



To Compare the Efficacy of Trunk Stability Exercise Versus Swiss Ball Exercise Combined with Conventional Therapy on Recovery of Postural Control and Balance in Hemiparetic Patients

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Stroke, Posture, Balance, Trunk Stabilization, Swiss Ball & Hemiparesis.

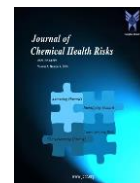
ABSTRACT:

Introduction :- The term stroke was coined and introduced to medicine by William Cole in the late 17th century (Cole 1689). Physiologically stroke is an acute, focal injury of the central nervous system of a vascular origin, contributing to a local or systematic neurological insult. After having a stroke, patients exhibit spasticity, cognitive impairment, decreased balance, sensorimotor deficiency, and may also have insufficient strength or tone in their trunk muscles. Balance, stability, and functional impairment might be hampered by the weakening of the trunk muscles and the loss of proprioception on the affected side.

Aims & Objectives:- To compare the efficacy of trunk stability exercise versus Swiss ball exercises in combination with conventional therapy on the recovery of postural control and balance in hemiparetic stroke patients.

Objective of Study:- To evaluate the efficacy of trunk stability exercise versus Swiss ball exercises in combination with conventional therapy on the recovery of postural control and balance in hemiparetic stroke patients.

Methodology :- All the participants were explained about the purpose of study. The subjects were screened for inclusion and exclusion criteria and then the baseline measurement was taken. An informed consent was taken from patients who were willing to participate in the study. Eligible subjects were randomly allocated into two groups. Group A participants receiving Trunk stabilization exercise along with conventional therapy. Group B participants receiving Swiss ball training along with conventional therapy. Both groups had received exercise program for postural control and balance. The study was of 6 weeks, 5 days per week at the department of physiotherapy in SMIH.



Results:The data were analyzed using the statistical software SPSS 20 version. To analyze the difference of BBS and PASS of Group-A and Group – B paired t- test was applied. The p values <0.05 in Group- B showing extremely significant and also in Group- A.

Conclusion:-Trunk stabilization exercise along with conventional therapy and Swiss ball training along with conventional therapy both showed improvement on recovery of postural control and balance in hemiparetic patients. But swiss ball exercises along with conventional therapy exercises shows more significant improvement in improving posture, weight shifting and balance reactions.

1. Introduction

In low- and middle-income nations like India, stroke is increasingly contributing to premature death and disability. This trend is mostly being driven by demographic changes and is being exacerbated by the rising prevalence of the main modifiable risk factors. As a result, non-communicable and communicable diseases place a double burden on developing nations. Because of changing population exposures to risk factors and, most tragically, their inability to pay the high cost of stroke care, the poor are becoming more and more afflicted by stroke.^[1]

The adoption of a new definition of stroke in the United States happened step by step, starting with the reclassification of transient ischemia. According to the earlier definition of transient ischemic attacks, they are "a rapid, focused neurologic deficit that lasts for less than 24 hours, is considered to be of vascular origin, and is restricted to an area of the brain or eye perfused by a specific artery."^[2]

After having a stroke, patients exhibit spasticity, cognitive impairment, decreased balance, sensorimotor deficiency, and may also have insufficient strength or tone in their trunk muscles. Balance, stability, and functional impairment might be hampered by the weakening of the trunk muscles and the loss of proprioception on the affected side. These patients have restricted functional capacities and a higher probability of falling toward the paretic side.^[3]

Trunk function issues are frequent in stroke patients. Trunk function has been demonstrated to be a useful predictor of balance, walking ability, and activities of daily living (ADL) outcomes in stroke patients and is related with these abilities. Trunk training is said to have improved trunk performance in experimental groups in several randomised controlled trials that looked at trunk function in stroke populations. Stabilization training is typically used in conjunction with muscle strength and

muscular endurance training to enhance the performance of the trunk muscles.^[4]

Static and dynamic balance are two different ways of maintaining one's centre of gravity within the base of support for one's body weight. The capacity to stand on a stationary surface without experiencing postural sway is known as static balance. Age, gender, cognitive capacity, musculoskeletal problems, sensory abnormalities, and muscular tone are some of the characteristics that can impair balance ability. Patients' everyday activities are limited and their danger of falling when their ability to balance is compromised.^[5]

