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Effect of balance training on dynamic postural control in male elderly able-bodied individuals

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ABSTRACT

Postural control, stability and the prevalence of falls leading to injury are topics of great concern within the older-adult population. It has been suggested that exercise efficiently hinders these age related disorders, significantly reducing falling risk. The purpose of this study is to consider the effect of Balance training on dynamic postural control in active elderly males. 20 subjects with average and standard deviation age of 56.26±3.24yr, weight 65.13±3.94kg and height 165.56±3.28cm were randomiz ed to two trial groups. The subjects were randomized consecutively into two Groups: the group submitted for the Balance Training Program (Intervention Group) for the six week and with 3 sessions per week, consisting of 10 subjects; and the Control group, consisting of 10 subjects without intervention. Dynamic postural control was evaluated in all subjects, before and at the end of the trial, with using the Star Excursion Balance Test (SEBT). Descriptive statistics, Paired sample t-test, and t-test for independent groups used to analyze the data (P≤0/05). Significant differences were seen between pre and post reaching distance using SEBT after the applying balance training program for practice group in all directions of SEBT. However the results not showed any difference between pre and post reaching distance in SEBT for control group. Balance specifically considering the methods of this study could be implemented for older adults.

Keywords: Balance training, Dynamic Postural Control, Active Elderly

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INTRODUCTION

The aging process is associated with loss of muscle mass, decreased strength, and impairment in physical functioning. Nowadays, falling is one of the largest public health problems among elderly people due to the high morbidity, mortality and costs for the family and society. As people age, many physical and psychological changes take place in them. One of these changes is a one's ability in maintaining his/her dynamic postural control. Dynamic equilibrium is responsible for maintaining balance in angular or rotary movements of the head in space. The crista ampullaris or crista inside the semicircular canal are responsible for maintaining balance while doing rotational movements such as twirling on the dance floor or during a rough boat ride(1,2). Poor postural control has been associated with increased fall risk and mobility disability among older people (3). Falls are multifactorial, and their causes are categorized as intrinsic (personal) and extrinsic (environmental) factors (4, 5). Some examples of intrinsic factors include: altered postural control, neurological diseases, sensory deterioration, musculoskeletal diseases, postural hypertension and the use of medication (6). Previous research has clearly identified that postural control is an issue with older adults and needs to be maintained or, in some cases, improved. Older adults need to understand that postural control will improve the quality of their life. Then, they need to be instructed on how to maintain postural control. Functional balance training or training that implements exercises that simulates real-life situations is a non-traditional yet practical way of looking at balance training. Nitz and Choy (7) used a balance training system that involved a work station format on balance in elderly population. Through this type of training, there was a significant reduction in falls. However, few researches have study effect of Balance training on the postural control

in elderly people. The purpose of this study is to consider the effect of Balance training on dynamic postural control in male Elderly Able-Bodied Individuals.

MATERIALS AND METHODS

20 subjects with average and standard deviation age of 56.26±3.24yr, weight 65.13±3.94kg and height 165.56±3.28cm were randomized to two trial groups. The subjects were randomized consecutively into two Groups: the group submitted for the Balance Training Program (Intervention Group), consisting of 10 subjects; and the Control group, consisting of 10 subjects without intervention. All subjects read and signed a term of free informed consent that described the procedures which would be realized during the research**.**

Dynamic postural control was evaluated in all subjects, before and at the end of the trial, by a physiotherapist who was blinded to the distinct group (Intervention, Control) with using the Star Excursion Balance Test (SEBT).

The Star Excursion Balance Test (SEBT) is a functional test that incorporates a single-leg stance on one leg (e.g. right leg) whilst trying to reach as far as possible with the opposite leg (e.g. left leg). The participants stand in a square at the centre of the grid with 8 lines extending from the centre at 45° increments (see Figure 1).

