ABSTRACT
A growing body of research has used standardized tests to demonstrate that school-aged children with cochlear implants (CIs) do not perform as well as their normally hearing (NH) peers on measures of speech perception and discrimination skills. A gap in our knowledge exists regarding these skills in infants and toddlers. Given the trend towards early implantation during infancy, it is crucial that speech discrimination measures at that age be available. In addition, bilateral cochlear implantation is being provided to a growing number of young children, with little understanding about the difference in performance between toddlers with unilateral cochlear implants (UCIs) and toddlers with bilateral cochlear implants (BICIs). In this study, the ability of toddlers with UCIs and BICIs (ages 24-36 mos.) to discriminate consonant contrasts that vary in voicing and place of articulation in their native language is being investigated. Testing is conducted using a novel reaching-for-sound methodology. Dependent variables percent correct and latency will help to determine whether unilateral implantation is sufficient for the development of speech discrimination skills and if bilateral implantation facilitates the rate at which these skills develop. The overarching goal of this study is to compare results from the speech discrimination task to measures of spatial unmasking in the same toddlers with UCIs and BICIs. We plan to evaluate whether early bilateral activation promotes the ability of young children to segregate target speech from background masks, in particular when target and masker are spatially separated.

REACHING FOR SOUND METHOD

STIMULI

The length of time between the release of the consonant and the beginning of vocal fold vibration is known as voice onset time or (VOT).

The place of articulation of a consonant is the point of contact where an occlusion occurs in the vocal tract between an active articulator and a passive location.

NH infants can discriminate consonants in their native language that differ in either voicing or place before they are 8 months old.

The stimulus consists of the carrier phrase “I’m hiding under” followed by one of the test words (BEE, PEA, or KEY). The stimulus is presented at 60 dB SPL A.

These values were chosen because a number of studies have used a voicing boundary at 25 ms: a phoneme with less than 25 ms VOT will be perceived as /b/ and a phoneme with greater than 25 ms VOT will be perceived as /p/ (Lisker et al., 1964).

Participants

Two children who use bilateral CIs (BICIs):

At least 1 year of experience with CI at first visit

Native English Speaker

Primary communication mode-oral

No diagnosed developmental disabilities

Any device type

Eight 24-36 mo. toddlers with normal hearing (NH):

Mean age 29.5 mos. (3 Male, 5 Female)

Recruited through birth registry list

No history of hearing loss, ear infections, or other developmental delays

Timpanometric screening performed

PRELIMINARY BICI RESULTS

Preliminary results show that two toddlers with BICIs discriminated the endpoint stimulus that differ in voice of articulation, but when the VOT was manipulated to be closer to the boundary, the toddlers with cochlear implants performed at or below chance.

HYPOTHESES

Because cochlear implants maintain timing information, toddlers with CIs should be able to discriminate the contrast (endpoint stimuli) better than the stimuli closer to the boundary (BeeVOT vs. PEAVOT).

The VOT (Bee vs. PEA) will be easier to discriminate than Place (PSEA vs. PEA) because temporal cues are relatively intact while spectral domain is degraded in CIs.

Voicing + Place contrast (Bee vs. Key) should be easier to discriminate because it differs in 2 features.

CONCLUSIONS & FUTURE DIRECTIONS

The new “Reaching for Sound” method that we implemented is highly promising as a novel means for testing speech sound discrimination in toddlers.

BICIs may be able to use temporal cues to discriminate voice contrasts. They need longer amounts of voice, compared to their NH peers to discriminate “bee” from “pumpkin”.

Further research will be done to compare measures of spatial unmasking in the same toddlers to evaluate the use of early bilateral activation promotes the ability to segregate target speech from background masks.

REFERENCES


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