Introduction

The N1-P2 auditory evoked response has been studied extensively using brief tonal and click stimuli. Therefore, much is known about the auditory cortex’s response to stimulus onset with regard to intensity effects on response latency and amplitude. Few studies have examined the auditory cortex’s off-response to sustained stimuli. Of the studies that have been done, many have used tonal stimuli (1000 Hz) presented at the same intensity to all participants in an effort to explain generators of the response.¹

Purpose:

• To determine if the on-off and sustained response can be recorded consistently
• To examine characteristics of the on-off response using a stimulus other than 1000 Hz - specifically broadband noise
• To determine effects of intensity and duration on waveform morphology, latency, and amplitude
• To examine the possibility of common vs. independent physiological generators of the response

Methods

Subjects:

13 young adult participants, all undergraduate and graduate students at the University of Connecticut, with no history of learning disabilities, auditory processing disorders, or otologic/neurological problems. All participants met the following criteria to ensure hearing function within normal limits bilaterally:

• Normal otoscopy
• Jerger type A tympanograms ²
• Peripheral hearing within normal limits for interoctave frequencies from 250 8000 Hz, as determined by pure-tone audiometry using the modified Hughson-Westlake procedure

Dichotic Digit Test scores of 90% or better at 50 dB SL to screen for Intensity effects were seen for onset N1 and P2 latencies resulting in shorter latencies for the 70 dB SL conditions that were statistically significant from their 40 dB SL counterparts.

Stimulus duration had no effect on onset and offset response amplitude and latency.

Intensity did not seem to affect offset N1 and P2 latency in either of the stimulus durations.

N1-off shows a definite trend of smaller amplitude when compared to N1-on.

Results & Discussion

A 2x2 factorial repeated measures ANOVA was used to analyze data:

Intensity effects were seen for onset N1 and P2 latencies resulting in shorter latencies for the 70 dB SL conditions that were statistically significant from their 40 dB SL counterparts.

• Stimulus duration had no effect on onset and offset response amplitude and latency.
• Intensity did not seem to affect offset N1 and P2 latency in either of the stimulus durations.
• N1-off shows a definite trend of smaller amplitude when compared to N1-on.

Off-stimuli duration with 10 ms rise/fall times, Peset et al., noted off responses occurring 13 ms earlier than the on-response on average, although they did not elaborate on the phenomenon.⁵

Conclusions & Future Directions

The off-response seemed to respond acutely overall to the decay of the stimulus envelope from plateau to the initial part of the fall 140 ms.

This lack of intensity effect on offset latency, coupled with the rapid response to envelope decay, argues for the consideration of different underlying physiological mechanisms for the on- and off-response in this study.

We entertain the possibility that a distinct group of neuronal cells within the auditory cortex may be responding to stimulus onset while a separate group of cells may be responding to the stimulus offset, creating this physiological difference. This hypothesis is consistent with previous research.⁶ Studies focusing on isolating the off-response from the on-off response should be explored.

Waveforms of 3 separate individuals with tinnitus were obtained and are shown below for the 2000 ms - 70 dB SL condition.

References