

The Effect of Fixation Stability on Balance & Posture in Vision Impairment

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Background

Fall risk increases with age

- 1/3 of adults 65+ fall each year¹
- 1/2 of adults 85+ fall each year¹

As we age, we rely more on the visual system to maintain posture and balance². This is problematic as older adults are often affected by age-related vision impairments.

The few studies that have been conducted on balance and vision loss conclude that number of falls correlate with visual acuity and contrast sensitivity³. However, these parameters are not good predictors of future falls.

Fixation stability, a visual parameter, frequently targeted and trained in low vision rehabilitation has yet to be investigated in relation to balance and fall risk.

Purpose

The aim of the study was to determine if reduced balance and postural stability in vision impairment is related to unstable fixation.

It is hypothesized that those with stable fixation will perform better on balance measures compared to those with unstable fixation.

Method

Participants over the age of 50 & diagnosed with a vision impairment were recruited from the Concordia Database of Retinal Images.

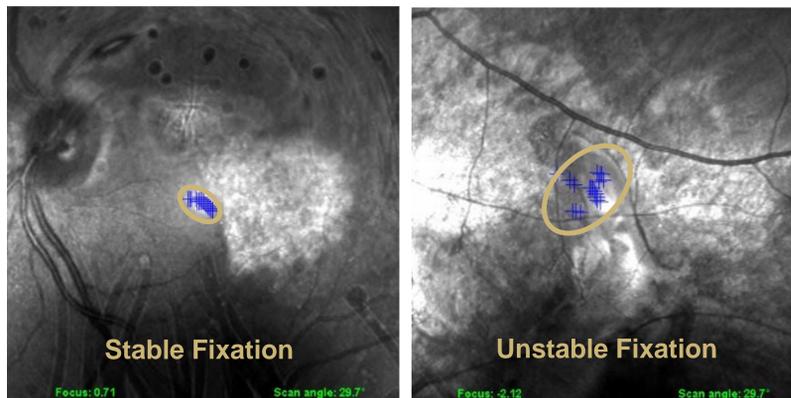
The **Activities-specific Balance Confidence (ABC) Scale** was used to measure balance confidence and fear of falling.

The **Timed Up-and-Go (TUG)** and the **Dynamic Gait Index (DGI)** were used to measure global balance objectively.

Postural control was measured using the **Nintendo Wii Balance Board**.

Fixation stability was measured using the Optos **optical coherence tomographer/scanning laser ophthalmoscope (OCT/SLO)**.

- Participants were asked to gaze steadily at a cross for 10 seconds while their eye movements were recorded.



- The resulting fixation images were analyzed using bivariate contour ellipse area (BCEA).

- Participants were grouped according to fixation stability.

- **Stable:** BCEA < 2°
- **Unstable:** BCEA ≥ 2°

Results

- A total of 25 participants (19 female, 6 male) participated in this study.
- They ranged in age from 52 to 98 years ($M: 81.20$, $SD: 11.79$)
- Visual acuities in the better eye ranged from 20/20 to hand motion in the best eye ($M: 1.07$, $SD: 0.68$ logMAR).
- Participants reported falling between 0 and 7 times in the last year ($M: 1.27$, $SD: 1.72$).

Mean fixation stability in the better eye was 3.64 ± 6.77 degrees.

Fixation data was obtainable for 21 participants:

- Stable Group: $N=16$ ($M: 0.70$, $SD: 0.52$)
- Unstable Group: $N=5$ ($M: 13.1$, $SD: 9.10$)

- Balance confidence was higher in the stable fixation group (Figure 1), but this was not significantly different from unstable fixators ($U = 32.00$, $p = 0.336$, $d = 0.196$).
- Participants with stable fixation performed better on the TUG (Figure 2), with significantly faster times, compared to the unstable group ($U = 14.00$, $p = 0.018$, $d = -1.29$).
- Stable fixators also had better performance on the DGI (Figure 3; $U = 13.00$, $p = 0.014$, $d = 1.42$).

