

## **Does Increased Walking Velocity Increase Fall Risk While Negotiating a Curb?**

Abbie Ferris, Emily Crisman, Christopher Silvernale, Jordan Real, Jeremy D. Smith  
Biomechanics Laboratory, University of Northern Colorado, Greeley, CO  
email: [abbie.ferris@unco.edu](mailto:abbie.ferris@unco.edu)

Slips, trips, and falls on level or uneven surfaces are the 7<sup>th</sup> leading cause of death in the US. During curb negotiation, older adults produce larger braking impulses and smaller propulsive impulses while stepping on and off raised surfaces compared to younger adults. Decreased lead foot clearance was also found in older adults, indicative of increased fall risk (Begg & Sparrow, 2000). Walking at faster than preferred speed may also increase fall risk. Our purpose was to evaluate ground reaction forces (GRF) and toe and heel clearance, between preferred and fast walking speeds. Ten healthy young adults negotiated a curb (16 cm) created using a force plate mounted to a steel frame and bolted to the floor spanning the force plates embedded in the floor below. Participants walked at their preferred and a fast speed up and down the curb. When stepping up a curb, larger braking impulses ( $23.2 \pm 7.7$  vs.  $36.5 \pm 11.5$  Ns, preferred speed) were produced by the leg on the floor compared to the limb stepping onto the curb. Regarding speed effects, the only notable impulse difference was that the limb stepping onto the curb produced greater propulsive impulses ( $22.6 \pm 8.1$  vs.  $32.5 \pm 8.9$  Ns) during the preferred speed. This suggests less momentum was carried onto the curb, requiring a greater propulsive impulse on the curb to return to the preferred speed in the next step. Peak vertical GRFs were significantly greater for the limb pushing off the ground compared to the GRFs produced on the curb. In addition, the vertical impulses on the ground were greater in comparison to those on the curb ( $415.5 \pm 81.7$  vs.  $443.80 \pm 91.2$  Ns, preferred speed) suggesting participants initiated the transition up the curb from the previous step and used the curb limb to stabilize the transition. Finally, lead foot toe clearance at the curb edge significantly increased during fast walking ( $27.6 \pm 2.4$  vs.  $30.3 \pm 3.6$  cm). Interestingly, the only significant differences found when stepping down the curb were that vertical GRFs (both speeds) and impulse (preferred speed) were greater for the limb landing on the ground compared to the curb limb. In general, these results suggest that walking speed had little effect on fall risk other than on response time to a perturbation, such as a trip, which is less when walking faster. Given the increased the safety factor (i.e., increased toe clearance), this may suggest one way which the neuromuscular system accounts for the reduced response time.

### **REFERENCES**

Begg, R. K., and Sparrow, W. A. (2000). *J Gerontology*, 55(3), M147-154.