Research article

Efficacy of task-oriented training vs proprioceptive neuromuscular facilitation on mobility and balance in spastic cerebral palsy

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(Received: August 2020 Revised: May 2021 Accepted: June 2021)

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ABSTRACT

Introduction and Aim: One of the most significant and common clinical finding in a majority of children with (CP) is difficulty in walking and exhibiting poor balance control which results in poor gait and reaching movements as maintenance of stability is critical. There are numerous approaches, protocols and treatment strategies to improve balance and gait control. The aim of this study was to compare the effects of task- oriented training and proprioceptive neuromuscular facilitation exercises (PNF)on mobility and balance in spastic cerebral palsy.

Methodology: This was a comparative study design with pre-post type 20 samples were selected based on the inclusion criteria and were divided into two groups. Group A received task-oriented training and group B proprioceptive neuromuscular facilitation and Pre & post measurements were done using paediatric balance scale and timed up and go test.

Results: On comparing the post-test values of group A and group B both the group showed significant difference with the pre-test, on comparing the post-test values of group A and group B, group A showed better significance than group B.

Conclusion: The present study concluded that there seems to be evidence that task-oriented training is more beneficial in training program for increasing the mobility and balance in spastic cerebral palsy comparing to proprioceptive neuromuscular facilitation.

Keywords: Spastic cerebral palsy; proprioceptive neuromuscular facilitation; task-oriented exercise; paediatric balance scale.

INTRODUCTION

Cerebral palsy refers to a wide variety of non-progressive brain disorders resulting from injury to central nervous system during prenatal, natal, postnatal period. Infants born prematurely or full-term with low birth weight have the highest risk of developing cerebral palsy. This being the 2nd common neurological impairment in the childhood after mental retardation, which is the first. The cause of this has been changing overtime, although the overall incidence remains same (1).

It is also called **'**Little Disease' after the name of an orthopaedic surgeon 'Little Club' who first established relationship between neonatal anoxia with cerebral palsy (2). Cerebral palsy is defined as a static "non-progressive" encephalopathy, neuro-motor disorder affecting posture and movement. Features like epilepsy, impaired speech, vision and intellect due to defect or lesion in developing brain are often associated with cerebral palsy. The hallmark of cerebral palsy is impaired posture and movement, often complicated by mental retardation or learning disabilities (50-75%) speech language disorders (65%) auditory impairments (25%) seizure disorders (25-30%) and visual disorders (25%).

Infants born prematurely and full-term infants with low birth weight have the highest risk of developing cerebral palsy. Moreover, the rate of cerebral palsy is about 30 times higher in babies who weigh less than 1,500g at birth than in full-term babies with normal weight (3).

In a population-based study cerebral palsy [cp] was diagnosed in 110 cases (2.4 per 1000) among live born children with birth weight > or = 500 g (n= 45,976) during 1970-89, 20year period [cp cases with a post neonatal aetiology excluded]. The incidence of birth weight specific CP declined in very low birth weight infants (500-1499g) and infants > or = 2500g from the first 10 year – cohort born (1970-1979 to the second born 1980-1989). The incidence of CP was 36.7 and 11.3 times higher among them infants with birth weight 500-1,499g and 1,500-2,499 with respectively compared to infants >or =2,500 g ($p< 0.01$). The origin of Cp was considered prenatal in 22 (20%) per natal in 47 (42.7%) and undifferentiated in (37.3%) of the cases. The results showed an

increased cp-incidence follow improved survival rates in low-birthweight infants (4).

Classification of cerebral palsy by clinical types and the topographic distribution of the most impairment adopted by the American academy of cerebral palsy remains the most widely used descriptive system of classification. Such as simple inheritance, prenatal syndromes, unequivocal prenatal infections, cerebral malformations, presence of one or more risk factors (5), such as spastic- diplegic, quadriplegia, hemiplegic, double hemiplegia, dyskinetic, hyperkinetic or choreoathetoid, dystonic, ataxic and mixed.

Spasticity is a motor disorder associated with upper motor neuron lesion. It is not a single component but as many like hyper reflexion, rigidity, resistance to passive movement. So, basically the general phase 'spasticity' may involve neutral and non-neutral components (6).

