Effects of Resistance Exercise combined with Balance Exercise on Static and Dynamic Balance among Community Dwelling Older Adults

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ABSTRACT

Introduction and Aim: Falls in elderly is a significant cause of morbidity and mortality and are an important class of preventable injuries due to the reduction in the muscle strength and balance among older adults. To determine the effects of resistance exercise combined with balance exercise on the static and dynamic balance among community-dwelling older adults.

Materials and Methods: Forty subjects with or without previous history of falls are selected based on the selection criteria and divided into two groups. Group-A subjects received resistance exercise and balance exercises. Group-B subjects received balance exercise alone. Both groups were treated for 3 days a week for 4 weeks. The outcome measures were Berg Balance Scale (BBS) and Timed Up and Go test (TUG).

Results: All the values were tabulated and statically analyzed using paired and unpaired t-test.

Conclusion: Resistance exercise combined with balance exercise is effective than balance exercise alone in improving the static and dynamic balance thereby reducing falls among the older adults.

Key Words: Falls, Balance, Resistance exercise, Balance exercise

INTRODUCTION

The number of people over the age of 60 years is vastly increasing, especially in India. India is the secondly ranked for having people at or over 60 years, constituting about 7.7% of the entire population (2). The major reasons for this substantial increase are because of higher life expectancy and decreased birth rates (8). Aging is associated with increased risk of disability and dependency. With increasing age, the risk of falls can increase up to 60% (16).

Evaluation of the risk factors is essential for tailoring effective fall prevention strategies (11). Some risk factors are modifiable while others can be modified with appropriate intervention (15,19). Despite rehabilitation, several individuals do not regain the level of functional independence they had before fracture which is why prevention of falls are important (9).

The causes of falls in elderly are multifactorial. The causes can be classified into intrinsic and extrinsic factors. The intrinsic risk factors are muscle weakness (lower extremity weakness), balance deficits and gait instabilities while extrinsic factors include polypharmacy (use of 4 or more medications) and environmental hazards such as loose carpets, poor lighting and lack of safety equipment such as handrails in bathroom (AGS Panel on Falls Prevention, 2001).

Some of the factors that are associated with greater probability of falls are problems such as gait and balance impairment, sensory impairment such as the peripheral neuropathy, vestibular dysfunction, vision impairment, and orthostatic hypertension.

Balance is important for maintaining postural equilibrium and thus avoiding falls. Aging may affect the central nervous system and neuromuscular system leading to a reduction in balance and gait performance (7). Studies reveal that for prevention of falls, resistance exercises and balance exercises can be prescribed for the elderly population.

Lower extremity resistance exercise is important for prevention of falls in elderly (4). Resistance exercise using the Thera-band is possible to improve the static and dynamic balance of elderly adults. The pre-

ferred resistance used for the elderly population is a yellow band as they are of lower resistance and can be used as beginner resistance training in the elderly population.

Balance exercises with the help of Swiss ball are proven at improving the static and dynamic balance ability of the elderly women. It is very important to have a physically active life in the satisfying independence of the elderly, preserving balance and mobility is essential.

This study is done to find out the effectiveness of the resistance exercises and balance exercises Vs balance exercises alone in improving the balance in elderly population by the administration of resistance exercise using thera band and balance exercise using swiss ball and then to suggest an appropriate exercise protocol with the interpretation of the results done in the study.

MATERIALS AND METHODS

A total of 40 subjects with or without previous history of falls between the age 60-80 year participated in the study. Subjects were selected from Anandam Old Age Home. All the subjects were signed an informed consent form approved by the Scientific review board and Institutional Human Ethical committee at Saveetha University before participating in the study.

Selection criteria for subjects with or without previous history of falls

Subjects of both the sexes, with or without previous history of falls, a score of 41-56 in the Berg Balance Scale were selected. Subjects were excluded if they had the Vestibular or visual disorder, Cardiorespiratory disorders, Neurophysiological diseases, Vertigo, any recent injury or previous trauma within 6 months.

Procedure

Group A received a combination of resistance exercise by Thera band, and balance exercise using Swiss ball and Group B received only balance exercise using Swiss ball. Dependent variables measured in the study were the Berg balance scale and Timed Up and Go test. The Berg Balance Scale is used to measure balance. It is a 14-item balance assessment tool that is scored on a 5-point scale (0-4) measuring levels of ability in performing each task (4-safe and independent, 0-incapable). The BBS includes task such as standing with eyes closed, reaching, standing on one foot and picking objects from the floor. The highest possible score is 56, indicating excellent balance.

