EFFECT OF SWISS BALL TRAINING ON TRUNK PERFORMANCE IN PATIENTS WITH STROKE

EFECTUL ANTRENAMENTULUI CU SWISS BALL ASUPRA PERFORMANȚEI TRUNCHIULUI LA PACIENȚII CU AVC

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Key words: Stroke, Swiss ball, Trunk Impairment Scale**.**

Abstract

Background. In stroke, there is paralysis or weakness of one side of the body includes upper limb, trunk and lower limb leading to the disturbances in the trunk muscles. The sensory and motor impairments of upper limb, lower limb and trunk interfere with the functional performance after Stroke. Trunk performance has been identified as an important early predictor of functional outcome after Stroke.

Objective. To evaluate the effect of Swiss ball training on improving trunk control in patients with stroke.

Design. Systematic review and meta-analysis of randomized, controlled trials published January 2013

Data sources. Electronic databases (Medline, Embase, and Cochrane Central Register of Controlled Trials)

Selection criteria. Randomized, controlled trials with ≥1 year of follow-up investigating the effect of Swiss ball training on improving trunk control.

Result. The pulled value of present metaanalysis shows that training concentrating on improving trunk control is effective in nature.

Conclusions. The present metaanalysis conclude that swiss ball training is effective in improving trunk control.

Cuvinte cheie: accident vascular cerebral, swiss ball, Trunk Impairment Scale**.**

Rezumat

Introducere. În accidentul vascular cerebral (AVC) apare o paralizie sau slăbiciune a unei jumătăți a corpului, incluzând membrul superior, trunchiul și membrul inferior, determinând perturbări în mușchii trunchiului. Deficitele senzoriale și motorii ale membrului superior, inferior și ale trunchiului interferează cu performanța funcțională după AVC. Performanța trunchiului este considerată a fi un predictor important al impactului functional, după AVC.

Obiective. Evaluarea efectului antrenamentului cu Swiss ball asupra îmbunătățirii controlului trunchiului la pacienții cu AVC.

Design. Recenzie și metaanaliză a unor studii randomizate, publicate în Ianuarie 2013.

Sursele de date. Baze de date electronice (Medline, Embase și Cochrane Central Register of Controlled Trials)

Criterii de selecție. Studii randomizate care au studiat ≥1 an efectul antrenamentului cu Swiss ball, pentru îmbunătățirea controlului trunchiului.

Rezultate. Rezultatele prezentei metaanalize demonstrează că antrenamentul concentrat pe îmbunătățirea controlului trunchiul este eficient.

Concluzii. Această metaanaliză concluzionează că antrenamentul cu swiss ball este eficient în îmbunătățirea controlului trunchiului.

Introduction

Stroke is a common neurological disorder, representing a major cause of disability. It is considered as significant health problem, which needs an unremitting and wide-ranging rehabilitation [1]. Stroke is also known as “cerebral vascular accident”, “brain attack” or “apoplexy” [2,3]. According to WHO stroke is defined as “acute onset of neurological dysfunction due to abnormality in cerebral circulation with resultant signs and Symptoms that corresponds to involvement of focal area of brain lasting more than 24 hours” Following the

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stroke trunk function is also impaired along with Impairment of limb function. Trunk muscle strength when measured by using isokinetic dynamometer and hand-held dynamometer showed that trunk Muscle strength was impaired multidirectionally while performing activities such as flexion, extension, lateral flexion and rotation.. Pelvis is a part of trunk that supports extremity motions. Hence, the pelvic motion comes from trunk muscles.

Trunk is the central key point of the body with its primary contribution to stabilize spine and trunk. Trunk control 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. Alteration of trunk position sense [4] and weakness [5] of trunk muscles in stroke has a significant influence on balance difficulty in these patients. Anticipatory postural adjustments of trunk muscles play a major role in maintaining antigravity postures like sitting and standing when a reaching task is executed [6].

There is convincing evidence that trunk performance is an important predictor of functional outcome after stroke.[6-8] A recent cross-sectional study showed a clear relation between trunk performance and measures of balance, gait, and functional ability after stroke. Dursun et al, examined the effect of the use of an angular biofeedback device in training stroke patients with impaired sitting balance significantly shorter than that of patients receiving conventional therapy. However there was no significant difference in level of sitting balance and independent ambulation between both groups at discharge. Dean and colleagues reported on the beneficial effect of practicing reaching tasks beyond arm's length on sitting ability and quality, reaching, and standing up, both in the acute and chronic phase after stroke.