Because Swiss ball exercise can enhance muscle strength, endurance, flexibility, and coordination as well as perceptual balancing ability, it is used as a rehabilitation tool to correct posture and to cure and prevent discomfort in the neck and waist.^[6]

In order to maintain an upright stance during functional activities and to account for both internal and external body disturbances to prevent falls, one must have postural control. In 50% of post-stroke patients, balance and postural abnormalities are among the most common aftereffects.^[7]

Balance regulation in the sitting and standing positions is a crucial motor behaviour skill for regaining autonomy in daily activities after a stroke. Long-term functional improvement has been found to be highly connected with postural performance of patients soon after a stroke.^[8]

2. Aims and Objectives

Aims:- To compare the efficacy of trunk stability exercise versus Swiss ball exercises in combination with conventional therapy on the recovery of postural control and balance in hemiparetic stroke patients.

Objective of study:- To evaluate the efficacy of trunk stability exercise versus Swiss ball exercises in combination with conventional therapy on the recovery



of postural control and balance in hemiparetic stroke patients.

3. Methods

Simple random sampling technique was used. Thirty (30) men and women subjects of age between 45-60 with stroke who were willing to take treatment for 6 weeks session after a written consent were taken. The subjects were divided into two Groups. Group A 15 patients in group B..15 patients were selected randomly and was included in group A and 15 patients in group B. Study group was divided into two groups (A & B). First group A consist of patient in which treatment was given with trunk stability exercises with conventional therapy and second group B consist of patients in which treatment was given with swiss ball exercises with conventional therapy. The study was conducted at the department of physiotherapy and neuro ward SGRRIMHS/SMIH, Patel Nagar, Dehradun Uttarakhand. Each subject has received treatment for 30 min five days a week for - 6 weeks. Time duration will be 30 min for each session. The subjects were selected according to inclusion and exclusion criteria. Subjects were included as 45-60 years of age, 1-3 months post stroke patients, Motor Assessment Scale sitting score of 3, Brunnstrom recovery stage score 4,,Both males and females, No visual deficits and No sensory deficits, Subjects were excluded as history of any severe injury or defects, peripheral vascular disease, neuromuscular abnormalities, orthopaedic abnormalities, cardiac abnormalities and uncooperative subjects. Independent variables: Swiss ball training and Trunk stabilization exercises. Dependent variables: Balance and Postural co-ordination. Outcome measures: - Berg balance score for balance and Postural analysis scale

Procedure:- The subjects were taken for primary evaluation and those who satisfied the inclusion criteria were randomly allocate into two groups A and B. Individuals selected for the study were assessed prior and post of the intervention program with outcome measure like: Berg balance score and Postural assessment scale. Group A receives Trunk stabilization exercise for 45 minutes in addition to conventional treatment. At the beginning of treatment program , 5 minutes warm up exercises were given. Intermittent rest periods were conducted between each set of exercise. At the end of training program cool down exercises were carried out,

monitored and supervised with an adequate care to avoid the risks of falls or fracture.

WARM –UP :

➤ **5 minutes brisk walking.**

➤ **Mild stretching :** Hamstring stretch, gluteus maximus stretch, quadriceps stretch , Gastrocnemius & soleus stretch , trapezius & deltoid stretch, biceps , triceps, erector spinae , latissimus dorsi and rhomboids stretch, paraspinal stretch. (5 repetitions and 10 seconds hold).

Trunk exercises or other activities targeting the trunk while sitting/lying, to minimize the influence of lower extremity function.

Reaching: performed beyond arm's length to enhance the truncal influence.

✧ **Core stability:** consisting of task-specific movements of the upper and lower parts of the trunk both in the supine and sitting, for example, bridging, dead bug position, planking and so on.

✧ **Weight shifting:** the pelvis shifted the body weight to the paretic side and back, aiming to encourage the experience of weight-bearing on the paretic side during sitting.

