ejpmr, 2022,9(1), 402-407

SJIF Impact Factor 6.222

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Research Article

ISSN 2394-3211

EJPMR

EFFECTIVENESS OF CORE STABILITY EXERCISES AND PHYSIOBALL EXERCISES ON TRUNK CONTROL AND BALANCE IN POST STROKE SUBJECTS

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Article Received on 09/11/2021 **Article Revised on 30/11/2021** **Article Accepted on 20/12/2021**

ABSTRACT

Background and Objectives: Stroke is defined as rapidly developing clinical signs of focal or global disturbances of cerebral function with symptoms lasting for 24 hours or longer or leading to death with no apparent cause other than of vascular origin. Functional inactivity commonly leads to poor quality of life it is; it affects the activities of daily living (ADL's). The purpose of this experimental study is to compare and summarize the evidences for the effectiveness of core stability exercises and swissball exercises on trunk control and balance of post stroke subjects. **Methodology:** 30 hemiplegic patients were assigned into two treatment groups. The first group (n=15) was treated with Core stability strength exercises. The second group (n=15) was Physioball exercises. The effect of 5 weeks treatment was measured by Berg Balance Scale score (BBS) and Trunk impairment scale (TIS). **Results:** Statistical analysis of the data revealed that the scores from TIS and BBS analysis of the pre score and post score intervention shows a significant improvement in core stability exercises Group (Group A) and physioball exercises group (Group B). **Conclusion:** Finally, the study concluded Both the groups shows significant improvement on trunk control and balance in post stroke subjects but core stability exercises shows more improvement than physioball exercises in improving trunk control and physioball exercises shows more improvement than core stability exercises in improving balance in post stroke subjects.

KEYWORDS: Stroke, berg balance scale, trunk impairment scale, Balance, Core stability, Physio ball exercises.

INTRODUCTION

Stroke is defined as rapidly developing clinical signs of focal or global disturbances of cerebral function with symptoms lasting for 24 hours or longer or leading to death with no apparent cause other than of vascular origin.[1] The major causes of stroke may be high blood pressure, smoking, alcohol, diabetes, obesity, artery diseases. Unlike myocardial infarction, which is almost always due to large vessel atherosclerotic disease affecting the coronary arteries, identification of risk factors for stroke is complicated by the fact that strokes come in many varieties. Stroke survivors have difficulty in balance and postural control for standing upright because they are impaired by asymmetric posture, abnormal body imbalance, and deficit of weight transfer. The trunk being the central key point of the body, proximal trunk control is a pre requisite for distal limb movement control, balance and functional activities. Many hemiplegics shift their center of gravity to unaffected side when maintaining quiet stance and show left right asymmetry and decreased balance ability.[2]

Symmetry of weight bearing is also impaired following stroke, with patients bearing as much as 61% to 81% of their body weight through non – paralytic lower extremity. Hemiplegia also can cause a reduction in patient's limits of stability.[3] A major focus of rehabilitation program therefore is needed to improve trunk control and balance. The outcome measure used for measuring balance is berg balance scale.[4]

Trunk function is associated with balance and walking ability in stroke patients, and has also been found to offer a useful predictor of balance and walking ability in activities of daily living.[5] The outcome measure used for measuring trunk function / trunk control is the trunk impairment scale.[6]

Core stabilization exercises are the exercises that are done to develop the muscular control that is required around the lumbar spine for maintenance of functional stability. The 'core' has been described as a box, with the abdominals in the front, paraspinal and gluteal muscles in the back, the diaphragm as the roof, and the pelvic floor and hip girdle musculature as the bottom.[7]

Core stability is usually used to strengthen the muscles around the abdominal, lumbar, and pelvic regions, because the muscles of these regions play an important role in stability as well as in controlling the lumbar posture by using tonic or postural muscles during whole-body exercises. The following muscles are related to core

stability: multifidus, transversus abdominis, external/internal oblique abdominis, paraspinalis, gluteus, diaphragm in rear part, and hip muscles. The ventral muscles, multifidus, transversus abdominis, and oblique abdominis, provide core stability via cooperative contraction before moving out. The multifidus muscle serves as the intersegmental muscle placed on spiral part, followed by the interspinales and intertransverse muscles.[8] These muscles control movement of the spinal units while lifting things and while rotating the core. Additionally, owing to the short length of these muscles, the reaction time is very rapid and this is highly important for maintaining stability.

