

## Postural and Movement Characteristics of Multidirectional Gait Initiation

KUANTING CHEN & ADAM KING

Motor Behavior Laboratory; Department of Kinesiology; Texas Christian University; Fort Worth, TX

---

Category: *Masters*

Advisor / Mentor: King, Adam (a.king@tcu.edu)

### ABSTRACT

Voluntary gait initiation (GI) comprises a preceding anticipatory postural adjustment (APA) phase and a stepping phase where the lower leg functions complementarily as a stance leg and a swing leg. Understanding how stepping leg and obstacle negotiation shape the organization of GI has benefited the rehabilitation for individuals with unilateral limb dysfunction and facilitated the development of fall prevention programs. However, these studies primarily examined the forward GI than the multidirectional GI which is common in daily activities and sports. **PURPOSE:** To investigate the effects of stepping leg and obstacle negotiation on the APA characteristics and stepping kinematics of healthy young adults when performing multidirectional gait initiation. **METHODS:** Fourteen right-leg dominant frequent exercisers (M: 7, F: 7; age:  $22.4 \pm 2.4$ ; physical activities: frequency =  $4.6 \pm 1.3$  times per week, duration =  $75.0 \pm 36.3$  minutes per session) performed 5 trials of GI at their comfortable pace per condition. Experimental conditions included legs (Left or Right), obstacle (a 15cm-height hurdle; presence or absence), and directions (forward: F00, lateral: L90, medial 45 degrees: M45, lateral 45 degrees: L45). APA parameters were collected through a force plate, and the stepping characteristics were captured by an 8-camera motion capture system. Repeated Measure ANOVAs with legs, direction, and obstacle as within factors were used to assess the statistical significance. Bonferroni pairwise comparison was applied to specify the conditional effects. **RESULTS:** When performing L90, participants demonstrated significantly smaller and faster APA ( $\Delta$  magnitude: -0.03, -0.04 m,  $\Delta$  velocity: -0.07, -0.08  $\text{ms}^{-1}$  for AP and ML respectively) and slower stepping velocity ( $\Delta$ : 0.40  $\text{ms}^{-1}$ ) with greater variability in stepping path ( $\Delta$ : 0.19 m) comparing to the F00. The presence of the hurdle influenced mediolateral APA parameters more than the ones in the anteroposterior direction especially when stepping to the lateral directions (L45, L90). Subjects also stepped further ( $\Delta$ : 0.12 m) with longer duration ( $\Delta$ : 0.28s) and faster ( $\Delta$ : -0.29  $\text{ms}^{-1}$ ) when stepping over the hurdle. On average, the APA remained relatively consistent between left and right, while the right leg stepping was slower ( $\Delta$ : 0.10  $\text{ms}^{-1}$ ) than the left leg stepping. **CONCLUSION:** Stepping leg and the presence of an obstacle are influential factors to the APA and stepping characteristics of multidirectional GI; however, these changes depend on the directions of GI. Stepping toward lateral directions generally imposes a larger degree of unfamiliarity which is more susceptible to the ecological constraints comparing to the forward stepping. Therefore, we recommend practitioners to implement ecological approach and increase the exposure of lateral movements in rehabilitation and training programs to enhance versatility of their clients.