WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.074
Volume 7, Issue 12, 408-419. Research Article ISSN 2277– 7105

EFFECTS OF TRUNK EXERCISES ON SWISS BALL VERSUS BED EXERCISES IN HEMIPLEGIC PATIENTS

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Article Received on
25 April 2018,

Revised on 16 May 2018,
Accepted on 06 June 2018

DOI: 10.20959/wjpr201812-12243

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ABSTRACT

Background and purpose: of this study was to compare the effects of trunk mobility exercises on bed versus swiss ball in acute hemiplegic patients. **Method:** 30 subjects of age group 45-60 years both male and female with duration of disease <1 month were divided into 2 groups viz. A (Bed exercises) and B (Swiss ball exercises). Each patient was assessed using TIS. Treatment was given for 12 days and carryover effect was checked in the 4th week of the intervention. Pre and post TIS scores were compared. **Results:** both the treatment group showed significant improvement but training on Swiss ball had highly significant result and better carryover effect in the 4th week compared to bed exercises group with (p= 0.03) which is significant. **Conclusion:** as both the interventions have significant improvement but the exercises performed on Swiss ball proved to be better than the exercises performed on bed traditionally for trunk mobility.

KEYWORDS: trunk mobility exercises, swiss ball, bed exercises, carryover effects,acute stroke.

INTRODUCTION

Stroke is sudden loss in neurological functions caused by interruption of blood flow to the brain. In the 1970s the World Health Organisation defined stroke as a "neurological deficit of cerebrovascular cause that persists for beyond 24 hours or is interrupted with death within 24 hours". The 24 hours limit divides stroke from Transient Ischaemic Attack, which is related syndrome of stroke symptoms that resolve within 24 hours. After coronary heart disease (CHD), and cancer of all types, stroke is the third commonest cause of death worldwide.

During the last decade, the age-adjusted prevalence rate of stroke was between 250-350/100,000. Stroke represented 1.2% of total deaths in India. To be classified as stroke, neurological deficit should persist for more than 24 hours. Motor deficits are characterised as paralysis (hemiplegia) or weakness (paresis), typically on the side of the body opposite to the lesion. the term hemiplegia generically refers to the variety of motor problems that results from stroke. Impairment may resolve spontaneously as brain swelling subsides, generally within 3 days. Residual neurological impairments caused by strokes are those that persist longer than 3 weeks and may lead to permanent disability.

Atherosclerosis is a major contributing factor in cerebrovascular disease. It is characterised by plaque formation with an accumulation of lipids, fibrin, complex carbohydrates and calcium deposits on arterial walls that leads to narrowing progressive narrowing of blood vessels. Stroke is classified by etiological categories as (thrombus, embolus, or haemorrhage). Ischaemic strokes are a result of thrombus, embolus, or conditions that produce low systemic perfusion pressures. Haemorrhagic strokes, with abnormal bleeding into the extravascular areas of the brain are the result of rupture of a cerebral vessel or trauma. Interruption of blood flow for only a few minutes' sets in motion a series of pathological events. Complete cerebral circulatory arrest results in irreversible cellular damage with a core area of focal infarction within minutes. Ischemia triggers a number of damaging and potentially reversible events, termed ischemic cascade. The release of excess neurotransmitters produces a progressive disturbances of energy metabolism and anoxic depolarization. This results in an inability of brain cells to produce energy. Thus, this energy deprivation further causes damage to brain cells resulting into stroke. Hence the attack of stroke results in neurological deficits causing Hemiparesis including muscles of upper extremity and lower limbs, trunk and face.

The sensory-motor impairment of trunk interferes with functional performance after stroke. Along with hemiplegic limb muscles, the trunk muscles are also impaired multidirectional following a unilateral stroke. As the trunk is the central key point of the body, proximal trunk control is very essential for distal limb movement control, balance and functional activities. A prospective study demonstrated trunk control as an early predictor of comprehensive ADL functions in stroke patients. A randomised control trial by Verhyden et al demonstrated that additional trunk exercises performed on plinth along with regular rehabilitation had a beneficial effect in improving selective performance of trunk lateral flexion subacute stroke

patients. The potential activation of trunk muscles is greater when exercises are performed on a Swiss ball because it is an unstable surface which provides a postural perturbation to which the trunk muscles has to respond in order to maintain a desired posture. Later in the 4th week patients will be assessed to check the carryover effect of the same intervention to determine the long term effects of these exercises.

To compare the pre and post treatment effects each individual will be assessed using a TIS as an outcome measure for our study. A systemic review of clinical tools designed to evaluate trunk performance after stroke has concluded TIS developed by Verhyden et al has found to be essential psychometric properties in stroke which stated that the test re-test and inter-observer reliability total score as 0.96.

