

THE EFFECT OF LATERALLY WEDGED INSOLES ON STANDING ALIGNMENT

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INTRODUCTION

Laterally wedged insoles (typically inclined 5-10 degrees) have been used as a conservative treatment for medial knee osteoarthritis (OA). The goal of wedged insoles is to alter the mechanical alignment of the lower extremity and redistribute forces at the knee. The mechanism of pain relief is unclear, however. Potential mechanisms include an alteration in static alignment and a decrease in knee adduction moment during stance phase of walking.

As the aim of the insole is to realign the limb to reduce a varus position of the knee, frontal plane radiographs of static alignment in patients with and without the insoles should reveal a significant difference between the two conditions. Reports have been conflicting as to whether or not static alignment changes. Toda et al. (2001) and Maly et al. (2002) did not find significant differences in tibio-femoral angle (TFA) between the two conditions, while Giffin et al. (1995) did find a significant varus to valgus alteration. Yasuda and Sasaki (1987) did not find a difference in TFA but did report a shift in the mechanical axis (MA).

The purpose of our study is to determine the effects of laterally wedged insoles on standing alignment in patients with medial knee OA. We hypothesized that TFA will shift towards valgus, and the MA will become more upright with respect to vertical with the addition of the wedged insoles.

METHODS

Two males and six females ($M_{\text{age}} = 59.4 \pm 4.0$ yrs; $M_{\text{height}} = 166.9 \pm 9.0$ cm; $M_{\text{mass}} = 92.4 \pm 16.3$ kg) with diagnosed medial knee OA of at least a grade II in the Kellgren-Lawrence scale volunteered as subjects in this study. Subjects were fitted with a full length laterally wedged foot orthoses for their affected knee side. The amount of wedging (10.4 ± 2.9 deg) was determined for each subject by a reduction in pain during a lateral step-down task.

Subjects were given two weeks to accommodate to the orthotic device. Full-length frontal plane radiographs were then taken of the subject's affected leg while they stood in bilateral stance, with and without the wedged insole in the shoe.

The TFA was determined from the intersection of the line joining the hip joint and knee joint centers and the line joining the knee joint and ankle joint centers. Zero degrees defines the neutral angle, while varus is positive and valgus is negative. MA was calculated as the angle that the line connecting the hip and ankle joint centers makes with the vertical. Positive angles represent a lateral tilt of the MA.

A two-factor, measure (TFA, MA) by condition (no wedge, wedge) within-subjects ANOVA was used to test for a significant interaction in alignment.

RESULTS AND DISCUSSION

Mean data for the eight subjects are provided in Figure 1. There was non-significant measure by condition interaction for alignment [$F(1,7) = 0.008, p = 0.932$]. For the wedge condition, the smaller TFA angle indicates a decrease in varus angulation, while the increase in MA indicates a more lateral tilt of the leg. Although the average values indicate a trend towards decreased varus and a more lateral MA tilt with the wedged insoles these differences were roughly one degree and resulted in a non-significant condition main effect [$F(1,7) = 2.13, p = 0.185$].

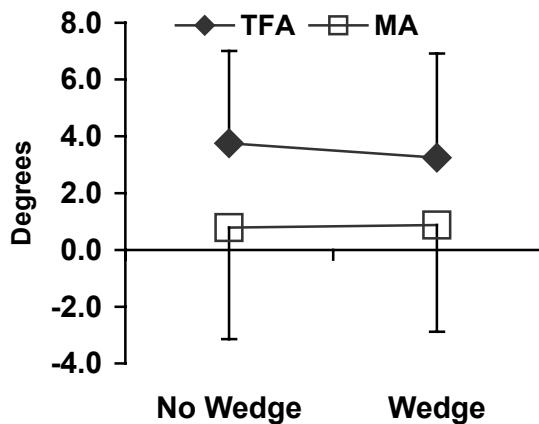


Figure 1: There were no significant differences between insole conditions. Zero degrees is vertical; positive angles are varus (TFA) and lateral tilt (MA).

Both TFA and MA are predictors of medial joint forces in the knee. The more acute the varus angle (TFA) or the greater the lateral tilt relative to vertical (MA), the greater the forces are on the medial side of the joint. Decreasing the varus angulation and tilting the MA into a more upright position should shift the knee joint load laterally and thus decrease load and ultimately pain on the medial side of the knee.

The TFA was not significantly altered in this study, which is consistent with three

previous studies (Yasuda and Sasaki, 1987, Toda et al., 2001, Maly et al., 2002) but inconsistent with the results of Giffin et al. (1995). While our mean results are similar to Giffin and colleagues (1995), a closer examination of data showed that some of our subject's TFA improved while others worsened. This resulted in an average absolute angle change that was actually larger (1.8 ± 2.2 deg) than those of Giffin and colleagues (0.8 ± 1.1 deg).

Yasuda and Sasaki (1987) reported an improvement in MA measured during unilateral stance with the use of wedged insoles. Our MA, measured in bilateral stance, was not different between conditions. Perhaps MA measured during unilateral stance is more sensitive to the use of wedged insoles than MA measured during bilateral stance, which may explain the differences in results.

SUMMARY

The use of wedged insoles resulted in a decrease in knee pain during a lateral step down test; however, standing alignment measures (e.g., tibio-femoral angle and mechanical axis) did not differ between insole conditions as hypothesized.

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