherapy.	showed very good control of trunk position. In the control group, improvement was observed only in control of trunk position and hand function.
Lesley Wiart et al.	Children with cerebral palsy of various ages	The mechanisms of muscle contraction in children with CP are unclear, and clinical research evaluating the effects of stretching is inconclusive. Recent changes in thinking about the management of children with CP suggest an increased emphasis on flexibility, physical fitness, and participation in activities that are meaningful to children and families.	Additional research is needed to investigate the structural changes that occur in the shortened muscles of children with CP and the effects of practical stretches used in pediatric physical therapy.
Tordis Ustad et al.	5 infants with CP	The intervention consisted of two periods of 4 weeks of daily physical therapy, which were interrupted and replaced by 8 weeks of usual physical therapy. Children were assessed every 4 weeks using the gross motor function measure.	All infants showed gross motor improvement compared to baseline, but the differential effect of daily physiotherapy from usual physiotherapy was unclear. The parents preferred the alternative of intensive care.
Mariusz Drużbicki et al.	children with CP, aged 6-14 years, independent posture, GMFCS level II-III	Balance was assessed on a stabilometric platform. The experimental group was given a rehabilitation program using an active Lokomat orthosis.	A statistically significant improvement in balance was found in the experimental group. However, in the control group the improvement was also visible, but not at a statistically significant level. Comparing the results of both groups, significantly greater improvement was achieved by the children of the experimental group. Lokomat active orthosis is one of the newest devices applied in rehabilitation.
Abd El-Kafy	57 children of both sexes, aged 6 to 8 years. Participants in all groups received a traditional Neurodevelopmental physical therapy program that included standing and walking exercises.	Gait speed, cadence, stride length, and hip and knee flexion angles in the mid-stance phase were assessed before and after treatment using a 3D motion analysis system.	Statistically significant differences were recorded between the three groups after treatment in walking speed, cadence and stride length. The P values for these variable differences were 0.03, 0.011, and 0.001, respectively. Significant post-treatment differences were also recorded for bilateral hip and knee flexion angles. For all measured parameters, significant results were better recorded for group C than for the other groups.
O Picciolini et al.	The two groups underwent a physical	Hip radiographs were measured with the migration	Follow-up measurements showed a progressive reduction in MP values of the treated hip,

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	therapy program (Neurodevelopmental therapy) twice a week and 5 hours of sitting per day with the siège moulé.	percentage (MP) described by Reimers.	confirming the significant benefit of the combined nonsurgical approach. The study supports the evidence that conservative treatment of hip deformity with siège moulé can be successful if applied before the development of hip dysplasia.
Antigone S Papavasiliou	Children with cerebral palsy	The presentation aims to analyze the effectiveness of rehabilitation therapy, orthosis, oral medications, botulinum toxin, intrathecal baclofen, complementary or alternative therapies and will discuss guidelines for a goal-oriented approach.	There is evidence that botulinum toxin combined with conservative treatments reduces the number of complex orthopedic interventions.
Nicholas F Taylor et al.	48 participants with spastic diplegia CP (26 males, 22 females) classified as levels II or III on the Gross Motor Function Classification System were randomly assigned to progressive resistance training or usual care control.	Resistance training was completed twice a week for 12 weeks. The exercises were based on gait analysis with instruments and targeted muscles that contribute to gait difficulties. Outcomes at 12 weeks and 24 weeks included objective mobility measures (6-minute walk test, instrumented gait analysis, and mixed motor function measurement dimensions D and E), participant-rated mobility measures (Functional Mobility Scale and Functional Assessment Questionnaire), and muscle performance.	Target muscle strength increased by 27% (95% CI 8-46%) compared to the control group. There were no between-group differences in any objective measure of mobility at 12 weeks (6-min walk test: mean difference 0.1 m, 95% CI -21 to 21 m) or 24 weeks. Participant-rated mobility improved (5-meter Functional Mobility Scale: mean 0.6 points, 95% CI 0.1-1.1 points, Functional Assessment Questionnaire: 0.8 points, 95% CI 0.1- 1.6 points) compared to the control group at 1 weeks.