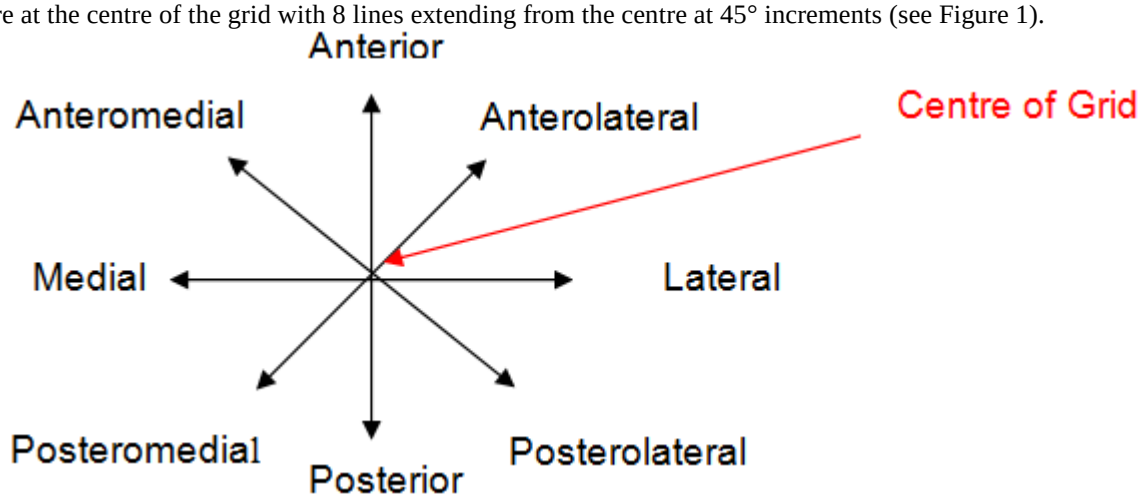

Figure 1: The Star Excursion Balance Test Layout Plan (SEBT)

Each of the 8 extended lines extending represent the individual directions which each subject are required to reach out with the most distal part of their reach foot. The eight directions consist of antero-lateral (AL), anterior (A), antero-medial (AM), medial (M), postero-medial (PM), posterior (P), postero-lateral (PL) and lateral (L). A standard tape measure (cm) was used to quantify the distance the subject had reached from the centre of the grid (see Figure 2) to the point that the subject managed to reach along each diagonal line. Set guidelines for each trial were adhered to (Figure 2) (8).

Trials were discarded if the examiner felt that
(1) The subject lifted the stance foot from the centre of the grid (2) Subject lost his/her balance (3) Subject did not touch the line with the reach foot while continuing to fully weight bear on the stance leg.

Figure 2: Guidelines for each trial

Training protocol:

Balance training group participated in balance classes. These classes consisted of a half hour of functional training twice a week aimed at increasing balance. The program consisted of various exercises on a fitball, soft foam balance beam and ankle extension board. Five exercises were performed on the fitball and five on the soft foam balance beam, each exercise was performed for two minutes. The ball exercises were as follows: ball sit and balance, ball balance seated with one foot alternating feet every 5-sec, sit to standing to sit with ball, arm reach seated on ball and ball rolls. Each of these exercises had the flexibility to become progressively harder as each individual increased their balance. The sit to standing to sit and ball roll exercises included a 5-sec rest period between movements. The soft foam balance beam exercises were as follows: OLS with alternating legs every 5-sec, tandem walking, object pick up from floor, object move from shelf to floor, and chair raise. All exercises except the tandem walking included a 5-sec rest period between repetitions. The ankle extension board was used as an advancement tool(9).

The control group was instructed to maintain usual exercise and daily activities throughout the 6 week training period.

Statistical Analyses

Standard descriptive statistics were used to report means, standard deviation, and range for baseline characteristics. Paired sample t-test, and t-test for independent groups used for determine significant differences among groups and between pre-test and post-test periods. Statistical analyses were conducted in SPSS, Version 16.0 (SPSS Inc, Chicago, IL). Statistical significance was established a priori at $P \leq 0.05$).

