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Effect of trunk control exercises on balance and gait in stroke patients-randomized control trial

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Abstract
Background Sub-acute stroke patients suffer from impaired trunk control due to the affection in brain. Due to the impaired trunk control with affected shoulder girdle and lower limb strength is seen. Patient undergoes difficulty resulting into affected daily activities like sitting, standing, getting up from sit to stand, turning around.
Aim: To study the effects of trunk control exercises on gait and balance of trunk in stroke patients.
Objectives: 1 - To study effects of trunk control exercises on gait using dynamic gait index in stroke patient 2 - To study effects of trunk control exercises on balance using berg balance scale in stroke patients. Methodology: 30 samples were taken from age group 40yrs to 60yrs with mean age of (47.466±) were selected and Assessment was done on trunk impairment scale, berg balance scale for assessing trunk, balance and dynamic gait index scale for assessing the balance and gait. Group A were given conventional exercises and 15 samples with group B were given trunk control exercises with conventional exercises. Total 3 sessions per week for 4 weeks were given. The pre and post readings were compared for trunk impairment scale with berg balance scale and dynamic gait index which shows more significant improvement in experimental group (p<0.0001). Conclusion: Trunk control exercises with conventional exercises found to be more effective than conventional exercises in stroke patients.

Keywords: Sub-acute stroke, trunk impairment, balance, gait

1. Introduction
Stroke (cerebrovascular accident [CVA]) is sudden loss of neurological function caused by an interruption to of the blood flow to the brain [1]. Warning signs of stroke are -1) sudden numbness or heaviness of the face, arm, or leg. 2) Sudden confusion or dysarthria, 3) Trouble in seeing in one or both the eyes, 4) consciousness, disorders of speech, language, dysphagia, sudden trouble with walking, dizziness, loss of balance or coordination [1]. Ischemic stroke the most common affects 80% of the Population whereas the hemorrhagic affects 20% [1]. Motor deficits are characterized by either hemiplegia or hemiparesis and affected trunk control with affected shoulder girdle and lower limb strength [1]. Most researches have proven that trunk control remains impaired in stroke patients [1]. Trunk control refers to the ability to control individual's torso. It's an ability of trunk muscles to allow the body to remain upright adjust weight shifts and perform selective movements of the base of support during static and dynamic postural adjustments [1]. It affects body to hold your body upright when sitting or moving. Trunk control helps an individual to remain seated without falling over and keeps the body aligned while walking and running. Therefore the trunk control is important for an individual to perform daily activities.

2. Materials and Methodology
2.1 Methodology
- Study design:-Randomized control study
- Study Setting:-Neuro rehab opd
- Target Population:-Sub acute stroke patients.
- Place Study :- Pune
- Sample Size:-30

2.2 Materials
- Plinth
- Swissball

2.3 Inclusion Criteria
- Sub-acute stroke patients
- Patients including both the male and female
- Age group: 40yrs -60yrs

2.4 Exclusion Criteria
- Patients with spinal deformity
- Psychiatric disorders
- Surgeries done systemic illness
- Transient ischemic attack

2.5 Out Come Measures
- Tis(trunk impairment scale) [2]
- Berg balance scale [3]
- Dynamic gait index [4]

2.6 Procedure
Permission was taken from institutional ethical committee of Tilak Maharashtra Vidyapeeth, department of physiotherapy. Screening of 30 patients according to the inclusion and exclusion criteria was done. Patients were explained about the study, participation and their importance in the study. Consent forms were given them for signing. Sub-acute stroke patients were taken from age group 40yrs-60yrs. Then Allocation was done into two groups. Control group A, with 15 subjects Conventional exercises for 4 weeks, 3 sessions/week. Experimental group B, 15 subjects Conventional and trunk control exercises for 4 weeks 3 sessions per week. Then patients were assessed using the berg balance scale and dynamic gait index. Those patients scoring for moderate risk of fall were selected for study. They were explained about the role of trunk and importance of trunk control in rehab for stroke patients. Therapists explained the patients about the exercises and the protocol. The protocol included exercises for trunk control. The follow up was taken thrice a week for up to 4 weeks, 3 sessions per week. After the follow up of 4 weeks again the patient were assessed and the TIS, BBS and DGI score was taken. Pre and post TIS scores were compared.