DISCUSSION

A total of 18 articles (table 1) were included in this review. The methods and techniques investigated were hippotherapy (n=3), Neurodevelopmental therapy (Bobath) (n=3), stretching (n=2), hydrotherapy (n=1), resistance and orthotics (n=3), and the parameters of classical physical therapy (n=4). It was also compared whether continuous or intermittent physical therapy is preferable and more effective and whether an intense physical therapy program can bring about satisfactory results.

In the article it appears that researchers do not agree on the various issues arising for the physical therapy approach around CP. Regarding the parameters of intensity, frequency of sessions and intensity, from Brunner A. et al. [21], Shamir M. et al. [18] and Braswell-Christy J. et al. [17] it seems likely that intense and intensive physical therapy is more effective. Most of these studies report significant improvements in gross motor skills and participation. On the other hand, Tinderholt Myrhaug H. et al. [31] and Tordis Ustad et al. [23] argue that no significant difference was detected in the effectiveness of the intensity, so further research is needed on this specific topic. According to Nicholas F Taylor et al. [27] progressive resistance training for adolescents and young adults with diplegia CP is safe and feasible and increases muscle strength did not lead to objective improvements in mobility-related function, but improved participant-rated mobility.

Regarding the various methods, NDT-Bobath Neurodevelopmental treatment is proven by Picciolini et al. [26], Zanon M. A. et al. [30] and Abd El-Kafy [25] to be a method that can improve many of the deficits of children with cerebral palsy.

Matusiak-Wieczorek E. et a. [22], Tulay K. et al. [16] and Lightsey P. et al. [14] results supported hippotherapy, as it seems to be important in the intervention program. In more details, it helps in the transfer of the center of gravity, which implies better balance, better static and motor control. It is likely that there can be an improvement in walking parameters after a reasonable period of treatments, as with only one session the positive results are not noticeable. E. Matusiak-Wieczorek et al. [22] study showed that postural improvement that can be seen and includes better control of the position and function of the head, trunk and upper limbs. Regardless of the child's age, type of cerebral palsy, or GMFCS level, hippotherapy may provide more benefit to younger children with milder forms of the disease, who are classified at higher levels of the GMFCS.

On the subject of stretching in children with spastic CP, Wiart L. et al. [29] study showed that it does not lead to statistically significant differences in spasticity. Although, it may help to maintain and gain a functional range of motion in the joints using passive stretching. Regarding spastic muscle strength, it increased after Nicholas T. et al. [27] strengthening program, but there was no significant difference in mobility.

The orthosis based on the words of Papavasiliou A. [28], Druzbicki et al. [24] and Abd El-Kafy [25] can improve the child's balance and prevent any structural deformities in the body, such as hip dislocation. Special mention is made of the combination of orthosis, with medication and physical therapy, which may result in the delay of a surgical procedure. According to Abd El-Kafy et al. study [25] orthotic intervention consisting of a static ankle ground reaction orthosis combined with the TheraTogs strap system improves gait more than conventional treatment with or without TheraTogs in children with spastic diplegia cerebral palsy.

On the subject of hydrotherapy, Munoz-Blanco E. et al. [20] agree that it is a good option for improving the motor deficits of children with CP. For practitioners, Aquatic Therapy is motivating, enjoyable and beneficial to the health of children and young people, enabling them to further explore their potential. The different mechanical properties offered by water promote learning and encourage children's ability to participate in their educational, therapeutic and family environment. E. Muñoz-Blanco et al. results can be used to develop and coordinate intervention programs in controlled settings, such as special school settings. These experiences can also be applied to other types of pathologies affecting children and youth besides CP, as well as the involvement of children's family members in these programs.

The existence of an interdisciplinary team, according to Westcolt McCoy S. et al. [15], is important for the smooth and comprehensive treatment of the patient. Such a team may consist of doctors (neurologists, orthopedics, etc.), physiotherapist, speech therapist, occupational therapist, social worker and psychologist. As an important fact has aroused the treatment of the patient with CP as a whole, with the physical therapist having to take into account the perceptions and expectations of himself, the family and the wider community, with the aim of the best possible integration into society.

CONCLUSION

The results of this review demonstrates that modalities such as Bobath and hippotherapy have beneficial effects on balance, static and motor control and may also have beneficial effects on gait on children with CP. Passive stretching researchers agree that there are no significant changes in reducing spasticity, while they help a lot in gaining greater range of motion as does resistance. Braces presented to be a very important tool in the hands of the physical therapist to avoid various deformities. Finally, intensity, frequency and intensive physical therapy seem to improve children's gross motor skills and participation. Further studies must be conducted in order to define physical therapy intervention, intensity, and frequency as to be tailored to meet the needs of each individual infant and family. As well as each therapeutic approach’s efficacy and safety.

