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Effect of Spider Therapy on Motor Functions and Balance in Cerebral Palsy - An Evidence Based Study

Shital Bhimsingbhai Gamit[1], Jayshree M. Sutaria[2]

[1]M.P.T. (Neuroscience),
[2]M.P.T. (Musculoskeletal), Lecturer, Government Spine Institute and Government Physiotherapy College, Civil Hospital, Asarwa, Ahmedabad

Corresponding Author: Shital Bhimsingbhai Gamit

ABSTRACT

Background: Cerebral palsy describes a group of disorders of development of movement and posture, causing activity limitation, that are attributed to non- progressive disturbances that occurred in developing fetal or infant brain. Spider therapy is an intensive treatment approach which was originally developed in Poland. It involves suspending the child in the Centre of universal exercise unit by using a number of elastic bungee cords of different elasticity. These cords are attached to specific points on special belt around the child's waist, forming a unique spider web around the child which provides them essential support.
Purpose: The purpose is to study the scientific evidences regarding the effect of the spider therapy on motor functions and balance in cerebral palsy
Methodology: A search for relevant articles was carried out using key words- cerebral palsy, spider therapy, motor functions and balance and search engines-Google Scholar, PubMed, PEDro, Science Direct, Research Gate and CINAHL. Studies were selected from year 2005-2020. eleven studies were included in which there were 1 Meta-analysis, 2 Systematic reviews and 4 Randomized controlled trials,1Quasi- Experimental study, 1 case study, 1 interventional study and 1 retrospective study.
Results: 11 studies were reviewed from which 6 studies concluded that spider therapy is more effective than a control group receiving conventional treatment, 2 study highlighted MFR to be equally effective to alternative treatment and 3 studies concluded that spider therapy have significant but small effects on functioning at post-treatment and follow-up
Conclusion: Based on the analysis of these 11 articles, it can be concluded that spider therapy is an effective treatment regimen in cerebral palsy.
Clinical Implication: Spider therapy is found to be effective in improving balance and motor functions in s cerebral palsy, therefore spider therapy can be considered as an adjunctive treatment in cerebral palsy.

Key words: cerebral palsy, spider therapy, motor functions and balance.

INTRODUCTION

Cerebral palsy is an umbrella term covering a group of non-progressive, but often changing, motor impairment syndromes secondary to lesions or anomalies of the brain arising in the early stages of development.[1] Cerebral palsy is non-progressive disorders of posture and movement which is caused by damage to motor control centers of the developing brain.[2]

1. It is disorder of movement and posture.
2. It results from abnormality in the brain.
3. It is acquired early in life.[3]

Cerebral palsy is the commonest physical disability in childhood occurring 2.0 to 2.5 per 1000 live births in western societies. It was first described by English physician sir Francis William Little in 1861 and was known as little's disease for a long

time.[4]

According to World Health Organization (WHO) estimation, 10% of global population has some form of disability due to different causes, in India, it is 3.8% of the population. Nearly 15-20 % of the total physically handicapped children suffer from cerebral palsy. For India, the estimated incidence is around 3 per 1000 live births; however, being a developing country, the expected actual figure may be much higher.[5] Cerebral palsy can result from brain injury occurring during prenatal, perinatal or postnatal periods. 70-80 % cases of cp are acquired prenatally and are largely from unknown sources.[6,7] Birth complications including asphyxia are currently estimated to account for about 6 % of patients with cerebral palsy.[8] In 10-20% patients, cerebral palsy is acquired postnatally mainly because of damage to the brain due to bacterial meningitis, viral encephalitis, hyperbilirubinemia, trauma, seizures.[4,8]

Spider therapy is an intensive treatment approach which was originally developed in Poland. It involves suspending the child in the Centre of universal exercise unit by using a number of elastic bungee cords of different elasticity. These cords are attached to specific points on special belt around the child's waist, forming a unique spider web around the child which provides them essential support.[9]

This unique suspension allows the child to move independently while controlling their movements with greater precision and ease, as well as strengthening parts of the body. It improves the child's stability, balance and coordination. It improves the child's body alignment and their awareness of their body parts proprioception. Elastic resistance of cords can be used to strengthen the weak muscles.

