

BIOMECHANICAL ANALYSIS OF ROUNDED OUTSOLE DESIGN SHOE DURING WALKING

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INTRODUCTION: Studies have investigated biomechanical benefits of functional walking shoes such as unstable (Nigg, et al., 2006) or rounded outsole design shoes. However, it is still unclear how they influence lower extremity biomechanics during movement. The purpose of this study was to determine biomechanical differences and its mechanism of newly designed power walking shoes with lifted toe design compared to control shoe and bare foot conditions for middle-age females.

METHODS: Ten healthy females (43.6±2.99 years, 55.3±5.23 kg, 158.7±4.64 cm, shoe size: 235 mm) participated in this study. Kinematic and kinetic data were collected for the right leg of each subject during walking with 3 different shoe conditions (Figure 1). Subjects walked on a 10 m walkway at self-selected speed monitored by a motion capture system (Motion Analysis Corp., USA) and a force platform (AMTI, USA). The kinematic and kinetic data were filtered using a fourth order low-pass Butterworth filter with a cut-off frequency of 6 Hz and 100 Hz, respectively. Knee moment was calculated using a standard inverse dynamics approach while knee angle was calculated using a segment coordinate system (SCS).



Figure 1: Tested shoe model (A: Control, B: Power walking and C: Bare foot)

RESULTS: There were statistical differences in knee moment and ROM between type B shoe and type C ($P < 0.05$). Subjects tended to have higher knee moment (abduction) when wearing type B shoes during walking compared to type A and type C shoes.

	Frontal	Sagittal	Transverse
A Type	9.05±3.30	63.20±3.56	16.64±5.40
B Type	9.41±3.98	70.03±4.18	19.46±5.66
C Type	9.10±3.74	60.68±3.45	18.80±6.64

	Frontal	Sagittal	Transverse
A Type	0.302±0.095	0.577±0.250	0.019±0.012
B Type	0.305±0.076	0.576±0.233	0.018±0.014
C Type	0.261±0.078	0.555±0.213	0.023±0.017

Bolded number indicates significant differences at $\alpha = 0.05$

DISCUSSION & CONCLUSION: As range of knee movement and knee moments increased with Type B shoes it may have a positive training effect as an exercise tool during walking. Long-term effect on biomechanical factors is unclear; kinetic and kinematic and EMG will be needed to be examined. This research concludes that the shoe B type has an immediate effect on biomechanical variables during walking.

REFERENCES: Nigg B. M., Hintzen S. and Ferber, R. (2006). Effect of an unstable shoe construction on lower extremity gait. *Clinical Biomechanics*, 21(1), 82-88.