The prognosis for benefit from use of cochlear implants in congenitally deaf adolescents, who have a long duration of profound deafness prior to implantation, has typically been low. Speech perception results for two congenitally deaf patients implanted as adolescents at the University of Melbourne/Royal Victorian Eye and Ear Hospital Clinic show that, after 12 months of experience, both patients had significant open-set speech discrimination scores without lipreading. These results suggest that although benefits may in general be low for congenitally deaf adolescents, individuals may attain significant benefits to speech perception after a short period of experience. Prospective patients from this group should therefore be considered on an individual basis with regard to prognosis for benefit from cochlear implantation.

Given these results, a realistic assessment of the expected outcomes and candidature of congenitally deaf adolescents for cochlear implantation is appropriate. This report presents results of speech perception evaluations of two congenitally profoundly hearing-impaired children who received a cochlear implant as adolescents. They have demonstrated greater benefits to speech perception than those currently reported in the literature. Although these results are unique to the particular “star” children, and are not indicative of the overall clinical results for this population, they suggest that this group must be considered on an individual case basis.

**METHODS**

**Patients**

**Patient 114** • Patient 114 had a congenital profound bilateral sensorineural hearing loss of unknown etiology. She was fitted with hearing aids from 18 months of age and wore them consistently from this time. Bilateral aided thresholds are shown in Table 1. Patient 114 was enrolled in a total communication program from age 3 until 11, and subsequently attended an oral school. Patient 114 communicated orally and had speech production that was intelligible to listeners experienced in understanding deaf speech.

She received the Minisystem 22 cochlear implant in her right ear at age 13 years 8 months, and had 12 months' postoperative experience at evaluation. She had 22 functional channels in her implant system.

**Patient 144** • Patient 144 had a congenital profound bilateral sensorineural hearing loss due to maternal rubella. She was fitted with hearing aids from 16 months of age and wore them consistently (refer to Table 1). Patient 144 attended oral commu-

| Frequency (Hz) | Patient 114 | | | | | | Patient 144 | | | | |
and 96% on the BKB Sentence test. CL scores were also greater than either LA or L scores by 25% and 28% on the PBK Word test and by 18% and 52% on the BKB Sentence test. Patient 114 scored 45% on the PBK Word test, and 34% on the BKB Sentence test in the C condition.

Statistical analysis, shown in Table 3, showed that the differences between CL and L scores were significant (p < 0.05) on both tests. Postoperative CL scores for both tests were also significantly higher than postoperative LA scores. Comparison of preoperative and postoperative LA or L scores on both tests showed no significant differences. Comparison of LA with L scores in either the preoperative or postoperative period showed significant differences for the BKB Sentence test both pre- and postoperatively. As mentioned, child 114 would not cooperate for testing in the A condition, so no statistical comparison of C scores with A scores is possible.

**Patient 144** Scores in the CL condition for patient 144 were also high overall: 91% for PBK Phonemes and 78% for BKB Sentences. CL scores were higher than postoperative LA scores by 18%, and were higher than preoperative LA scores by 4% on the BKB Sentence test. On the PBK Word test, the CL score was higher than the postoperative LA score by 36%, and was higher than the preoperative LA score by 10%. In the C condition, patient 144 scored 40% for PBK Phonemes and 48% for BKB Sentences.

Statistical analysis showed that CL scores were significantly higher than L scores on both tests. CL scores were significantly higher than postoperative LA scores on the PBK Word test, but not on the BKB Sentence test. A comparison of LA or L scores between the pre- and postoperative period showed no significant differences. A comparison of LA with L scores in either the preoperative or postoperative period showed a significant difference for BKB Sentences and PBK Phonemes in the preoperative period. A comparison of C and A scores for both tests showed C scores to be significantly higher. There was no significant difference between pre- and postoperative A scores for either test.

