



COMPARISON BETWEEN SWISS BALL TRAINING AND SIT TO STAND BALANCE TRAINING EXERCISES ON BALANCE PERFORMANCE AND FUNCTIONAL INDEPENDENCE IN HEMIPLEGIC STROKE PATIENTS

DR. SUMAN RANI ¹ | DR. SHEFALI KAPOOR ² | DR. NEHA ³

¹ MASTERS IN PHYSIOTHERAPY (NEUROLOGY), PREM PHYSIOTHERAPY AND REHABILITATION COLLEGE, PANIPAT.

² ASSOCIATE PROFESSOR, PREM PHYSIOTHERAPY AND REHABILITATION COLLEGE, PANIPAT.

³ ASSISTANT PROFESSOR, PREM PHYSIOTHERAPY AND REHABILITATION COLLEGE, PANIPAT.

ABSTRACT:

Objective: To find out whether the Swiss ball exercises or sit to stand balance training exercise is better to improve balance and functional independency in hemiplegic patients.

Method: A comparative study was done with 40 hemiplegic patients of age between 45 to 55 years with first time hemorrhagic stroke diagnosed middle cerebral artery involvement not more than of 3 months along with mini mental status examination score greater than 24/30 and Brunnstrom recovery stage grading 2 to 4. They were divided into 2 groups by convenient sampling method. Patients in group A (n=20) were given conventional treatment along with Swiss ball exercises and Patient in group B (n=20) were given conventional treatment along with sit to stand balance training exercise. Treatment was given for 3 days a week for a total of 6 weeks with 60 min per session. The outcome was measured by Berg Balance Scale and Functional Independence Measure.

Conclusion: The result of the study showed that exercise on Swiss ball and sit to stand balance training exercise both improve the balance and functional independence but statistically Swiss ball training give more significant improvement in improving balance and functional independence in stroke patient.

KEYWORDS:

INTRODUCTION

Stroke is an acute onset of neurological dysfunction due to an abnormality in cerebral circulation with resultant sign and symptoms that correspond to involvement of focal areas of the brain.¹ The most common symptom of stroke is hemiparesis or hemiplegia, which ranges from weakness to full paralysis of the body apposite to the side of supratentorial lesion². It is also known as cerebral vascular accident or brain attack or apoplexy. In stroke there is reduced oxygen supply and blood supply to brain which may be because of blood clot in artery to the brain or a narrowing of arteries blocking the blood flow³.

Common problem after stroke are impaired motor functions including gait and balance disturbances. Balance impairment is a major consequence of stroke and is shown to greatly affect one's gait or the ability to carry out independently activity of daily living⁴.

Studies of balance impairments consistently have shown that people with stroke have greater postural sway than age-matched volunteers who are healthy. They also have altered weight distribution patterns, so that less weight is taken through the weak leg, and they have smaller excursions when moving their weight around the base of support, especially in the direction of the weaker leg. This pattern is seen in all aspects of balance—static, dynamic,

or responses to external perturbations—and even in people with stroke with high levels of function, such as those who are ambulatory in the community⁵. Balance status is one of the predictors of outcome of stroke rehabilitation¹.

In carrying out normal activities in daily life, the sit to stand motion is the most frequently occurring movement. It is precondition for engaging in independent gait or movements, and refer to the process of shifting one's centre of mass from sitting position to standing position.⁶

Loss or decline of this function leads to functional limitations in self-care, walking, and independent functioning. However, balance improvement as a result of exercise would support the value of developing and implementing long-term programmes for functional performance after stroke.⁷

The ability to maintain balance is the most basic element required for people to lead normal daily lives and perform intended activities. Balance training on an unstable surface has also been used. Training on an unstable surface rather than a stable surface can generate more external sway, thus improving postural control ability, can induce more diverse motions and muscular uses, can increase proprioceptive senses, and can potentially change the neuromuscular mobilization pattern. The training requires the subject to maintain their balance and posture or shift their weight n unstable surface such as a sling, a rocker

board, a swiss ball, and a balance pad.⁸ The Swiss ball is commonly used unstable surface in stroke rehabilitation. Its effects are widely studied and reported to be effective in improving balance and postural control.⁹

MATERIAL AND METHOD

A comparative study was done with 40 patients divided equally into two groups. Group A (Swiss ball exercise+ conventional therapy) and Group B (Sit to Stand exercise+ conventional exercise) each had 20 patients aged between 45 to 55 years with first time hemorrhagic stroke diagnosed middle cerebral artery involvement not more than of 3 months. Patients having mini mental status examination score greater than 24/30 and Brunnstrom recovery stage grading 2 to 4 were included.

