Available online at www.ijpcr.com
International Journal of Pharmaceutical and Clinical Research 2016; 8(9): 1319-1322

ISSN- 0975 1556

Research Article

Effectiveness of Partial Body Weight Supported Treadmill Training in Children with Spastic Diplegic Cerebralpalsy

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Available Online:20th September, 2016

ABSTRACT

Background: The objective of this study is to find out the effectiveness of partial body weight support treadmill training in children with spastic diplegic cerebral palsy in improving self-selected gait velocity and Gross Motor Function. *Study design*: Experimental study with two groups' pre and post test. *Intervention:* 15 subjects in experimental group received partial body weight support treadmill training with conventional therapy and 15 subjects in control group received only conventional therapy for two months. *Results:* The statistical tool used in this study was paired 't'-test and independent 't'-test. The results of the study showed that partial body weight support treadmill training was highly significant for children with cerebral palsy with mean (group A-72.0040; 0.092), (group B-66.9187; 0.078) and ($p<0.05$). *Conclusion:* The study concluded that partial body weight support treadmill training can be viewed as more value therapeutically for improving an accessible, practical and safe method to improve Gross Motor Function and walking velocity in spastic diplegic children.

Keywords: Treadmill training, Cerebral palsy, Spastic diplegic, Gross Motor Function, Walking velocity

INTRODUCTION

Cerebral palsy describes a group of permanent disorders of the development of movement and posture, causing activity limitation. These disorders are attributed to non progressive disturbance that occurred in the developing fetal or infant brain. The development of efficient and independent walking is an important therapeutic goal for many children with cerebral palsy. As a result of impairments such as spasticity, muscle weakness and postural instability, as much as 90% percentage of children with cerebral palsy have difficulty in walking. "Cerebral Palsy (CP) is a group of conditions characterized by motor dysfunction due to non-progressive brain damage early in life", affecting approximately 1- 2 per 100 live births[1]. Strength training has been regarded as controversial and inappropriate, due to concerns that it would increase abnormal muscle tone and movement abnormalities[2]. some studies have shown that strength gains can be achieved in children with Cerebral palsy, without adverse effects[3]. The treatment approach with neuro developmental training and dynamic system approaches, the task specific approach to attainment of locomotors skills in children with cerebral palsy has been identified, that of partial body weight supported treadmill training. The manual guidance of foot and leg movements in a repetitive, task specific approach to walking on moving treadmill. Two reviews concluded that partial body supported treadmill training is effective and safe for improving gross motor skills[4]. In most of the studies, the improvement in walking performance was generally evaluated by motor tests, such as the Gross Motor Function measure and their result suggest that body weight supported treadmill training can improve walking in children with cerebral palsy[5]. The reciprocal walking motion on the treadmill is thought to be controlled at least in part by the spinal cord, which can function in the absence of higher brain center function[6]. Reciprocal stepping is considered to be a largely organized by networks of sensory and motor neurons within the spinal cord, which are referred to as central pattern generators[7].Central pattern generators appear to be activated by lower brain centers, such as the brainstem and the basal ganglia, which in turn activate muscles that perform cyclic and repetitive walking movements[8]. Humans can easily learn novel rhythmic motor patterns (e.g. swimming strokes, dances) that, once learned seem as 'automatic' and ingrained as do clearly Central Pattern Generators-driven motor patterns such as walking (1) Central Pattern Generators development does not require movement-induced sensory feedback, or even muscle innervations; (2) later rhythmic motor patterns arise by modification of the Central Pattern Generators that generated earlier patterns; and (3) the ability to produce motor patterns that are expressed at only one developmental stage (hatching) is not lost as the animal matures, but can be re-induced by applying the proper sensory input at more mature stages[9]. Activation of this automatic reciprocal mechanism is believed to play an important role in the stimulation of ambulation using body weight supported treadmill training after neurological injury, when higher brain centers have been damaged[10].There are several widely used treadmill

