Spatial Hearing Abilities in Toddlers with Bilateral Cochlear Implants
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PURPOSE OF STUDY
The purpose of the study was to examine the emergence of spatial localization skills in toddlers with bilateral cochlear implants (BCI) and to compare them with their normal hearing (NH) peers using a novel Reaching for Sound (RFS) method.

PARTICIPANTS
Thirteen 24-34 mo. old toddlers with normal hearing (NH) were recruited through local lists. No history of hearing loss, ear infections, or other developmental delays were identified. Symptomatic screening performed.

PROCEDURE
Experiment Design: Training consists of a randomized right-left discrimination task, with blocks of trials in which only two locations, at equal angular separations from midline, are visible. The following rules apply:
- Testing begins with the widest angular separation (60°).
- The child must pass the criterion of 4/5 correct trials before proceeding to a smaller separation of 30°.
- If the child passes at 30°, then testing is also conducted at 15°.
- If the child does not pass at 30°, then testing is conducted at 45°.
- If the child passes at 45° then 30° is repeated, followed by 15°.

Stimulus: The prism, “When I hear a tone...”, is followed by three bursts of white noise presented at a fixed level of 60 dB SPL.

Task: An experimenter positions a small puppet above the center loudspeaker to draw the child’s attention. Once the child’s eyes and head are facing forward, the experimenter initiates the trial by playing a sound from one of the loudspeakers. The child’s task is to reach to the correct hole and obtain the hidden toy. Trials either after the child reaches either correctly or incorrectly into a hole, or if it becomes clear that a reach is not forthcoming.

TARGET LOCATION
- Of the 13 toddlers with BCI tested, 11 passed the 4/5 criterion and were able to be tested on localization. 12/13 passed the 4/5 criterion, and did not participate in localization due to lack of attention.

SUMMARY & CONCLUSIONS
- In NH children. RMS error ranged from 0.35 degrees, with 11/13 children showing performance levels similar to that seen in 5-8 year olds. Thus, spatial hearing abilities appear to be well developed in the majority of these children.
- The RFS method appears to be reliable because during training, all children except those two were able to understand and complete the task.
- Right-Left Discrimination with CI: 11/13 of the children with BCI were able to attain 4/5 correct in training at ±45° and ±15° with CIs activated. However, when the children were only allowed to use one CI (implanted ear), only one child was able to attain 4/5 correct at ±60°, ±30°, and ±15°. This suggests the benefit of bilateral cochlear implants for spatial hearing abilities.
- Localization with CI: RMS errors were notably higher in the BCI group than in the NH group. Future work on the emergence of spatial hearing in the BCI group will be conducted to determine whether they can achieve NH levels of performance with additional exposure to bilateral hearing.

REFERENCES

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