



Short Report:

Effect of Modified Suit Therapy in Spastic Diplegic Cerebral Palsy - A Single Blinded Randomized Controlled Trial

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Abstract:

Background & Objective: Development of gross motor function in children with cerebral palsy has been a primary goal of physical therapists for decades. Suit therapy has been proposed as an adjunct to conventional physiotherapy to treat the impairments associated with cerebral palsy. Providing an orthosis along with the conventional therapy improves the motor performance of the child. Hence, this study aimed to determine the effect of modified suit therapy in gross motor function of spastic diplegic children. **Method:** A simple random sample of 30 spastic diplegic subjects in age group of 4-12 years fulfilling inclusion criteria from Mobility India, Bangalore was included. The outcome was evaluated using Gross Motor Function Measure-88 scale before and after the intervention. Suit therapy along with the conventional therapy is given for 2hrs daily for duration of 3 weeks. **Results & Conclusion:** Wilcoxon signed rank test and Mann-Whitney U test were used to find the significance of improvement before and after the intervention. There was statistically significant difference between the experimental and control groups ($P=0.030$). It is concluded that modified suit therapy along with conventional physiotherapy is effective in improving the gross motor function of children with spastic diplegic cerebral palsy.

Key Words: Cerebral palsy; Spastic diplegia; Modified Suit therapy

Introduction:

Cerebral palsy describes a group of disorders of the development of movement and posture, causing activity limitation that is attributed to non-progressive disturbances that occurred in the developing brain. The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, cognition, communication, perception and behaviour and by seizure disorder.(1) Around 8000-10000 babies and infants are diagnosed annually with cerebral palsy. Cerebral palsy is the second most common neurological impairment in childhood. The incidence of cerebral palsy is 2-2.5 per 1000 live births. The incidence of spastic cerebral palsy is more common than the other types of cerebral palsy which accounts 50% of identified cases.(2)

Treatment program is use of specific sets of exercise to work towards 3 important goals, preventing the weakening or deterioration of muscles that can follow disuse, avoiding contractures and to improve the child's motor development. It also includes activities and education to improve flexibility, strength, mobility and function.(3)

A variety of functional aids are available for therapy programs for cerebral palsy children like the prone or supine board, corner chair, feeding chair, other adaptive seating arrangements, sensory and motor stimulating toys, standing tables, etc. Use of brace together with a therapy program has both components and detractors. Therapy and bracing may be mutually supplemental in helping to achieve functional development. Use of braces should be task oriented like, in standing or weight bearing. As the child develops toward weight bearing and ambulation, appropriate use and progression to walker, crutches and canes must be considered.(4-6)

Suit therapy has been proposed as an alternative to conventional therapy to treat the impairments associated with cerebral palsy. Suit therapy also known as the Adeli suit, polish suit, therapy suit and penguin suit. It is a modification of a space suit. This therapy is based on a suit originally designed by the Russians for use by cosmonauts in space to minimize the effect of weightlessness. Although the cause of motor dysfunction between cerebral palsy patients and astronauts are different, results of a treatment trial with the Penguin suit to rehabilitate children with cerebral palsy appeared promising.(7)

Therasuit is a soft dynamic proprioceptive orthotic device, which is classified as class I Limb Orthosis by the U.S. Food and Drug Administration. (8) It consists of a vest, shorts, head-piece and knee piece, and shoes with hooks. Suit therapy has been proposed as an alternative to conventional physiotherapy to treat the impairments associated with cerebral palsy.(7) Providing an orthosis along with the conventional therapy improves the motor performance of the child. Hence, the purpose of this study is to determine the effect of modified suit therapy in spastic diplegic children aimed at making the child more independent.

The objective of the study was to determine the effect of Modified Suit Therapy in gross motor function of children with spastic diplegic cerebral palsy.

Methodology:

Source of data: Children with spastic diplegic cerebral palsy, between 4 and 12 years of age from Mobility India, Bangalore were selected for the study. Both sexes were included for the study. Subjects with subluxation or dislocation of hip, fracture of spine or limbs, severe scoliosis, seizures, mental retardation, severe spasticity with contractures and any other congenital deformity were excluded from the study.

Sampling technique: 30 children fulfilling inclusion criteria were selected with informed consent from their parents and assigned randomly into two groups with 15 in each by lottery method. Group-A, Experimental group receiving Modified Suit therapy along with conventional therapy and Group-B, Control group receiving only conventional therapy.

Study design: Single Blinded Randomized Controlled Trial.

Ethical Clearance: The study was approved by Institutional Ethical Committee.

Intervention: Control group received conventional therapy, which includes available active movements of the limbs, strengthening of the muscles, stretching, weight bearing on both the feet first supported and later unsupported standing,(4) weight bearing facilitation with proper rotation of trunk and pelvis.(3) It also included weight shifts, correction of abnormal postures and deformities, technique to improve the stability, balance training technique to train standing and counterpoising using the facilitation of arm.(4) Facilitation of walking using techniques of balance and posture control, Gait training and stair climbing.(3)

Experimental group received conventional therapy while wearing Modified Suit consisting of a vest, shorts, knee pad and shoe attachments.(9,10) Both groups were treated for 2 hours daily with short breaks of around 20 minutes for duration of 3 weeks.(10)

Outcome measure: Gross Motor Function Measure-88 scale was used to evaluate all subjects before and after the intervention.

Tester: The data were collected by a blinded tester working as Associate Professor in Physiotherapy for a teaching institute in Bangalore.

Data Analysis and Results:

The data were put for analysis using SPSS 11.5 software, to compare the pre and post therapy test scores and to find out the significance of the data by using Wilcoxon signed rank test and Mann Whitney U-test.

