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EFFECTS OF TRUNK CONTROL EXERCISE WITH SWISS BALL IN IMPROVING TRUNK PERFORMANCE IN STROKE PATIENTS-SINGLE BLINDED STUDY.

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ABSTRACT

Trunk control requires appropriate sensorimotor ability of the trunk in order to provide a stable foundation for balance functions in patients with stroke. Concentrating on trunk strengthening exercises to improve their balance and make them independent. Our study focused on investigating the comparative efficacy of the two interventions i.e. effects of trunks exercise with and without Swiss ball in improving trunk performance in stroke patients. Twenty Subjects were selected based on inclusion and exclusion criteria from OPD of Saveetha physiotherapy Chennai. The subjects were allocated equally into two groups. The trunk performance, balance was assessed before and after the intervention using the Trunk Impairment Scale and The Berg Balance scale respectively. Group-A received conventional physiotherapy and Swiss ball exercises for trunk and Group-B received conventional physiotherapy and plinth exercise for trunk. This study shows statistically significant improvement in trunk control (p=0.0177) and balance (p=0.0019) in group-A treated with a Swiss ball.

KEY WORDS: Balance, Stroke, Swiss ball, trunk control.

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INTRODUCTION

Stroke is the sudden loss of neurological function caused by an interruption of the blood flow to the brain. To be classified as stroke, neurological deficits should be persisting at least 24 hours.[1] Clinically, a variety of is focal deficits are possible including changes in level of consciousness and sensory impairments, motor, cognitive, perceptual and language functions. Motor deficits are characterized by paralysis (hemiplegia) or weakness (hemiparesis), typically on the side of the opposite side of lesion. Studies using an isokinetic dynamometer have shown the weakness of the trunk flexors, the extensors and the bilateral rotators in patients with stroke. [5, 6]A cross-sectional study revealed a positive relation between trunk control and the measures of balance, gait and functional ability in patients with stroke. [10] It 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.[4] Trunk control requires appropriate sensorimotor ability of the trunk in order to provide a stable foundation for balance functions in patients with stroke.[2,3] 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.[7] so it important for stroke patients to concentrate on trunk strengthening exercises in order to improve their balance and make them independent.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.[8,9] Research has shown that with the traditional plinth exercises the trunk control was not achieved to that extent and the balance was also not considerably improve. some studies have proven that core exercises using Swiss ball gives better result than to plinth exercises.[11] The reason being is the movement of swiss ball beneath the patients provide a postural perturbation to which the muscles respond in order to maintain the desired postural thus improves balance and co-ordination.The purpose of the study was to find out the effects of swiss ball exercise for trunk and to compare it with plinth exercise in improving trunk control and functional balance in stroke patients.

METHODOLOGY

Twenty Subjects were recruited from Physiotherapy Outpatient Department Saveetha Nagar, Thandalam Chennai. The subjects were randomized into two groups by asking to take a lot. The lot box contained 10A and 10B lots. Those who have picked A were placed in group A and those who have picked B were in group B. All the subjects signed an informed consent form before participation. The study was approved by scientific and ethical committee of Saveetha University, Chennai.IEC reff.no.006/03/2014/IEC/SU. The subjects were included in the study if they fulfill the following criteria. Both male and female between 35 to 55 years, Had a first onset of stroke within last one year, Able to understand and follow simple verbal instruction, Able to sit independently at least for 30 seconds in stable surface. Subjects who had Neurological disease affecting balance other than stroke, any musculoskeletal disorder of trunk, Auditory or visual impairment were excluded from the study. The outcome was taken before and after the treatment by co investigator. The treatment was given by the researcher following below mentioned protocol. The researcher was blinded for the outcome measure.

Treatment Protocol

Group A(with swiss ball)	Group B(without Swiss ball)
• Conventional Physiotherapy treatment to the affected extremities of upper and lower limb on plinth.	• Conventional Physiotherapy treatment to the affected extremities of upper and lower limb on plinth.
• Trunk exercise with Swiss ball	• Trunk exercise without Swiss ball
45 minutes per day x 5 sessions per week x 4weeks	45 minutes per day x 5 sessions per week x 4weeks

The conventional treatment included exercises such as tone facilitation or inhibition and a range of movement exercises for the affected side upper and lower extremities.