OBJECTIVES

Trunk exercises performed on Bed improves trunk control whereas exercise performed on Swiss ball also shows beneficial effects. Thus, the purpose of this study is to compare the effects of trunk control on bed exercises versus Swiss ball exercises in Acute hemiplegic patients and to check the carryover effect of the same intervention in the 4th week for long term effects.

MATERIALS AND METHODOLOGY

The study was conducted at the Dr. D. Y. Patil College of Physiotherapy, pimpri, Pune. Institutional Ethical committee approval was obtained for the comparative study. A simple random sampling was done to allocate the 30 acute hemiplegic patients in two groups viz. group A for bed exercises and group B for Swiss ball exercises for 12 days.

Inclusion criteria: the participants required for the study were 30 acute hemiplegic patients who is out of cerebral shock, first CVA attack and duration of the disease <1 month with age between 45-60 years both male and female. Patient should be able to stand unsupported for at least 1 min and follow simple verbal commands i.e. MMSE scoring >24.

Exclusion criteria: subjects diagnosed with cerebellar stroke and cerebellar disorders, patients with uncontrolled illness and epilepsy, obese and neurological conditions affecting balance other than stroke.

PROCEDURE

The study was conducted at Dr. D. Y. Patil College of Physiotherapy, Pimpri, Pune from September 2016- January 2017. Total 30 acute hemiplegic subjects were taken for the intervention and divided into 2 groups A & B with Bed exercises and Swiss ball exercises respectively using simple Random sampling method 15 patients in each group fulfilling the inclusion criteria. The purpose of the study was explained to the subjects and informed consent was obtained.

The same set of trunk exercises were given on bed or Swiss ball for 12 days which included exercises such as static sitting, forward reach outs, trunk rotations, lateral trunk flexion , trunk flexion and extension, pelvic bridging, etc. in supine and sitting. For both the groups the exercises were gradually introduced and the number of repetitions was determined on the basis of patient's performance. The intensity of the exercises was increased by: Reducing the Base of support, advancing the balance limit and increasing the hold time. Trunk Impairment Scale was used as an outcome measure for trunk control assessment before and after the treatment. After the completion of all the given sessions of the therapy the subjects were re-assessed as mention earlier. Then the pre and post TIS scoring were compared in order to find out the differences. Proper precautions were taken in order to reduce the risk of fall by taking care of foot and knee position and co-ordination and base of support as well the size of the Swiss ball.

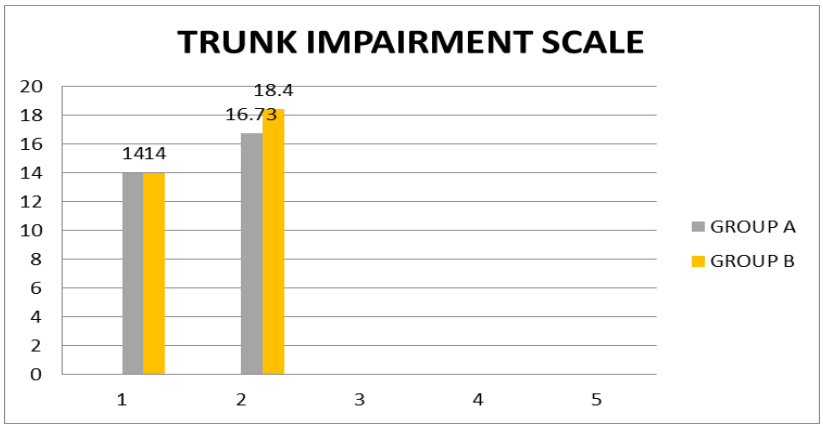
At the end of the 4^{th} week, patients were again assessed to find out the carryover effects of the same treatment given in first 2 weeks using Trunk Impairment Scales an outcome measure.

Data analysis

Data analysis was done before and after the intervention in both the groups as well at the 4^{th} week by using the TIS scorings which were recorded and tabulated. The statistical analysis was done by using Primer version 7.0 software to evaluate the effects of the interventions. The P value considering <0.05, with 95% confidence interval and both the groups were compared using paired t-test, the standard deviation, t value and mean value was obtained.

RESULTS

This study was done on 30 patients with acute hemiplegia. The aim of this study was to examine whether the trunk exercises are performed on Swiss ball are more beneficial than the exercises performed on bed and to check the carryover effect of the same in the 4th week.

