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Is home exercise for dizziness after mild traumatic brain injury enough? Could wearable sensors help?

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Abstract

Purpose

Vestibular rehabilitation (VR) is used to treat dizziness after mild traumatic brain injury (mTBI) and relies on patients to independently perform a prescribed home exercise program (HEP). Barriers to this approach include impaired cervical proprioception that may impact ability to position the head and trunk and self-limiting movements to avoid symptoms. Wearable sensors may aid clinical assessment and performance monitoring, improving rehabilitation efficacy during HEP. The purpose of this study is to determine if 1) wearable sensor technology is a reliable measure for performance of VR exercises and 2) there are differences in exercise performance between controls and mTBI.

Subjects

Twenty-three participants with mTBI (18F/5M, 35.4 [12.7] yo; 44.1 (22.5) days post injury) and 16 controls (9F/7M, 28.7 [5.1] yo) have enrolled.

Methods

Participants wore two wearable sensors (Opal V2, APDM) on their head and trunk while four common vestibular exercises were performed. Exercises were performed on three separate days; including two bouts of horizontal and vertical head turns. Outcomes measures included sensor-based range of motion (ROM) and angular velocity. SPSS v22 was used to calculate intraclass correlation coefficients (ICC) for reliability and independent-samples t-tests compared between group baseline performances.

Results

Reliability measures were good-excellent; ICCs 0.689–0.976 for ROM and 0.822–0.957 for angular velocity. The largest group differences were seen in angular velocity of head movements during gait: horizontal (mTBI: 263.5°/s ± 74.3; control: 377.8°/s ± 81.7; p = 0.001) and vertical (mTBI: 178.9°/s ± 65.5; control: 265.2°/s ± 69.7; p = 0.001).

Conclusions

Wearable sensor characterization of a vestibular HEP revealed good reliability for both head ROM and angular velocity during exercises indicating they could be useful for tracking progress. Preliminary analyses suggest that people with mTBI moved their heads slower compared to control subjects. Wearable sensors could guide physical therapy, improving HEP efficacy and compliance.