

## Efficacy of Core Stability Exercise Versus Trunk Stabilization Exercise Combined With Conventional Therapy on Recovery of Postural Control and Balance in Hemiplegic Patients



### Medical Science

**KEYWORDS :** Stroke, Trunk impairment scale (TIS) and Berg Balance Scale (BBS).

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### ABSTRACT

*Aim of the study: To find out the efficacy of Core stability strength exercise versus Trunk stabilization exercise on recovery of postural control and balance in sub-acute hemiplegic patients.*

*Methodology: 30 patients with sub acute stage of hemiplegic patients were assigned into two treatment groups. The first group (n=15) treated with Conventional Physiotherapy with Core stability strength exercise. The second group (n=15) was given Conventional Physiotherapy with Trunk stabilization exercise. The effect of 12 weeks treatment was measured by Trunk Impairment scale score (TIS) and Berg Balance Scale score (BBS).*

*Result: After 12 week intervention using Conventional Physiotherapy with Trunk stabilization exercise had a statistically significant improvement on recovery of postural control and balance in hemiplegic patients than conventional Physiotherapy with Core stability strength exercise. Conclusion: The study proves that trunk stabilization exercise in addition to the conventional therapy is more effective on recovery of postural control and balance in hemiplegic patient, than the core stability strength exercise along with conventional therapy. So trunk stabilization exercise in addition to the conventional therapy can be used as an effective treatment programme in improving postural control and balance of sub acute hemiplegic patients.*

### INTRODUCTION

Cerebrovascular accident is a common nervous system disorder that occurs due to abnormal blood circulation in the brain with a completely developed nervous system. Unilateral paralysis accompanied by CVA reduces muscle control, body movements, and balance in unusual or asymmetrical positions. Thus, patients lose the ability to perform elaborate tasks and face difficulty while walking and standing up. The trunk is the center of the body, and it plays a postural role in functional movement by preparing the body for the movement of the extremities against gravity. It also plays an active role in smoothing the movement of the center of gravity, and it enables ease of movement into a new posture. Balance is the result of interactions among the visual system, vestibular system, proprioceptive system, musculoskeletal system, and cognitive ability. Stroke patients suffer from balance disability due to abnormalities in the proprioceptive system, sensory system, trunk muscles, and muscles of the limbs. Stroke often causes paralysis on the affected side as soon as it occurs, decreasing the adjustment ability of the trunk. 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. The trunk exercise on a stable support surface with subacute stroke patients improve the function of the trunk and observed that exercise on different support surfaces had a positive influence on subacute stroke patients. 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.

This study is appropriate to establish the effect of adding core stability strength exercise and trunk stabilization exercise to standard conventional rehabilitation in stroke.

### AIM OF THE STUDY

The aim of the study is to compare the effect of conventional Physiotherapy with core stability strength exercise and conventional Physiotherapy with trunk stabilization exercise on recovery of postural control and balance in hemiplegic patients.

### OBJECTIVES OF THE STUDY

- To find out the effects of conventional Physiotherapy with core stability strength exercise on recovery of postural control and balance in hemiplegic patients.
- To find out the effects of conventional Physiotherapy with trunk stabilization exercise on recovery of postural control and balance in patients.
- To compare the effects of conventional Physiotherapy with core stability strength exercise and conventional Physiotherapy with trunk stabilization exercise on recovery of postural control and balance in hemiplegic patients.

### HYPOTHESIS

#### Null Hypothesis

There was no statistically significant difference between conventional Physiotherapy with core stability strength exercise and conventional Physiotherapy with trunk stabilization exercise on recovery of postural control and balance in hemiplegic patients.

#### Alternate Hypothesis

There was statistically a significant difference between conventional Physiotherapy with core stability strength exercise and conventional Physiotherapy with trunk stabilization exercise on recovery of postural control and balance in hemiplegic patients.

