



Poster # 33

Title of poster: Slip-resistant winter footwear design and testing for older adults

Abstract

We all know an elderly friend or relative who has broken a hip or an arm after a fall on ice or snow. This winter was particularly treacherous in North America. Even the elderly who avoided a fall likely felt confined in their own homes for long stretches. Falls and the inactivity resulting from the fear of falling both lead to dramatic declines in the health of older adults each winter. At Toronto Rehab we are developing better footwear in WinterLab by testing on real ice and snow. We can tilt this lab to measure the maximum angle that someone can walk up, across and down a wintry slope. The results show remarkable repeatability and can distinguish between the performance of footwear with much greater certainty than existing methods. Our results can be surprising. While most good winter footwear manages slopes up to about 7°, one undistinguished smooth boot enabled us to walk up and down 18° slopes on wet ice!

The winter footwear slip resistance testing program at Toronto Rehabilitation Institute aims to reduce instances of slips and falls in older adults. Our objectives are to:

- (1) Improve winter footwear slip resistance standards
- (2) Test, classify and develop an easy to understand labeling system for consumers so they can select the best performing footwear
- (3) Develop new materials and designs for high performance winter footwear

Current winter footwear slip resistance standards rely on measuring the force required (coefficient of friction) to drag a fixture-mounted shoe across an ice surface. Our testing has shown that user-worn shoe testing based on real users walking up ice slopes is a more ecologically valid approach as it involves a subject's natural gait cycle and biomechanics. This is particularly a concern when selecting winter footwear for older adults as their balance abilities and reaction times are severely impaired.

We are also exploring new materials and design strategies to improve the slip resistance of winter footwear with the aim of developing universal footwear for indoor use on hard tile surfaces and outdoors on snow and ice. We have developed a new rubber compound that is a hybrid of a soft rubber and a hard fibrous phase, and which according to preliminary testing possesses a three times greater coefficient of friction on ice than other similar compounds. This material grips ice similar to metal cleats but remains soft and flexible for use on hard tile indoor surfaces. Our work considers the design of optimal tread patterns on winter footwear and we use 3D printing technology for fast and iterative slip resistance testing of evolving tread patterns. The knowledge generated from these activities will increase awareness regarding winter issues facing older adults and provide solutions to these issues through winter footwear testing and design. Addressing these issues is essential now more than ever due to our nation's shifting demographics and the pressing need for older adults to remain physically active in all seasons as they age.