PROCEDURE

Patients who were fulfill the inclusion criteria were included. Purpose of the study and procedure was explained to the patients. Written consent from patients was taken. Patients were conveniently divided into two groups with equal number of males and females patients in each group.

Group A: Conventional treatment + Swiss ball

Group B: Conventional treatment + sit to stand balance training exercise

Group A:

- Pre-training berg balance score and functional independence measure were recorded on day 1. Therapy was initiated with conventional therapy followed by Swiss ball exercises.

CONVENTIONAL THERAPY WAS INCLUDED

- Slow sustained stretches to spastic muscles with 30 sec hold with 5 repetitions.
- In upper limb: shoulder adductors, shoulder depressor, internal rotators, elbow flexors, forearm pronators and wrist and finger flexors.
- In lower limb: hip adductors and internal rotators, hip and knee extensors, plantar flexors and supinator and toe flexors.
- Passive movements of all joints on affected side.
- Mat exercises: rolling, quadruped, kneeling, half kneeling.
- Strengthening exercise to antagonistic muscle of spastic muscle.
- Functional activities such as bed mobility, standing, reaching, transfers, stair climbing and gait training on different surfaces.

SWISS BALL EXERCISES

- In supine lying
- Pelvic bridging: In supine lying both the patient's legs were placed on a Swiss ball and asked to lift the pelvis off the support surface. Initially the ball was kept beneath the knees and advanced to the

lower leg.

- Unilateral bridging: It was performed by lifting the uninvolved leg off the ball while maintaining the pelvic bridge position.
- Trunk rotation: It was performed by placing the both the patient's legs on the Swiss ball and asked to move the ball to both the left and the right by rotating the pelvis. Initially the ball was placed beneath the knees, and then advanced towards the ankles.
- IN SITTING
- Static sitting balance: In this the patient was seated on the Swiss ball with hips and knee bent at 90 degrees and the feet were kept flat on the support surface.
- Trunk flexion- extension: In this the patient was flex and extend the trunk without moving the trunk forwards or backwards.
- Upper trunk lateral flexion: It was executed by initiating movement from the shoulder girdle so as to bring the elbow towards the ball.
- Lower trunk lateral flexion: It was achieved by initiating movement from the pelvic girdle so as to lift the pelvis off the ball and bring it towards the ribcage.
- TRUNK ROTATION:
- Upper trunk rotation: It was performed by moving each shoulder forwards and backwards.
- Lower trunk rotation: It was performed by moving each knee forwards and backwards.
- Forward reach: It was performed by asking the patient to reach a fixed point at shoulder height by forward flexing the trunk at the hips.

Lateral reach: It was performed by asking the patient to reach out for a fixed point at shoulder height so as to elongate the trunk on the weight-bearing side and shorten the trunk on the non-weight-bearing side.

Exercise progression: The participants were performed 15 repetitions in the first two weeks; it was increased after the second week to 20 repetitions and finally 25 repetitions at the last two week, making a total of 6 weeks.

Group B:

- Pre-training berg balance score and functional independence measure were recorded on day 1. Therapy was initiated with conventional therapy followed by sit to stand balance training exercises.

CONVENTIONAL THERAPY INCLUDES

- Slow sustained stretches to spastic muscles with 30 sec hold with 5 repetitions.
- In upper limb: shoulder adductors, shoulder depressor, internal rotators, elbow flexors, forearm pronators and wrist and finger flexors.

- In lower limb: hip adductors and internal rotators,, hip and knee extensors, plantar flexors and supinator and toe flexors.
- Passive movements of all joints on affected side.
- Mat exercises: rolling, quadruped, kneeling, half kneeling.
- Strengthening exercise to antagonist muscle of spastic muscle.
- Functional activities such as bed mobility, standing, reaching, transfers, stair climbing and gait training on different surfaces.

Balance Training Exercise: The balance training exercise was sit-to-stand training exercise. The balance training was conducted according to standard protocol.²

Step 1: Participant was ask to sit on the chair, well supported by the back of the chair. Sit upright with the feet flat on the floor and the knees at right angle to the ankles.

Step 2: Shift forward to the edge of the chair by placing hands on the sides of the chair to assist, in so doing keep the back and head straight.

