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RESEARCH ARTICLE

EFFECTIVENESS OF PROGRESSIVE RESISTANCE TRAINING FOR IMPROVING BALANCE AMONGST ELDERLY

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ABSTRACT

Introduction: The frequency of falls in elderly may be correlated to the reduced muscle strength and ineffective balance strategies.The present study was to evaluate the effectiveness of progressive resistance training in improving balance amongst elderly.

Materials and Methods: The interventional study was carried out on elderly individuals selected from senior citizen groups across Mumbai and Pune cities, India. The individual surveyed were categorized using simple random sampling method into subjects receiving progressive resistance strength training (n=20, mean age 69.25±2.863) and control group (n=20, mean age 69.45±2.704) receiving conventional balance exercises. The intervention was carried out for 4 weeks and balance was assessed using berg balance scale (BBS) and Performance Oriented Mobility Assessment (POMA) score Pre and post treatment.

Results: Berg balance score in PRT group improved from 49.9±3.30 to 54.6±1.72 (p= 0.001) as compared to control group that improved from 49.2± 2.28 to 51.4 ±1.81 (p= 0.005). POMA score in PRT group improved from19.6±4.07 to 25.35±3.11(p=0.001) as compared to control group that improved from 18.3±4.39 to 22.2±4.11(p= 0.005)

Conclusion: Progressive resistance training was significantly effective in improving balance thereby reducing the risk of fall amongst elderly.

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INTRODUCTION

Elderly population faces a number of health issues and falls are among the most important ones (Tinetti *et al*., 1994) leading to injury, dependency and death in a considerable proportion (Sleet *et al*., 2008). Falls in the elderly are a major cause of morbidity and mortality. The reason that falling becomes a major health hazard in persons older than 65 is a result of the complex and poorly understood interaction of biomedical, physiological, psychological, and environmental factors (Andrew guccion, chpt.18 p280) Approximately 28-35% of people aged of 65 and over fall each year (Blake *et al*., 1988), (Prudham, and Evans, 1981), (Campbell *et al*.,1981) increasing to 32-42% for those over 70 years of age (Tinetti *et al*., 1988), (Downton, 1991), (Stalenhoef *et al*., 2002). The frequency of falls increases with age and frailty level. Approximately 30-50% of people living in long-term care institutions fall each year, and 40% of them experienced recurrent falls (Tinetti, 1987). As the age increases balance alteration and risk of fall also increases. There is a significance of prevalence of balance alteration and risk of fall in geriatric population (Gaurai *et al*., 2016). Studies have shown that elderly subjects who fall, demonstrate impaired functioning in sensory-motor factors accountable for balance or postural stability (Lord SR *et al*., 2001). Inactive lifestyle and physiological changes related to aging, characterized by senile sarcopenia and progressive decline in muscle strength, joint range of motion, reaction time, and sensory system lead to reduced physical performance and increased risk of fall (Howe *et al*., 2011). The relationship between impairments in generation of muscle force and balance has been explored. The force generating capacity of the ankle muscles, weakness of hip flexors, extensors, and abductors, reduced torque and power of knee flexors, knee extensors, ankle dorsiflexors and plantar flexors are found to be either predictors or contributors for postural instability during dynamic activities (Daubney *et al*., 1999). Studies addressing fall prevention have focused on various group and individualized strength training programs (Rubenstein *et al*., 2006). Many of the progressive resistance training interventions are designed to increase strength (Liu *et al*., 2009) and reduce the falls in elderly (Liu *et al*., 2009), (Hess *et al*., 2005) were effective in reducing both rate of falls and risk of falling. The research done to study the effectiveness of tai

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chi on balance in elderly showed the significant improvement in balance and with reduced risk of fall (Ujwal *et al*., 2016) Strength training or resistance exercise, is generally defined as training in which the resistance against which a muscle generates force is progressively increased over time. A long-term program of strength training is necessary to sustain improvements in muscle function. This is particularly important in the elderly, in whom loss of muscle mass and weakness are prominent deficits. Resistance training of both the upper extremities and lower extremities can be accomplished with precautions and supervision and be of significant value in maintaining basic self-care activities and increasing strength and muscle mass. Strength training is an effective method for developing musculoskeletal strength and is often prescribed for fitness, health and the prevention and rehabilitation of orthopaedic injuries. A properly designed and supervised resistance training program can enhance the muscular strength and power in youth (Avery D. Faigenbaum *et al*., 2005). As there is lack of literature on elderly population so this study is to evaluate the effectiveness of progressive resistance training in improving balance amongst elderly.