✧ **Cool down:** 5 Minutes walking, Light stretching - hip extensor and hip flexor stretch, Gastrocnemius and soleus stretch, core muscle stretch , Paraspinal stretch (5 repetitions and 10 seconds hold)



Fig 4.1 (a) Showing Patient Reaching Forward



Figure:- 4.1 (b) showing patient bridging



Fig 4.1(c) showing patient weight shifting

Group B receives Swiss ball training along with conventional physiotherapy was administered to subjects for 3 to 5 times a week for 6 weeks. At the beginning of treatment program, 5 minutes warm up exercises were given.

Swiss ball training includes supine exercises, sitting exercises, Standing exercises, Prone exercises, Trunk rotations, Swiss ball core stability enhancing exercises, Swiss ball balance and co-ordination exercises. Conventional physiotherapy interventions included Stretching & strengthening exercises, PNF techniques & passive movements.

Supine Exercises:

Bridging

Trunk rotations (upper trunk and lower trunk)

Bridging: Patient is asked to lie down on mat in supine position. With hip flexed and knee extended, patient's legs are kept on Swiss ball. Patient is asked to lift off the pelvis with the Swiss ball placed under knees, then slowly and progressively the ball is placed under the foot, in order to increase the ability to maintain balance. The position is maintained for 10sec.

Lower trunk rotations: In supine lying, with both the lower limbs supported on the Swiss ball. Then in crook lying position patient is asked to move the knees and rotate the pelvis on either sides. Slowly the position of Swiss ball is shifted from knees to foot end in order to gain more control.

Prone Exercises:

- ❖ Swiss ball opposite arm and leg lift
- ❖ Back extension (abdomen supported on ball) or T-raise.

Swiss ball opposite arm and leg lift: In prone position, patient lies down on belly-side, so that the navel is over the center of Swiss ball and trunk is supported. Initially

both hands and feet are supported on floor. Then slowly patient lifts his alternate one arm and one leg (right arm and left leg) and maintains the position for 10 sec.

Back extension: In prone position, patient lies on the ball with umbilicus over the center of Swiss ball. Initially the upper body was relaxed and both feet were in contact with the floor. Then, both hands were kept behind the head with both feet on ground and patient was asked to lift the upper body up and extend his back. The position was maintained progressively for 5-10 second.

Sitting exercises:

- ❖ Trunk flexion and extension
- ❖ Static sitting balance
- ❖ Swiss ball rocking
- ❖ Trunk lateral flexion
- ❖ Front and back bending
- ❖ Forward reach
- ❖ Lateral reach

Trunk flexion & extension: In sitting position on Swiss ball, initially patient is asked to flex and extend the trunk without moving the forwards or backwards. Then patient is asked to flex and extend his lumbar spine. Slight rotations of the trunk also occur with flexion and extension.

Static sitting balance: The patient is told to sit firm on the Swiss ball and asked to maintain a correct back posture and balance with both the feet on the ground. Position is maintained for 10 second.

Swiss ball rocking: Patient is made to sit on the Swiss ball and asked to rock (bounce) the pelvis and hips from side to side, front to back, up & down or in circular direction.

Trunk flexion: In sitting position on Swiss ball, patient is asked to laterally flex his trunk. Upper and lower trunk lateral flexion initiates with the movement of shoulder and pelvis girdle.

Front and back bending: In sitting position on Swiss ball, with clasped hands position the patient is asked to bend the trunk forward and backward.

Forward reach: In sitting position on Swiss ball, patient is asked to reach the object in forward direction. So when the patient reaches forward towards the object, rotations also occur with the trunk flexion.

Lateral reach: In sitting position on Swiss ball, patient is asked to reach the object by flexing his trunk laterally.

STANDING EXERCISES :

✧ Wall squatting exercises (swiss ball squats) with knees in extension

✧ Wall squat with knees bending

Swiss ball wall squats with knee extension: patient is asked to Stand and hold the swiss ball behind the back, so that the swiss ball should get pressed between the wall and patient's back. Keep the little distance between both the feet so that body can maintain balance. Maintain the position for 10sec.

