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# Effects of Swiss Ball Trunk Exercises on Trunk Control and Functional Balance in Post Stroke Patients - An Interventional Study

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## ABSTRACT

**Background And Objective-** Trunk control requires appropriate sensorimotor ability of the trunk in order to provide a stable foundation for balance functions in patients with stroke. Balance is disturbed following stroke with impairments in steadiness, symmetry, and dynamic stability. All normal functional activities depend on normal trunk control as the base for movement. The trunk muscular function is an essential factor for balance, transferences, gait and several functions. Training on the Ball forces you to use muscles that stabilise and control the body's position. So Aim of the study was to see the effectiveness of Swiss ball trunk exercises on Trunk Control and functional balance in post stroke patients.

**Method-** 30 subjects fulfilling inclusion criteria were equally divided into two groups. Group A (Interventional group) received conventional physiotherapy plus Swiss ball trunk exercises and Group B (Control Group) received conventional physiotherapy. Each subject of the study received treatment for 3 weeks, 6 days/week. An assessment was done prior to treatment and after 3 weeks using Trunk Impairment Scale (TIS), Berg Balance Scale (BBS) and Time Up and Go (TUG) test.

**Result-** For within group analysis Wilcoxon signed rank test and for between group analyses Mann-Whitney U test was used. Statistical analysis showed significant improvement in Trunk Control and Functional Balance after 3weeks.

**Conclusion-** It can be concluded that Swiss Ball Trunk Exercises along with Conventional Physiotherapy is more effective in improving Trunk Control and Functional Balance in post Stroke Patients.

***Keywords:*** Stroke, Balance, Trunk control, Trunk Exercise.

## INTRODUCTION

Stroke is classically characterized as a neurological deficit attributed to an acute focal injury of the central nervous system (CNS) by a vascular cause, including cerebral infarction, intracerebral hemorrhage (ICH), and subarachnoid hemorrhage (SAH), and is a major cause of disability and death worldwide. [1] Following stroke, patients suffer from severe postural unsteadiness, and tend to have frequent numbers of falls, as well as greater restriction of activities after fall. Reports stated that only approximately 20-66% of patients with stroke manage to walk independently in the community again. [2] Stroke is the most common cause of disability or dependence in activities of daily living (ADL) among the elderly. Reducing the degree of dependence in ADL is often a central aim of rehabilitation programs and other related interventions for patients who have suffered a stroke. Trunk control is a crucial component to perform ADL. Some studies found that trunk control or sitting balance at an early stage could predict ADL outcome at a late stage in patients after a stroke. [3]

Balance is the condition in which all the forces acting on the body are balanced such that the centre of mass (COM) is within the stability limits, the boundaries of the base of support (BOS). [4] Balance is the result of interactions among the visual system, vestibular system, proprioceptive system, musculoskeletal system and cognitive ability. Balance maintenance is a very important element for safe and independent performance in ordinary life of movements and walking. Stroke patients suffer from balance disability due to abnormalities in the proprioceptive system, sensory system, trunk muscles, and muscles of the limbs. In particular, reduction in the activity of the muscles of the trunk reduces movement of the pelvis, leading to the development of asymmetry of the trunk and preventing use of strategies protecting against the risk of balance loss. [5]

Trunk is the central key point of the body with its primary contribution to stabilize spine and trunk. Trunk control is the ability of the trunk muscles to allow the body to remain upright, adjust weight shifts and perform selective movements of the trunk that maintains the base of support during static and dynamic postural adjustments. Trunk muscle strength is impaired multi directionally in hemiplegic patients. Although hemiplegia affects unilateral limb activity, it has a potential to deteriorate the function of trunk muscles on both sides of the body affecting the proximal control. [6] Trunk control requires appropriate sensorimotor ability of the trunk in order to provide a stable foundation for balance functions in patients with stroke. A recent study using a clinical measurement tool also found that selective movements of the upper and the lower trunk are impaired after a stroke.

