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ORIGINAL ARTICLE

Effect of Swiss Ball Training on Balance and Postural Stability in Stroke Patient

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ABSTRACT

Stroke is sudden loss of neurological function. It is caused by interruption in cerebral blood flow.
Objectives: To analyze the difference in the balance and postural stability score pre &post swiss ball training in stroke patients**.**
Study Design: Randomized control trial.
Methodology: This study was performed on stroke patients which are selected according to inclusion and exclusion criteria. The patients were allocated randomly into two groups, experimental group with exercises being performed on swiss ball and control group with exercises performed as per conventional methods with no additional intervention.
Statistical analysis: SPSS software, v 20 analyzed data. Independent samples t test and paired sample test were applied.
Results: The results showed mean difference of Berg Balance Scale at pre-intervention level and post-interventional level was 0.15 and 14.15 with p values 0.653 and 0.000, respectively. The TIS also showed non-significant difference at pre-interventional level as shown by p value 0.170 , which was significant at post interventional level with a p value to be 0.000 . Paired sample statistics showed a significant improvement for both groups at pre-post level of measurement with a p value of 0.000.
Conclusion: We concluded that in stroke patients performing exercises on swiss ball showed significant better outcomes as compared to control group in improving balance and postural stability. However, both groups improved significantly when tested at pre-post levels of measurement.
Keywords: Swiss Ball, Stroke, Physical Therapy, Exercise Therapy and Balance.

INTRODUCTION

Stroke is a clinical syndrome, which is presumed vascular origin, characterized with rapid growth of signs of focal or global alteration of brain functions that last more than 24hours and lead to death. Including Stroke Council of the American Heart Association, there are other bodies who convened a group of writers to establish an expert opinion and consensus for an upgradation of stroke definition for twenty first century. Infarction of Central nervous system is defined as retinal cell, spinal cord or, death due to ischemia, because of neuropathological, neuro-radiography and/or clinical evidence of permanent or major injury[1]. Such infarction occurs over a clinical spectrum: Ischemic stroke specifically refers to central to central nervous system infarction comes along with overt symptoms, while other form of infarction such as silent infarction carries no causes or known systems. There are other symptoms included in stroke such as hemorrhage of subarachnoid space and intra-cerebral hemorrhage. Therefore, upgraded definition of stroke can be used in criterial clinical or neural tissues criteria and can be employed in research, practice and public health assessments[2].

The literature about an estimation of stroke incidence shows that cerebral infarction lead to 85% of cerebrovascular accidents. Furthermore, 5% may be due to subarachnoid hemorrhage and 10% due to cerebral hemorrhage.

Subarachnoid hemorrhage (SAH) is a bleeding from a cerebral vein, aneurysm or vascular abnormality into the subarachnoid space (the space encompassing the cerebrum where veins lie between the arachnoid and layers). It is described by unexpected beginning of cerebral pain and retching with or without loss of cognizance. It influences 6-12 individuals for every 100,000 of the populaces for each year and comprises about 5% of first strokes. Around 85% of patients seep from an intracranial aneurysm,10% from a non-aneurysmal peri mesencephalic drain and 5% from other vascular variations from the norm including arteriovenous contortion[3]. Clinically the intense introduction is normally not the same as the introduction of other cerebrovascular mishaps. Explicitly in light of the fact that it presents with unexpected beginning of extreme migraine and non-central neurological side effects that may incorporate loss of cognizance[4].

Stroke is a beginning of neurological injury because of a variation from the norm in cerebral course with resultant sign and side effects that compare to contribution of central zones of cerebrum. Stroke is the third leading reason for death in industrialized nations and driving reason for grown-up inability[5]. Half of all stroke survivors are left with major utilitarian issues close by walk, parity and perception. Lingering disintegration that keeps going longer than 3 weeks prompts perpetual handicap. For some individuals, these scatters are the significant snags counteracting their arrival to autonomy and personal satisfaction. Hemiplegia establishes the fundamental somato-nerological clutter in roughly 90% of the patients. Patients with stroke have different deficiencies in equalization, muscle quality, engine control, uninvolved versatility, sensation, tone and discernment[6].

