Agreement Between Evoked Potentials and Behavioral Thresholds Using LS-Chirp and 1 kHz Tone Burst in Normal-Hearing Adults: A Pilot Study

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Abstract

Background Auditory evoked potentials (AEPs), including the auditory brainstem response (ABR) and cortical auditory evoked potential (CAEP), are widely used to estimate hearing thresholds in individuals unable to provide behavioral responses. However, it remains unclear whether brainstem or cortical activity better reflects perceptual thresholds, and how stimulus characteristics influence this relationship. This study investigated the agreement between evoked potentials and behavioral thresholds using different stimuli and presentation rates. Methods Two experiments examined agreement between AEPs and behavioral thresholds. Experiment 1 (n = 8 ears) used LS CE-Chirp stimuli at 33.3 stimuli/second. Experiment 2 (n = 12 ears) used 1 kHz tone burst stimuli and examined three conditions: behavioral thresholds at 33.3 stimuli/second (Experiment 2a), behavioral thresholds

at 1.0 stimuli/second (Experiment 2b), and standard 1 kHz pure tone audiometry (Experiment 2c). Different adult groups (≥18 years) were recruited for each experiment. Behavioral thresholds were obtained via the Hughson-Westlake method. Thresholds were compared using Wilcoxon signed-rank tests. Results Agreement patterns varied systematically with stimulus characteristics. For LS CE-Chirp stimuli at 33.3 stimuli/second, ABR thresholds showed significantly better agreement with behavioral thresholds than CAEP thresholds ($p < 0.05$). For 1 kHz tone burst stimuli at 33.3 stimuli/second, no significant difference was observed between ABR and CAEP agreement with behavioral thresholds ($p > 0.05$). However, at 1.0 stimuli/second, CAEP thresholds demonstrated significantly better agreement with behavioral thresholds than ABR thresholds ($p < 0.05$). Both ABR and CAEP thresholds showed comparable agreement with clinical 1 kHz pure tone audiometry thresholds ($p > 0.05$). Conclusion These preliminary findings demonstrate that both stimulus type and presentation rate influence threshold estimation, with slower rates favoring cortical-behavioral agreement and faster rates favoring brainstem-behavioral agreement. These context-dependent patterns may guide measurement strategies and support their use in the identification of auditory dysfunction. Further research with larger samples is needed to validate these findings and establish their clinical applicability.

Author keywords

1 kHz tone burst; ABR; behavioral hearing thresholds; CAEP; LS CE-chirp

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