Toward a New Evidence-Based Fitting Paradigm for OTC Hearing Aids

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BACKGROUND

• We conducted a two-part study to develop an evidence-based fitting paradigm for over-the-counter (OTC) hearing aids.
• In the previous study, we used audiometric data from an epidemiology database to develop a set of four gain-frequency responses (presets) that can fit approximately 70% of older adults with mild-to-moderate presbycusis.
• The set of four gain frequency responses are shown below as audiograms and their associated NAL-NL2 REAR targets.

METHODS

• Participants: 37 older adults age 55-88 (17 females, mean age= 70.1) with mild-to-moderate SNHL (PTA ≥ 25 & ≤ 55 and all frequencies 250Hz-6kHz ≤ 65 bilaterally).
• Participants were tested in several device conditions, including five selection models and one best-practice verification condition.

Device Conditions:

Select by Audiogram: Preset assigned using clinical audiogram. For each ear, preset with corresponding audiogram within +/- 5 dB HL of the participant’s audiometric thresholds from 250 Hz-4kHz was assigned. If more than one or no preset fulfilled this criteria, the preset with lowest absolute value deviation from the participant’s thresholds was selected.

Select by Questionnaire (BHI): Preset assigned using Better Hearing Institute (BHI) Quick Hearing Check, which provides predicted five-frequency pure-tone average (PTA) based on questionnaire score. For both ears, preset with closest audiometric PTA to participant’s BHI predicted PTA was assigned.

NAL-NL2 (Gold Standard): Each participant was fit with basic-level hearing aids custom-programmed to match NAL-NL2 REAR targets within +/- 5 dB of target from 250 Hz-6kHz. All hearing aids were coupled using non-custom tulip dome tips.

Random Assignment: The same preset was randomly assigned to both ears.

Select by Self Test: Presets assigned using NSRT Online Hearing Screening. This suprathreshold online self-hearing test generates a pseudaudiogram at the conclusion of the test. The test was completed in each ear individually–test ear had Apple EarPod, non-test ear masked with earplug. For each ear, the preset closest to the pseudaudiogram–using procedure from select by audiogram–was assigned.

RESULTS

• The purpose of this study was twofold: 1) to test the efficacy of our four presets relative to best-practice verification; 2) to determine the best method for older adults to select presets

Fig 1: Audiograms associated with the four presets

Fig 2: REAR targets of the four presets

Fig 3: Audiograms associated with the four presets in quiet by selection model. ** denotes consonants in quiet by selection model. * denotes significance at p < 0.05.

Fig 4: NST consonants in quiet. Gold Standard is the NAL-NL2 condition.

Fig 5: Composite clarity and pleasantness rating in quiet (for each subject, CL and PS scores averaged due to high correlation between these ratings). Gold Standard is the NAL-NL2 condition

Fig 6: Loudness ratings in quiet. Gold Standard is the NAL-NL2 condition.

Fig 7: Controlling for better-ear PTA and sound quality ratings, mean and 95% confidence interval of percent correct NST consonants in quiet by selection model. ** denotes significance at p < 0.01.

Fig 8: Controlling for better-ear PTA and sound quality ratings, mean and 95% confidence interval of percent correct NST consonants in noise by selection model. * denotes significance at p < 0.05.

DISCUSSION

• Considering results in both quiet and noise, select by audiogram, select by self test, and select by trying produced comparable results to custom-fit NAL-NL2 amplification. BHI produced poor outcomes in noise and Random produced poor outcomes in quiet.
• Statistical analysis on the individual level indicated that select by self test produced outcomes most consistent with individual outcomes for the NAL-NL2 condition.
• A set of four OTC presets could produce comparable outcomes to best-practice verification in a laboratory setting.
• Older adults are able to self-select appropriate amplification using several selection methods.
• The results provide empirical evidence for the efficacy of a new OTC fitting paradigm.

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