INTRODUCTION

- **Hypothesis**: Early bilateral stimulation is not required for emergence of spatial hearing acuity in children with cochlear implants (CIs).
- A recent study (Grieco-Calub & Litovsky, 2012), measured spatial acuity in toddlers fitted with unilateral vs. bilateral CIs (BiCIs).
  - Some toddlers with BiCIs obtained Minimum Audible Angle (MAA) thresholds in the range of peers with normal hearing.
  - Other toddlers with BiCIs, and all toddlers with unilateral CIs (UCIs) were unable to perform the MAA test even at large angular separations.
- The current study aims to investigate emergence of spatial acuity in these children as they grow older and gain more bilateral experience.

METHODS

Participants

- Twelve of the 39 toddlers in the Grieco-Calub & Litovsky 2012 study returned for follow up testing between the ages of 49 – 85 months.
- All twelve children had BiCIs for the duration of the current study.
  - Six had UCIs during initial visit as toddlers in the previous study.
  - Six had BiCIs as toddlers in the previous study.
- Six children (3 from UCI toddler & 3 from BiCI toddler groups) were followed longitudinally with return visits every 12-14 months.

<table>
<thead>
<tr>
<th>Participant Information</th>
</tr>
</thead>
</table>
| **Table 1**: Participant Information

Stimuli

- Recordings of 25 spondees spoken by male talker (e.g., ice cream, bird nest)
- Stimulus level varied randomly over an 8 dB range (60 ± 4 dB SPL)

Procedure

- **MAA**: 2-AFC task: Source locations varied for fixed pairs of speakers equi-distant from midline; MAA = smallest angle at which performance ≥75% correct.
- **Sound Localization**: 15-AFC task: Source location varied randomly at each of 15 possible locations from -70º to +70º azimuth and 0º elevation; 150 trials.

RESULTS

- Longitudinal individual MAA data show that thresholds decrease with bilateral experience (one exception), reaching <20º by 24-45 months.
- At 40 months of bilateral experience there was no difference in MAA thresholds between children who were able to perform the task as toddlers and children who were unable to do the task (CND) as toddlers.

<table>
<thead>
<tr>
<th>MINIMUM AUDIBLE ANGLE &amp; LOCALIZATION RMS ERROR AT FIRST VISIT WITH ≥36MO BILATERAL EXPERIENCE</th>
</tr>
</thead>
</table>
| **Figure 3**: Minimum Audible Angle & Localization RMS Error at first visit with ≥36mo bilateral experience

CONCLUSIONS

- Results suggest that there is an emergence of spatial hearing acuity regardless of whether or not children were able to perform the MAA task as toddlers.
- Some of the best performers for MAA and for sound localization were children who were unable to perform the MAA task as toddlers (from both the BiCI and UCI groups).
- These findings suggest that early bilateral implantation may not be required for the emergence of spatial hearing acuity, as measured with the MAA task or sound localization ability.

REFERENCE


ACKNOWLEDGEMENTS

We would like to thank all our participants and their families. This work is supported by NIH-NIDCD (SR01 DC008365, R. Litovsky) and in part by a core grant to the Waisman Center from the NICHD (P30 HD03352).