Editorial

Quantitative Measures of Dynamic Head Movements As Outcome Measures for Vestibular Rehabilitation

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I have thought it would be a wonderful thing to have a method of measuring, in vivo (using a head-worn recording device), the magnitude of head displacement, direction, and acceleration, and further, to be able to record these values over several days. One could use the product of these measures as baselines against which future recordings could be compared. For example, a symptomatic patient might restrict head movements in the plane of an impaired horizontal canal. Over time (and therapy), as the patient became less symptomatic, head accelerations might increase.

I am featuring the study by Hogan and colleagues (2018) in my editorial this month. The study raises the issue of whether it is enough to rely on self-report measures that are conducted pre- and post-treatment, or whether it is valid to assess treatment effects using more precise functional measures.

The investigators were determined to answer these questions:

- How much should a person move his or her head during habituation exercises?
- Is there a difference across age?
- Does a decrease in subjective symptoms correlate with an increase in head movements?
- Does a "better" subjective, patient-reported score of dizziness correlate with faster head movements?
- How much should a person move his or her head in vestibular rehabilitation therapy (VRT) exercises for habituation to achieve maximal improvement?

It was the purpose of the current study to quantify both linear and angular accelerations during head movement-based VRT exercises across age, dizziness, and levels of balance confidence.

Subjects were split into three groups (total N = 52) of unpaid volunteers with an age range of 20-96 years (mean age 45 years). The groups were normals, dizzy subjects, and subjects with poor balance confidence. The subjective measures were the Berg Balance Scale, the Mini-Mental State Examination, the Dizziness Handicap Inventory, and the Activity-Specific Balance Scale. The performance measures were four exercises extracted from the larger Motion Sensitivity Quotient.

The exercises included:

- nose to left knee
- nose to right knee
- horizontal head shake, i.e. head shake as if to say "no"
- vertical head shake, i.e. head shake as if to say "yes"

The performance data were collected over 15-second periods for each condition. Subjects performed these movements three times at a slow pace and three times at a fast pace. During data collection, subjects were asked to perform the movements as fast as comfortably possible. The investigators recorded linear and angular head acceleration for azimuth, elevation, and roll. The investigators calculated these measures using magnetometery as the subjects were completing the four tasks.

Magnetometry is a technique where the patient is placed in a magnetic field. The patient/subject wears on their head a device that interacts with the magnetic field. The outputs of the measurement device are precise measures of head velocity, acceleration, and direction. The recording technique is not without problems. I became aware of the frailties of magnetic field recordings when we conducted neuromagnetic brain recordings in a couple of auditory evoked magnetic field studies we conducted over a decade ago. Any ferrous metal in the near environment, especially if it is in motion, can become a recording artefact.

Not surprisingly, the results of the investigation (and I am not going to "spill the beans" entirely) showed that head acceleration varied as a function of the subject's age, dizziness, and balance confidence. I hope you enjoy this interesting start to a new year and thank you for joining us for a new volume of the journal.

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REFERENCE

Hogan AE, Spindel JH, Gray LC. (2018) Quantification of head acceleration during vestibular rehabilitation exercises. *J Am Acad Audiol* 29(1):15–24.