METHODOLOGY

Study Type: This is an Evidence Based Study, conducted according to Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) guidelines (Figure 1).

Search strategy: The search engines used to find the appropriate articles were: Google Scholar, PubMed, PEDro, ScienceDirect, ResearchGate,CINAHL

Key words used for the search were: cerebral palsy, spider therapy, motor functions and balance.

Eligibility criteria: Articles were selected from last 15 years (2005-2020).Total 160 articles were found, out of which 15 articles were relevant. Out of 15 articles, 11 articles were included in the study (Table 1). Other articles were excluded because they used spider therapy and outcome measures were other than balance and motor function.

Data Analysis: All 10 articles were assessed using 2 scales:

1. **The PEDro scale:** It assesses methodological quality and consists of a checklist of 11 criteria, 10 of which are scored. For each criterion the study met, 1 point was awarded. The points were tallied and presented as a score out of 10. The scale applies only to experimental studies. For this review, investigations with PEDro scores of 6 to 10 were considered high quality, of 4 to 5 were considered moderate quality, and of 0 to 3 were considered low quality. The PEDro score has demonstrated 'fair' to 'excellent' inter-rater reliability (Intraclass Correlation Coefficient 0.53-0.91) for randomized controlled trials of physiotherapy interventions. Convergent validity is supported for the PEDro score through correlation with other quality rating scales including: the Jadad scale (0.35) and van Tulder 2003 scale (0.71) for clinical trials of physiotherapy related interventions.[7](Appendix 1)

2. **The CEBM's Levels of Evidence scale:** It assesses quality based on study design, which categorize the studies in a scale ranging from 1 to 5 with further subdivision for each. (Appendix 2)

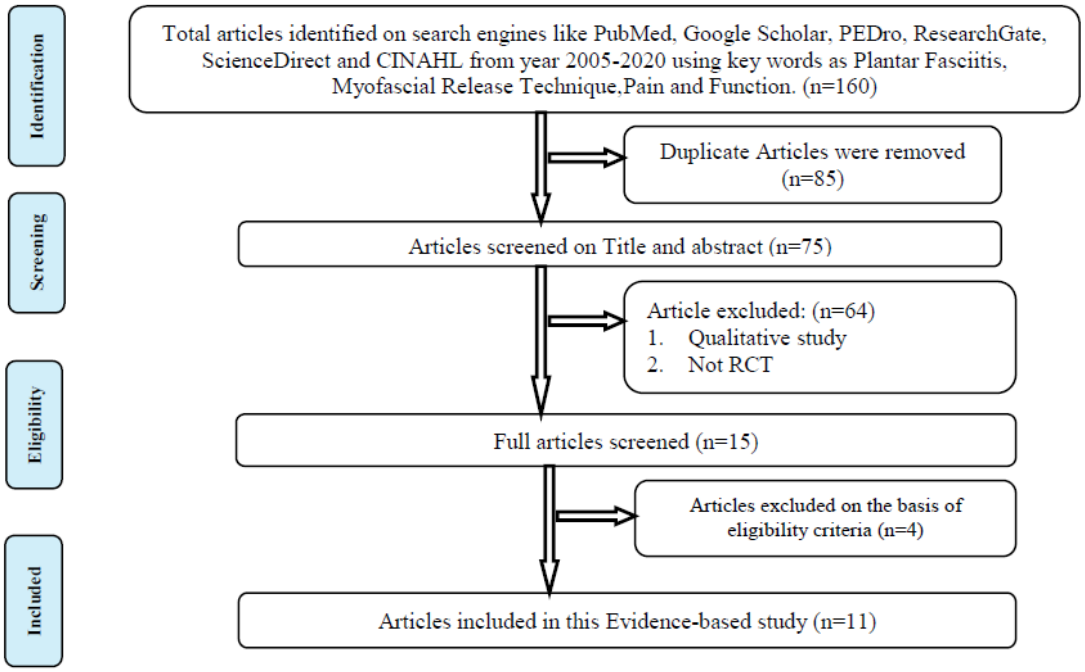

Figure 1: Preferred Reporting Items for Systematic reviews and Meta-analysis (PRISMA)

