Effect of Stability Trainer Exercises with Mirror Feedback on Balance and Level of Physical Activity in Community Dwelling Elderly

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Abstract

Background: Balance is always dependent on feedforward and feedback mechanism which can be classified as intrinsic and extrinsic factors; with advancing age individuals will become more independent on external factors. Stability trainer with mirror feedback will give sensory as well as visual feedback to train balance in elderly. **Objectives:** To study the effect of stability trainer exercise with mirror feedback on Dynamic balance using (FRT) & (TUG), functional balance task using (BBS); and on level of physical activity using (PASE). **Method:** Our study was conducted amongst 60 subjects who were selected as per the inclusion and exclusion criteria. Subjects were divided into 2 groups namely experimental (Group A) and control (Group B) consisting of 30 individuals in each group. Demographic data including name, age, gender were noted. The participants of Group A and B were assessed before and after treatment. Dynamic balance was assessed using (FRT) & (TUG), functional balance task was assessed using (BBS); and on level of physical activity was assessed using (PASE). Data was collected & statistically analysed. **Results:** Data was statistically analyzed using Man-Whitney's test for among the groups. On comparing TUG mean values of group A=3.8secand group B=1.8sec with p value <0.0001 which is found to be significant. On comparing FRT mean values of group A=6.37and group B=2.47 with p value <0.0001 which is found to be significant. On comparing BBS mean scores of group A=31.93and group B=40.63 with p value <0.0001 which is found to be significant. On comparing PASE mean values of group A=39.43and group B=42.27 with p value=0.0014 which is found to be significant. **Conclusion:** The study concluded that stability trainer exercises with mirror feedback is extremely effective for balance training and improving level of physical activity in community dwelling elderly.

Keywords: *Balance, stability trainer, mirror feedback, TUG, BBS, FRT, PASE*

Introduction

Aging is referred as gradual dimination in physiological capacity of various systems with increasing age related balance issues have to be focused and treated mainly in community dwelling elderly in order to improve their level of physical activity to reduce fear of fall. Balance is always dependent on feedforward and feedback mechanism which can be classified as intrinsic and extrinsic factors with advancing age individuals will become more dependent on feedback from external environment than body because of declining function of the body.Stability trainer are nothing but foam pads which are oval shaped which provide sensory feedback that challenges proprioceptive system and mirror feedback will give sensory feedback which is important for balance training.[1]

A predictable, progressive, universal deterioration is found in various physiological systems, mental and physical, behavioural and biomedical system. In India, individuals above 60 years of age are called as aged/ elderly. [2]There has been a sharp increase in the number of elderly individuals between the year span of 1991 and

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2001 and it has been projected that by the year 2050, the number of elderly people would have risen upto 324 million. India has thus been acquired the label of "an ageing nation" with 7.7% of its population being more than 60 years of age. [2]

Balance is defined as the ability to maintain an upright posture during static and dynamic tasks which requires complex interactions between peripheral and central factors such as vision, somato-sensation, vestibular sensation, motor output, and musculature.[3] Balancing is an interplay and integration of contributions from vision, vestibular sense working in conjunction with the cerebellum, proprioception, muscle strength and reaction time.[4]

This proportion of the population faces numerous problems owing to the social and cultural changes that are taking place within the society. The health of the elderly with multiple medical and psychological problems is considered to be the major area of concern. Balance is referred to be one of the major problems in the elderly and are considered one of the "Geriatric Giants". Balance is an important cause of morbidity and mortality in the elderly and are a marker of poor physical and cognitive status. Following are the physiological changes according to the age. [5-8]

Dynamic balance indicates the ability to control posture during active motion; i.e., keeping the center of pressure (COP) of the body mass within the allowable area of the base of support. In controlling dynamic balance, anticipatory postural adjustments are required. Anticipatory adjustments of the posture prepare a person's balance prior to or parallel to postural disturbance induced by any subsequent voluntary motion which follows. Thus, it is important to note that dynamic balance depends on an anticipatory feed-forward adjustment of the posture.[9-11] When the COP deviates beyond the allowable area in standing balance, the postural response of the whole body is elicited to return the COP to within the controllable area of the base of support.[12,13] When this postural response does not function adequately, falling is inevitable. The postural response is therefore the final response acting to prevent falls.

