report scale that assesses the frequency of occurrence (on a scale of 0 to 4) of the following behaviors in everyday situations: device “bonding,” alerting to sound, and deriving meaning from sound. The remaining end points will employ speech perception tests that will be administered via live-voice with the clinician seated in the same room as the child. The clinician will use a mesh screen in front of her face to eliminate speech-reading cues. The ideal situation is administration of the tests in a recorded format; this situation, however, is not practical, given the young age of the children under study. Moreover, as in standard clinical audiology, a survey of participating implant centers revealed that recorded tests are seldom used with the pediatric population.

The following speech perception tests will be used as outcome measures for the remaining study end points. The Early Speech Perception Test consists of three subtests. The Pattern Perception subtest contains words that differ in number of syllables or stress pattern. A response to any word in the same stress category is counted as correct. The Spondee Identification subtest evaluates the child’s identification of words with the same stress pattern in a closed-set response task. The Monosyllable Identification subtest evaluates identification of one-syllable words that differ from one another primarily in the vowel sound in a closed-set response format. The Minimal Pairs Test contains pairs of pictured words that differ from one another in the initial consonant or medial vowel sound. The Mr Potato Head task involves the toy, Mr Potato Head, and the 24 parts that accompany the toy. The task assesses recognition of key words (Mr Potato Head parts) and simple commands in a large modified open set (eg, “Put a hat on Mr Potato Head”). The Common Phrases Test consists of 10 simple phrases (per list) that are presented in an open set with pretest familiarization of the item topics. The Phonetically Balanced Kindergarten (PBK) test consists of four lists of common monosyllabic words that are phonetically balanced. Subjects’ performance on these measures will be analyzed to determine the proportion of the study sample that achieves each study end point.

REFERENCES


10. Robbins AM. Mr Potato Head task. Indiana, Ind: Indiana University School of Medicine, 1993.


For adults or children unable to benefit from a cochlear implant for medical or other reasons, tactile devices are a noninvasive means of providing additional speech information. When used in combination with aided residual hearing and lipreading, tactile devices have been shown to provide cues to speech features that can be used to improve speech perception on both closed- and open-set word and sentence tests. These benefits have been established for a wide range of patient groups, including postlingually and congenitally deaf adolescents, children, and adults.

Given that benefits for most congenitally deaf adolescents with multiple-channel cochlear implants are limited, tactile devices may provide a more viable alternative for prospective adolescent cochlear implant candidates than for younger children or adults. To establish whether in fact a tactile device may be a more suitable choice than a cochlear implant for some groups of children, the comparative performance of children with both devices should be studied.

METHODS

This study assessed speech perception benefits for three congenitally profoundly deaf adolescents who used an electrotactile speech processor (Tickle Talker) and subsequently went on to use a Nucleus Minisystem-22 cochlear implant. Prior to the evaluations reported here, each child had received a similar habilitation program with both devices, conducted by the same clinician. Experience with the Tickle Talker prior to cochlear implantation varied from 10 months to 5 years. Experience with the cochlear implant was 1 year at the time of evaluation. Specific details for the three children are shown in the Table.

Speech perception benefits were measured with open-set Phonetically Balanced Kindergarten (PBK) words and Bamford-Kowal-Bench (BKB) Sentences. Tests were administered live-voice, and a written response was required. Speech perception scores were analyzed with the binomial model and significance table developed by Thornton and Raffin.6

RESULTS

The Figure shows speech perception test results for all patients. Both devices provided significant and comparable benefits for all children in the device-plus-lipreading condition. All children benefited from the additional information provided by either the Tickle Talker or the cochlear implant, and were able to perceive speech information with these devices that was not available through either aided residual hearing or lipreading. None of the three children were able to understand open-set words or sentences using either hearing aids alone or the Tickle Talker plus hearing aids, without the aid of lipreading. Two of the children showed significant (p < .05) open-set speech perception benefits while using their cochlear implant alone.

DISCUSSION

The results of this study show that it is possible for individual adolescents to achieve a significant degree of open-set speech perception using a cochlear implant, despite the low expectations the literature suggests for this patient group. However, no direct association can at present be demonstrated between preimplant use of the Tickle Talker and success with a cochlear implant. On the basis of the open-set speech perception benefits achieved in both this and other studies, the cochlear implant would be the preferred option for most potential candidates, including congenitally deaf adolescents.

