

## Postural responses to otolith-specific gait tasks in vestibular patients

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**Introduction:** The otoliths end-organs, part of the vestibular system, detect roll tilt and linear acceleration including gravity. We hypothesized that otolith-specific balance tasks, such as a sudden freeze of gait, reversals of gait after walking forward, and head tilts during static standing are mediated by otolith function. This study aimed to investigate postural responses to these tasks in healthy adults and individuals with vestibular hypofunction.

**Methods:** In this cross-sectional study, healthy adults and vestibular patients performed static and dynamic otolith-specific tasks: standing with a head tilt, sudden freezes of gait, and instant reversals from forward to backward walking. Participants wore inertial measurement units (IMU), and in the vestibular patients and additional analysis using a 3D pose estimation model was collected. Postural responses were compared between groups. The relationship between objective postural responses and otolith function will be examined using IMU and 3D pose model data, which will be fully processed by the end of February 2025.

**Results:** Twelve vestibular patients ( $62.6 \pm 9.8$  years, 5 women) and 13 controls ( $35.6 \pm 11.5$  years, 4 women) participated. Compared to controls, vestibular patients walked slower overground (2.7 vs. 3.2 mph,  $p=0.007$ ) and on a treadmill (2.6 vs. 3.1 mph,  $p=0.015$ ), with worse freeze and reverse responses, including more corrective steps and increased fall risk. Vestibular patients could stand as long as the controls on foam with eyes closed and contralesional head tilt ( $p=0.168$ ) but stood significantly shorter with an ipsilesional tilt ( $p<0.001$ ).

**Discussion:** Vestibular patients experience greater difficulty with otolith-specific tasks, particularly with ipsilesional head tilts, likely due to otolith-spinal pathway dysfunction.