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Effect Of Proprioceptive Training On Children With Spastic Diplegia

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Abstract:

Introduction: *Spastic diplegia is considered as one of the most common geographical classifications of cerebral palsy, with bilateral involvement of the lower extremities and fine motor and/or sensory abnormalities in the upper extremities due to affected interaction between sensory inputs, correct active muscle contraction and the central nervous system which will result in a balance problem and reduced functional mobility. Proprioception training has shown to be effective in improving balance and functional mobility in different population but not in pediatric conditions. Study* ***objective*** *was to measure the balance and functional mobility before and after 4weeks of active progressive proprioceptive training program in children with spastic diplegia cerebral palsy.* ***Methodology:*** *This study uses a single group experimental study. There were 20 children with spastic diplegia cerebral palsy selected according to history, Tardieu scale, Gross motor function classification system scale, pediatrics mini mental scale, Pediatrics Balance Scale (PBS) and Modified Timed Up and Go (MTUG) scale. There were 8 children completed the duration of the study. Duration of intervention was 4 weeks; and children were re-assessed post intervention.* ***Results:*** *The finding of this study is that there is a statistically significant (p<0.000) increase in post means of balance with large effect size 0.576, while There is no statistically significant (P =0.734) increase in means of functional mobility with small effect size 0.08. The power of the study shows weak 0.24 (24%).* ***Conclusion:*** *Four weeks of active progressive proprioceptive training program has a significant effect on balance while it has no significant effect on functional mobility in children with spastic diplegia cerebral palsy.*

Keywords: *Cerebral Palsy, Diplegia, Balance, Proprioception, Functional mobility, modified timed up and go scale.*

1. INTRODUCTION:

Cerebral palsy is defined as a non-progressive disorder of the motor control centers of the developing brain, accompanied by disturbances in many motor and sensory aspects[1]. It may occur during pregnancy, during delivery or even after birth until age of 3 years old[2]. It is one of the most important causes of disability affecting children[3]with a prevalence is of an approximately 2 per 1000 live birth[4]. The presentation of children with CP is highly variable[2] ranging from spasticity, hypotonia, dyskinesia to ataxia, while in some cases the child may show a mixed presentation. Diplegia is the most common type of CP with about 35% of children with CP are having spastic diplegia. Generally, children with cerebral palsy have an affected interaction between sensory input, musculoskeletal (correct active muscle contraction) and central nervous system[5]. They are known to have a reduced functional mobility[7] and balance problem due to many factors including abnormal muscle tone, weakness and lack of fitness, limited variety of muscle synergies, contractures and altered biomechanics[6]. They are also well documented to have proprioceptive deficits in all limbs and they tend to rely on visual input to maintain posture and limb position during gait which indicates proprioception deficits[7]. Balance is defined as the ability of positioning the body that affects all activities of daily living, being maintained through organs of proprioceptive sense, vision and vestibular sense that produce stability through coordination among muscular contraction in lower limbs. Proprioception is defined as a sense[1] that provides sensory feedback from the body to the central nervous system[8]. This sensory feedback is defined as sensory or perceptual information that can be either extrinsic which means it is received from outside (the environment) or intrinsic which means it is received from within the body[9].proprioception feedback is important because it helps us to detect errors in movement, provide us with an understanding of self-control and awareness, improve body stability and reduce falling incidents[10]. When proprioception sense is declined, balance ability will be declined affecting postural control, protective reflex and joints [9] as well as functional mobility[11]. Functional mobility is defined as the physiological ability of people to move independently and safely in a variety of environments in order to accomplish functional activities or tasks at home, work and community[12]. It is considered as one of the building blocks of activities of daily living (ADL) together with standing, bending, climbing, and many other activities. Therefore, an impaired functional mobility is associated with a greater risk of falls and loss of independence[13,14,15].

2. METHODOLOGY:

Single group experimental design used in this study. Convenient sampling used and there were 20 children with spastic diplopia selected and 8 children completed the duration of the study. Children were between 5 and 12 years old. Pre and post intervention evaluation were applied. Ethical clearance was obtained from Ethical committee of Goutham College of Physiotherapy, Bangalore, India and a written informed consent was obtained from the parents prior to participation. The intervention were for 4 weeks. Its includes Level of spasticity using Tardieu scale, Level of function using Gross Motor Function Classification System, Cognitive ability using pediatrics mini-mental scale, Balance ability using Pediatrics Balance Scale (PBS), Functional mobility using Modified timed Up and Go (MTUG). Intervention applied as follows:

Week 1:

