A Comparison of Loading Patterns Between Shod and Unshod Walking in ACLR Individuals

Introduction: Ground reaction force (GRF) is the equal and opposite force that the ground returns to the body during movement. The vertical component of GRF (vGRF) is commonly used to characterize gait patterns during walking, and has been associated with outcomes of knee joint health. vGRF differs between shod and unshod walking in uninjured individuals. However, the effects of walking condition on vGRF waveforms remains unknown in anterior cruciate ligament replacement (ACLR) populations. Characterizing the differences between shod and unshod walking provides necessary understanding for accurate interpretation and comparison of shod and unshod gait biomechanics in ACLR individuals.

Purpose: To compare vGRF waveforms between shod and unshod walking.

Hypothesis: Shod walking will increase vGRF peaks and decrease vGRF during midstance compared to unshod walking waveforms.

Methods: Twenty-nine individuals 6-12 months post-ACLR completed five shod and unshod walking trials at self-selected walking speeds over two staggered and embedded force plates. Force data was sampled at 1200 Hz and low-pass filtered at 10 Hz. Functional waveform analyses of variance were used to compare vGRF during shod and unshod walking throughout stance phase of gait.

Results: Shod walking produced smaller vGRF than unshod walking during weight acceptance, midstance and push off portions of stance, and produced larger vGRF during first peak. Post-hoc analysis using a tenfold cross validation identified the following model to predict first peak vGRF during shod walking (RMSE = 0.0219 BW):

\[ v\text{GRF shod} = (1.0606 \times \text{peak vGRF unshod}) + (-0.3454 \times \text{speed unshod}) + (0.3856 \times \text{speed shod}) + -0.0976 \]