

MUSCLE CO-CONTRACTION AROUND THE KNEE IS INCREASED WHEN WALKING WITH AN UNSTABLE SHOE CONSTRUCTION

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AIM: The purpose of this study was to compare co-contraction levels around the knee when walking with an unstable shoe construction compared to walking with a regular shoe.

METHODS: In this study data of one previously conducted study focusing on gait biomechanics during walking with a regular and with an unstable shoe constructions, Masai Barefoot Technology (MBT), was used retrospectively. 12 healthy (7 male and 5 female) participants (age: 25 ± 6 years, height: 174 ± 7 cm, mass: 68 ± 10 kg) were asked to walk with both, a regular shoe and with the MBT shoe at self-selected walking speed at a 10-meter walkway. Surface EMG data were recorded and time normalized to one gait cycle. Resulting linear envelopes were then amplitude normalized to the mean peak muscle activity of all valid control shoe trials (= 100%). This time series then was used for calculating the co-contraction indices (CCI) for following opposing muscle groups: vastus medialis to biceps femoris (VM/BF), vastus lateralis to biceps femoris (VL/BF), vastus medialis to gastrocnemius medialis (VM/GMM), vastus lateralis to gastrocnemius medialis (VL/GMM) and tibialis anterior to gastrocnemius medialis (TA/GMM).

RESULTS: Comparing co-contraction between opposing muscle groups around the knee when walking with MBT and regular shoes revealed some statistically significant alterations. For the first half of stance, CCI increased for VL/GMM ($p = 0.002$; 95% CI: 2.1-7.1) and for VM/GMM ($p = 0.007$; 95% CI: 1.5-7.1) (see Figure 1). Both, VM/GMM and VL/GMM, showed trends towards an increase of co-contraction level ($p < 0.1$) during the second half of stance, but failed to reach significance. Co-contraction for VM/BF also showed a significant increase for walking with MBT shoes during first half of stance ($p = 0.046$; 95% CI: 0.1-8.3). Neither TA/GMM nor VL/BF showed significant differences during first or second half of stance.

CONCLUSION: Results were highly consistent to an earlier published study focusing on CCI when walking with MBT shoes. Based on the findings of this study, it can be concluded that MBT shoes significantly increase co-contraction between the quadriceps and gastrocnemius muscles when walking at self-selected walking speed.

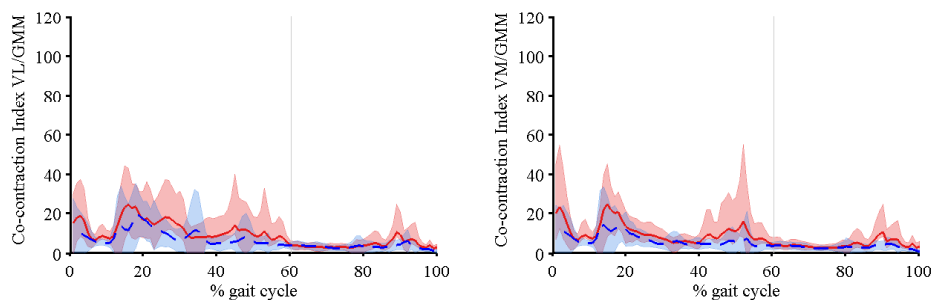


Figure 1: Mean co-contraction index (CCI) for VM/GMM and VL/GMM wave forms and the corresponding standard deviation for walking with the stable shoes (dashed line) and MBT shoes (solid line). The vertical line shows toe-off.