Submitted For:
Podium Presentation

Title:
Forward-pressure level calibration improves accuracy and reliability of pure-tone audiometry

Abstract:
Clinical pure-tone audiometry is conducted using headphones or earphones with a coupler (average ear) calibration. Deviations in individual-ear acoustics from average affect test validity, and variations in probe insertion or headphone placement affect test-retest reliability. Using a standard otoacoustic emissions probe, containing a microphone and loudspeaker, an in-the-ear calibration may be performed for each insertion. However, if the stimulus level is set according to the probe microphone pressure, acoustic standing waves in the ear canal cause stimulus level errors at the eardrum as large as 20 dB above 4 kHz, depending on probe depth. Forward pressure level (FPL) calibration removes these errors, and reduces variations due to probe angle.

We compare standard audiometry using a modern clinical audiometer to a FPL-calibrated prototype audiometer. The test procedure was similar to those commonly used in hearing-conservation programs, using pulsed-tone test frequencies at 0.5, 1, 2, 3, 4, 6, and 8 kHz, and an automated modified Hughson-Westlake audiometric procedure. Results indicate that reliability is better with FPL calibration and that the improvement is clinically meaningful, potentially allowing hearing-conservation programs to have more confidence in determining significant threshold shifts at 6 and 8 kHz - key frequencies for early detection of noise-induced hearing loss.

Abstract Focus:
1. *"Diagnostic Audiology / Otology"*

Bio of Presenter:
A native of Maryland, Sarah Robinson is a Ph.D. student in the Department of Electrical and Computer Engineering at the University of Illinois at Urbana-Champaign, under the advisement Jont Allen. She received her B.S. in Applied & Engineering Physics from Cornell University in 2010, with minors in Music and Electrical Engineering. She is a UIUC Neuroengineering IGERT fellow and SURGE fellow. Her primary area of research is acoustics of the outer and middle ear, specifically the effects of the ear canal and middle ear pathology on wideband acoustic immittance measured in the ear canal.

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Learner Outcomes:

"After this presentation, participants will be able to..."

1. Compare methods of calibration for pure-tone audiometry headphones and earphones
2. Identify sources of error in stimulus delivery for pure-tone audiometry
3. Describe the effect of ear canal standing waves on in-the-ear hearing measurements
4. Describe advantages of forward pressure level calibration for pure-tone audiometry at high frequencies