Effect of Gross Motor and Fine Motor Exercises on Trunk Control in Subjects with Spastic Cerebral Palsy

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Abstract

Background: Gross motor and fine motor activities are important to achieve as it is important aspect for ADL activities. It is widely known that when trunk control is affected, gross and fine motor activity is also affected. For efficient distal movements, proximal stability should be sufficient i.e for hand usage, development of trunk stability and central axis control is one of the important prerequisites. Recent studies have showed that there is positive correlation between trunk control and upper extremity functions. There is paucity of literature available showing effect of gross motor and fine motor activities on trunk control in cerebral palsy children, hence this study would be helpful to analyse the same.

Objectives: Objective of this study was to to find out the effect of gross motor and fine motor activities on trunk control, on hand function and also to find out the correlation between trunk control and hand function.

Methodology: There were total 35 subjects, out of which 21 subjects were participants of this study. This is a study of effect of gross motor and fine motor activities on trunk control in cerebral palsy children. Demographic data, assent and consent was taken from the child and his/her parents, respectively. Pre and post assessment was taken on the basis of Gross Motor Function Classification System for Cerebral Palsy, Manual Ability Classification System and Trunk Control Assesment before and after 6 weeks (total 16 sessions) of the treatment respectively. Each session was of 45 mins. Later evaluation and interpretation of data was done.

Result: The 9.1% improvement is seen in pre and post treatment GMFCS, 18% improvement is seen in pre and post treatment MACS and 16.2% improvement is seen in pre and post treatment TCMS.

Conclusion: There is significant effect of gross motor and fine motor exercises on trunk control in subjects with spastic cerebral palsy.

Keywords: *spastic cerebral palsy, gross motor and fine motor, hand function, trunk control, physiotherapy.*

Introduction

Cerebral palsy is defined as non progressive disoders which restricts activities in developing foetus or infant brain. The most prevalent form of physical disability is cerebral palsy in children[1]. Cerebral palsy can result from brain injury occurring during the prenatal, perinatal or postnatal periods, beacause brain development continues during the first two years of life[2]. Sensory, cognitive, communication, behavioural and perceptional problems, with epilepsy and other seconday musculoskeltal system problems are seen along with the motor disorders in cerebral palsy**.** Inability to use movement control for balance and also inability to use the hands for reaching and manipulation in day to day activities is one of the

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major problem in cerebral palsy children[3]. The ability to maintain centre of gravity within the base of support, without affecting the balance can be defined as postural control. The trunk plays a crucial role because it maintains centre of all body mass and therefore centre of gravity, as it organizes postural control and balance reactions[4].

For efficient distal movements, proximal stability should be sufficient i.e for hand usage, development of trunk stability and central axis control is one of the important prerequisites[1,9]. In children with cerebral palsy, brain lesions will affect hand functioning, making it difficult for them to perform many manual activities. Hand functioning requires integrity of the central nervous system, which may be altered by different brain disorders. Hand function is impaired due to increased or varying muscle tone leading to imbalance and sometimes even contractures. Hand function includes different components such as gripping and releasing objects, reach, speed and accuracy, grip strength and sensations[5]. Arm hand dysfunction is present in almost 50% of cerebral palsy children. The hand and its components i.e muscles, joints, and bone, and also several body functions i.e muscle strength, control of rapid co-ordinated movements, sensations and stereognosis may be affected in cerebral palsy children[3].

Skills are divided into two groups such as gross motor and fine motor skills. Manipulation of large objects controlled with arm and hands movements are often included in gross manual motor skills, whereas manipulation of smaller objects controlled with hand and fingers are included in fine motor skills. For daily life activities and overall functioning, fine motor skills are necessary[7,9].

In cerebral palsy children, gross motor dysfunction is the primary problem[8]. For various activities of daily life, arm movements such as reaching and grapsing are very essential[6].

Fine motor skill is dependent upon the development of gross motor skills. For many day to day activities such as dressing, feeding, holding objects, cutting, etc their development is necessary. Children have less control over the movements and almost all the movements are dominated by primitive reflexes at the time of birth. Reflexes disappear and are replaced by sophisticated intentional movements as the development takes place, and are controlled by the brain. Children should have ability to pinch and grasp little objects between the fingers, at the end of first year of life[9].

It is especially important for the children having motor problems to use their hands to support themselves in activities like sitting, standing, and walking, or during transfer activities. They also have difficulty in coordinating their fingers while gripping and releasing their grip. The ability to perform and participate in day to day activities needs proper upper extremity functioning. There is a strong positive correlation between trunk control and upper extremity in cerebral palsy children. Hence, it is important to understand the effect of gross motor and fine motor activity training on trunk control in cerebral palsy children[1].