Group A: ***Exercises with Swiss Ball***

Exercises in Sitting

I.*Static abdominals*

The patient was seated on the swiss ball with hips and knee bent at 90 degrees and the feet kept flat on the floor surface. The patient performed all the task- specific dynamic exercises while balancing in a sitting posture on the ball with static TA contraction.

II.*Weight shifting*

It was executed by letting the ball roll forward until it touched the back of the 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.

Forward & Lateral reach was performed by asking the patient to reach a fixed point to shoulder height by forward flexing the trunk at the hips. Furthermore, progression may be made by forward diagonal reached at shoulder height while balancing the swiss ball. lateral reach was performed by asking the patient to reach out at 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 while balancing the swiss ball.

Exercises in Supine

I.Lower trunk rotation

It was performed by placing both the patient's legs on the ball and asking him or her to move the ball to both left

and right by rotating the pelvis. Initially the ball was placed beneath the knees, and then advanced towards the ankles.

II. The pelvic bridge

It was performed by placing both the patient's legs on the swiss ball and asking him or her to lift the pelvis off the floor surface. Initially the ball was kept beneath the knees and advanced to the ankle. The exercise intensity was further increased by flexing the uninvolved upper limb. Follow by the unilateral pelvic bridge was performed by lifting uninvolved leg off the ball while maintaining the pelvic bridge position.

III. Upper trunk rotation

It was executed by having the patient rest his or her trunk on the ball with knee flexed at 90 degrees and the feet flat on the support surface. The patient was asked to perform a task-specified reach-out for an object kept above the hip by flexion rotation of the upper trunk.

Group B:-trunk exercise without Swiss ball

Exercises in sitting

I. *Static abdominals*

It the patient was seated on the plinth with hips and knee bent at 90 degrees and the feet kept flat on the support surface. The patient was asked to perform all the task-specific dynamic exercises while balancing in a sitting posture on the plinth with static TA contraction.

II. ***Weight shifting***

It was performed by ante-flexion and retro-flexion of the lower part of the trunk.

III. ***A forward & lateral reach***

Forward reach was performed by asking the patient to reach a fixed point to shoulder height by forward flexing the trunk at the hips. Furthermore, progression was made by forward diagonal reached at shoulder height. lateral reach was performed by asking the patient to reach out at 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.

Exercises in supine

I. *Lower trunk rotation*

It was performed by placing both the patient's legs on the plinth with knee bent 90 degrees and asking him or her to move the knee to both left and right by rotating the pelvis.

II. *The pelvic bridge*

It was performed by placing both the patient's legs on the plinth and asking him or her to lift the pelvis off the support surface. The exercise intensity was further increased by flexing the uninvolved upper limb. Follow by the unilateral pelvic bridge was performed by lifting uninvolved leg while maintaining the pelvic bridge position.

III. *Upper trunk rotation*

It was executed by having the patient rest his or her trunk on the plinth with knee flexed at 90 degrees and the feet flat on the support surface. The patient was asked to perform a task-specified reach-out for an object kept above the hip by flexion rotation of the upper trunk. Number of repetition and intensity of the exercises were increased based on the individual patient's performances. Intensity of the exercise was increased based by Reducing base of support, Increasing the lever arm and Increasing hold time.

Statistical Analysis

Statistical analysis was done for all the collected data. Paired t-test was used to compare pre-test and post-test values within the groups and unpaired t-test was used to compare the post-test values between the groups.

Figure1

Comparison of Pre-Test and Post-Test Values Of Group-A

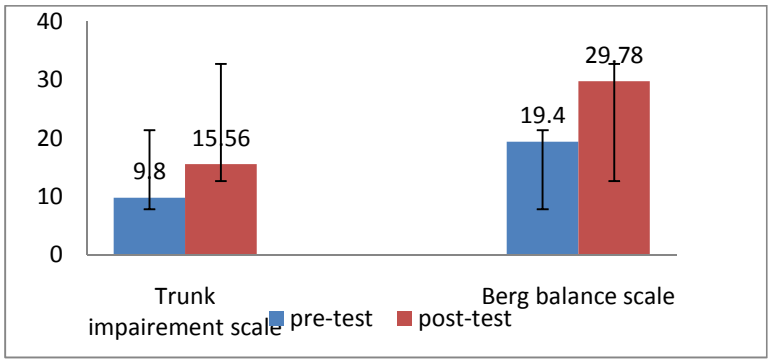

Table1
Pre-Test and Post-Test Value of Group-A (With Swiss ball)

