TACSM Abstract

Effect of Gait Speed on Knee Extensor Eccentric Control during Unpredictable Abrupt Gait Termination

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ABSTRACT

Unpredictable gait termination is an important and common functional ability to prevent pedestrian accidents and/or falls. To dissipate kinetic energy and recover balance during unpredictable gait termination, knee extensor eccentric control in the stopping leg decelerates forward momentum and absorbs downward ground impact resisting body weight against gravity. Therefore, knee extensor eccentric control plays an important role in balance recovery as the initial defense against falls during unpredictable abrupt gait termination. In real world scenarios, required walking speeds are unpredictable and ever-changing. However, the influence of gait speed on the characteristics of knee extensor eccentric control during unpredictable abrupt gait termination have not yet been studied. **PURPOSE:** To examine the effects of gait speed on knee extensor eccentric control during unpredictable abrupt gait termination. **METHODS:** Ten healthy younger adults participated in this study (mean age = 20.7 ± 1.8 years). All participants performed unpredictable abrupt gait termination for each trial at various gait speeds. In response to a visual light cue, each participant was asked to stop walking and freeze their motion for 3 seconds. Each test session was comprised of a total of 10 trials for each of the three walking speeds (preferred walking speed (100%), slow (80%), and fast (120%)) in a random order. The stopping leg during each trial of abrupt gait termination was analyzed. The outcome variables are 1) vastus medialis (VM) and vastus lateralis (VL) electromyography (EMG) burst duration, 2) area under EMG curve, 3) knee flexion angle, and 4) knee power during knee extensor eccentric control. One-way multivariate analysis (MANOVA) was used for each variable with Tukey's post hoc test to correct for multiple comparisons. A Pearson's correlation was used to examine the correlation between speed and each variable of eccentric control. **RESULTS:** Fast gait speed requires greater eccentric control across all the EMG and kinematic variables compared to slow gait speed (all $p < 0.01$). Compared to normal gait speed, fast gait speed requires longer VL and VM EMG burst duration (both $p < 0.01$), greater VM EMG area under the curve ($p < 0.01$), and greater knee power ($p = 0.04$). There was a positive correlation between gait speed and knee extensor eccentric control (1. EMG burst duration: VL (r = 0.55) and VM (r = 0.57), 2. EMG area under curve: VL (r = 0.69) and VM (r=0.74), and 3. knee power (r = 0.73), all $p < 0.01$). **CONCLUSION:** The findings of our study demonstrated that unpredictable abrupt gait termination at a high walking speed requires greater knee eccentric control than at normal and slow speeds. We also found that as gait speed increases, greater knee eccentric control is required for adequate balance recovery following unpredictable gait termination. The positive correlation between walking speed and the need for greater knee extensor eccentric control for balance recovery from gait termination informs important clinical insights to create fall prevention interventions that integrate knee extensor eccentric strengthening to improve dynamic balance controls.