There are many Interventions to improve trunk control of stroke patients such as Neuro developmental treatment (NDT), Electrical stimulation,[7] some Advanced therapies that included Strength Training for spastic group of muscles, Virtual reality training, Bimanual Training, Robotic Training, EMG biofeedback [8]. Swiss ball training improve the strengths of the abdominal and back muscles, balance, co-ordination and range of motion of the joints, hence thereby improve trunk balance, using less effort and increasing patient's confidence level [9] But the best possible treatment for trunk dysfunction still is a mystery. Also effect of Swiss ball training in patients with stroke is not studied at depth. So, before proceeding on the research study to see this effect, it was thought the systematically analyze the existing literature thoroughly for possible reasons behind improvement of trunk performance with Swiss ball.

Methods

Data sources and searches

We followed the guidelines for reports of meta-analyses of randomised controlled trials. Investigators independently searched Medline and Embase (from inception to January 2013) as well as the Cochrane Central Register of Controlled Trials (CENTRAL) (issue 1, 2013)

Study selection

A priori, we defined the following inclusion criteria:

Inclusion criteria-

1. Study involving only acute and sub cute stroke patients
2. There should be use of Swiss ball training in either control or experimental group.
3. Treatment duration should be at least one month.

Exclusion criteria

Data extraction

Investigators extracted data and entered them in a customised database. Disagreements were resolved by consensus. Extracted data included author's Name, post stroke duration, treatment given in both the group, duration & frequency of treatment, outcome measures & results of study. All data were extracted from the published papers.

Table 1. Following table shows analysis of different studies involving acute and sub acute stroke patients

Sr. no	Authors name	Interventions	Duration Of stroke	Frequency of treatments	Outcome measures	Statistical tools	Results
1	Akshatha N Vijaya K Karthik B	**Control gr.-** Task specific trunk ex. On stable surface **Experimental gr.-** Task specific trunk ex. On unstable surface	12 days	4 days in a week for 4 week.	1.TIS 2.Brunel balance assessment	1.Student's unpaired t-test 2. a chi-square test P<0.05.	Post intervention experimental gr shows better result t in term of trunk control
2	Gregory Lehman. Steven olive	**Control gr.-** trunk bridging ex. **Experimental gr.-** Swiss ball training in addition to control	1 year	40 min in a day for 3 day in a week for 4 week	TIS	ANOVA with a post hoc Tukey test At 5% level of significance.	Addition of Swiss ball training enhance the activity of abdominal & trunk muscle.
3	Atsushi Imai, Koji Kaneoka, **Yu** Ok**ubo,** T**atsu**m**ura,**	**Control gr.-** Trunk stabilization on stable surface **Experimental gr.-** trunk stabilization exercises on unstable surface		5 Times in week for 3 weeks		Wilcox on signed-rank test.	This study indicates that lumbar stabilization exercises on an unstable surface enhanced the activities of trunk muscles,
4	Akshatha N Vijaya K Karthik B	**Control gr.-** conventional rehabilitation program **Experimental gr.-**CRP + Swiss ball training.	>1month	6 times in week for 3 week.	TIS	T -test p value <0.05	Experimental group showed greater improvement than control group.

Results

1. In the present literature the control group has received task-specific trunk exercises on stable surface and experimental group has received task-specific trunk exercises on an unstable surface (Physio ball) for four days a week for three weeks. Post-intervention, both-groups improved trunk control and functional balance but the experimental group improved more significantly than the control group on Trunk Impairment Scale and Brunel Balance Assessment scale. The level of significance was set at P<0.05.
2. In the present literature the control group has received five trunk muscle exercises without Swiss ball and experimental group has received five trunk muscle exercises on Swiss ball. ANOVA with a post hoc Tukey test was used for analysis. All statistical tests were performed at the 5% level of significance. Post-intervention, both the groups improved on trunk muscle activity but the improvement in experimental group was statistically significant.
3. In the present study the control has received lumbar stabilization exercises on an stable surface and experimental group has received lumbar stabilization exercises on an

unstable surface which demonstrated that muscle activity differs, depending on surface stability, this study shows that lumbar stabilization exercises on an unstable surface enhanced the activities of trunk muscles, except for the back bridge exercise. The level of significance was set at ($P < .05$)

4. In the present study, control group has received conventional physiotherapy treatment and experimental group has received supervised trunk exercises on Swiss ball. For 45 minutes with adequate rest periods 10–15 minutes, 6 times a week, for 3 weeks. Post intervention the experimental group has shown an improvement in TIS score. A significant improvement was seen in dynamic balance and coordination subscales and also in total score (p value <0.05) of TIS.