The Timed Up and Go test is used to measure functional mobility. The time taken to complete rising from a chair, walking 10ft, and turning, walking back to the chair and sitting was recorded in seconds. The starting position is standardized so that the subjects commenced the test with feet flat on the floor and the arm resting on armrests. No physical assistance was provided. The subject was asked to perform three trails, and the mean score was recorded.

Group A received resistance exercise using Thera band and balance exercise using Swiss ball for improving the balance. Thera band of yellow colour is given as it provides the least and beginner's resistance. Balance exercises are provided using Swiss ball. The resistance exercises and the balance exercises were performed for about 2 sets per day, 3 days a week for 4 weeks. Resistance exercise using Thera band and balance exercise using Swiss ball are performed for all the lower extremity joint movements in the hip, knee and ankle joints. The entire duration is about 30 minutes per session for 3 days per week for 4 weeks.

Group B received the balance exercises alone using Swiss ball. The balance exercises were performed for about 2 sets per day, 3 days a week for 4 weeks. Balance exercise using Swiss ball is performed for all the lower extremity joint movements in the hip, knee and ankle joints. The entire duration is about 30 minutes per session for 3 days per week for 4 weeks.

RESULTS

The collected data were tabulated and analyzed using descriptive and inferential statistics. To all parameters mean and standard deviation (SD) was used. A paired t-test will be used to analyze significant changes between pre-test and post-test measurements. Unpaired t-test was used to analyze significant changes between two groups.

The post-test mean value of BBS in Group A is 52 (SD is 2.99), and post-test mean value in Group B is 48 (SD is 3.70). This shows that BBS scores in Group A are gradually increased, with P value (<0.0001) extremely statistically significant.

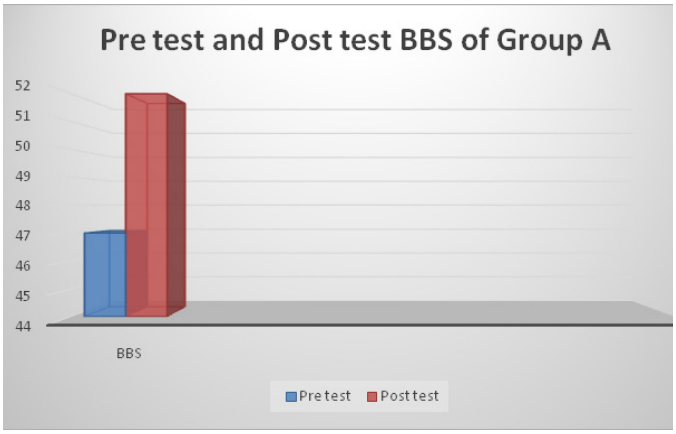
The post-test mean value of TUG is 9.4 (SD is 1.57) in Group A, and post-test mean value in Group B is 8.4 (SD is 0.91). This shows that TUG scores

in Group A are gradually decreased, with P value (<.0001) extremely statistically significant.

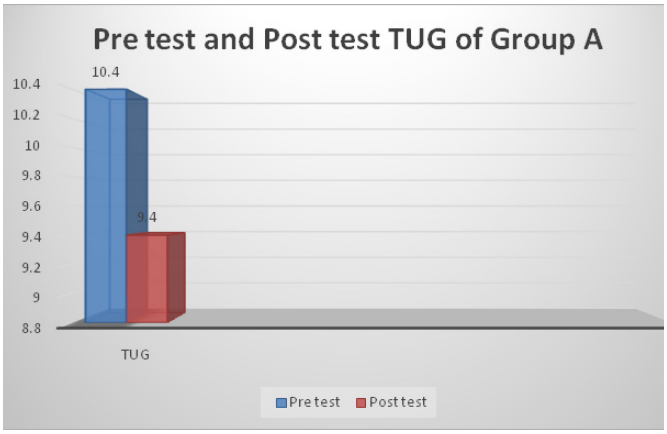
From the statistical analysis made with the quantitative data, it is concluded that there is a significant difference between pre-test and post-test values within Group A and Group B.