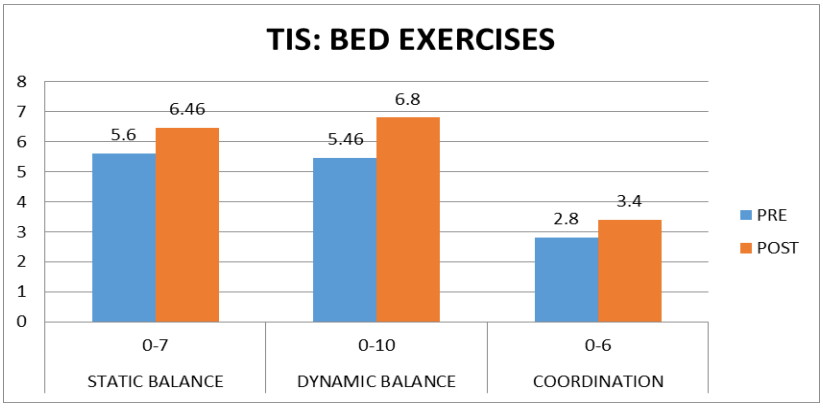


GRAPH 1: Showing pre and post trunk mobility assessment score on TIS amongst GROUP A & GROUP B.

Table 1: Showing comparison pre and post TIS scoring.

Tis						
Mean	Pre	Post	Sd	Mean difference	T value	P value
GROUP A	14	16.73	1.39	2.66	7.39	0
GROUP B	14	18.4	1.54	4.4	11	0

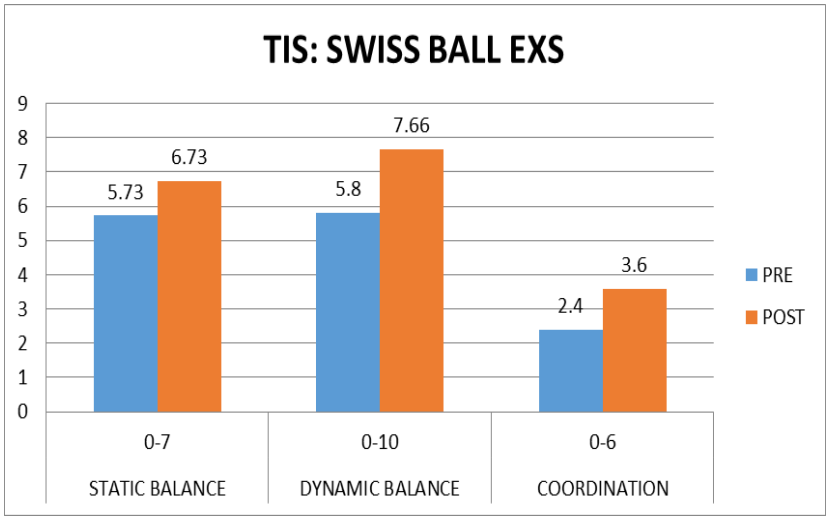
As shown in the TABLE 1, all subjects in Group A and Group B showed improvement in TIS scoring with mean difference of 2.66 and 4.4, standard deviation of 1.39 and 1.54 respectively. By using the paired t test the t value was calculated as 7.39 and 11.0 respectively, and the P value as 0.00 which was <0.05, this shows there was a significant improvement in TIS in both the groups.



GRAPH 2.

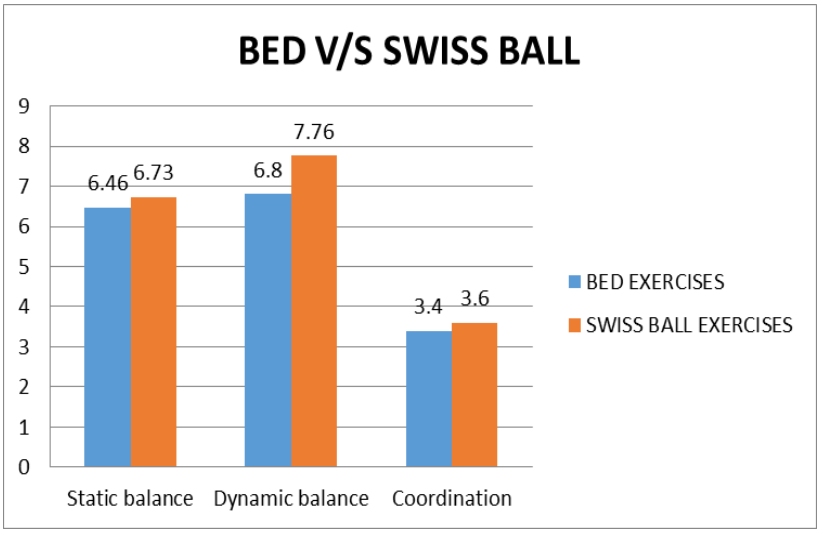
Tis	Static balance	Dynamic balance	Co-ordination
Group a	0-7	0-10	0-6
Pre	5.6	5.46	2.8
Post	6.46	6.8	3.4
Mean difference	0.86	1.3	0.6
P value	0.00	0.00	0.00
T value	6.5	4.83	3.14
Standard deviation	0.51	1.23	0.73