Group A		Mean	Standard Deviation	t-test	p-value
Trunk Impairment Scale	Pre-test	9.80	2.74	9.2057	<0.0001
	Post-test	15.56	4.19		
Berg Balance Scale	Pre-test	19.40	4.35	7.9098	<0.0001
	Post-test	29.78	5.07		

It is observed from the above table - 1, that mean value of trunk impairment scale in pre-test is 9.80 with standard deviation of 2.74 and mean berg balance scale is 19.40 with standard deviation of 4.35. The corresponding figure-1 in the post test mean of trunk impairment scale is 15.56 with standard deviation of 4.19 and mean berg balance scale is 29.78 with standard deviation of 5.07.

Figure-2
Comparison of Pre-Test and Post-Test Values Of Group-B

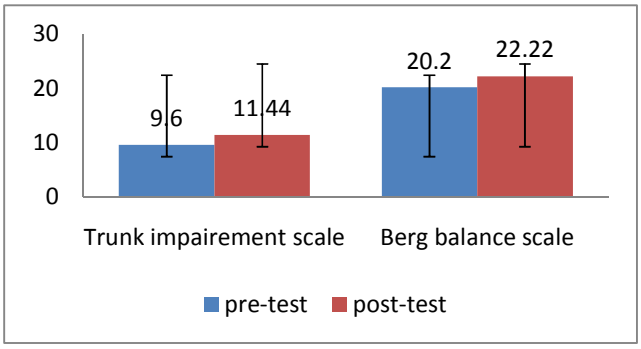

Table 2
Pre-Test and Post-Test Value of Group-B (Without Swiss ball)

Group B		Mean	Standard Deviation	t-test	p-value
Trunk Impairment Scale	Pre-test	9.60	2.32	8.0000	<0.0001
	Post-test	11.44	2.24		
Berg Balance Scale	Pre-test	20.20	3.43	5.9330	0.0003
	Post-test	22.22	3.60		

It is observed from the above table - 2, that mean value of trunk impairment scale in pre-test is 9.60 with standard deviation of 2.32 and mean berg balance scale is 20.20 with standard deviation of 3.43. The corresponding figure-2 in the post test mean of trunk impairment scale is 11.44 with standard deviation of 2.24 and mean berg balance scale is 22.22 with standard deviation of 3.60.

Figure 3
Comparison of Post-Test Values of Group-A and Group-B

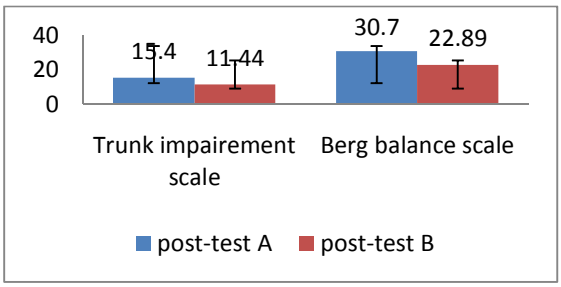

Table 3
Post-Test Value of Group-A and Group-B

Parameter	Post Test Values				T-Test	Significance
	Group-A		Group-B			
	Mean	Standard Deviation	Mean	Standard Deviation		
Trunk Impairment Scale	15.40	3.98	11.44	2.24	2.6266	0.0177
Berg Balance Scale	30.70	5.33	22.89	3.69	3.6690	0.0019

It is observed from the above table-3, that mean value of trunk impairment scale in Group-A post-test is 15.40 with standard deviation of 3.98 and mean berg balance scale is 30.70 with standard deviation of 5.33. Where as in the post test mean of trunk impairment scale in Group-B is 11.44 with standard deviation of 2.24 and mean berg balance scale is 22.89 with standard deviation of 3.69.

