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EFFECTS OF PNF TECHNIQUE ON TRUNK CONTROL, BALANCE AND MOBILITY FUNCTION IN CEREBRAL PALSY CHILDREN WITH SPASTIC HEMIPLEGIA

[1]*Logeshwari Selvaraj, MPT (Neuro) and [2]P. Ranjitha

[1]Assistant Professor, School of Physiotherapy, Vistas, Chennai.

[2]B.P.T Intern, School of Physiotherapy, Vistas, Chennai.

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***Corresponding Author**
Dr. Logeshwari Selvaraj
Assistant Professor, School of Physiotherapy, Vistas, Chennai.

ABSTRACT

Background: The center key point of the body is trunk which plays a major role, proximal trunk control, balance improves functional activities. Trunk control is the ability of the trunk muscles to allow the body to remain upright, adjust weight shift, and perform selective movements of the trunk so as to maintain the center of mass within the base of support during static and dynamic postural adjustment. This study examines the effect of PNF technique on trunk control, balance, and mobility function in children with spastic hemiplegia cerebral palsy. **Method:** A quasi experimental study was done using convenient sampling technique at NIEPMD for 30 spastic hemiplegic cerebral palsy children age group 10 – 14 yrs were selected on basis of inclusion and exclusion criteria were assigned to two groups Group A: (n=15) Trunk exercise and trunk stabilization exercises GROUP B: (n=15) Trunk exercise and PNF techniques were taught and follow up was obtained after 3 months. Pre and Post values of TRUNK IMPAIRMENT SCALE and POMA was taken. **Result:** The mean value of Trunk impairment scale:10.15±0.185, Tinetti performance oriented mobility assessment: 21.80±0.537 of Group A and mean value of Trunk impairment scale: 14.00±0.505, Tinetti performance oriented mobility assessment: 24.15±0.509 of Group B. **Conclusion:** PNF technique exercises improved significantly in Group B than Group A (trunk exercise) in Trunk Impairment Scale and Tinetti Performance Oriented Mobility Assessment were able to gain confidence and had better performance in their activities of daily living.

KEYWORDS: Cerebral Palsy, Postural Control, Trunk Impairment Scale, POMA.

INTRODUCTION

Cerebral palsy is a non-progressive lesion which occurs during the brain development process in the fetal period or infancy, as a result of continuous limitation in activities of daily living it commonly reflects the mobility development disability. Cerebral palsy is the most common cause of physical disability in children, with an estimated incidence of 2.11 per 1000 live birth. Cerebral palsy incidence rate keeps rising, partly due to greater numbers of premature infants who are surviving and longer overall survival.[1]

Muscular imbalance is one of common cause in Cerebral palsy subjects which further leads to insufficient head control and trunk stability, decreasing their mobility and decreased functional activity although the mobility depends upon the properties of different type of cerebral palsy and ability of individual child. Children with cerebral palsy shows hypotonic symptoms, weakness of the trunk muscles, decrease muscle tone in upper and lower limbs, absence or diminished postural reflex, and absence of ability to move their upper and lower limbs, which leads to the loss of trunk stability.

Cerebral palsy describes a group of permanent disorders of the development of movements and posture, causing limitation in their functional activity. It is the most common cause of physical disability during childhood that affects the child on several health dimensions including neuromuscular deficits, such as spasticity, muscle weakness and decreased selective motor control and secondary musculoskeletal problems.

Children with cerebral palsy have improper sitting and standing balance in both static and dynamic balance, abnormality of muscle tone and lack of postural control. Children spend 60% time in sitting posture in school, play indoor and outdoor games thereby trunk control is a very important element that causes difficulties not only for maintain upright position, most of the activities in day to day life need trunk balance for better performance with minimal energy expenditure.

The motor disorders of cerebral palsy are often accompanied by disturbance of sensation, perception, cognition, communication and behavior by epilepsy and by secondary musculoskeletal problems.[2]

These motor impairments may be accompanied by mental retardation, visual impairments, speech impediments, perceptual disorders, trunk muscle postural control.[3] Insufficient trunk

muscle is the most serious concern for those who are suffering from cerebral palsy because it cause insufficient posturalcontrol and trunk stability.[4]

Children with cerebral palsy find it difficult to maintain the correct posture and balance due to insufficient stability of the head and the trunk, while muscle strength weakening and result in muscular imbalance. In addition children with cerebral palsy make inaccurate judgment with respect to the power, speed and direction required for posture control and balance.

