

Original Research Article

Efficacy of Modified Task Oriented Exercises Performed On Swiss Ball Over Conventional Task Oriented Exercises on Improving Balance Post Stroke

Sukumar S¹, Jayasrikanth S²

¹Assistant Professor and PhD Student, Nitte Institute of Physiotherapy, Nitte University, Mangalore.

²Professor, Shree Devi College of Physiotherapy, Mangalore, India.

Corresponding Author: Sukumar S

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ABSTRACT

Background: Balance deficits in hemiplegic subjects are common due to the reduction in multisystem functions. Task oriented training is considered to be an effective intervention to improve balance and mobility function.

Aims & Objective: Application of modified task oriented training on swiss ball may put more demands on multisystem proprioceptive function which may leads to increase in balance and mobility function.

Methods: Among the total 45 subjects selected using simple random sampling, 5 subjects were dropped out and remaining 40 subjects (20 in each group) were completed the two months of intervention. The interventional group treated with modified task oriented exercises on a swiss ball and comparator group was treated with conventional task oriented exercises on stable surface for two months duration.

Outcome measures: Balance was assessed using Berg Balance Scale and mobility function was assessed using Rivermead Mobility Index on the first day and four month after treatment.

Results & Discussion: In this present study it was found that there was a significant ($p=.000$) increase in BBS score in subjects who performed task oriented exercises on a Swiss ball. As similar significant ($p=.05$) improvement was also found on subjects who performed task oriented exercises on a stable flat surface. But when the improvements of two groups were compared those subjects who used Swiss ball had shown a significant ($p=0.02$) and better improvement in the BBS scores. In this present study it was also found that there was a significant increase in RMI score ($p=.000$) in subjects who performed task oriented exercises on a Swiss ball and stable flat surface. But when the two groups were compared there was no significant ($p=1$) difference in the RMI scores.

Conclusion: Modified task oriented training performed on a Swiss ball can be used as a one of the balance training method in the management of individuals with post stroke.

Key words: Swiss Ball Training, Task Oriented Training, Stroke Management, Balance Training

INTRODUCTION

WHO defined stroke as rapidly developing clinical signs of focal or global disturbance of cerebral functions; lasting

more than 24 hours or leading to death, with no apparent cause other than vascular origin. [1] Stroke has turned out to be a common cause of disability and dependence with

more than 70% of stroke survivors and the remaining 30% population requiring assistance for the activities of daily living. [2] Balance impairment is the most common in the any form of stroke because the balancing function of the body after stroke can be affected by more than one component. In stroke one's ability to balance may reduce due to deficits in strength, range of movements, proprioception, vision, vestibular function and endurance. [3]

Most common cause for falls in the stroke patients is due to reduction in the balancing function of the body which leads to various musculoskeletal and neurological complications. Balance training is an important component of stroke intervention for physical therapist and there are several interventions were used by the physical therapist all over the world to treat the balance deficits and other related dysfunctions. Among all interventions the task oriented training and unstable surface balance training was the two interventions commonly adopted for balance retraining in stroke survivors. [4,5]

Task oriented training is a effective method of treatment in any form of stroke survivors to improve the multi system functioning of central nervous system. [6-8] Task oriented exercises have been used for quite long time by physiotherapists as an effective means of improving balance. [9] It may reduce the causative impairment and helpful in retraining the effective task specific functional movements of the body. Few recent studies were also suggesting that Balance training in unstable surface may also improve the postural control mechanisms among neurologically impaired persons especially after stroke. [10-12]

There are several researches has been done on the stable surface balance training and task specific training in normal [13, 14] as well as hemiplegic subjects and the researchers were proven the effects of both

the interventions. [15] Even though, task oriented training is considered to be an effective interventions, it was performed on the stable platform surfaces. In the recent years Task oriented exercises like weight shifting exercises, [16] trunk training exercises, [12] sit to stand training, [17] gait training, [10] upper limb object reach exercises, [11] deep flexion activity training, [18] strength training, [19] task oriented circuit training [20] on stable and unstable surface used by various researchers to improve the balance and mobility functions in post stroke individuals. However, only very limited studies were used the swiss ball as an unstable surface balance training tool in stroke patients. [4] In this present study we hypothesis that if the task oriented exercises performed on the unstable surfaces like Swiss ball it may reinforce the effectiveness of task specific exercises to make better clinical outcomes.

Swiss ball is a large inflated ball generally measuring from 45 to 85 cm in height. They were first used in the 1940s in England by the Bobaths to treat children with cerebral palsy. Exercise balls were introduced to Swiss physiotherapist to use them for treating athletes and train other physical therapists. A Swiss ball may be used as effective unstable surface balance training tool by performing task oriented exercises on it. [21] So, this present study was conducted to study and compare the effectiveness of modified task oriented training performed on a Swiss ball compared with the conventional task oriented exercises performed on stable surface in stroke patients.