Trunk control has also been identified as an important early predictor of functional outcome after a stroke. [7] Alteration of trunk position sense and weakness of trunk muscles in stroke has a significant influence on balance difficulty in these patients. Anticipatory postural adjustments of trunk muscles play major role in maintaining antigravity postures like sitting and standing when a reaching task is executed. [6] One of the neurodevelopmental principles states that the control of movement proceeds from the proximal to the distal part of the body. The trunk being the central key point of the body, proximal trunk control is a prerequisite for distal limb movement control, balance and functional mobility. [7] The Stability ball, also called the Swiss ball, Exercise ball, Flexibility ball. The Stability ball was originally created in Italy in the 1960's and provides instability or resistance which requires the user to rely on 'core' muscles to retain balance - thus improving strength and flexibility of those muscles. Swiss ball is used for training the core, improving posture, improving Balance & stability. [8] Trunk muscle exercises performed on a swiss ball lead to better trunk muscle activity in healthy individuals. [7] It is therefore possible that the same may be beneficial for patients who have had a stroke. Bayouk et al. observed that exercise on different support surfaces had a positive influence on sub acute stroke patients. Shumway cook et al. noted that an unstable support surface stimulated the sensory system and the motor system more than a stable support surface, effectively changing postural orientation ability and aiding postural strategies. [5] Despite the trunk performance is considered to be the important predictor for balance and functional performance, the evidence supporting the effectiveness of trunk rehabilitation are very few. Most literature concerning rehabilitation after stroke focuses on the hemiplegic upper and lower limbs while the trunk receives very little attention. In patients with stroke, poorer balance is associated with falls, as well as greater restriction of activities after fall. Hence, there is a need for a trunk exercise regime that studies a carry-over effect on functional balance. So the need of my study is to find the effect of trunk exercises on dynamic surface has any effect on trunk

control and functional balance in post stroke patients.

## METHOD

**Study Design:** An Interventional study.
**Study Setting:** This study was conducted at Maniben Ayurvedic Hospital and at Physiotherapy Department of Civil Hospital, Ahmedabad.
**Sampling Technique:** Convenience Sampling.

**Study Duration:** The duration of the study whole was 6 months. The Subjects in the Interventional group (A) received Swiss Ball Trunk Exercises in addition to Conventional Physiotherapy for 6 days / week, once a day for 3 weeks. Subjects in the Control group (B) received Conventional Physiotherapy for 6 days /week once a day, for 3 weeks

Sample Size: 30
Interventional group (Group A) n=15
Control group (Group B) n=15

**Selection Criteria**

- **Inclusion Criteria :**

1. Belonging to any gender with age 40 to 70 years.
2. Willingness to participate in a three week study.
3. The first onset of Unilateral Lesion associated with ischemic or hemorrhagic stroke.
4. Duration of stroke less than equal to six months.
5. Both Right Hemiplegic and Left Hemiplegic were included.
6. Mini Mental Status Exam of ≥ 24/30 indicating intact Cognition.
7. Spasticity on Modified Ashworth Scale should be 1, 1+ or 2
8. Voluntary Control 2 or more than 2 (according to Brunnstrom Grading for Voluntary Control).
9. Berg Balance Scale score >20 were included.

- **Exclusion Criteria:**

1. Head Injury.
2. Brain Tumor
3. Neurological diseases affecting balance other than a stroke such as for instances cerebellar disease, Parkinson‘s disease.
4. Pregnancy
5. Medically unstable
6. Musculoskeletal disorder of trunk and lower limb affecting the motor performance.
7. Seizures.

**Materials Used in the study**

Consent Form, Assessment Form, Pen and Paper, Mini Mental State Questionnaire (MMSE), Berg Balance Scale, Trunk Impairment Scale, Swiss Ball of different size, Chair, Measure tape, Stopwatch, Cone, Step stool, Mats and Plinth, Weight Cuff .