Aim and Objectives

To evaluate the effectiveness of progressive resistance training in improving balance among the elderly.

HYPOTHESIS

Null hypothesis:

Progressive resistance training (PRT) is not significantly effective in improving balance among the elderly.

Alternative hypothesis

Progressive resistance training (PRT) is significantly effective in improving balance among the elderly.

MATERIALS AND METHODS

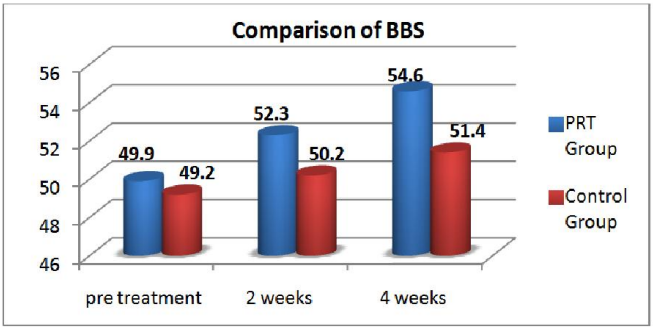
This intervention based study was carried out by using simple random sampling. The study was conducted across the Mumbai and Pune city which includes 40 elderly individuals aged between 65-75 years as recruited according to inclusion criteria. The individual surveyed were categorized into subjects receiving progressive resistance strength training (PRT Group =20) and control group=20 using simple random sampling method. PRT Group received progressive resistance strength training and control Group received only balance exercises. The respondents were made clear that the information gathered would remain confidential and would be used only for research purpose. Aim and objectives of the study were clearly stated in an assessment form in order to obtain the consent of respondents. The balance assessment was carried out by using Berg Balance Scale and POMA. The PRT group has received resistance training for the key muscles of both lower extremities. The muscle group involve were hip flexors, extensors and abductors, knee flexors, and extensors, and ankle dorsiflexors and plantar flexors. DeLormes and Watkins protocol was used for progressive resistance strength training, which will lasts for approximately an hour per session. Traditional balance exercises consisted of following components: weight-shifts, standing on one leg, tandem walking, crossover walking, figure of eight walking, forward, backward and sideways walking, perturbations of balance in all directions while sitting on plinth. These exercises were given to control group. The balance assessment was carried out prior to the 1st session of training, on completion of 2 weeks and after 4 weeks. The data was collected for interpretation and evaluation.

RESULTS

Berg balance score in PRT group improved from 49.9±3.30 to 54.6±1.72 (Graph:1, Table:1) as compared to control group that improved from 49.2± 2.28 to 51.4 ±1.81 (p= 0.005) (Graph:2, Table:2). POMA score in PRT group improved from19.6±4.07 to 25.35±3.11(p=0.001) as compared to control group that improved from 18.3±4.39 to 22.2±4.11(p= 0.005)

Table 1. Comparison of Berg balance score of PRT and control group

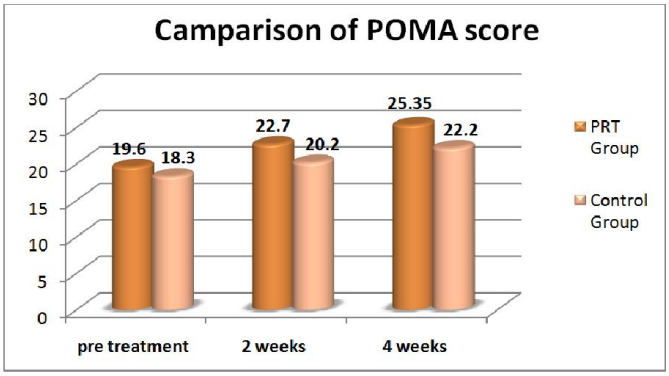
	Pre treatment	2 weeks	4 weeks	P Value
PRT Group (mean±sd)	49.9 ±3.307	52.3±2.830	54.6± 1.72	0.001
Control Group (mean±sd)	49.2± 2.285	50.2± 2.016	51.4 ±1.81	0.005



Graph 1.

