Balance & Posture in Older Adults: Simulated Vision Impairment Versus Real Vision Impairment

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Background

The Nintendo Wii Balance Board has been shown to be an accurate and reliable tool to measure balance in a clinical setting[1]. One issue with this is that we do not know what the baseline balance capability of an individual is before the onset of visual impairment. Thus, the increased variance in postural control due vison loss cannot be separated from fall risk.

One solution to this confound is to use simulated impairment goggles that replicate the loss of acuity that occurs with onset of vision loss.

The aim of the study was to determine if the increased variance in postural control seen in older adults with vision impairment (VIPs) could be accounted for by simulating vision impairment in older adults with normal vision

Method

Participants diagnosed with a vision impairment were recruited from the Concordia Retina Image Database and those with normal vision were recruited through community events targeting older adults.

Fear of Falling was assessed using the **Activities-specific Balance Confidence (ABC) Scale**[2].

All participants performed the **Timed Up-an-Go (TUG)**[3] with their normal correction. Individuals with healthy vision performed an additional TUG while wearing goggles (Fork in the Road, LCC) simulating visual acuity of 20/80 or 20/200.

The **Nintendo Wii Balance Board** was used to measure postural stability in three different conditions:

- Eyes Closed
- Normal Correction
- Simulated Vision Impairment (control group only)

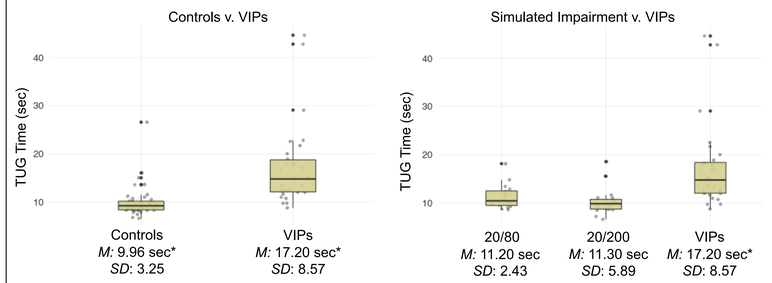
Statistical analyses were performed using Jamovi software[4]. Balance and postural stability are known to decrease with increasing age, therefore age was treated as a covariate.

Results

To date, 74 individuals have participated in this study: 43 controls and 31 VIPs. Of the controls, 17 wore the 20/80 goggles and 25 wore the 20/200 goggles.

Preliminary results show that the number of falls in the past year did not significantly differ between individuals with vision impairment (*M*:1.19, *SD*: 1.59) and those with normal vision (*M*: 0.63, *SD*: 0.87), however, TUG times did, $F(1, 69) = 4.5$, $p = 0.037$, even in simulated impairment $F(2, 68) = 5.80$, $p = 0.019$.

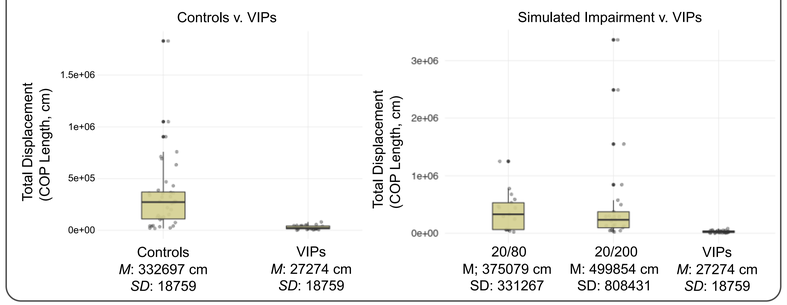
Timed Up & Go Performance



*The average TUG time for older adults is 10 seconds. Individuals are clinically at risk of falling if TUG time > 14 sec[5].

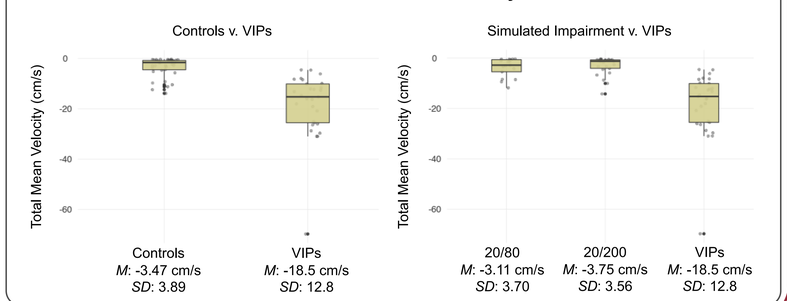
Total displacement recorded by the Wii was also significant under normal correction (VIPs v. Controls: $F(1, 66) = 25.56$, $p < 0.001$) and VIPs v. simulated impairment ($F(2, 67) = 8.13$, $p < 0.001$) with Tukey post-hoc analysis showing the control group had greater displacement under 20/80 ($p = 0.02$) and 20/200 ($p < 0.01$) condition compared to the VIP group.

Wii Board Total Displacement



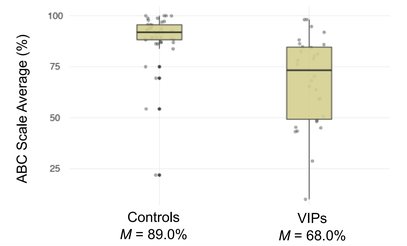
Total mean velocity also significantly differed between VIPs and controls, $F(1, 66) = 9.47$, $p = 0.003$. The same was true for VIPs versus controls with simulated impairment $F(2, 67) = 4.90$, $p = 0.01$. Tukey post-hoc analysis showed that the VIP group had significantly greater velocity than the simulated 20/80 ($p < 0.01$) and 20/200 ($p < 0.01$) conditions.

Wii Board Total Mean Velocity



Results – Fear of Falling

ABC Scale Response



Fear of falling was significantly different between groups $F(1, 68) = 9.62$, $p = 0.003$.

ABC Score < 67% = at risk of falling[6]

Conclusions

Global balance as measured by the TUG was poorer in VIPs compared to controls with simulated vision impairment. This indicates that **there are additional factors contributing to decreased postural control in VIPs besides decreased visual acuity and contrast sensitivity**.

The Wii board showed that during quiet stance, **VIPs displayed greater velocity and smaller displacement** when compared to controls, even in comparison to simulated vision impairment conditions. **This reflects the "stiffening strategy" that is adopted when individuals experience fear of falling**[7]. Muscles are contracted and there is a tighter coupling between the head and trunk resulting in smaller displacement, but faster body sway. This is supported by the significant difference in the results of the ABC scale, suggesting **fear of falling is a factor that merits further study**.

References

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