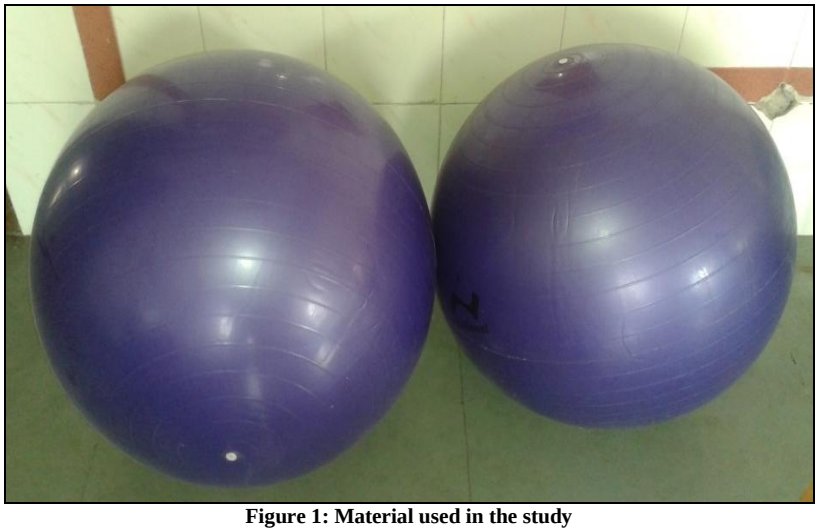

**Figure 1: Material used in the study**

**Procedure**

Subjects referred from the neuro medicine outpatient department and indoor patient at Maniben ayurvedic hospital those who fulfilled the inclusion criteria were taken up for the study. Ethical Clearance was obtained from the ethical committee of my study setting. The procedure was explained to all the subjects. A written informed consent of all subjects was taken. A total of 30 subjects were taken for the study and assigned to

**Group A –** Conventional Physiotherapy and Swiss Ball Trunk Exercises.

**Group B –** Conventional Physiotherapy.

A pre participation evaluation was carried out to find the descriptive demographic data, history, chief complaint, duration of stroke, type of stroke, and all were evaluated for the baseline data of Trunk Impairment Scale, Berg Balance Scale, Time Up and Go Test prior to starting of Intervention and after the 3 weeks of intervention.

All the subjects in Interventional group (group A) received Swiss ball trunk exercises session of 35- 40 minutes for 6 days /week once a day for 3 weeks. Intensity and Repetitions of exercise were dependent on patient performance. All treatment session were given by Physiotherapist. Moderate Assistance was given by therapist. All the subjects received trunk exercises in the Supine and Sitting Positions. The intensity of Exercise was increased by introducing one or several of the following changes: 1) reducing Base of Support, 2) Increasing the lever arm, 3) Advancing the Balance limits 4) Increasing Hold time.

**Supine exercise were as follows:** [7], [9]

**1) The Pelvic Bridge** was performed by placing both the patients' legs on a swiss ball and asking him or her to lift the pelvis off the support surface. Initially Ball was kept beneath the knees and advanced to the lower leg. **2) Unilateral Pelvic Bridge** was performed by lifting the uninvolved leg off the ball while maintaining the pelvic bridge position. This Unilateral pelvic Bridge exercise was performed in addition to pelvic bridge exercise in progression. **3) Upper Trunk Rotation** was performed by placing both the patient legs on a Swiss ball with knee flexed at 90˚ degree than patient was asked to perform reach out for a therapist hand above the hip by flexion rotation of the upper trunk. **4) Lower Trunk Rotation** was performed by placing both the patient legs on the Swiss ball and asking patient to move the ball to both the left and right side by rotating the pelvis. Initially ball was placed beneath the knees and then advanced towards the ankles. 5) The patient in a supine position places both legs over top of the ball. Then patient draws the ball towards him with both the legs flexing at hip and knee & then moves the ball away from him by extending at hip and knee. 6) The patient in supine position places both legs over the top of the ball. He draws the ball towards him, presses his heels against it & lifts it up. His hip and knee flex actively and he lifts his buttocks off the bed as well. His spine remains flat on the bed. The therapist helps the patient learns to keep both knees apart and at the same level as he lifts his buttocks off the floor by tensing his lower abdominals.