### MATERIAL AND METHODS

#### Study Design: Quasi Experimental study design

A total of 30 ambulatory hemiplegic stroke patients were recruited into this study and randomly assigned into two groups, the control group and trained group. Visual feedback core stability strength exercise and trunk stabilization exercise were used in the trained group. Berg balance scale score and Trunk impairment scale scores of each patient were recorded. Data were collected before training and 3 months after completing the training program

#### Study Setting:

The study was conducted at Portea Medical, Home health care, Bangalore, under the supervision of concerned authority.

#### Sample Size:

A total number of 30 subjects were selected and assigned into

experimental group 1 and experimental group 2 of 15 each.

**Sampling Method:**

Non probability convenient sampling was used for selecting the sample from the population. Thirty patients were selected by non probability convenient sampling was assigned into experimental 1 and experimental 2 group of 15 each. Group A – Receives conventional physiotherapy with core stability strength exercise (Experimental group - I) Group B – Receives conventional Physiotherapy with trunk stabilization exercise (Experimental group -II)

**SELECTION CRITERIA:**

**Inclusion criteria**

- 45-60 years of age
- 1-3 months post stroke patients
- Motor Assessment Scale sitting score of 3
- Brunnstorm recovery stage score 4
- Both males and females
- No visual deficits
- No sensory deficits

**Exclusion criteria:**

- Any cognitive deficits
- Any other neurological deficits as multiple sclerosis, Parkinson's disease etc.
- Any musculoskeletal disorder like osteoarthritis, ligament injury etc
- Patient undergoing any other balance training protocol simultaneously
- Non-cooperative patients
- Degenerative and demyelinating disease

- Traumatic head injury
- Seizures
- Aphasia
- Brain tumors
- Study Duration:
- Duration of the study was 3 months

**Procedure:**

Prior sanction was obtained from the authorities for conducting the study. The patients were taken for primary evaluation and those who satisfied the inclusion criteria were selected for the study. Filled in consent form from the patient or the relatives of the each patient were taken. .On the first day before the first treatment session all patients in the study were assessed using Berg balance scale and Trunk impairment scale. The patients were checked for sensory and vasomotor impairments. Cognitive 13 level, language and speech were assessed with the Mini- Mental state examination chart. Any auditory problem was ruled out with Five-Minute hearing test.

**Each experimental group's exercise method**

The group I conducted the Core stability strength exercise, in addition to existing rehabilitation exercises five times per week for 12 weeks. The group II conducted the trunk stabilization exercises on the respective support surfaces, in addition to existing rehabilitation exercises five times per week for 12 weeks. Both groups conducted warming up exercises for 5 minutes, the main exercise for 20 minutes, and cooling-down exercises for 5 minutes, for a total of 30 minutes, in addition to existing rehabilitation treatment five times per week for 12 weeks.