Methodology

Total 35 subjects were approached in Krishna college of physiotherapy and out of them only 21 subjects were selected for the study according to the inclusion and exclusion criteria. Inclusion criteria were age group between 6-12 years, have a diagnosis of cerebral palsy and GMFCS level 3 and 4 and the exclusion criteria were previous surgery or pain in the upper limbs, vision and hearing problems, Cardio- respiratory problems and previous BoNT-A injections in the upper limbs. Demographic data and assent and consent form was taken from the child and his/her parents, respectively. Pre and post assessment was taken on the basis of of Gross Motor Function Classification System for Cerebral Palsy, Manual Ability Classification System and Trunk Control Assesment before and after 6 weeks (total 16 sessions) of the treatment respectively. Each session was of 45 mins[6,11,12,13].

Exercise protocol was started with warm up exercises i.e stretching for wrist flexors, followed by somato-sensory stimuli (finding objects in beans, rice or sand, pulling piece of clay off a ball of clay, pushing fingers into clay, stretching rubber bands around finger), then gross motor activities (objects of different shapes like rectangular and circular,with different texture like rough and smooth, and also heavy or light in weight),and then fine motor activities(ADL activities, picking up buttons,wooden beads, marbles ,hold thick crayons or thick chalk, pencils and scribble on paper and also begin screwing action)[10,15].

Statistical Analysis

Statistical analysis of the recorded data was done by

using the software SPSS version 20. The paired Ttest and one way ANOVA test were used for analysis of data.

Findings

Age Group	**Subjects**	**Gender**	
		Male	Female
6-8yrs	12	5	7
9-12yrs	9	5	4
TOTAL	21	10	11

1. Age and gender wise distribution.

INTERPRETATION: Above table represents, two age groups i.e 6-8 yrs which consists of total 12 subjects (male-5 and female-7) and in other age group 9-12 yrs it consists of total 9 subjects (male-5 and female-4).

2. Gross Motor Function Classification System

GMFCS	**Mean**	**Standard deviation**	**p value**	**Interference**
Pre test	3.571	0.5071	0.0156	Considered significant
Post test	3.238	0.6249		

Interpretation: In the present study pre interventional mean and standard deviation of GMFCS was 3.571±0.5071, whereas post-interventional mean ± SD was 3.238±0.6249. It concluded that interference was considered significant. This was calculated by Wilcoxon test (W=28.00). 9.1% improvement is seen in pre and post GMFCS.

3. Manual Ability Classification System.

MACS	**Mean**	**Standard deviation**	**p value**	**Interference**
Pre test	3.667	0.7303	0.0001	Considered extremely significant
Post test	3.00	0.8367		

Interpretation: In the present study pre interventional mean and standard deviation of MACS was 3.667±0.7303, whereas post- interventional mean ± SD was 3.0±0.8367. It concluded that p value was 0.0001 and interference was considered extremely significant. This was calculated by Wilcoxon test (W=105.00).). 18% improvement is seen in pre and post MACS.

4. Trunk Control Measurement Scale

TCMS	Pre test	Post test	p value	Interference
	Mean±SD	Mean±SD		
Static sitting balance	7.810±1.078	9.048±1.431	0.0002	Considered extremely significant
Dynamic sitting balance	5.952±0.9735	6.905±1.70	0.0010	Considered extremely significant
Dynamic reaching balance	4.524±0.8136	5.571±1.248	0.0010	Considered extremely significant
Total score	18.286±1.056	21.286±3.379	0.0003	Considered extremely significant

Interpretation: In this study, pre interventional Mean±SD was 7.810±1.078 for static sitting balance, Mean±SD was 5.952±0.9735 for dynamic sitting balance, Mean±SD was 4.524±0.8136 for Dynamic reaching balance and Mean±SD was 18.286±1.056 for total score. Post-interventional Mean±SD was 9.048±1.431 for Static sitting balance, Mean±SD was 6.905±1.70 for Dynamic sitting balance, Mean±SD was 5.571±1.248 for Dynamic reaching balance and Mean±SD was 21.286±3.379 for Total score. 16.2% improvement is seen in pre and post TCMS.

Discussion

Cerebral palsy is defined as non progressive disoders and it is the most prevalent form of physical disability in children[3]. Cerebral palsy can result from brain injury occurring during the prenatal, perinatal or postnatal periods, beacause brain development continues during the first two years of life[9]. Inability to use movement control for balance and also inability to use the hands for reaching and manipulation in day to day activities is one of the major problem in cerebral palsy children[2]. The ability to maintain centre of gravity within the base of support, without affecting the balance can be defined as postural control. The trunk plays a crucial role because it maintains centre of all body mass and therefore centre of gravity, as it organizes postural control and balance reactions[1].