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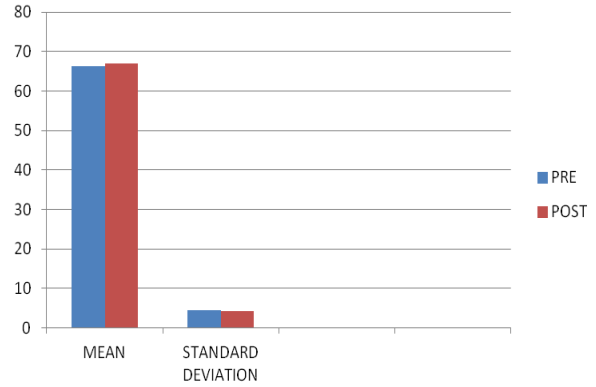
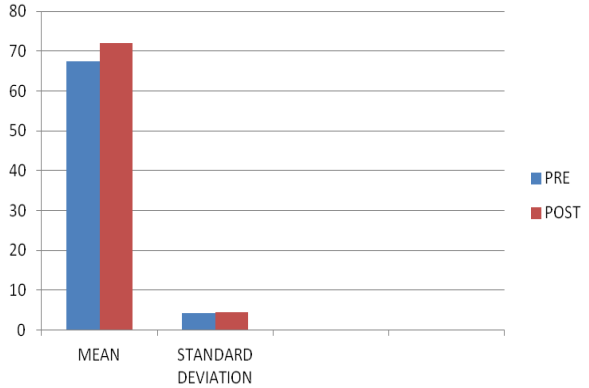
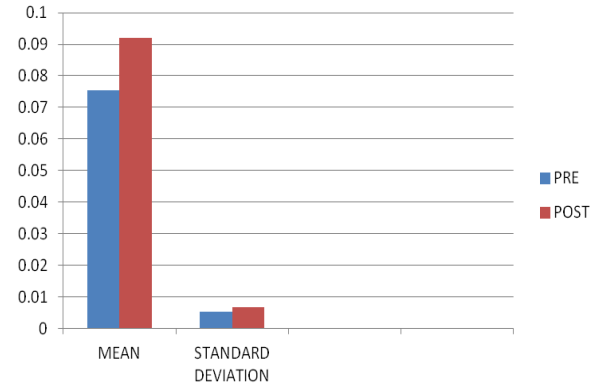


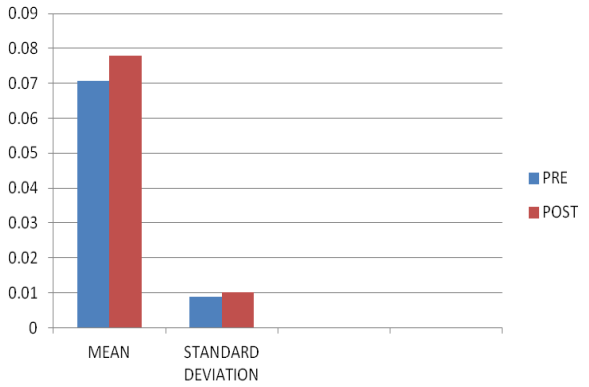
Graph 1: Mean and Standard Deviation values of (GMFM) in Group A.



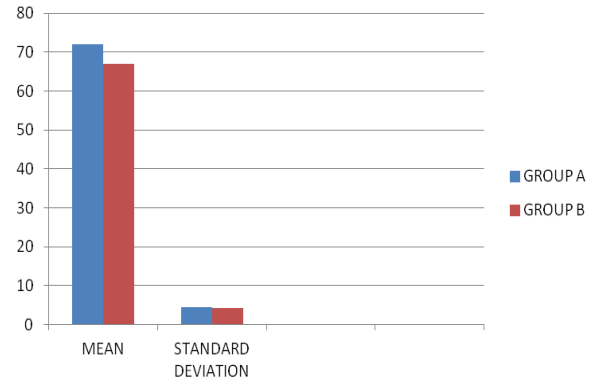
Graph 2: Mean and Standard Deviation values of(GMFM) in Group B.



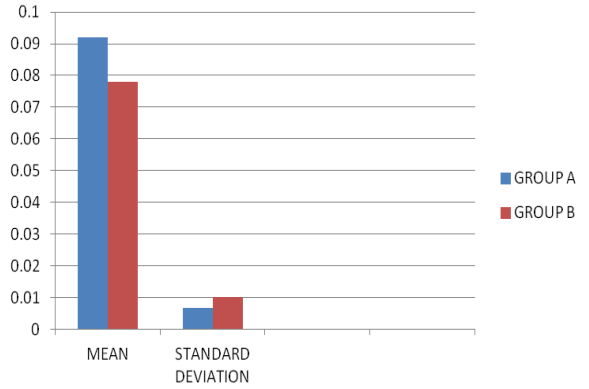
Graph 3: Mean and Standard Deviation values of (10MWT) in Group A.



