EFFECT OF OBSTACLE TRAINING OVER BALANCE TO REDUCE THE RISK OF FALLS IN GERIATRIC INDIVIDUALS

Dr. Joanna Baptist[*1], Dr. Sanjivani Dhote[2], Dr. Tushar Palekar[3], Dr. Pratik Kamble[4]

1Assistant Professor, 2Associate Professor, 3Principal, 4Head Physiotherapist

1Terna Physiotherapy College, Navi Mumbai,

2Dr. D.Y.Patil College of Physiotherapy, Pune,

3Dr. D.Y.Patil College of Physiotherapy, Pune,

4Kerala Blasters Football Club

ABSTRACT

Background: The aging process contributes to a decrease in muscle mass, vision, and joint range of motion leading to loss to balance and fear of falls. Tripping over obstacle is very common among older adults due to loss of balance leading to falls.

Introduction: Declines in all sensory systems (somatosensory, vision, vestibular) and all three stages of information processing (i.e sensory processing, sensorimotor integration, motor output) are found with aging. Older adults have more difficulty maintaining balance when sensory inputs from more than one system are greatly reduced, particularly when they rely solely on vestibular inputs for balance control. Balance problems occur most frequently among the elderly, falls are the leading cause of accidental death among older adults.

Methodology & Results: 100 subjects were selected according to inclusion criteria and pre and post outcome measures were taken. They were randomly assigned to intervention & control group. Obstacle crossing was given for 2 weeks 3 times in a week. Results showed statistical significant improvement in pre and post measures of BBS($p<0.000$) of the intervention group when compared to the control group.

Conclusion: Hence obstacle training on balance and risk of falls by obstacle crossing in geriatric individuals is more effective in improving gait and reducing the risk of falls.

Key Words: Aging, Obstacle training, BBS (Berg Balance Scale), balance, risk of falls.

1. INTRODUCTION

Aging is an age-dependent or age-progressive decline in intrinsic physiological function, leading to an increase in age specific mortality rate and a decrease in age-specific reproductive rate.[1] Older people become increasingly limited in their abilities to perform activities of daily living because of poor balance, reduced endurance, generalized weakness, or repeated falls.[2] Declines in all sensory systems (somatosensory, vision, vestibular) and all three stages of information processing (i.e sensory processing, sensorimotor integration, motor output) are found with aging. Older adults have more difficulty maintaining balance when sensory inputs from more than one system are greatly reduced, particularly when they rely solely on vestibular inputs for balance control.[3]

Age-related reductions in muscle mass are a direct cause of declines in muscle strength with aging. This reduction in muscle strength is a major cause of disability in the older adult since strength and power are major components of gait, balance, and the ability to walk.[2] Even though older adults are capable of independent: walking, there could be a substantial decline in their ability to control equilibrium, which does not become evident until a slip or trip happens.[4]

Aging has a detrimental effect on postural control as a consequence of general age-related deterioration of sensory and neuromuscular control mechanisms and specific pathologies. Impaired postural control can have serious consequences regarding physical functioning and is a predictor for falls in older adults.[5]

Balance problems occur most frequently among the elderly,falls are the leading cause of accidental death among older adults, are a serious clinical problem among adults over 65 years of age with approximately one-third of elders 65 years or older falling each year.[6] Falls can result in permanent reduction in function, loss of independence, and death in this age group. Additionally, the psychological consequences of limited balance can have debilitating effects on elders' mental and physical health as manifested by loss of confidence in performing physical tasks, loss of self-esteem, feelings of vulnerability, and fear of future falls.[7] Once an older person falls, a downward spiral often begins. They may live in constant fear, become less active, less independent, and less confident. One of the most common fears among elderly adults is the "fear of falling".[8] Fear may have a tremendous impact on quality of life and physical decline.[9] To reduce the consequences of falls for both the individual and society, it is imperative that preventive steps be taken to reduce the risk of falls.[8]

Falls and fall related injuries can cause restricted mobility and functional decline leading to disability and may have a negative effect on the socioeconomic status and quality of life in elderly individuals.[9]

