



Evidence Based Comprehensive Treatment Approach For Cerebral Palsy: Systematic Review

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ABSTRACT

Background: Cerebral palsy is a permanent disorder affecting infants' movement and posture, affecting mobility, eyesight, learning, and reasoning. It affects 1.5-2.5 infants per thousand live births worldwide and affects 17 million individuals. Treatments include sensory integration (SIT), neurodevelopmental therapy (NDT), horseback riding therapy, hydrotherapy, feeding difficulties, and vestibular physical therapy. SIT focuses on sensory processing and motor function, while NDT focuses on the central nervous and neuromuscular systems. These treatments aim to improve motor efficiency and independence. Additionally, it is said that SIT improves balance, gross motor skills, gait and it might therefore be helpful in picking up new motor abilities. Various advanced treatment modalities such as hydrotherapy, hippotherapy. Are beneficial in treating children with cerebral palsy.

Methodology: The study was conducted and reported according to the PEDRO (Physiotherapy Evidence Database for Systematic Reviews and Meta-Analyses) statement. The assessment of the methodological quality of the included studies was done using the Methodological Index for Randomized Studies for all randomized studies.

Results and Discussion

This study explores an evidence-based comprehensive treatment approach for cerebral palsy patients, focusing on sensory integration to enhance motor and sensory function. It aims to resolve issues with sensory information absorption and processing in young infants, promoting balance and steady movements. Qualitative interviews with parents and participants provide insights into the SMART program's user experience and factors to consider when developing cognitive therapies. Obstacles such as low motivation, time constraints, and reading proficiency affect participation and completion of training programs. New technologies may help children complete at-home physiotherapy treatments and maximize participation in communal physical activity. When hippocampus stimulation was paired with traditional therapy, the study discovered that children with cerebral palsy (CP) significantly improved in hand activities, such as picking things and turning over cards. Compared with patients getting only conventional therapy, the hippocampus group benefited more. Children who took part in a 12-week programmed of hippotherapy also demonstrated improved grip strength and range of motion. Additional study has demonstrated that Hippocrates enhances muscle strength and balance. This analysis demonstrates that physiotherapists and the medical team of patients with cerebral palsy (CP) priorities the acquisition of mobility.

conclusion:

Cerebral palsy affects many children and requires appropriate treatment. Neurodevelopmental therapy (NDT) is a common treatment, focusing on gross motor, balance, and postural control improvement. Sensory integration treatment (SIT) improves vision, touch, and proprioception, balance, and gross motor skills. Advanced treatment modalities like hydrotherapy and hippotherapy are also beneficial for treating children with cerebral palsy.

Key word: NDT, Sensory integration, Hippotherapy, Hydrotherapy. Visual impairment.

INTRODUCTION

Cerebral palsy is a permanent disorder affecting movement and posture in infants, causing activity limitations due to non-progressive disturbances in the developing brain. It affects mobility, eyesight, learning, and reasoning, and affects 1.5-2.5 infants per thousand live births worldwide. It results in long-term physical impairment and affects 17 million individuals [1] Sensory integration (SIT) helps children reach their full potential in motor and sensory function by enhancing their ability to process and integrate sensory information, promoting balance and steady movements through training [2]. Neurodevelopmental therapy (NDT) is a widely used treatment for children with cerebral palsy, focusing on the central nervous and neuromuscular systems. It involves task-oriented training and aims to enhance motor efficiency and functional independence. Sensory integration therapy (SIT) was developed by A. Jean Ayres to improve sensory processing and motor function [3]. Horseback riding therapy, including hippotherapy and therapeutic horseback riding, is also beneficial [4]. Hydrotherapy enhances endurance, muscle strength, and reduces spasticity, while providing sensory information, lymphatic circulation improvement, postural support, independence, and rotational movements that some patients cannot achieve without hydrotherapy [5,18] Feeding difficulties in children with cerebral palsy significantly impact growth, nutrition, health, social interaction, behavior, and developmental outcomes, potentially leading to growth and developmental retardation.[6] Vestibular physical therapy is an exercise-based method used to enhance motor function in children with cerebral palsy (CP) by promoting gaze stability, balance, gait, and sensory integration [7]

METHODOLOGY

The study was conducted and reported according to the PEDRO (Physiotherapy Evidence Database for Systematic Reviews and Meta-Analyses) statement. The assessment of the methodological quality of the included studies was done using the Methodological Index for Randomized Studies for all randomized studies. There were 100 items found in the literature search. Sixty articles were deemed appropriate for full-text examination after 60 articles were screened by title and abstract and duplicates were removed. Out of 40 studies, none met the eligibility requirements. Ultimately, 16 papers satisfied the review's inclusion requirements. These articles were all eligible for inclusion.