Characteristics of included studies

First Author Name and Year	Outcome Measure	Conclusion	Sample Size	PEDro	Level of evidence
Simona Bar-Haim [10] 2006	GMFM-66 EI_{HB}	Both AST and NDT shows significant improvement but AST shows better improvement in cerebral palsy.	24	6/10	1b
Jagatheesan Alagesan [11] 2011	GMFM-88	Modified suit therapy along with conventional physiotherapy is effective in improving the gross motor function of children with spastic diplegic cerebral palsy	30	8/10	1b
Myung-Sook Ko [12] 2015	GMFM PBS	AST shows significant improvement in gait,balance and gross motor function in diplegic cp.	1	-	4
Mi-Ra Kim [13] 2016	GMFM PBS	Greater effectiveness of combined AST/ NDT than NDT alone in gross motor functions, balance and gait parameters in cp.	20	5/10	2b
Elisabete Martins 2016[14]	GMFM PEDI	short intensive suit therapy interventions have significant but small effects on functioning at post-treatment and follow-up in children and adolescents with cp.	46 studies		1a
Kanu Kaushik [15] 2016	GMFM-88	The Cage Therapy with Spider Suit is more effective and beneficial therapy than Traditional Physical Therapy in improving Gross Motor fuction in cp.	10	6/10	2b
Tainá Ribas Mélo [16] 2017	GMFM-88	Intensive Neuromotor Therapy improved gross motor abilities of children with CP and this effect was higher in the initials modules, with continuous improving in all followed modules.	53	6/10	2b
Campus L, [17] 2018	GMFM-88 TIS	Universal exercise unit can be used with other strength training on mobility in adults with cerebral interventions to improve the gross motor function palsy.	05	3/10	4
Kannea M. almeida [18] 2019	GMFM PBS	The suits DEFO and thera togs seem to improve postural alignment and gait performance in spastic cp.	13 studies	-	1a
Evrim Karadağ-Saygı, [19] 2019	GMFM	Suit therapy with conventional treatment shows significant improvements in the proximal stability, gross motor function, and gait than suit therapy alone.	29 studies	-	1a
Ahmed Salim Mohamed [20] 2020	BID	Universal Exercise Unit might be effective way for improving lower limb strength more than Functional resisted training exercises in spastic diaplegic cerebral palsy.	40	7/10	1b

RESULTS

Evidences were reviewed and analysis was done on the basis of PEDro score and CEBM's Level of Evidence Scale.

Articles were selected from last 15 years (2005-2019).Total 189 articles were found, out of which 15 articles were

relevant. Out of 15 articles, 11 articles were included in the study

6 studies concluded that spider therapy is more effective than a control group receiving conventional treatment, 2 study highlighted MFR to be equally effective to alternative treatment and 3 studies concluded that spider therapy have significant but small effects on functioning at post-treatment and follow-up

DISCUSSION

Total 11 studies (1 Meta-analysis, 2 Systematic reviews and 4 Randomized controlled trials, 1 Quasi- Experimental study, 1 case study, 1 interventional study and 1 retrospective study) were included in this evidence-based study.

The methodological qualities of included studies were low to high. The sample size varied from 24-414 subjects. All these studies include different outcome measures which are measured at different follow up times.

The studies investigating the effect of spider therapy on balance and motor functions in spastic cerebral palsy

According to Centre of Evidence-Based Medicine: Levels of Evidence, there are 3 strong (1a) scientific evidences (1 Meta-analysis and 2 Systematic review)

1st Systemic reviews shows that significant improvements in the proximal stability, gross motor function, and gait 2nd systemic review shows that the suits DEFO and thera togs seem to improve postural alignment and gait performance in spastic cp.

Meta-analysis shows that short intensive suit therapy interventions have significant but small effects on functioning at post-treatment and follow-up.

There are 4 (1b,2a,2b) RCTS, comparative studies, moderate to high quality of evidences.

It suggest that spider therapy alone or can be adjunct to other conventional treatment provide significant benefits in improving motor functions and balance in spastic cerebral palsy.

Resistance to strong muscles to further enhance strength, helping to decrease contractures and improving coordination.

