



Efficacy Of Core Strengthening Exercises On Swissball Versus Conventional Exercises For Improving Trunk Balance In Hemiplegic Patients Following Stroke

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ABSTRACT

In stroke, there is paralysis or weakness of one side of the body including upper limb, trunk and lower limb leading to the disturbances in the trunk muscles. Trunk is often neglected part in the stroke rehabilitation, trunk training exercises and Swiss ball exercises results in better recruitment of trunk muscles thus improving sitting balance. To compare the effect of core strengthening exercises on Swiss ball and Conventional exercise, to improve trunk balance in hemiplegic patients following stroke. A total number of 70 subjects were screened as per inclusion and exclusion criteria. The subjects were divided into two groups, Group-A received core strengthening exercises on Swiss ball along with conventional treatment and Group-B received core strengthening exercises along with conventional treatment. Subjects showed improvement in trunk balance following 6 weeks of core strengthening exercises. Post-intervention the TIS, BBA and MBI score of both groups improved but the Group-A improved more significantly than Group-B. The level of significance was $P < 0.0001$. This study concluded that both the interventions have improved the trunk balance and activity of daily living by making the patient functionally independent.



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INTRODUCTION

The "American Heart Association/American Stroke Association" (2016), stated that on a normal, every 3 minutes 42 seconds, somebody dies of a stroke (Benjamin and Muntner, 2019). World Health Organization (WHO) defined stroke as: "rapidly developing clinical signs of focal (or global) disturbance of cerebral function, with symptoms lasting 24 hours or longer or leading to death, with no apparent cause other than of vascular origin" (Sheikh et al., 2020). Among

the non-communicable illnesses as assessed by Indian council of medical research, the mortality rate is resulted in 41% of cases, and differently-abled is observed in 72% of stroke (Viswaja, 2015). Throughout the United States, roughly 1 of each 19 expiries (Benjamin and Muntner, 2019), and more than 7,95,000 individuals consistently experience the ill effects of a stroke (Dhakate and Bhattad, 2020). The trunk muscles are impaired on both ipsilateral and contra lateral side of the body to that of the site of the lesion because the trunk muscles of the two sides of the body function in synchrony (Das, 2016). The back extensors and the abdominal muscles are the two group of muscles which are essentially important for moving and controlling the trunk (Chaudhary et al., 2020). The pelvic movement originates from trunk muscles, as pelvis is a part of a trunk that supports further extremity movements (Shinde, 2014).

Balance is defined as the ability to maintain functional equilibrium (Taly et al., 1998). Balance is a complex process which includes the integration and reception of sensory inputs and (Das, 2016), the visual, proprioceptive and vestibular system, along with the central functions of planning and execution of movement (Sathe et al., 2018). Anticipatory postural adjustments (APA) predicts the level of balance impairment and related danger of mobility, as well as falls and, are significant neuromuscular biomarkers (Lee and You, 2018).

Core stability is regarded as a recovery of balance after perturbation, by utilizing the capability of the lumbo-pelvic-hip complex to prevent buckling of the vertebral column (Cabanas-Valdes and Bagur-Calafat, 2016). A "core" comprising of the abdominals anteriorly, backside gluteal and paraspinal muscles, diaphragm as the roof, and hip girdle and pelvic floor muscles at the bottom, is referred to as a box (Chung and Kim, 2013). Bergmark (1989) (Bergmark, 1989) had differentiated the muscles as "local" muscles and "global" muscles, on the basis of the activity on the lumbosacral spine. The local muscles are actively involved in segmental stability of the trunk, whereas the global muscles modulate the spine and trunk movement (Haruyama et al., 2016).

Swiss ball (physioball), also known as Pezzi ball, was created in 1963 by Aquilinocosani, an Italian plastic manufacturer (Muniyar and Darade, 2018). Before testing the patient's balance on the Swiss ball, the balance during static and dynamic condition is checked on rigid and steady support in sitting and standing posture (Carriere and Tanzberger, 1998).

The Conventional program includes the patient in

exercises that combines both movement and stability (Adler et al., 2014). Functional exercises are planned dynamically for improving the patient's independence (Hollis, 1999).

As a primary and secondary outcome measures, the results are estimated for the control of trunk by using the Trunk Impairment Scale (TIS), and the Brunel Balance Assessment (BBA), and Modified Barthel Index (MBI) for assessing functional balance after the stroke.