RESULT AND DATA ANALYSIS:

Sr no	Author	Title of study	Pedro score
1	Mustafa Cemali et.al	The Effectiveness of Sensory Integration Interventions on Motor and Sensory Functions in Infants with Cortical Vision Impairment and Cerebral Palsy: A Single Blind Randomized Controlled Trial	10/11
2	Mohamed K Seyam et.al	Effect of sensory integration on gait for children with mild hemiplegic cerebral palsy	8/11
3	Sandeep Khanna et.al	Neurodevelopmental Treatment in Children with Cerebral Palsy: A Review of the Literature	7/11
4	Silvia Faccioli et.al	Evidence based management and motor rehabilitation of cerebral palsy children and adolescents: a systematic review	7/11
5	Xiao-Liang Chen et.al	Combined effect of hydrotherapy and transcranial direct-current stimulation on children with cerebral palsy A protocol for a randomized controlled trial	9/11

6	Gönül Acar et.al	The Effects of Neurodevelopmental Therapy on Feeding and Swallowing Activities in Children with Cerebral Palsy	8/11
7	Mustafa Cemali et.al	Relationship between Sensory Processing Skills and Feeding Behaviors in Children Aged 3–6 Years with Cerebral Palsy with Cerebral Visual Impairment	9/11
8	Muhammad Abubaker Tobaiqi et.al	Application of Virtual Reality-Assisted Exergaming on the Rehabilitation of Children with Cerebral Palsy: A Systematic Review and Meta-Analysis.	7/11
9	Rowan W Johnson et.al	Evaluating the effectiveness of home exercise programs using an online exercise prescription tool in children with cerebral palsy: protocol for a randomized controlled trial	10/11
10	Vaishnavi B. Warutkar et.al	Review of Sensory Integration Therapy for Children with Cerebral Palsy	8/11
11	Silvia Faccioli et.al	Gait analysis patterns and rehabilitative interventions to improve gait in persons with hereditary spastic paraplegia: a systematic review and meta-analysis	7/11
12	Alexandra Spuropolou et.al	Hydrotherapy In Children with Cerebral Pals	8/11
13	Serebral palsili et.al	Effects of hippotherapy on upper extremity functions in children with cerebral palsy Effects of hippotherapy on upper extremity functions in children with cerebral palsy	9/11
14	J. Wotherspoon et.al	randomized controlled trial of an online cognitive training program in school-aged children with cerebral palsy J. randomized controlled trial of an online cognitive training	10/11

		program in school-aged children with cerebral palsy	
15	Sevda Adar, Ümit Dünder et.al	The effect of aquatic exercise on spasticity, quality of life, and motor function in cerebral palsy	7/11
16	Chih-Jou Lai et.al	Paediatric Aquatic Therapy on Motor Function and Enjoyment in Children Diagnosed with Cerebral Palsy of Various Motor Severities.	10/11



Sr.no	Author [year]	Type of study	Aim	Conclusion
1	Mustafa Cemali et.al [2022]	RCT	The study was examined the effectiveness of sensory integration interventions on sensory, motor, and oculomotor skills in infants with cortical vision impairment.	Cortical vision impairment (CVI) and Cerebral Palsy (CP) lead to decrement in sensory and motor functions of infants. Sensory integration intervention delivered with the conventional physiotherapy program was more effective than the conventional physiotherapy program in increasing sensory processing skills in one measure in infants with CVI and CP.
2	Mohamed K Seyam et.al [2021]	RCT	The purpose of this study was to examine the efficacy of the sensory integration on gait parameters among children with hemiplegic cerebral palsy.	Sensory integration along with a conventional physical therapy program for 3 months led to the statistically significant difference in the gait parameters among children with hemiplegic cerebral palsy
3	Sandeep Khanna et.al [2023]	A Review of the literature	aimed to explore the current literature on neurodevelopmental treatment (NDT) in children with cerebral palsy.	Studies on Non-Destructive Therapy (NDT) focus on improving gross motor, balance, and postural control, with outcomes linked to body structure and function. However, there is limited data on NDT's participation component in ICF. Future research should analyze NDT's impact from a participatory perspective and explore larger sample sizes and strategies.
4	Silvia Faccioli et.al [2023]	A Systematic review	The Aim of the present study was to provide an updated overview of the state of knowledge,	Multiple-disciplinary family-centered evidence-based management is recommended for motor rehabilitation approaches for minors with cerebral palsy. These approaches should be individualized,

