190P

Emergence of bilateral abilities in children who transition from using one to two cochlear implants

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ABSTRACT

Recent findings indicate that children with bilateral cochlear implants (CI) show benefits for understanding speech in noise and discriminating the direction of sounds in space. To date, benefits have been measured by comparing bilateral listening results with those obtained when only one CI was turned off. The monaural condition may be considered an unnatural situation leading to overestimation of bilateral benefits.

This study followed 10 children transitioning from monaural to bilateral CI use. All children visited our lab at three intervals and were tested on measures of speech intelligibility in noise and minimum audible angle (MAA). Longitudinal intervals occurred while monaurally implanted (baseline), at 3mo and 12mo following bilateral activation. At the baseline interval, 6 children used a hearing aid in the non-implanted ear and 4 children used a CI alone. Results will provide guidance for quantifying effects of bilateral stimulation in sequentially-implanted children.

INTRODUCTION

The number of children with bilateral cochlear implants is increasing. Many of the children receive the two implants in sequential procedures, months or years apart. In addition, children vary with respect to auditory input provided to the second-implanted ear; while some children transition from wearing a hearing aid in that ear (CIHA) to using an implant (CICI), others children receive little or no input in that ear (CI-only). This study compared data from children in these two categories. In addition, this study provides an important benchmark regarding the abilities of the children to perform on spatial hearing tasks prior to having their second implant activated. All children were recruited for a baseline set of measures, and returned to the lab for testing at all 3 test intervals following activation of the second implants.

METHODS

Participants

10 children followed longitudinally during their transition from 1 to 2 cochlear implants (see Table 1 below for characteristics). CI-only used single CI only at baseline then received 2nd CI.

Conditions

Bilateral (B) and 1st CI only (M1) listening modes

Testing Procedure

20-back test at fixed right/left pairs equidistant from 0º (front), speaker pairs varied according child’s performance

Target randomly presented from right or left side of arc

AAFmask with response options indicated by green or yellow star affixed below speaker pair. Child instructed to click on or point to side where target was heard.

MAA Estimation

Psychometric functions were constructed by plotting the %correct for each angle. MAA thresholds were defined as the angle at which performance was significantly above chance (72.4% correct for the number of trials used on the 2 AFC task).

RESULTS

Average data were computed from children who were able to complete testing at all 3 testing intervals (N=8 B, N=5 M1). While skill appears to resolve by 12mo for all 3 children (Figure 5A), in both Quiet and Front conditions data indicate that bilateral advantage 12mo after bilateral activation is similar for CIHA-CICI and CICI groups (Figure 5B). All children show to appear a benefit while others demonstrate some disparity, at both 3- and 12mo.

CONCLUSIONS

1. Using the CRISP test, speech intelligibility improved over time, most notably in Quiet with bilateral CIs.

2. When comparing performance under monaural or bilateral listening modes, children with a single CI at the baseline CICI group, showed some bilateral disruption at 3mo, while the CICI group shows bilateral advantage at 3 months after activation. However, at the 12mo interval, the two groups performed similarly. These results might be useful for counseling parents of children who are about to receive a second CI with regard to expectations in the short- and long-term.

REFERENCES


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