

Introduction

- Postural stability is a complex skill dependent upon the coordination of motor, sensory and cognitive systems which are subject to decline with healthy aging¹
- Increased cognitive and sensory demands (i.e., hearing and vision loss) compete for attentional resources used to maintain balance²
- Hearing³ and simulated vision loss⁴ have shown to increase instability and fall risk
- When a cognitive and motor task are simultaneously performed (dual-task) older adults (OAs) often allocate a greater proportion of their attention to maintaining balance instead of cognitive performance, especially when balance task complexity increases (i.e., *Posture First Principle*)⁵

Objectives

- To evaluate how single- and dual-task balance is compromised by increased cognitive load and simulated vision loss
 - To investigate differences in single- and dual-task performance between healthy older adults (HOAs) without hearing loss and those with Age-Related Hearing Loss (ARHL)
- ### Hypotheses
- 1) Balance and cognitive performance would decrease under conditions of increased cognitive load and simulated low vision loss
 - 2) Balance and cognitive performance would decrease as a function of hearing acuity
 - 3) OAs with ARHL would prioritize posture resulting in lower postural dual-task costs and higher cognitive dual-task costs compared to HOAs

Methods

Participants

- 27 community-dwelling OAs (aged 56-90 yrs.) recruited through Concordia's engAGE Living Lab
 - 11 healthy OAs with no hearing loss (M age = 71.27)
 - 16 OAs with ARHL (M age = 77.13)

Methods

Measures

- Demographic Questionnaire: Age, gender, fall history
- Montreal Cognitive Assessment (MoCA)
- Visual Acuity: Freiburg Visual Acuity and Contrast Test
- Hearing Acuity: SHOEBOX Audiometry: Grades of hearing acuity were calculated using pure tone average (PTA) for the better ear as an average of four frequencies .5, 1, 2, 4 KHz

Apparatus

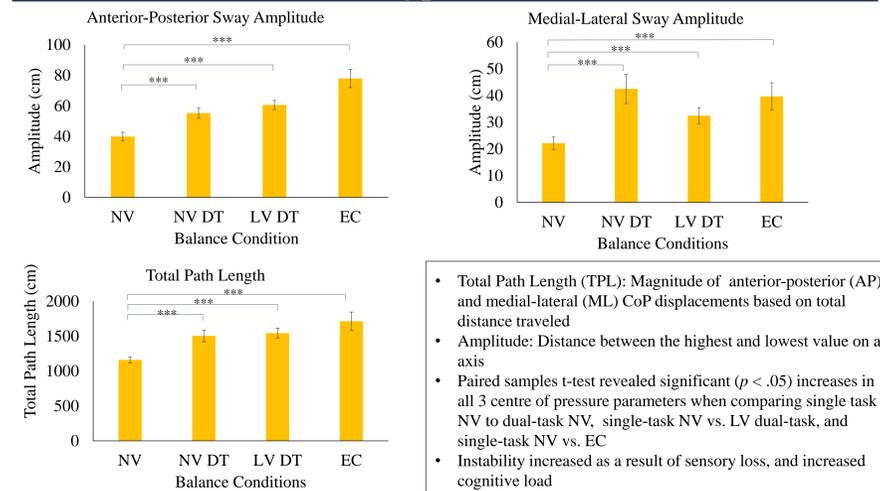
- Nintendo Wii Balance Board used to measure centre of pressure (CoP) displacements

Assessment

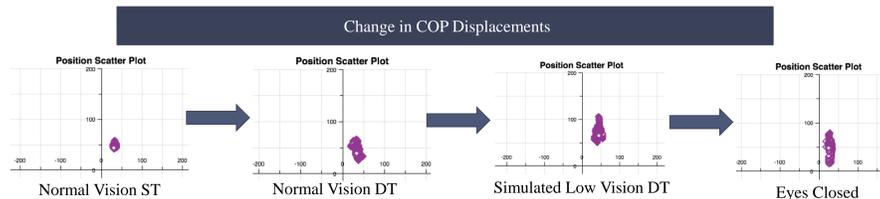
- Single-Task (ST) Cognitive: Counting backwards by 7s (serial 7s) seated
- Single-Task Balance: Balance with normal vision goggles (NV), simulated vision loss goggles (20/80)(LV), eyes closed (EC)
- Dual-Task (DT) Balance: NV serial 7s, LV serial 7s



