Effects of ankle exercises on balance ability when using shoe height insoles

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Abstract. [Purpose] The purpose of this study was to examine the effects of ankle exercises on balance ability when using shoe height insoles. [Subjects and Methods] Thirty adults in their 20s, who were students, were randomly divided into an experimental group and a control group (n=15/group). Individuals in the experimental group wore height-adjustable silicon insoles measuring 3, 5, and 7 cm three times per week for four weeks. The ankle exercise program consisted of stretching exercises, resistance training, and a balance exercise. [Results] There was a significant improvement in the balance ability of the experimental group for all height insoles (3, 5, and 7 cm) following the exercise program, as compared with before the exercise program. There was no significant improvement in the balance ability of the control group for all height insoles following the exercise program as compared with before the exercise program. The experimental group exhibited a significant improvement in balance ability following the exercise program for all the height insoles as compared with the control group. [Conclusion] According to the results of this study, active ankle exercises are helpful in preventing ankle joint damage, as they improve balance ability.

Key words: Insole, Balance, Ankle joint exercise

INTRODUCTION

Young people typically use shoe height-increasing insoles to appear taller. Height insoles are also used to counteract foot deformities and enhance balance; however, there is little evidence of the beneficial effects of height insoles1). Furthermore, since insoles alter the plantar pressure distribution, improper use of insoles can cause deformities in a normal foot2). Height insoles also retain the ankles in a plantar flexion position, which places the mechanical state of the ankles in the open-packed position and can have negative effects on balance ability3,4). It has been demonstrated that wearing shoes height insoles or a high-heeled shoe affects balance ability5,6). Previous studies have also reported on the effects of ankle exercises on balance ability9–11); however, these studies focused on alterations in balance ability while wearing height insoles, after performing ankle exercises in bare feet, or while wearing shoes with low heels. The present study examined the effects of ankle exercises on improving the balance ability of an individual wearing height-increasing insoles.
were no significant differences between the two groups (p>0.05). Ethical approval for the present study was granted by the Institutional Review Board of Youngdong University. All subjects were informed of the objectives and methods of the study beforehand and gave informed consent to participate in the experiments.

Height-adjustable silicon insoles measuring 3, 5, and 7 cm were used. The experimental group participated in a total of 12 sessions of an exercise program, which was performed three times per week for four weeks. The program consisted of stretching exercises, resistance training, and a balance exercise. The stretching exercises involved four stretching routines: (i) plantar flexion active stretches, (ii) dorsiflexion active stretches, (iii) a stretch that involved tracing letters in the air with the foot while in a prone position with the leg on a pillow, and (iv) a calf muscle stretch with one leg forward and the other back while bending the upper body forward and keeping both heels on the ground.

Stretching was performed, alternating between legs, for three 30-s sets with a break of 15 s between the sets. Stretching exercises were followed by a 1 min break, after which resistance training was performed. Resistance training routines consisted of, (i) performing plantar flexion, dorsiflexion, inversion, and eversion in a prone position while changing the position of a TheraBand™, which was anchored to a sturdy object and wrapped around the foot; (ii) using the foot to pick up a towel while seated; and (iii) heel raise exercises in a standing position. Resistance training was performed, alternating between legs, for three 20-s sets with a break of 15 s between the sets. Resistance training was followed by a 1 min break, after which the balance exercise was performed. For the balance exercise, subjects were asked to stand on one leg on an air cushion for 1 min. While they could use the wall for support if required, participants were encouraged to stand on the cushion without support. The balance exercise was performed, alternating between legs, for three 1-min sets with a break of 15 s between the sets. A Biodex Balance System™ was used to assess the balance ability of all 30 subjects in order to determine how height-increasing insoles affected the balance ability with and without ankle exercises. Subjects were asked to stand on one leg on the platform of the Biodex Balance System™ for 30 s whilst wearing a blindfold and crossing both arms, with both hands placed on the shoulders. Balance ability was assessed three times, once before the exercise program and twice after the exercise program.

An independent t-test was performed to compare the balance ability of the experimental group with that of the control group. A paired t-test was used to investigate alterations in the balance ability of each group before and after the intervention.

### RESULTS

A significant improvement was detected in the balance ability of the experimental group in all height-increasing insole subgroups (3, 5, and 7 cm) after the exercise program as compared with before the exercise program (p<0.05). There was no significant improvement in the balance ability of the control group in any of the height insole subgroups (3, 5 and, and 7 cm) after the exercise program as compared with before the exercise program (p>0.05). The experimental group exhibited a significant improvement in balance ability following the exercise program for all the height insoles as compared with the control group (p<0.05; Table 1).

### DISCUSSION

The present study examined the effects of ankle exercises on improving the balance ability of individuals wearing height-increasing insoles. Height-adjustable silicon insoles measuring 3, 5, and 7 cm were used. A height-increasing shoe insole between 3 and 5 cm was found to be ideal, whereas a shoe insole measuring >5 cm could excessively shift the plantar...
pressure to the front of the foot\textsuperscript{12}. Although individuals endeavor to be healthy, occasionally they put beauty before health\textsuperscript{12}. For example, individuals wear height-increasing shoe insoles despite knowing that wearing these insoles may decrease their balance ability. Reduced balance ability can lead to ankle joint damage, which may result in a chronic disease that ultimately undermines the individual’s quality of life\textsuperscript{13}. Although it is important to recommend that individuals refrain from wearing height-increasing shoe insoles, it is also important that individuals who do wear these insoles wear them correctly and identify, develop, and perform exercises that can help maintain or improve balance ability. According to the results of the present study, active ankle exercises may be helpful in preventing ankle joint damage, as they improve balance ability. These findings may also be applied to people who wear high-heeled shoes. While the present study focused on young adults in their 20s, high-heeled shoes are worn by people across the age spectrum. The present study was unable to determine which of the three exercises (stretching, resistance training, and balance exercises) contributed the most to the improvement in balance ability. In order to fully elucidate the effect of ankle exercises on balance ability, future studies should focus on how diverse age groups, different shoe types, and more specialized exercise programs affect balance ability.

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