**Discussion**

Both children showed significant benefits to speech perception from use of their cochlear implant. They also showed significant implant-alone open-set speech perception benefits on both the word and sentence tests. In addition, both patients demonstrated significant levels of supplementation to lipreading from implant use, and in the case of patient 114, to aided residual hearing. Although the CL postoperative score is not much higher than the preoperative LA score on the PBK Word test, scores in these conditions are both high, and there may be a "ceiling effect" at this level. More importantly, C scores were significantly higher than A scores, suggesting that more speech information was made available through the implant than through hearing aids.

In assessing contributing factors to the unique results for these two congenitally deaf adolescent patients, it has been suggested that early auditory experience is an important factor to successful cochlear implant use in later life (Eisenberg et al., 1983; Dorman, Hannley, Dankowski, Smith, & Candler, 1989; Luxford, 1989). Both patients were aided at a young age and were consistent hearing aid users. Patient 144 did demonstrate a nonzero hearing-aid-alone score preoperatively on both the PBK Word test and the BKB Sentence test. In addition, her LA scores were significantly higher than her L scores preoperatively for PBK Phonemes and BKB Sentences (p < 0.05). These results suggest that she was deriving significant benefit to speech perception from residual hearing in terms of supplementation of lipreading, and was also able to obtain a small amount of speech information through her hearing aids alone. It is unfortunate that patient 114 would not cooperate for testing in

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**Table 3. Summary of the results of statistical analysis on the differences in percentage scores on PBK Words and BKB Sentences in different conditions for two patients. In all cases of significant difference, the case mentioned first is significantly greater.**

<table>
<thead>
<tr>
<th>Condition tested</th>
<th>Significance of difference in scores</th>
<th>Patient 114</th>
<th>Patient 144</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PBK Phonemes</td>
<td>BKB Sentences</td>
<td>PBK Phonemes</td>
</tr>
<tr>
<td>LA vs. L (Preop)</td>
<td>NS&lt;sup&gt;a&lt;/sup&gt;</td>
<td>p &lt; 0.05&lt;sup&gt;b&lt;/sup&gt;</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>LA vs. L (Postop)</td>
<td>NS</td>
<td>p &lt; 0.05</td>
<td>NS</td>
</tr>
<tr>
<td>CL vs. L (Postop)</td>
<td>p &lt; 0.05</td>
<td>p &lt; 0.05</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>CL vs. LA (Preop)</td>
<td>p &lt; 0.05</td>
<td>p &lt; 0.05</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>LA vs. LA (Pre/postop)</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>L vs. L (Pre/postop)</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>A vs. A (Pre/postop)</td>
<td>NA&lt;sup&gt;c&lt;/sup&gt;</td>
<td>NA</td>
<td>NS</td>
</tr>
<tr>
<td>C vs. A (Postop)</td>
<td>NA</td>
<td>p &lt; 0.05</td>
<td>p &lt; 0.05</td>
</tr>
</tbody>
</table>

<sup>a</sup> NS = no significant difference between scores at p > 0.05 level of significance.

<sup>b</sup> p = level of significance of difference in scores.

<sup>c</sup> NA = not assessed.
the A condition. As a result, we have little indication of how much open-set speech information she received through her hearing aids alone. However, it can be seen from Tables 2 and 4 that her LA scores were overall higher than L scores pre- and postoperatively for PBK Phonemes and BKB Sentences. The differences in scores were significant only for pre- and postoperative BKB Sentences and suggest minimal speech perception benefits from her aided residual hearing at a word level. This is consistent with closed-set preoperative test results in the A condition on the Picture Vocabulary test (33%).

Surveys of the literature (Luxford, 1989; Osberger et al., 1991a; Staller et al., 1991) suggest a more limited benefit to speech perception for patients with a longer duration of profound deafness and/or congenital etiologies. The results for these two patients were much higher than those usually associated with benefits for congenitally deaf adolescents, and were more comparable to speech perception benefits received by children with acquired deafness. Although it is acknowledged that these are “star” performers, and that these results are not indicative of general outcomes of implantation in congenitally deaf adolescents, they provide strong support for the inclusion of this group as candidates for cochlear implantation. The results suggest that these children should be assessed on an individual basis.

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REFERENCES


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