Method

A experimental study was conducted on 60 elderly population with age group 65-84 years. The participants were selected according to the inclusion criteria exclusion criteria. Inclusion criteria were elders between age group of 65-84 years, both male and female population were included in the study, participants willing to participate. Exclusion criteria were Patients who had undergone any recent spine and lower limb surgeries, Patients having any neurological defect, Patients having cognitive dysfunction, Patients who are using assistive device. The participants are divided into 2 groups namely Group A (Experimental Group) and Group B (Control group) by randomised sampling each group having 30 elderly. The aim, objectives and method of study is explained to the participants. Consent is taken on the consent form.

Procedure

Permission was taken from the institutional ethical committee of Tilak Maharashtra Vidyapeeth, Department of Physiotherapy, Pune. Different centres were approached and permission will be obtained prior to the study. Explanation of the experiment was explained to the patient. Patients willing to give consent to participate in the study was included. A pilot study was conducted and the errors were resolved with approval of the guide. Subjects were interviewed for their demographic history and instructions were given to them. Pre-treatment dynamic balance was assessed by using (FRT) & (TUG) scale, functional balance task was assessed by using (BBS) scale; and level of physical activity was assessed by using (PASE).Group A was taken on stability trainer and following balance exercises were given for 20 min for a period of 4 weeks for 3 times per week:-

1) Stand on the stability trainer and raise both the heels and hold for 20 sec and release it repeating for 5 times.

2) One leg standing holding for 20 sec and release it, repeating it for 5 times. Same should be done with the other leg.

3) Single leg standing with the same sided upper limb giving reach out for 30 sec followed by other upper limb and repeating it twice.

4) March for 2 min

5) Stand on the stability trainer holding a stick performing side rotations for 2 min.

Group B (Control group) was given conventional balance exercises.

The treatment plan was given 3 times a week for

consecutive 4 weeks. Post-treatment dynamic balance was assessed by using (FRT) & (TUG) scale, balance task was assessed by using (BBS) scale and level of physical activity was checked by using PASE.

Data was collected and statistical analysis will be done.

Materials used in the procedure were demographic data sheet, consent form, stability trainer, inch tape, stopwatch, chair, pen and paper.

Statistics

The analysed data showed that it was not a normal distribution using Stability trainer exercises, hence Non parametric Man-Whitney's test was performed to analyse the data among the groups.

Results

The present study was done on 60 elderly population which were divided into 2 groups i.e Group A which was an Experimental group containing treatment by Stability trainer and Group B which was Control group containing conventional exercises.

Table no. 1: Comparison of FRT between Group A and Group B

FRT	Group A	Group B	P value
Mean	6.37	2.47	<0.0001

Interpretation: Above table shows a comparison of mean of FRT values of group A & group B; with (p value=<0.0001), extremely significant.

Table no. 2: Comparison of TUG between Group A and Group B

TUG	Group A	Group B	p value
Mean	3.8	1.87	<0.0001

Interpretation: Above table shows a comparison of mean of TUG values of group A & group B; with (p value=<0.0001), extremely significant.

Table no. 3: Comparison of BBS between Group A & Group B

BBS	Group A	Group B	P value
Mean	31.93	40.63	<0.0001

Interpretation: Above table shows a comparison of mean of BBS values of group A & group B; with (p value=<0.0001), extremely significant.

Table 4:- Comparison of PASE between Group A & Group B

PASE	Group A	Group B	P value
Mean	39.43	42.27	0.0014

Interpretation: Above table shows a comparison of mean of PASE values of group A & group B; with (p value=0.0014), extremely significant.

Discussion

The present study was done to find out the effects of stability trainer exercises with mirror feedback on balance and level of physical activity in community dwelling elderly of age group 65-84 years. Pre-treatment dynamic balance was assessed by using (FRT) & (TUG) scale, functional balance task was assessed by using (BBS) scale; and level of physical activity was assessed by using (PASE).