Children with spastic have weakness in the trunk and spasticity in upper and lower extremities. They have motor impairment of their upper extremities, milder than lower extremity. They suffer from poor postural reflexes, poor alignment of the trunk and abnormal back geometry posture is affected and reflected on their life and activity of daily living.

Majority of children with cerebral palsy have difficultyin walking and demonstrate poor balance control and coordination, that leads to poor gait and functional reaching movement as the maintenance of stability is critical in all movements.

Proprioceptive neuromuscular facilitation integration pattern stimulate the proprioceptors with in the muscle and tendon to enhance the performance, flexibility and balance. It is generally effective in maintaining the reaction of exercise unit by increasing the co-ordination which react to the stimulation in muscular strength and flexibility.[5]

Therapist rebuild the movement and function of the limbs rendered paretic due to paralysis or paresis by guiding a specific movement pattern, for concomitant muscle or contractions with reversal, stabilization repetition or combination techniques.[6]

The motor control movement pattern facilitated by the dynamic and assistive-active resistant progressions regaining motor control and enhance the muscle strength of the paretic limbs of cerebral palsy patient.

Postural control involves controlling the body's position in space for the purpose of stability and orientation and emerges from the interaction of multiple systems that are organized around a task and constrained by the environment.(Shumway-cook and woollacutt).[4]

The center key point of the body is trunk which plays a major role, proximal trunk control, balance improves functional activities. Trunk control is the ability of the trunk muscles to

allow the body to remain upright, adjust weight shift, and perform selective movements of the trunk so as to maintain the center of mass within the base of support during static and dynamic postural adjustment.

The trunk is essential for limb movements, affects motor movements and has an interdependent relationship with other body parts and nervous tissues. In normal developmental processes, trunk stability is related to the movement of the limbs. The upper and lower limbs helps to compensate for any trunk instabilities that make exist. When the trunk is stable, the upper and lower limbs are freely usable for their normal purposes.[2]

The PNF procedures are often accompanied by verbal or visual and tactile feedback to facilitate muscle contraction and motor control in terms of many techniques. Such as joint approximation traction, irradiation or overflow.[7]

The facilitated progression due to PNF procedures follows a hierarchical process from mobility to stability then controlled mobility to skillful movement. If various patterns are applied simultaneously, targeting the specific muscle groups, improves muscle strength and stability.[8] Children with cerebral palsy have decreased muscle strength more in lower limb muscles, reduced flexibility, poor posture, impaired coordination and gait. Studies have stated that PNF techniques is effective in improving muscle strength, flexibility, posture coordination and gait. Hence, this study examines the effect of PNF technique on trunk control, balance, and mobility function in cerebral palsy children with spastic hemiplegia.

MATERIALS AND METHODS

A quasi experimental study was done using convenient sampling technique at NIEPMD for 30 spastic hemiplegic cerebral palsy children age group 10 – 14 yrs were selected on basis of inclusion and exclusion criteria were assigned to two groups Group A(n=15) & Group B (n=15) after obtaining informed constant from their parents and were followed for3 Months.

Inclusion criteria: Spastic hemiplegic cerebral palsy child age group 10-14 years, Both gender, Gross motor function level I and II (Walks with and without limitation), Modified Ashworth scale grade I and II & Mini Mental Status Examination>24.

Exclusion Criteria: Unco-operative subjects Children with visual, auditory, vestibular or perceptual deficit. Recent Orthopedic surgery, Fractures of ribs for upper limb, other

neurological and Cardio logical conditions like Mental disorder, Autism and tetralogy of fallout.

PROCEDURE

The spastic hemiplegia subjects who fulfill the inclusion criteria were included and informed consent was obtained from their Parents/ Guardian. Subject's demographic data, onset duration and spastic side and assessment was done. The subjects participating in this study were informed that they have to do the exercise regularly and can withdraw from the study if they have discomfort or difficulty. Thirty spastic hemiplegic cerebral palsy children were randomly distributed into two equal groups.