MATERIALS AND METHODS

Methods

The study was conducted after taking approval from the institutional research ethics committee, approval no. (DMIMS(DU)/IEC/2018-19/7197) in Department of Neuro Physiotherapy, Ravi Nair Physiotherapy College, Acharya VinobaBhave Rural Hospital, Sawangi (Meghe), Wardha. Inclusion criteria were atients suffered from the first episode of stroke within 1-3 months of duration, age between 40 to 60 years, tage 2, on the Modified Ashworth Scale, no visual and sensory deficits, ability to communicate verbally. Exclusion criteria were the existence of any other neurological or orthopaedic diseases, haemorrhagic stroke, patients having cognitive problems. Of each of the 70 subjects composed pre-informed consent, marked or with thumb impression was taken and they were told about the conceivable result of the intercessions. Pre and post-TIS score, BBA score and MBI score were taken. Patients were distributed in two groups with 35 subjects in each group respectively and were chosen randomly.

Subjects in a Group-A received core strengthening exercise on Swiss ball along with conventional treatment and subjects in the Group-B received core strengthening exercise along with conventional treatment. The total duration of exercises was almost approximately 45 minutes to one hour. Subjects had permitted to take rest for 2 minutes in the middle of each new exercise or as and when he/she wished. Also, for core strengthening the patient had to ask to draw-in the abdominal muscles for 5 counts or 5 seconds.

Conventional physiotherapy was received for 15 minutes by both groups which include, Active assisted range of motion exercise of upper limb (15 times each movement)-Shoulder, Elbow and Wrist and finger range of motion exercise.

Lower limb(15 times each movement)-Hip, knee and ankle range of motion exercise.

Core strengthening exercises on a Swiss

ball(GROUP-A) was given in supine-lying position, with upper trunk flexion, and with lateral upper trunk flexion.

Interventional exercise (Group-A)

Supine-lying exercises: Bridging, Unilateral Bridging, Lower trunk rotations.

Sitting exercises: Static sitting balance, Forward trunk flexion, lateral trunk flexion, Trunk rotations in sitting, Weight shifts, Forward reach, Lateral reach, Perturbations, sit to stand.

Core strengthening exercises (Group-B)

Supine-lying position- Core strengthening exercise was done in crook lying position, Upper trunk in flexion, Upper trunk diagonal rotation.

Bridging, Unilateral pelvic bridging, Upper trunk rotation, Lower trunk rotation, Prone on an elbow, Quadruped position, kneel sitting, Kneel standing, Half kneeling.

Data Analysis

Statistical analysis was done by using descriptive and inferential statistics using chi-square test, Wilcoxon Signed Rank Test and Mann Whitney U test as well as SPSS version 22.0 and GraphPad Prism 7.0 version. The $p < 0.05$ is considered as the level of significance.

Mann Whitney U Test

According to Table 1, based on the Mann Whitney U test, the mean difference of total Trunk Impairment Scale score in Group-A and Group-B was compared. The P-value was 0.0001 ($P < 0.05$), which was found to be significant and represented graphically.

Mann Whitney U Test

According to Table 2, based on the Mann Whitney U test, the mean difference of Brunel Balance Assessment Scale in Group-A and Group-B was compared at 1 week and 1 month. The P-value was 0.62 ($P > 0.0001$), which is found to be non-significant at 1 week in both groups respectively while the P value 0.0001 ($P < 0.05$) was found at 1 month which was found to be significant and represented graphically.

Mann Whitney U Test

According to Table 3, based on the Mann Whitney U test, the mean difference of the Modified Barthel Index score in Group-A and Group-B was compared. The P value was 0.0001 ($P < 0.05$), which was found to be significant and represented graphically.

Discussion

Regain of the trunk balance or proximal and distal stabilization is an important part of stroke rehabilitation, as trunk balance is related to a marked

improvement of functional activity of daily living (Hariharasudhan and Balamurugan, 2016). Usually, the functional exercises of everyday living require the co-ordination between the limb and the trunk. The goal of the current study was to analyze the impact of core strengthening exercises on Swiss ball combined with conventional treatment and core strengthening exercises combined with conventional treatment for increasing the strength of core muscles to improve trunk balance in subacute stroke patients (Sahu and Naqvi, 2020).