**Table -1 Experimental group's exercise method**

Group-I Core stability strength exercise	Group-II Trunk stabilization exercise
<p><b>LYING POSITION:</b> The core stability-enhancing program was performed as follows. Patient was lying rightly on an adjustable treatment table.</p> <p>After extending the hip and knee joints, both the hip and knees were supported by a pillow to maintain this posture.</p> <p>Next, the blade bone was retracted such that the shoulder girdle is positioned in abduction, and a towel was placed below the blade bone to prevent the pectoralis major from performing a compensatory action via relaxing both shoulders. Another preparatory step is enhancing the stability of the neck region. For this, the head was lifted and held in this position by flexing the abdominal region. At the same time, the neck was pulled down to prevent the column from bending.</p> <p>Maintaining this posture, the upper part of the back was lifted as much as possible and twisted slightly in a diagonal direction so that the right hand can face the left knee. This position was maintained for a moment before lowering the back.</p> <p>At this moment, the left arm was aligned, and therapists lead them in right direction and provide minimum help for patients who have difficulty in doing it due to weak abdominal muscle in order that they can control it by themselves.</p> <p>This exercise was repeated; only this time the left hand faced the right knee for enhancing the abdominal muscles on the left.</p> <p>While maintaining this position, the jaw should be on the middle of the chest, and care should be taken that the jaw is not twisted. All these exercises enhanced the stability of core muscles.</p>	<p><b>SUPINE POSITION</b></p> <p>Pelvic bridge (raising the pelvis with both legs on the physio ball)</p> <p>Unilateral bridge (raising and maintaining the foot on the non-paretic side in a pelvic bridge position from the ball)</p> <p>Upper trunk flexion rotation (placing the trunk on the physio ball, bending the knees, placing the soles of the feet on the ground and grabbing an object on the hip joint on the opposite side)</p> <p>Lower trunk flexion rotation (bringing the pelvis diagonally to the shoulder in a pelvic bridge posture)</p> <p><b>SITTING POSITION:</b></p> <p>Lower trunk flexion extension (performing anteflexion and retroflexion on the physio ball)</p> <p>Upper trunk lateral flexion (moving the elbow down to the ball from the shoulder girdle)</p> <p>Lower trunk lateral flexion (raising the pelvis from the ball in the direction of the ribcage from the pelvic girdle)</p> <p>Upper trunk rotation (moving the shoulders forward and backward)</p> <p>Lower trunk rotation (moving the knees forward and backward)</p> <p>Weight shifting (moving the ball forward and touching the tops of the feet and moving the ball backward to a maximum level)</p> <p>Forward reach ( forward flexing the trunk and grabbing an object at the height of the shoulders)</p> <p>Lateral reach (grabbing an object at the height of the shoulders by elongating the trunk where the weight is loaded and shortening the opposite trunk)</p>

**Statistical Tool:**

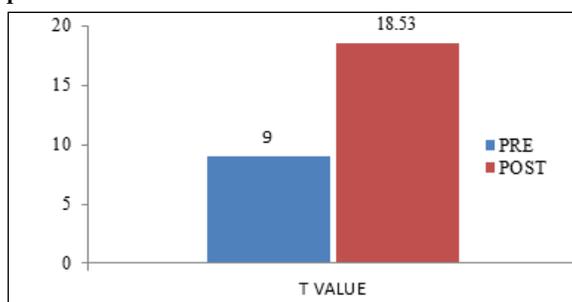
The collected data were subjected to statistical analysis using dependent and independent “t” test to find out the research effectiveness. **Dependent “t” test :** The dependent “t” test was used to compare the pre and post test value of TIS and BBS of two experimental groups. **Independent “t” test:** Independent “t” test was used to compare the mean difference between Group A and B subjects.

**DATA ANALYSIS**

**Table II - Statistical result of Trunk impairment scale Dependent ‘t’ test**

Variable	Pair	Group	Pair Difference		T Value	Df	Sig
			Mean	Std. Dev.			
Trunk impairment scale	Pre	Exp - 1	9.0000	2.10442	16.564	14	.000
	Post	Exp - 2	18.5333	1.64172	43.722		

**Graph I - Statistical Result of Trunk impairment scale Dependent ‘T’ Test**



A) Comparing the pretest and post test values of experimental group - 1 (Core stability strength exercise)

The mean pretest Trunk impairment scale (TIS) score of Group - 1 experimental is 8.7333, and post test mean score of Group - 1 experimental is 9.8000. Calculated “t” value for TIS is 16.564 which is greater than table value at .01 level of significance showing that there is significant difference between two value. This shows the efficacy of Core stability strength exercise along with conventional therapy.

B) Comparing the pretest and post test values of experimental group - 2 (Trunk Stabilization exercise)

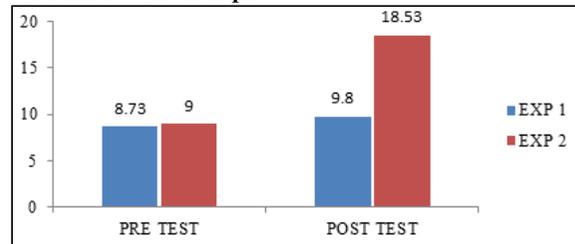
The mean pretest TIS score of experimental group - 2 is 9.0000 and the mean post test TIS score is 18.5333. Calculated “t” value is 43.722 which is greater than the table value, at .01 level of significance, showing that there is significant difference between the two values. This shows the efficacy of Trunk stabilization exercise in improving postural control and balance of the hemiplegic patients.