GROUP A: (Trunk exercise and trunk stabilization exercises)

GROUP B: (Trunk exercise and PNF techniques)

GROUPA(CONTROL GROUP)

TRUNK EXERCISES

Upper and Lower part of the trunk in supine and sitting position.

	EXERCISES IN SUPINE	**REPITITIONS**
1)	Pelvic bridging	3
2)	Unilateral pelvic bridging	3
3)	Upper trunk rotation (clasped hand)	3
4)	Crook lying (lower trunk rotation)	3
	EXERCISES IN SITTING	
1	Flexion and extension of lower trunk	3
2	Rotation upper and lower trunk	3

TRUNK STABILISATION

1) Lifting the head in a modified bridge exercise to activate the neck flexor muscles and the lower abdominal muscles simultaneously in lying position.-3 Repetitions.
2) Pushing the neck backward in supine position to activate the erector muscle of neck and the upper thoracic vertebrae, through the extension of the muscles of the back of the back in lying position.3 Repetitions.

GROUP B (Trunk exercise and PNF techniques)

	PNF EXERCISES:	REPITITIONS
	UPPER TRUNK	
1)	Flexion with rotation to the left (chopping)	3
2)	Extension with rotation to the right (lifting)	3
	LOWER TRUNK	
1)	Flexion with rotation to the left	3
2)	Extension with rotation to the right	3

Group A received trunk stabilization exercises for 15mins and GROUP B: PNF for 15 mins. Both the groups received trunk exercises for 15 mins. Each group receives 30 minutes intervention period for three days per week, for three successive months.

DATA ANALYSIS

- All statistical analysis were performed on IBM compactible micro computer using Statistical Package for the Social Sciences (SPSS 17.0).
- The significance was set at alpha=0.005 level Paired t Test was used to compare the pre and post values of Trunk Impairment Scale and Tinetti Performance Oriented Mobility Assessment.

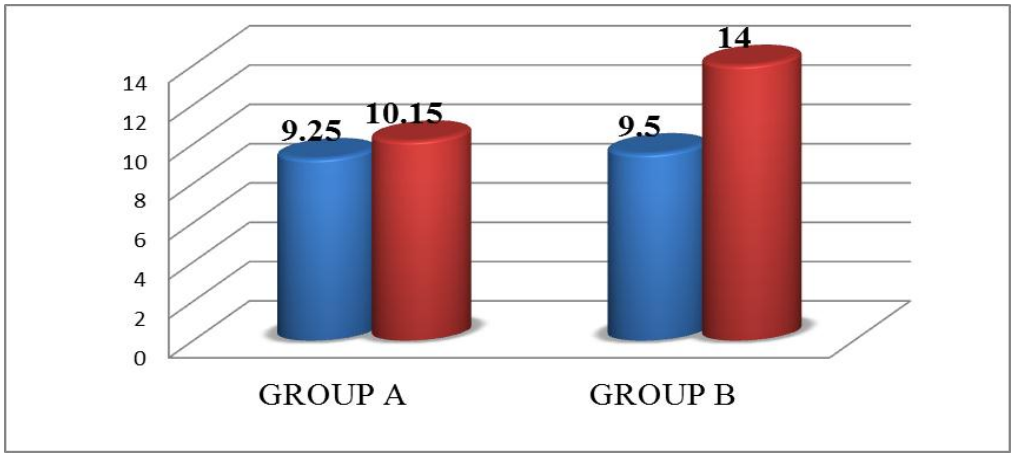
Table 1: Group A (Control Group).

Outcome Measure	Mean Value		Standard Deviation		t-VALUE	p-VALUE
	Pre Value	Post Value	Pre Value	Post Value		
TIS	9.25	10.15	1.8	1.81	9	<0.0001
POMA	20.85	21.8	1.53	1.85	6.190	<0.0001

Table 2: Group B (Study Group).

