

Older Adults are Less Sensitive to the Contrast Level of an Obstacle on the Floor than Young Adults

Purpose:

Tripping over obstacles can cause falls and is therefore a health concern for both young and older adults. The ability to discern features of obstacles on the ground is important to avoid tripping. The purpose of this study was to determine how the contrast of obstacles on the ground affects foot clearance when stepping over a single obstacle in older versus younger adults.

Methods:

Twelve normally sighted adults, 5 older (mean 68.8 years, SD 3.56) and 7 younger (mean 24.67 years, SD 2.31), walked along a 6-meter, black carpeted walkway. Visual acuity (VA) and contrast sensitivity (CS) were measured with the Early Treatment Diabetic Retinopathy Study and Pelli Robson charts respectively. Subjects walked along the path and stepped over a single obstacle positioned 4 m from the start that varied in both height (1 cm and 19 cm) and contrast (6% and 90% Michelson contrast). Each subject completed 10 trials for each of the 4 randomized conditions. Lower limb kinematics were recorded using 13 motion capture cameras. Foot clearance (FC) was calculated as the vertical distance between the top of the obstacle and the distal toe or heel of the subject's shoe, whichever was closer to the top of the obstacle. A repeated-measures ANOVA was run to assess how FC in the lead foot changed as a function of age group, obstacle height and contrast. Post-hoc analyses were done as appropriate with Bonferroni correction to assess for any significant interactions. Independent t-tests were run to compare subject variables.

Results:

VA was similar in both groups ($P = .580$) though CS was higher in the young relative to older adults ($P = .024$). Lead FC was significantly higher for the young versus older adults ($P < .001$), tall versus short obstacles ($P < .001$), and high contrast versus low contrast obstacles ($P = .046$). The Contrast x Height interaction was not significant ($P = 0.580$). Pairwise comparisons showed no significant difference in FC between high and low contrast obstacles for both the short ($P = .180$) and the tall ($P = .133$) obstacles. There was a significant Group x Contrast interaction ($P = .046$). Pairwise comparisons showed that the young adults had greater FC for the high contrast compared to the low contrast obstacle ($P = .002$), but there was no significant difference in FC between the contrast levels for the older adults ($P = .997$).

Conclusions:

While young adults lift their feet higher to step over a more visible (high contrast) obstacle, older adults do not. The behavior of the older adults may be explained by reduced visibility of the high contrast obstacle due to an age-related decline in CS. Young adults adjust their FC based on obstacle contrast, while older adults do not, indicating that older adults are not as visually sensitive to obstacle features. Recruitment of normally sighted and vision impaired participants is ongoing to confirm these observations.

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