This research was undertaken with the aim to study the effect of gross motor and fine motor exercises on trunk control in subjects with spastic cerebral palsy.

The study was carried out and the result was drawn by Gross Motor Function Classification System, Manual Ability Classification System, Trunk Control Measurement Scale and NPRS.

An approval for the study was obtained from the Protocol committee and the Institutional Ethical Committee of KIMSDU. Total 35 subjects were approached in Krishna college of physiotherapy and out of them only 21 subjects were selected for the study who fulfilled inclusion criteria. The procedure was explained and consent was taken from those willing to participate and written assent was taken from caregivers.

Demographic data of the subjects was taken. The individuals were explained about the purpose of the study. Also, they were informed about the procedure. Subjects were selected for the study according to the inclusion and exclusion criteria using convenience sampling method. Demographic data and assent and consent form was taken from the child and his/her parents, respectively. Pre and post assessment was taken on the basis of of Gross Motor Function Classification System for Cerebral Palsy, Manual Ability Classification System and Trunk Control Assesment before and after 6 weeks (total 16 sessions) of the treatment respectively.

Each session was of 45 mins.

Exercise protocol was started with warm up exercises i.e stretching for wrist flexors, followed by somato-sensory stimuli (finding objects in beans, rice or sand, pulling piece of clay off a ball of clay, pushing fingers into clay, stretching rubber bands around finger), then gross motor activities (objects of different shapes like rectangular and circular,with different texture like rough and smooth, and also heavy or light in weight),and then fine motor activities(ADL activities, picking up buttons,wooden beads, marbles ,hold thick crayons or thick chalk, pencils and scribble on paper and also begin screwing action).

It was found that among 21 subjects, 57% subjects belonged to 6-8 years of age group and remaining 43% belonged to 9-12 years of age group. In age group 6-8 years, there were total 12 subjects out of which 5 were males and 7 were females. In age group 9-12 years, total 9 subjects were there, out of which 5 were males and 4 were females.

Among 21 subjects, 7(33%) subjects showed changes in their level of Gross motor function classification system and remaining 14(67%) subjects showed no change in their level. In the present study pre interventional mean and standard deviation of GMFCS was 3.571±0.5071, whereas post-interventional mean ± SD was 3.238±0.6249. It concluded that interference was considered significant (p=0.0156). This was calculated by Wilcoxon test (W=28.00).

In total 21 subjects, 14(67%) individuals showed changes in their level of manual ability classification system, whereas remaining 7(33%) individuals showed no change in their level. In the present study pre interventional mean and standard deviation of MACS was 3.667±0.7303, whereas post- interventional mean ± SD was 3.0±0.8367. It concluded tha p value was 0.0001 and interference was considered extremely significant. This was calculated by Wilcoxon test (W=105.00).

Out of 100%, 57%(12 subjects) had changes in their trunk control measurement scale and remaining 43% (9 subjects) had no changes in their scoring.In this study, pre interventional Mean±SD was 7.810±1.078 for static sitting balance, Mean±SD was 5.952±0.9735 for dynamic sitting balance, Mean±SD was 4.524±0.8136 for Dynamic reaching balance and Mean±SD was 18.286±1.056 for total score. Post-interventional Mean±SD was 9.048±1.431 for Static sitting balance, Mean±SD was 6.905±1.70 for Dynamic sitting balance, Mean±SD was 5.571±1.248 for Dynamic reaching balance and Mean±SD was 21.286±3.379 for Total score. It concluded that interference was considered extremely significant (p=0.0003)

Passive stretch is used to improve range of motion and also improves flexibility. Somato-sensory stimuli helps to activate or facilitate muscle motor response. Gross motor exercises are used to improve grasping and fine motor exercises are used to produce small precise movements[2,15,16].

It concluded that, 9.1% improvement is seen in pre and post treatment GMFCS, 18% improvement is seen in pre and post treatment MACS and 16.2% improvement is seen in pre and post treatment TCMS

Conclusion

On the basis of the results of the study, it can be concluded that gross motor and fine motor exercise program is effective in improving trunk control in spastic cerebral palsy. Effect of gross motor and fine motor exercises on trunk control was found more within the age group 6-8 yrs as compared to 9-12yrs.

Conflicts of Interest: There is no conflict of interests in this study.

Ethical Clearance: This study has undergone ethical clearance through the university level ethical committee of Krishna institute of medical sciences, deemed to be University, Karad. Protocol number 0101/2019-2020.

Funding: This study was funded by Krishna institute of medical sciences'deemed to be' university,karad.(Maharashtra).

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