

Comparison of Lower Limb and Trunk Muscle Strength Training on Balance in Elderly Population

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Abstract

Aging refers to the time sequential deterioration that occurs in most animals including weakness, increased susceptibility to disease and adverse environment conditions, loss of mobility and agility and age related physiological changes. Balance and muscle force deteriorate with aging, and it has been suggested that a decrease in the ability to generate force in the lower extremity muscles contributes to balance impairment. Balance impairments are also associated with poorer mobility measures in elderly population. *Sample A* group of 24 elderly subjects of age between 60-80 years were included in the study. Subjects are divided into two groups 12 in each group (Group A no. = 12), (Group B no. = 12). Group A (Lower limb muscle strength training) Group B (Trunk muscle strength training) was given. *Conclusion:* Based on the result of present study, it can be concluded that there is no significant change in lower limb and trunk muscle strength training on balance in elderly population. Thus, the null hypothesis, that there is no difference in lower limb and trunk muscle strength training on balance in elderly population holds true.

Keywords: Lower Limb Muscle Strengthening; Trunk Muscle strengthening; Elderly Population.

Introduction

Aging refers to the time sequential deterioration that occurs in most animals including weakness, increased susceptibility to disease and adverse environment conditions, loss of mobility and agility and age related physiological changes [1].

For the frail elderly, falls and fractures constitute a major health problem. The cost for healthcare involved is substantial, and there is also great social and personal suffering involved. The injuries and their complications may even be a threat to life in old age. Previous studies have shown that falls occur mainly during walking, and if the fall occurs while turning, there is a particularly high risk of hip fracture. During walking, there is a considerable multisensory load upon the individual. It is obvious that there are complex mechanisms involved in walking and balance control [2].

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Poor balance in older persons increases the risk of injurious falls during daily activities [3]. It is probable that balance declines in the elderly due to age-related degeneration, potentially aggravated by infections and injuries which can affect the sensory, motor and adaptive components of balance function. Mild changes in any one system may not lead to significant disturbances of control, but if there is a combination of these factors then there may be severe balance deficits [4]. Studies in young people show that muscle fatigue in the lower limbs increases postural sway, that fatiguing postural back muscles impairs head and trunk control while walking, and that quadriceps muscle fatigue alters gait parameters related to slip propensity [5].

Balance and muscle force deteriorate with aging, and it has been suggested that a decrease in the ability to generate force in the lower extremity muscles contributes to balance impairment. Balance impairments are also associated with poorer mobility measures in elderly population [1].

Good trunk stability is essential for balance and extremity use during daily functional activities and higher level tasks. Dynamic stability of the trunk requires adequate flexibility, muscle strength, neural control, and proprioception [8].

The functional reach test was designed to measure

the limits of stability in an anterior direction. The maximal distance that subjects can reach forward horizontally while maintaining a fixed base of support is measured [10].

Aim of this Study is to Analyze the Effectiveness of

1. Lower limb strengthening on balance in elderly people.
2. Trunk muscle strengthening on balance in elderly people.
3. Compare the effect of lower limb strengthening with trunk muscle strengthening on balance in elderly.

Methodology

Sample

A group of 24 elderly subjects of age between 60-80 years were included in the study. Subjects are divided into two groups 12 in each group (Group A no. = 12), (Group B no. = 12).

The subjects for this study were taken from O.P.D of Banarsidas Chandiwala Institute of physiotherapy.

Inclusion Criteria

1. Age group of 60-80 years.
2. Both male and female geriatric subjects.
3. Elderly with score less than 10 inches on functional reach measure.
4. No known neurological symptoms which affects balance.

Exclusion Criteria

1. Subjects with cardio - respiratory symptoms which will hinder strength training.
2. Subjects with Musculoskeletal / Neurological problem of lower limb or spine (Apart from age related changes).
3. Uncooperative patients.