Within the Group Analysis

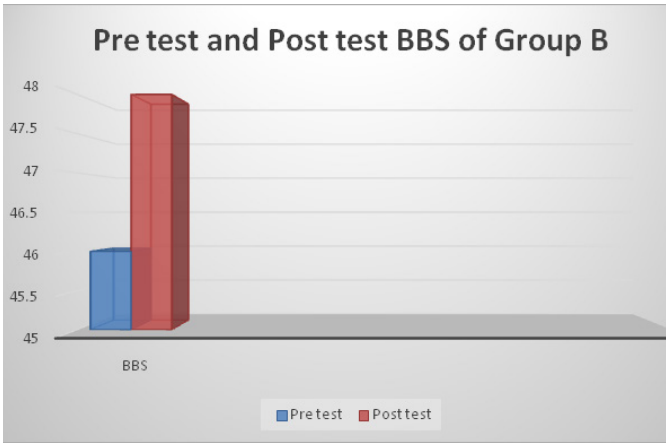
Graph 1: Graph showing Pre and post test BBS values of Group A



Graph 2: Graph showing Pre and post testTUG values of Group A

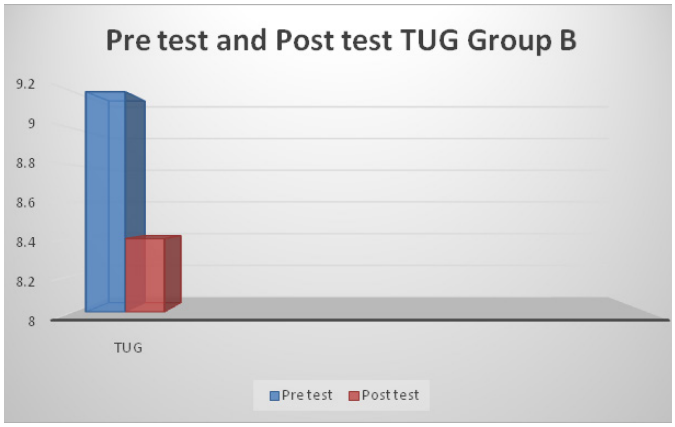


Graph 3: Graph showing Pre and post test BBS values of Group-B



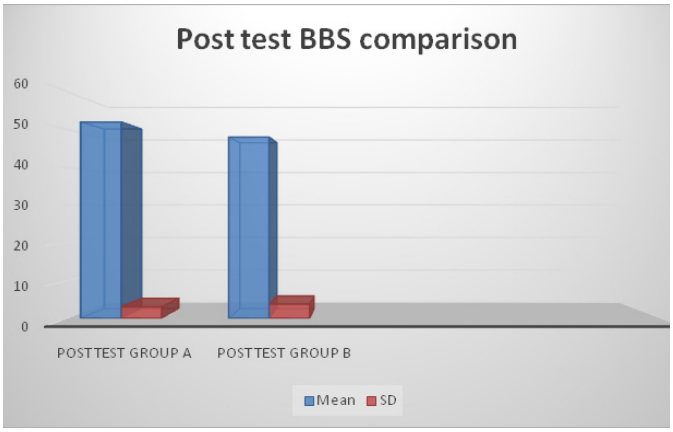
From the above statistical analysis with the quantitative data, it is concluded that there is a significant difference between pre and post-test values within Group A and Group B, signifying that Group A (Resistance exercise and balance exercise) is an effective treatment protocol than Group B.

Graph 4: Graph showing pre and post test TUG values of Group B

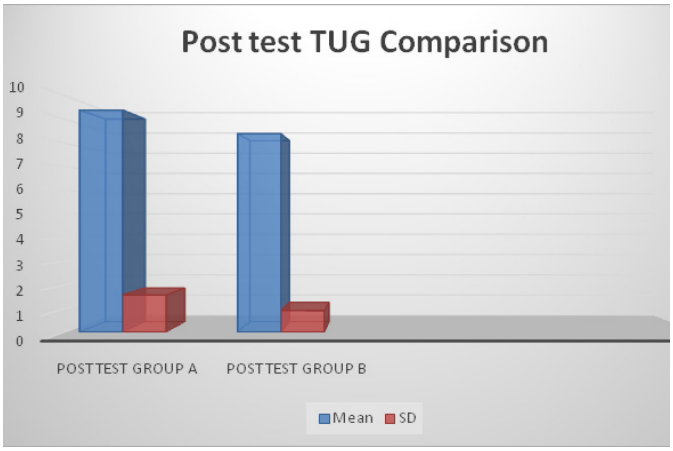


Between the Group Analysis

Graph 5: Graph showing Post test-post testBBS values of Group A and Group B



Graph 6: Graph showing Post test-post test TUG values of Group A and Group B



DISCUSSION

This study investigates the effect of resistance exercise combined with balance exercise on the static and dynamic balance among community-dwelling older adults, proving that resistance exercise combined with balance exercise is better than balance exercise alone. There were 40 older adults who participated in the study. They were divided into two groups, Group A receiving resistance and balance exercise and the latter group (Group B) received balance exercises alone and further showed a statistical significance better than BBS, TUG for 4 weeks duration in Group A more than Group B. Handling geriatric population was a challenge. They were apprehensive at the beginning and later got comfortable with the exercise schedule.

