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COHORT FEASIBILITY STUDY

Multifactoral measures of fall risk in the visually impaired population: A pilot study

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KEYWORDS
Visual impairment;
Accidental fall;
Risk assessment;
Physical examination;
Interdisciplinary communication

Summary *Objective:* To determine the feasibility of taking multiple measures of visual and physical function in adults with visual impairment. A second objective was to obtain preliminary data on risk for falls in this population.
Design: Cohort feasibility study.
Setting: University ambulatory patient care center and research center.
Participants: Convenience sample of community-dwelling men and women over age 18 with visual impairment (n = 12). Thirteen subjects were enrolled in the study; one was subsequently excluded due to self-reported cognitive decline at time of testing. Subjects were grouped by prospective fall incidence.
Interventions: Verbal education.
Main outcome measures: Subjective measures of function; objective measures of visual and physical function.
Results: Visually impaired adults can safely complete a battery of physical functions to predict fall risk. Recent onset of visual impairment was correlated with higher fall risk [-0.53 ± 0.22, $p = 0.04$].
Conclusions: It is feasible for an interdisciplinary team to measure risk for falls in adults with a visual impairment. Further investigation is needed to identify predictors of falls in adults of all ages with visual impairment.

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Introduction

Intervention across the lifespan is ideal to maximize quality of life for people with visual impairment (Leissner et al., 2014). The World Health Organization (WHO) classifies visual impairment as a decrease in visual acuity or a reduction in visual field (WHO, 2015). People with visual impairment may experience more handicap or disability, specifically related to mobility problems and reduced participation (Owsley et al., 2009). Visual impairment is on the rise due to increasing incidence in the United States (Ko et al., 2012). This population may seek care from a variety of healthcare providers including physicians, rehabilitation specialists, and eye care providers. The low vision population has different challenges with movement and navigating the environment than the sighted population. A person without visual impairment constantly scans the area, gathering information to formulate a motor plan to avoid obstacles. People with visual impairment use a variety of approaches, including compensatory tactile strategies to guide their movement plan (Wade and Jones, 1997).

Visual impairment causes problems across the lifespan, as it is linked to fall risk in the elderly (Lord and Dayhew, 2001; Kulmala et al., 2008), and poor health in younger adults (Leissner et al., 2014). Among the elderly, multifactoral risk factors for falls include medicine side-effects, cognitive decline, loss of mobility, and visual impairment (Graafmans et al., 1996; Tinetti et al., 1988). Visual impairment in younger adults is linked to inactivity, higher body mass index (BMI), and poor balance reactions (Leissner et al., 2014; Ramulu, 2012) as well as an increase in chronic health conditions (Leissner et al., 2014). All the above mentioned factors can lead to falls (Wu et al., 2012; Fjeldstad et al., 2008).

The level and cause of visual impairment leading to fall risk is less clear, as characteristics of visual impairment remains poorly defined in most fall risk and balance studies. In one study, a threshold of 20/40 acuity correlated to impaired independence in activities of daily living (ADLs), instrumental activities of daily living (IADLS), and mobility, but not falls specifically (Laitinen et al., 2007). There are inconclusive studies investigating the impact of specific visual interventions on balance, mobility and participation (Skelton et al., 2013; Virgili and Rubin, 2010). Intervention appears to reduce fall risk in this population; however a standard approach is not defined.

The aim of this study was to determine the feasibility of taking multiple measures of visual and physical function to better understand fall risk and prevention in the adults 18 years or older with visual impairment. A second aim was to obtain preliminary data on fall risk in this population.

Methods

Participants

Subjects were recruited from a convenience sample of patients at the Western University Eye Care Center's Vision Rehabilitation Clinic. Subjects were excluded if they were under 18 years of age or were non-ambulatory. Thirteen subjects met the inclusion criteria and were enrolled in the study; one was subsequently excluded due to self-reported cognitive decline at time of testing. Each subject gave signed consent to participate in the study. Trained examiners assisted with form completion and all testing. This protocol was approved by the Western University Institutional Review Board and the tenants of the Declaration of Helsinki were followed.

Procedures

Subjects of both genders aged 20—86 underwent a battery of tests to measure visual function, subjective measures of function, and physical function. The investigators in this study were a low vision optometrist and a physical therapist, who supervised or performed all testing. In a separate preliminary study, the investigators trained each other to perform all measures, and then compared results for the Four Square Step Test (FSST) and the Walking Speed Test. We found good reliability between each other ($p = 0.96$, unpublished data).

As a result of this, we trained student from our own individual professional programs to perform testing under direct supervision. The physical therapist supervised or performed all physical testing and the optometrist supervised or performed all measures of vision function. Subjects completed all tests within a 2 h timeframe.

Visual acuity was measured using a separate retro-illuminated Early Treatment of Diabetic Retinopathy Study (ETDRS) chart for each eye and a separate chart for both eyes together (OU) at 4 m, or 1 m if the subject could not read the top line. If the subject still could not read the top line, the eye was evaluated for light perception acuity. Subjects were asked to read every letter on the chart until they could not read any more letters. Total number of letters read was ultimately converted into Snellen equivalent and is reported in this study as 20/X, with the denominator representing the level of vision. Higher denominator values represent worse visual acuity.

Binocular (both eyes together) contrast sensitivity was measured with the Mars contrast sensitivity chart according to manufacturer instructions. Monocular (one eye only) visual fields were determined by a chart review of patients' medical record (measured either by confrontation method, Humphrey Visual Field Analyzer or Octopus® 900 Perimeter) and are reported as full or constricted.

Subjective function was assessed by oral history and with 2 questionnaires: Activity Balance Confidence Scale (ABC), and the Visual Functioning Questionnaire-25 (VFQ). The ABC is a validated instrument to describe subjects' perceived confidence with mobility (Lajoie and Gallagher, 2004; Powell and Meyers, 1995; Meyers et al., 1998). This tool is validated in multiple populations as predictive of future falls. The short (25 questions) version of the VFQ is a validated instrument developed by Mangione et al. (2001) to measure self-reported quality of vision and health in persons with chronic eye disease.

Subjects performed three tests of physical function: Walking Speed Test, Four Square Step Test (see Fig. 1), and the NeuroCom Balance Master™ Sensory Organization Test (see Fig. 2). Examiners used either a safety belt around the waist or a harness during all mobility tests to prevent falls.

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