

## EFFECTS OF CORE MUSCLES STRENGTH TRAINING ON BALANCE AND TRUNK STABILITY IN STROKE PATIENTS: A RANDOMIZED CONTROLLED TRIAL

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### ABSTRACT

**Objective:** To determine the effects of core stability exercises compared to conventional physical therapy in improving balance and trunk control in stroke survivors.

**Material & Methods:** A randomized controlled trial was conducted. A sample size of thirty- six patients was taken in this current study by using 90% power of study and 10% level of significance with 20% dropout was included in it. So, each group contained 18 participants. The routine physical therapy program for stroke patients were followed by all patients that was provided by rehabilitation centre for an 8-week period, this program was consisted of one hour session a day, 3 times per week for 8 weeks (24 sessions). The core stability exercises were discerning, selective, repetitive movements and convoluted tasks without resistance to recover and improve endurance, strength and synchronization of the core. The outcome was calculated and evaluated by using Berg balance scale and trunk impairment scale.

**Results:** Out of 36 participants 21 were male and 15 were female. After treatment, the core exercise group showed statistically significant difference ( $p < 0.05$ ) on TIS and BBS. The TIS and BBS score increased in experimental group as equated to control group after performing core stability enhancing exercises when comparing base lines.

**Conclusion:** Core stability exercise plus conventional physical therapy has shown better results in trunk control and balance as compared to routine physical therapy alone.

**Key Words:** Balance, Physiotherapy, Stroke, Trunk.

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### INTRODUCTION

In stroke the damage of brain occurs because of disruption in the blood supply to brain. The stroke is mainly of two types either it is ischemic and haemorrhage.<sup>1</sup> After the spell of the stroke, the cognitive, motor or sensory deficits might occur, and these impairments might also have numerous impacts on the functional of the stroke survivor causing disabilities and affecting the potential of rehabilitation.<sup>2</sup>

The survivors of the stroke might also have difficulty in balance and controlling their posture while standing upright because now they are

compromised due to impaired posture, body imbalance and weight transfers deficits.<sup>3</sup> Previously conducted studies have verified the significance of trunk control I while walking stably and thus cause decrease in the risk of fall in stroke survivors.<sup>4</sup>

Strengthening of the core is used in rehabilitation settings to imply the stabilization of the lumbar and other therapeutic exercise regimes. It has been known to describe the muscular control around the spine in the lumbar region for maintaining the stability. The core can be considered as the box, which contains abdominal

muscles on front side while paraspinal and gluteal muscles on the back, roof covered by the diaphragm and bottom being covered by pelvic floor and the muscles of the hip girdle.<sup>5</sup> Special attention has been given to the core because it has been known to serve as a corset which work as a unit to stabilize the spine. Precisely, the core has been recognized to serve as the centre of the functional kinetic chain.<sup>6</sup> Considering the impaired control of the trunk and poor control of the balance, previously conducted studies had showed that effective neuromuscular control for stabilizing trunk is necessary for maintain posture.<sup>7,8</sup> Effect of trunk control exercises on balance and gait in stroke patients published by Tushar and his colleagues. it was concluded that from his study There is substantial effect of trunk control exercises on balance and gait in stroke survivors.<sup>9</sup>

Numerous recently conducted studies have been accomplished which focus on core stability in patients suffering from lower back pain and athletes. However, very a smaller number of studies have been conducted on determining effects of core stability and trunk control and balance ability in stroke survivors. Hence, the aim of our current study was to determine the effects of core stability exercises on balance control and trunk control in people with stroke.

## MATERIAL AND METHODS

A single blinded randomized controlled trial (RCT) was conducted, in which assessor was unaware of the treatment received by the patient. The sample size was 36, using 90% power of study and 10% level of significance with 20% dropout was included in it. So, each group contained 18 participants. Sample was recruited through simple random sampling technique, and lottery method was used for randomization.

Individuals whose diagnosis was based on CT or MRI and had suffered in first stroke with stroke duration of between 1 month to 6 months with age limit of 25 to 50 years were included in this study. Those individuals who had hemineglect, and congenital abnormality, Apraxia and score greater than 3 on Rankin scale were excluded from this study. Study was completed in nine months. Data was collected from Stroke Rehabilitation Centre from Lahore. There were two groups in the study; group A had received

conventional physical therapy whereas group B had received conventional physical therapy combined with core stability exercises

A conventional physical therapy program that was which was provided by rehabilitation department was e consisted of 8 weeks period were given to all stroke patients, this program was consisted of 60-minutes of treatment a day, 3 times per week for 8 weeks (24 sessions). This patient specific routine treatment program was consisted mainly of stretching and passive mobilization for the affected side and walk in parallel bars. Additionally, patients were also performed activities of the trunk.

In the experimental group patients along with routine physical therapy program received core stability exercises for 15 minutes. These exercises were also patient specific and selective, repetitive movements and involved tasks without resistance to improve strength, endurance, and coordination of the core. The exercises employed was divided into three levels according to difficulty level. The patients were not promoted to next stage until they grasped the exercise, they were affianced in.

**Level I:** Level I core stability training was performed when the patients were not able to sit unsupported. In 1<sup>st</sup> level training were performed on plinth in supine position. The exercise regime was consisted of bridging exercise mainly, with leg cross, with one leg and curl-up with straight and diagonal reaching and side bridging exercises. When patients were able to sit on edge of plinth without any support with hip and knee flex at 90 for one minute, they can move to level II.

