

Effect of Core Stabilization Exercises on Balance Performance in Older Adults

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Abstract

Objective: Fall is defined as unintentional loss of balance that leads to failure of postural stability. Around 30% of older adults aged over 65 years have an episode of falls each year. All postural control components undergo changes with ageing. Any impairment in neuromuscular, central nervous system and sensory system leads to fall. So the aim of present study was to determine the effects of Core stabilization exercises on balance performance in older adults. **Methodology:** Sixty participants both males and females aged between 65 -75 years were divided into 2 groups, Experimental and Control group (n=30). Experimental group performed core stabilization exercises 5 times a week for 6 weeks, while control group carried on their routine daily activity for 6 weeks. Berg Balance Scale (BBS), Y-Balance Test, Functional Reach Test were assessed at the baseline and after 6 weeks of intervention. **Results:** Statistical analysis revealed that Experimental group showed significant improvement in BBS, Y – Balance Test and Functional Reach Test scores with ($p < 0.05$) post 6 weeks of intervention. Control group showed no significant improvement in the scores. **Conclusion:** Core stabilization exercises had significant improvement on balance variables in experimental group when compared to control group.

Key words: Core, balance, older adults, fall, trunk muscles.

Introduction

Individuals above 65 years of age are considered to be older adults. Around 30% of older adults population aged over 65 years have an episode of falls each year^[1]. As the age advances there are physiological changes which lead to lack of proprioception, reduced muscle strength, decline in reflex reaction to sudden changes, reduced sense of equilibrium, vision and decreased cognitive ability.^{[2][3]} Ageing is associated with decline in balance ability and muscle strength which causes

movement and gait disorders leading to falls.^[3] Muscle strength is lost in the axial muscles i.e. core muscles along with distal muscles which make it difficult to maintain balance.^[4]

Balance is the ability to maintain the body's center of gravity within the limits of stability as determined by the base of support.^[5] The ability to maintain balance is an integrated task of neuromuscular, central nervous system and sensory system.^[1] As the age advances, changes taking place in these systems leads to fall in older adults people.

In static and dynamic situations, balance is achieved by positioning body's Centre of Gravity (COG) over the Base of Support (BOS).^[1] Dynamic balance activities are the activities that cause the COG to move in response to muscle activity.^[5] Dynamic control is essential in many functional tasks and involves integration of proprioception, range of motion and strength.^[5]

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Trunk extensors, flexors, and lateral flexors provide spinal stability during every dynamic movement [6] Impairments in trunk muscle such as decreased trunk strength or endurance, are likely to cause changes in balance and mobility status which leads to fall in older adults [7] Core stability is maintained by increasing the activity of core segmental muscles. [8]

Core muscles are the kinetic link that transfers the torques and angular momenta between upper and lower extremities during the execution of whole-body movements [9] Global muscles (Rectus abdominis, external obliques and some parts of the erector spinae) are ideal for creating movement of the trunk and producing torque, because of their large moment arms and long levers as they are attached from the thorax to the pelvis. [6] These muscles are labelled as the prime movers for trunk or hip flexion, extension and rotation. During whole body movement stability of the corespine is associated with Local muscles. [5] Local muscles (Transversus abdominis, multifidus, pelvic floor, diaphragm and internal obliques) are responsible for producing sufficient force for segmental stability of the spine. [5] The co-ordinated muscle recruitment between the global muscles and the local muscles during functional activities maintains stability of the corespine. [8] Core stabilization exercises help in improving neuromuscular control, strength and endurance of the muscles [10] Core stability training targets the muscles deep within the trunk which are connected to the spine, pelvis and shoulders and it assists in maintaining good posture and provides the foundation for arm and leg movements. [7] Exercises that target core muscles are effective for core stabilization and motor control training and thus are used for maintaining balance. [3,11]

Studies suggested that core muscles play an important role in improving balance and training functional mobility in older adults individuals. [12] A study done by Suri et al., 2009 have shown associations between diminished trunk muscle strength, endurance,

muscle quality, mobility and poor balance in older adults. [7] So the study aims to measure effect of core stabilization exercises on balance in older adults.

Methodology

The study was commenced after approval from Institutional ethics committee. Sixty geriatric participants both males and females aged 65-75 years whose Berg Balance Score was more than 40 and were functionally independent were included in the study. Participants were excluded if they had history of recent fractures of lower limb, spinal fractures in past 1 year and any cardiovascular and neurological impairment since past one year. Informed written consent from all the participants were taken after the explanation of the testing procedure, protocol and duration of the intervention. Participants were allocated into two groups i.e. Group (A) Experimental and Group (B) Control group. Group A was given core stabilization exercises like: Drawing in manuevers, Bent leg fall out, Drawing in manuevers along with a) Lift bent leg to 90 degree hip flexion b) slide heel to extend knee c) straight leg raise to 45 degrees were given which help them to activate the deep segmental muscles along with their normal daily activities for 5 days week for 6 weeks, while Group B was not given any intervention and was told to carry out their regular routine for 6 weeks. All necessary precautions were taken in order to prevent any kind of fall during the testing procedure and intervention. The measurement of variables Berg Balance Scale, Functional Reach test and Y- Balance Test were taken pre training (0 week) and post training (post training)

Statistical Analysis

Statistical analysis was done in statistical package for social sciences. Paired t- test was done for Intra group while un-paired t- test was done for Inter group comparison.

Results

TABLE 1: Intra group comparison of Mean pre and post 6 weeks of intervention using paired t-test in Experimental Group.

