TACSM Abstract

The Effects of Shoe Design on Lower Limb Running Kinematics

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ABSTRACT

The preference of running as a form of exercise exposes more recreational athletes to the risk of injury. Stress fractures occur for 0.7-20% of all running injuries (Wilder & Sethi, 2004) and 24-50% of stress fractures occur in the tibia (Aweid, Aweid, Talibi, & Porter, 2013). Stress fractures have been associated with high vertical impact peaks while running (Willy & Davis, 2013) so methods such as barefoot running and minimalist shoes aim to reduce these impact peaks by enforcing a more forefoot running pattern. Shoes with a lower drop height have been shown to induce a more forefoot running pattern without the discomfort of running barefoot or in non-cushioned minimalist shoes (Horvais & Samozino, 2012). The purpose of this study was to compare ankle joint kinematics, dorsiflexor muscle activity, and tibial axial acceleration while wearing low and high heel-drop shoes. Six female participants (19.8(1.0) years, 163.0(3.8) cm, and 60.4(5.5) kg) who ran a minimum of 10 miles per week provided informed consent prior to testing. Participants were equipped with a 16g BioNomadix tri-axial accelerometer attached to the tibia, a Bi-axial electrogoniometer attached at the ankle, two Ag-AgCl surface electrodes attached to the tibialis anterior with adhesive discs, one reference electrode placed on the anteromedial aspect of the tibia (not above a muscle), and a heart rate monitor. Participants completed two data running trials at a target effort of 65-70% of the heart rate reserve. Trials were performed in different shoes (drop heights 4mm(S1) and 11.7mm(S2)) with a minimum 10-minute rest between trials. Paired t-tests were used to compare conditions for each variable. Mean ankle angles at ground contact (S1=100.9(3.8)°, S2=102.6(3.0)°) were not significantly different ($t(5)=-1.465$, $p=0.203$) and had a small effect size (Cohen $d=0.598$). Mean peak tibial accelerations (S1=5.22(2.51g), S2=5.90(2.90)g) were not significantly different ($t(5)=-1.238$, $p=0.271$) and had a small effect size (Cohen $d=0.505$). The mean percentages of maximal EMG for the tibialis anterior (S1=66.2(45.7)%, S2=55.6(38.5)%) were not significant ($t(5)=1.380$, $p=0.226$) and had a small effect size (Cohen $d=0.563$). Though differences were observed between shoe conditions for each participant, the shoe drop height did not significantly affect the measured variables and cannot be assumed to be responsible for these observed differences.