Physio balls are a popular and versatile piece of fitness equipment used in gyms, homes, physical therapy sessions and even the workplace. Also known as exercise balls, Swiss balls, Physio balls, and balance balls, the purpose of the physio ball is to improve balance, muscle tone and core strength.[12]

Hence from the above literature both the intervention that is core stability exercises and physio ball exercises, both are effective in improving trunk control and balance and there is no study comparing these two groups till date.

AIM OF THE STUDY

The aim of the study is to find out the effectiveness of physioball exercises and core stability exercises on trunk control and balance in post stroke subjects.

OBJECTIVES OF THE STUDY

To determine the effectiveness of physio ball exercises and core stability exercises on trunk control and balance in post stroke subjects.

METHODOLOGY

STUDY SETTING: Outpatient department, sims college of physiotherapy, Guntur.
STUDY DESIGN: comparative study.
SAMPLING METHOD: simple random sampling method.
STUDY DURATION: 5 weeks.
SAMPLE SIZE: 30 subjects.
GROUP – A: 15 subjects: received core stabilization exercises GROUP – B: 15 subjects: received physio ball exercises.

MATERIALS USED

Swiss ball
Mat
Couch
Pillows
Chair
Assessment chart
Marking tools
Berg balance scale
Ruler
Two standard chairs (1 with arm rests, 1 without)
Footstool or step
Stopwatch
15 ft walkway

INCLUSION CRITERIA

1st onset of unilateral stroke
Independent ability to sit for 30 seconds
The ability to reach with intact arm
Age between 50 – 70 years.
Both genders (male and female)

EXCLUSION CRITERIA

Visual problems which would interfere with reaching to pick up objects
Vestibular lesions
Hemi spatial neglect
Musculoskeletal disorders of trunk or lower extremities affecting the motor performance
Severe aphasia
Other neurological problems like cerebellar disorders, parkinsonism etc
Cardiovascular conditions

OUTCOME MEASURES

BERG BALANCE SCALE

BBS has a good reliability and validity with a score of Test retest (ICC=0.98); Internal Consistency (a=0.98); Inter observer (ICC=0.97) and validity of (r=0.81).

TRUNK IMPAIRMENT SCALE

The TIS score ranges from 0 to 23, with higher points indicating good core control ability. Inter-tester reliability ranged from 0.87 to 0.96 and intra-tester reliability from 0.85 to 0.99, indicating high reliability and internal validity.[13]

PROCEDURE

Subjects of age group between 30 to 50 years those who fulfilled the inclusion criteria will be randomly selected for this study. A consent form will be signed prior to the study in which the patient care givers are thoroughly explained about the study. All the subjects who are chosen in group B received physio ball exercises and group A received core stabilization exercises for 5 weeks in 2 sessions per day for 6 days a week. Each session will last for 60minutes. Pre-test and post-test calculated before and after the treatment for results.

At the beginning of treatment program, 5 minutes warm up exercises will be given. Intermittent rest periods will be conducted between each set of exercise. At the end of training program cool down exercises will be carried out. During exercise sessions subjects will be monitored and supervised with an adequate care to avoid the risks of falls or fracture.

GROUP – A: [CORE STABILITY EXERCISES]

WARM –UP EXERCISES:

- 5 minutes brisk walking.
- Mild stretching: Hamstring stretch, gluteus maximus

stretch, quadriceps stretch, gastronemius & soleus stretch, trapezius & deltoid stretch, biceps, triceps, erector spinae, latissimus dorsi and rhomboids stretch, paraspinal stretch. (5 repetitions and 10 seconds hold).[14]

The **core stability-enhancing program** is performed as follows.
Core stabilization exercise consists of two subparts: Bed exercises, Wedge exercises. First, the bed exercises without devices consisted of bridge exercise, bridge exercise with legs crossed, bridge exercise with one leg, curl-ups with straight reaching, curl-ups with diagonal reaching, bird dog exercise, and side bridge exercise. Second, the wedge exercises consisted of curl-ups with straight reaching, curl-ups with diagonal reaching, and curl-ups with arms crossed.[15]

All core stability-enhancing exercises were preceded by reducing lumbar lordosis by placing a pillow under both knee joints. Shoulder is placed in abduction and a towel should be placed under the scapula to prevent the compensatory action of pectoralis major.

COOL DOWN EXERCISES: 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).

The core stability exercise training is given with 60 min/day for 5 days a week for 5 weeks.