**Sitting Exercises were as follows:** [7]

The patient was seated on swiss ball with hips and knees bent at 90 degrees and feet kept flat on the support surface. The patient performed all the task specific reach out dynamic exercises while balancing in a sitting posture on the Ball.

**1) Selective flexion & extension of trunk** was performed **2) Upper Trunk Lateral Flexion** was performed by initiating movement from the shoulder girdle so as to bring the elbow towards the ball. **3) Upper Trunk Rotation** was performed by clasping both the hands of patient together. Than clasped Hands were Raised up to Shoulder level and then upper trunk rotation was performed by moving each shoulder

forward and backward for reaching the reach out hand of therapist at shoulder height. **4) Weight Shifting** was performed by letting the ball roll forward until it touched the back of legs, thereby allowing the lower spine to curve, followed by rolling the ball Backward as far as possible and allowing the lower spine to arch. **5) A Forward Reach** was performed by asking the patient to reach a fixed point at shoulder height by forward flexing the trunk at the hips, with clasped hands together and or with normal limb. Progression was made by a forward diagonal reach out at shoulder height. **6) A lateral reach** 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.

All the subjects in both the group received Conventional Physiotherapy exercises session of 30 minutes for 6 days /week once a day for 3 weeks. Conventional physiotherapy included Strategies to improve Sensory function and Strategies to improve Motor function: are to improve flexibility and joint integrity, strength, Management of spasticity and to Improve movement control, motor learning, postural control and functional mobility, upper extremity function, lower extremity function, balance, locomotion. All this conventional treatment varies from patient to patient according to the recovery of patient and functional level of patient.

## STATISTICAL ANALYSIS

The data analysis was done using the statistical software SPSS-20 and Microsoft Excel. Before applying statistical tests, data was screened for normal distribution. Confidence interval was set at 95% and $p< 0.05$ was considered as significant. For within the group analysis, Wilcoxon Signed Rank Test was used. For comparison of outcome measure in between two groups, Mann- Whitney U Test was used.

## RESULT

All selected Subjects Completed the Study Program Satisfactory. The Study Comprised of total 30 Subjects due to 2 dropouts 1 from each group. So there were 28 Subjects in the end for data Analysis. So 14 Subjects in Interventional Group (Group A) & 14 Subjects in Control Group (Group B). All 28 Subjects completed the 3 weeks of treatment Session and 2 assessment sessions were taken pre and post treatment. The Outcome measure for Trunk Control was Trunk Impairment Scale (TIS), and for Functional Balance was Berg Balance Scale (BBS), and Time Up and Go Test were taken on the 1st day and after completion of training at 3 weeks.

Table 1 Shows the Age Distribution of 28 subjects who participated in the Study. Among the 28 Subjects, the mean age of 14 Subjects in Interventional Group (Group A) was 57.35 with a Standard Deviation (SD) of 8.55 and the mean age of 14 Subjects in Control Group (Group B) was 52.64 with a Standard Deviation (SD) of 8.04. No Significant age difference was seen across the two groups.

**Table 1: Age Distribution of The Subjects In Years**

| Groups | No. | Mean | ±SD |
|---|---|---|---|
| Group A | 14 | 57.35 | 8.55 |
| Group B | 14 | 52.64 | 8.04 |

Table 2 Shows the gender distribution of the 28 subjects who participated in the study. In Interventional Group (Group A) there were 13 males and 1 female and in Control Group (Group B) there were 11 males and 3 female.

**Table 2: Gender Distribution of the Subjects**

| Gender | Group A | Group B |
|---|---|---|
| Male % | 13<br>92.8% | 11<br>78.5% |
| Female % | 1<br>7.1% | 3<br>21.4% |
| Total % | 14 (100%) | 14 (100%) |

Table 3 Shows Affected Side among 28 subjects. In Interventional Group (Group A) there were 7 subjects with Right side affected and 7 subjects with Left side affected. In Control Group (Group B) there

were 11 subjects with left side affected and 3 with Right side affected.

