INTRODUCTION

In 1987, the effect of wearing a laterally wedged insole in osteoarthritic patients with a varus deformity of the knee (OA patients) was first reported, and, since then, kinematic and kinetic analyses concerning this condition have mainly focused on a static standing position. Yasuda and Sasaki reported that wearing a laterally wedged insole reduced the load in the medial compartment of the knee, which was effective for the treatment in OA patients. Recently, Kerrigan et al. found that, in dynamic gait conditions, wearing a laterally wedged insole reduced the knee joint varus moment in OA patients, which suggested an effective mechanism for the treatment in OA patients. However, it was not show how the evidence resulted in the reduction in the knee joint varus moment with a laterally wedged insole.

Our previous study found that the healthy young adults wearing a laterally wedged insole had both changes of knee joint varus moment and subtalar joint valgus moment during gait via the more laterally shifted location of the center of pressure. The objective of this study was to assess the kinematic and kinetic effects of wearing a laterally wedged insole on the knee joint moment during gait, specifically in the frontal plane, in normal healthy elders.

METHODS

Twenty elderly females (age: 68.2±5.7 yr, height: 149.9±5.2 cm, weight: 55.7±7.4 kg) participated in this experiment. The anteroposterior radiographs of bilateral whole-legs including the hip, knee, and ankle were taken with standing and knee full extension position with barefoot in each side. With these weight-bearing radiographs, the femorotibial angles of right leg (174.6° ± 4.6°) were measured as the static alignment of the lower extremity.

Three-dimensional gait analyses were conducted with a motion analysis system (VICON) operating at 60 Hz with 12 infrared cameras and 8 force platforms (KISTLER) operating at 60 Hz. The laterally wedged insoles used in this study were made of Ethylene Vinyl Acetate (EVA 8200), which has a coefficient of elasticity of 100-300 kg/mm². Two different laterally wedged insoles were tested: no wedge (N) and a wedge with a 6° lateral angle (W) along the full length of the insole from the hindfoot to the forefoot. They were attached to the bare feet of the subjects using adhesive tapes after ethanol swab.

Subjects were asked to walk at a controlled cadence of 95 steps/minute while listening to a metronome along the walkway. Angles and moments at the knee and subtalar joints in the frontal plane, and ground reaction forces and center of pressure during the stance phase of the gait were measured.

RESULTS AND DISCUSSION

The knee joint varus moment was significantly smaller for insole W compared with insole N (a 10.4% reduction, \(P < .001\)), whereas the subtalar joint valgus moment was significantly greater for insole W compared with insole N (a 33.3% increase, \(P < .001\)) (Figure 1). The angles at the
knee and subtalar joints did not show any changes between the two insole conditions. No obvious differences in the insole conditions were found for the mediolateral and vertical GRFs during the stance phase; however, this was not true for the moment arm of the subtalar joint valgus moment. The distance for insole W was significantly greater compared with insole N (a 41.1% increase, \( P < .001 \)). The location of the center of pressure parallel to the subtalar joint axis was more laterally shifted for insole W, and, hence, it had a significantly smaller knee joint varus moment than insole N.

Regression analysis was used to examine the association between the femorotibial angle and the knee joint varus moment during gait with insole N. There was a highly correlation between pairs of variables \( (r^2=0.80, \ P < .001) \). Our next research will be to show how the beneficial effects of wearing a laterally wedged insole is found in age matched OA patients.

**SUMMARY**

In comparison with insole N, insole W significantly reduced the knee joint varus moment and increased the subtalar joint valgus moment during gait. This finding was correlated with a more laterally shifted location of the center of pressure during the stance phase of the gait with insole W. These results show that wearing a laterally wedged insole reveals its dynamic effect during gait biomechanically.

**REFERENCES**


**Figure 1:** Differences between the knee joint varus moment and the subtalar joint valgus moment when the subjects walked with insoles no wedged (N) and high wedge with 6° lateral (W). Each symbol indicates the subjects (n=20). * indicated \( P < .001 \).