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Gait Mechanics And Proprioceptive Adaptations From Minimalistic "Five-Finger" Shoe Use

Holly N. Remmenga
University of Nebraska at Omaha, hremmenga@gmav.unomaha.edu

M. L. McGrath

Sara A. Myers
University of Nebraska at Omaha, samyers@unomaha.edu

Neal Grandgenett
University of Nebraska at Omaha, ngrandgenett@unomaha.edu

T. L. Grindstaff

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Remmenga H, McGrath ML, Myers SA, Grandgenett N, Grindstaff TL: University of Nebraska, Omaha, NE; St. John's University, Collegeville, MN; Creighton University, Omaha, NE

Context: Barefoot running is a growing phenomenon in the running community and has spurred the popularity of minimalistic shoe use. Little is known about how minimalistic shoed running effects gait mechanics and relatively no research has been performed to analyze how the habitual use of these shoes effects proprioception. **Objective:** To determine the proprioceptive and gait differences of traditional shod individuals (TRAD) compared to their counterparts with habitual minimalistic five-finger shoe use (MIN). Specifically comparing measures of time to stabilization, gait mechanics and kinematics, as well as any transfer of potential adaptations back to the normal shod condition. **Design:** Cross-sectional comparative study. **Setting:** Biomechanics laboratory. **Patients or Other Participants:** Two groups of subjects were recruited: eight TRAD subjects (6 M, 2 F: age: 23.4 ± 2.3 years, height: 177.7 ± 7.8 cm, mass: 74.2 ± 10.8 kg) and seven MIN individuals (5 M, 2 F: age:26.1 ± 4.7 years, height:176.07.7 cm, mass: 79.7 ± 13.3 kg) who had been running in minimalistic "five-finger" shoes for a minimum of six months. All subjects ran at least ten miles per week for six continuous months or more. **Intervention(s):** Each subject performed a time to stabilization test (TTS), involving a jump over a hurdle and landing on his/her right foot, holding the landing position for 20 seconds. Subjects also completed 10 over ground running tests at a self-selected running pace. These two tests were conducted under three different shoewear conditions; barefoot (BF), normal running shoes/minimalistic five-finger shoes (SHOE), and in standardized laboratory footwear (LAB). **Main Outcome Measure(s):** Gait mechanics were captured using a Motion Capture System and analyzed by Cortex Motion Analysis Software. Ground reaction forces were collected on a force platform. TTS was calculated using previously published methods. Separate 2x3 mixed model ANOVAs were conducted for stride length, stride frequency, maximum stance phase sagittal plane angles at the ankle, knee, and hip, impact force, peak force, anterior-posterior TTS, and medial-lateral TTS in each of the three conditions. Foot strike pattern (forefoot, rearfoot) was analyzed using a Chi squared test ($\alpha \leq 0.05$). **Results:** MIN group demonstrated greater stride frequency (MIN: 0.52 ± 0.18 sec/stride, TRAD: 0.67 ± 0.14 sec/stride, $F(1, 26) = 6.330$, $p = 0.026$), greater maximum hip flexion (MIN: 36.02 ± 7.34°, TRAD: 25.89 ± 5.61°, $F(1, 24) = 9.026$, $p = 0.011$) and less extension (MIN: -9.27 ± 4.43°, TRAD: -13.32 ± 2.34°, $F(1, 24) = 5.326$, $p = 0.040$) compared to TRAD. One difference was observed between the 3 shoewear conditions: hip extension ($F(2, 24) = 3.708$, $p = 0.040$). Bonferroni pairwise comparisons revealed that BF (-11.93 ± 3.60°) resulted in greater hip extension than SHOE (-10.79 ± 3.58°) ($p = 0.044$). **Conclusions:** This study yielded few significant differences in gait mechanics between MIN and TRAD and no difference in dynamic TTS. The three conditions (BF, SHOE, LAB) were also similar. However, the differences in stride frequency and hip angles suggest alterations in gait, possibly as a result of minimalistic shoe use. These alterations suggest that new minimalistic shoe users should take time to adapt to new gait parameters in order to prevent injury.