MATERIALS AND METHODS

There are 45 post stroke hemiplegic individuals were selected after the inclusion and exclusion criteria during the period between May 2007 and December 2008, at Department of Physical Therapy in Shree

Devi College of Physiotherapy and Government District Wenlock Hospital, Mangalore. Patients those who are diagnosed with hemiparesis after stroke and able to sit independently on stable surface, and BBS score of minimum 20 were selected for this study. And also patients with orthopaedic problems like fracture and spinal injuries, cognitive impairment, dependence on anticonvulsant drugs, and uncooperative patients were excluded. All 45 subjects had given informed consent to participate in the study and they were instructed about the possible outcome of the interventions. Patients were allocated in two groups and 23 subjects in the intervention group received modified task oriented exercises on a Swiss ball, another group with 22 subjects was treated with conventional task oriented exercises on the stable surface. The treatment planned was weekly 6 days for two months duration, but at the end of first week 3 subjects from interventional and 2 subjects from comparator group were dropped out. The remaining 40 subjects continued and completed the intervention. All exercises on the Swiss ball and stable surface were demonstrated to the subjects in the intervention group and comparator group respectively. Once subjects are familiar with the exercises in different surface platform, the patients were given set of task oriented exercises to perform on the Swiss ball and stable surface. Pre and post intervention assessment was taken for balancing function using Berg Balance Scale and Rivermead Mobility Index was used for assessing functional mobility function.

Modified task oriented exercises: modified task oriented exercise is a modified version of task specific exercise which is performed on a unstable surface like swiss ball. A set of task specific exercises were selected and performed on Swiss ball in different positions like sitting, kneeling,

quadruped, and standing positions. The earlier studies on task oriented training to improve upper limb reaching, [22] and functional activities [23] were suggested that a set task specific exercises were beneficial in improving both mobility and stability function after stroke. Object manipulation and weight shifting training on unstable surface also useful in improving balance and functional mobility in post stroke survivors. Based on the previous evidence from previous studies a set of task oriented exercises were selected and demonstrated to patients for better understanding and manipulation of objects during the unstable surface balance training by the principal investigator of this study. [10, 12, 16]

In sitting position subjects were asked to sit on the Swiss ball and perform reaching objects in all the direction, shifting objects from one side to another side by rotating the trunk, lifting objects from floor and placing it on the table or therapist hand, and reaching objects while standing from sitting. The same above mentioned exercises were performed in kneeling position on Swiss ball placed within the parallel bar to reduce the fear and increase the confidence of the patients. Then the patients were shifted to the exercise mat and placing the Swiss ball below the abdomen in quadruped position, objects reaching exercises were performed. Once the patients were adjusted to the sitting and quadruped position exercises the subjects were asked to perform task oriented exercises in standing position by keeping the sound side knee over the Swiss ball.

Conventional task oriented training: Another set of task specific exercises were selected and performed on stable surface in different positions like sitting, kneeling, quadruped, and standing positions. Subjects in the comparator exercise group were asked sit on the chair or other form of stable platform and they were asked to perform

objects reaching in all the direction, shifting objects from one side to another side by rotating the trunk, lifting objects from floor and placing it on the table or therapist hand, reaching objects while standing from sitting. The same above mentioned exercises were performed in kneeling and quadruped position on stable surface. Once the patients were adjusted to the sitting, kneeling and quadruped position exercises the subjects were asked to perform task oriented exercises in standing position.

Outcome measures: Before and after treatment balancing function was assessed using Berg Balance Scale and mobility functions was assessed by using Rivermead Mobility Index. Berg balance scale and river mead mobility index scales are reliable tool to measure the balancing and mobility function in stroke patients respectively. [24, 25] There are two physiotherapist were involved in the measurement of balance and mobility of the subjects to make the assessment easy and convenient for both patient and therapists.

Statistical methods:

Nominal data like gender and side affected was described in frequency and percentiles. The both qualitative and quantitative data like berg balance scale and Rivermead mobility index score, and age of subjects were described in mean, median, standard deviation and Interquartiles. Inferential

statistics of intra group comparison for both intervention were carried out with paired t test and inter group comparison was made using independent t test for the mean difference among the two groups.

RESULTS

The mean age of 67.1 ± 8.61 was observed in subjects of both interventional groups. There was 12 male and 8 female patients in the experimental group, 11 male and 9 female patients in comparator group were participated in this study (Table 1.). The statistical results of paired t test for berg balance scale score have shown the mean difference of 14.8 (Pre Mean 29.1, Post Mean 43.5) in the interventional group and 11.4 (Pre Mean 28.5, Post Mean 39.9) in comparator group (Table 2). And also, the results of Paired 't' test for The Rivermead Mobility Index score have shown the mean difference of 4.2 (Pre Mean-8.29 and Post Mean 12.45) in the interventional group and 3.95 (Pre Mean 7.9 and Post Mean 11.85) in the comparator group (Table 3). The inferential statistical results of Independent 't' test for the intergroup comparison of Berg Balance Scale score had shown the 't' value of 2.64 (p-value= 0.02) and intergroup comparison of Rivermead Mobility Index score had shown the 't' value of 0.0208 (p-value=1) (Table 4).

