GROUND REACTION FORCES DURING LEVEL WALKING WITH AND WITHOUT LATERAL HEEL WEDGE ORTHOTICS

David A. Wallace, and Rod A. Harter
Sports Medicine Laboratory, Oregon State University, Corvallis OR
email: wallaced@onid.orst.edu,

INTRODUCTION

Osteoarthritis (OA) affects an estimated 21 million Americans and is responsible for more than 7 million physician visits per year. Knee OA is a debilitating condition that frequently transforms physically active individuals into sedentary persons. Heel wedge orthotics are designed to mechanically lower the magnitude of the tibiofemoral joint loads in order to reduce pain and disability in knee OA patients. Heel wedge orthotics have been shown to effectively reduce knee pain[1] but few studies have compared the ground reaction forces of both medial and lateral orthotics. The purpose of this study was to characterize the effects of medial and lateral heel wedge orthotics on peak ground reaction forces during level walking.

METHODS

Ten healthy volunteers (6 females, 4 males; mean age, 24 ± 7 yr) with no history of knee injury participated in the study. Three-dimensional kinematic data (6-camera, Vicon Motion Systems, 120 Hz) and ground reaction forces (2 Kistler force plates, 1080 Hz) were collected as subjects ambulated at a self-selected pace along a 10m walkway. Each subject was tested under 3 conditions (10 trials per condition): lateral wedge (LAT), medial wedge (MED) and no wedge (CONTROL). The order of testing was selected randomly.

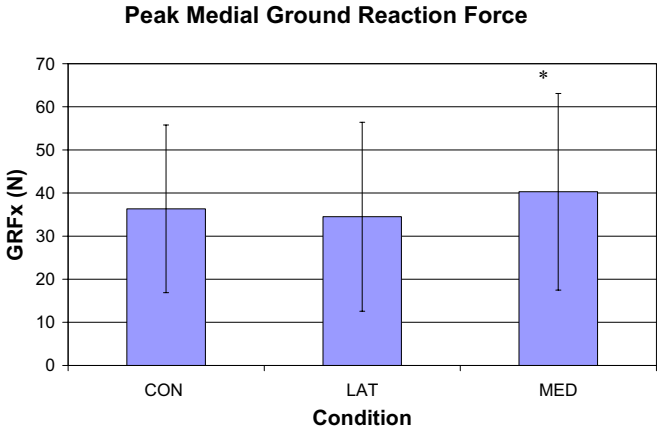
Peak ground reactions forces in the medial (GRF_x), anterior (GRF_y) and vertical (GRF_z) directions were analyzed from the initial contact to mid-stance phase of the gait. Force data was filtered using a second order recursive Butterworth filter with a 50Hz low-pass cutoff frequency. For reach direction of force, a repeated measures ANOVA was used to detect differences between three conditions. When appropriate, Bonferroni *post-hoc* tests were employed to determine significant differences between pairs of the three conditions.

RESULTS AND DISCUSSION

Peak GRF_x was significantly higher in the MED condition compared to both the LAT (p=.0005) and CONTROL conditions (p=.0025). Although the LAT condition tended to be lower than the CONTROL, no significant differences were determined (p>0.05). There were no significant differences between conditions found in either peak GRF_z or peak GRF_y (p>0.05).

Table 1: Peak Ground Reaction Forces

Condition	Peak Ground Reaction Force		
	GRFx	GRFy	GRFz
CON	36.3 ± 19.4	36.5 ± 24.4	878.5 ± 207.3
MED	40.2 ± 22.8	36.6 ± 19.4	898.2 ± 206.8
LAT	34.5 ± 21.1	33.3 ± 19.8	894.9 ± 197.1



* Significant difference between MED and both CON and LAT

CONCLUSIONS

These data suggest that heel wedge orthotics can effectively alter ground reaction forces during gait. In the current study, the application of a medial heel wedge created a much larger medially directed force during the initial loading phase of gait thus potentially increasing the varus joint torques of the lower extremity. However, in agreement with previous studies, the orthotics did not reduce vertical peak forces.[2] Previous studies have suggested that lateral heel wedge orthotics reduce the varus joint torque at the knee.[3] These findings suggest the mechanism by which this occurs is through a change in the medial/lateral ground reaction force rather than by a reduction in the magnitude of the vertical ground reaction force.

REFERENCES

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