Step 3: Place hands, palms down, on the thighs. Push down with the hands as one stands up. Step 4: Participant was continues pressing down on the thighs with the hands as one stands all the way up, making sure the weight gradually shifts forward from the heels to the entire foot. Keep a small bend in the knees at all times without buckling towards each other.

Step 5: Gently sit back down into the chair and repeat 10 times

Step 6: Placed the hands on the back of a second chair in front, if needed. Breathe normally throughout the exercise.

Balance Training Exercise Progression: The participant performed 15 repetitions in the first two weeks; it was increased after the second week to 20 repetitions and finally 25 repetitions at the last two week, making a total of 6 weeks.

Patients balance and functional independency were reassessed by berg balance scale and functional independence measure score were documented.

DATA ANALYSIS

This chapter deals with the analysis of data collected of 40 patients. The analysis was carried out by using suitable tests with the help of IBM Statistics package (SPSS 20) in order to verify the investigation of the study. Paired t test was used to find the difference within the group between pre and post intervention scores in the outcome measures. Unpaired t test was used to find the difference between the groups in the outcome measures. The statistical significance for this study was set as $p < 0.005$.

RESULT

By applying paired t test we compared within group values of BBS for group A we found significant difference between pre and post treatment values with a mean of 16.75 ± 8.66

SD and 45.55 ± 6.13 SD respectively.

Similarly we compared within group values of BBS for group B by we found significant difference between pre and post treatment values with a mean of 17.20 ± 7.05 SD and 41.55 ± 4.66 SD.

When we compared within group values of FIM for group A we found significant difference between pre and post treatment values with a mean of 43.10 ± 7.03 SD and 90.30 ± 13.91 SD respectively.

Similarly we compared within group values of FIM for group B by we found significant difference between pre and post treatment values with a mean of 45.20 ± 7.90 SD and 79.80 ± 7.63 respectively.

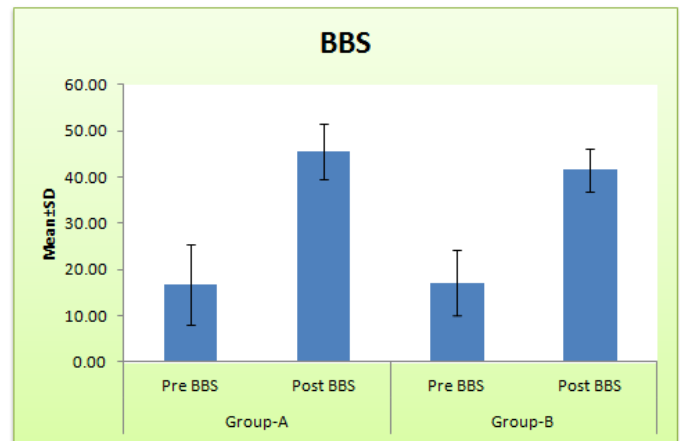
So the above finding showed that the Swiss ball exercises and sit to stand balance training exercise both have significant improvement in balance and functional independence of patients.

T- Test

BBS

		Mean	Std. Deviation	t-value	p-value
Group-A	Pre BBS	16.75	8.66	34.871	.0001**
	Post BBS	45.55	6.13		
Group-B	Pre BBS	17.20	7.05	28.752	.0001**
	Post BBS	41.55	4.66		

Table showing the change in pre and post treatment values of mean, SD with t value and p values over BBS within group A and within group B



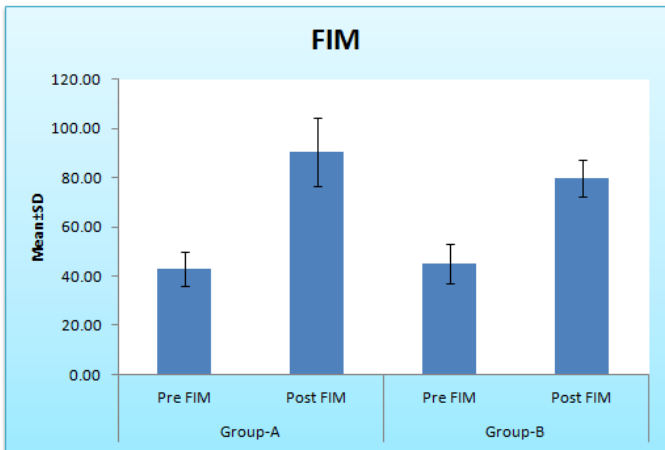
The above mentioned graph showing the mean value of change over BBS within group A and within group B