Table 2. Comparison of POMA score of PRT and control group

	Pre treatment	2 weeks	4 weeks	P Value
PRT Group (mean±sd)	19.6±4.070	22.7±3.88	25.35±3.11	0.001
Control Group (mean±sd)	18.3±4.390	20.2±4.34	22.2±4.11	0.02



Graph 2.

DISCUSSION

This study was carried out by using simple random sampling for the evaluation of effectiveness of progressive resistance

training in improving balance among elderly. The interventional study was carried out on elderly individuals selected from senior citizen groups across Mumbai and Pune cities, India. The individual surveyed were categorized using simple random sampling method into subjects receiving progressive resistance strength training (n=20, mean age 69.25±2.863) and control group (n=20, mean age 69.45±2.704) receiving conventional balance exercises. Strength training or resistance exercise, is generally defined as training in which the resistance against which a muscle generates force is progressively increased over time. The changes in strength-trained muscles are generally limited to adaptations in the muscle itself. Increases in resting levels of anaerobic substrates (ATP, CP, glycogen), Increase in fibre size (fast-twitch type II fibers), Increase in activity of anaerobic enzyme function (glycolysis), Increased capacity for levels of blood lactic acid, Improved motivation, Improved pain tolerance (Andrew Guccion, 2000, Chpt3, p.49) Both the Progressive resistance training and control group showed improvements in the berg balance and POMA score. But the p value of PRT (p=0.001) group was statistically significant. A study conducted by Joshua AM at in 2014cited that for both per-protocol and post treatment for balance, the PRT had a steady progression from the baseline to 4 weeks which was highly statistically significant ($p<0.001$). The control group also showed considerable improvement from baseline to 2 week and beyond which moderate improvement was seen (Joshua *et al*., 2014). Studies demonstrate that frail elderly men and women, well into their tenth decade of life, retain the capacity to adapt to resistance exercise training with significant and clinically relevant muscle hypertrophy and increases in muscle strength. Results from the resistance training studies performed in the young, middle-aged, elderly, and the oldest old indicate that it is the intensity of the stimulus, not the underlying fitness or frailty of the individual, that determines the magnitude of the gains in strength and muscle size. The study concluded that PRT appears to be an effective intervention to increase strength in older people and has a positive effect on some functional limitations. A study conducted by Latham N *et al* in concluded that PRT appears to be an effective intervention to increase strength in older people and has a positive effect on some functional limitations (Latham *et al*., 2003).Strength training can also have substantial benefits for protection from injury in the elderly, as falling is strongly related to hip weakness, poor balance, and postural sway. Progressive resistance training seems to have profound anabolic (to build up) effects in the older adult. Resistance training is therefore an effective way to increase energy requirements, decrease body fat mass, and maintain metabolically active tissue mass in older people. Resistance training may be an important adjunct to weight loss intervention in the older adult.

In addition to its effect on energy metabolism, resistance training improves insulin action in older adults (Andrew Guccion 2000 Chpt3, p.49). Regularly performed exercise, in the form of resistance training, results in a remarkable number of positive changes in elderly men and women. Because sarcopenia and weakness may be almost universal characteristics of advancing age, strategies for preserving or increasing muscle mass in the elderly should be implemented. Resistance training, in addition to its positive effects on skeletal muscle, insulin action, bone density, energy metabolism, and functional status, may also be an important way to increase overall levels of physical activity in the elderly (Andrew Guccion 2000 Chpt 3, p.49). Strength training, as part of a comprehensive fitness program, may reduce the risk of coronary heart disease, non-insulin-dependent diabetes, and certain types of cancer. It improves function and reduces the probability of falls in the elderly. These benefits can safely be obtained when exercise program variables (frequency, volume of training, and model of training) are manipulated to meet the needs of the individual. Hence progressive resistance training is effective in improving balance among elderly.

Conclusion

Progressive resistance training significantly improves balance and reduces the risk of fall in elderly.

Limitations and Future scope

The supervised exercise intervention was given for 4 weeks and effectiveness of progressive resistance training was assessed and compared pre –post training. A follow up study can be done to check whether the effectiveness of progressive resistance training is retained after the protocol is stopped. Also comparative study can be done to evaluate effectiveness of unsupervised balance training program.

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