			regarding the management and motor rehabilitation of children and young people with cerebral palsy, as the framework to develop evidence-based recommendations on this topic	age-appropriate, goal-directed, skill-based, intensive, and feasible considering individual needs and family preferences
5	Xiao-Liang Chen et.al [2023]	RCT	This study aims to estimate the efficacy of a combined application of tDCS and hydrotherapy in patients with CP	This protocol outlines a randomized, controlled trial investigating the effectiveness of combining tDCS and hydrotherapy in treating CP, aiming to determine if this combination leads to longer-lasting motor function improvement.
6	Gönül Acar et.al [2021]	RCT	The effect of the structured Neurodevelopmental Therapy Method- Bobath (NDT-B) approach on the feeding and swallowing activity of patients with cerebral palsy (CP) and feeding difficulties	The study suggests that NDT-B-based exercises, when combined with feeding therapy, can significantly enhance swallowing and oral motor skills in children with CP.
7	Mustafa Cemali et.al [2023]	RCT	aimed to examine the relationship between sensory processing skills and feeding behavior in cerebral palsy (CP) children aged 3–6 years with	Children with CP with CVI have more problematic sensory processing skills and feeding behavior attitudes than those without CVI. As sensory processing skills increase, feeding behavior problems also increase. The addition of CVI diagnosis worsens the sensory and feeding status of children with CP

			cerebral visual impairment (CVI)	
8	Muhamma d Abubaker Tobaiqi et.al [2021]	A Systematic review and meta-analysis	This study aimed to systematically review the evidence on the application of VR-based exergaming in rehabilitating children with CP	The study suggests that VR-assisted exergaming, a combination of conventional physiotherapy and exergaming, may be an effective and feasible alternative to conventional rehabilitation for children with cerebral palsy (CP).
9	Rowan W Johnson et.al [2017]	RCT	effectiveness of delivering home exercise programs for children with disabilities using an online exercise prescription tool in comparison with conventional methods.	Home exercise prescription tool, offers innovative features that enable physiotherapists to assist individuals in completing home exercise programs, enabling them to achieve therapy goals and maximize community participation.
10	Vaishnavi B. Warutkar et.al [2022]	Systematic Reviews and Meta-Analyses	Several different approaches are used to treat cerebral palsy children like neurodevelopmental therapy (NDT), sensory integration	CP is a common developmental disorder affecting children, requiring appropriate treatment strategies to improve daily living activities and functionality. Sensory Integration Therapy (SIT) is an important treatment that focuses on vision, touch, and proprioception, enhancing gait, balance, and gross

			therapy (SIT), and hippotherapy	motor functioning, potentially aiding in learning new motor skills.
11	Silvia Faccioli et.al [2023]	A systematic review and meta-analysis	The aim of this systematic review was 2-fold: to identify specific gait analysis patterns and interventions improving gait in HSP subjects	HSP exhibits unique patterns like knee hyperextension, non-sagittal pelvic movements, and reduced ROM. Botulinum improves gait velocity after 2 months, but interventions reducing spasticity may result in term improvement.
12	Alexandra Spuropolou et.al [2023]	Systematic Reviews and Meta-Analyses	The purpose of this work is the systematic study of the modern literature regarding the effects of hydrotherapy and specifically overall health and functionality of people diagnosed with Cerebral Palsy.	The review concluded that the method is able to improve the ability to adapt to the water, sociability of the patient and their motor functions, strengthen their respiratory system, reduce spasticity, increase range of motion and balance. However, due to limitations the results of the concentrated work are not completely secure.

13	Serebral palsili et.al [2024]	RCT	aimed to increase range of motion, muscle strength, and improve the coordination of the upper extremities	In children with CP, hippotherapy provided in addition to conventional treatment was an effective practice, especially in improving fine motor skills in the hands.
14	J. Wotherspoon et.al [2024]	A Randomized controlled trial	To assess the efficacy of an online cognitive intervention in school-aged children with CP.	The study found no significant impact of SMART on intelligence, academic achievement, attention, executive functioning, or social emotional functioning in children with CP. The RCT component highlighted challenges in testing with children with learning difficulties. The study provided valuable insights for future studies.