All Randomized control trial showed Significant improved in gross motor function, balance and gait parameters in both groups (control and treatment group) but there is more significant improvement when spider therapy is used as adjunct to other conventional treatment.

1 quasi experimental study, level of evidence is 2b.

It showed significant improvement with Cage therapy using advanced spider suit therapy than traditional physical therapy on Gross Motor Function Measure.

1 retrospective study, level of evidence 2b

It shows Intensive Neuromotor Therapy improved gross motor abilities of children with CP and this effect was higher in the initials modules, with continuous improving in all followed modules.

1interventional study, level of evidence is 4.

It shows that Universal exercise unit can be used with other strength training on mobility in adults with cerebral interventions to improve the gross motor function palsy.

1 low to moderate quality of evidence having case report

It shows effect of adeli suit treatment on gait in children with cerebral palsy. Total study duration is 50min per session, once a week for an 18 week period.

The spider suit provides external stabilization to the trunk and therefore allows more fluent and coordinated movement for both upper and lower extremities. The vestibular system, through the position of the body, records space and analyzes the muscle tone necessary to execute the movement. The theory behind the Suit therapy is that it induces a strong afferent proprioceptive input, which stimulates the formation of cerebral systems whose postnatal development has been delayed.

Benefits of Suit therapy includes external stabilization, normalizing muscle tone, aligns the body to as close to normal

as possible, normalizing gait pattern, providing tactile stimulation, influencing the vestibular system, improving balance, supports weak muscles, providing resistance to strong muscles to further enhance strength, helping to decrease contractures and improving coordination.

CONCLUSION

Based on above evidences found from search engines like Google Scholar, PubMed, PEDro, Science Direct, Research Gate and CINAHL from year 2005-2019, 11 out of 15 articles were selected and from its analysis it can be concluded that spider therapy alone or can be adjunct to other conventional treatment provide significant benefits in improving motor functions and balance in cerebral palsy.

Clinical Implication

Spider therapy is found to be effective in improving balance and motor functions in cerebral palsy therefore spider therapy can be considered as an alone or adjunctive treatment in cerebral palsy.

Abbreviations

WHO: world health organization, COP: centre of pressure, CP: cerebral palsy, GMFM: gross motor function measure, PBS: pediatric balance scale, EI_{HB}: Mechanical efficiency index PEDI: pediatric evaluation of disability inventory, TIS: trunk impairment scale, BID: Biodex Isokinetic Dynamometer, AST: adeli suit treatment, NDT: neurodevelopmental treatment, DEFO: Dynamic elastomeric fabric orthosis, RCTs: randomized controlled trial PEDro: Physiotherapy Evidence Database, CEBM: Center of Evidence Based Medicine, CINAHL: Cumulative Index of Nursing and Allied Health Literature, RCT: Randomized Controlled Trial, PRISMA: Preferred Reporting Itemsfor systematic reviews and meta-analysis.

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Conflict of Interest: There is no conflict of interest.

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Ethical Approval: Ethical approval was not required.

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APPENDIX 1: PEDro SCALE

No.	Description	Yes / No
1.	Eligibility criteria were specified (No points awarded)	
2.	Subjects were randomly allocated to groups	
3.	Allocation was concealed	
4.	The groups were similar at baseline regarding the most important prognostic indicators	
5.	There was blinding of all subjects	
6.	There was blinding of all therapists who administered the therapy	
7.	There was blinding of all assessors who measured at least one key outcome	
8.	Measure of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups	
9.	All subjects for whom outcome measures were available received the treatment or control condition as allocated	
10.	The result of between group comparisons are reported for at least one key outcome	
11.	The study provides both point measures and measures of variability for at least one key outcome	

APPENDIX 2: CEBM'S LEVEL OF EVIDENCE

Level	Definition
1a	Systematic reviews of randomized controlled trials
1b	Individual randomized controlled trials
1c	All-or-none studies
2a	Systematic reviews of cohort studies
2b	Individual cohort studies or low-quality randomized controlled trials
2c	Outcome research
3a	Systematic reviews of case-control studies
3b	Individual case-control studies
4	Case series, poorly designed cohort or case-control studies

5	Animal and bench research, expert opinion

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