The fact that the Tickle Talker and cochlear implant offer comparable benefit in terms of supplementation to lipreading confirms that the Tickle Talker is a viable alternative for people who cannot benefit from cochlear implantation for medical reasons (eg, middle ear problems, cochlear malformations, etc) or for those who do not wish to have surgery. The Tickle Talker could also be used in cochlear implant preoperative programs for evaluating the capabilities of potential implantees for processing speech information presented through a different sensory modality. It could also be

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**SUBJECT DETAILS FOR THREE CASE STUDIES**

<table>
<thead>
<tr>
<th>Patient 114</th>
<th>Patient 144</th>
<th>Patient 165</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cause of deafness</td>
<td>Unknown</td>
<td>Rubella</td>
</tr>
<tr>
<td>Age at onset</td>
<td>Congenital</td>
<td>Congenital</td>
</tr>
<tr>
<td>Age at implantation</td>
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<td>Communication mode</td>
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<td>Oral</td>
</tr>
<tr>
<td>No. of channels</td>
<td>22</td>
<td>18</td>
</tr>
</tbody>
</table>

---

**Speech perception test results. A) Phonetically Balanced Kindergarten Word test speech perception results for all three patients. B) Bamford-Kowal-Bench Sentence test speech perception results for all three patients.**
used preoperatively with selected patients (particularly adolescents) to determine the level of commitment and motivation for using a speech-processing device.

Overall, congenitally deaf adolescents need to be considered on an individual basis with regard to prognosis for benefit from a cochlear implant and/or tactile devices.

REFERENCES

EFFECTS OF SHORT-TERM DEAFNESS IN YOUNG CHILDREN IMPLANTED WITH THE NUCLEUS COCHLEAR PROSTHESIS

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INTRODUCTION

The implantation of congenitally deaf children at a young age has been shown to be beneficial to the development of auditory perceptual skills. Gantz et al found that speech perception and production scores continue to improve over at least a 7-year time period following implantation of young congenitally and prelingually deaf children. Waltzman et al examined the development of suprasegmental features and speech recognition abilities in prelingually and congenitally deaf children implanted between 2 and 3 years of age. After 2 to 4 years of usage, all subjects had significant amounts of open-set speech recognition, communicated orally, and were either in regular nursery schools or mainstreamed.

Miyamoto et al reported on results obtained in a limited number of prelingually deaf children implanted at a mean age of 6.1 years. Although these children obtained significant benefit from the prosthesis, their progress and achievements were not as rapid as those reported by Waltzman et al for younger children. Other factors, such as programming, rehabilitation, and education, to name a few, contribute significantly to successful implant usage, thereby making comparisons between centers difficult; therefore, a within-center comparison of results could be helpful in determining the effects of length of deafness (age at time of implantation) on the postimplantation progress of children. The purpose of this study was 1) to evaluate the postoperative performance of congenitally deaf children implanted between 3 and 5 years of age after 2 years of device usage and 2) to compare their progress to previously reported 2-year results on congenitally deaf children implanted between the ages of 2 and 3.

SUBJECTS AND METHODS

As of July 1994, 97 children were implanted with the Nucleus multichannel cochlear prosthesis. Twenty-nine of the 97 children (30%) were congenitally deaf. Fourteen of the 29 children were implanted between 3 and 5 years of age and had been users for at least 2 years and were therefore subjects for this study. The mean age at time of implantation and, therefore, mean length of deafness, was 4.0 years (range, 3.50 to 4.83). All subjects had bilateral profound sensorineural hearing losses and received no substantial benefit from amplification. The children all used PM systems and received extensive rehabilitation services during the preoperative evaluation period. Eight children had no pattern perception, and 6 children had some pattern perception prior to implantation using amplification. No child had any closed- or open-set speech recognition. All subjects had complete insertions of the Nucleus Minisystem-22 device and were programmed with the Mpeak strategy.

Standard audiometric testing was performed under earphones for each ear and in the sound field with amplification. Speech perception tests designed for children were administered preoperatively and postoperatively to assess function in the auditory-only condition. Tests administered included the 1) CID Early Speech Perception (ESP) battery, 2) Discrimination-After-Training (DAT) test, 3) Northwestern University Children's Perception of Speech (NU-CHIPS) test, 4) Glendon Auditory Screening Procedure (GASP), and 5) Phonetically Balanced Kindergarten (PBK) word lists.

The children were seen often for reprogramming and received extensive oral-aural training following implantation.

RESULTS

All results presented were collected at the 2-year poststimulation interval. The mean warble tone sound field thresholds in decibels hearing level were 27.9 at 250 Hz, 28.2 at 500 Hz, 28.6 at 1,000 Hz, 29.3 at 2,000 Hz, 28.5 at 3,000 Hz, and 31.1 at 4,000 Hz. The mean speech detection threshold was 23.6.

Closed-Set Tests. Eleven of the 14 children placed in category 4 of the ESP, the highest possible level, indicating consistent monosyllabic word recognition. Two children were in category 3, indicating some word recognition, and 1 child
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