EFFECTS OF UNIVERSAL EXERCISE UNIT THERAPY ON SITTING BALANCE IN CHILDREN WITH SPASTIC AND ATHETOID CEREBRAL PALSY: A QUASI-EXPERIMENTAL STUDY

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ABSTRACT

OBJECTIVE: To find out improvement in sitting balance by using universal exercise unit (UEU) along with gym ball and rocker board training in children with spastic and athetoid cerebral palsy (CP).

METHODS: This study was a quasi-experimental design where 23 (15 male, 8 female) children, age 6-15 years of spastic and athetoid CP with Gross Motor Functional Classification Scale; level III were recruited during the period of 6 months. Data was recorded on trunk control measurement scale to measure sitting balance and control. UEU therapy along with gym ball and balance board training were part of the treatment protocol.

RESULTS: Out of 23 subjects, 16 (69.6%) were having spastic CP and 7 (30.4%) had Athetoid CP. The results of the study demonstrated that CP children who received therapy in UEU showed improved sitting balance after intervention of 4 weeks. While considering the components of trunk control measurement scale (TCMS) on subscale of static sitting balance, performance was least impaired compared to subscales of dynamic sitting balance. Mean scores of trunk control measurement scale before and after treatment were 18.35±5.81 and 21.83±5.38 respectively with p-value <0.05. Static sitting balance was 8.65±3.379 before treatment and 10.22±3.219 after treatment. Dynamic sitting balance was 5.57±3.043 & 6.91±2.695 before treatment and after treatment respectively. Dynamic reaching was 4.13±1.687 before treatment and 4.78±1.976 after treatment.

CONCLUSION: Universal exercise unit therapy bring significant improvement is sitting balance and control of CP children with spasticity and athetosis.

KEY WORDS: Cerebral palsy (MeSH); Muscle Spasticity (MeSH); Exercise Therapy (MeSH); universal exercise unit Therapy (Non-MeSH); Postural Balance (MeSH).

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INTRODUCTION

Cerebral palsy (CP) is a group of neurological disorders that causes permanent damage of motor areas in the brain and affects body movement and muscle in coordination.[1] Evidence suggests that this brain damage can't be cured completely but the treatment options are available for motor and sensory dysfunctions.[2] There are many types of CP, the most common are the spastic and athetoid.[3,4] Prevalence of CP ranges from 1.5-3 per 1000 children.[5]

CP children may have weak sitting balance and posture reactions while maintaining center of gravity in sitting position. Proper functioning of upper extremity and self-care mobility are integral for strong trunk control and sitting balance.[6]

Traditionally, available treatment approaches used for sitting balance are adaptive seating devices, ankle foot orthoses, perturbance to rocking base, gym ball activities, cross and side sitting with hands propped, prone lying and swing usage.[7] Universal exercise unit (UEU) therapy is one of the treatment approaches that can be used other than traditional physical therapy exercises for CP children.[8]

UEU is a unique metal construction developed by a Polish Orthopedic Surgeon, Professor Dega over sixty years ago. It consists of system of pulleys, suspensions, belts and elastic cords. Philosophy to use UEU is based on the concept of unloading the body against gravity and to perform movement of weak part of the body.[9] Therapist's hands are free to provide adequate support as required by the patient during exercise training. UEU activates somatosensory and proprioceptive systems that give signals to the brain and help in learning the correct movement patterns.[10] In UEU, the patient is supported with bungee cords. These elastic cords can be adjusted according to postural changes; as a result, more relaxed and upright position can be achieved.[11] Gym ball and rocker board training is used in UEU as a treatment approach in the present study.

A study done on six CP children by Butler et al assessed the potential of specific training for trunk and hip joint muscles in initiating and accelerating

movement control. Independent control of movement and balanced sitting were seen within 12-25 weeks in all the children. The study was irrespective of stoppage and continuation of traditional physical therapy. They suggested further verification of these findings using more refined methodology.[7]

Another case study conducted on two CP children with spastic diplegia; Gross Motor Functional Classification Scale (GMFCS); level III (CP children who walk with assistive mobility devices indoors and outdoors on level surfaces); to assess the effectiveness of therasuit using universal exercise unit (UEU) on caregiver assistance, gross motor ability, functional skills and gait. Outcomes were assessed using pediatric evaluation of disability inventory (PEDI) and GMFCS. These children received training in UEU using therasuit for the duration of 3 weeks, 5 days a week for 4 hours each; showed less improvement in GMFCS and PEDI self-care domain. The study suggested further research on UEU therapy in children with CP.[12]

In a study carried out in Pakistan on UEU and traditional physiotherapy, found significant improvement in gross motor function of the CP children.[13] Less importance was given to the trunkal control and balance. Further research was required to work on the specific functioning of the body i.e. sitting balance and control.

To our knowledge, no study has been done on UEU specifically, to improve sitting balance in CP children. Still there are fewer centers in Pakistan who have UEU units for training of these children. The objective of the study is to find out improvement in sitting balance by using UEU along with gym ball and rocker board training in children with spastic and athetoid CP.