	VARIABLES	MEAN VALUE		P VALUE	t VALUE
		PRE	POST 6 WEEKS		
1	Berg Balance Scale	45.76	48.1	7.96E-17	-16.85
2	Y BALANCE TEST				
RIGHT	ANTERIOR	57.2	60.4	6.01E-08	-6.95
	POSTEROMEDIAL	45.3	48.6	3.29 E-08	-7.18
	POSTEROLATERAL	34.16	37.2	4.81E-08	-7.03
LEFT	ANTERIOR	57.13	60.26	6.31E-08	-6.93
	POSTEROMEDIAL	44.13	47.06	3.47E-08	-7.16
	POSTEROLATERAL	33.5	36	4.27E-09	-7.9
3	Functional Reach Test	18.16	20.8	1.14E-11	-10.4

Interpretation: Post 6 weeks of exercises there was significant improvement seen in scores of Berg Balance scale ($p \leq 0.05$), Y balance test ($p \leq 0.05$) and Functional reach test ($p \leq 0.05$)

TABLE 2: Intra group comparison of Mean pre and post 6 weeks of intervention using paired t-test in Control Group

CONTROL GROUP						
	VARIABLES	MEAN VALUE		P VALUE	t VALUE	INTERPRETATION OF SIGNIFICANCE
		PRE	POST 6 WEEKS			
1	BERG BALANCE SCALE	45.6	45.33	0.13	1.13	INSIGNIFICANT
2	Y BALANCE TEST					
RIGHT	ANTERIOR	55	54.6	0.14	1.09	INSIGNIFICANT
	POSTEROMEDIAL	43.2	43.4	0.27	-0.61	INSIGNIFICANT
	POSTEROLATERAL	33.4	33	0.13	1.13	INSIGNIFICANT
LEFT	ANTERIOR	57.2	57.3	0.38	-0.29	INSIGNIFICANT
	POSTEROMEDIAL	42.5	42.8	0.28	-0.58	INSIGNIFICANT
	POSTEROLATERAL	33	32.6	0.13	1.12	INSIGNIFICANT
3	FUNCTIONAL REACH TEST	17.73	17.43	0.08	1.42	INSIGNIFICANT

Interpretation: Post 6 weeks intervention there was no significant improvement seen in the control group scores ($p \geq 0.05$)

TABLE 3: Inter Group Comparison of Mean of Variables using Un- Paired t-test between Experimental and Control group

INTER GROUP MEAN DIFFERENCE						
	VARIABLES	EXPERIMENTAL	CONTROL	P VALUE	t VALUE	
1	BERG BALANCE SCALE	2.33	-0.33	3.2 E-10	8.23	SIGNIFICANT
2	Y BALANCE TEST					
RIGHT	ANTERIOR	3.26	-0.4	8.48E-08	6.17	SIGNIFICANT
	POSTEROMEDIAL	3.26	0.23	3.65E-08	5.13	SIGNIFICANT
	POSTEROLATERAL	3.1	-0.46	1.87E-07	5.91	SIGNIFICANT
LEFT	ANTERIOR	3.13	0.1	1.86E-06	5.34	SIGNIFICANT
	POSTEROMEDIAL	2.93	0.26	6.07E-05	4.33	SIGNIFICANT
	POSTEROLATERAL	2.5	-0.33	1.58E-08	6.56	SIGNIFICANT
3	FUNCTIONAL REACH TEST	2.63	-0.3	2.10E-12	8.95	SIGNIFICANT

Interpretation: Significant improvement was seen in experimental group compared to control group ($p \leq 0.05$)

Discussion

Core stabilization exercises were carried on experimental group for 6 weeks. The exercises showed significant improvement in balance as compared to control group. Improvement in balance could be due to core stabilization exercises that target the deep stabilizers of the spine which play a crucial role in providing a stable foundation upon which the limb muscles can move.^[13]

The core stability system is the product of motor control and muscular capacity of lumbopelvic-Hip complex. It acts like a corset which gives tension to the trunk muscles when activated. These muscles are divided as local and global muscles. Global muscles like Erector spinae, rectus abdominis, external oblique and quadrates lumborum provides trunk motion with

rapid and powerful torques. The local muscles consist of transverse abdominis, multifidus, internal oblique are situated deep which provide dynamic segmental spinal stability^[15].

Statistical analysis showed significant improvement in BBS score, Y balance test and Functional reach test post six weeks of intervention. This could be attributed due to TrA activation prior to and during lower limb activity which helps in reducing the perturbing forces on posture and balance^[16]. Also the core stabilization exercises provide protection to the low back muscles that challenges the balance, flexibility and coordination^[17]. The exercises enabled improvement of reaction time which is important factor in optimal balance. The repetitive exercises and weekly progression helped in improving the endurance which was associated with

balance performance. Rosa Cabanas et al suggested the positive association of central nervous system (CNS) stabilizing the spine through the contraction of trunk and pelvis muscle in response to reactive forces of lower limb. Panjabi also stated that contraction of core muscle activates the postural responses by CNS which help in controlling the balance.

Core stability exercises are effective in motor control training. The exercise recover the postural control function of body and increases the range of motion. So it can be considered as appropriate exercise for older adults. Motor learning which occurs during the core training improves muscle reflexes and accelerates proprioception which affects balance control.

Control group did not show any significant change in Berg Balance Scale, Y – balance Test (anterior, posteromedial, posterolateral) and Functional Reach Test. As Ageing is an on-going process, there are normal age associated changes taking place in the body which leads to impairments in balance^[1]. Also, there is decline of physiological capacities and deterioration of ability to respond to stress in this period which increases vulnerability of the older adults to various impairments due to ageing process^[4]. So there was no change seen in the control group.

Conclusion

Based on the findings from our study, we conclude that along with peripheral muscles strengthening exercises, core stabilisation exercises are also important in maintaining the balance in older adults.

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