FIM

		Mean	Std. Deviation	t-value	p-value
Group-A	Pre FIM	43.10	7.03	19.290	.0001**
	Post FIM	90.30	13.91		
Group-B	Pre FIM	45.20	7.90	18.284	.0001**
	Post FIM	79.80	7.63		

Table Showing the change in pre and post treatment

values of mean, SD with t value and p values over FIM within group A and within group B



The above mentioned graph showing the mean value of change over FIM within group A and within group B

Both the groups were showing significant difference when we compare within group values for BBS and FIM then we found between group difference for that we used unpaired t test.

The result of that unpaired t test shows that there was non significant difference between group A and B before treatment on score of BBS (p=.858) and FIM (p=.380) whereas when we compared the values after treatment on score of BBS there was significant difference (p=.026*) between groups with mean values of 45.55 + 6.13 SD and 41.55 + 4.66 SD respectively and also on score of FIM there was significant difference (p=.005*) between groups with mean values of 90.30 + 13.91 SD and 79.80 + 7.63 SD respectively.

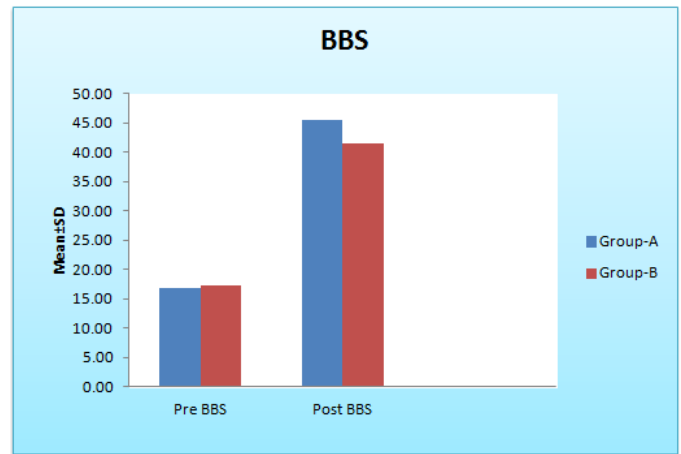
Overall this result showed that group A has higher mean value than group B both on BBS and FIM.

This indicate that Swiss ball exercise training have more improvement than sit to stand balance training exercise in balance and functional independence of patient after stroke.

BBS

Group		Mean	Std. Deviation	t-value	p-value
Pre BBS	Group-A	16.75	8.66	.180	.858
	Group-B	17.20	7.05		
Post BBS	Group-A	45.55	6.13	2.324	.026*
	Group-B	41.55	4.66		

Table showing the change in pre and post treatment values of mean, SD with t value and p values over BBS between group A and group B

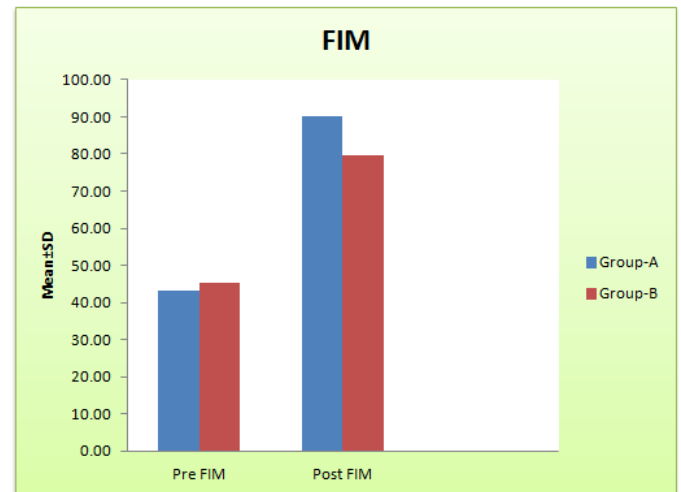


The above mentioned graph showing the mean value of change over BBS between group A and group B

FIM

Group		Mean	Std. Deviation	t-value	p-value
Pre FIM	Group-A	43.10	7.03	.888	.380
	Group-B	45.20	7.90		
Post FIM	Group-A	90.30	13.91	2.960	.005**
	Group-B	79.80	7.63		

Table showing the change in pre and post treatment values of mean, SD with t value and p values over FIM between group A and group B



The above mentioned graph showing the mean value of change over FIM between group A and group B

DISCUSSION

This study investigate the effectiveness of Swiss ball exercises along with conventional therapy compared with sit to stand balance training exercise along with conventional therapy on balance and functional independence in hemiplegic stroke patients.

