

Comparison between the Effects of Gait Training on Floor and Treadmill Through Partial Body Weight Support System in Cerebral Palsy

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Abstract

Gait is one of the most important motor skill require for optimal functioning of every human being. Gait impairment is common in cerebral palsy leading to reduce motor ability and impaired balance. The body weight support system is a therapeutic intervention technique that provides task specific gait training which helps cerebral palsy children by facilitating walking constraints. Research on gait training using PBWSS has been done in the past but none of them highlighted the importance of walking surface. Aim and Objectives: To compare the effect of PBWSS on gait function in floor versus treadmill set up. Methodology: Subjects are selected with due fulfilment of selection criteria, 30 spastic cerebral palsy children divided into two groups. Group A (n=15) was given conventional therapy for 45 minutes/day and gait training with PBWSS for 15 minutes/day on treadmill for 6 days in a week for 4 weeks and group B was given conventional therapy for 45 minutes/day and gait training with PBWSS for 15 minutes/day on floor for 6 days in week for 4 weeks. Cadence, stride length and GMFCS were taken as outcome measure. Results: All subjects were in the mean range of 6.33 ± 0.81 in group A and 6.73 ± 0.88 in group B. Both group showed positive difference in values of cadence, stride length and GMFM. However, ground is more significant than treadmill. Conclusion: The study concluded that a spastic CP child who has undergone intensive gait training with PBWSS on floor has better beneficiary effect than PBWSS with treadmill training.

Key words: cerebral palsy, partial body weight support system, gait training.

Introduction

Cerebral palsy is defined as a group of disorders the development of movement and posture, causing activity limitation that are attributed to non progressive disturbances that occurred in the developing fetal or an infant brain.^[1] The motor disorder (like gait deficit, balance deficit, spasticity, in coordination, involuntary motor control, reduced endurance and energy deficiency) of CP are often accompanied by disturbances in sensation, perception, cognition, communication and behaviour.^[1] The worldwide prevalence of cerebral palsy is 1.5 to 4 per 1000 live births and in India 3 per 1000 live birth

The common motor dysfunction of children with CP is the delay of motor development.^[2] Children with cerebral palsy either remain wheelchair dependent or

reach a low walking level characterized by slow speed and disturbed motor control that leads to numerous disabilities.^[2]

Gait is one of the most important as it is a motor skill that requires an optimal pattern of motor coordination and involves complex control mechanisms. The gait impairment is one of the major concerns for parents and caregivers. It can be due to spasticity reduced motor control ability and impaired balance. As the child grows with no simultaneous lengthening of skeletal muscles, muscular tightness and muscle contractures, they eventually develop bony torsion which leads to decline in gait function over time.

The use of Body weight support system is a therapeutic intervention technique that provides task

specific gait training it helps in reduction of gravitational force that would further reduce the load that should be overcome by the individual by facilitating walking constraints. Body weight support system consists of a mounting frame and a harness to support a percentage of individual's weight as he/she walks.^[3] By this intervention patient's effort will be reduced to a great deal and we can promote a gait pattern which is nearly close to typical gait^[3,9]. By doing this, child will be able to perform more repetitions and establish normal and efficient movement patterns.

Ambulatory difficulty is one of the most commonly seen disabilities in children suffering from cerebral palsy. Their inability to maintain a proper trunk control causes great variations when their gait patterns are taken into consideration. Children will be treated by incorporating partial body weight support system while they are given gait training. Fear of fall is eliminated by using PBWSS so children can focus more on gait training and trunk control. On ground, children walk according to their own wish and speed whereas on a treadmill, speed parameters can be control. There are very few studies comparing the two yet no study includes children suffering from spastic

cerebral palsy. In order to bridge this gap, the researcher wants to carry out the study.

Materials and Methods

Spastic cerebral palsy children between age 5 to 8 years and with GMFCS level 2 and 3 were taken. Surgical treatment before six months, botulinumtoxins before six months and fixed contractures in lower limb were excluded. Subjects were selected based on criteria, after obtaining the written consent letter from the parents of the children with CP. The children were randomly grouped into two groups. Group A (n=15) was given conventional therapy for 45 minutes/day and gait training with PBWSS for 15 minutes/day on treadmill for 6 days in a week for 4 weeks and group B was given conventional therapy for 45 minutes/day and gait training with PBWSS for 15 minutes/day on floor for 6 days in week for 4 weeks. Cadence, stride length and GMFCS were taken as outcome measure. All the participants received following conventional therapy: stretching, weight bearing exercise, strengthening exercise, mat exercise, and balance training ^[10]



Figure 1: Gait training over treadmill through PBWSS



Figure 2: Gait training on ground through PBWSS

Findings

All the data were expressed as a mean ± standard deviation (SD). A student’s version statistical package for social science(SPSS) version 20.0 software for windows was for the statistical analysis. The level of significance was at $p < 0.05$ for all statistical tests.