METHODS

Study was a quasi-experimental design with pretest and posttest measures. Data was collected from two clinical settings i.e. COMPASS (center of mentally and physically affected special students), Khursheed Alam Road, Lahore Cantt and Mobility Quest, Cavalry Ground, Lahore Cantt. Sample of 23 patients using convenient sampling technique was based on arbitrary time (within 6 months) based sample size recruitment.[14] Inclusion criteria were difficulty in independent sitting measured by trunk control measurement scale (TCMS), age range 6-15 years and established diagnosis of spastic and athetoid CP. Exclusion criteria of the study were children with fixed deformity of spinal column, any psychotic & behavioral disorders and children suffering from uncontrolled epilepsy. GMFCS was used as a baseline measure to identify level of severity in children with inter-rater reliability of 0.84.[15] Level I indicate less severity to level V indicating more severity.[16,17] After GMFCS measurement, TCMS was used before the treatment. TCMS consists of 15 items to measure static and dynamic trunk control with inter-rater reliability (ICC) 0.91 to 0.99 and intra-rater reliability 0.82 to 0.94.[18] In TCMS, 1-5 items measure the static sitting balance during movement of the limbs. Dynamic sitting balance component comprised of 6-15 items which are further divided into selective movement control (6-12 items) and dynamic reaching (13-15 items).[18] On TCMS score, 0 is considered poor and higher scores i.e. 58 show improvement in performance.

Intervention was given by the researcher which includes gym ball training and rocker board training in Universal exercise unit (UEU). The children were taken in the UEU room where UEU was fixed. Belt and bungees were tied around the child to maintain the center of gravity. Intervention was given one hour each day, 5 days a week for four weeks. Gym ball training was given for 30 mins and other 30 mins were used in rocker board training. Data was collected at baseline and after 4 week of the treatment. Consent of all the parents of CP children was obtained prior to children participated in the study. Research Ethical Committee of Riphah College of Rehabilitation Science, Lahore approved the study protocols for ethical consideration.

RESULTS

Data was analyzed using SPSS v.21. Descriptive statistics included frequency and mean, were used for demographic

TABLE: I OVERALL BASELINE MEASUREMENT OF TCMS AND DEMOGRAPHICS

Descriptive Statistics Baseline		Frequency	Mean± SD
Gender	Male	15	
	Female	8	
Age (years)	6-10	13	
	11-15	10	
Type of CP included	Spastic	16	
	Athetoid	7	
Pre-test Trunk Control Measurement Scale score			18.35±5.812
Post-test Trunk Control Measurement Scale score			21.83±5.382
Static sitting balance before treatment			8.65±3.379
Static sitting balance after treatment			10.22±3.219
Dynamic sitting balance before treatment			5.57±3.043
Dynamic sitting balance after treatment			6.91±2.695
Dynamic reaching before treatment			4.13±1.687
Dynamic reaching after treatment			4.78±1.976

TABLE II: WILCOXON SIGNED RANK TEST:

		N	Mean Rank	Z-value	p-value
Post-test TCMS score –Pre-test TCMS score	Negative Ranks	1[a]	2.00	-3.864	p<0.05
	Positive Ranks	19[b]	10.95		
	Ties	3[c]			
	Total	23			

a=post test TCMS score < pre test TCMS score, b=post test TCMS score > pre test TCMS score, c=post test TCMS score=pre test TCMS

variables (Table I). Pretest and posttest scores were compared to measure the effectiveness of intervention. Significance of intervention was measured using Wilcoxon signed ranked test as the data was not normally distributed and selected on convenient basis (Table II).

Significant difference ($p<0.05$) was seen using Wilcoxon signed rank test for pre and post test measures. Only one subject received negative rank, 19 received positive rank and 3 ties were seen (Table II).

DISCUSSION

Ability to control trunk in sitting is very important in human activities.[19,20] Results of the study demonstrated that CP children who received therapy of gym ball and rocker board in UEU showed improved sitting balance after intervention of 4 weeks.

While considering the components of TCMS, on subscale of static sitting balance, performance was least impaired compared to subscales of dynamic sitting balance.

Findings of the present study were consistent with previous research on 24 children with GMFCS II-IV comparing therasuit therapy with Neurodevelopmental therapy in UEU. Each child received therapy for 2 hours, 5 days a week for 4 weeks. Improved performance was seen in functional activities of the children.[21] The researchers studied the generalized effects of the therapy and used expensive equipment i.e. therasuit to treat CP patients. A recent study in 2015 in Pakistan conducted on UEU with traditional physiotherapy in cerebral palsy children gave significant result on Gross functional level when measured with GMFCS.[13] Their results were in accordance with the present study in case of using UEU. The current study was more specific on trunkal control and balance rather than measuring gross motor performance of the whole body. Also, TCMS was used as a specific tool for measuring sitting balance and control.

Another case study on two children with spastic diplegia who received therapy in UEU with therasuit reported insignificant improvement in gross functional status. However, improvement was seen in joint motion, symmetry, walking speed, cadence and standing posture.[12] Sitting balance was not studied as a primary factor for trunkal control and balance in their study. The present study on sitting balance and control, presented significant outcomes when treated in UEU with gym ball and rocker board training.

Weaknesses of this study were, the subjects were not randomized to an experimental or control group, sample size was arbitrary due to less patients in two clinical settings, blinding was not done, the age ranges of the children were not narrowed and data was taken on non-probability convenient sampling rather than probability one. There is less number of centers in Pakistan using universal exercise unit which emphasized the need of UEU. Results of present study cannot be generalized to wide range of age group in CP children.

CONCLUSION AND SUGGESTIONS

Gym ball and balance board training in UEU was found an effective treatment approach to improve sitting balance measured by TCMS, in spastic and athetoid CP children.

It is suggested that long term follow up should be carried out with high quality trials and large sample size.

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CONFLICT OF INTEREST

Authors declared no conflict of interest

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SL: Conception and design; acquisition, analysis and interpretation of data; drafting the manuscript; final approval of the version to be published

MSB: Analysis and interpretation of data, drafting the manuscript, final approval of the version to be published

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Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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