Shumway-Cook and Wollacott defines that**,** "Spasticity is a motor disorder characterized by velocity-dependent increase in tonic stretch reflex (muscle tone) with exaggerated tendon jerks, resulting from hyper-excitability of the stretch reflex as one components of upper motor neuro lesion". Increased motor neuron excitability and enhance stretch-evoked synaptic excitation of motor neurons are potential. The relative contribution of the distinct mechanisms likely to vary depending on the location of the lesion in the nervous system. Among the types various types of CP, spastic CP is the most common type of CP which results from damage or impairment to the motor cortex or white matter projection to cortical sensory motor areas of the brain.

The Ashworth scale is an 'ordinal 'scale of tone intensity 0 to 4: it's reciprocal and proven reliable. The Modified Ashworth Scale described by Bohannon and Smith was developed further define the lower end of the scale, making it more discrete by adding to 1+ (7). Task-oriented training is defined as acquiring a well organised and effective motor skills by providing repetitive training of significant functional activities or elements of such activities. Models of motor control and contemporary motor learning theories forms the basis of task-oriented training approach. The interactions between the sensory motor system components of strength, endurance, range of motion, coordination, sensory awareness, postural control, and perceptual skills are mainly focused and trained in task-oriented training approach (8).

Proprioceptive neuromuscular facilitation (PNF) is defined as a specific soft tissue mobilization involves specific, graded, and progressive application of force using physiological, accessory, or combined techniques either to promote collagen synthesis, orientation, and bonding in early stages of the healing process to promote changes in the viscoelastic response of the tissue in the later stages in healing. The performance, flexibility and balance are enhanced by stimulation of PNF integration pattern. It increases the coordination which reacts to the stimulations in muscle strength and flexibility thereby, maximizing the effectiveness of PNF (9). By guiding a specific movement pattern (diagonal or spiral direction) for concomitant muscle contractions with reversal, stabilization, repetition or combination techniques the therapists bring back the movement and function of the paretic limbs. Motor control techniques such as joint approximation, traction, irradiation or overflow are usually accompanied with PNF techniques to obtain maximum response from the patients (10).

Berg Balance Scale (BBS) is adapted and modified to make Paediatric Balance Scale (PBS) and the process is previously reported. The PBS examines functional balance in the context of day today tasks or activities by using a 14-item criterion. PBS is measured at schools and clinics within 20 mins. The PBS also has excellent test-retest (interclass correlation coefficient, ICC [2,1] = 0.923), Interrater reliability (ICC [2,1] = 0.972, Interrater reliability ICC [2,1] = 0.895-0.998) (11). The children with mild and moderate impairments, children who develops typically can also be differentiated by using PBS scale (12)**.**

The correlation coefficient between the Berg Balance scale and PBS scores was 0.797. The items in PBS AND BBS are significantly co related , (most items $p<0.01$; $p<0.05$).There are many previous reports showing that PBS assessment for children with cp was capable of predicting the correlations between the total paediatric balance score (13).

The time taken for the subject to stand from an armchair, walk a distance of 3m, turn walk back to the chair and sit down is measured by using Timed Up and Go Test (TUG). It was developed originally as a clinical measure of balance in children was scored on ordinal scale of 1 to 5 based on observer's perception of the children during the test. Podsiadlo and Richardson modified the purpose of original test and is used as a basic mobility skill test for children by measuring the time taken for the completion of the task (rather than scoring qualitatively) (14).

METHODOLOGY

This was a comparative study design with pre-post type and conducted in the special schools and took nearly 3 months to complete the study. Once the study gets approved from Institutional Review Board, 20 samples from the 30 volunteers were selected based on the inclusion and exclusion criteria, then they were divided into two groups by random sampling method where even numbers will be categorized in group A and odd numbers in group B. Initially demographic details like age, gender, height

and weight were collected assuring confidentiality of the same. Pre and post-test taken as a baseline value and at the end of 3 months, by using Paediatric balance scale questionnaire, timed up and go test. Group A received task-oriented training (15, 16) and group B proprioceptive neuromuscular facilitation (17) its pattern of facilitation (18) and parameters (19). Both the groups received exercise for 45 minutes / session per day for 6 days a week for 12 weeks. The data were compared and analysed within and between groups.

Data analysis

The collected data were tabulated and analysed using both descriptive and inferential statistics. All the parameters were assessed using statistical package for social science (SPSS) version 24. Paired t-test was adopted to find the statistical difference within the groups and independent t-test (Student's't' test) was adopted to find statistical difference between the groups.

