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Effect of Backward Treadmill Training Versus Conventional Therapies to Improve Functional Mobility in Children with Spastic Diplegic Cerebral Palsy

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Abstract

Spasticity in children can occur due to some disease process that affects upper movements. Neurons within the central nervous system. Spasticity is a major challenge for rehabilitation of children with cerebral palsy. Spasticity is defined as a speed-dependent increase in resistance as passive muscle stretching or associated inappropriate involuntary muscle activity associated with upper motor neuron palsy. Spasticity can cause functional problems in daily life activity (ADL) like walking, eating, laundry, toilet and the dressing.

The aim is to find the effectiveness of backward treadmill training vs conventional therapy in balance in spastic diplegic cerebral palsy. The study design was an Experimental design with pre and posttest evaluation was done. Subjects with spastic diplegic cerebral palsy were enrolled for this study.30 children with spastic diplegic cerebral palsy who fulfill the selection criteria were selected for this study. Children were selected by using probability sampling method and they were divided into two groups by using toss method. The study was conducted at an out-patient department. The total study duration was 12 weeks. The selected spastic diplegic CP children would be divided into two equal groups: Group A – control group/ conventional therapy group. Group B - Backward body weight supported treadmill training along with conventional physiotherapy. This study proves that 12 weeks of backward walking supports body weight treadmill training program and usually exercise program Indicated statistically Significant improvement in gross motor function and functional mobility when compared to conventional therapy training program and usually exercise.

Keywords: *Spastic cerebral palsy, Body Weight Support Treadmill Training (BWSTT), Balance, Functional Mobility, Pediatric balance scale.*

Introduction

CEREBRAL palsy is described as a group of disorders of the development of movement and posture, causing activity limitation that are attributed to non-progressive disturbances that occurred in the developing fetal or infant brain. The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, cognition, communication, perception and/or behavior[1].

Children with cerebral palsy are functionally limited to varying degrees because of their decreased central control and coordination of their movements. The effects of growth predispose children with neurological impairments to the secondary problems of muscle contractures, bony deformities, and unusual gait abnormalities. Health care

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programs aim to prevent deformities and encourage the development of functional and in-dependent skills and abilities.

Patients with cerebral palsy (CP) walk with several described gait patterns. Many patients with CP walk with a knee recurvatum pattern.

Knee recurvatum during gait is described as knee hyper-extension in stance phase. Efficiency of walking and the development of independent gait are often the focus of therapeutic interventions for children with CP. Motor learning theory suggests that when encountering a new motor skill or adapting a motor skill to a specific situation, a group of interconnected neurons is selected from a primary neuronal repertoire based on prior experience of the task. Generated movement patterns and postural adjustments are then refined via afferent feedback. Therefore, it has been argued that to develop and improve a motor skill such as walking, opportunities for repetitive practice of the skill need to be offered. For this reason use of a mechanical treadmill may improve walking in children with CP[2]. Treadmill walking provides increased opportunity to repetitively train the whole gait cycle, facilitate an improved gait pattern. Improved walking has the potential to increase the mobility and positively influence the societal participation of children with CP at home, at school and in the wider community.

Need of Study

The aim is to find the effectiveness of backward treadmill training vs conventonal therapy in balance in spastic diplegic cp.

Objective

1. To evaluate the effectiveness of backward treadmill training on functional mobility in spastic diplegic CP child.
2. To evaluate the effectivness of conventional therapy on functional mobility in spastic cp child.

Hypothesis

1. **Null Hypothesis:** There would not have been any statistically significant improvement in backward tredmill training and conventional therapy on functional mobility in spastic diplegic cp child.
2. **Alternate Hypothesis:** There would have been any statistically significant improvement in backward tredmill training or conventional therapy on functional mobility in spastic diplegic cp child.

Review of Literature

Sandy A Ross, ET AL. concluded that the spastic diplegic CP who ambulates with (or) without any assistive device, strength was highly related to function and spasticity does not influence the gait speed.