According to WHO, falls are prominent among the external causes of unintentional injury. They are coded as E880-E888 in International Classification of Disease-9 (ICD-9), and as W00-W19 in ICD-10, which include a wide range of falls including those on the same level, upper level, and other unspecified falls. Falls are commonly defined as "inadvertently coming to rest on the ground, floor or other lower level, excluding intentional change in position to rest in furniture, wall or other objects.

Falls exponentially increase with age-related biological change. Therefore, a pronounced number of persons over the age of 80 years will trigger a substantial increase in falls and fall injury at an alarming rate. In fact, the incidence of some fall injuries, such as fractures and spinal cord injury, have markedly increased by 131% during the last three decades (14).

According to Yves J Gschwind *et al*.: A best practice fall prevention exercise program to improve balance, strength/power, and psychosocial health in the older adults-Study protocol for Randomised controlled trial (2013), he stated that balance is important for maintaining postural equilibrium and thus for the avoidance of falls (1).

Besides balance, muscle strength also is required for the proper performance of ADL. There are many conventional procedures that are being practiced for improving the balance such as wobble board, swiss ball, balance exercises. But the additional training of the muscles was not focussed along with balance training in most of the clinical practices. Exercises such as resistance exercises can be used to improve the muscle power of the individual. Resistance exercise and balance exercise improves the balance, unlike any other treatment.

Granacher U *et al*. (2010), Howley ET *et al*. (2003) and several other authors have proved that combined balance and resistance exercise may positively improve physical (i.e., balance and strength) and also functional performance.

Granacher U *et al*.: Balance training and multi-task performance in seniors (2010) stated that age-related impairment in gait patterns when simultaneously performing cognitive (CI) and/or motor (MI) interference tasks are associated with an increased risk of falling in seniors. The objective of his study was to investigate the impact of balance training (BT) on walking performance with and without concurrently performing a CI and/or MI task in seniors. The intervention group conducted a six week BT (3/week). Pre and post-tests included the assessment of stride-to-stride variability during single (walking), dual (CI or MI+ walking), and triple (CI+ MI+ walking) task walking on an instrumented walkway. BT resulted in statistically significant reductions in stride time variability under a single ($p=0.02$, Delta34.8%). His findings showed that performance during single task did not transfer while walking, suggesting BT as an alternative training modality for MI and CI (10).

Wonjong Yu *et al*.: Effects of Resistance exercise using Thera band on balance of elderly adults-A randomized control trial (2013) decreased balance causes disturbances while standing and during gait, through a decrease in the ADL and an increase in the incidence of falls. The objective of this study is to investigate the effects of resistance exercise using thera band on balance of elderly adults. The intervention group conducted a five-week, and the participants were evaluated using Berg balance scale and Timed Up and Go test. The findings of the study concluded that resistance exercise using thera band is possible to improve the static and dynamic balance of the elderly adults (4).

According to Yves J Gschwind *et al*: A best practice fall prevention exercise program to improve balance, strength/power, and psychosocial health in older adults-Study protocol for Randomised controlled trial (2013), mentioned that Podsiadlo D et al, The "Timed Up and Go" a test of basic functional mobility for frail elderly persons stated that the TUG showed excellent test-retest reliability (ICC=0.99) in older adults. The Berg Balance Scale is also considered to be one of the most commonly used scales to measure balance in the elderly.

This study proves that combined resistance and balance exercise are useful in improving the balance of an older adult, thereby improving their functional independence. It is also proven that combined exercise strategies are better in improving the balance ability of the older adults.

The post-test mean value of BBS in Group A is 52 (SD is 2.99) the post-test mean value of TUG is 9.4 (SD is 1.57), and the graphical representation proves the same.

In future, easy to administer balance and muscle strength exercises can be developed for prescribing for the geriatric population.

To conclude, this trial will provide an insight into the effect of fall prevention on older adults and also the importance of leading a physically healthy lifestyle, especially to the older adults.

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