Table 1: Comparison of Paediatric balance scale (PBS) between group A and group B in pre-test and post-test

#PBS	#Group - A		#Group – B		t Test	Df	Significance
	Mean	S.D.	Mean	S.D.			
Pre-test	33	2.36	32.86	1.28	0.445	18	0.6609
Post-test	41.6	4.22	36.8	4.21	2.413	18	0.0268**

(***- $P \leq 0.001$)

Table 2: Comparison of Timed up and go test (TUGT) between group A and group B in pre-test and post-test

#TUGT	#Group A		#Group B		T test	Df	Significance
	Mean	S.D.	Mean	S.D.			
Pre-test	12.8	1.16	12.8	1.4	0.01	18	1.0000
Post-test	8.9	0.830	10.3	1.67	2.24	18	0.0375**

(***- $P \leq 0.001$)

RESULTS

On comparing the post-test mean values with the pre-test of group A and group B on Paediatric Balance Scale (PBS) questionnaire, both the groups showed improvement with the post-test mean value of group A showing 41.6 group B showing 36.8 at $P \leq 0.001$. On comparing group, A and group B with post-test values group A shows more significant difference than group B. Hence null hypotheses are rejected.

On comparing the post-test mean values with the pre-test of group A and group B on Timed Up and Go Test (TUGT), both the groups showed improvement with the post-test mean value with group A showing 8.9 group B showing 10.3 at $P \leq 0.001$.On comparing group A and group B with post-test values group A shows more significant difference between the Group B. Hence null hypothesis is rejected, and alternate hypotheses are accepted.

DISCUSSION

The aim of present study was to compare the effect of Task-oriented training and proprioceptive neuromuscular facilitation exercises for improving the mobility and balance in spastic cerebral palsy.

Task oriented training is now being used as a method of motor learning program (rather than neuromuscular facilitation technique) in rehabilitating the patients with disease of central nervous system. It is effective for improvement of the performance of a cerebral palsy (20). Task-oriented exercises have efficiency to improve mobility and balance in spastic cerebral palsy finding of this study is also matched with study done. The increased excitability of the muscle stretch reflex which occurs in upper motor lesion results in spasticity and velocity dependant increase in muscle tone. Spasticity is an abnormal state of a muscle where in there occurs increase resistance offered by muscles to passive stretch and is often associated with phenomenon like clasp-knife phenomenon, increased tendon reflexes, clonus, and flexor and extensor spasms. Loss of inhibitory supraspinal control disturbs the innervations of intra and extrafusal fibers of muscle spindle which results in spasticity. spasticity along with delayed onset after lesion and frequent reduction in reflex excitability over time suggests plastic changes in the central nervous system (3).

This result is supported by Kumar *et al.,* who concluded that both task- oriented training is improving mobility and balance in spastic cerebral palsy than the proprioceptive neuromuscular facilitation exercises (21). Blundell *et al.,* studied functional strength training in cerebral palsy determining task specific training and functional performance in children by practising functionality-based exercises. They concluded that task-oriented exercises for children with cerebral palsy, has improved mobility and balance (22). The study of Shaju aims at exploring the effectiveness of task-oriented training on mobility and balance among spastic cerebral palsy. on comparing both groups, task-oriented training group showed significant improvement in mobility and balance control among children with spastic type of CP than the PNF group (23).

This study suggests that task-oriented circuit training is more effective as compared to the PNF for the mobility and balance in spastic cerebral palsy. The improvement in balance can also be supported by the study of Kim *et al.,* the effect of task-oriented training program for mobility and balance. This study demonstrated that task-oriented training can improve the mobility and balance, which be effective in spastic cerebral palsy (24).

Goal directed practise and repetition in task oriented training programs makes it more efficient in improving the performance of tasks in children with spastic cp. The study concluded that neuromuscular electrical stimulation when given to the antagonistic muscle significantly reduces spasticity by reciprocal inhibition, it also increases active range of motion, passive range of motion, and gait parameters such as cadence when compared with cryotherapy (25).

CONCLUSION

The present study demonstrates that there is positive significant relation between task -oriented training and proprioceptive neuromuscular facilitation in spastic cerebral palsy. As mobility and balance is an important determinant factor in spastic cerebral palsy, it is concluded that there seems to be evidence that task-oriented training is more beneficial in training program in increasing the mobility and balance in spastic cerebral palsy comparing to proprioceptive neuromuscular facilitation.

CONFLICT OF INTEREST

Authors declare no conflicts of interest.

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