**Table 3: Affected Side of the Subjects**

| Affected Side | Group A | Group B |
|---|---|---|
| Right Side<br>% | 7<br>50% | 3<br>21.4% |
| Left Side<br>% | 7<br>50% | 11<br>78.5% |
| Total % | 14 (100%) | 14 (100%) |

Table 4 Shows Duration of stroke among 28 subjects. In Interventional group (Group A) mean duration of stroke was 2.75 with Standard Deviation of 1.36. In Control Group (Group B) mean duration of stroke was 3.17 with Standard Deviation of 1.44. No significant difference in duration of stroke was seen across the two groups.

**Table 4: Mean Duration of Stroke In Months**

| Groups | No. | Mean Duration in Months | ±SD |
|---|---|---|---|
| **Group A** | **14** | **2.75** | **1.36** |
| Group B | 14 | 3.17 | 1.44 |

Table 5 shows Within Group Analysis of Trunk Impairment Scale (TIS) Score and it Yielded p Value 0.001, Z= -3.309 for Interventional group (Group A) and for Control group (Group B) yielded p Value 0.001, Z= -3.269. Result shows significant difference in both the groups.

**Table 5: Comparison of Mean of Pre & Post TIS Score Within Group A & Within Group B**

| Groups | Pre Treatment | Post Treatment | Z | P Value |
|---|---|---|---|---|
| | **Mean ± SD** | **Mean ±SD** | | |
| Group A | 15.07±2.20 | 19.28±1.26 | -3.309 | 0.001 |
| Group B | 14.5±2.34 | 16.35±2.06 | -3.269 | 0.001 |

Table 6 shows Between Group Analysis of Trunk Impairment Scale (TIS) Score and it yielded p Value 0.003 and U= 35.5. Result showed significant improvement in Interventional Group (Group A) Compared to Control Group (Group B).

**Table 6: Mean Difference In TIS Score Between Group A & B**

| Groups | Mean Difference | ±SD | U Value | P Value |
|---|---|---|---|---|
| Group A | 4.21 | 2.51 | 35.5 | 0.003 |
| Group B | 1.85 | 0.94 | | |

Table 7 shows Within Group Analysis of Berg Balance Scale (BBS) Score and it Yielded p Value 0.001, Z= -3.304 for Interventional group (Group A) and for Control group (Group B) yielded p Value 0.001, Z= -3.342. Result shows significant difference in both the groups.

**Table 7: Comparison of Mean of Pre & Post BBS Score within Group A & within Group B**

| Group | Pre Treatment | Post Treatment | Z Value | P Value |
|---|---|---|---|---|
| | **Mean ± SD** | **Mean ± SD** | | |
| Group A | 34.21±6.20 | 41.71±5.77 | -3.304 | 0.001 |
| Group B | 33.42±7.64 | 36.42±7.64 | -3.342 | 0.001 |

Table 8 shows Between Group Analysis of Berg Balance Scale (BBS) Score and it yielded p Value 0.000 and U=6. Result showed highly significant improvement in Interventional Group (Group A) Compared to Control Group (Group B).

**Table 8: Mean Difference In BBS Score Between Group A & B**

| Groups | Mean Difference | ±SD | U Value | P Value |
|---|---|---|---|---|
| Group A | 7.5 | 3.03 | 6 | 0.000 |
| Group B | 3 | 1.10 | | |

Table 9 shows Within Group Analysis of Time Up and Go (TUG) test Score and it Yielded p Value 0.001, Z= -3.314 for Interventional group (Group A) and for Control group (Group B) yielded p Value 0.001, Z= -3.316. Result shows significant difference in both the groups.