Figure 1: ABC Scale

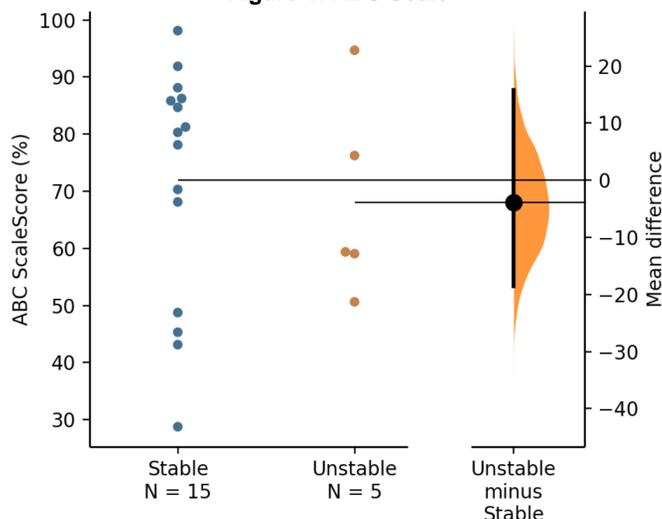


Figure 2: TUG Time

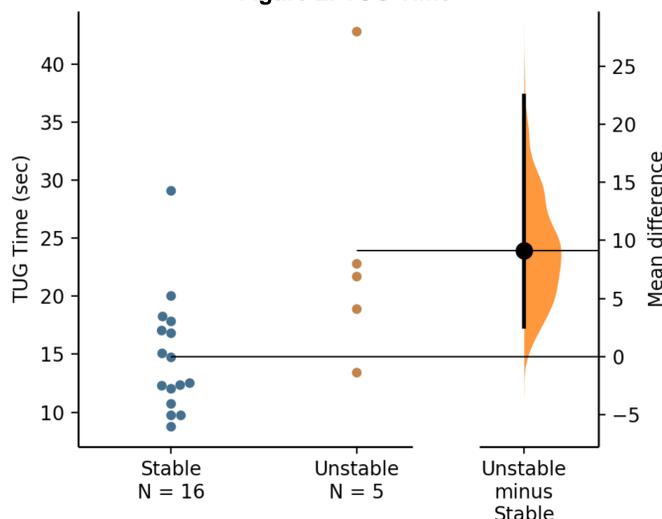
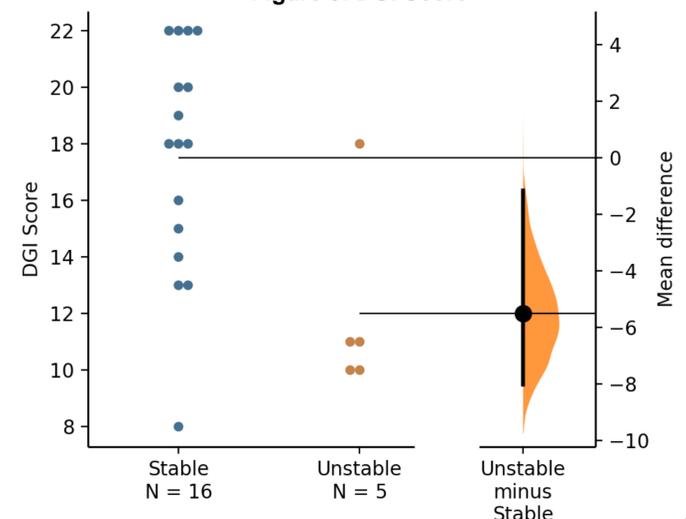


Figure 3: DGI Score



Conclusions

Preliminary results show that **balance confidence does not differ according to fixation stability**. However, the unstable fixators had an average confidence of 68%, which is close to the clinical cutoff of 67% indicating fall risk due to fear of falling⁴.

TUG time did differ according to fixation stability. Those with unstable fixation had slower TUG times ($M = 23.72$, $SD = 11.40$), well past the clinical cut-off of 14 seconds. The same was true for the DGI, indicating fixation stability is a visual parameter related to balance and fall risk. With a larger sample size, we will be able to determine if fixation is a better predictor of future falls than visual acuity and contrast sensitivity.

TUG time and DGI score for the Stable Group were clinically significant, falling outside the established limits for the TUG (14 seconds) and DGI (19 points). It is important to note that these clinical thresholds were established with older adults having normal vision. It is expected that a population with vision impairment would have a different threshold. This has yet to be established.

Recruitment for this study is ongoing. An *a priori* G*Power analysis recommends 21 participants per group. Future work will include the use of the Nintendo Wii Balance Board to measure the effects of fixation stability on postural control.

References

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