Objective: To document oral language proficiency in a group of prelingually deaf bilingual children with a cochlear implant.

Design: Using a repeated-measures paradigm, oral language skills in the first and second language were evaluated at 2 yearly intervals after implantation. Language data were compared with normative data from children with normal hearing.

Subjects: Twelve deaf children between the ages of 20 months and 15 years who had received a cochlear implant before the age of 3 years.

Outcome Measure: First-language skills were assessed using 1 of 2 standardized tests, either the Oral and Written Language Scales or the Reynell Developmental Language Scales, depending on the child’s age. Second-language proficiency was assessed using the Student Oral Language Observation Matrix.

Results: Average standard scores in the first language fell solidly within the average range of normal-hearing peers. Second-language skills showed steady improvement from year 1 to year 2, along a continuum that reflected the amount and intensity of exposure of the child to the second language and the length of experience with the implant.

Conclusion: A cochlear implant can make oral proficiency in more than 1 language possible for prelingually deaf children.

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MASTERNG ORAL COMMUNICATION in 1 language remains an uphill battle for most profoundly deaf children. Numerous investigators have shown that profoundly deaf children wearing hearing aids learn their language at only half the rate of normal-hearing (NH) children.1-3 Deafness denies the developing child adequate exposure to the complex phonemic patterns that make up the spoken language code. Thus, the deaf child attempts to construct an internal language system based upon incomplete, distorted, or muffled signals.4 Furthermore, deafness severely limits the child’s access to the richest source of spoken language learning, ie, the natural, spontaneous ambient language of fluent speakers that occurs all around children every day. Most of this ambient language is not specifically addressed to the NH child nor do its users attempt to teach its specifics. Rather, parents of NH children talk to, with, and around their children as they evolve into highly proficient users of the language.

The capacity for language learning is so strong in the early years of life that NH children from multilingual homes can become fluent in 2, 3, or more languages with no special instruction. Recent research has shown that linguistic milestones occur at the same rate and have the same characteristics in NH bilingual and monolingual children.5-7 Even so, educators have often viewed second-language learning with skepticism, based on concerns that it would interfere with first-language acquisition, causing language impairment.

Considering the factors above, it is understandable that clinicians are reluctant to recommend bilingual language environments for children with a cochlear implant (CI). A CI, however, offers broader access than hearing aids to the fine phonetic features of language. A CI also allows for incidental, natural language learning, including the overhearing of conversations among native language users. In addition, children are now receiving CIs at very young ages, during optimal language-learning periods. It was our...
hypothesis, therefore, that some children with a CI could develop proficiency in more than 1 spoken language. The purpose of this study was to document oral language proficiency in 2 languages, over time, in a group of children with a CI.

METHODS

SUBJECTS

Twelve congenitally profoundly deaf children who received a Nucleus 22 or Nucleus 24 cochlear implant (Cochlear, Lane Cove, Australia) before the age of 3 years participated in this study. Their characteristics are shown in Table 1. All were from environments where they were exposed to more than 1 language. Mean preoperative pure-tone averages were 109 dB in the implanted ear and 107 dB in the contralateral ear. One subject had no response to sound. The cause of deafness was hereditary in 6 children and unknown in the other 6. Their mean age at the time of implantation—and mean length of deafness—was 20 months (range, 6 months to 2 years 11 months) and mean length of device experience was 4.5 years (range, 11 months to 12 years). Oral language was the sole mode of communication for all of the children, who received intensive communication therapy before and after implantation and participated in programs that emphasized parent involvement. Parents of all the children were highly competent speakers of English, even those who were not native English speakers. All of the children were exposed to a second language with varying amounts of intensity; typically this exposure was in the home, but not exclusively. More than half of the children went to a school where the second language was used, some of them had speech/language therapy in that language, and many belonged to social communities and attended houses of worship where the second language was spoken.

TESTS

The children were administered tests to assess language ability in English and in the second language. Measures (described below) were administered at year 1 and approximately 12 months later, at year 2. Of the 10 children tested at year 1, 3 were unavailable for testing at year 2; however, 2 new subjects began participating in the study at year 2, for a total of 12 subjects tested during the 2 intervals. The length of device experience reflects the point of initial testing for each child in the study.

English Language Assessment

The children were administered a standardized test to assess their English language abilities. Those who were 3 years or younger were given the Reynell Developmental Language Scales (RDLS).

This test assesses language comprehension and expression using object manipulation, naming, and description based on questions that vary in length and complexity. Children 4 years and older were given the verbal portions of the Oral and Written Language Scales (OWLS). The OWLS is a broad-based measure of communication that assesses comprehension and use of connected language in such formats as picture selection and sentence completion. Unlike many other standardized language tests, it also assesses some of the higher-level and subtle aspects of language that have often confounded deaf children, such as conversational discourse, humor, idioms, taking another’s perspective, and metaphoric language. Raw scores on the RDLS and OWLS were converted to standard scores with norms comparing the child’s language skills to those of NH children of the same age. The OWLS provides a combined Oral Composite standard score representing both receptive and expressive language. To compare children across tests, we averaged the separate standard scores for receptive and expressive language on the RDLS and used the Oral Composite standard score from the OWLS. A standard score of 100 is average for a NH child on both the RDLS and OWLS tests, with an SD of 15. Thus, standard scores between 85 and 115 are considered to be within the broad normal range for a NH child.