GROUP – B [PHYSIO BALL EXERCISES]
The warm up and cool down exercises are same as given in the core stability exercises group.
Physio ball training includes supine exercises, sitting exercises, standing exercises, prone exercises, trunk rotations, physio ball core stability enhancing exercises, physio ball balance and co-ordination exercises.[16]

SUPINE EXERCISES
- Bridging
- Lower trunk rotation

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 sec.[17]

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.

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 sec.

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 sec.[18]

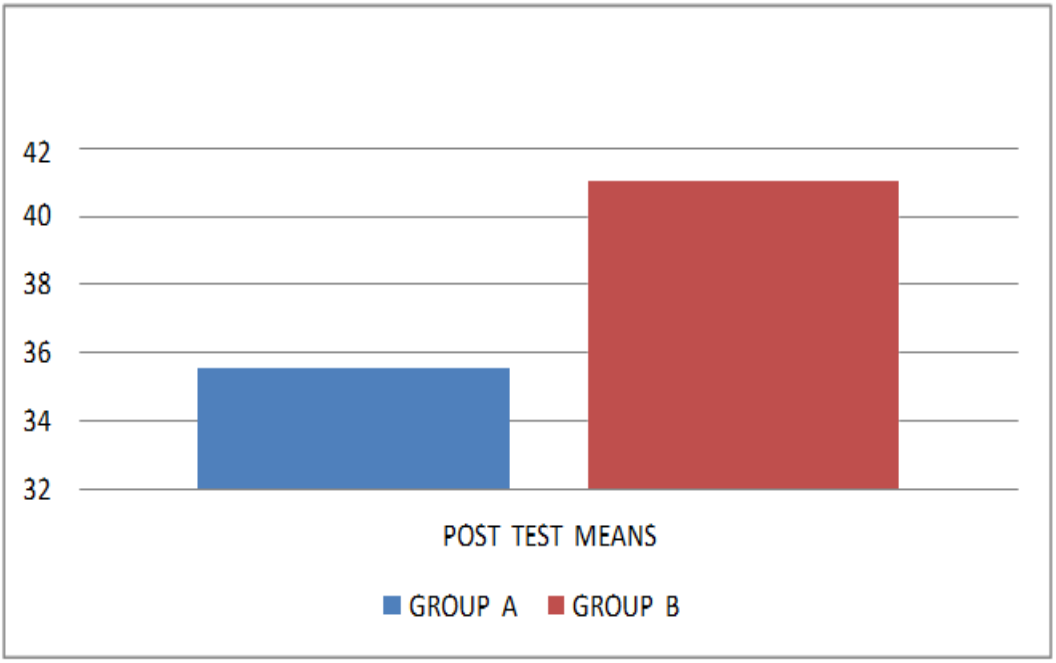
The Swiss ball training is given with 10 repetition, 3 sets of each segment, for 45 min per session. The data is collected before and after 5 weeks of intervention by using berg balance scale and trunk impairment scale.

DATA ANALYSIS AND RESULTS

The aim of the study was to find the effectiveness of core stability exercises and physio ball exercises on trunk control and balance in post stroke subjects. A total of 30 subjects who met the inclusion criteria have undergone baseline assessment and included subjects were randomized into two group consisting 15 and 15 subjects respectively. In this study 15 participants completed training in group- A and 15 subjects completed training in group-B without any dropouts in respective groups.

Table 1: Analysis of mean scores of post test values of berg balance scale in between group – A and group – B

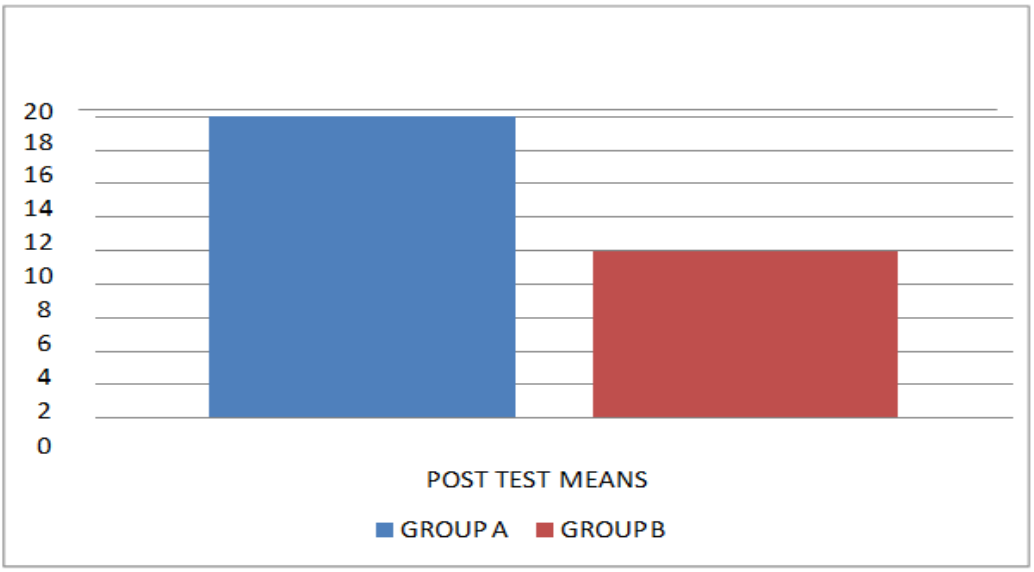
BBS	MEAN	N	SD	T value	P value	inference
Group – A	35.53	15	1.212	4.914	<0.0001	Highly significant
Group – B	41.06	15	4.072			



