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Effect of conventional balance exercises and electronic balance board on elderly individuals

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Abstract
Fall is the external causes of unintentional injury. It is the most common complaint in the old age group which is due to loss of balance. Physical therapy intervention is effective in minimizing balance instability and reducing the risk of fall. Objective was to find out the effectiveness of Electronic Balance Board along with Conventional Balance Training (CBT) on the balance performance in the elderly individuals. 50 participants were involved. Group A were given CBT and Group B were given Electronic Balance Board Training along with CBT for 3 weeks and the risk of fall and balance were assessed pre and post intervention then Data analysis was done using unpaired 't' test. Result showed statistically significant improvement in the Group B as compared to Group A. Conclusion was that electronic balance board along with CBT is more effective in improving balance than conventional balance exercise in elder individuals.

Keywords: electronic balance board, conventional balance training, elderly, falling risk

1. Introduction

Aging is defined as a process that is genetically determined and environmentally modulated or it is simply getting old [1]. No of cells comprising the body decrease, and physical adaptability is gradually lost, ultimately leading to death [1]. It is associated with a loss in muscle strength and loss of peripheral motor and sensory nerves, loss of both vision and control of the eye through the vestibular and visual cortex.[2] These disabilities, secondary to the normal aging process, can lead to loss of balance and poor gait in the older population [2].

Balance is the ability to maintain an upright posture during static and dynamic tasks which requires complex interactions between peripheral and central factors such as vision, somatosensation, vestibular sensation, motor output, and musculature [3]. Along with interaction of the nervous and musculoskeletal system, balance and postural control also requires interaction between vestibular system, visual system and somatosensory system. Vestibular system sends information to the occulomotor nucleus which then triggers the reflexes such as the Vestibulo-Ocular Reflex (VOR) and the Vestibulo-Spinal Reflex (VSR) that act on visual field stabilization thus helps to stabilize the eyes and help to sustain the postural stability throughout stance and walking[4].Decline in VOR instability makes them vulnerable to lose balance while walking in community or even during stance phase or when there would be sudden distraction causing increased postural sway with higher risk of fall. Gaze stability exercises can improve the VOR function. These exercises incorporate vestibular adaptation and substitution exercises. It is therefore hypothesized that addition of these exercises in balance training will prove as aid in elderly having balance impairment [4].

Falls and fall related injuries can cause limited mobility and functional decline leading to disability and may have a negative effect on the socioeconomic status and quality of life (QOL) in elderly individuals [3]. ADLs are frequently impaired due to weakness in core muscles such as the rectus abdominis, transversus abdominis, and the internal and external oblique muscles. This results in a lack of ability to reach the objects away from the body [4].

Exercise is an important intervention in the maintenance of bone health, muscle strength and balance, thereby reducing the risk of falls. Physical factors that influence falls include weakening of lower extremity muscular strength, a decrease in gait ability, a reduction in balance ability, and a decrease in sensory motor control. [7]

Currently there are many programs that helps to improve balance in older adults for e.g. unstable surface balance training, gait training, gaze stability exercises, Swiss ball, Conventional Balance Exercises etc. Among these strengthening of muscle power and balance training has largely been used as exercise for methods [7]. Conventional physiotherapy, through the training of muscle strength, is described as a satisfactory method to improve functional limitations of such individuals. Conventional balance training (CBT) exercise includes training the strength and endurance maximizing flexibility and postural control has been proven effective in improving functional ability in addition to reducing the risk of fall in elderly individuals. Strategy training program involving ankle, hip strategy training in group of people.

MFT (My Fitness Trainer) balance board was created for skiers and followed by surfers to practice their skills in the off season and at night, a balance board is a device that has come to be used for training in all sports and martial arts, physical fitness and for non-athletic purposes. New MFT Balance boards and discs feature a unique modular design that is easily adaptable for athletics training therapy, rehabilitation, senior

fitness. It was developed by 'Ewald Aigner', trainer for the Austrain ski team for 5 years. It is used to develop balance, motor co-ordination skills, weight distribution and core strength .As the age advanced to evade injurious falls; to prevent sports injuries, especially to knee and ankle, rehabilitation after injuries to several parts of the body. Use of a balance board that are distant from the athletic purpose of its origin have gradually become more common to expand neural networks that enable the left and right hemispheres of the brain to communicate with each other, thereby increasing its efficiency to develop sensory integration and cognitive skills in children with developmental disorders [9,10,11].