Swiss ball wall squats with knee bending: Initially, Patient is asked to stand and hold the swiss ball behind his back. Then patient is asked to slowly bend his knees with the ball supported where the ball is pinned between wall and patient's back. Maintain the position with bent knees for 10 second.



Fig 4.2 (a) showing patient bridging with swiss ball



Fig 4.2 (b) showing patient doing wall squatting with knee bending



Fig 4.2 (c) showing patient Trunk lateral flexion with swiss ball



Fig 4.2 (d) showing patient Forward reaching

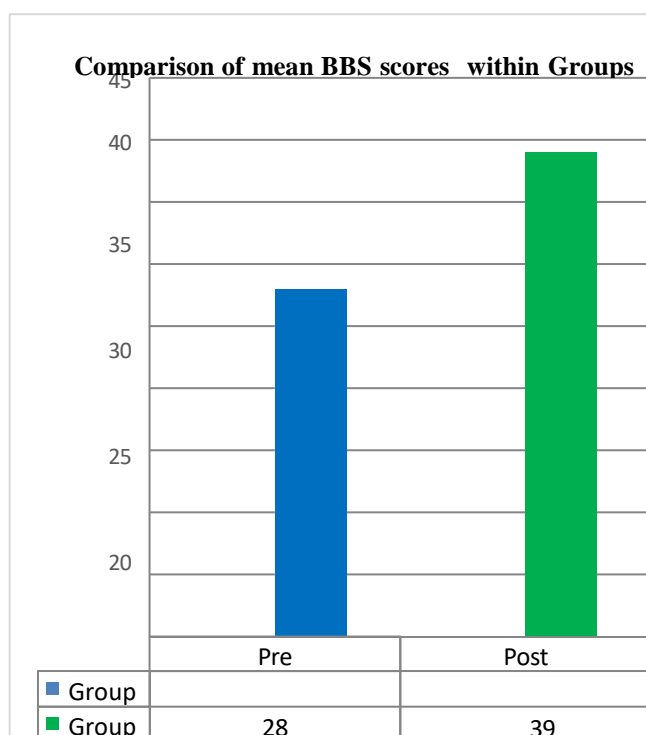
Results

The data were analyzed using the statistical software SPSS 20 version. To analyze the difference of BBS and PASS of Group-A and Group – B paired t- test was applied. The p values <0.05 in Group- B showing extremely significant and also in Group- A.



Duration	Mean \pm SD	t-value	p-value
Baseline (0 Week)	28.6000 \pm 5.24813	-13.552	0.000
After 6 week	39.7333 \pm 6.1466 2		

Table-1 : Comparison of mean BBS scores within Groups A

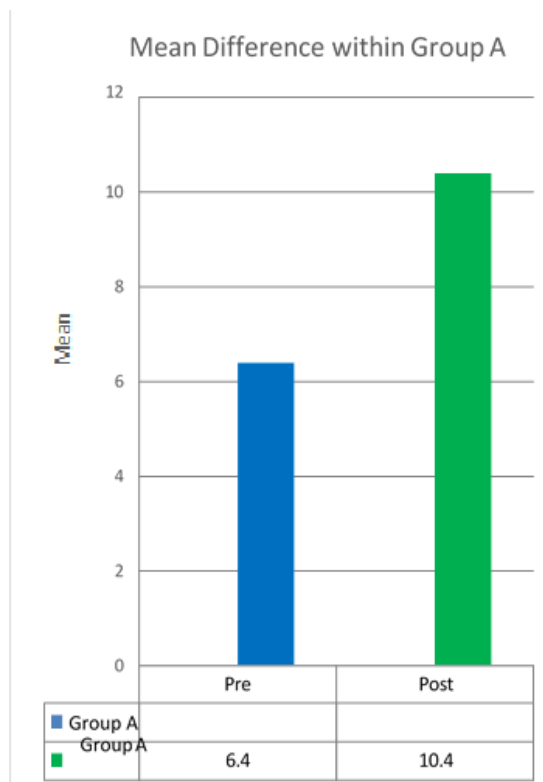


Graph-1 : Comparison of mean BBS scores within Groups A

EXPLANATION: From the table above we can see that the value of mean is more in post intervention of BBS scores in Group A. As $p < 0.05$, It shows that there is a significant difference between the pre & post scores of BBS. The difference is also shown by the graphs also.