Graphs 4: Mean and Standard Deviation values of (10MWT) in Group B.



Graph 5: Comparison of pre and post Mean and Standard deviation value of (GMFM) in Group A and Group B.



Graph 6: Comparison of pre and Post test Mean and Standard deviation values of (10MWT) in Group A and Group B.

protocols for assessment of children's physical capacity. The classical Bruce protocol is presumed to be suitable for all ages, but the simultaneous change of speed and slope appears to be difficulty for the younger children[11].The children received a combination of conventional therapy and treadmill training at intensity four times per week, the gross motor function measure and gait velocity was increased[12].A recent review has shown that low muscle strength, and spasticity not causes the greatest limitations in motor function in children with Cerebral palsy, and this has shifted the focus from spasticity management towards treadmill training for these children[13].

METHODOLOGY

Study design was Experimental, Study type was Quasi Experimental, Sampling method was convenient sampling and Sample size was 30 subjects, Group A – 15 subjects (experimental) Group B – 15 subjects (control), Study duration was 4 weeks, Study Settings was .spastic society of TamilNadu, Tarmani, Chennai and Maithree special school, Tambaram, Chennai 30 children with spastic diplegic were taken by the convenient sampling for this study, after they met up all the inclusion criteria and were divided into two groups by which school they were studying and the consent form was filled by the parents or care givers. Institutional ethical committee approval

Table 1: Pre and post test values of gross motor function measures scale of group a.

Group A	Mean	S. D	t-test	Sig
Pre test	67.3407	4.11461	-9.415	0.000
Post test	72.0040	4.46279		

Table 2: Pre and post test values of gross motor function measures scale of group b.

Group B	Mean	S. D	t-test	Sig
Pre test	66.2693	4.40020	-4.544	0.000
Post test	66.9187	4.25229		

Table 3: Pre and post test values of 10 meter walk test of group a.

Group A	Mean	S. D	t-test	Sig
Pre test	.0753	.00516	-13.229	0.000
Post test	.0920	.00676		

Table 4: Pre and post test values 10 meter walk test of group b.

Group B	Mean	S. D	t-test	Sig
Pre test	.0707	.00884	-6.205	0.000
Post test	.0780	.01014		

obtained from our Institution. Inclusion criteria were a consultant diagnosis of spastic diplegic Cerebral Palsy, age between 8 to 16 years, both male and female, Gross Motor Function measure A &B, ability to walk with or without any mobility aid, able to follow simple instructions. Exclusion criteria were Orthopedic or Neurological surgeries in lower limb in past 3 months, Baclofen pump implantation within one year or oral medication within three months, Botulin toxin injection within three months, Serial casting or new orthotic within three months, Flexion deformity greater than 30 degrees in hip and 20 degrees in knee and 15 degrees in plantar flexion.

Group A – Experimental group of 15 subjects.

Group B – Control group of 15 subjects. Physical therapy session consisted of conventional treatment included Neuro developmental training in a dynamic system approach (facilitation of active motor learning by developmental positions and transition). Along with this, Group A received partial body weight supported treadmill Training. The child was secured into the harness and the body weight was positioned in an erect posture to allow full knee extension. Treadmill speed and inclination was determined according to the BRUCE PROTOCOL, the protocol was extended till the child capability. Most of the children achieved till stage five with inclination of 3% to 5%, rest was given to the children in between three stages. Five participants were used ankle foot orthotics after their treatment session. Pre test score was taken before the study and post test score was taken after 8 weeks of the study.

Outcome Measures

Gross Motor Function Measurement

The GMFM is a standardized observational instrument and the criteria of reliability and validity measure change in gross motor function over time in children with cerebral palsy. The test consists of five dimensions and the scoring key is meant to be a general guideline. The crawling &kneeling(C), standing (D) and walking, running and jumping (E) goal areas of the Gross Motor Function was measured by asking the patients to complete the goals.