Second-Language Assessment

Each child’s proficiency in a second language was quantified using a modified version of the Student Oral Language Observation Matrix (SOLOM). The SOLOM is designed to rate a non–English-speaking child’s proficiency in a second language on a 5-point scale across 5 communication domains that reflect both comprehension and expression. In the study, the examiner observed each child conversing in the non-English language with the parent fluent in that language and asked a series of structured interview questions. Based on this information, the examiner assigned a numerical rating to the child’s non-English language skills in each of the 5 following communication domains: comprehension, fluency, vocabulary, pronunciation, and grammar. The total score placed the child in 1 of 4 proficiency categories: phase I, preproduction/early production; phase II, speech emergence; phase III, intermediate fluency; and phase IV, advanced fluency.

Yiddish was considered the first language of 2 of the children, as it was the only language spoken in the home and they received therapy in Yiddish. They had only recently been exposed to English at school. To assess their competency in their primary language, these 2 children were given a Yiddish translation of the RDLS administered by the mother under the clinician’s direct supervision. The SOLOM scores for these 2 children reflected skills in their second language, English.

Table 2 shows standard scores in first-language proficiency for the 7 children who were tested in both year 1 and year 2. In year 1, standard scores ranged from 78 to 115, with a mean standard score of 92.4. In year 2, standard scores ranged from 84 to 121, with a mean standard score of 95.7. Since a standard score of 100 is average for a NH child on both the RDLS and OWLS tests, with an SD of 15, standard scores between 83 and 115 are considered...
SOLOM scores, representing second-language proficiency, are seen in Table 2. Data are shown for the 7 subjects who were tested in year 1 and year 2. At the first-year assessment, 5 children were rated in phase I (early production of second-language competency); none in phase II (emergence); 1 in phase III (intermediate fluency), and 1 in phase IV (advanced fluency). At the second-year assessment, none of the children were rated in phase I, 5 in phase II, and 1 each in phase III and phase IV. The average SOLOM score across the 7 children was 1.7 in the first year and 2.4 in the second year.

The children in this study demonstrated exceptional first-language proficiency compared with findings from published studies of children using CIs.1,11 Such studies typically reveal a wide range of language ability, as some children using CIs compare favorably with NH peers whereas others do not. In the present study, only 3 children in year 1 and 1 child in year 2 scored below the broad average range of NH children. Even the children who scored lower than 1 SD below the mean on the OWLS or RDLS had highly functional (though delayed) first-language proficiency and attended school with NH peers.

The findings from this study also suggest that it is possible for profoundly deaf children using a CI to develop some proficiency in a second oral language in addition to their first language. Second-language proficiency in these children, as rated by the SOLOM, showed steady improvement from year 1 to year 2. Further inspection of the SOLOM scores revealed that they fell along a continuum that reflected 2 factors, the amount and intensity of exposure the child had to the second language and the length of implant experience. Thus, the children most proficient in 2 languages were those whose parents spoke the second language at home, who had opportunities to use the language outside of home, and who had been wearing their CI for an extended time. It is also important to note that the adults using the second language were highly fluent in that language. Reports from these parents suggested that children with CIs follow a course of development in the second language that mimicks second-language learning in NH children. Parents gave examples of grammatical or phonological errors their child made that were similar to errors made by their NH siblings.

The absence of very low performers in this study may be a function of the small sample size. On the other hand, the characteristics of this group of children may predispose them to be successful spoken language users. The intensive auditory-oral therapy that all of them received before and after receiving a CI is assumed to have contributed highly to their excellent language skills. Half of the children had hereditary deafness unassociated with any additional handicaps. None of the 12 children had meningitis, a cause of deafness often associated with additional learning problems, and none had ossification in the cochlear or less than a full electrode insertion. These children, as a whole, had above-average speech perception,11 which allowed them good access to the phonetic

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**Table 2. Standard Scores for First-Language and SOLOM Scores for Second-Language Proficiency for Children With Cochlear Implants Tested in Year 1 and Year 2**

<table>
<thead>
<tr>
<th>Patient No.</th>
<th>Standard Scores*</th>
<th>SOLOM Scores</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Year 1</td>
<td>Year 2</td>
</tr>
<tr>
<td>1</td>
<td>91</td>
<td>91</td>
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<tr>
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<tr>
<td>7</td>
<td>99</td>
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</tbody>
</table>

*First-language standard scores based on performance on the Oral and Written Language Scales or Reynell Developmental Language Scale, depending on the child's age. Mean standard score ± SD, 100 ± 15.

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**Figure** shows standard scores for first-language proficiency for all 12 children. Data points for the same child across the 2 years are connected by a line. Single data points without a line indicate a child who was only tested at 1 interval.

Individual standard scores on the Oral and Written Language Scales (OWLS) or Reynell Developmental Language Scales (RDLS) representing first-language proficiency for all 12 subjects. Mean standard score ± SD, 100 ± 15. The shaded area represents performance within the average range of normal-hearing children. Data points for the same child across the 2 years are connected by a line. Single data points without a line indicate a child who was only tested at 1 interval.

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Abbreviation: SOLOM, Student Oral Language Observation Matrix.

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The children, as a whole, had above-average speech perception,11 which allowed them good access to the phonetic.
pair first-language skills in children wearing CIs. In fact, children's educators and health care providers. use available resources and engage in dialogue with their ture are at a distinct disadvantage as they are unable to develop native English-language skills via the CI and cli-

facilitators in their native language for their children with CIs. At the same time, they should be advised that im-

complex models that would allow their children to de-

velop native English-language skills via the CI and cli-

mimicked that of bilingual NH children. As a group, they demonstrated high levels of proficiency in the first language, and their ongoing acquisition of a second language mimicked that of bilingual NH children. This provides compelling evidence that the implant replicates phonemic codes unique to different languages, and suggests that it is possible for some congenitally deaf children to learn multiple spoken languages via a CI.

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REFERENCES