As shown in TABLE 2 and GRAPH 2 represents the pre and post comparison of each component of the TIS; Static balance, Dynamic balance and Co-ordination on bed exercises with mean difference of 0.86, 1.3 and 0.6 respectively, and the standard deviation of 0.51, 1.23 and 0.73 respectively on bed exercises.



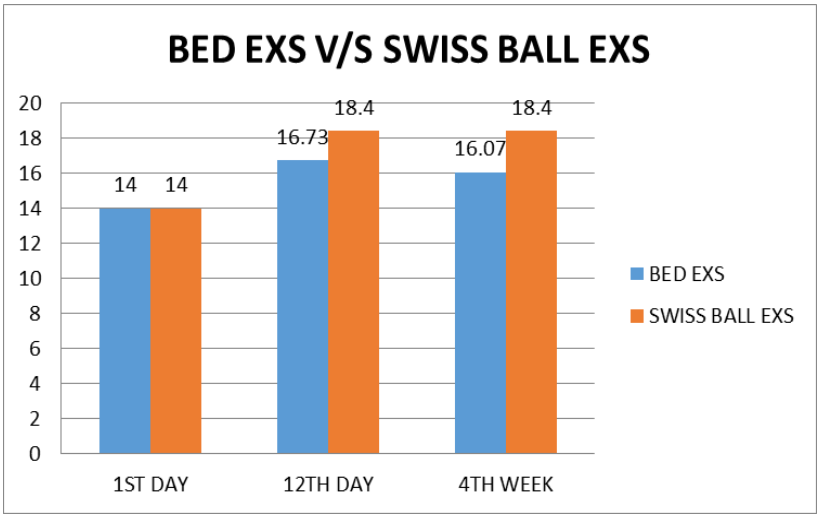
Tis	Static balance	Dynamic balance	Co-ordination
Group b	0-7	0-10	0-6
Pre	5.73	5.8	2.4
Post	6.73	7.66	3.6
Mean difference	1	1.86	1.2
P value	0.00	0.00	0.00
T value	10.24	8.67	5.39
Standard deviation	0.37	0.83	0.86

As shown in TABLE 3 and GRAPH 3 represents the pre and post comparison of each component the TIS; Static balance, Dynamic balance and Co-ordination on Swiss ball exercises with mean difference of 1, 1.86 and 1.2 respectively; and the standard deviation of 0.37, 0.83 and 0.86 respectively on Swiss ball exercises.



Tis	Bed exercises	Swiss ball exercises	Mean difference
Static balance	6.46	6.73	0.27
Dynamic balance	6.8	7.76	0.96
Co-ordination	3.4	3.6	0.2

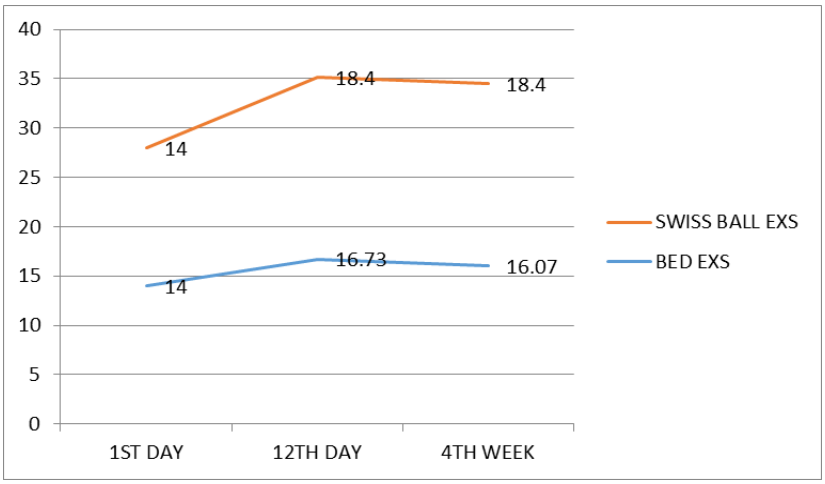
TABLE 4 and GRAPH 4 represents the comparison of each component of TIS scoring the mean difference of 0.27, 0.96 and 0.2 for static balance, dynamic balance and co-ordination subscale respectively.