Balance status can predict outcome of stroke exercise, physical therapy care and rehabilitation. Balance is defined as body's ability to maintain center of gravity on its base of support with less influence or more stability[7]. Each activity being performed requires reaction of gravity to the body for adjusting accordingly to maintain balance. In stroke, one's ability to balance may be impaired because deficits of strength, range of movements. proprioception, vision, vestibular function and endurance. Previous literature has showed perceptual disturbance and balance as risk factors for fall in stroke patients. The basic components of balance include center of gravity, the alignment of posture, limit of stability (LOS), the change of rhythmic weight. Weight bearing symmetry is observed in stroke that may be as high as 61-80% of their body weight through non paretic lower extremity[8].

Common treatments for balance impairment include training of trunk muscle exercises, functional electrical stimulation and mental images, motor learning program etc[9]. Trunk muscle training is the most common clinical methods to strengthen core muscle functions, stability and promote the recovery of balance function after a cerebro-vascular accident. Intensive training on unstable support surfaces can improve the stability of the core muscles and extend the cross- sectional area of muscles, thus increasing the frequency of discharge and the number of motor units. Therefore, unstable support training can be used significantly to improve the balance that training on stable support surfaces[10].
Objectives: To analyze the difference in the balance and postural stability score pre &post swiss ball training in stroke patients**.**

METHODOLOGY

The study (single blinded randomized clinical trial) was conducted in physiotherapy department Madinah Teaching hospital Faisalabad. This study was completed within the time duration of six months after the approval of synopsis.

Group A: Conventional treatment followed by swiss ball training. **Group B**: Conventional treatment. Non probability convenience sampling technique was used. Participants who met inclusion and exclusion criteria were requested to take part in the study. Written consent was taken.

Data collection tools were:

1 Berg balance scale.
2 Trunk impairment scale.

All exercises were assisted initially by therapist & later it was carried out actively by patients. Conventional treatment was tailor-made according to muscle affected. Duration of training –3 weeks, 4 times per week. An exercise was terminated on patients demand if they feel tired or fatigue or any complains. Appropriate rest pause between each exercise was given. Total treatment duration 60minutes. After 3week, patients were re-assessed and score was documented.

Swiss ball exercises were: Sitting on the ball:

1. Pelvic tilt exercises and weight shift exercises.
2. Limb movements first alone and then with alternate upper and lower limbs.
3. Reach out in all direction with both hands clasped or with normal hands.

Patient was lying supine on mat with lower limb on the ball:

1. Bridging with lower limbs on ball
2. Abduction and adduction movement of legs.

Statistical Analysis: SPSS software, v 20 analyzed data. Independent samples t test and paired sample test were applied.

RESULTS

Table-1: Berg Balance Scale Score Between Groups

Parameters	Groups	Mean	SD
Berg Balance Scale Score before Treatment	Experimental	25.35	1.03
	Control	25.50	1.05
Berg Balance Scale Score after Treatment	Experimental	41.25	1.97
	Control	27.10	.911

Pre-treatment as well as post-treatment mean value of Trunk Impairment Scale Score between groups was presented as mean ± SD in table-2.

Table-1: Berg Balance Scale Score Between Groups

Parameters	Groups	Mean	SD
Score of Trunk Impairment Scale before Treatment	Experimental	11.85	0.670
	Control	12.20	0.894
Score of Trunk Impairment Scale after Treatment	Experimental	18.10	0.788
	Control	14.15	0.875

Pre-treatment as well as post-treatment mean value of Berg Balance Scale Score within groups was demonstrated as table-3.

Table-3: Berg Balance Score within Group

Treatment Group			Mean	N	SD	SEM
Experimental	Pair 1	Berg Balance Scale Score before Treatment	25.3500	20	1.03999	.23255
		Berg Balance Scale Score after Treatment	41.2500	20	1.97017	.44054
Control	Pair 1	Berg Balance Scale Score before Treatment	25.5000	20	1.05131	.23508
		Berg Balance Scale Score after Treatment	27.1000	20	.91191	.20391

Out of 100% in the conventional group there were female were 9(45%) and 11(55%) male. In the experimental group there female 7(35%) and 13 (65%) male. Pre-treatment as well as post-treatment mean value of Berg Balance Scale Score between groups was presented as mean ± SD in table-1.