2.7 Statistical Analysis
Data was collected, tabulated and analyzed using primer of biostatistics software. MS Excel sheet 2007 was used. Mean and standard of deviation of all variables were analyzed. Data was compared using student paired t test with 95% of confidence Mean Age for group A (control group) was 46.93±5.257 and for group B (experimental group) was 48±4.870. Total number of 30 samples with 8 males and 7 females in group A and 9 males and 6 females in group B participated in study of which 28 samples where having right hand dominance and 2 with left hand dominance had right side dominance. After comparing pre and post intervention data using student paired t test results showed that there was significant improvement in trunk control with (p<0.0001) for TIS BBS and DGI in control group, similarly (p<0.0001) for TIS BBS and DGI in experimental group.

3. Results and Discussion
3.1 Tables and Figures

Table 1: Represents gender, age, BMI, duration of stroke and hand dominance along with side affected of the stroke patients.

Group	Gender	Age(YRS) (Mean±SD)	BMI	Duration Of Stroke	Dominance	Side Affected
Control Group (A)	M=8(53.33%)	48±4.870	26.43±3.796	3±1.69	R=15 (50%)	R=9
	F=7(46.66%)				L=1	L=6
Experimental Group (B)	M=9(60%)	46.93±5.257	25.56±4.32	3.6±1.50	R=13	R=7
	F=6(40%)				L=1	L=8

Table 2: Represents pre and post values of Trunk impairment scale, Berg balance scale, and Dynamic gait index from control group.

Control Group	Pre Treatment	Post Treatment	P value
	Mean ± SD	Mean± SD	
TIS	9.133±3.42	20.333±1.29	<0.0001
BBS	22.266±10.81	35.33±11.06	<0.0001
DGI	6.333±2.76	12.53±2.87	<0.0001

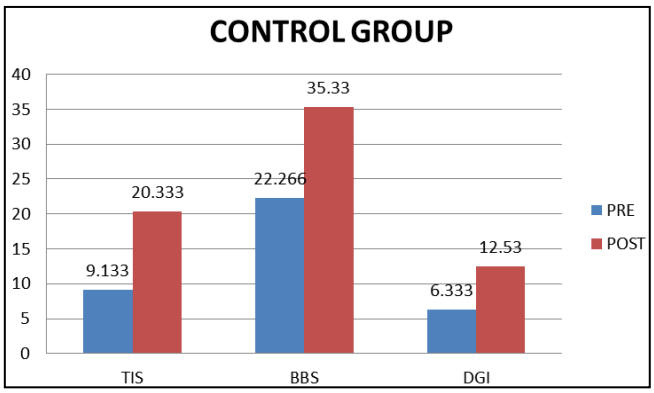

Fig 1: Comparison of Pre and Post values of Trunk impairment scale, Berg balance scale, Dynamic gait index from control group.

Table 3: Represents pre and post values of Trunk impairment scale, Berg balance scale, and Dynamic gait index from experimental group.

Experimental Group	Pre Treatment	Post Treatment	P value
	Mean ± SD	Mean± SD	
TIS	9.21±2.21	21.22±1.63	<0.0001
BBS	27.266±4.97	49.133±4.59	<0.0001
DGI	5.2±3.77	14.8±2.98	<0.0001

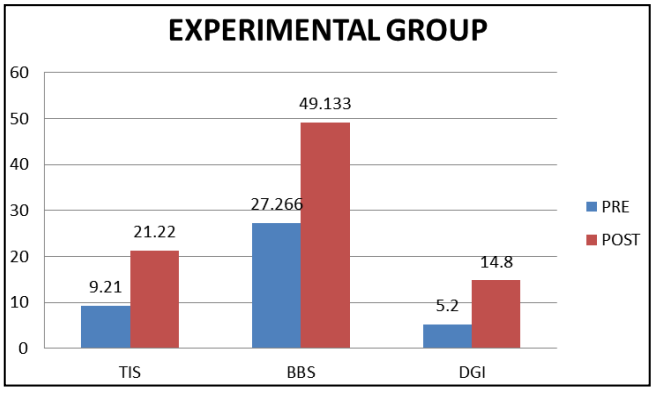

Fig 2: Comparison of pre and post values of Trunk impairment scale, Berg balance scale, and Dynamic gait index from experimental group.

Table 4: Represents mean difference values for pre and post values of Trunk impairment scale, Berg balance scale, and Dynamic gait index from experimental group.

