

Effects of core muscle stability training on the weight distribution and stability of the elderly

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Abstract. [Purpose] This study investigated the effects of core muscle stability training on the weight distribution and stability of the elderly. [Subjects and Methods] Thirty elderly persons were randomly divided into an experimental group which performed core strengthening exercises, and a control group which performed standard strengthening exercises for 8 weeks. A Tetrax Interactive Balance System was used to evaluate the weight distribution index (WDI) and the stability index (SI). [Results] The experimental group showed a significant improvement in terms of WDI and the SI. However, the control group showed no significant improvement in either. [Conclusion] Core muscle stability training should be considered as a therapeutic method for the elderly to improve their WDI, and SI, and as a fall prevention measure.

Key words: Core muscle stability training, Elderly, Weight distribution

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INTRODUCTION

As the human body gets older, proprioception and muscle strength weaken, and reflexes in reaction to sudden changes decline due to the physiological effects of aging. These phenomena affect the body's balance ability and increase the likelihood of bruising and injury from falls¹⁾. A person's ability to balance remains stable until the age of 40 but declines gradually thereafter²⁾. Thus, in order to maintain or increase muscle strength and improve balance and gait velocity, elderly people should engage in various forms of exercise, such as muscle strengthening exercises, stretching exercises, aerobic exercises, and walking³⁾. Among these exercises, core strengthening exercises are often used as a rehabilitation exercise for athletes. In Europe, they are used as an intervention to prevent and treat stroke, and spine and posture revision, and to address lumbar and cervical pain. Core strengthening exercises are helpful muscle strengthening exercises, joint exercises, and equilibrium training, because they help the development of flexibility and stability⁴⁾. Also, core strengthening exercises are effective for lumbar stabilization and motor control training, so they are widely used as a key exercise for maintaining body balance⁵⁾.

In the case of elderly people, bruising from a fall can increase the death rate related to fracture, immobility, and injury. The death rate associated with a bruise caused by a

fall is eight times higher in the elderly than in children; the resulting hospitalization rate is also 10 times higher⁶⁾.

In Korea, the incidence rate of accidents or injuries involving the elderly is increasing every year. Among the elderly people who experience bruising, 56.7% are aged over 65. The average period an elderly bruising victim spends in hospital ranges from 8 to 15 days⁷⁾. An experiment involving elderly people living in a nursing home showed that the risk factors for bruising include the following: decreased flexibility, low extremity strength and visual function, lower muscle tension, and weakened knee joints. In general, the issue of bruising in the elderly as a result of falls is a subject of interest for many researchers, but there is a need for more studies offering various perspectives on exercises aimed at preventing elderly bruising.

SUBJECTS AND METHODS

Subjects

The study subjects were thirty elderly people who were inpatients at C University Hospital. The experiment was conducted after the study objectives and methods had been explained to the subjects and they had signed a consent form agreeing to participation in the study in accordance with the ethical principles of the Declaration of Helsinki. In general, the participants were free of musculoskeletal system problems, capable of independent walking, had no vestibular sense problems, and had sufficient cognitive ability. The physical characteristics of the subjects were as follows. The experimental group had a mean age of 75.2 years, an average height of 160.1 cm, and an average weight of 58.7 kg. Seven of the patients were female and three were male. The control group had a mean age of 74.7 years, an average height of

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161.8 cm, and an average weight of 60.2 kg. Six patients were female and four were male.

Methods

The control group performed standard strengthening exercises. Specifically, the subjects were asked to alternately perform upper and lower strengthening exercises. The experimental group performed co-contractions of the transverse abdominis, multifidus, and pelvic floor muscle exercises to make a bridging position. This position was maintained as a cross-extended knee joint. They were then asked to lie face down and maintain a crawling position while co-contracting the transverse abdominis, multifidus, and pelvic floor muscles. After that, they were requested to stretch one arm and the opposite leg, and repeat this exercise using the opposite arm and leg. Each position was practiced for five minutes per set, and there were a total of three sets. The total exercise time was 30 minutes a day, 5 times per week and the intervention lasted for 8 weeks. It appeared that the fluctuation of the weight % on the force plate increased as the weight distribution increased and that the degree of imbalance increased as the stability index increased. In this study, SPSS V 17.0 was used for the statistical analysis of the data. The paired t-test was used to examine within group differences, and the differences in values between the groups were analyzed with the independent t-test. A significance level of $\alpha=0.05$ was chosen.

RESULTS

The WDI score of the experimental group improved from 6.54 ± 1.48 to 4.04 ± 1.12 and the SI score improved from 15.85 ± 2.10 to 13.07 ± 1.78 ($p<0.05$). The WDI score of the control group decreased from 6.58 ± 3.17 to 6.68 ± 1.80 and the SI score decreased from 15.81 ± 3.35 to 16.61 ± 3.58 ($p>0.05$).

The change in the WDI score was -2.14 ± 0.36 in the experimental group and 0.22 ± 1.37 in the control group. The change in the SI score was -2.78 ± 0.32 in the experimental group and 0.8 ± 0.23 ($p<0.05$) in the control group.