Analysis of results Using Independent “t” test – Trunk impairment scale

**Table III - Statistical result of Trunk impairment scale Independent ‘t’ test**

Group	Pre Test			Post Test		
	Mean	SD	Independent T	Mean	SD	Independent T
Exp 1	8.7333	2.34419	0.328	9.8000	2.80815	10.398*
Exp 2	9.0000	2.10442		18.5333	1.64172	

**Graph II - Statistical Result of Pre & Post Test Trunk impairment scale – Both Groups**



A) Comparing pre test TIS scores of experimental group -1 and experimental -2

Mean pre test TIS score of experimental group 1 is 8.7333 and that for experimental group 2 is 9.0000. Calculated “t” value 0.328 is lesser than that of table value at .01 level of significance showing that there is no significant difference between two groups. We can conclude that both the groups are homogenous.

B) Comparing post test TIS scores of experimental group 1 and experimental group 2

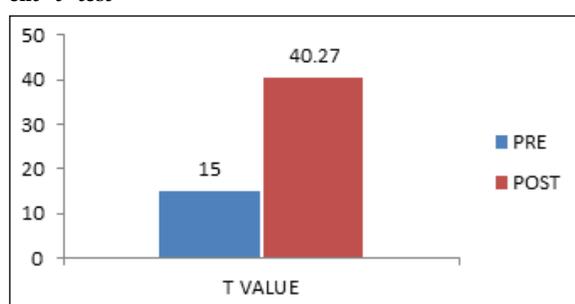
Mean post test TIS score of group - 1 (experimental) is 9.8000 and that for group-2 (experimental) is 18.5333. Calculated “t” value is 10.398 greater than that of table value at .01 level of significance, showing that there is significant difference between two groups. From statistical analysis TIS score significantly improved in experimental group - 2 when compared with that of experimental group 1 (Core stability strength exercise). Hence we can conclude that there is significant improvement in Trunk stabilization exercise in improving postural control and balance of the hemiplegic patients.

Analysis of results Using Dependent “t” test – Berg balance scale

**Table IV - Statistical result of Berg balance scale Dependent ‘t’ test**

Variable	Pair	Group	Pair Difference		T Value	Df	Sig
			Mean	Std. Dev.			
Berg balance scale	Pre	Exp -1	15.00	3.52542	16.479	14	.000
	Post	Exp -2	40.27	2.60403	59.889		

**Graph III - Statistical Result of Berg balance scale Dependent ‘t’ test**



A) Comparing the pretest and post test values of experimental group -1 (Core stability strength exercise group)

The mean pretest Berg balance scale score (BBS) of group -1 is 16.67 and mean post test BBS score of group-1 is 21.20. Calculated “t” value for wrist flexion is 16.479 which is greater than table value at .01 level of significance showing that there is significant difference between two values. This shows the efficacy of Core stability strength exercise along with conventional therapy.

**B) Comparing the pre test and post test values of experimental group - 2 (Trunk stabilization exercise group)**

The mean pretest wrist flexion score of experimental group is 15.00 and the mean post test wrist flexion score is 40.27. Calculated “t” value is which is 59.889 greater than the table value, at .01 level of significance, showing that there is significant difference between the two values. This shows the efficacy of Trunk stabilization exercise in improving postural control and balance of the hemiplegic patients.

Analysis of results Using Independent “t” test – Berg balance scale

**Table V - Statistical result of Berg balance scale Independent “t” test**

Group	Pre Test			Post Test		
	Mean	SD	Independent T	Mean	SD	Independent T
Exp 1	16.67	3.37357	1.323	21.20	3.27763	17.640*
Exp 2	15.00	3.52542		40.27	2.60403	

**Graph IV - Statistical Result of Pre & Post Test Berg balance scale – Both Groups**



A) Comparing pre test Berg Balance scale score of experimental group 1 and 2

Mean pre test BBS of experimental group1 is 16.67 and that for experimental group 2 is 15. Calculated “t” value 1.323 is less than that of table value at .01 level of significance showing that there is no significant difference between two groups. We can conclude that both the groups are homogenous.