Group	TIS(Mean difference)	BBS(Mean difference)	DGI(Mean difference)
Control	11.2	13.07	6.2
Experimental	12.1	21.87	9.6

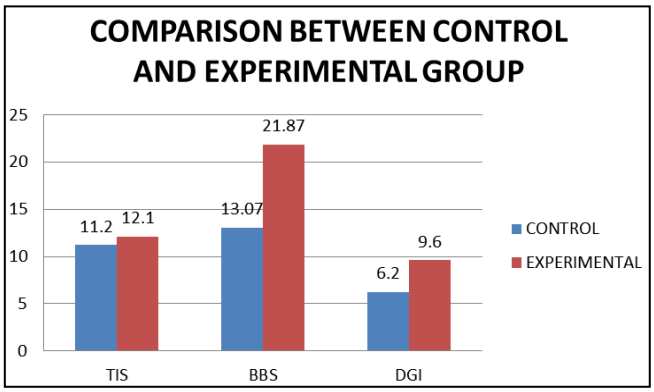

Fig 3: Comparison of mean difference of pre and post values of Trunk impairment scale, Berg balance scale, and Dynamic gait index from experimental group.

Discussion

In the study conducted 30 samples were taken, from which two groups were formed. Group A known as control group and group B known as experimental group. Both the groups included 15 samples each, chosen according the inclusion and exclusion criteria. They included the sub-acute stroke patient's visiting various OPD and clinic for the further treatment. Samples included both females and males participants amongst which there where (8) males and (7) females in the control group and (9) males and (6) females in experimental group. The age group selected was from 40 yrs-60 yrs with mean age 48±4.87 for group A and 46.93±5.25.The mean value for BMI in group A is 26.43±3.79 and group B 25.56±4.32. Month of diagnosis had mean value 3±1.69 for group A and 3.6±1.50.The number of people affected with the right and left side of the body group A had mean 26.43±3.79 and that of B group had mean 25.56±4.32.Result table 2 shows comparison of pre an post values of TIS, BBS, DGI for group A with P value <0.0001 respectively. Similarly table 3 shows comparison of pre an post values of TIS, BBS, DGI for group B with P value <0.0001 respectively. When mean difference of group A and B were compared group B (experimental) found to have significantly improved scores than group A (control).This explains that group B that was treated with trunk control exercises along with conventional exercises found to have increased trunk control along with significantly improved scores for Berg balance scale and Dynamic Gait index than group A. Task specific trunk control exercises on physio ball results in short term improvement in dynamic sitting balance and co-ordination [10]. S Karthikbabu *et al*. (2011) concluded that Selective trunk muscle exercise regime has an overall large effect size index. This study showed a large effect size index for trunk control and balance than for gait. Treatment for hemiplegic lower limb and along with the selective trunk exercise regime may result in large effect size index for gait. reason for better trunk control improvement in the experimental group may be because of the movement of the physio ball beneath the patients provides a postural perturbation in gravitational field to which the trunk muscles respond reactively therefore maintaining the desired postural stability [4]. Rosa Cabanas Valdes *et al.* (2013) underwent a study and Concluded that trunk training exercises performed with either stable or unstable Surfaces could be a good rehabilitation strategy and might help improving trunk performance and dynamic stability balance after stroke [7]. Lynne Sheffler *et al.* (2012) concluded that chromic stroke subjects with a higher BMI were less likely to demonstrate improvement in motor impairment, functional mobility [8]. Lynne Sheffler *et al.* (2014) concluded that subjects with hemiparetic stroke demonstrated greater hip hiking, step width of affected limb as compared to lower BMI [9]. A study by Mudie et al found that training the patient in the awareness of trunk position could improve weight symmetry in sitting after the early phase of the stroke [4]. The probable reason for the significant trunk rotation improvement may be the improved weight shift ability with the physio ball training. Kanika. D. Muniyar *et al*. (2018) underwent a study concluded that there was significant improvement in berg balance scale and decrease in time up and go test by using swiss ball training and conventional physiotherapy. Exercises performed on physio ball improves balance along with correcting various abnormalities thus helping to improve postural co-ordination, trunk control, strength, stability, flexibility, lower limb strength, anticipatory activation improves proprioception and sensory motor function, and also restores visual sensory feed back [9]. Akshatha Nayar *et al.* (2012) concluded that training on physio ball post stroke improves trunk performance. Trunk training on swiss ball results in improved trunk control since trunk is the central key point of body and proximal stability of trunk is a prerequisite for distal head and limb movement therefore related to functional adl's [10].

Conclusion

There is significant effect of trunk control exercises on gait and balance in stroke patients.

Limitations

Smaller sample size, short study duration, Not considered craniotomy, Exact location in brain not consider (MCA, PCA, ACA), No follow up

Future Scope of Study

Using advance equipment, Study duration time. Consider exact location.

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