DISCUSSION

A study was carried out of the effect of exercises in addressing bodily changes due to aging, and it was concluded that the physical condition and ability of elderly people should be assessed and exercises assigned accordingly⁸⁾. Other studies found that regular exercises, lumbar muscle strengthening exercises, and balance exercises are effective at preventing injury in the elderly⁹⁾, and enhance the sensory motor system functions needed to maintain body safety¹⁰⁾.

For elderly people to enjoy a healthy and happy life free from worries about accidents resulting in bruising, they need both muscle strength and balance ability. There is a considerable volume of existing research on posture and balance control, as well as related disorders¹¹⁾. Core strengthening exercises recover the postural control function of the body and increase the range of motion, and they can therefore be considered appropriate exercises for the elderly. Among the exercises that prevent bruising, posture training and dy-

namic balance training were found to be the most effective at decreasing the incidence of bruising¹²⁾. In this study, it was found that the weight support and balance of the treatment group who went through the core strengthening exercises showed a statistically significant improvement ($p<0.05$). The lumbar muscle is crucial in daily life, allowing the body to maintain various positions; therefore, maintaining enough lumbar muscle strength and stamina is very important. In this regard, it has been reported that lack of co-contraction of the lumbar muscle is strongly related to lumbar instability^{13–15)}. To prevent dysfunction of the trunk muscle, which causes lumbar instability, core strengthening exercises must be practiced¹⁶⁾. Motor learning improves muscle reflexes and accelerates proprioception, which affects balance control, so core strengthening exercises are particularly important for improving balance ability. In this study, the elderly participants who practiced core strengthening exercises showed statistically significant improvements in balance ability. Thus, it is evident that core strengthening exercises are effective at improving balance ability. In summary, this study conducted core strengthening exercises to improve the balance ability of elderly subjects. Its aim was to identify an effective exercise method which prevents elderly people from getting bruises as a result of falling.

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REFERENCES

- 1) Steinweg KK: The changing approach to falls in the elderly. *Am Fam Physician*, 1997, 56: 1815–1823. [[Medline](#)]
- 2) Balogun JA, Akindele KA, Nihinlola JO, et al.: Age-related changes in balance performance. *Disabil Rehabil*, 1994, 16: 58–62. [[Medline](#)] [[CrossRef](#)]
- 3) Duncan PW, Studenski S, Chandler J, et al.: Functional reach: predictive validity in a sample of elderly male veterans. *J Gerontol*, 1992, 47: M93–M98. [[Medline](#)] [[CrossRef](#)]
- 4) Michael J, Andre NP: *The Great body ball handbook; productive fitness products*. 2000.
- 5) Nadler SF, Malanga GA, Bartoli LA, et al.: Hip muscle imbalance and low back pain in athletes: influence of core strengthening. *Med Sci Sports Exerc*, 2002, 34: 9–16. [[Medline](#)] [[CrossRef](#)]
- 6) Tibbitts GM: Patients who fall: how to predict and prevent injuries. *Geriatrics*, 1996, 51: 24–28, 31. [[Medline](#)]
- 7) Bayne CG: Falling: why and what to do about it. *Nurs Manage*, 1997, 28: 22–23. [[Medline](#)] [[CrossRef](#)]
- 8) Kligman EW, Pepin E: Prescribing physical activity for older patients. *Geriatrics*, 1992, 47: 33–34, 37–44, 47. [[Medline](#)]
- 9) Wolfson L, Whipple R, Judge J, et al.: Training balance and strength in the elderly to improve function. *J Am Geriatr Soc*, 1993, 41: 341–343. [[Medline](#)] [[CrossRef](#)]
- 10) Lord SR, Caplan GA, Colagiuri R, et al.: Sensori-motor function in older persons with diabetes. *Diabet Med*, 1993, 10: 614–618. [[Medline](#)] [[CrossRef](#)]
- 11) Skelton DA, Dinan SM: Exercise for falls management: rationale for an exercise programme aimed at reducing postural instability. *Physiother Theory Pract*, 1999, 15: 105–120. [[CrossRef](#)]
- 12) Woollacott MH, Shumway-Cook A: Changes in posture control across the life span—a systems approach. *Phys Ther*, 1990, 70: 799–807. [[Medline](#)]
- 13) Sung PS: Multifidus muscles median frequency before and after spinal stabilization exercises. *Arch Phys Med Rehabil*, 2003, 84: 1313–1318. [[Medline](#)] [[CrossRef](#)]
- 14) Chang WD, Lin HY, Lai PT: Core strength training for patients with chronic low back pain. *J Phys Ther Sci*, 2015, 27: 619–622. [[Medline](#)]

- [\[CrossRef\]](#)
- 15) Kachanathu SJ, Zakaira AR, Sahni A, et al.: Chronic low back pain in fast bowlers a comparative study of core spinal stabilization and conventional exercises. *J Phys Ther Sci*, 2012, 24: 821–825. [\[CrossRef\]](#)
 - 16) Koumantakis GA, Watson PJ, Oldham JA: Trunk muscle stabilization training plus general exercise versus general exercise only: randomized controlled trial of patients with recurrent low back pain. *Phys Ther*, 2005, 85: 209–225. [\[Medline\]](#)