During locomotion, it is rare to experience prolonged situations that are void of clutter, crowds, or constraints. Indeed, external factors such as icy sidewalks, poorly lit hallways, narrow walkways, and obstacles frequently contribute to the challenge OA have in maintaining their balance. Tripping over obstacles is one of the most common causes of reported falls in the elderly. In fact, uneven pavement was the leading cause of falls in one year. In addition to trips over expected obstacles, Obstacle avoidance have high rates of falling due to trips over unexpected or suddenly appearing obstacles.[10]

The gait adjustments required for successful obstacle negotiation become increasingly difficult as with age. The aging process contributes to a decrease in muscle mass, vision, and joint range of motion leading to loss to balance and fear of falls. There is lacuna of researches which provide us information regarding benefits of obstacle training on balance and gait to reduce the risk of falls in geriatric individuals.

Thus this study was conducted to measure the effects of obstacle training on balance and risk of falls among elderly individuals.

2. MATERIALS AND METHODS

An experimental study was conducted at Jyeshta Nagarik Sangha, Pimpri, Pune and Annasaheb Behere Old Age Home, Kharadi, Pune. 100 geriatric individuals were selected by random sampling technique according to the inclusion & exclusion criteria and were divided into 2 groups:Group A-50 (Obstacle training course) & Group B-50(Control group).Inclusion criteria: Age group above 65-75,Berg balance score between 31 to 56 and participants able to view the distance of the obstacle training and obstacles clearly. Exclusion criteria: History of any fall related fracture, presence of any prosthesis, Cardiovascular problems such as recent MI / CABG, any surgical treatment during the last year, participating in any other balance training programme and use of any assistive devices. Ethical approval was taken. All participants irrespective of the group were tested for balance parameters using the Berg Balane Scale. Vitals were measured before the test using the sphygmomanometer. Group A: Obstacle crossing:10 obstacles, 10sets of trials per session, 3 times a week for 2 weeks, Duration: 45 min per session. Obstacle dimensions: Dense foam blocks of different shapes,size & colour, Height: 4 / 5.5/7 inches, Width: 8 inches, Length: 18 inches, Spacing 15-20 inches.
Training protocol consisted of: First Week (3 sessions):Crossing Obstacle with pause in between every obstacle, Crossing Obstacle without pause, Front, Side and back stepping around the obstacles.Second Week (3 sessions):Walking around in figure of eight pattern, Sideways crossing of obstacle.

Group B consisted of 50 geriatric individuals in the control group. Conventional Balance Training were given to them, which consisted of: Strengthening of Abdominals (curl ups), spinal extensors (prone extension), hip abductors (side lying with a weight around the ankle), hip extensors (in prone), hamstring (prone knee flexion) and quadriceps (knee extension in high sitting): all movements are given for 10 repetitions. Endurance training: Walking for 12 minutes at self-selected comfortable pace on a level surface. Postural control: Stepping in all direction, step up and down, single limb standing (eyes open and closed.)3 times per week, 45 minutes per session. After two weeks post readings were taken for testing the balance using the Berg Balance Scale post intervention programme.

3. RESULTS

Statistical Analysis: The data collected was entered in EXCEL sheet and statistical analysis was done using SPSS (17.0) package (SPSS Inc. Chicago, USA). Parametric testing was used to compare groups since the quantitative dependant variables were reasonably normally distributed. Paired t-tests were used to compare quantitative outcomes within group. Independent t-tests were used to compare quantitative outcomes between the two independent groups.

3.1 MEAN AGE OF THE STUDY GROUP.

Group	Mean Age
Group A	69.82
Group B	67.5

Table no 3.1 depicts the demographic characteristics of experimental and control group of the study. The mean and standard deviation values for age in group A (Obstacle training) is 69.82 ± 3.13 and group B(Control group) is 67.5 ± 3.24.

3.2 GENDER DISTRIBUTION

Gender	No.
Male	52
Female	48

Table no 3.2 illustrates the total number of males and females participated in the present study. There were 48 females and 52 males overall who participated in the study.

3.3 COMPARISON OF BBS 'PRE' & 'POST' EXERCISE IN GROUP A.

BBS	N	Mean	Std. Dev	Median	p-value
Pre	50	40.04	3.82	70	
Post	50	45.54	3.59	40	p<0.001*

Table 3.3: Shows that pre training BBS was 40.04 and post training was 45.54. There was significant increase in mean value of BBS in group A (p<0.001) which signifies that the BBS is improved in experimental group.