MFT S3 test is a reliable and valid balance measurement system for performance and Sensorimotor regulation during lateral and forward, backward test. The test system consists of a uniaxial unstable platform with an integrated sensor, which records all discrepancies in the horizontal plane. All function of center of gravity are measured and transformed into stability, sensorimotor and symmetry indexes to define the individual state of balance. For dynamic standing stability on an uneven support surface, this shows good reliability, objectivity and validity [9, 10, 11].

Physical activity is helpful to counteract these age-related functional declines & help in prolonging independence in elderly individuals. Thus balance assessment, training & fall prevention in elderly individuals is of major importance and should be incorporated into treatment [7].

2. Material and Methods

50 participants using convenient sampling were done. The participants were selected according to the inclusion and exclusion criteria. The selected participants were evaluated for balance on time up and go test, berg balance scale and electrical balance Board then divided in two groups i.e. Group A and Group B. The subjects in Group A were given Conventional Balance Exercises and in Group B were given Electrical Balance Board (EBB.MFT®) training for 15-20 minutes and Conventional Balance Exercises for 20-30 minutes 4 days per week for 3 weeks.

The group A i.e. Conventional Balance Training (CBT) were given flexibility exercises, strength training, postural control exercise and general endurance training.

2.1 Conventional Balance Training (CBT)

1. **Flexibility:** Calf, hamstring, quadriceps, hip flexors & hip adductors (15 sec hold and 5 repetitions).
2. **Strength:** Abdominal (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.
3. **Postural control:** Stepping in all direction, reaching to limits of stability in different position (kneeling, half kneeling, standing: on hard surface and foam surface), step up and down, tandem standing and walking, single limb standing (eyes open and closed).
4. **Endurance:** Walking for 12 minutes at self-selected comfortable pace on a level surface Surfaces and general endurance training.

The group B i.e. Electronic Balance Board (EBB) and Conventional Balance Training (CBT) were first given training on EBB for 15-20 minutes. The participant's name, age, gender, height (cm) and weight (kg) was entered in the data form provided in the EBB software. The subjects were then explained about the training on EBB, a walker was placed in front of the balance board for safety purpose to avoid fall of the subject. Primarily forward backward and then side to side training was selected for the participant; time was set for the current session. For Forward Backward Balance the Electronic Balance Board was placed 45 degree from 90 degree position and for side to side balance the subjects were asked to stand on both his feet opposite to computer screen for visual feedback then were asked to shift the COP in form of arrow as per displayed on the monitor as a green colour circular target. At the end of training, the score was displayed in the screen & recorded for 30, 45, 60 seconds. After 3 weeks again balance was evaluated by the outcome measures Timed Up and Go Test (TUG), Berg Balance Scale (BBS) and Electronic Balance Board (EBB.MFT®). Then effect of conventional balance exercises and exercises on electronic balance board on balance were compared [10].

3. Data Analysis and Result

Statistical analysis was carried out utilizing demo version of INSTAT software and p value 0.05 is considered as level of significance unpaired 't' test was applied to analyse the data

Table 1: Comparison of mean of TUG scores between in CBT and EBB Group

	Mean ±SD		't' value	'p' value	Result
TUG	Pre	Post			
Group A	12.339±2.293	11.668±2.269	6.180	<0.0001	Extremely Significant
Group B	11.604±1.813	10.558±1.535	9.421	<0.0001	Extremely Significant
Group A v/s Group B	Group A Post 11.668±2.269	Group B Post 10.558±1.535	2.028	0.0482	Statistically Significant

