Comparison of Hip Electromyographic Patterns During Overground Versus Treadmill Gait in Healthy Females

Ian Al’khafaji, Alexis Wright, Kevin Ford, Nicholas Pritchard, Steven Dischiavi, Allston J. Stubbs
Wake Forest University School of Medicine, High Point University Congdon School of Health Science, Winston Salem, High Point, North Carolina, USA

FDA Status: Not Applicable

Summary: This study’s goal is to better understand the electromyographic patterns of overground versus treadmill gait in females and concluded that only gluteus maximus has a significant increase in activation during treadmill gait.

Introduction: A greater understanding of muscle activity during treadmill and overground gait is needed to optimize post-operative hip rehabilitation protocols. More specifically, one can determine if treadmill use alters normal gait patterns. The purpose of this study is to compare hip muscle activation patterns during overground gait and treadmill gait in healthy individuals with no known lower extremity injuries. Our hypothesis is that there will be a significant difference in muscle activation patterns when comparing treadmill and overground gait.

Methods: Thirteen females, mean age 20.4 (1.0) yrs, mean BMI 22.8 (4.0) kg/m2, participated in the study. Prior to data collection, subjects performed three trials of the overground gait task at a self-selected speed over 10 meters. Average velocity was calculated and used to standardize gait velocity during treadmill and overground conditions. Delsys Trigno Wireless surface electromyographic (EMG) electrodes were placed on the gluteus maximus, gluteus medius, tensor fasciae latae, and rectus femoris. EMG data was recorded on the dominant leg as each subject walked over a smooth, flat surface for 10 m and a Woodway ELG treadmill, in randomized order. Participant data was averaged over the three trials. For the treadmill component, subjects were allowed to familiarize themselves with the treadmill after which subject data was collected over three, 30 second time intervals. All signals were normalized to the peak average overground signal and time normalized from 0 to 100% of the gait cycle. Paired sample t-tests were used to detect differences between conditions (p < 0.05).

Results: The average walking speed collected in real-time was 1.4 (0.2) m/s. Activation patterns of hip musculature during the overground gait cycle was consistent with previous findings. A significant difference between treadmill and overground gait was seen in the gluteus maximus during the initial loading response. During loading response (0-10% of gait cycle), the gluteus maximus muscle activity was greater during treadmill gait (86.6% (17.2%)) compared to overground gait (78.2% (13.1%) (p = 0.034)). No significant differences (p > 0.05) were found for the gluteus medius, tensor fasciae latae, or rectus femoris.

Conclusions: In this study group of female subjects, the hypothesis was supported demonstrating significant activation differences in the gluteus maximus muscle between treadmill and overground gait tasks. Other muscle groups comprising the gluteus medius, tensor fasciae latae, and rectus femoris were unaffected. Our findings with treadmill use may support one etiology of hip pain in the postoperative hip arthroscopy setting in which treadmill induced muscle imbalance impairs hip neuromuscular function.