No.	Intervention	Type of intervention	time
1	Standing on a stable surface (the floor) with eyes open	Static stability	10 sec/ 5 times
2	Standing on a stable surface (the floor) with eyes closed	Static stability	10 sec/ 5 times
3	Single leg stance with opposite knee raised from the floor (flexed) with eyes open	Single leg stance stability	10 sec/ 5 times
4	Single leg stance with opposite knee raised from the floor (flexed) with eyes closed	Single leg stance stability	10 sec/ 5 times
5	Standing on the floor keeping feet together, eyes open	Double leg stance stability	10 sec/ 5 times
6	Standing on the floor keeping feet together, eyes closed	Double leg stance stability	10 sec/ 5 times
7	Walking over exercise matt. or carpet	Walking on different surfaces, dynamic stability	6 minutes

Week 2:

No.	Intervention	Type of intervention	time
1	Stand on sand bag or folded piece of cloth with eyes open	Static stability on different surface	10 sec/ 5 times
2	Stand on sand bag or folded piece of cloth with eyes closed	Static stability on different surface	10 sec/ 5 times

3	Alternate feet marching on pillows or sand bag or folded piece of cloth with eyes open	Weight shifting, short single leg stance	30 sec/ 5 times
4	Alternate feet marching on pillows or sand bag or folded piece of cloth with eyes closed	Weight shifting, short single leg stance	30 sec/ 5 times
5	Reaching objects from different directions while keeping feet together	Double stance stability	10 times/ 5 sets
6	Forward one step by turn	Dynamic stability	10 sec/ 5 times
7	Walking over pillows	Walking on different surface, dynamic stability	6 minutes

Week 3:

No.	Intervention	Type of intervention	time
1	Stand on sand bag or folded piece of cloth with eyes open	Static stability on different surface	10 sec/ 5 times
2	Stand on sand bag or folded piece of cloth with eyes closed	Static stability on different surface	10 sec/ 5 times
3	Place alternate foot on pillow in front	Single leg stance stability	30 sec
4	Jumping on exercise matt.	Dynamic stability on different surface	10 repetitions
5	Kicking the ball "pass the ball to a friend"	Single leg stance stability	10 repetitions
6	Sit to stand while feet on sand bag or folded piece of cloth or pillows, putting weight on legs	Weight shifting, double leg stance	30 sec
7	Making one step forward, backward, to the right, to the center then to the left	Dynamic stability	10 sec/ 5 times

Week 4:

No.	Intervention	Type of intervention	time
1	Standing on an inclined surface (ex: ramp) with eyes open	Static stability	10 sec/ 5 times
2	Standing on an inclined surface (ex: ramp) with eyes closed	Static stability	10 sec/ 5 times
3	Pass objects while standing on an inclining surface	Static stability	10 sec/ 5 times
4	Walk over an inclining surface forward and backward	Walking on different surface, dynamic stability	6 minutes
5	Clean the floor with feet dragging pieces of tissues on the floor	Single leg stance stability	10 repetitions/ 3 sets
6	Therapist draw circle on the floor and the child walks around and stands inside the circle then move to the next circle (the size of the circle decreases with time)	Dynamic stability. Walking	6 minutes
7	Jumping inside the circle	Dynamic stability	10 repetitions

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Sit to stand while feet are on pillow, putting weight on legs

Standing on different surfaces: stable surface "the floor" and unstable surface "the exercise mattress"

Reaching while standing on different surfaces: easy surface "the floor" and difficult surface "an inclined ramp"

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Single leg standing balance exercises

Targeted walking

3. RESULTS AND DISCUSSION:

The mean age of eight children studied was 11.13 years and there were 4 males and 4 female children included in the study.

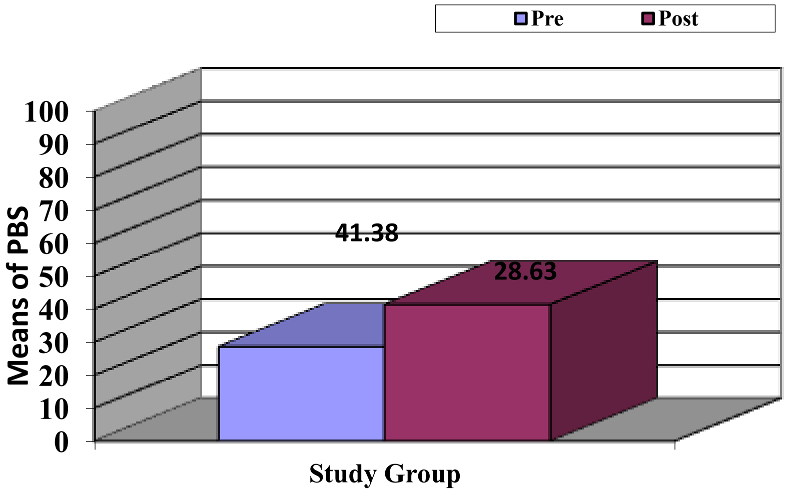
Table 3.1: Pre to post test analysis of measurements:

