Are attentional demands increased when carrying a load while stepping over obstacles?

Over the past several years an extensive body of research has demonstrated that gait and postural control are not as automated as was previously thought. However, the extent to which different locomotor tasks draw on attentional resources is not well characterized. For example, it is unclear whether common daily tasks such as obstacle avoidance and load carriage increase the attentional demands associated with the control of gait. The demands associated with obstacle avoidance and carrying during gait may be enhanced not only by the potential need to stabilize and avoid dropping the load, but also by the potential for visual occlusion of the obstacle by the load being carried, for example when carrying a laundry basket and simultaneously navigating a cluttered environment.

Better understanding of the attentional demands associated with locomotor tasks plays an important role in fall prevention, especially in the elderly. For example, tripping over obstacles and instability have been reported as two of the most common causes of falls in older adults, and increasing the cognitive demands during an obstacle clearance task has been associated with increased risk of tripping.

In this paper we use a probe reaction time test to measure the attentional demands associated with carrying an anterior load while clearing an obstacle. Our results clearly suggest that visual occlusion and heavier loads during carrying are associated with increased attentional demands while stepping over an obstacle, as well as a reduction in toe clearance and trail limb toe distance form the obstacle (see Perry et al. 2010). These findings imply that the risk of tripping over an obstacle in the travel path is elevated during carrying tasks, especially in an environment with other attentional demands or distractions. Recognizing the link between these risk factors provides insight that can be applied to future fall-risk reduction strategies.

Reference: Hawkins KM, Perry CJ, Kiriella JB, Shanahan CJ, Moore AE, **Gage WH**. Attentional demands associated with obstacle crossing while carrying a load. J Mot Behav. 2011;43(1):37-44.

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Peripheral vascular disease affects millions in North America and is caused by arterial blockages, usually in the upper thigh region, which lead to inadequate delivery of blood to leg muscles (ischemia). Individuals with peripheral vascular disease may suffer a range of debilitating effects, from exercise intolerance to limb amputation. Currently, there are few successful treatments for peripheral vascular disease. Increasing the growth of new blood vessels within the oxygen-starved muscles is thought to be one means to enhance the muscle function and prevent

limb amputations. Unfortunately, physiological mechanisms that stimulate blood vessel growth ultimately fail within the ischemic skeletal muscle.

We hypothesized that muscles with long term reduced blood flow increase the production of factors that inhibit the normal growth of new blood vessels. In this study, we assessed whether ischemia increases the production of FoxO1, which is a transcription factor known to inhibit cell growth and cause cell death. We found that FoxO1 protein is much greater in ischemia leg muscles, and that within the ischemic muscle, FoxO1 protein is highest in the capillaries. We determined that ischemia was associated with reduced levels of a negative regulator of FoxO1, phosphorylated Mdm2. By demonstrating that there was reduced interaction between Mdm2 and FoxO1 in ischemic endothelial cells, we provide novel evidence that Mdm2 is a regulator of FoxO1 in endothelial cells. Thus, our study is the first to demonstrate that ischemia results in elevated levels of FoxO1, which may caused by reduced levels of phosphorylated Mdm2. These experiments provide support for the hypothesis that ischemia causes increased production of factors that prevent the normal growth of blood vessels, and set the stage for further investigation of the role of FoxO1 in peripheral vascular disease.

Reference: Milkiewicz M, Roudier E, Doyle JL, Trifonova A, Birot O, **Haas TL**. Identification of a mechanism underlying regulation of the anti-angiogenic forkhead transcription factor FoxO1 in cultured endothelial cells and ischemic muscle. Am J Pathol. **2011** Feb;178(2):935-44.

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