Multi-Frequency Electrophysiological Estimate Of Auditory Temporal Acuity

Negar Ahzan, David Purcell
National Centre for Audiology, Faculty of Health Sciences, Western University, London, ON, Canada

Objectives: To record envelope following responses (EFRs) to amplitude modulated (AM) narrow-band noise carriers with various center frequencies in which modulation frequency (Fm) is gradually changed over time and compare the result of this electrophysiological test with the corresponding psychophysical measure in normal-hearing participants.

Background: Auditory temporal acuity, a listener's ability to discriminate rapid changes in the envelope of an auditory signal over time, is crucial for speech understanding. The EFR evoked by a changing (swept) AM broadband carrier is significantly correlated with behavioral measures of temporal acuity. Previous research using AM broadband noise carrier may have been affected by the out of phase interference of evoked potentials initiated from one region of the basilar membrane with another. This study uses frequency specific carriers to determine how these individual regions might affect the amplitude modulation (AM) threshold.

Methods: Participants: 60 young normal-hearing adults aged 17 to 35 years (three groups). Fm of low, mid, and high frequency narrow-band noises at a fixed modulation depth of 50 percent is swept gradually over time from 80 to 600 Hz. EFRs are recorded and analyzed as a function of Fm. The highest Fm at which EFR is significantly detectable is considered as the electrophysiological AM detection threshold. A three-interval two-Alternative forced-choice (3I-2AFC) procedure is used to estimate the highest Fm a listener can detect psychophysically.

Results: We hypothesize that narrow-band noise stimuli that are amplitude modulated will elicit EFRs at rates most similar to those detectable psychophysically.

Conclusion: This study will determine whether the EFR response pattern differs for different carrier bands and how to optimize EFRs to serve as a neural correlate of behavioral measures. The results from our investigation will strengthen future clinical applications of the EFR as an objective assessment of temporal acuity