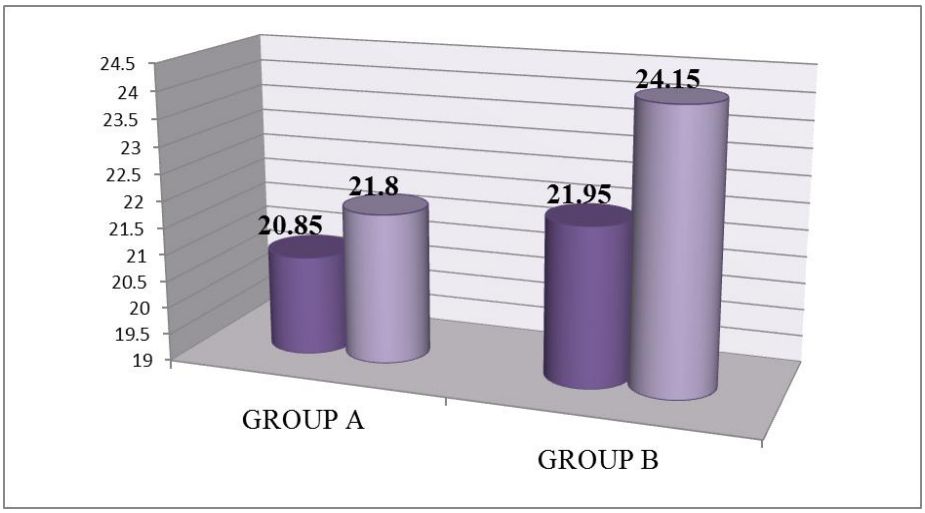
Outcome Measure	Mean Value		Standard Deviation		t-Value	p-Value
	Pre Value	Post Value	Pre Value	Post Value		
TIS	9.5	14	1.54	1.65	24.329	<0.0001
POMA	21.95	24.5	1.69	1.52	6.569	<0.0001

TRUNK IMPAIRMENT SCALE OF GROUP A AND GROUP B



Graph 1.

TINETTI PERFORMANCE ORIENTED MOBILITY ASSESSMENT OF GROUP A AND GROUP B



Graph 2.

RESULTS

- Table 1 Shows the Group A (Control Group) mean value of Trunk impairment scale:10.15±0.185, Tinetti performance oriented mobility assessment: 21.80±0.537.
- Table 2 shows the Group B (Experimental Group)mean value of Trunk impairment scale: 14.00±0.505, Tinetti performance oriented mobility assessment: 24.15±0.509.
- Graph 1 shows the Group A and Group B mean value of Trunk impairment scale.
- Graph 2 shows the Group A and Group B mean value of tinetti performance oriented mobility assessment.

DISCUSSION

Trunk control plays one of the major role in postural adjustment which enhances the functional activities among spastic hemiplegic cerebral palsy children.

The proprioceptive neuromuscular facilitation techniques is a method to improve the trunk stability of cerebral palsy. PNF stimulates proprioceptors with in the muscles and tendons, thereby improves the functional ability and increases the muscle strength, flexibility and balance**.**

PNF patterns are effective in improving trunk control in patients with cerebral palsy. Proprioceptive Neuromuscular Facilitation (PNF) technique on facilitation of trunk movement. The probable mechanism by which PNF could have worked is by facilitating the neuromuscular mechanism, by stimulating the proprioceptors.

PNF increases the ROM by increasing the length of muscle and the neuromuscular efficiency. The physiological mechanism for increasing the ROM and strength may be due to autogenic inhibition, reciprocal inhibition, and stress relaxation. i.e. rhythmic initiation, slow reversal and agonistic reversal might have helped to normalize the tone of affected side trunk muscles, lengthening the contracted structures, relax the hypertonic muscles, initiating the movements, strengthening the weak muscles and improving the control of the pelvis.[37]

All these effects might directly or indirectly aid in improving the trunk control. The PNF approach to treatment uses the principle that control of motion proceeds from proximal to distal body regions.

Facilitation of trunk control, therefore, is used to influence the extremities. The result of the present study found improvement in trunk performance in terms of static sitting balance and dynamic sitting balance and coordination.

LIMITATIONS

1) Small sample size.
2) Development Milestones were not considered.
3) Spastic hemiplegic cerebral palsy children were only included.

RECOMMANDATION

1) Further study, can be conducted to large sample size and other types of cerebral palsy.

2) Other outcome measures such as post urography and electromyographic analysis and biofeedback.

CONCLUSION

The present study concluded that PNF technique exercises improved significantlyin group B, Other than group A(trunk exercise)and trunk impairment scale and tinetti performance oriented mobility assessment were able to gain confidence and had better performance in their activities of daily living.

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