Instrumentation

1. Strain gauge
2. Plinth
3. Yard stick
4. Chair
5. Velcro

Protocol

Group A – Lower Limb Muscle Strength Training

Before strength training program proper warm up was given for a period of 5 minutes in the form of free exercise.

The following exercise were given for 30 minutes each day, 6 days in a week for duration of 20 days.

Hip Flexion

POP – Supine with knee extended. Pelvis is stabilize and the opposite hip and knee are flexed. Patient lift the leg to above 45 degree of hip flexion. Hold the leg in that position for a count of 10 second and then lower it and repeats.

Isometrics to Quadriceps

POP – Supine with knee extended. Towel roll is placed under the knee. Patient is then pushes the knee down against the towel roll into the ground . patient holds that position for 10 second and repeats.

Isometrics to Hamstring

POP – Supine with knee extended. Towel roll is placed under the heel, patient then pushes the heel down against the towel roll. Holds the position for 10 second and repeat it.

Step Up Exercise

Patient begins with the step of 2 to 3 inches in height. Patient step up sideways, forward and backward. Patient places the foot on step and the body is lifted with smooth motion.

Standing on Uneven Surface, Patient stand with bilateral support on wobble board with single plane weight shifting forward, backward and side to side.

Knee Extension Exercise

POP – High sitting, with the knee at edge of the treatment table and flexed as far as possible. Patient relax and actively flex the knee to the end of the range and hold in the same position for 10 seconds and repeats the same.

Ankle Dorsiflexion

POP – Sitting with knee extended. Patient strongly dorsiflex the feet, keeping the toes relaxed. Holds the position for 10 seconds and repeats.

Hip Extension Exercise

POP – Prone lying with knee extended. Patient lifts the extremity away from the table. Hold the extremity in the same position for the 10 seconds and repeats.

Hip Abduction Exercises

POP– Side lying. Patient flexes the other extremity and lifts the another extremity away from the table and holds for 10 seconds and repeats.

Group B – Trunk Muscle Strength Training

Before strength training program proper warm up was given for a period of 5 minutes in the form of free exercise and stretching. The following exercise were given for 30 min each day,6 days in a week for duration of 20 days.

Pelvic Bridging

POP – Hook – Lying Position.

Patient press the upper back and feet into the mat elevate the pelvis and extend the hips. Patient hold the position for 10 seconds and relaxes and repeats.

Abdominal Curls

POP – Crook Lying

Patient lifts the head, progress by lifting the

shoulders until the scapula and thorax clear the mat, keeping the arm horizontal.

Seated Back Extension

POP – Sitting Upright on the Ball with the Feet on the Floor.

Wall Squats with Ball

Patient lower the trunk by flexing the hips and knees with back rolling a gym ball down the wall.

Procedure

The Purpose of the study was explained to the subject. The subjects were encouraged to participate in the study. Subjects were taken into the study only if they met inclusion criteria. A baseline assessment of the subjects in both the groups was done prior to the study and demographic data was collected which includes name, age group 60-80 for both the sexes. Following the completion of all baseline assessment. All the subjects were evaluated before commencement of training and at the end of the 20th day by FRT and strain gauge for the evaluation of muscle strength. The exercises were given for 30 min each day, 6 days in a week for duration of 20 days. Subjects are divided into two groups, 12 in each group. Group A for lower limb strength training and Group B for trunk muscle strength training.

Table 1: Comparison of Pre and Post test outcome variables of Group A

S. No	Variables	Muscle Strength			
		PRE		POST	
		Mean	S.D	Mean	S.D
1	Hip flexor	6.67	0.7	7.35	0.61
2	Hip extensor	6.55	0.32	7.4	0.36
3	Knee flexor	5.96	0.85	6.70	0.88
4	Knee extensor	6.47	0.58	7.32	0.52
5	Ankle dorsiflexor	2.33	0.23	2.97	0.18
		FRT			
		PRE		POST	
		Mean	S.D	Mean	S.D
		8.04	0.81	8.3	0.8