Static sitting balance assesses the capacity to sit upright in a sitting position within the normal base of support or when the base of support has been decreased. Results indicated noteworthy improvement in the two groups following an intervention. The mean pretest score was improved from 5.51 to 7.00 following 6 weeks of treatment in Group-A while the Group-B improved from 5.65 pretest score to 7.00 post-test score following intervention which was significant. Anyhow, when we correlate the mean difference in static sitting balance in Group-A and Group-B with the mean values of 1.48 and 1.34, there was no significant change found, the P-value was 0.22. The dynamic sitting balance domain assesses specific side flexion of upper and the lower part of the trunk. Over a 6week's time of treatment, the mean pre and post-test scores of the dynamic sitting balance domain of TIS in the Group-A enhanced from 4.77 to 9.94 while the Group- B improved from 4.91 to 10.00. But, when we compared the mean difference in dynamic sitting balance in Group- A and Group- B with the average values was 5.17 and 5.08, which shows that there was no significant difference found. The co-ordination domain of TIS assesses the upper and lower trunk rotations independently and checks for the symmetry in the rotations. Following intervention mean score of co-ordination in the Group-A improved from 2.00 to 6.00 and 1.88 to 5.22 in Group- B and after comparing the average difference of co-ordination scores in Group-A and Group-B with the mean values of 4.00 and 3.34, a significant enhancement was found in two groups, the P-value was less than 0.05.

Following a month of intervention, the mean pretest and post-test scores of BBA at baseline evaluation, one-week evaluation and following 1 month of evaluation changed from 5.62 to 6.00 and 10.51 respectively in Group-A and from 5.48 to 5.80 and 8.88 in Group-B. However, by comparing the mean difference of BBA at one week and one month, we found that the mean values were increased from 0.37 to 4.88 in Group-A and 0.31 to 3.40 in Group-B respectively.

Table 1: Comparison of mean difference in Total Trunk Impairment Scale Score in Group A and Group B

Group	N	Mean	Std. Deviation	Std. Error Mean	z-value
Group A	35	10.71	0.57	0.09	4.83
Group B	35	9.77	1.00	0.16	P=0.0001,S

Table 2: Comparison of mean difference in Brunel Balance Assessment Scale at 1 week and at 1 month in Group A and Group B

	Group	N	Mean	Std. Deviation	Std. Error Mean	z-value
1 week	Group A	35	0.37	0.49	0.08	0.49
	Group B	35	0.31	0.47	0.07	P=0.62,NS
1 month	Group A	35	4.88	0.58	0.09	10.47
	Group B	35	3.40	0.60	0.10	P=0.0001,S

Table 3: Comparison of mean difference in Modified Barthel Index Score in Group A and Group B

Group	N	Mean	Std. Deviation	Std. Error Mean	z-value
Group A	35	11.65	0.59	0.09	8.64
Group B	35	9.65	1.23	0.20	P=0.0001,S

Significant improvement of Modified Barthel Index scores in both the groups might be because of the common conventional treatment which was given to both the groups. Average pre-test grade of Modified Barthel Index in Group-A and Group-B was 6.05 and 6.41. Following 6 weeks of a treatment program, the average post-test grade in Group-A and Group-B stood at 17.71 and 15.80, which was found to be significant. Also, when we compare the mean difference in the Modified Barthel Index score in Group-A and Group-B, which was 11.65 and 9.65, respectively.

CONCLUSIONS

This research concluded that the trunk equilibrium and daily living behaviour were enhanced by both the treatments by making the patient functionally autonomous. This study concluded that core muscle strengthening exercise is an important recovery strategy for all chronic low back pain patients, irrespective of the length (chronicity) of their pain, along with lumbar flexibility and gluteus maximus strengthening. Findings suggest that when a patient has chronic non-specific low back pain, doctors have an option to either administer core stability exercise or general exercise. If the patient is more acceptable and will promote compliance, core stability exercise may be used as an alternative to general encourage-

ment and stretching. However, by selecting core stability in terms of pain and function, clinicians do not expect a dramatic change, especially in the long run.

Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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REFERENCES

- Adler, S., Beckers, D., Buck, M. 2014. *PNF in Practice*. Heidelberg, Berlin.
- Benjamin, E. J., Muntner, P. 2019. Heart Disease and Stroke Statistics -2019 Update: A Report from the American Heart Association. *Circulation*, 139:56–528.
- Bergmark, A. 1989. Stability of the lumbar spine. *Acta Orthopaedica Scandinavica*, 60(sup230):1–54.
- Cabanas-Valdes, R., Bagur-Calafat, C. 2016. The effect of additional core stability exercises on improving dynamic sitting balance and trunk control for subacute stroke patients: a randomized controlled trial. *Clinical Rehabilitation*, 30(10):1024–1033.

- Carriere, B., Tanzberger, R. 1998. *The Swiss ball*, volume 46. Springer, Berlin.
- Chaudhary, S., Chaudhary, N. I., Ghewade, B., Mahajan, G. 2020. The Immediate Effects of Breathing Exercises with Acapella and Incentive Spirometer on Preventing Early Pulmonary Complications Following Cabg. - A Comparitive Study. *International Journal of Current Research and Review*, 12(17):51-58.
- Chung, E., Kim, J. 2013. The Effects of Core Stabilization Exercise on Dynamic Balance and Gait Function in Stroke Patients. *Journal of Physical Therapy Science*, 25(7):803-806.
- Das, J. 2016. A Study to Assess the Effectiveness of Trunk Rehabilitation Programme on Trunk Control and Balance in Acute Ischemic Hemiparetic Stroke Patients. *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 15(12):72-81.
- Dhakate, D., Bhattad, R. 2020. Study the Effectiveness of Bilateral Arm Training on Upper Extremity Motor Function and Activity Level in Patients with Sub-Acute Stroke. *International Journal of Current Research and Review*, 12(20):31-37.
- Hariharasudhan, R., Balamurugan, J. 2016. Enhancing trunk stability in acute poststroke subjects using physioball exercise and proprioceptive neuromuscular facilitation technique: A pilot randomized controlled trial. *International Journal of Advanced Medical and Health Research*, 3(1):5-5.
- Haruyama, K., Kawakami, M., Otsuka, T. 2016. Effect of Core Stability Training on Trunk Function, Standing Balance, and Mobility in Stroke Patients. *Neurorehabilitation and Neural Repair*, 31(3):240-249.
- Hollis, M. 1999. *Practical exercise therapy*. Functional Activities on Mats, P. J. Waddington, fourth, chapter 24 edition .
- Lee, N., You, J. 2018. Best Core Stabilization for Anticipatory Postural Adjustment and Falls in Hemiparetic Stroke. *Archives of Physical Medicine and Rehabilitation*, 99(11):2168-2174.
- Muniyar, K., Darade, S. 2018. Effect of Swiss Ball Training And Conventional Physiotherapy To Improve Balance And Mobility In Post-Stroke Patients. *International Journal of Physiotherapy and Research*, 6(4):2813-2822.
- Sahu, A., Naqvi, W. M. 2020. Upper limb functional independence in subacute stroke patients: a study protocol investigating the impact of haptic enhanced virtual reality system. *Journal of Critical Reviews*, 7(9):446-451.
- Sathe, P., Chitre, P., Ghodey, S. 2018. Added Effect of Pilates Mat Exercises On Balance And Limits Of Stability In Chronic Stroke Patients: A Pilot Study. *International Journal of Physiotherapy and Research*, 6(3):2732-2739.
- Sheikh, M. K., Malavde, R., Daigavane, S. 2020. Yogic Eye Exercises Followed by the Ergonomic Advice on Eye Fatigue in Children Attending Online Classes in COVID-19. *International Journal of Current Research and Review*, 12(17):132-136.
- Shinde, S. 2014. Effect of Swiss Ball Training On Trunk Performance In Patients With Stroke. *Romanian Journal of Physical Therapy*, 20(34).
- Taly, A., Nair, K. S., Murali, T. 1998. *Neurorehabilitation principles and practice*. National Institute of Mental Health and Neuro Sciences, Bangalore.
- Viswaja, K. 2015. Effectiveness of Trunk Training Exercises Versus Swiss Ball Exercises for Sitting Balance And Gait Parameters In Acute Stroke Subjects. *International Journal of Physiotherapy*, 2(6):925-932.