**Table 9: Comparison of Mean of Pre & Post TUG Test Score within Group A & within Group B**

| Group | Pre Treatment | Post Treatment | Z Value | P Value |
|---|---|---|---|---|
| | **Mean±SD** | **Mean±SD** | | |
| Group A | 33.07±13.65 | 25.71±10.04 | -3.314 | 0.001 |
| Group B | 27.06±10.82 | 24.42±10.80 | -3.316 | 0.001 |

Table 10 shows Between Group Analysis of Time Up and Go (TUG) Test Score and it yielded p Value 0.000 and U=22. Result showed highly significant improvement in Interventional Group (Group A) Compared to Control Group (Group B).

**Table 10: Mean Difference In TUG Test Score Between Group A& B**

| Group | Mean Difference | ±SD | U Value | P Value |
|---|---|---|---|---|
| Group A | 7.35 | 4.72 | 22 | 0.000 |
| Group B | 3.17 | 2.03 | | |

## DISCUSSION

The goal of the Present study was to find out the additional effect of Swiss Ball Trunk Exercises and Conventional Physiotherapy in improving Trunk Control and Functional Balance in Stroke Patients. According to the Convenience Sampling 30 Subjects were divided In to Interventional Group (Group A) (n=15) and Control Group (Group B) (n=15). 2 dropouts occurred 1 Subject each from both the groups. The subject who left interventional group (A) could not continue study due to social reason and the subject who left Control Group (B) cannot continue study as cannot come from long distance due to transport problem. So analysis of 28 subjects was done with n=14 in control group and n=14 in interventional group. Total Study Duration was of 6 months. Control group (B) received Conventional Physiotherapy and Interventional group (A) received Conventional Physiotherapy as well as Swiss Ball Trunk Exercises for improving Trunk Control and Functional Balance in Post Stroke Patients for 6 days/ week for 3 weeks.

Both the Interventional group(A) and Control group(B) were similar at the baseline Characteristics of age, gender distribution, side of hemiplegia, duration of stroke, Scores of TIS, BBS and TUG test.

The result of within group analysis of the present study showed significant improvement in TIS (p=0.001), BBS (p=0.001) and TUG test (p=0.001) in both control group (group B) and Interventional group (group A). Results of between the group analysis showed significant Improvement in Trunk Impairment Scale (TIS) with p= 0.003 and highly significant improvement in Berg Balance Scale (BBS) and Time Up and Go (TUG) test with p=0.000. Thus between group analysis result showed significant improvement in interventional group (Group A) compared to control group (Group B).

The subject‘s treated with Conventional Physiotherapy plus Swiss Ball Trunk Exercises (Interventional Group) gained significant improvement in the Trunk Control and Functional Balance as compared to the subjects treated with Conventional Physiotherapy (control group). The trunk control and balance improvement was quite good in study.

The sequelae of a CVA are variable and can be sensitive, motor and/or cognitive, generating deficits in functional capacity, independence and quality of life (QOL) of the individuals. In addition to causing deficits in limb movement, gait and language, the trunk movement control deficit is also a very important problem. All normal functional activities depend on normal trunk control as the base for movement. The trunk muscular function is an essential factor for balance, transferences, gait and several functions. Thus, the trunk must provide, simultaneously, stability and mobility so that the individuals can perform their daily activities. The posture of the whole trunk, including the pelvis, affects the scapula (shoulder blade) and the collarbone, which, on the other hand, exercise a direct effect, muscular as well as biomechanical, on all upper extremity movements. Therefore, the upper-limb movements are highly dependent on trunk control and posture. In hemiparetic patients, even when they have a motor return and a normal upper-limb sensibility, the movement will not be normal if the trunk is not capable of performing the necessary functional control. The lower-limb (LL) function also depends on the trunk. Several studies have reported a correlation between gait performance in hemiparetic patients after a CVA and motor recovery and muscular strength. Bohannon suggested that the motor control is one of the best prognostic factors for gait performance. Additionally, the trunk control is a vital component for the performance of the activities of daily living (ADL).Some authors have demonstrated that the trunk control or balance in the sitting position at an early stage can influence the ADL outcome at a later stage of the CVA. [10]