Karen J Dodd, ET AL. stated that strength training can increase strength improve motor activity in people with CP without adverse effects.

Hua Fang Liao, ET AL**.**found that after the loaded sit to stand exercise children with mild spastic diplegia improved their basic motor abilities, functional muscle strength and walking efficiency.

Nicholas F Taylor, ET AL**.** concluded that progressive resistance exercise appears to be a safe and efficacious intervention for many patients with muscle force deficits contributing to their motor disability in physical therapy.

KAREN J DODD, ET AL. have reported that strength training programs can improve muscle strength in young people with spastic diplegic CP. Trends also suggest that strength training may have beneficial effects on activities in walking, running and jumping as well as stair climbing.

JoongHwi Kim and Hye Jung Seo have compared the conventional exercise to modified exercise and concluded that there was more effective for trunk hip activation improvement and anterior pelvic tilt motion decreased during standing in children with spastic diplegic CP.

Anderson, ET AL**.** reported based on their finding suggested that a 10-week of progressive strength training program improves muscle strength and walking ability without increasing spasticity.

ABDEL-AZIEM AA1, EL-BASATINY HM(2017):

Ayoub, H. (2016): Children were asked to walk backward with suspension held on the treadmill with body weight support (30% body weight release) with speed of 0.01 m/sec. and 0 degree inclination for 5 min. firstly increased gradually to reach 2m/ sec. for total time of session 15 min., totally. Partial body weight supported backward treadmill training was conducted once a day, 3 sessions a week for 3 months.

HAMADA EI SAYED ABD ALLAH AYOU B et.al., (2015): He did the study on impact of body weight supported backward treadmill training on walking speed in children with spastic diplegia. Twenty children with spastic diplegia enrolled in the study, they were classified into two groups of equal number. The control group (A) received selected physical therapy program based on the neuro developmental approach for such cases,while the study group (B) received partial body weight supported

backward treadmill training in addition to regular exercise program. Gait pattern was associated using the Biodex Gait trainer II for each group pre and post three months of the treatment program. There was statistically significant improvement in the walking speed in the study group ($p<0.05$) with significant difference when compared post treatment results between groups ($P<0.05$).

Material & Method

Subject: Number & sources-30

Study design: A controlled Experimental study.

Sample size: A total of 30 spastic diplegic CP children is to be selected on the basis of the selection criteria and allocating in two groups. The group A (experimental group)consist of 15 children and the other group B (control group)consist of 15 children.

Treatment duration: The treatment duration would be of 12 weeks.

Inclusion criteria

- Age: 4-10 years
- Both gender
- Spastic diplegic cp child
- Able to accept and follow verbal instructions
- Ability to walk independently in indoors and outdoors with (or) without mobillity aids.

Exclusion criteria

- Unstable seizures
- Any other type of cp-hemiplegic, quadriplegic
- Any surgical procedures up to 3 months prior to the study
- Botulium toxin injection up to 6 months prior to the study
- Other cardio vascular and pulmonary disease which interferes the resisted training exercise.

Method of collection of data: The selected spastic diplegic CP children would be divided into two equal groups: Group A/ experimental group/ backward tredmill training and Group B/ control group/ conventional therapy group. The parents (or) the care giver of all the participants were explained about the study.

Instumentation and Tools Used

Materials

- Exercise mat
- Swiss ball
- Weight cuff 2 kg
- Wobble board
- Stool
- Treadmill

Procedure

Design of the study

Method of collection of data: The selected spastic diplegic CP children would be divided into two equal groups: Group A/ experimental group/ backward tredmill training and Group B/ control group/ conventional therapy group. The parents (or) the care giver of all the participants were explained.