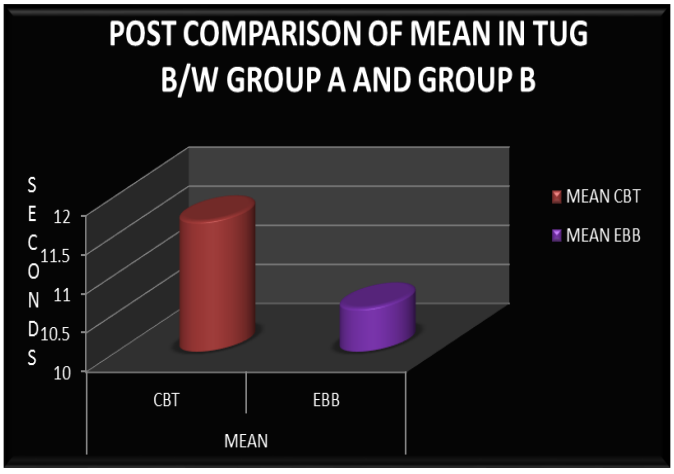

Fig 1: Comparison of mean in post intervention between Conventional Balance Training and Electronic Balance Board using TUG where t value is 2.028 and p value 0.482 which is statistically significant.

Table 2: Comparison of mean of BBS scores between CBT and EBB Group.

BBS	Mean ±SD		't' value	'p' value	Result
	Pre	Post			
Group A	43.640±3.946	47.400±3.416	8.187	<0.0001	Extremely Significant
Group B	42.960±4.108	49.560±3.798	14.402	<0.0001	Extremely Significant
Group A v/s Group B	Group A Post	Group B Post	2.114	0.0397	Statistically Significant
	47.400±3.416	49.560±3.798			

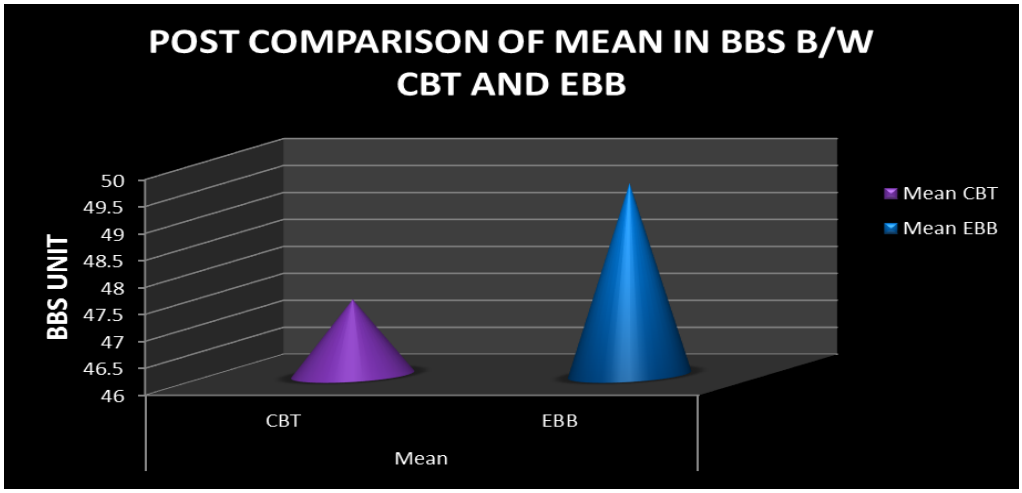

Fig 2: Comparison of mean in post intervention between Conventional Balance Training and Electronic Balance Board using BBS where t value is 2.114 and p value 0.0397 which is statistically significant.

Table 3: Comparison of mean of EBB

EBB	Mean ±SD		't' value	'p' value	Result
	Pre	Post			
Group A	4.148±0.5643	3.808±0.5951	10.396	<0.0001	Extremely Significant
Group B	4.024±0.5732	3.372±0.5927	11.286	<0.0001	Extremely Significant
Group A v/s Group B	Group A Post	Group B Post	2.596	0.0125	Statistically Significant
	3.808±0.5951	3.372±0.5927			