Age (yrs)	Experimental Group			Control Group		
	Male	Female	Total	Male	Female	Total
4-6	1	1	2	5	2	7
7-9	6	3	9	3	2	5
10-12	2	2	4	3	0	3
Total	9	6	15	11	4	15

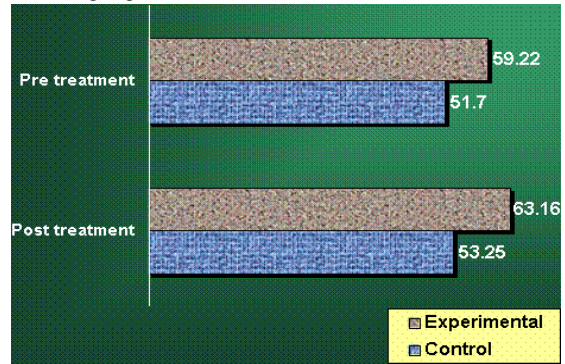
It is observed in the study that, of the 15 subjects from experimental group there were 2 (13.3%) belong to 4-6 years of age, 9 (60.0%) were from 7-9 years of age and 4(26.7%) had belonged to 10-12 years of age. In the control group, of the 15 subjects, 7 (46.7%) were from 4-6 years of age, 5 (33.3%) from 7-9 years of age and only 3 (20.0%) had belonged to 10-12 years of age.

Study group	Pre treatment	Post treatment	z-value	p-value
	Mean ± SD	Mean ± SD		
Experimental	59.22 ± 9.41	63.16 ± 10.25	5.525	<0.001
Control	51.7 ± 12.97	53.25 ± 13.25	4.298	<0.001

Comparison within group was done by using Wilcoxon signed rank test and it is observed that in the experimental group the mean ± SD of pre-treatment is 59.22 ± 9.41 and in post-treatment is 63.16 ± 10.25. The difference in the mean from the pre-test to post-test is statistically significant with z=5.525 and p<0.001. In the control group, the mean ± SD of pre-treatment is 51.7 ± 12.97 where as in post-treatment it is 53.25 ± 13.25. The improvement is statistically significant with z=4.298 and p<0.001. Both groups displayed statistically significant improvement with p value less than 0.001.

Treatment	Experimental group	Control group	z-value	p-value
	Mean ± SD	Mean ± SD		
Pre	59.22 ± 9.41	51.70 ± 12.97	1.818	0.080
Post	63.16 ± 10.25	53.24 ± 13.25	2.293	0.030

The comparison between the experimental and control group was done by using Mann Whitney U-test. The pre-test scores of both groups displayed no statistically significant difference with z=1.818 and p=0.080 which proves the experimental and control groups were homogenous before treatment. In the post-treatment, the mean ± SD for experimental group is 63.16 ± 10.25 and for control group is 53.24 ± 13.25 with z=2.293 and p value being 0.030 showing statistically significant difference between groups.



Graph 1: Graphical representation of Pre and Post treatment mean values of the experimental and control groups.

Discussion:

A spastic diplegic child usually stands on the toes, Standing on the toes does not allow for proper weight bearing on the heels. In addition, it will increase the muscle tone in the calf muscles. Also, when standing on the toes with the upper extremities abducted, and flexed, the entire body tilts forward displacing the center of gravity forward. Hence it would be difficult to maintain adequate balance and weight shifting.(9,11) Studies show that a CP person would use 3 times more energy performing the same activity as a non-affected peer. Therefore fatigue and lack of endurance is very common.(12)

The therasuit 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. Patients with ataxia and athetosis benefit from the use of the therasuit through stabilization effect to the trunk.(9) 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. When modified suit is applied, very specific and precise placement of the elastic bands moves the entire body back on the heels and into, a more vertical position. Center of gravity moves back in between the feet. Very noticeable changes in muscle tone take place. A more relaxed and upright posture with corrected alignment of lower and upper extremities is noted immediately. This is how the orthosis normalizes muscle tone through the postural changes. This restoration of posture and proper function of postural muscles allows the child to learn (or relearn) proper patterns of movement.(9)

Bar-Harim et al on Comparison of efficacy of Adeli suit and neurodevelopmental treatments in children with cerebral palsy stated that improvements in motor skills and their retention 9 months after treatment were not significantly different between the two treatment modes.(10)

A study by Elizabeth Datorre on intensive therapy combined with strengthening exercises using the Therasuit in a child with cerebral palsy concluded that the thesuit with intensive program including aquatherapy, hippotherapy helps to improve patient's functional abilities.(13)

Raouf Seifeldin et al in a pilot study on the use of Suit Therapy in childhood cerebral palsy suggested that the combination of suit therapy with a short course of intensive physiotherapy may sufficiently reduce the functional limitation of children with cerebral palsy.(14)

Koscielny and Koscielny in a study on the effectiveness of thesuit method confirmed that there is high level of effectiveness of the intensive exercise method in conjunction with the soft dynamic proprioceptive orthosis.(15)

Semenova, claims positive clinical effects of dynamic proprioceptive correction with orthosis in 70% of patients with residual-stage infantile CP, including improvements in walking and self-care. These effects were demonstrated by EEG, EMG, studies of somatosensory evoked potentials, and studies of the vestibular system.(16) The result of this is matching with the present study, but in this study the effects were demonstrated using the GMFM-88 scale.

Alexander Frank et al reported a marginal improvement in control group and suit therapy group without any statistical difference in results between the groups.(17)

Limitations of the Study

- Treatment was given for a short duration (3 weeks) and long term effects were not intended.
- The study was conducted on a small population.

Conclusion:

This study concludes that modified suit therapy along with conventional physiotherapy is effective in improving the gross motor function in children with spastic diplegic cerebral palsy.

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