**B) Comparing post test Berg Balance scale score of experimental group 1 and 2**

Mean post test BBS score of experimental group 1 is 12.10 and that for experimental group 2 is 40.27. Calculated “t” value is 17.640 greater than that of table value at .01 level of significance, showing that there is significant difference between two groups. From statistical analysis Berg balance scale score (BBS) are significantly improved in experimental group 2 when compared with that of experimental group 1. Hence we can conclude that there is significant improvement in the postural control and balance, of experimental group 2 which received Trunk stabilization exercise in addition to the conventional therapy for hemiplegic patients.

**RESULT**

The results of the statistical analysis showed significant improvement in postural control and balance of the experimental group 2 over experimental group 1. Thus it can be concluded that trunk stabilization exercise in addition to the conventional therapy can be used to improve the postural control and balance of the sub acute hemiplegic patients.

**DISCUSSION**

The research work was experimental comparative approach, which studied the effectiveness of Core stability strength ex-

ercise and Trunk stabilization exercise in addition to the conventional therapy to improve the postural control and balance of hemiplegic patients. For this study 30 patients from Health Vista India Private Ltd. Portea Medical, Bangalore. 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. Out of 15 patients in experimental group - 1, 11 were male patients and 4 were female patients. Out of 15 patients in experimental group - 2 were 12 were male patients and 3 were female patients. The outcome measurement was done by Trunk Impairment Scale (TIS) and Berg balance Scale (BBS). The outcome measurement for this study is widely used and yields scores that are reliable and valid. The group I conducted the Core stability strength exercise, in addition to existing rehabilitation exercises five times per week for 12 weeks. The group II conducted the trunk stabilization exercises on the respective support surfaces, in addition to existing rehabilitation exercises five times per week for 12 weeks. Both groups conducted warming up exercises for 5 minutes, the main exercise for 20 minutes, and cooling-down exercises for 5 minutes, for a total of 30 minutes, in addition to existing rehabilitation treatment five times per week for 12 weeks. Both groups were assessed on the first and last day of treatment. Along with conventional therapy, Core stability strength exercise and Trunk stabilization exercise were given to the experimental group 1 and 2. The results of the present study indicate that trunk stabilization exercise along with conventional therapy is more effective, thereby supporting the experimental hypothesis. Data were analyzed using Independent “t” test and Dependent “t” tests. Results showed significant improvement in the post test scores of experimental group 1 and 2. The experimental group 1 consists of 15 patients. Mean pretest score of TIS for experimental group - 1 was 8.7333 and for BBS was 16.67. After 12 weeks treatment programme the mean post test was 9.80 and 21.20 respectively. The experimental group 2 also had 15 patients who were satisfying the inclusion criteria. Mean pre test score of TIS for experimental group - 2 was 9.0000 and for BBS was 15.00. After 12 weeks treatment programme the mean post test was 18.5333 and 40.27 respectively. The difference may be due to combined effect of conventional therapy and trunk stabilization exercise.

On statistical analysis using Independent and Dependent “t” test, it was found that there is significant difference in the post test scores of experimental group - 2 over the experimental group -1 in stroke rehabilitation, thus rejecting the null hypothesis.

**CONCLUSION**

The study proves that trunk stabilization exercise in addition to the conventional therapy is more effective in improving postural control and balance of hemiplegic patient, than the core stability strength exercise along with conventional therapy. So trunk stabilization exercise 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 core stability strength with conventional physical therapy. This helps the patient to improve the quality of functional independence.

**LIMITATIONS**

1. Time allotted for data collection was 3 months.
2. Sample size was small, which reduces the generalisability.
3. No specific side of the hemiplegic patients have been selected
4. Hemiplegic patients of 1-3month duration only were considered
5. Duration of treatment programme was only 12 weeks.
6. The study assessed only short term progress of the patient. Long term follow up is needed to evaluate the differences in the condition of the patients from current status

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