In this study the outcome measures used are TUG(validity=0.75; reliability=0.99), FRT(validity=0.71; reliability=0.89), BBS(validity=0.96; reliability=0.98) and PASE(validity=0.48; reliability=0.75). In the present study subjects were divided into 2 groups Group A & Group B. Group A was given stability trainer exercises as an intervention for 20 min for a period of 4 weeks for 3 times per week and Group B was given conventional exercises for a period of 4 weeks. Post-treatment dynamic balance was assessed by using (FRT) & (TUG) scale, functional balance task was assessed by using (BBS) scale; and level of physical activity was assessed by using (PASE). Data was collected and statistical analysis was done. Our study noted that patients who were been given treatment using stability trainer exercises with mirror feedback had a great improvement in their balance as compared to the ones treated conventionally.

There was a study done by Chavan U et.al (2017) on Effect of Stability Trainer Exercise Program on Balance in Geriatric Population to study the effect of stability trainer exercise program on Static balance, Dynamic balance, Static functional and Balance confidence concluded that Stability trainer exercise program (STEP) is extremely effective for balance training and improving the quality of life in the elderly.

In our study, there was a significant difference in the mean TUG before and after administration of stability trainer exercises indicated by p value (p value<0.0001) which is extremely significant.Inputs to the internal and external environment play an important role in reducing the response of the body to any stimulus. With the increasing age our body becomes more dependent on the feedback from external environment rather than internal environment which in deed results in reduction of body's internal functions. The exercises included in the stability trainer exercise program had a very good effect on the proprioception, lower limb muscle strength and vestibular system which helps our body to work on our internal functions. The feedback from internal environment starts redeveloping which increases body function because of which our body responses in a right way to any stimulus. This would help the elderly to balance themselves which could be seen as improvement in reducing the risk of fall in elderly assessed by Timed Up and Go scale.[14]

There was a significant difference in the mean FRT before and after administration of stability trainer exercises indicated by p value (p value<0.0001) which is extremely significant. As per the age our tensile structures i.e our muscles loose their flexibility. With the stability trainer exercises, the muscle strength increases and hence the flexibility of the muscle increases which could be possibly seen in the increased FRT ranges.[14,15]

There was a significant difference in the mean BBS before and after administration of stability trainer exercises indicated by p value (p value<0.0001) which is extremely significant.The stability trainer exercises helps in the development of the vestibular system. The vestibular system helps the body to recognize its position by the sensory feedback mechanism. The increasing sensory feedback would result in improved balance which is proved by the improvement in the Berg Balance Score.[14,15]

There was a significant difference in the mean PASE before and after administration of stability trainer exercises indicated by p value (p value=0.0014) which is extremely significant.With the increasing age response of our body towards any stimulus reduces. Due to which the body becomes incapable of any movements which in return reduces the activities. As the stability trainer exercises are given it works on balance and stability, the body becomes stable and could balance. Once our body's internal functions are improved and maintains his balance, the activities of their life improves. The effectiveness in performing in their activities increases which could be seen in the improvement of PASE score. [14]

The significant improvements in the exercise adherers indicate that the program was of an appropriate nature, the stimulus sufficiently intensive, and the program of adequate duration to produce considerable improvements in stability in the intervention group. The exercisers showed continued improvement in both stability tests throughout the study year, which indicates that long-term exercise trials (of the frequency and intensity of the present study) are necessary to assess the maximal beneficial effect exercise can have in improving dynamic stability and related measures in older people. Balance control is a complex process, with inputs and control is from a diverse array of sensory and motor systems.

Balance is always dependent on feedforward and feedback mechanism which can be classified as intrinsic and extrinsic factors; with advancing age individuals will become more independent on external factors. Stability trainer with mirror feedback will give sensory as well as visual feedback to train balance in elderly.

A study conducted by Sukwon Kim etal concluded that fear of falling and social activity levels are associated with each other. Improving physical activity can act as an effective measure to improve quality of life.

Conclusion

The study concluded that the stability trainer exercises with mirror feedback is extremely effective for balance training and improving level of physical activity.

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