The Influence of Fixation Stability on Posture and Balance in Central Vision Loss

# Producer notes

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The Influence of Fixation Stability on Posture and Balance in Central Vision Loss

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# Introduction

* Poor balance and posture can lead to falls
* 1/3 of individuals aged 65+ fall each year
* In 2012, medical costs for falls among older adults cost approximately $30 billion and is expected to more than double by 2020.

{Illustration not described}  
Legend: Every 18 seconds an older adult is in the emergency room because of a fall.  
(Zhang et al., 2015)

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# Vision: The Most Overlooked Factor

* Often forgotten when considering effect on balance because changes are progressive and slow
* Research has shown that visual impaired people (VIPs) have trouble with balance and older adults show greater visual sensitivity in postural control compared to younger adults.

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# What About Fixation Stability?

* When attempting to fixate on a target, eyes are not completely static
  + Tremors
  + Drift
  + Saccades
* For those with normal vision, those movements are small in magnitude, keeping the fovea on target
* VIPs with central vision loss often compensate by using their peripheral retina
* This can result in non-central, often unstable fixation

(Crossland et al., 2009; Macedo et al., 2011; Seiple et al., 2005)

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# Methods: Part I

* Participants (N=44)
  + Age: 50-89 years
  + Central vision loss
  + Visual Acuity 20/200 or better
* Divided into two groups
  + Stable Fixation
  + Unstable Fixation
* ETDRS Visual Acuity
* Mirametrix Eye Tracker
* Timed Up-and-Go
* Activities-specific Balance Confidence (ABC) Scale

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## Results I: Timed Up-and-Go (TUG)

* Performance on the TUG was significantly different between groups, with the unstable fixation group having a slower TUG time.
* Clinically, taking longer than 12 seconds to complete the task indicates an increased risk of falls
* The poor-fixation stability group had a mean score of 14.3 seconds

{Illustration not described}

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## Results I: ABC Scale

* "How confident are you that you will not lose your balance or become unsteady when you…"
  + … walk up or down stairs?
  + … walk in a crowded mall where people rapidly walk past you?
  + … get into or out of a car?
* Subjects with poor fixation stability were less confident about their balance compared to their stable-fixation counterparts

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# Methods: Part II

* Participants (N=10)
  + Age: 50-89 years
  + Central vision loss
  + Visual Acuity 20/200 or better
* Age-matched normative data from Greffou et al. 2013
* ETDRS Visual Acuity
* Optical Coherence Tomographer Scanning Laser Ophthalmoscope (OCT/SLO)
* The CAVE

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## Specification of Central Vision Loss

{Illustration not described or reproduced}

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## Fixation Stability

BCEA: Bivariate Contour Ellipse Area  
{Illustrations not described or reproduced}

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## The CAVE: Virtual Tunnel Paradigm

{Illustration}

Tunnel creates illusion of moving through the environment: *Vection.*

Induces a postural response to the visual stimuli while eliminating many confounding factors.

The visual stimulation will be the virtual tunnel paradigm.

The tunnel has an inner texture of a checkerboard pattern with each square scaled for linear perspective. The tunnel image will move in a front-to-back oscillating motion at four different speed conditions (0, 0.125, 0.25 and 0.5 Hz).

Three trials of each of the four conditions will be completed.

{/Illustration}

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## The CAVE in Action

Visual Psychophysics and Perception Laboratory  
{Video excerpt not available.}

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## Body Sway in the CAVE

* Anterior-posterior displacement measured in degrees
* Reflects participant's capacity to react and synchronize with the tunnel frequency

{Illustration not described or reproduced}

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## CAVE Results

**Overall**

* No significant correlations with visual or balance measures

**Individuals**

* The participant who was clinically at risk of falling according to the TUG had the greatest body sway under static conditions
* The participant with the poorest fixation stability showed the least response to the tunnel

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## Central Vision Loss v. Controls

{Chart}

| **Tunnel Frequency** | **Normal Body Sway (degrees/s)** | **AMD Body Sway (degrees/s)** |
| --- | --- | --- |
| Static | 0,54 | 0,5798 |
| 0.125Hz | 0,61 | 0,5826 |
| 0.25Hz | 0,61 | 0,58 |
| 0.5Hz | 0,61 | 0,5834 |

{/Chart}

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# What We Learned

* Fixation stability is a visual component that affects balance
* Poorer fixation stability can lead to less confidence in balance abilities
* Fixation stability has a stronger correlation with fall risk and past falls compared to visual acuity
* Those with central vision loss have greater baseline body sway than age-matched peers and do no respond to peripheral visual stimuli

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# What's Next?

* Overcome study limitations
* Can current fixation stability programs improve balance too?

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