

SHOE CONTROL OF FOOT MOTION DURING WALKING AND RUNNING

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INTRODUCTION: Rearfoot motion can be quantified in three dimensions by examining the movements of the rearfoot relative to the leg occurring at the ankle/subtalar joint complex. In turn, these movements can be broken down into their components of dorsiflexion/plantarflexion, inversion/eversion and adduction/abduction. The aim of the present study was to quantify the shoe control of rearfoot motion during walking and running.

METHODS: Sixteen subjects (eight males and eight females) underwent a series of walking and running trials with and without footwear. Surface markers were placed on the lower right leg and foot, and a wand marker system was fixed to the calcaneus. The wand marker system consisted of a shim connected to the heel with a screw-in three-dimensional array of markers attached. In the shoe condition this wand was replaced through a single hole in the heel counter of the shoe. All subjects were fitted with the same model shoe designed for motion control. The three-dimensional position of these markers during stance phase of movement was captured using a seven-camera motion analysis system and segment angles were calculated using a joint co-ordinate system. Repeated measures analysis of variance was conducted with main effects and interactions reported and a significance level set at $p < 0.05$.

RESULTS: The wand marker system was found to be valid and reliable for measuring rearfoot movement and no between trial effect was seen. Time series analysis showed an increase in dorsiflexion/plantarflexion and inversion/eversion range of motion when moving from walking to running (Table 1). Analysis of movement between barefoot condition and in-shoe condition showed an increase in dorsiflexion/plantarflexion (Figure 1) and abduction/adduction (Figure 2) in the in-shoe condition. No alteration to inversion/eversion range of motion was found.

Table 1 Discrete Measures for Barefoot Walking and Running

Variable	Discrete Measure (Walking)	Discrete Measure (Running)
Max Dorsiflexion	$14.34 \pm 1.77^\circ$	$21.09 \pm 0.31^\circ$
ROM – Inversion/Eversion	$11.95 \pm 0.75^\circ$	$15.16 \pm 0.56^\circ$

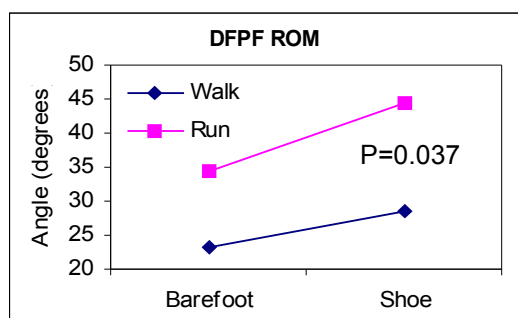


Figure 1 - DFPF ROM for walking and running

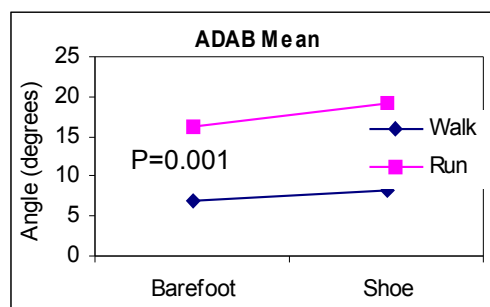


Figure 2 - ADAB Mean for walking and running

DISCUSSION: Markers placed on the shoe were also deemed valid as a measure of foot movement inside this particular shoe by the wand marker system. The shoe used in this study restricted the range of movement in the frontal plane to that of barefoot walking and running. However in the saggital and transverse planes the shoe caused the foot to move through a greater range of movement. For all planes in-shoe rearfoot motion was more variable than barefoot rearfoot motion.