Table 1: Descriptive characteristics of variables in experimental and comparator group

Variables	Experimental Group [MTOE]			Comparator Group [CTOE]		
Age	67.1 ± 8.6166			67.1 ± 8.6166		
Gender	Male	12 (60%)		11(55%)		
	Female	8 (40%)		9 (45%)		
Side Affected	Right	7(35%)		9(45%)		
	Left	13(65%)		11(55%)		
Berg Balance Scale	Pre	29.1 ± 2.9362		28.5 ± 2.8928		
	Post	43.5 ± 2.3819		49.5 ± 2.2919		
Rivermead Mobility Index	Pre	8.29 ± 0.9105		7.9 ± 0.6407		
	Post	12.45 ± 0.8870		11.85 ± 0.6708		

Table 2: Intra comparison of Berg Balance Scale score before and after treatment in the experimental and comparator group.

Outcome Measure [BBS]	Experimental Group				Comparator Group			
	Mean	M.D	T-Value	P-Value	Mean	M.D	T-Value	P-Value
Pre	29.1	14.8	9.1681	0.000	28.5	11.4	2.4959	0.05
Post	43.5				39.9			

Table 3: Intra group comparison of Rivermead Mobility Index score before and after treatment in the experimental and comparator group.

Outcome Measure [RMI]	Experimental Group				Comparator Group			
	Mean	M.D	T-Value	P-Value	Mean	M.D	T-Value	P-Value
Pre	8.29	4.2	7.9450	0.000	7.9	3.95	9.7288	0.000
Post	12.45				11.85			

Table 4: Inter group comparison of Berg Balance Scale and Rivermead Mobility Index score between the modified task oriented exercises and conventional task oriented exercises.

Group	Berg Balance Scale Score				Rivermead Mobility Index Score			
	M.D	S.D	T-Value	P-Value	M.D	S.D	T-Value	P-Value
MTOE	14.8	2.3819	2.6464	0.02	4.2	0.88	0.0208	1
CTOE	11.4	2.2919			3.95	0.67		

DISCUSSION

The purpose of this study was to assess the efficacy of modified task oriented exercises performed on a Swiss ball over conventional task oriented exercises on improving balance and mobility function post stroke. Various combination of Task oriented training on stable and unstable surfaces were effectively used to treat balance, mobility and hand function issues in post stroke subjects. [\[10, 18, 26\]](#) However, there are very few studies available by using a swiss ball as an unstable surface tool for non task oriented trunk control in stroke patients. [\[4, 6\]](#) As there is no study available on task oriented balance training by using swiss ball, this study aimed at comparing it with conventional task oriented exercises on stable surface. The results of this study showed that there was a significant increase in BBS score ($p=.000$) in subjects with interventional group as well as in comparator group ($p=.05$). When comparing the improvement of balance between two groups it was found that the subjects used Swiss ball had shown a significant improvement in the BBS scores ($p=0.02$). The above finding may be explained by the fact that subjects those who performed task oriented exercises on a Swiss ball were subjected to high proprioceptive activation in trunk and lower limb components [\[11,12\]](#) than the comparator group who performed task oriented exercises on stable flat surface. The statistical evidences

of this study also correlated with the findings of previous study done by Akshatha Nayak et.al, on balance for non task oriented trunk control exercises on a swiss ball in stroke patients. [\[4\]](#)

Within groups comparison of Rivermead mobility index score between the pre and post intervention mobility function demonstrated that there was a significant increase in RMI score with t value of 7.94 ($p=.000$) in subjects who performed task oriented exercises on a Swiss ball and 't' value of 9.27 ($p=.000$) for the subjects performed exercises on stable surface. When the mean difference of post interventional Rivermead mobility index score were compared, there was no significant ($p=1$) difference in the RMI scores between two groups. This evidence also suggesting that task oriented training on a swiss ball was not shown any comparable improvement in the context of mobility function. This may be due to the tasks performed on swiss ball utilised comparatively lesser range of motion in trunk and lower limbs than the same tasks done on stable surface.

Several similar studies have concluded that task oriented training on stable surface when administered with other balance intervention to hemiplegics after stroke has beneficial effects. Other related studies have also suggested that exercises on unstable surface may improve trunk and abdominal muscle strength as well as

balance function in stroke patients. [6, 16-18, 20] The results of present study suggest that task oriented exercises performed on a swiss ball may facilitate multisystem function thereby it may improve cortical reorganization of neurons and thereby help in the balance recovery post stroke. [27] However a larger sample size studies required to support this present study finding for using swiss ball as an unstable surface for performing task oriented training in stroke patients.

CONCLUSION

Based on the present study we recommend modified task oriented training performed on a Swiss ball can be used as an one of the balance training method in the management of individuals with post stoke.

Limitations of this study:

Exercises on Swiss ball required greater supervision and precaution

Patient required a longer time to get accustomed to the Swiss ball

There is only limited literature on the use of Swiss ball in post stroke rehabilitation

Scope for further study:

The authors of this present study recommend for further research to understand the effects of unstable surface having in improving upper limb function and overall functional improvement.

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