The Use of Musical Stimuli to Obtain Speech Detection Thresholds

Anne Fitzpatrick, B.S., Janet Koehnke, Ph.D, CCC-A, Joan Besing, Ph.D., CCC-A, Maryrose McInerney, Ph.D., CCC-A

Montclair State University, Montclair, NJ

Purpose of the Study

To determine whether using filtered, musical stimuli with vocals is a valid method for obtaining Speech Detection Thresholds (SDT) in young listeners

Introduction

- Stimuli used during audiometric testing with the pediatric population include pure tones, warble tones, monitored live voice, or musical stimuli (Sabo, 1999; Day et al., 2012)
- A Speech Detection/Awareness Threshold (SDT/SAT) is established in a typical pediatric audiologic evaluation in order to determine a child's awareness of the presence of speech sounds, which is crucial for speech and language development (American Speech-Language-Hearing Association [ASHA], n.d.)
- Speech audiometry is often conducted before frequency specific, tonal testing because children typically respond better to speech stimuli than to tonal stimuli (Sabo, 1999)
- Not only is live voice difficult to replicate reliably, but also it may not maintain a child's attention for an extended period of time (Sabo, 1999)
- Presenting children with a musical stimulus has been found to be an effective method to maintain or re-gain attention during testing (Trainor & Zacharias, 1998; Corbeil et al., 2013; Paul et al., 2015)
- Filtered, frequency specific stimuli with some musical properties been shown to be effective in obtaining detection thresholds in listeners (Abouchacra et al., 2007; Myers et al., 1996)
- Lipovetsky et al. (2021) found that narrowband filtered 'Baby Shark' stimuli are a promising alternative to pure tones for audiologic evaluations in adults

Subjects

- 10 adults with normal hearing (≤25 dB HL) from 250-8000 Hz bilaterally
- 10 adults with sloping, bilateral, sensorineural hearing loss ranging from mild to severe from 250-8000 Hz

Methods

- Three stimuli band-pass filtered to isolate low, mid, and high frequencies were created from the children's song, 'Baby Shark', to be utilized
- A pre-recorded and a live voice presentation of the stimulus 'ma ma ma' were also used to obtain SDTs
- Participants were asked to detect pure tones, filtered 'Baby Shark' stimuli, and 'ma ma ma' stimuli, which were presented in random order for each ear
- All thresholds were obtained via the Hughson-Westlake descending method

Results

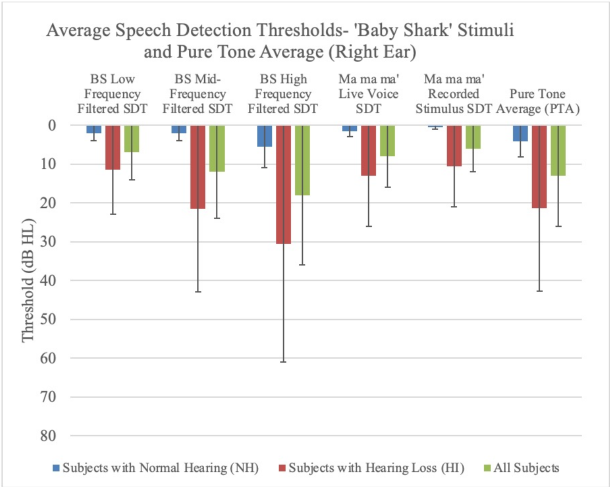

Figure 1. *Average Speech Detection Threshold and Pure Tone Average for the right ears of subjects with normal hearing, hearing loss, and across all subjects. BS='Baby Shark', SDT= Speech Detection Threshold.*

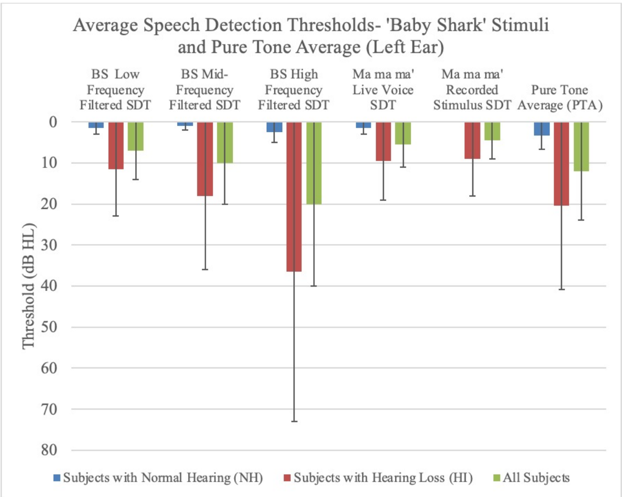

Figure 2: Average Speech Detection Threshold and Pure Tone Average for the left ears of subjects with normal hearing, hearing loss, and across all subjects. Missing bar for the recorded 'ma ma ma' stimulus indicates a value of zero dB HL. BS= 'Baby Shark', SDT= Speech Detection Threshold.

Results

- Results of a paired samples t-test revealed no significant differences between the SDTs obtained for live voice and recorded ma ma ma stimuli
- Stepwise linear regression revealed low and mid-frequency 'Baby Shark' stimuli were good predictors of live voice detection thresholds for the right and left ears respectively
- Additional stepwise linear regression revealed SDTs obtained with mid-frequency filtered 'Baby Shark' stimulus were strong predictors for a Pure Tone Average (PTA) of 500, 1000, and 2000 Hz for both ears
- STDs obtained with low frequency filtered 'Baby Shark' stimulus were strong predictors for a PTA of 250, 500, and 1000 Hz for both ears
- SDTs obtained with the high frequency 'Baby Shark' stimulus were strong predictors for a PTA of 2000, 4000, and 8000 Hz for both ears
- Stepwise linear regression to identify which 'Baby Shark' filtered stimulus would best predict the pure tone threshold at each test frequency revealed the low frequency stimulus to predict 250 and 500 Hz, the mid- frequency stimulus to predict 1000, 2000, 3000 Hz, and the high frequency stimulus to predict 4000, 6000, and 8000 Hz thresholds for the right ear. For the left ear, the low frequency stimulus predicted 250 and 500 Hz, the mid frequency stimulus predicted 1000 Hz, and the high frequency stimulus predicted 2000, 3000, 4000, 6000, and 8000 Hz

Summary & Conclusion

- ***The novel 'Baby Shark' stimuli have promise for clinical use in obtaining information about auditory sensitivity in young children***
- ***Further research should evaluate the efficacy and reliability of using these stimuli with the pediatric population and in individuals with varying degrees and configurations of hearing loss***

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