3.4 COMPARISON OF BBS 'PRE' & 'POST' EXERCISE IN GROUP B.

BBS	N	Mean	Std. Dev	Median	p-value
Pre	50	39.36	4.83	40	
Post	50	39.98	4.90	40.5	p<0.001*

Table 3.4: Shows that pre training BBS was 39.36 and post training was 39.98. There was significant increase in mean value of BBS in group B (p<0.001) which signifies that the BBS is improved in control group.

3.5 COMPARISON OF BBS BETWEEN GROUP A and GROUP B.

BBS	N	Mean	P-value
A	50	5.5	<0.001
B	50	0.62	

Table 3.5: Depicts that there was highly significant difference of the BBS between group A and group B (p<0.001) which shows that groups are comparable with higher mean value for group A(5.5) compared to the group B (0.62)

4. DISCUSSION

The present study aimed to evaluate the effect of obstacle training over balance and reduce the risk of falls in geriatric individuals. There is scarcity of literature which provide us information regarding benefits of obstacle training on balance to reduce the risk of falls. Whenever a balance training programme is designed the use of obstacle crossing is rarely involved. Thus the present study emphasized on the effect of obstacle training alone over balance, gait and reduce the risk of falls in geriatric individuals.

(Ki-Tae Park et al.,2016) studied the impact of a circuit training program on the walking and balance abilities of stroke patients. In the comparison of balance ability, the experimental group showed an increase in the Berg Balance Scale score. The results of this study indicate circuit training program using obstacles resulted in significant improvements in the 10-m walking time, an index of walking ability, and the Berg Balance Scale and the Timed Up and Go test, indices of balance ability.

Other study conducted on the effect of task-oriented training including obstacles on trunk control ability, and balance and walking ability using a sample of 20 patients with stroke. He reported a decrease of 10-m walking time after the intervention, and conjectured that walking speed increased due to increased of walking efficiency

of the lower limbs after performing obstacle tasks, such as climbing up and down the stairs, climbing up and down a ramp, and stepping over boxes.[11]

In a previous study, they studied the effect of intensive treadmill training with virtual obstacles in parkinsons disease. Gait speed while crossing obstacles improved after training. Immediate effects of training were also observed in step length thus improving the foot placement after crossing. Patients took larger step while crossing increasing the distance between the foot and obstacle further leading to decrease in risk of falls.[12]

A previous study proved that increased CoM in the medial-lateral direction has been repeatedly identified as a predictor for future falls. Improvements in ML balance control may be related particularly to obstacle crossing practice. During single leg stance phase of obstacle crossing balance control is challenged in the frontal plane. Repeated practice of obstacle crossing in the frontal plane may have minimized medial-lateral sway during balance testing.[12]

It is our conjecture that repeated practice of obstacle crossing, increases the distance between foot, increases speed, increases confidence during walking by reducing the fear to cross the obstacle, must have improved the mobility, increased obstacle clearance capacity, improved balance & reduced the risk of falls and improved the confidence in walking in geriatric individuals. Obstacle training involves single leg standing which increases the joint proprioception sense thereby improving the balance.

The control group who received conventional balance training which proved to be statistically significant. Muscle strengthening combined with balance training has been shown to be effective in prevention of falls.[13] Strength training can improve muscle strength in elderly patients.[14] This is confirmed in this study. Balance training can improve postural stability in elderly people and thus training can be given.[15]

Obstacle training intervention lead to significant and greater improvement in some key balance variables when compared with control group. The factors that might have contributed to more improvement in the obstacle group was the pattern of exercise and the justification is mentioned above.

This study further adds to the existing literature regarding the importance and benefits of obstacle training intervention in improving balance in geriatric population.

5. CONCLUSION AND LIMITATIONS

From our study we conclude that obstacle training on balance, gait and risk of falls by obstacle crossing in geriatric individuals is more effective in augmenting their performance by increasing their balance, gait and reducing the risk of falls.

5.1 Limitations

The study duration was for two weeks only three times in a week.

Only low fall risk geriatric individuals were included in the study.

Study was carried out on age group of only 65 to 75 years.

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