RESULTS

In the pretest of SEBT, distance of reaching in each of direction eight showed no significant difference between control and experimental subjects (diagram 1). Significant differences were seen between pre and post reaching distance using SEBT after the applying balance training program for practice group in all directions of SEBT. However the results not showed any difference between pre and post reaching distance in SEBT for control group (table 1).

Table 1: Mean and standard deviation of reaching distance (centimeter divided by foot length multiply by 100) of subjects of two groups before and after applying exercise programs

groups	directions	Anterior	anterolateral	lateral	posterolateral	posterior	Posteromedial	medial	Anteromedial
Balance training	Pre	72.87±4.42	69.12±2.85	67.62±1.06	81.75±3.28	83.62±2.55	84.62±2.50	85.50±2	83.75±3.01
	Post	78.68±2.33	77.12±2.29	74.09±2.11	90.11±2.98	88.29±2.59	91.01±2.89	91.18±2.85	89.20±2.68
control	Pre	73.50±2.54	69.90±2.72	68.40±1.77	80.50±2.46	83.10±3.24	83.40±3.27	85.30±2.86	83±3.80
	Post	74.28±2.51	68.98±2.55	68.59±2.01	81.12±2.11	83.78±2.96	82.35±2.29	84.56±2.25	83.54±2.91

DISCUSSION

The purpose of this study was to consider the effect of Balance training on dynamic postural control in elderly males. The results of the study showed that balance training for six weeks had a significant effect on dynamic postural control in active elderly males. The findings in the present study in line with the findings of Nagy et al (12), Nitz and Choy (7), Hu and Woollacott (13), Wolfson et al (14) and Liu-Ambrose et al (10), and don't in line with the findings of Buchner et al (11) that can be probably attributed to the type and time of training. Buchner et al in their study used a combination of resistance and powerful training while in the present study balance training were used. The improvement of dynamic postural control due to balance training can be attributed to the increase of muscular strength, joints range of motion, neural control of movements, psychological factors and imposing overload over the information transferring through the three sensory systems of central nervous mechanism (visual, vestibular, somatosensory systems). It has been reported that the changes in the range of motion, muscle strength or length can make disorder in dynamic postural control. Decrease in muscular strength of lower extremity can result in exposure of center of gravity against ankle joint that can cause disorder in dynamic postural control and falling of the elderly. The improvement of muscular strength can cause displacement of gravity center to the joint ankle and improve the dynamic postural control (15). As a result, according to this research the increase of the range of motion and muscular strength can have an important role in improving dynamic postural control. Although in this research, muscular strength and joints range of motion were not measured but it is proved that the balance exercises have increased these variables. Also, as the balancing exercises which used in this research, especially are designed like the elderly daily motor tasks, the probable improvement in control of nervous movement, can cause functional adaptations (16). balance exercise can have a role in some of the sensory-motor system which is effective in maintaining the dynamic postural control of the elderly (16). Balance exercise also improve dynamic postural control by imposing overload over transferring information through triple sensory systems of central nervous mechanism (visual, vestibular, somatosensory) and also movement system for maintaining dynamic postural control. It has been proved that balance exercises improve propriception and increase neuromuscular coordination (17, 18).

On the other hand, the improvement of the elderly dynamic postural control as a result of physical exercises can be gained by the improvement of psychological factors of subjects. From the theoretical point of view, psychological factors such as fear, depression, stress, low self-confidence, low self-esteem and isolationism in interaction with physical internal factors and environmental factors caused increasing of fall risks of the elderly (19, 20).

In other words, any fall is accompanied with psychological effects that can affect the falling risk and the function of the person. The evidence indicates that there is a relationship between psychological disorders in physical acts. The findings indicate that any psychological factor has an important effect on the function of the person and potentially affects their physical function (19). The psychological disorders may be related to the physical ability and

performance of the older person and affect their reaction to the exercises. But it has been proves that the psychological disorders of people can be improved by exercises (21).

CONCLUSION

Regarding the results of the research, it seems that applying the balance training programs can increase the dynamic postural control of the elderly. As a result, the balance training not only can improve the muscular strength, but can increase dynamic postural control and in this way the fall risk of the elderly is decreased.

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