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Effect of Two Types of Shoe Insole on the Dynamics of Lower Extremities Joints in Individuals with Leg Length Discrepancy during Stance Phase of Walking

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Abstract : Limb length discrepancy (LLD), or anisomeric, is defined as a condition in which paired limbs are noticeably unequal. Individuals with LLD during walking use compensatory mechanisms to dynamically lengthen the short limb and shorten the long limb to minimize the displacement of the body center of mass and consequently reduce body energy expenditure. Due to the compensatory movements created, LLD greater than 1 cm increases the odds of creating lumbar problems and hip and knee osteoarthritis. Insoles are non-surgical therapies that are recommended to improve the walking pattern, pain and create greater symmetry between the two lower limbs. However, it is not yet clear what effect insoles have on the variables related to injuries during walking. The aim of the present study was to evaluate the effect of internal and external heel lift insoles on pelvic kinematic in sagittal and frontal planes and lower extremity joint moments in individuals with mild leg length discrepancy during the stance phase of walking. Biomechanical data of twenty-eight men with structural leg length discrepancy of 10-25 mm were collected while they walked under three conditions: shoes without insole (SH), with internal heel lift insoles (IHLI) in shoes, and with external heal lift insole (EHLI). The tests were performed for both short and long legs. The pelvic kinematic and joint moment were measured with a motion capture system and force plate. Five walking trials were performed for each condition. The average value of five successful trials was used for further statistical analysis. Repeated measures ANCOVA with Bonferroni post hoc test were used for between-group comparisons ($p \leq 0.05$). In both internal and external heel lift insoles (IHLI, EHLI), there was a significant decrease in the peak values of lateral and anterior pelvic tilts of the long leg, hip, and knee moments of a long leg and ankle moment of short leg ($p \leq 0.05$). Furthermore, significant increases in peak values of lateral and anterior pelvic tilt of short leg in IHLI and EHLI were observed as compared to Shoe (SH) condition ($p \leq 0.01$). In addition, a significant difference was observed between the IHLI and EHLI conditions in peak anterior pelvic tilt of long leg and plantar flexor moment of short leg ($p=0.04$; $p= 0.04$ respectively). Our findings indicate that both IHLI and EHLI can play an important role in controlling excessive pelvic movements in the sagittal and frontal planes in individuals with mild LLD during walking. Furthermore, the EHLI may have a better effect in preventing musculoskeletal injuries compared to the IHLI.

Keywords : kinematic, leg length discrepancy, shoe insole, walking
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