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Original Article

Comparison of the effectiveness of balance training using a reaching task between a sitting position and a standing position in the elderly

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Abstract. [Purpose] The purpose of this study was to compare the effectiveness of balance training using a reaching task between a sitting position and a standing position in the elderly. [Subjects and Methods] The study included 30 elderly women from D city. The subjects were divided into the following two groups, according to the training position: the sitting group (n = 15) and standing group (n = 15). Both groups performed training for 20 min, thrice a week for 8 weeks. The short form of the berg balance scale (SFBBS), timed 10-m walk test (10MWT), timed up & go test (TUG), and falls efficacy scale (FES) were used before and after training. [Results] SFBBS, 10MWT, and TUG values were significantly different between before and after training in both groups. However, FES values were significantly different in only the standing group. [Conclusion] Balance training in a standing position is helpful for improving activities that mainly use the lower extremities, such as gait, and training in a sitting position is somewhat helpful for improving balance ability. In addition, balance training in both positions can help overcome the fear of falling.
Key words: Postural balance, Falls efficacy, Elderly

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INTRODUCTION

In the elderly, even a small injury can be fatal owing to decreased physical ability with age. Falling is the most frequent accident experienced by the elderly[1)]. In the elderly, there are multiple reasons for falling, and one of them is the inability to cope with environmental risk factors such as a slippery or uneven road because of reduced balance control ability caused by decreased physical ability[1, 2)].

One method to reduce the risk of falling in the elderly is removal of environmental risk factors from their living spaces as much as possible[2)]. However, this method only reduces the risk of falling during household activities, and the risk of falling during outdoor activities still exists. In addition, staying in the house all day is very difficult; however, even if it is done, social participation will decrease, lowering quality of life[3)].

In the elderly, one method to reduce the risk of falling during outdoor activities is improvement of balance ability through balance training[4)]. Many studies are being performed on reducing the risk of falling through balance training in the elderly; however, the risk of falling exists during training. A change in position, for instance from standing to sitting, can considerably reduce the risk of falling during balance training[2)]. If little difference exists in the effectiveness of balancing training between a sitting position and a standing position in the elderly, safe training in a sitting position would be ideal.

This study hypothesized that the effectiveness of balance training in a sitting position is similar to that in a standing position, and balance training may be performed in a sitting position to reduce the risk of falling during training. Therefore, this study compared the effectiveness of balance training using a reaching task between a sitting position and a standing position in the elderly to determine whether the effectiveness of balance training is greater in a sitting position (the safe position) compared to that in a standing position.

SUBJECTS AND METHODS

This study included 30 elderly community-dwelling women in D city. The selection criteria were as follows: (1) at least 65 years of age; (2) no falls in the last year; (3) no diseases that might affect gait. Those who had visual impairment, hearing loss, or nervous system or vestibular organ problems, or those who were unable to understand the nature of the experiment were excluded. All subjects were informed of the purpose and methods of the study, and written informed consent according to the ethical standards of

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the Declaration of Helsinki was obtained from all subjects prior to their participation. All the subjects agreed to participate in this study.

The mean age, height, and weight of the subjects were 73.2 ± 3.1 years, 156.1 ± 4.1 cm, and 55.5 ± 4.6 kg, respectively. The subjects were divided into the following two groups according to the training position: the sitting group (n = 15) and the standing group (n = 15). They performed training for 20 min, thrice a week for 8 weeks. The subjects bent over stretching both arms out in front of them, then bent over stretching their right arm out from the right side of the body, and finally bent over stretching their left arm out from the left side of the body as far as possible. They maintained each of these postures for 3 s and returned to their original position after each posture. The short form of the berg balance scale (SFBBS), timed 10-m walk test (10MWT), and timed up & go test (TUG) were used to measure balance-related ability and the falls efficacy scale (FES) was used to measure the fear of falling before and after balance training. All data are presented as mean ± standard deviation. The subjects rested when they felt fatigued.