Table 1.2: Comparison of Pre and Post test outcome variables of Group B

S. No	Variables	Muscle Strength			
		Pre		Post	
		Mean	S.D	Mean	S.D
1	Trunk flexor	6.23	0.35	6.78	0.39
2	Trunk extensor	6.65	0.43	7.15	0.42
		FRT			
		PRE		POST	
		Mean	S.D	Mean	S.D
		7.90	0.93	8.35	0.89

Table 1.3: Comparison of FRT outcomes between Group A and Group B

	PRE		FRT		POST	
	Mean	S.D	Mean	S.D	Mean	S.D
GroupA	8.04	0.81	8.3		8.3	0.8
GroupB	7.90	0.93	8.35		8.35	0.89

Discussion

Present study which compares the Functional Reach Test after lower limb muscle strengthening with that of trunk muscle strengthening in elderly people. The hypothesis that one group would gain more improvement in functional reach as compared to other group cannot be accepted on the basis of finding in this study, our primary finding was Lower Limb and Trunk Muscles Strengthening results in improvement in Functional Reach in elderly population. It appears from the result of study that strengthening of muscle group in trunk and lower limb had very similar improvements in the Functional Reach Test.

It has been well established that aging is associated with a loss in muscle strength. Muscle strength is lost not only in radial muscle i.e lower limb muscle but also to the trunk muscles or core muscles of body, making balance difficult. There are also deficits in neurological, vestibular and visual system. It is a combination of the two and the resulting lack of reflex coordination that leads to the loss of balance and poor gait in older individuals. This loss in reflex ability as well as muscle strength in lower limb and trunk muscle reduces functional ability of people over 60 years of age.

The resistance training is recognized as beneficial for the health, the most appropriate technique is still controversial. It is well established that progressive resisted exercises in elderly people produces the strength that results from the increased motor unit activation of trained muscles and hyper-trophy of muscle fibers. This is supported by previous study done by Laidlaw DH [18] strength training improves the steadiness of slow lengthening contractions performed by older adults.

According to them Maximum voluntary contraction increase in heavy load muscles. These improvements were associated with reduced level of muscle activation especially during the lengthening contractions. Frontera WR et al [19], conducted that strengths gain in older adults were associated with muscles hyper-trophy and an increase in myofibrillar protein turn over.

Daubney et al [20], found that the distal muscle

force measure may be able to contribute to the prediction of functional balance scores. According to them, Ankle dorsiflexors and hip extensor forces were lower in subjects reporting falls and force of ankle dorsiflexor predicts fall status.

Deepak Kumar [21], concluded that age is negatively related to balance performance and with muscle force production. The torque production of hip extensors and knee extensors can serve to predict balance performance on certain scales and have significant contribution in maintenance of older adults.

Nelson SE [22], support the result of lower limb that the progressive strengthening of the lower limb muscles and upper limb muscles will lead to improved Functional Reach Test measure and timed get up and go test in the elderly population who are at risk of falls. The results in trunk muscle group shows that their is significant improvement in muscle strength in both the muscle groups and significant improvement in functional reach measure and dynamic balance in elderly people who got trunk muscle strengthening.

According to Goldberg A [23], controlling the flexing trunk is critical in recovery from a loss of balance and avoiding falls. The trunk repositioning error is more in balance impaired group in older individuals as compared to normal people.

A study done by Jerrold S, Petrofsky [24] supports the results obtained from the present study that the strengthening of core muscles i.e. rectus abdominis, transversus abdominis and back extensors muscles will lead to the improvement in the functional reach in all the three directions i.e. forward reach, right and left reach in elderly populations of age group more than 65 years.

Although no significant difference were noted in the clinical outcome between the trunk muscle and lower limb muscle strengthening groups in this study.

Conclusion

Based on the result of present study, it can be concluded that there is no significant change in lower limb and trunk muscle strength training on

balance in elderly population.

Conflict of Interest: Nil

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Ethical Clearance: it was approved by ethical committee

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