When compared the result within groups A and B respectively on BBS and FIM it shows that the patient treated with Swiss ball combined with conventional

therapy and those treated with sit to stand balance training exercise combined with conventional therapy had significant improvement on balance and functional independence. But on comparison between both groups on BBS and FIM the improvement was more in patients of group A who were treated with Swiss ball along with conventional therapy.

Training on Swiss ball provides the patient with visual and somatosensory feedback at each challenge level. This is supported by the study on relationship of sensory organization to balance function in patient with hemiplegia by Richard Fabio, Mary Badke who found that balance behaviour can be influenced by somatosensory, visual and vestibular system.¹

The another possible reason for better improvement in Swiss ball group may be as the movement of Swiss ball under patient provide a postural perturbation to which the trunk muscle respond reactively in order to maintain the desired postural stability.¹⁰

The achievement of good balance will translate to a better functional performance. This may be due to the fact that if an individual is able to maintain good balance he/she may be able to perform independent function without fear of losing balance or fall. The fact that functional independency increase with balance performance in a balance training protocol shows that balance training can be used to compliment functional training and functional performance in an individual with functional deficiency.⁷

Most subject in study had reduced social activity were restricted to home due to fear of fall, could not use public transport and could not walk in crowded places. After training, patients were more confident about their upright posture and its control thereby became more social.

Therefore we can say that Swiss ball training enhance the effect of conventional therapy on balance and functional independence in hemiplegic stroke patients. The most promising application of the study would be to implement balance training on Swiss ball in early phase of rehabilitation to provide a reduce risk of falling.

CONCLUSION

The result of present study shows that exercise on Swiss ball and sit to stand balance training exercise both improve the balance and functional independence but statistically Swiss ball training give more significant improvement in improving balance and functional independence in stroke patient.

REFERENCES

1. Preeti Gazbare, Tushar Palekar. Effect of Swiss ball training on balance in hemiplegic Patient. Indian

Journal of Physiotherapy and Occupational Therapy. 2014;8:4.

2. Rajrupinder Kaur Rai, Lalit Arora, Smati Sambyal, Reena Arora. Efficacy of trunk rehabilitation and balance training on trunk control, balance and gait in post stroke hemiplegic patients. IOSR Journal of Nursing and Health Science. 2014;3(3):27-31.

3. Kanika D. Muniyar, Shrikant B. Darade. The effect of Swiss ball training & conventional physiotherapy was effective to improve balance & mobility in post-stroke. International journal of physiotherapy and research. 2018;6(4):2813-2822.

4. Masahito Mihara, Ichiro Miyai, Noriaki Hattori, Megumi Hatakenaka, Hajime Yagura, Teiji Kawano et al. Cortical control of postural balance in patients with hemiplegic stroke. Neuroreport. 2012;23(5):314-319.

5. Sarah F Tyson, Marie Hanley, Jay Chillala, Andrea Selley, Raymond C Tallis. Balance disability after stroke Physical Therapy. 2006;86(1):30-38.

6. Byeong-mu Mun, Yeon-seop Lee, Tae-ho Kim, Ji-hyun Lee, Sun-mi Sim, In-mo Park et al. Study on the usefulness of sit to stand training in self directed treatment of stroke patients. J. Phys. Ther. Sci. 2014;26:483-485.

7. Caleb Ademola Gbiri, Aishat Shittu. Effect of A Six Weeks Balance Training On Balance Performance and Functional Independence in Hemiplegic Stroke Servivors. Indian Journal of Physiotherapy and Occupational Therapy. 2014; 8:4.

8. Gui Bin Song, Eun Cho Park. Effect of dual task on balance ability in stroke patients. J. Phys. Ther. Sci. 2015;27:2457-2460.

9. Vadnagarwala Rasheeda, Ramachandran Sivakumar. The effect of Swiss ball therapy on sit to stand function, paretic limb weight bearing and lower limb motor score in patients with hemiplegia. Int J Physiother. 2017; 4 (6):319-323.

10. S Felix Renald, J Raja Regan. Efficacy of trunk exercises on Swiss ball versus bed in improving trunk control in hemiparetic patients. Int J Physiother Res. 2016;4(2):1444-1450.