THE EFFECTS OF AN OVER-THE-COUNTER ORTHOTIC ON LOWER EXTREMITY KINEMATICS IN MALE AND FEMALE RECREATIONAL RUNNERS

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INTRODUCTION

Abnormal foot mechanics during the stance phase of running may affect the kinematics of the lower extremities and predispose an individual to injuries of the foot, ankle, and knee. Custom-made foot orthotics are often prescribed to correct abnormal mechanics during running by restoring dynamic stability to the closed chain of the lower extremity. However, there has been no research done to examine the efficacy of using an over-the-counter orthotic to correct abnormal gait mechanics. In addition, females are reported to demonstrate different lower extremity mechanics during running as compared to males [1]. The goals of this study were: (1) to examine the effects of an over-the-counter orthotic on ankle and knee joint kinematics during running in individuals identified as excessive pronators, and (2) to determine if there are any gender-specific effects of orthotics on ankle and knee joint kinematics during running.

METHODS

Thirty college-age recreational runners (15 males, 15 females) identified as being excessive pronators participated in this study. Excessive pronators were defined as those individuals with a navicular drop of greater than or equal to 9 mm.

Subjects were required to perform two testing sessions in which they ran with and without orthotics. All subjects used the same model of soft, over-the-counter orthotic (Flat Foot Products, Marathon Shoe Co.) and the same model running shoe (Air Max Moto II, Nike Inc.) during testing. During both testing sessions, the subjects ran on a treadmill at a velocity of 3.35 $m \cdot s^{-1}$ for 15 min. A three-dimensional motion capture system (Visualeyez VZ3000, PhoeniX Technologies, Inc.) was used to record the position of light emitting diodes placed on the foot, shank, and thigh segments at 100 Hz for 50 complete gait cycles during the last 5 min of each testing session.

Range of motion, peak angular velocity, and peak angular acceleration of the ankle and knee joints were calculated for the frontal, sagittal, and transverse planes of motion according to the methods outlined by Eng and Pierrynowski [2]. A two-way analysis of variance was used to assess the effects of orthotic and gender on all kinematic variables.

RESULTS AND DISCUSSION

No differences between the orthotic and non-orthotic conditions across gender were found for ankle joint kinematics (range of motion, peak angular velocity, and peak angular acceleration) in the frontal, sagittal, and transverse planes of motion. One finding of note is that there was no difference in the amount of pronation between the orthotic (4.1±2.7°) and non-orthotic (3.5±2.8°) conditions. This contradicts previous findings that soft orthotics reduce pronation [2,3].

In addition, no differences between the orthotic and non-orthotic conditions were found for knee joint kinematics (range of motion, peak angular velocity, and peak angular acceleration) in the frontal and sagittal planes of motion. However, there was significantly greater ($p<0.05$) transverse plane motion in the orthotic (4.6±2.9°) versus the non-orthotic (1.7±1.2°) condition. Increased knee joint range of motion in the transverse plane when using soft orthotics has been documented previously [2].

Finally, it should be noted that there were no significant interaction effects between gender and orthotics on ankle and knee joint kinematics. While there was significantly greater ($p<0.05$) pronation in the female (7.2±1.5°) versus male (4.0±1.4°) runners across orthotic condition, the use of orthotics did not reduce pronation to a greater extent in female as compared to male runners.

CONCLUSIONS

The results demonstrate that the over-the-counter orthotic used in this study was not effective in altering lower extremity kinematics in male and female runners identified as excessive pronators. It can be concluded that over-the-counter orthotics provide mostly cushioning and little, if any, functional control. For individuals with gait pathomechanics, the use of a custom-made rigid or semi-rigid orthotic may be necessary.

Also, while there were differences in lower extremity kinematics between male and female runners, there were no gender-specific effects of orthotics on ankle and knee joint kinematics during running. Therefore, the over-the-counter orthotic used in this study was no more effective in reducing abnormal gait mechanics in female versus male recreational runners.

REFERENCES

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