

Official Title: Comprehensive Wide Bandwidth Test Battery of Auditory Function
in Veterans

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Study Protocol

The goal of this research is to evaluate a comprehensive test battery of new wide-bandwidth, i.e., wideband (WB), acoustical tests of auditory function in the differential diagnosis of middle ear, cochlear and neural pathologies in a population of Veterans. WB tests refer to ear canal tests using sound responses measured from 200 Hz to frequencies as high as 8000 Hz, a bandwidth that is critical for speech perception. There will be tests in the battery for middle-ear assessment using absorbance cochlear assessment using otoacoustic emissions (OAEs) and the acoustic stapedius reflex (ASR) using middle ear power absorption. Results will be compared with a standard single-frequency clinical immittance test battery routinely used in the assessment of auditory function in Veterans.

Aim 1 seeks to evaluate the accuracy of the WB test battery in the differential diagnosis of middle-ear pathology and related conductive hearing loss by comparing the sensitivity and specificity of the WB battery to the traditional immittance battery for disorders common in Veterans including tympanic membrane perforation and serous otitis media. Aim 2 seeks to modify a WB ASR test to provide automatic detection of the ASR threshold for comparison with the traditional single-frequency ASR threshold. Aim 3 seeks to validate the use of Transient-evoked otoacoustic emission (TEOAE) and spontaneous otoacoustic emissions (SOAEs) tests in Veterans to assess cochlear status, and evaluate their test performance in classifying ears with normal hearing and sensorineural hearing loss. The combination of tests across aims will allow for examination of the diagnostic accuracy of the full WB test battery in comparison to the single-frequency admittance test battery to detect any type of hearing loss including sensorineural, conductive and mixed. The hypothesis is that the WB test battery is more accurate than the traditional immittance test battery in identifying ears with normal auditory status and ears with a range of risks for auditory pathology.

Methods:

Subjects- Human subjects will be recruited for this study who have had a hearing evaluation from the VA Audiology Service at the Portland VA Medical Center and the H. Quillen VA Medical Center. These subjects will respond to flyers or be contacted from an IRB-approved human subject volunteer registry. Data will be acquired from three groups of subjects with normal hearing, sensorineural hearing loss (SNHL), and middle ear disorders.

Testing- All subjects will receive the same clinical and WB test battery. Each subject will be tested in one laboratory visit. Subjects will be enrolled in this study that upon otoscopic inspection of their ear canals, have no active drainage from the ears, and have ear canals free of cerumen (wax) impaction, bilaterally. Subjects who are found to have draining ears or cerumen impaction will be referred for treatment. These individuals may be enrolled in the study following successful treatment for their conditions. All subjects will have a standard pure-tone air- and bone-conduction

audiogram while comfortably seated in a sound-treated booth. Standard insert earphones and a bone-conduction vibrator will be used to present the sound stimuli. Next, speech audiometry will be completed and the speech reception thresholds, uncomfortable loudness test for speech, and speech recognition scores will be obtained. Then the subjects will have a standard immittance test battery consisting of a tympanogram and acoustic reflex threshold testing. Stimuli will not exceed a level of 100 decibels hearing level (dB HL). Finally, the wideband test battery will be performed with adults seated comfortably in a sound-treated booth. A small probe with a soft rubber tip will be inserted in the subject's ear canal, and the subject will be asked to remain quiet while sounds are presented to an ear via sound sources within the probe. Responses will be measured using a miniature microphone within the probe. The tests in the wideband battery are similar to the clinical admittance battery and include ambient absorbance, absorbance tympanometry and acoustic reflex threshold. The otoacoustic emission testing is a separate measurement of inner ear function typically conducted in the clinic using different equipment.