LOWER EXTREMITY STRUCTURAL ALIGNMENT AND MOBILITY DETERMINES IF VALGUS WEDGED ORTHOSES REDUCE KNEE ADDUCTION MOMENTS IN MEDIAL KNEE OSTEOARTHRITIS (OA)  

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Introduction: It has previously been demonstrated that patients with medial knee OA have increased loads across the medial knee, and have shown that valgus posted foot orthoses have an effect on these knee adduction moments (AddM). This study aimed to determine whether the reductions in AddM in the presence of the wedge orthoses are related to static structural alignment and mobility of the rearfoot in symptomatic medial compartment knee OA.

Methods: Following institutional review and informed consent, 40 subjects (63.4±9.9, mean±S.D, years of age, BMI of 28.5±4.4) with medial knee OA (symptomatic OA according to the ACR Clinical Criteria for OA, radiographic OA of Kellgren-Lawrence (K-L) grades 2-3, predominantly medial disease, and ambulatory knee pain ≥20mm on a 100mm VAS scale) were recruited from participants in an ongoing double-blind randomized controlled trial [NLM Identifier: NCT00078453, at clinicaltrials.gov]. Subjects were recruited through the rheumatology clinics at Rush University Medical Center and from the community through advertisements. Exclusions included symptomatic arthritis of the hip, ankle, or foot; structural foot pathology; or any inflammatory arthritis. WOMAC site-specific surveys for each knee and weight-bearing AP knee X-rays were obtained. Radiographic alignment of the rearfoot and lower leg along with anthropometric measurements were obtained by a blinded experienced clinician with the subject standing in two different stance-foot positions. Subjects were randomized into two groups, one consisting of treatment with custom molded foot orthosis with no post (neutral), and the other with custom molded foot orthosis with no post (neutral). Kinematic and kinetic gait data were obtained as previously described using an optoelectronic system (Qualysis, Gothenburg, Sweden) and a multicomponent force plate (Bertec, Columbus, OH). The subjects wore the orthoses daily for three months and the gait tests were repeated. For statistical evaluation, subjects were dichotomized into “high mobility” where changes in the static foot stance showed greatest changes in radiographic alignment in the ankle and tibia along with a rearfoot range of motion (ROM≈8º (12.4±4.0) and “low mobility” with minimal radiographic changes and a ROM <8º (4.9±3.1) between the two stance positions. Each treatment group was analyzed separately using ANOVA to determine statistical significance. Changes in the radiographic angles were compared between positions and groups and analyzed with Pearson’s Correlation Coefficient and ANOVA.

Results: At 3 months, among the wedge-treated subjects there was a 12% reduction in knee AddM for those that were “high mobility,” i.e., had greater frontal plane rearfoot motion, compared to those that were “low mobility” (p=0.001); in contrast, the control group had no change in AddM regardless of alignment changes or available frontal plane motion. In addition, the “low mobility” group did not have significant reductions in AddM, even when treated with the wedge. No correlation was demonstrated between the reduction in moments and either WOMAC pain severity or radiographic severity as determined by K-L grade. The changes in the radiographic alignment demonstrated that a wider stance position resulted in less varus of the rearfoot and lower leg and confirmed the dichotomization of the groups with a strong correlation between changes in radiographic alignment and anthropometric measurements (R²=0.69 p<0.001). The changes in lower extremity radiographic alignment were also correlated to the reduction of knee adduction moments when the subjects wore wedged orthotics (R²=0.66 p<0.001).

Discussion: These data suggest that 1) in some subjects foot position is more directly related to knee position while in others the foot has less influence on the knee and 2) changes in the foot position corresponds to varying degrees of response by the ankle-subtalar joint to compensate and 3) this seems to determine how much benefit the wedges can contribute to any one individual. This is consistent with the theory that motion at the leg segments distal to the knee may have substantial effect on the forces within the knee, and suggests that evaluation of rearfoot motion and position may permit identification of patients likely to benefit from such unloading therapy.

References:  

Acknowledgements: Supported by NIH SCOR grant #P50-AR39239 and NIH grant #RO1 AR 48292

53rd Annual Meeting of the Orthopaedic Research Society  
Paper No: 0158