Statistical analysis was performed using SPSS for Windows (version 20.0). The paired t-test was used to examine differences between before and after training, and the independent t-test was used to examine differences between the groups. The statistical significance level was set at $\alpha = 0.05$.

RESULTS

On comparing the results between before and after balance training, SFBBS, 10MWT, and TUG values were significantly different between before and after training in both groups ($p < 0.05$); however, FES values were significantly different in only the standing group ($p < 0.05$).

On comparing the results between the two groups, 10MWT speeds were significantly higher in the standing group than in the sitting group ($p < 0.05$) (Table 1).

Table 1. Comparison of the measurement values between before and after training

Variable	Group	Before training	After training
SFBBS (score)	Sitting	26.6 ± 1.5	27.0 ± 1.1[a]
	Standing	25.4 ± 3.0	26.8 ± 2.0[a]
10MWT (m/s)	Sitting	0.73 ± 0.1	0.68 ± 0.1[a]
	Standing	0.81 ± 0.1	0.92 ± 0.1[ab]
TUG (s)	Sitting	7.78 ± 1.1	7.53 ± 1.1[a]
	Standing	8.18 ± 0.9	7.97 ± 0.9[a]
FES (score)	Sitting	24.1 ± 10.9	21.2 ± 5.9
	Standing	27.8 ± 13.4	21.9 ± 6.5[a]

[a]Significant difference between before and after training
[b]Significant difference between the sitting and standing groups after training
SFBBS: Short form berg balance scale, 10MWT: Timed 10-m walk test, TUG: Timed up & go test, FES: Falls efficacy scale

DISCUSSION

This study compared the effectiveness of balance training using reaching task between a standing position and a sitting position in the elderly. The SFBBS, 10MWT, and TUG were used to measure balance-related ability, and the FES was used to measure the fear of falling before and after the 8-week training program in order to determine the effectiveness of balance training. The SFBBS evaluates overall balance ability, 10MWT evaluates gait ability, TUG evaluates dynamic balance ability, and FES evaluates the fear of falling.

Previous studies have used the SFBBS in the elderly; Karthikeyan et al. reported a score of 20.6[5], and Hawk et al. reported a score of 22.3[6]. The present study noted higher scores compared to those in previous studies both before and after training. This difference may have occurred because the elderly subjects in the present study were healthy and lived independently. Balance training using the reaching task appeared to be effective, as the subjects showed better balance ability after the training compared to that before the training. However, the SFBBS values appeared to be similar with training in a standing position and training in a sitting position.

Previous studies have used the TUG in the elderly; Hofheinz et al. reported a result of 8.39 s[7], and Shumway-Cook et al. reported a result of 8.4 s[8]. The present study noted results similar to those of previous studies before the training. In the present study, the TUG values significantly improved in both groups after training compared to those before training. However, the TUG values appeared to be similar with training in a standing position and training in a sitting position.

A previous study by Bohannon using the 10MWT reported a mean 10MWT speed of 1.27 m/s for healthy elderly individuals in their 70s, which was faster than that in the present study[9]. In the present study, the 10MWT speed significant increased after training compared to that before training in the standing group; however, the sitting group showed a decrease in the 10MWT speed. This may have occurred because training in a sitting position involves lower stimulation of the lower extremities and lesser use of the lower extremities compared to those in a standing position. Therefore, training in a sitting position did not significantly improve movements that largely involve the lower extremities, such as gait.

The FES is a survey that evaluates the fear of falling by determining the level of self-confidence in conducting daily activities against falling[10]. A high score indicates a high fear of falling. The FES score significantly improved in the standing group after training compared to that before training, and the score improved in the sitting group but not significantly.

On comparing balance training using a reaching task between a sitting position and a standing position, the standing position was found to be very helpful for improving activities that mainly use the lower extremities, such as gait, and the sitting position was found to be somewhat helpful for improving balance ability. In addition, balance training can help overcome the fear of falling.

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