Duration	Mean \pm SD	t-value	P-value
Baseline (0 Week)	6.4000 \pm 1.88225	-13.663	0
After 6 week	10.4000 \pm 1.88225		

Table-2 : Comparison of mean PASS Scale scores within Groups A.

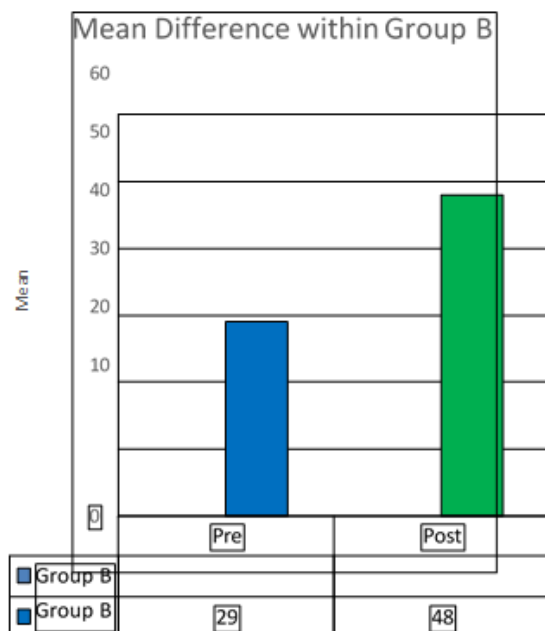


Graph-2 : Comparison of mean PASS Scale scores within Groups A.

EXPLANATION : From the table above we can see that the value of mean is more in post intervention of PASS in Group A. As $p < 0.05$, It shows that there is a significant difference between the pre & post scores of PASS. The difference is also shown by the graphs also.

Duration	Mean \pm SD	t-value	p-value
Baseline (0 Week)	29.5333 \pm 5.97455	-16.303	0
After 6 week	48.8667 \pm 4.71876		

Table-3 : Comparison of mean scores BBS within Groups B

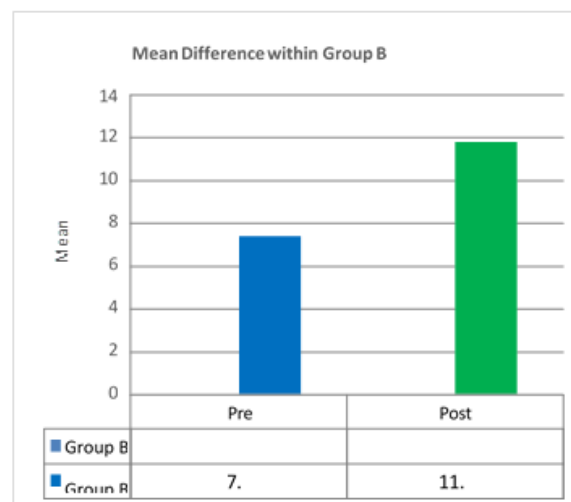


Graph-3 : Comparison of mean scores BBS within Groups B

EXPLANATION: From the table above we can see that the value of mean is more in post intervention of BBS scores in Group B. As $p < 0.05$, It shows that there is a significant difference between the pre & post scores of BBS. The difference is also shown by the graphs also.

Duration	Mean \pm SD	t-value	p-value
Baseline (0 Week)	7.4667 \pm 2.19957	-17.197	0
After 6 week	11.8000 \pm 1.61245		

Table-4 : Comparison of mean PASS scores within Groups B



Graph-4 : Comparison of mean PASS scores within Groups B

EXPLANATION: From the table above we can see that the value of mean is more in post intervention of PASS scores in Group B. As $p < 0.05$, It shows that there is a significant difference between the pre & post scores of PASS. The difference is also shown by the graphs also.