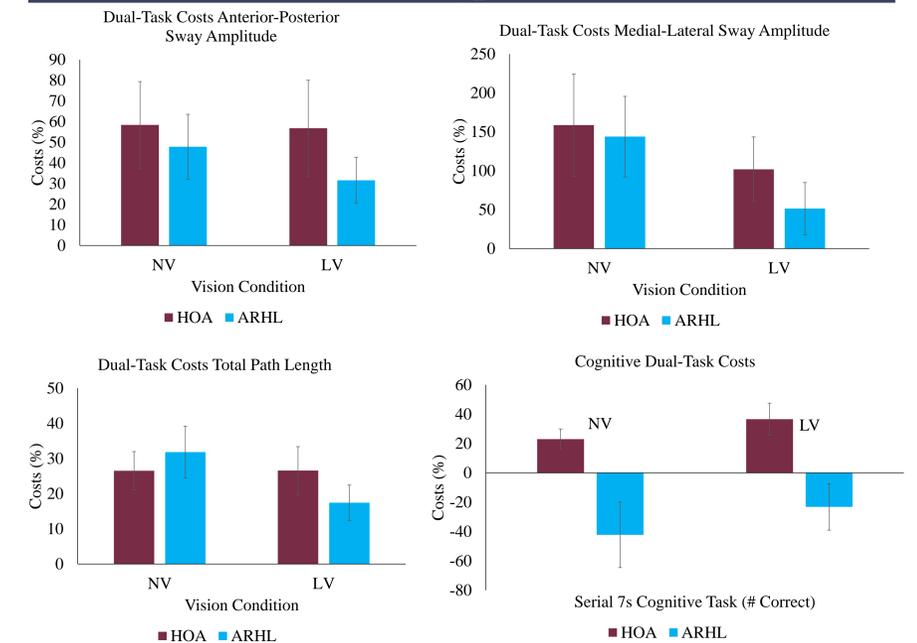
Results: Hypotheses 1 & 2



A mixed-model ANOVA using hearing acuity as a covariate with a Greenhouse-Geisser correction revealed a significant main effects of complexity in anterior-posterior sway amplitude, $F(2.23, 55.82) = 6.40, p < .002$. Total path length, $F(1.76, 44.89) = 1.96, p < .107$, and media-lateral sway amplitude, $F(2.07, 51.84) = 2.63, p < .08$ approached significance



Results: Hypothesis 3



Postural Dual-Task Costs: Older adults with ARHL on average had lower dual-task costs compared to healthy older adults across 5 of the balance condition parameters excluding NVTPL, however they appear to have prioritized the Serial 7s task over their balance

Cognitive Dual-Task Costs: Older adults with ARHL on average had fewer dual-task costs compared to healthy older adults in both NV and LV conditions

- Older adults with ARHL showed cognitive facilitation (i.e., increase in the # of correct serial 7s subtractions) when comparing single-task to dual-task performance. One possible explanation for this effect may be those with ARHL did not feel the balance task threatened fall risk, therefore they could direct more of their attention towards the cognitive task. Potentially, cohort effects may play a role as those with ARHL are on average older than those without hearing loss and may be more motivated to do better cognitively

Correlations: Hearing loss was positively correlated to single-task low vision medial-lateral amplitude, $r(26) = .498, p = .008$, and single-task normal vision medial-lateral amplitude, $r(26) = .517, p = .006$, such that those with greater hearing loss exhibited worsened medial-lateral sway in single-task balance conditions regardless of goggle condition. However, hearing loss was negatively correlated with cognitive dual-task costs in the normal vision condition, $r(26) = -.424, p = .027$ such that those with greater hearing loss showed more facilitation in their cognitive outcome scores comparing normal vision single-task to dual-task

Conclusions

- The attentional demands from increased cognitive load and simulated vision loss, led to decreases in older adults' single- and dual-task balance performance
- Older Adults with ARHL seemed to prioritize the cognitive task over the postural task which resulted in cognitive performance improvements

Implications: Prioritizing cognition over posture may be an ineffective dual-task strategy putting older adults with ARHL at risk of falling

Limitations: A small sample size resulted in increased variability in scores resulting in an inflated standard deviation. Education level was not accounted for but may explain why the ARHL group showed dual-task facilitation on serial 7s performance

Future Research Directions: Recruit older adults with dual-sensory loss to measure its effect on dual-task performance outcomes

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