15	Chih-Jou Lai et.al [2024]	A Randomized controlled trial	effects of paediatric aquatic therapy on motor function, enjoyment, activities of daily living, and health-related quality of life for children with spastic cerebral palsy of various motor severities	Paediatric aquatic therapy improves gross motor function and physical activity enjoyment in children with motor impairment, particularly those with spastic diplegic subtype. This therapy is a safe alternative to land-based treatments, even for severe cerebral palsy. Future studies should include larger sample sizes, longer follow-up periods, and randomized controlled designs.
16	Sevda Adar,Ümit Dündar et.al[2020]	A Randomized controlled trial	aim of this study was to compare the effects of aquatic exercises and land-based exercises on spasticity, quality of life, and motor function in children with cerebral palsy (CP).	Aquatic exercises are effective for spasticity management and motor function improvement in children with cerebral palsy, resulting in higher quality-of-life scores and improved muscle elasticity.

DISCUSSION

This study aims to provide an overview of evidence-based comprehensive treatment approaches for cerebral palsy patients. Sensory integration (SIT) is a method that enhances children's ability to process and integrate sensory information, promoting their normal development. SIT helps resolve issues faced by young infants with sensory information absorption and processing, leading to improvements in balance and steady movement [8]. Various approaches have been studied for patients with cerebral palsy, including sensory integration, neurodevelopment therapy, hippocampal therapy, hydrotherapy, and the GMFM scale [9]. Sensory integration involves supporting children in various positions throughout each session, while neurodevelopment therapy focuses on improving motor. Skill and posture stability. Neurodevelopment therapy (NDT) has been shown to enhance children's mobility, with studies showing gains in self-care and motor function after NDT training combined with balance training therapy [10]. Hippocampal therapy has also shown improvements in hand functions, such as turning over cards and picking up small objects [11].

Hydrotherapy has been shown to improve muscle strength and balance in children with cerebral palsy. The GMFM scale has been used to assess patients' mobility, with studies showing the biggest improvement in values when comparing initial and final measures [12]. The study outlines an assigned, controlled superiority trial that is blinded by the participants' age and gender. In conclusion, sensory integration, hydrotherapy, and the GMFM scale are all effective treatments for cerebral palsy patients [13]. However, challenges such as low motivation, time constraints, and reading proficiency may affect participation and completion of these treatments [14]. By incorporating these techniques into their treatment plans, physiotherapists can help children achieve their therapy goals and maximize their involvement in communal physical activity[15,16].

CONCLUSION:

Numerous children are affected by cerebral palsy, an incurable condition affecting movement and development that manifests as a variety of abnormalities that need be addressed with the right treatment plan. It's never easy to improve their everyday functioning and activities. All combination therapies used in our study found that neurodevelopmental therapy (NDT) is a frequently used treatment for cerebral palsy worldwide. The majority of the gross motor, balance, and postural control improvement areas are examined in the literature. Children with CP benefit from treatments in a number of ways. SIT is a significant one even if it is not new. Some specific components of rehabilitation, including vision, touch, and proprioception, are the focus of sensory integration treatment. Additionally, it is said that SIT improves balance, gross motor skills, gait and it might therefore be helpful in picking up new motor abilities. Various advanced treatment modalities such as hydrotherapy, hippotherapy. Are beneficial in treating children with cerebral palsy.

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- 13] Effect of sensory integration on gait for children with mild hemiplegic cerebral palsy** Mohamed K Seyam^{1*}, Abdel Aziz A Sherief², Mohamed I Waly³, Faizan Z Kashoo¹, Mahmoud S. Elfakharany⁴.
- 14] Effects of hippotherapy on upper extremity functions in children with cerebral palsy** Serebral palsili çocuklarda hippoterapinin üst ekstremitte fonksiyonları üzerine etkisi
- 15] Combined effect of hydrotherapy and transcranial direct-current stimulation on children with cerebral palsy** A protocol for a randomized controlled trial Xiao-Liang Chen, MDa, Li-Ping Yu, MDb, Ying Zhu, MDa, Tie-Yan Wang, MDa, Jing Han, MDc, Xiao-Yan Chen, MDd, Jia-He Zhang, MDc, Jia-Li Huang, MDe, Xiao-Ling Qian, MDf, Bo Wang, MDb
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