Spatial attention (contralateral unmasking) in children with bilateral cochlear implants and in normal hearing children

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INTRODUCTION

Auditory Scene Analysis
• The process by which the auditory system segregates information in various streams.
  • This is related to the ability to selectively attend to a target while simultaneously ignoring distracting information.
  • The ability to perform “spatial attention” (contralateral unmasking) tasks is complex, challenging, and essential for successful communication in noisy environments.
  • It is especially important for children, who spend much of their day in noisy environments where learning is facilitated by a target talker (i.e. teacher in classroom).

For this study, we are particularly interested in how children who are deaf and fitted with bilateral cochlear implants (BiCIs) function in noisy environments and, more specifically, perform on contralateral unmasking tasks.

Previous free-field spatial unmasking studies show that children with BICIs receive little to no benefit when the target and interfering speech are spatially separated vs. co-located (i.e. unlike children with NH, children with BICIs show no spatial unmasking).

METHODS

Participants:
- Normal Hearing (NH) (n=4)
- Bilateral Cochlear Implants (BiCI) (n=5)

Stimuli:
- Auditory signals: sine waves, noise, and words
- Spatial separation: targets and interferers presented to separate ears

Procedure:
- Participants were seated in a sound-attenuated booth.
- A word was presented to one ear, and a noise to the other ear.
- Participants were asked to identify the word.

Overall comparison to previous adult data3
• NH adults show the lowest SNR (i.e. best performance), even in the easiest condition (1) with no interferers

RESULTS

Are children able to ignore a contralateral interferer? (condition 3 vs. condition 1)
- Children with NH and BiCIs show little to no difference for thresholds vs. without an interferer in the contralateral ear, suggesting no difficulty in attending to the target with a contralateral interferer.

Does performance improve when the interferer is contralateral the target vs. co-located? (condition 2 vs. condition 1)
- BiCIs children: RE/LE (as)ymmetry in the ability to attend to the target
- NH adults: bilateral presentation shows better performance vs. when interferer is in opposite ear.

Do children show contralateral unmasking? (condition 3 vs. condition 4)
- On average, the children with BICIs show little to no contralateral unmasking. This is, adding an interferer in the opposite ear does not benefit the BiCI group.

Discussion
• With more data, these findings may help to elucidate limitations in spatial unmasking for children with BICIs.
• Specifically, in this study we are interested in investigating if exposure to BICIs early in life facilitates emergence of contralateral unmasking.
• Results thus far suggest that the lack of spatial unmasking in children with NH is due to the inability to attend to a target in the presence of an interferer.
  • This may suggest that the problem is due to the reduced cues provided by the coding of the incoming signal.

REFERENCE

Questions:
• What factors contribute to the lack of spatial unmasking for children with BICIs (i.e. central processing, peripheral coding)?