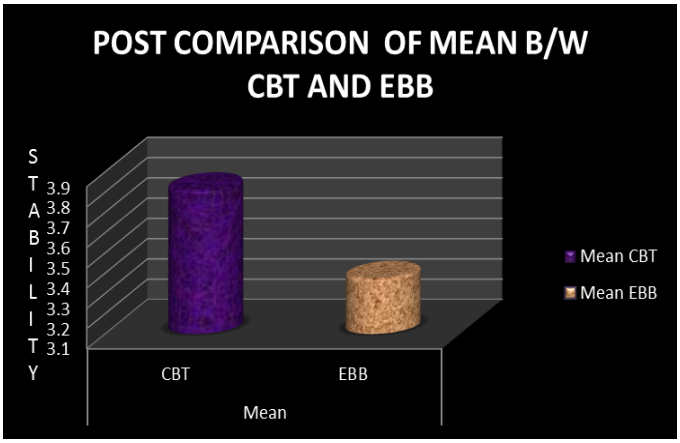

Fig 3: Comparison of mean in post between Conventional Balance Training and Electronic Balance Board using EBB where t value is 2.596 and p value 0.0125 which is statistically significant.

4. Discussion

The present study showed that the intervention given to both the groups was effective in terms of balance and reduction in risks of fall, irrespective of the treatment received which was EBB or Conventional Balance Training (CBT).However, EBB along with CBT showed more significant improvement as compared to the Conventional group in overall outcomes.

Conventional Balance Training, physical exercises to increase flexor and extensor muscles resistance in general decrease pain and incapacity improving joint function. Pain, when affecting body weight unload joints, especially the knee, leads to more marked decrease in muscle function and, as a consequence, to decreased balance, gait changes and/or loss of functional independence. Progressive resistance training prevents loss of muscle strength and mass and may also improve such parameters, which helps in the acquisition of better balance [6].

In this study both the groups showed significant improvement balance and reduction in risk of fall this could be because of the Electronic Balance Board (EBB.MFT) training. In this study EBB.MFT® Balance board is a unique modular design that is used to develop balance, motor coordination skills, weight distribution as well as core strength. Balance and equilibrium constitute a complex reflexive response initiated by three primary sensory system (Vestibular, Visual and somatosensory) and coordinated by central nervous system. Until about twenty years ago simple behavioural tests such as Romberg and Mann test were used to test postural control. More recently computer posturography has been developed and evaluated (Turner 1998). These devices allow the assessment of balance function more exactly, objectively and efficiently [9]. Progress in balance score after interventional period, could be due to training or conditioning improvement of compensatory postural strategies and increase in neuro transfer between brain and effector muscle through descending pathway, facilitation of neural pathway, enhancement of vestibulocochlear pathway, sensory motor integration and neuroplasticity. In addition by giving the individual visual feedback, they become more aware of body displacement and orientation in space, they were able to integrate somatosensory and visual information in relation to stance and movement,

which may recalibrate deficient proprioceptive information and compensate the Sensorimotor deficit [10-11]. Information concerning body position, gravity, musculoskeletal activity, tactile and visual feedback and other input provides the nervous system with the information required to maintain balance during daily activities taking place in an ever changing environment and also reducing the fear of fall. Several studies have utilized a balance board as a way to demonstrate functional adaptation of spinal reflex in healthy and elderly population [8].

A study by Richard G. Mynark and David M. Koceja has utilized a balance board as a way to demonstrate functional adaptation of spinal reflex in healthy and elderly population. CNS adaptation was related with clinical outcome of improved static balance and then provide a direct connection between the sensorimotor system and postural control. A 2008 review found that balance training may decrease the risk of acute injury.

A study done by Snehal K. Patel showed similar results that Electronic Balance Board as a training method is a useful exercise intervention for improvising balance.

A study done by Kalpita Parab showed similar results that progressive stepping exercise along with the Electronic Balance Board as a training method was a useful intervention for improving balance performance in geriatrics with significant history of fall and imbalance.

As seen in the present study, Electronic balance board along with Conventional exercises can be a useful intervention for improving balance performance in older individuals with significant history of fall, imbalance or concern about their balance.

5. Conclusion:

The present studies show that electronic balance boards are more effective in improving balance than conventional balance exercises in older individuals.

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