**Level II:** The exercises comprised of curl-ups with straight reaching, curl-ups with diagonal reaching, and curl-ups with arms crossed. When the patient will able to sit on an unstable surface 30 seconds, she/he will move on to step three.

**Level III:** the exercises was performed in sitting position on a physio ball. The ball exercises included bridge exercise, bridge- ups abdominal curl- ups, bridge exercise to the side, push- ups and bird dog exercise.

In this study, the trunk impairment scale (TIS) and berg balance scale (BBS) were used as a data collection tools. The patients were evaluated beforehand and afterwards the application of the intervention. All the statistical analysis was conducted by employing statistical packages for

social sciences version 23 and by considering the level of significance to be  $P < 0.05$ .

**RESULTS**

In current study Mean age of patients in experimental and in control group was  $49.00 \pm 7.66$  and  $49.44 \pm 8.66$  years respectively. In both treatment groups patients age ranged between 27-60 years. In experimental group the minimum age of participants was 27 and maximum was 58 while in control group the mean age was 30 and maximum was 60. Out of total 36 participants, in among experimental group ten were male and eight were female and in among control group eleven were male and seven were female. In experimental group 7(38.9%) were suffered in ischemic type of stroke and 11(61.1%) were suffered in haemorrhagic type of stroke,

while in control group 13(72.2%) were suffered in ischemic type of stroke and 5(27.8%) were suffered in haemorrhagic type of stroke The normality of data was checked by Kolmogorov-Smirnov<sup>a</sup> and because data was normally distributed, so parametric tests were applied.

Experimental group showed significant increase in pre and post treatment mean scores of TIS and BBS with  $p < 0.05$ . In TIS scale among experimental group before treatment mean score was 4.11 and increased to 10.00 and among control group it changes from 3.72 to 7.44. (**Table 1**) While in BBS tools among experimental group the mean score was changes from 29.28 to 46.11 and among control group it was 28.39 to 39.61. (**Table 2**)

**Table 1: Pre and post treatment scores on Trunk Impairment Scale (TIS)**

	Before Treatment		After Treatment		P-value <sup>b</sup>	
	Experiment	Control	Experiment	Control	Experiment	Control
Mean	4.11±1.87	3.72±1.52	10.00±1.41	7.44±.0.85	0.00 (5.88)**	0.00 (3.72)**
P-value	0.500		0.000*			

<sup>a</sup> Between groups (Independent sample t-test), <sup>b</sup> Within Groups (Paired sample t-test), \* $p\text{-value} \leq 0.05$ , \*\*Change in TIS score before & after treatment

**Table 2: Pre and post treatment scores on Berg Balance Scale (BBS)**

	Before Treatment		After Treatment		P-value <sup>b</sup>	
	Experiment	Control	Experiment	Control	Experiment	Control
Mean	29.28±4.84	28.39±4.92	46.11±3.75	39.61±3.72	0.000 (16.83) **	0.000 (11.22) **
P-value <sup>a</sup>	0.589		0.000*			

<sup>a</sup> Between groups (Independent sample t-test), <sup>b</sup> Within Groups (Paired sample t-test), \* $p\text{-value} \leq 0.05$ , \*\*Change in BBS score before & after treatment

## DISCUSSION

Our existing study was accomplished with the objective to determine the effectiveness of core stability exercises and routine physical therapy to improve trunk control and balance and stability among stroke patients in comparison of routine physical therapy alone. Balance and stability were main impairments of stroke impairments. In stroke rehabilitations regime usually balance control exercises and functional activities are focused to gain better results.

Nearly all the kinetic chains in human body are centred around core.<sup>10</sup> During sporting activities for sustaining proper posture of lumbar and pelvic region core stability is considered as criterion.<sup>11,12</sup>

In present study, the results showed significantly increased in both the experimental and control groups scores of TIS and BBS when equated with those beforehand treatment but there is substantial increase in experimental group ( $p > 0.05$ ) than in control group. This indicates that with core stability exercises patients showed better results.<sup>13</sup>

In hemiplegic patients the core stability workout has positive effects on balance, trunk control and mobility as there is a significant difference between pre and post treatment scores. The results of current study were also supported by the work of Koshiro et. al in which they proved that through core stability exercises and training patients showed improvement in standing balance and mobility.<sup>14</sup>

The trunk control is predominantly imperative for maintaining balance as it stabilizes the pelvis and spine. The study of Roth et al.<sup>15</sup> with specific exercises for the trunk, favourable results were obtained in comparison of routine treatment. In current study it was proved that balance was improved with core strengthening exercises.

In present study the TIS along with BBS scale was used.<sup>14</sup> Stroke patients showed recovery in balance and trunk control after core stability interventions. After stroke the main clinical rehabilitation problem of patients are deterioration in the sitting balance and poor sitting control. The results of current study as also supported by the work of XIBO Sun who reported that core stability exercises have enhanced effects on stroke patients.<sup>16</sup> In end through current work we found that the excrises for stabilizing core were effective in trunk and balance control of stroke patients.

## CONCLUSION

It was concluded that core stability exercise in addition routine physical therapy to have shown better results in trunk control and balance as compared to routine physical therapy alone.

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