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Combination of Plantar Pressure and Star Excursion Balance Test for Evaluation of Dynamic Posture Control on High-Heeled Shoes

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Abstract : High-heeled shoes force the foot into plantar flexion position resulting in foot arch rising and disturbance of the articular congruence between the talus and tibiofibular mortice, all of which may increase the challenge of balance maintenance. Plantar pressure distribution of the stance limb during the star excursion balance test (SEBT) contributes to the understanding of potential sources of reaching excursions in SEBT. The purpose of this study is to evaluate the dynamic posture control while wearing high-heeled shoes using SEBT in a combination of plantar pressure measurement. Twenty healthy young females were recruited. Shoes of three heel heights were used: flat (0.8 cm), low (4.0 cm), high (6.6 cm). The testing grid of SEBT consists of three lines extending out at 120° from each other, which were defined as anterior, posteromedial, and posterolateral directions. Participants were instructed to stand on their dominant limb with the heel in the middle of the testing grid and hands on hips and to reach the non-stance limb as far as possible towards each direction. The distal portion of the reaching limb lightly touched the ground without shifting weight. Then returned the reaching limb to the beginning position. The excursion distances were normalized to leg length. The insole plantar measurement system was used to record peak pressure, contact area, and pressure-time integral of the stance limb. Results showed that normalized excursion distance decreased significantly as heel height increased. The changes of plantar pressure in SEBT as heel height increased were more obvious in the medial forefoot (MF), medial midfoot (MM), rearfoot areas. At MF, the peak pressure and pressure-time integral of low and high shoes increased significantly compared with that of flat shoes, while the contact area decreased significantly as heel height increased. At MM, peak pressure, contact area, and pressure-time integral of high and low shoes were significantly lower than that of flat shoes. To reduce posture instability, the stance limb plantar loading shifted to medial forefoot. Knowledge of this study identified dynamic posture control deficits while wearing high-heeled shoes and the critical role of the medial forefoot in dynamic balance maintenance.

Keywords : dynamic posture control, high-heeled shoes, plantar pressure, star excursion balance test.
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