	Pre Mean±SD (min-max)	**Post Mean±SD (min-max)**	**Percentage of Difference**	**t value [a] (Parametric)**	**a.Parametric Significance (2-tailed) P value**	**95% Confidence Interval of the Difference**		**Effect Size (r)**	**Observed Power**
						Upper	Lower		
PBS	28.63± 10.08 (10- 42)	41.38±7.87 (26-48)	44.51%	-8.656	P <0.000**	-16.233	-9.267	0.576 (Large)	0.447 (Moderate)
MTUG	22.07±15.19 (1.26-45.53)	24.68±15.89 (2.52-54.61)	11.82%	-0.353	P =0.734 (NS)	-20.12503	14.89503	0.08 (Small)	0.378 (Weak)

**** Statistically Significant difference p<0.05; NS- Not significant; a. Pared t test. Power of the study PBS*MTUG: 0.240**

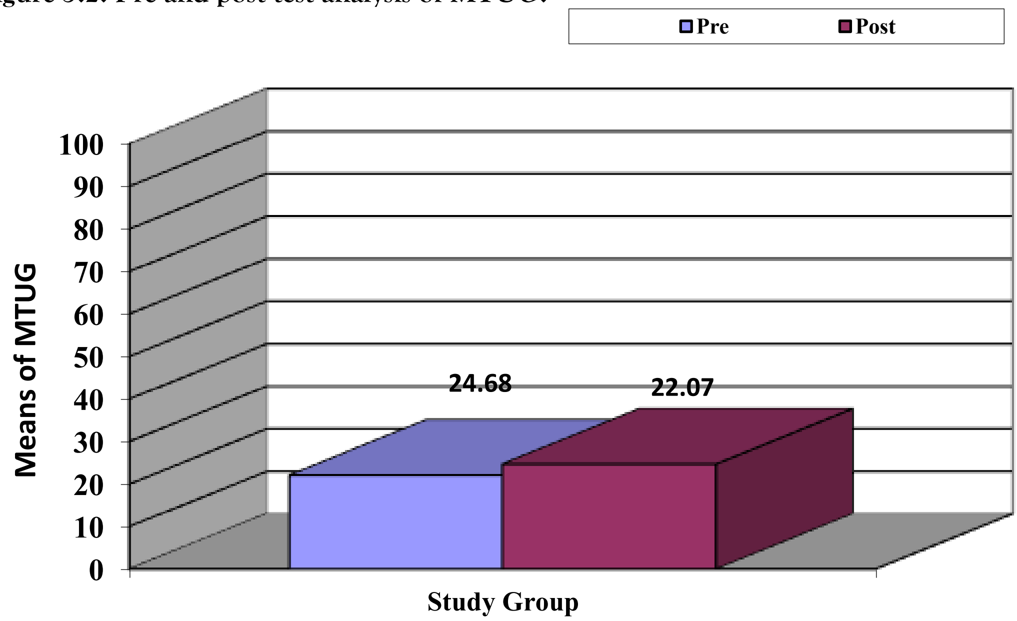
The above table 3.1. Shows that analysis within study group there is a statistically significant (p<0.000) increase in post means of Pediatric Balance Scale for Balance with large effect size 0.576. There is no statistically significant (P =0.734) increase in means of MTUG with small effect size 0.08. The power of the study shows weak 0.24 (24%) due to small sample size.

Figure 3.1: Pre and post test analysis of PBS:



The above figure 3.1. Shows that analysis within study group there is a statistically significant (p<0.000) change in means of PBS for Balance with large effect size 0.576.

Figure 3.2: Pre and post test analysis of MTUG:



The above figure 3.2. Shows that analysis within study group there is no statistically significant (P =0.734) change in means of MTUG with small effect size 0.08. The power of the study shows weak 0.24 (24%) due to small sample size.

4. CONCLUSION:

This study concludes that, four weeks of active progressive proprioceptive training program has a significant effect on balance while it has no significant effect on functional mobility in children with spastic diplegia cerebral palsy. These study findings were based on small sample size. Therefore, it is recommended that the active progressive proprioceptive training program to be considered in the rehabilitation program of children with spastic diplegia cerebral palsy that may improves balance ability.

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