The Minimal Pairs Test contains pairs of pictured words that paired children receive significant speech perception benefits and provide alternative means for improving the speech perception of profoundly hearing-impaired children. 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 Minimal Pairs Test contains pairs of pictured words that differ from one another primarily in the vowel sound in a closed-set response format. 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.

INTRODUCTION

In order to adequately advise prospective cochlear implant patients and their families, a clinician must have a good knowledge of the potential for particular individuals to benefit from cochlear implants and other alternatives. Multiple-channel cochlear implants and tactile devices provide alternative means for improving the speech perception of profoundly hearing-impaired people who receive little benefit from conventional hearing aids. Recent studies have shown that the majority of implanted profoundly hearing-impaired children receive significant speech perception benefits from the Nucleus Minisystem-22 cochlear implant. However, the degree of benefit for individual children with cochlear implants varies over a wide range, with congenitally or prelingually profoundly hearing-impaired children demonstrating poorer speech perception benefits. Prelingually profoundly hearing-impaired children implanted at or after adolescence appear to have less potential for benefit with a multiple-channel implant than children implanted before they are 10 years of age. Speech perception data from the Melbourne and Sydney cochlear implant clinics suggest that it is reasonable to expect that children implanted at an earlier age may develop an ability to perceive open-set speech through their implant alone without lipreading. However, to date, prelingually hearing-impaired children implanted during adolescence have not generally achieved open-set speech perception with their implant alone without lipreading. These results for congenitally deaf adolescents suggest that a cochlear implant is of primary benefit as a supplement to lipreading.

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WITHIN-SUBJECT COMPARISON OF SPEECH PERCEPTION BENEFITS WITH A MULTIPLE-CHANNEL COCHLEAR IMPLANT AND A TACTILE DEVICE

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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.5

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
used preoperatively with selected patients (particularly ado-
lescents) to determine the level of commitment and motiva-
tion for using a speech-processing device.

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

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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 al1 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 al2
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 al3 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 al2 for
younger children. Other factors, such as programming, rehabi-
litation, and education, to name a few, contribute signifi-
cantly to successful implant usage, thereby making comparis-
on 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 ampli-
fication. The children all used FM systems and received
extensive rehabilitation services during the preoperative evalu-
ation 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 ear-
phones for each ear and in the sound field with amplification.
Speech perception tests designed for children were adminis-
tered preoperatively and postoperatively to assess function in
the auditory-only condition. Tests administered included the
1) CID Early Speech Perception (ESP) battery, 2) Discrimi-
nation After Training (DAT) test, 3) Northwestern University
Children’s Perception of Speech (NU-CHIPS) test, 4) Glen-
donald Auditory Screening Procedure (GASP), and 5) Pho-
etically Balanced Kindergarten (PBK) word lists.

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

RESULTS
All results presented were collected at the 2-year post-
stimulation interval. The mean warble tone sound field thresh-
olds 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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