RESULTS

The statistical analysis revealed significant difference (p<0.0001) between pre-test and post-test values of trunk impairment scale and Berg balance scale with swiss ball and without swiss ball exercises.The pre-test mean value of trunk impairment scale for trunk exercises with swiss ball (Group-A) was 9.80(SD=2.74) and Berg balance scale was 19.40(SD=4.35) while the post-test mean value for trunk impairment scale was 15.56(SD=4.19) and Berg balance scale was 29.78(SD=5.07).thus, showing statistically significant difference of<0.0001 for both of trunk impairment scale and Berg balance scale respectively. The pre-test mean value of trunk impairment scale for trunk exercises without swiss ball (Group-B) was 9.60(SD=2.32) and Berg balance scale was 20.20(SD=3.43) while the post-test mean value for trunk impairment scale was 11.44(SD=2.24) and Berg balance scale was 22.22(SD=3.60). this also shows there is significance difference between pre-test and post-test. This study shows statistical significant difference of post test value in Group-A and Group-B was p=0.0177;t=2.6266 in trunk impairment scale and p=0.0019;t=3.6690 in Berg balance scale.

DISCUSSION

In this study the effect of trunk control exercises on swiss ball was compared to trunk control exercise without swiss ball.The results of this study shows that there is a statistical significant differences in pre-test and post-test of both the Group-A and Group-B while measuring with Trunk impairment scale and Berg balance scale. however when the post-test results of both the Group are compared, the results showed a statistical significant difference an indicating trunk control exercise performed over swiss ball has a remarkable outcome than trunk control exercise without swiss ball in patients with stroke. The outcome of this study was measured with the trunk impairment scale [4] and berg balance scale [22]. Both the scales have very good validity and reliability. [21]The treatment techniques incorporated in this study were based on the task-specific system and Ecological motor control theory. Task-specific trunk exercises practiced in a challenging environmental field (i.e. a stable as against an unstable surface) provided a gradual biomechanical demand on the trunk muscles. The trunk control improvement was quite impressive in our study, suggesting better trunk muscle activity due to destabilizing forces while exercises were performed on the swiss ball. The effect size in the total Trunk Impairment Scale supports for trunk exercises performed on the swiss ball indicated an appreciable improvement.The possible reason for better trunk control improvement in the Group-A may be that the movement of the swiss ball beneath the patients provides a postural perturbation in a gravitational field to which the trunk muscles respond reactively in order to maintain the desired postural stability.A study by Mudie et al. found that training the patient in the awareness of trunk position could improve weight symmetry in sitting after the early phase of the stroke.[23] The probable reason for the significant trunk rotation improvement may be the improved weight shift ability with the swiss ball training and also may be that the movement due to which trunk muscles act in order to maintain the postural stability. [10]Another exciting finding of this study was that trunk exercises performed on the swiss ball had a carry-over effect in improving functional balance such as standing and stepping as indicated by Trunk impairment scale and Berg balance scale. Experts in the field of neurological rehabilitation have addressed the trunk as the central key point of the body[10]. The neuro developmental treatment principle states that the control of movement proceeds from proximal to distal body regions. Proximal stability of the trunk is a prerequisite for distal limb movement. Therefore, proximal trunk control improvement influences the functional balance involved in activities such as standing and stepping.This study findings is of clinical importance for the treatment of trunk performance i.e. dynamic sitting balance, coordination of the trunk, standing and stepping balance in patients with stroke duration less than 1 year, who are able to sit independently for 30 seconds. Inclusion of the dynamic treatment equipment (i.e. swiss ball) may thus be considered to have not only a beneficial task-specific effect on the selective trunk movement control .But also a carry-over effect on functional balance in the comprehensive rehabilitation for stroke care. Future studies can also concentrate on larger number of patients

and outcome measures like EMG and Brunel Balance Assessment can be use to assess better muscles activities for exercise performed on swiss ball. Others neurological impairments such as Parkinson disease, cerebral palsy can be benefited.

CONCLUSION

From this study it is concluded that the addition of a Swiss ball in trunk control exercises is capable of influencing trunk performance. i.e. dynamic sitting balance, coordination of the trunk, standing and stepping balance in patients with stroke.In this study both the group have shown difference between pre-test and post-test values but Group-A treated with swiss ball has showed statistically significant improvement than Group-B.

CONFLICT OF INTEREST

There is no conflict of interest in the study.

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