REFERENCES

1. Kirby, R. S. et al. Prevalence and functioning of children with cerebral palsy in four areas of the United States in 2006: a report from the Autism and Developmental Disabilities Monitoring Network. Res. Dev. Disabil. 32, 462–469 (2011).
2. Christensen, D. et al. Prevalence of cerebral palsy, co-occurring autism spectrum disorders, and motor functioning – Autism and Developmental Disabilities Monitoring Network, USA, 2008. Dev. Med.Child Neurol. 56, 59–65 (2014).
3. Reid, S. M. et al. Temporal trends in cerebral palsy by impairment severity and birth gestation. Dev. Med. Child Neurol. 58 (Suppl. 2), 25–35 (2016).

4. Zhang, J. Y., Oskoui, M. & Shevell, M. A population-based study of communication impairment in cerebral palsy. J. Child Neurol. 30, 277–284 (2015).
5. Mei, C. et al. Language outcomes of children with cerebral palsy aged 5 years and 6 years: a populationbased study. Dev. Med. Child Neurol. 58, 605–611 (2016).
6. Levy, S. E. et al. Autism spectrum disorder and co-occurring developmental, psychiatric, and medical conditions among children in multiple populations of the United States. J. Dev. Behav. Pediatr. 31, 267–275 (2010)
7. Pakula, A. T., Van Naarden Braun, K. & Yeargin-Allsopp, M. Cerebral palsy: classification and epidemiology. Phys. Med. Rehabil. Clin. N. Am. 20, 425–452 (2009)
8. Delobel-Ayoub, M. et al. Prevalence and characteristics of autism spectrum disorders in children with cerebral palsy. Dev. Med. Child Neurol. 59, 738–742 (2017)
9. Bax M, Goldstein M, Rosenbaum P, et al. Executive Committee for the Definition of Cerebral Palsy. Proposed definition and classification of cerebral palsy. Dev Med Child Neurol. 2005;47(8):571–576. doi:10.1017/ S001216220500112X
10. Rosenbaum P, Paneth N, Leviton A, et al. A report: the definition and classification of cerebral palsy. Dev Med Child Neurol. 2007;109:8–14
11. Cans C, Dolk H, Platt MJ, Colver A, Prasauskiene A, Krageloh-Mann I; SCPE Collaborative group. Recommendations from the SCPE collaborative group for defining and classifying cerebral palsy. Dev Med Child Neurol Supp. 2007;109:35–38. doi:10.1111/j.1469-8749.2007.tb12626.x
12. Kirsten Vitrikas, and Heather Dalton, Dakota Breish. Cerebral Palsy: An Overview. Am Fam Physician.2020;101(4):213-220.] Approximately 92% of cases of cerebral palsy are traced to the perinatal period. [Morgan C, Fahey M, Roy B, et al. Diagnosing cerebral palsy in full-term infants. J Paediatr Child Health. 2018;54(10):1159-1164.
13. Moher d, liberati a, tetzlaff J, altmandG; prisMa Group. preferred reporting items for systematic reviews and meta-analyses: the prisMa statement. ann intern Med 2009;151:264–9, W64.
14. Lightsey, P., Lee, Y., Krenek, N., & Hur, P. (2021). Physical therapy treatments incorporating equine movement: A pilot study exploring interactions between children with cerebral palsy and the horse. Journal of Neuroengineering and Rehabilitation, 18(1), 132.
15. McCoy, S. W., Palisano, R., Avery, L., Jeffries, L., Laforme Fiss, A., Chiarello, L., & Hanna, S. (2020). Physical, occupational, and speech therapy for children with cerebral palsy. Developmental Medicine and Child Neurology, 62(1), 140–146.
16. Koca, T. T., & Ataseven, H. (2015). What is hippotherapy? The indications and effectiveness of hippotherapy. Northern Clinics of Istanbul, 2015 2(3), 247–252.
17. Christy, J. B., Chapman, C. G., & Murphy, P. (2012). The effect of intense physical therapy for children with cerebral palsy. Journal of Pediatric Rehabilitation Medicine, 5(3), 159–170.
18. Shamir, M., Dickstein, R., & Tirosh, E. (2012). Intensive intermittent physical therapy in infants with cerebral palsy: A randomized controlled pilot study. The Israel Medical Association Journal: IMAJ, 14(12), 737–741.
19. Van den Broeck, C., De Cat, J., Molenaers, G., Franki, I., Himpens, E., Severijns, D., & Desloovere, K. (2010). The effect of individually defined physiotherapy in children with cerebral palsy (CP). European Journal of Paediatric Neurology: EJPN: Official Journal of the European Paediatric Neurology Society, 14(6), 519–525.
20. Muñoz-Blanco, E., Merino-Andrés, J., Aguilar-Soto, B., García, Y. C., Puente-Villalba, M., Pérez-Corrales, J., & Güeita-Rodríguez, J. (2020). Influence of Aquatic Therapy in Children and Youth with Cerebral Palsy: A Qualitative Case Study in a Special Education School. International Journal of Environmental Research and Public Health, 17(10), E3690.
21. Brunner, A.-L., Rutz, E., Juenemann, S., & Brunner, R. (2014). Continuous vs. blocks of physiotherapy for motor development in children with cerebral palsy and similar syndromes: A prospective randomized study. Developmental Neurorehabilitation, 17(6), 426–432.
22. Matusiak-Wieczorek, E., Dziankowska-Zaborszczyk, E., Synder, M., & Borowski, A. (2020). The Influence of Hippotherapy on the Body Posture in a Sitting Position among Children with Cerebral Palsy. International Journal of Environmental Research and Public Health, 17(18), E6846.