Graph 1: Comparison of mean scores of post test values of berg balance scale in between groups – A and group – B.

Table 2: Analysis of mean scores of post test values of trunk impairment scale in between group – A and group – B.

TIS	MEAN	N	SD	T value	P value	Inference
Pre test	18.53	15	3.081	9.337	<0.0001	Highly significant
Post test	10.06	15				



Graph 2: Comparison of mean scores of post test values of trunk impairment scale in between group – A and group – B.

DISCUSSION

For this study 30 patients from outpatient department of SIMS College of Physiotherapy, Guntur were recruited. From this sample of 30, the subjects were divided into 2 groups consisting of 15 subjects each. The age and duration of the subjects were almost similar in both groups. The outcome measurement was done by Berg balance Scale (BBS) and trunk impairment scale (TIS).

There is a statistically significant change between pre- and post-treatment mean scores of berg balance scale and trunk impairment scale in both groups. In between group analysis there is statistically significant difference between core stability exercises and physio ball exercise measures, there is a significant difference in trunk control and balance after 5 weeks of intervention for post stroke subjects. There is improvement in trunk control and balance, from pre mean 28.8 to post mean 35.5 in core stability exercises group and physioball exercises group from pre mean 29 to post mean 41.06. Both the groups shows significant improvement on trunk control and balance in post stroke subjects but core stability exercises shows more improvement than physioball exercises in improving trunk control and physioball exercises shows more improvement than core stability exercises in improving balance in post stroke subjects.

Previous studies have reported the positive effects of trunk stabilization exercises on unstable surfaces possibly due to stimulation of the proprioceptors of the joint and muscle. Trunk stabilization training on unstable surfaces activates the postural muscles around the abdomen and pelvis, more than that on a stable surface. It has been reported that stroke patients showed improvements of balance and gait ability after trunk stabilization exercise on an unstable surface.[19]

Abraham et al, concluded that there was significant improvement in stroke subjects with physio ball training. But there were no confined measures for improvements in gait. A study on EMG analysis observed that anticipatory postural adjustment of trunk muscle activity is impaired in stroke patients and they also found that reduced recruitment of high threshold motor units in trunk muscles which are essential for postural adjustments. EMG activity following upper limb movement caused a significant attenuation in erector spinae, external oblique and internal oblique and rectus abdominis when activities are performed on a ball.[20]

Physio balls can provide postural perturbations to trunk muscles which need to be activated in order to gain the postural stability. The possible reason for better trunk control improvement in group – A may be that the movement of the physio ball beneath the patient provides a postural perturbation in a gravitational field to which the trunk muscles respond reactively in order to maintain the desired postural stability. In biomechanical aspects when weight is shifted in any plane, the trunk responds with a movement to counteract the change in the center of gravity training on Swiss ball as a change in the surface stability may influence trunk muscle activity and also influences anticipatory postural adjustments and trunk performance.

Improved weight shifting ability through rotations also can enhance trunk muscle stability and balance. Improved lower trunk control effectively stabilizes the pelvis, which can lead to improved mobility and gait in the Swiss ball group.

Given that core stability exercises and physioball exercises could be considered by most stroke patienst. We will now support that these two different exercise programs are considered as to improving balance and trunk control in pot stroke subjects.

CONCLUSION: Finally, the study concluded Both the groups shows significant improvement on trunk control and balance in post stroke subjects but core stability exercises shows more improvement than physioball exercises in improving trunk control and physioball exercises shows more improvement than core stability exercises in improving balance in post stroke subjects.

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