Tis	1st day	12th day	4th week
Bed exercises	14	16.73	16.07
Swiss ball exercises	14	18.4	18.4
Mean difference	2.66	4.4	2.33
Standard deviation	1.39	1.54	---
P value	0.00	0.00	0.03
T value	7.39	11	2.26

TABLE 5 shows the comparison of Bed exercises and Swiss ball exercises with the carryover effect in the 4th week in respective groups with the mean difference of 2.33. the P value calculated for carryover effect in both the groups is <0.03 which is significant.

The calculated p value for this comparison is 0.00 in both the group for trunk mobility which shows highly significant improvement with mean difference of 2.66 and 4.4 respectively.



DISCUSSION

The aim of this study was to find the effects of trunk mobility exercises on Swiss ball versus bed exercises and to check the carryover effect of both the interventions after 2 weeks respectively in acute stroke patients.

Trunk Impairment Scale was taken as an outcome measure to assess the trunk mobility. The study was conducted on 30 subjects since the duration of <1 month, both males and females with age group 45-60 years for 12 days.

For the Static sitting balance subscales, there is not much difference between both the groups with mean difference of 6.46 and 6.73, and standard deviation of 0.51 and 0.45 respectively on Group A and B with the p value >0.05 i.e. 0.14 which shows non-significant result. The possible reason for 1 minute and also the mean score of almost 6 before the treatment out of maximum 7 points.

This study results have shown that trunk exercises performance on a Swiss ball resulted better improvement in dynamic balance with mean difference 0f 1.86 and standard deviation of 0.83, whereas on bed 1.3 and 1.23 respectively the co-ordination subscale of TIS shows that there was early recovery found in group B i.e. Swiss ball therapy with mean difference1.2

and standard deviation of 0. 86 with p value 0.0, exercises compared to the other group with mean difference of 0.6 and standard deviation 0.73 and p value 0.0 which was significant.

This study shows similar results of previous research done by S. Felix Renald , J. Raja Regan, conducted in 2016 as a Quasi experimental with pre-test and post-test design, with two comparison treatment. A total of 16 stroke patients in the age group of 45-60 years. Group A received trunk exercises on Swiss ball whereas group B on bed for 12 days. The study revealed significant improvement in trunk mobility with patients treated on Swiss ball rather than the Group B.

Another study done by Karthikbabu et al. April 2011, an observer-blinded pilot randomized controlled trial supports the findings of our study stating that the trunk exercises performed on physio ball gives a better result than the similar exercises performed on plinth in acute stroke patients suggesting a task-specific effect, and benefits on carryover effects.

The possible reason for better trunk control improvement in the Swiss ball group may be as the movement of the Swiss ball under the patient provides postural perturbations to which the trunk muscles respond reactively in order to maintain the desired postural stability. This improvement might be due to the improved weight shifts ability with the Swiss ball training.

Furthermore, the trunk exercises performed on the bed involves the same exercises as Swiss ball training, but the co-ordination would only be due to lack of postural perturbation. These strategies can be characterized by their different muscle synergies, kinematics, and joint torques. The ankle strategy uses distal to proximal muscle activation, the hip strategy uses early proximal hip and trunk muscle activation of hip abductors and ankle co-contractions. These strategies can be differentiated by the large angular trunk acceleration of hip strategy and by the flexible inverted pendulum style of the ankle strategy, which includes motions at the knee and hip as well as at the ankle. The ankle strategy moves the body's COM with torques primarily at the ankle and knee. The hip strategy adds up the hip torque to the ankle and knee torque. The stepping strategy is characterized by loading and unloading of the legs to move the base of support under the falling COM.

As the detraining effects begin within a week or two after the cessation of exercises and continue until training effects are lost, hence later in the 4^{th} week, subjects were again assessed to check the carryover effect of the previously given exercises in either groups using

the TIS which showed the mean difference of 16.07 and 18.4 in Group A and Group B respectively and the p value of 0.03, which shows there is a significant effect in the Swiss ball training for longer period of time.

CONCLUSION

In this study we concluded that exercises performed on Swiss ball have beneficial effects than the exercises performed on bed for trunk mobility in Acute stroke patients as well as the carryover effect shows significant improvement in Swiss ball group which was checked in the 4th week of the intervention.

LIMITATIONS

The sample size was less. There was an amount of uneven distribution of samples. Exercises for upper limb and lower limb was not included in this study treatment. Future studies may include the functional assessment of trunk mobility in acute hemiplegic patients. Study must be conducted on a larger number of population with accurate distribution of participants.

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