23. Ustad, T., Sorsdahl, A. B., & Ljunggren, A. E. (2009). Effects of intensive physiotherapy in infants newly diagnosed with cerebral palsy. Pediatric Physical Therapy: The Official Publication of the Section on Pediatrics of the American Physical Therapy Association, 21(2), 140–148; discussion 149.
24. Drużbicki, M., Rusek, W., Szczepanik, M., Dudek, J., & Snela, S. (2010). Assessment of the impact of orthotic gait training on balance in children with cerebral palsy. Acta of Bioengineering and Biomechanics, 12(3), 53–58.
25. Abd El-Kafy, E. M. (2014). The clinical impact of orthotic correction of lower limb rotational deformities in children with cerebral palsy: A randomized controlled trial. Clinical Rehabilitation, 28(10), 1004–1014.
26. Picciolini, O., Albisetti, W., Cozzaglio, M., Spreafico, F., Mosca, F., & Gasparroni, V. (2009). 'Postural Management' to prevent hip dislocation in children with cerebral palsy. Hip International: The Journal of Clinical and Experimental Research on Hip Pathology and Therapy, 19 Suppl 6, S56-62.
27. Taylor, N. F., Dodd, K. J., Baker, R. J., Willoughby, K., Thomason, P., & Graham, H. K. (2013). Progressive resistance training and mobility-related function in young people with cerebral palsy: A randomized controlled trial. Developmental Medicine and Child Neurology, 55(9), 806–812.
28. Papavasiliou, A. S. (2009). Management of motor problems in cerebral palsy: A critical update for the clinician. European Journal of Paediatric Neurology: EJPN: Official Journal of the European Paediatric Neurology Society, 13(5), 387–396.
29. Wiart, L., Darrah, J., & Kembhavi, G. (2008). Stretching with children with cerebral palsy: What do we know and where are we going? Pediatric Physical Therapy: The Official Publication of the Section on Pediatrics of the American Physical Therapy Association, 20(2), 173–178.
30. Zanon, M. A., Pacheco, R. L., Latorraca, C. de O. C., Martimbianco, A. L. C., Pachito, D. V., & Riera, R. (2019). Neurodevelopmental Treatment (Bobath) for Children With Cerebral Palsy: A Systematic Review. Journal of Child Neurology, 34(11), 679–686.
31. Tinderholt Myrhaug, H., Østensjø, S., Larun, L., Odgaard-Jensen, J., & Jahnsen, R. (2014). Intensive training of motor function and functional skills among young children with cerebral palsy: A systematic review and meta-analysis. BMC Pediatrics, 14, 292.