



KEY POINT SUMMARY

OBJECTIVES

The focus of the current study was on understanding the effects of a novel lighting system that provided enhanced perceptual cues on balance control among older adults. It was hypothesized that, together with low-level illumination from conventional nightlights, laser lines that demarcate a pathway should provide older adults with perceptual cues about the horizontal walking plane, and therefore, improve gait measures in two populations of older adults, those with high and low falls risks (HFR and LFR, respectively). A second lighting system that was designed to provide low-level ambient illumination together with enhanced horizontal plane information to a person while walking was tested using the GAITRite© Mat.

Lighting and Perceptual Cues: Effects on Gait Measures of Older Adults at High and Low Risk for Falls

Figueiro, M., Plitnik, B., Rea, M., Gras, L., Rea, M. S.
 2011 / *BMC Geriatrics*
 Volume 11, Issue 49, Pages 1471-2318

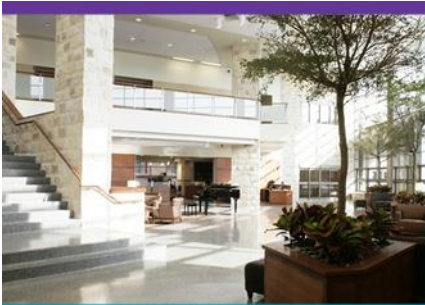
Key Concepts/Context

The visual system plays an important role in maintaining balance while navigating the environment. Older adults often depend heavily on visual information to maintain balance and orientation due to age related changes that affect their vestibular system (contributes to balance and spatial orientation) and somatosensory system (that moderates sensations of touch, smell etc.). Even small reductions in visibility could severely impact their gait and balance and potentially result in a fall. Even in healthy older adults, gait becomes slower and step lengths become shorter under dim lighting conditions.

Methods

Twenty-four older adults, aged 65 and older were recruited to participate in this study. Twelve of these participants had a history of falling in the six month period before the study and 12 participants had not fallen in the six-month period. Falls risk was assessed using the Berg Balance scale. Based on their score on this scale as well as an understanding of their history of fall in the past 6 month period, they were classified as either at high risk for falls (HFR) or low risk for falls (LFR).

Three lighting conditions were tested: 1) general ceiling-mounted fixtures; 2) conventional plug-in incandescent night lights; 3) plug-in night lights supplemented by laser lines outlining the pathway. Gait measures such as step length, stride length and velocity were measured using The GAITRite© Mat system, a 4.6- meter (12 feet) long flexible mat with built-in pressure activated sensors. Study participants were asked to begin walking two meters before the mat threshold (to ensure that they were demonstrating their steady gait pattern), walk over the mat at



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a comfortable speed, and continue walking two meters beyond the end of the mat. Participants were asked to perform four trials under every lighting condition.

Findings

Participants performed best under the general ceiling-mounted light system and worst under the night light alone. Step length was significantly higher for all participants under the ambient ceiling mounted light condition as compared to night lights alone or night light with lighted pathway. Older adults at HFR were significantly slower under night lights alone as compared to the ambient condition or night lights plus pathway light. Their velocity under the ambient light condition or the night lights plus pathway light condition was not significantly different. The pathway plus night lights increased gait velocity and reduced step length variability compared to the night lights alone in those at greater risk of falling. Thus, providing additional perceptual cues in a dim light condition helped in increasing postural stability and control for adults at higher risk of falling. Compared to HFR older adults, LFR older adults were less impacted by the use of perceptual cues.

Limitations

Limitations identified by the authors include:

- A relatively small sample size
- Sample comprised only of healthy older adults so results should not be directly generalized to other older adults with high-level gait disorders.
- Study participants had normal visual acuity. However, many older adults especially those living in long term care environments may have visual impairments and additional studies may be needed to understand if the lighted pathways are effective for those populations as well.
- Additionally, this is a controlled laboratory study. In a real life context, other environmental conditions (such as abrupt loud noises) or individual conditions (medication use, drowsiness) may also impact an individual's perception of their visual environment and their ability to navigate using the pathway lights. There is a need for additional studies conducted in live settings to understand the effectiveness of this intervention in improving balance and stability and in reducing falls.

Design Implications

Use of pathway lights that provide perceptual cues about horizontal and vertical surfaces along with dim night lights may help in improving balance and control among older adults at high risk for falling.