Timed 10-Meter Walk Test

walking velocity is a valid and reliable measure of walking ability in children with or without neuromuscular disability. Gait speed was measured utilizing a timed 10 meter walk test. The participant was asked to walk at a comfortable, normal pace for 10meters.The middle six meters were timed to assess the effect of acceleration and deceleration[14]. The outcome measures were gross motor function measure and 10 meter walk test. It also shown to (1) provide a useful measure of walking endurance, (2) a measure of child community walking speed and (3) it has high retest reliability in children with cerebral palsy.

RESULTS

In this table, p value is lesser than .05 which shows that there is significant difference of pre and post test values in Gross motor function measures in Group A subjects trained with partial bodyweight supported treadmill training. P<.05In this table, p value is lesser than .05 which shows that there is significant difference of pre and post values test in Gross motor function measures in Group B subjects trained with Conventional physiotherapeutic exercises. In this table, p value is lesser than .05 which shows that there is significant difference of pre and post values in 10 meter walk test in Group A subjects trained with partial body weight supported treadmill training. In this table, p value is lesser than .05 which shows that there is significant difference of pre and post test values in 10 Meter Walk Test in Group B subjects trained with conventional physiotherapeutic exercises. In this table, p value is lesser than .05 which shows that there is highly significant difference in Gross Motor Function Measure between Group A and Group B subjects. In this table, p value is lesser than .05 which shows that there is highly significant difference in 10 Meter Walk Test (10MWT) between Group A and Group B subjects. The statistical tool used in this study was paired'-test and independent 't'-test. Paired 't'- test was used for analysis of pre-test and post-test means within the groups, where as independent 't'-test was used for analysis of comparison between the 2 groups. According to the statistical results there is improvement in both treadmill training and conventional therapy but there is highly significant improvement in GMFM and 10WT in treadmill training (Group A).

DISCUSSION

The objective of this study was to find out the effectiveness of Partial body weight supported treadmill training in children with spastic diplegics in improving self selected gait velocity and Gross Motor Function. In this study, it was observed that there was highly significant difference between the Partial body weight supported treadmill training and conventional therapy in children with spastic diplegic in improving self selected gait velocity and gross motor function. This result go in hand with partial body supported treadmill training is effective and safe for improving gross motor skills. Teixeira-Salmela LF

Table 5: Post test values of gross motor function measures scale for group a and group b.

Post Test Values	Mean	S. D	t- value	Signif icance
Group A	72.0040	4.46279	3.195	0.03
Group B	66.9187	4.25229		

Table 6: Post test values of 10 meter waliking test in group a and group b.

Post Test Values	Mean	S. D	t- value	Signif icance
Group A	.0920	.00676	4.448	0.000
Group B	.0780	.01014		

concluded that "muscle strengthening and physical conditioning is very useful to reduce impairment and disability in cerebral palsy[15]. Neural changes continue with training, helping to achieve movement. This phase is more beneficial for Cerebral Palsy than the hypertrophy phase. Once the neurological "learning" phase begins to diminish, remodeling of the muscle was beginning to take place and strength gains continue[16]. Current studies show that proper training can induce fiber-type alternation. Fast-twitch fibers might become more oxidative with regular treadmill training[17].However, in this study it was observed that along with the conventional physiotherapeutic exercises, partial body weight support treadmill training was effective for children with cerebral palsy. There is a highly significant effective in Group A trained by partial body weight support treadmill training than Group B trained by conventional therapeutic exercises. There was significant improvement in Group B; because of regular conventional therapy. It was inferred from our study that partial body weight supported treadmill training in children with spastic diplegic cerebral palsy enhance their gross motor function and self selected velocity. This study is in agreement with other authors, who reported statistically significant Gross Motor Function Measure and Self Selected Velocity were gained after 8 weeks period of training.

CONCLUSION

This study focused on effect of partial body weight support treadmill training and conventional physiotherapeutic exercises in children with spastic diplegic cerebral palsy. This study concludes that partial body weight support treadmill training was more effective than conventional physiotherapeutic exercise in children with spastic diplegic cerebral palsy. Thus the results of this study concludes that partial body weight support treadmill training can be viewed as more value therapeutic for practical and safe method to improve Gross Motor Function Measure and walking velocity in spastic diplegic children.

ACKNOWLEDGEMENTS

Authors express gratitude to those who supported to complete this research.

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