Discussion

Patients with stroke experience balance impairment as a result of anomalies in their proprioceptive system, sensory system, trunk muscles, and limb muscles. Stroke frequently results in immediate paralysis on the damaged side, reducing the trunk's capacity to adjust. Particularly, a decrease in the activity of the trunk muscles inhibits movement of the pelvis, causing the trunk to become asymmetrical and preventing the employment of counterbalance techniques.

Balance is a difficult motor control task that requires coordinated responses from the musculoskeletal, ocular, vestibular, and proprioceptive systems and mental processes. Having balance is a skill to keep the gravitational field in balance by keeping a base of support for the body's centre of mass support. All practical activities carried out in our daily lives require the capacity to maintain balance while sitting, standing, and walking.

Due to motor incoordination, sensory disintegration, muscular weakness, shortening of muscles with loss of



ROM, abnormal muscle tone & stiffness, and other factors, post-stroke causes a multidirectional impairment of a group of muscles that affects them in multiple ways. This leads to poor balance and posture. Patients have decreased walking speed, are unable to walk on their own, have decreased cadence, endurance, stride length, and symmetry, which causes longer stance time on the non-paretic side and decreased step length on the paretic side.

In this study 30 post-stroke patients were randomly assigned to the Group A and Group B. Among these 30 patients, 15 patients were included in the Group A who receive trunk stabilization exercises with conventional therapy and rest 15 patients were included in Group B who receive swiss ball exercises with conventional therapy. Each group receive 45 min. physiotherapy, 5 days for 6 weeks.

The outcome was measured by using Berg balance scale and postural assessment scale. Balance and postural impairments were the early predictor in post-stroke patients. The main objective of the study was to improve the overall balance and postural impairments with use of trunk stability exercises along with conventional physiotherapeutic interventions and swiss ball training along with conventional physiotherapeutic interventions. Treatment given at the early stage of symptoms, improved a much better balance and postural stability in post-stroke.

Balance maintenance is a very important element for safe and independent performance in ordinary life of movements and walking (Ryerson S et al, 2008). The BBS is based on (2008) study by Lisa Blum, Nicol Korner-Bitensky suggest that it is an effective and appropriate assessment of balance in patients with stroke.

Postural assessment is a key point of the rehabilitation program in stroke patients. The Postural Assessment Scale for Stroke Patients (PASS) based on Charles Benaim, Dominique Alain Pérennou, (1999) confirm that the PASS is one of the most valid and reliable clinical assessments of postural control in stroke patients during the first 3 months after stroke. BBS and PASS are preferred tool due to its superior characteristics and clinical utility and comparable psychometric properties.

Group A receives Trunk stabilization exercises along with conventional therapy exercises. According to BBS and PASS, Post-intervention analysis demonstrates a small but significant shift. This suggests that using trunk stability exercises in addition to conventional therapy is not very effective at helping stroke patients with balance and posture. The purpose of the trunk stabilization exercise is to change the aspect of the trunk muscles to increase the ability to regulate movement, to maintain proper coordination between muscles, and to create stability of the trunk against external resistance, hence improves the balance ability.

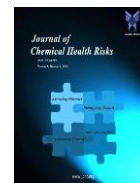
Group B receives Swiss ball training along with conventional therapy exercises which shows significant shift in post-intervention analysis using BBS and PASS. Exercise balls, or "Swiss Balls," were first developed in 1963. They have since been largely used in physical therapy settings for various purposes: Developing strength, flexibility, relaxation, balance reactions, and coordination (Posner-Mayer, 1995). Sitting on the ball requires the center of gravity to be maintained over a mobile base of support. Proper posture, joint alignment, weight shifting, equilibrium reactions, and righting reactions must be utilized in order to maintain balance. In addition, movements on the ball displace the center of gravity, therefore, balance reactions are being further tested (Hypes, 1991)

Conclusion

The study proves that swiss ball exercises in addition to the conventional therapy is more effective in improving postural control and balance of hemiparetic patient, than the trunk stabilization exercise along with conventional therapy. So swiss ball exercises in addition to the conventional therapy can be used as an effective treatment programme in improving postural control and balance of hemiplegic patients than receiving trunk stabilization exercises with conventional physical therapy. This helps the patient to improve the quality of functional independence

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