Treatment Techniques

Group A/ experimental group/ backward tredmill training: The children of this group would receive the backward tredmill training and also the conventional therapy. The backward tredmill training was aimed to improve the strength of Anti–gravity muscles- Hip extensor, Knee extensors and Ankle plantar flexors muscle groups. The children would receive training for 6 days in a week for a period of 12 weeks. Each session would last for 40-60 minutes. Including Backward tredmill training.

Group B/ control group/ conventional Group: The children in this group would receive the conventional physiotherapy regularly for a period of 12 weeks, Each session which lasts for 40-60 minutes. The training includes

1. Stretching- calf muscle
   - Hamstring
2. Swiss ball exercises
   - hamstring curl
   - Trunk control exercise
3. Weight bearing exercise
   - Positioning exercise
   - Kneeling
   - Half kneeling
   - Squatting
4. Balance training-parallel bar training
   - Single leg Balance
   - Sit to stand
   - heel raise forward
   - lateral step up
5. Gait training
   - Heel to toe walk

- Lifting your legs
- Sitting down
- Standing up
- Stepping over objects

Outcome measures: Modified TUG test: Testing would be conducted in rehabilitation set-up with the child's parent present. The test began with the subject sitting on a stable stool, which was selected according to the height of subjects. The stool is to be positioned such that it would not move when the subject moved from sitting to standing. Subject would be seated with feet flat on the floor in such a way that hip and knee remained in 90° of flexion. A marking tape would be used to stick star mark on the wall at a distance of 3 m from the chair.

The following instructions would be delivered to the subject slowly and clearly: "This test is to see how you can stand up, walk, and touch the star, then come back to sit down. The stopwatch (of cell phone) is to time you." Subjects would wear their regular footwear or orthosis, and would be allowed to use walking aid, but were not allowed to be assisted by another person during the performance of the test. There would be no time limit for the performance of the test, and they may stop and take rest (but not sit down) if they needed to do so. Instructions given would "After I say 'go,' stand up, walk up to and touch the star, and then come back and sit down. Remember to wait until I say 'go.' This is not a race; you must walk and not run, and I will time you. Don't forget to touch the star, come back and sit down." A practice trial would be given to the subject. Thereafter, the test would be conducted thrice and respective time will be recorded. The mean of three values would be documented and used for analysis. The investigator sat on a chair in clear view of the subject. Subjects would be tested in small groups. Every completed TUG test would be recored and noted. The same investigator conducted all the testing procedures for the study.

Operational Definitions

CEREBRAL PALSY: Cerebral palsy is an umbrella term covering a group of non-progressive, but often changing motor impairment syndromes which may or may not involve sensory deficits that are caused by a defect, lesion or anomaly of the developing brain.

Williams and Wilkins

Cerebral palsy is the commonly used name for a group of conditions characterized by motor dysfunction due to non-progressive brain damage early in life. There are usually associated disabilities as well as emotional, social and family difficulties.

Sophie Levitt

Modified Tug Test: Modified TUG is version of TUG test, The TUG test measure is the time taken, in seconds, by an individual to stand up from a standard arm chair, walk a distance of 3meter, turn, walk back to chair, and sit down again.

Sanjivani N. Dhote

- **Evalution Performa**
  - Name:
  - Age:
  - Date of assessment:
  - Gender:
  - Height:
  - Weight:
  - Informant:
- **Developmental history**
  - Current abilities:
  - Current disabilities:
  - Deformity/Weakness:
  - Trunk control:
  - Achieved goals up to age:
  - GMFM level:
  - GMFM score:
- **Higher mental functions:**
  - Cognitive development
  - Social adaptive:
  - Speech:
  - Vision:
  - Hearing:
- **Gait parameters:**
  - Mobility aids:
  - Splints:
  - Symmetry in walking:
  - Duration of walking with assistance:
  - Duration of walking without assistance:
  - Falling history during walking:
  - Playing activates with the peer group:
  - Running:
  - Jumping:

- Stair climbing:
- MAS :(modified Ashworth scale)

Ethicial Clearance: Taken

Conflict of Interest: Nil

Source of Funding: Self

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