Pre-treatment as well as post-treatment mean value of Trunk Impairment Scale Score within groups was demonstrated as table-4.

Table-4: Trunk Impairment Score within Group

Treatment Group			Mean	N	SD	SEM
Experimental	Pair 1	Score of Trunk Impairment Scale before Treatment	11.8500	20	.67082	.15000
		Score of Trunk Impairment Scale after Treatment	18.1000	20	.78807	.17622
Control	Pair 1	Score of Trunk Impairment Scale before Treatment	12.2000	20	.89443	.20000
		Score of Trunk Impairment Scale after Treatment	14.1500	20	.87509	.19568

DISCUSSION

There found important findings in this study. The main benefit of doing exercise with swiss ball is the body's respond to instability of ball to be balanced and activating more muscles and group of muscles. Over the time muscles gain their strength to maintain balance specially core muscles, back muscles and muscles of abdomen. Ball exercise enables to recruit more group of muscles without even increasing weight to load. In this way, core muscles get activate and dependency of push up and curl up. Electromyography showed that there is produced more electrical activity when same muscle is exercised on swiss ball and without swiss ball.

There was perfect baseline equality before intervention in measurement of Berg Balance Scale and standard deviation was also minute. There was no difference in variances, so assuming that both deviations equally distributed, there found a non-significant difference as measured by independent samples t test. The negative value of mean difference showed that control group was at slight advantage over swiss ball group, before intervention.

After intervention, the score of Berg Balance Scale was surprisingly boosted much more for those in swiss ball exercise group as compared to those in control group. There was difference in variances of both groups' deviations. However, both groups have parametric distribution of data. It is shown by Levene's method of testing normality of data. Assuming unequal variances, the p value of 0.000 showed a highly significant difference in both groups with swiss ball exercise while the degree of freedom was 29.14 which again showed strong correlation of data with minimum dispersion[11].

Next outcome measure was trunk impairment scale which was primarily measured to see dynamic capability and improvement of trunk musculature. As for as swiss ball is concerned it was supposed to activate all bodily muscles especially trunk muscles. It was done with patients sitting straight, then legs crossed passively and then legs crossed actively for measure of static impairment. Secondly it was measured for dynamic impairment by lateral flexion, unilateral hip lifting, trunk coordination in upper and lower parts from shoulder girdle to pelvic[12].

Before intervention, the both groups i.e. swiss ball and control group taking regular care were have almost similar mean scores of trunk impairment scale with no variances in standard deviations. The p value of 0.170 also showed a non-significant difference. At post-interventional level, swiss ball group made a marked improvement with a highly significant p value of 0.000 with mean difference of 14 points on trunk impairment scale.

Previous literature showed role of swiss ball exercise with variety of outcomes. The past studies have been conducted to see effect of exercise of performed on swiss ball for improvement of balance, trunk control, dynamic ability, function, gait and even in static core muscles' training. It has been proven multiple times that the exercise performed on swiss ball have better outcomes[13]. The comparison methods in all these include regular exercise, or exercise on treatment table or on mat or methods of other routine care. The outcomes of current study are similar to findings as those of previous studies. The difference is magnitude of effect. The size of effect found to be higher in current study as compared to past literature[14,15]. This would be due to psychological impact of method. Because the swiss ball was new for almost all patients and exercises on ball was something very elite. The apparent complexity of exercise on swiss ball may have triggered hope in patients of swiss ball. It seems also true due to the fact the patients were swiss more motivated and passionate about recovery. This advantage is considered a huge advantage. In short, swiss ball group performed significantly better than control group despite the fact that control group and swiss ball group improved significantly measured at pre-post level.

Limitations: The study has few limitations as well. The size of the sample was not enough to generalize the results. Limited resources were available.

CONCLUSION

We concluded that in stroke patients performing exercises on swiss ball showed significant better outcomes as compared to control group in improving balance and postural stability. However, both groups improved significantly when tested at pre-post levels of measurement.

Authors' Contribution:

NG&SM Conceptualized the study, analyzed the data, and formulated the initial draft.

HMG&AI Contributed to the histomorphological evaluation.

SI&TL Contributed to the analysis of data and proofread the draft.

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