S Karthikbabu, Akshatha Nayak. et al. 2011 conducted a study on "Comparison of physio ball and plinth trunk exercises regimens on trunk control and functional balance in patients with acute stroke: a pilot randomized controlled trial." The experimental group performed task-specific trunk exercises on an unstable surface (physio ball) while the control group performed them on a stable surface (plinth). In addition to regular acute physiotherapy, both the groups underwent 1 hour of trunk exercises a day, four days a week for three weeks. The study concluded that Task-specific trunk exercises using physio ball is superior to similar exercises performed on plinth in improving trunk control and functional balance in patients with acute stroke. [7]

Exercises performed on Swiss Ball increases kinaesthetic awareness because of the unstable nature of the ball, the user is forced to be intrinsically aware of the positioning of their body in space. The unstable nature of the ball forces the user to make constant weight shifts while on the ball, to find their balance points, various stabiliser muscle groups are also challenged while exercising. [11] The potential activation of trunk musculature is better when the exercises are performed on a physio ball rather than when they are performed on a plinth, since the movement of a ball beneath the participants provides a postural perturbation to which the muscles respond in order to maintain the desired posture. [7]

Sea Hyun Bae, Hong Gyun Lee et al. 2013 conducted a study on Effects of Trunk Stabilization Exercises on Different Support Surfaces on the Cross-sectional Area of the Trunk Muscles and Balance Ability. Sixteen stroke patients with onset of stroke six months earlier or longer were randomly and equally assigned to group I (exercise performed on a stable support surface) and group II (exercise performed on an unstable support surface). The two groups conducted the trunk stabilization exercises on the respective support surfaces, in addition to existing rehabilitation exercises five times per week for 12 weeks. The study concluded that Exercise on the unstable support surface enhanced the size of the cross-sectional area of the trunk muscles and balance ability significantly more than exercise on the stable support. [5]

Wim Saeys, Luc Vereeck et al. 2011 conducted a study on "Randomized Controlled Trial of Truncal Exercises Early After Stroke to Improve Balance and Mobility. Objective of this study was to assess the effect of additional truncal exercises on truncal function, standing balance, and mobility. In addition to conventional therapy, the experimental group received 16 hours of truncal exercises. The control group received 16 hours of sham treatment. Truncal function was evaluated by the Trunk Impairment Scale (TIS) and standing balance and mobility by the Tinetti Test. The Study Concluded that In addition to conventional therapy, truncal exercises have a beneficial effect on truncal function, standing balance, and mobility in people after stroke. [12]

Ching-Lin Hsieh, Ching-Fan Sheu et al. 2002 Conducted study on Trunk Control as an Early Predictor of Comprehensive Activities of Daily Living Function in Stroke Patients The findings of this study provide strong evidence of the predictive value of trunk control on comprehensive ADL function in stroke patients. The results imply that early assessment and management of trunk control after stroke should be emphasized. [3]

Vanita D'souza, Sydney Roshan Rebello et al. 2009 conducted study on Trunk performance correlates with functional outcome in stroke patients – a cross sectional study. The study concluded that Trunk performance is correlated with the functional outcome of stroke patients which is significant both clinically and statistically. [13]

The result of the present study concludes that Swiss Ball Trunk Exercises are more effective along with conventional Physiotherapy in improving Trunk Control

and Functional Balance in Post Stroke Patients.

**Limitation Of The Study –** 1) Sample size was small. 2) The duration of the study was short, three weeks.

**Future Recommendation -** a large sample size study should be done to make the findings more specific and applicable to whole population.

## CONCLUSION

Interventional group (Group A) receiving Conventional Physiotherapy and Swiss Ball Trunk Exercises improved much better than Control group (Group B) receiving Conventional Physiotherapy alone. Thus it can be concluded that Swiss Ball Trunk Exercises along with Conventional Physiotherapy is more effective in improving Trunk Control and Functional Balance in Post stroke patients.

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