Table-1: Mean and SD of outcome measures of GMFM in between the groups			
Sr.no	Outcome measures	Post test	
		Group- A	Group- B
		Mean ±SD	Mean ±SD
1	GMFM	59.83±3.54	58.69±3.94
Between group comparison Mann –Whitney U test		GMFM: U = 98.5, $p < 0.55$ (Not significant)	

In the above table the post values of GMFM are compared between the 2 groups. The mean and SD of group A was 59.83±3.54 and group B was 59.83±3.54. U value of the same is 98.5, p<0.55. This shows that there was no significant difference between the two groups.

Table-2 : Mean and SD of outcome measures of cadence and stride length in between the groups			
Sr.no	Outcome measures	Post test	
		Group- A	Group- B
		Mean ±SD	Mean ±SD
1	Cadence	23.33±2.43	26.26±2.63
2	Stride length	46.32±1.49	47.97±1.47
Between group comparison Unpaired t- test		Cadence: t =-3.16 , p<0.003 (significant) Stride length: t= -3.04, p<0.005	

In the above table the post values of cadence are compared between the 2 groups. The mean and SD of group A was 23.33±2.43 and group B was 26.26±2.63. T value of the same is -3.16, p<0.003. This shows that there was significant difference between the two groups.

The post values of stride length are compared between the 2 groups. The mean and SD of group A was 46.32±1.49 and group B was 47.97±1.47. T value of the same is -3.04, p<0.005. This shows that there was no significant difference between the two groups.

Discussion

The purpose of this study was to find out and to compare the effect of partial body weight support system on gait function (cadence and stride length) and motor function in ground setting over treadmill setting.

For group A(treadmill): After 4 weeks of therapy, cadence (p<0.05), stride length (p<0.05), GMFM (p<0.05) were statistically significant. Treadmill training has variety of benefits. First of all, treadmill can be used in confined space which proves a boon for small setups. [5] Secondly, child can repeat more number of gait cycles with complete and symmetrical steps because belt is in motion and the child has to walk as long as

the belt is moving. [5] Moreover speed of locomotion can be controlled which constantly gives us a feedback for the intensity of training. With moving belt, child will improve balance to maintain upright posture. [5, 6] There is significant correlation between balance and gait. [6] Balance improves cadence, step length and stride length. Treadmill training improves the functions other than gait like standing, rising, transfer and balance. [6]

For group B(over ground): after the 4 weeks of therapy, cadence(p<0.05), stride length (p<0.05) and GMFM(p<0.05) were found to be statistically significant. When the child is given on ground training, time period for double limb support is increasing and that of single limb support is decreasing which has a positive impact on the child’s transfer abilities and weight shifting. [7] Further more, it also improves strength of hip and knee flexor-extensor. [8] So child will be more confident to take step.

In between the group: gait training improves strength especially hip and knee flexion-extension; there is significant difference found in cadence and stride length. There is statistically more significant difference found in ground setting compared to treadmill setting. Over ground gait training showed positive impact on

stride length, cadence, decreased double limb support, increased single limb support. [7] And ground training also improves the kinematics of pelvic position, hip and knee and ankles which is required for normal gait pattern. Floor walking involves a mandatory aspect of using lower limb strength more when compared to treadmill walking where lesser effort is required to walk because the belt is moving automatically. These improvements can be explained by various theories like neuroplasticity and motor learning. [5] Treadmill belt is in continuous motion with pre determined speed, so child is just raising and keeping down the limbs on belt and there is no active muscle activation for propulsion. [5] Child moves his hips, knees and ankles with more range of motion as he has to clear the moving surface on treadmill, which is not required in normal gait pattern. One more disadvantage of using treadmill is it may limit the transfer of skill to over ground walking, since the strategies required for treadmill walking are not necessarily the same for over ground walking, which is type of surface that we normally walk.

Conclusion

This study was conducted to find out and to compare the effect of partial body weight support system on gait function (cadence and stride length) and motor function in ground setting over treadmill setting. As per the gait outcome measures (cadence and stride length) and GMFM scores, there is significant improvement found in both groups. However, there is significant difference observed (in gait parameters) on ground than treadmill and no significant difference found (GMFM) in between the groups.

Future Recommendation:

Further study can be done on backward gait training on treadmill vs over ground and with gait analyser so that other parameter of gait can be measured.

Conflicts of Interest: no conflict of interests

Ethical Clearance: Ethical clearance certificate was taken from Oxford College of Physiotherapy

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