Discussion

The study results showed that trunk exercises performed on the physio ball are more effective than those on the plinth for improving lateral flexion and rotation of the trunk as measured by dynamic sitting balance and the coordination subscales of the Trunk Impairment Scale, respectively. Furthermore, the experimental (physio ball) group showed greater improvement in functional balance, particularly in the stepping component of the Brunel Balance Assessment, than the control group, suggesting a carry-over effect with trunk rehabilitation. The overall effect size index (1.7) observed in the study is in favor of the experimental group.

The treatment techniques incorporated in our 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 physio ball. The effect size index (2.1) observed in the total Trunk Impairment Scale supports for trunk exercises performed on the physio ball indicated an appreciable improvement

The possible reason for better trunk control improvement in the experimental group may be that the movement of the physio 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.

Differences in trunk muscle activity are seen with the addition of a Swiss ball to bridging exercises. The addition of an exercise influences the muscle activity in the Internal Oblique in both bridging exercises. During the prone bridge the addition of an exercise ball resulted in increased myoelectric activity in the rectus abdominis and external oblique. The exercise ball influences the Rectus Abominis or the External Oblique muscle activity during a supine bridge. The addition of an exercise ball did not influence the Erector Spinae activity during the supine bridge or the prone bridge. Increased trunk muscle activation in the experimental group is due to excessive load on abdominals and back muscles which leads to more recruitment of motor units in this muscle group.

In this study there is greater activity of the global muscles when the exercise was performed on an unstable surface. Whereas, the activity of local muscles either did not differ between stable and unstable conditions when the hand-knee exercise performed on an unstable surface, activity of the RA, EO, and ES was enhanced. We presume that activity of the EO and RA was enhanced because these muscles serve to control rotation and extension of the trunk. With the side bridge exercise, activity of the RA was greater when performed on the unstable surface. It is possible that the unstable surface generates greater lateral bending, extension, and rotation torque of the trunk, and that the increased muscle activity is associated with controlling these movements. Comparing to a stable surface, performing the curl-up exercise on an unstable surface results in greater activity of the EO, but less activity of the TrA. The unstable surface had generated extension and rotation torque. Therefore the activity of the EO, which acted on

rotation and flexion of the trunk, increased. In this study, we found greater muscle activity for exercises performed on unstable surface compared to a stable surface, especially for the global trunk muscles, RAs, and Eos. the increase in EO activity was most notable, suggesting that an unstable surface increases the need to control trunk rotation. From the results of the present study, there is greater participation of the global muscles for additional trunk control than the local muscles.

In the present study, control group has received conventional physiotherapy treatment and experimental group has received supervised trunk exercises on Swiss ball. In this article Swiss ball exercises are designed to bring movement to the spine in a controlled manner to help keep the discs nourished. Moving the vertebrae helps nourish the discs in the spine by increasing blood flow around the disc and by causing the water to flow in and out of the disc. Swiss ball Exercises are accompanied by increased proprio receptor activity, combined with keeping balance on an unstable support. Performance of each exercise demands participation of the whole body (visual perception, vestibular system, deeper perception, muscular reaction etc). These back exercises using exercise balls are designed to strengthen the muscles that support the spine from the low back to the upper back, in front and in back. Specific muscles targeted by these exercises include the abdominal, chest and back muscles. Stability is achieved through the co activation of trunk muscles; Co-activation of the trunk muscles has a compressive loading cost that may outweigh the benefits of trunk muscle training. [2]Post intervention the experimental group has shown an improvement in TIS score. A significant improvement was seen in dynamic balance and coordination subscales and also in total score (p value <0.05) of TIS.

Conclusion

In this meta-analysis of randomized trials, we found that physio ball is more effective than other techniques for improving both trunk control and balance in acute stroke patients. This analysis also showed greater improvement in Swiss ball training group than any other exercise treatment protocol or conventional physiotherapy group in terms of trunk performance and balance. Therefore, this analysis concluded that Swiss ball therapy is effective in improving trunk performance and balance in stroke patients.

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