

# FRONTAL PLANE MECHANICS DURING WALKING IN PATIENTS WITH LATERAL COMPARTMENT TIBIOFEMORAL OSTEOARTHRITIS WITH AND WITHOUT A MEDIALLY WEDGED ORTHOSIS

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## INTRODUCTION

Tibiofemoral (TF) osteoarthritis (OA) is a progressive disease process affecting millions of Americans. It can affect the medial, lateral or both compartments of the TF joint. Medial TF OA is more common and has received the most attention in the literature. However, lateral TF OA is equally as debilitating and costly to those that suffer from it. Little work has been done to understand and conservatively manage lateral TF OA.

Recently, laterally wedged orthoses have been shown to be beneficial in the management of medial TF OA. These orthoses are designed to alter frontal plane knee mechanics by realigning the foot. Crenshaw et al reported a 7% decrease in the external adduction moment in normal subjects when wearing a laterally wedged insole. Furthermore, Kerrigan et al reported that laterally wedged insoles reduced the external adduction moment in patients with medial TF OA by 6-8%.

Despite the support generated for laterally wedged orthoses and medial TF OA, there is little evidence to support the use of medially wedged orthoses in the treatment of lateral TF OA. Previous studies suggest that patients with lateral TF OA demonstrate smaller peak external adduction moments in comparison to both healthy controls and patients with medial TF OA. The goal of a medially wedged device would be to augment the external adduction moment so it more closely resembles the frontal plane profile of a healthy adult.

Therefore, the purpose of this study was to compare frontal plane knee angles and moments in patients with lateral TF OA during walking with and without a medially wedged orthoses. We hypothesized that patients with lateral TF OA will demonstrate increased peak knee external adduction moments and decreased peak knee abduction angles during walking in a medially wedged orthoses as compared to a no-wedge condition.

## METHODS

This is an ongoing study of which ten subjects (8 women and 2 men) with lateral TF OA have been recruited. Subjects were included after being classified with a Kellgren-Lawrence grade of 2-4, based on an anterior-posterior 30° flexed knee radiograph. The degree of wedging was individually prescribed for each subject so as to maximally reduce knee pain during an 8" lateral step-down test, and was constrained between 5-15 degrees. The wedging was added to a non-custom, contoured orthosis. A 6-camera VICON motion analysis system and a Bertec force plate were used to collect three dimensional kinematics and kinetics during walking at a self-selected speed. A wedge and a no-wedge condition were collected for each subject in a randomized order.

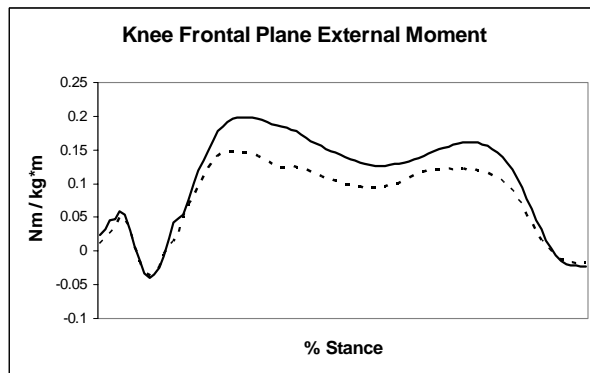
The variables of interest included the peak knee external adduction moment and the peak knee abduction angle during the first half of stance. Due to the small sample size, descriptive statistics will be reported at this time.

## RESULTS AND DISCUSSION

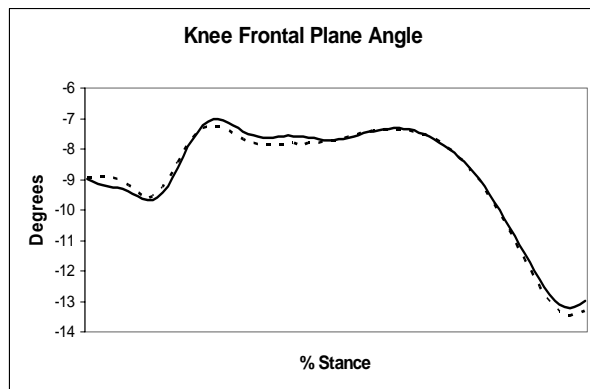
Results are reported in Table 1 and Figures 1-2.

**Table 1.** Mean and (SD) values for variables of interest in the no-wedge (NW) and the wedged (W) conditions

	NW	W	% diff
<b>Pk Add Mom</b> (Nm / kg*m)	0.181 (.10)	0.219 (.17)	21.0%
<b>Pk Abd Angle</b> (degrees)	10.34 (4.07)	10.49 (4.19)	1.45%



**Figure 1.** Ensemble curves of frontal plane moments in the wedged (solid) and no-wedge (dashed) conditions



**Figure 2.** Ensemble curves of frontal plane angles in the wedged (solid) and no-wedge (dashed) conditions

Contrary to our hypotheses, it appears that the peak frontal plane angles are similar in patients with lateral TF OA when comparing a wedged condition to a no-wedge condition. This result is similar to the results reported by Butler et al. (2004) when investigating the effects of laterally wedged orthoses on frontal plane angles in medial

TF OA. In support of our hypotheses, the peak external adduction moment did increase. This suggests that medially wedged orthoses can have an immediate beneficial impact on frontal plane knee mechanics.

For these subjects with lateral TF OA, the order of magnitude of change in the external adduction moment was greater than expected. Based on previous work investigating laterally wedged orthoses in medial TF OA, a percent difference of over 10-15% could be considered a positive result. The 21% increase demonstrated in this preliminary study is promising and warrants further research into the biomechanical and clinical efficacy of medially wedged orthoses in lateral TF OA.

## SUMMARY

The results of this study suggest that patients with lateral TF OA exhibit an increased external adduction moment at the knee during walking with a medially wedged orthoses compared to a no-wedge condition. These increased values are closer to the values exhibited by healthy subjects without TF OA. One-year follow-up data are also being collected. We hope those results will elucidate the long-term effects of medial wedging in patients with lateral TF OA.

## REFERENCES

- Rudolph K, et al (in review). *Arthritis Care and Research*.
- Butler RJ, et al (2004). *Proceedings from ASB*.
- Cashen CM, et al (2004). *Proceedings from CBER 2004*.
- Crenshaw SJ, et al (2000). *Clin Orthop and Related Research*, 375,185-192.
- Kerrigan DC, et al (2002). *Arch of Physical Med and Rehab*, 83:889-893.

## ACKNOWLEDGEMENTS

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