

Sequential bilateral cochlear implantation in children

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Research has shown that listeners with normal hearing use binaural hearing every day to understand speech in noisy environments and to locate where a sound is coming from. When listening monaurally, it is more difficult to understand a person talking in the presence of background noise. It is also more difficult to locate a sound in the environment. Similar research with bilateral hearing aid use has shown the advantages of wearing two hearing aids over one hearing aid.

Cochlear implant surgery has traditionally been performed unilaterally for a number of reasons. While most appropriately selected recipients benefit by cochlear implantation, there is always concern that the candidate may not benefit from the procedure. Cochlear implantation usually results in the loss of residual hearing. Typically, the better hearing ear has been preserved so that the potential for auditory stimulation via a hearing aid is not lost in the unfortunate, but relatively rare, circumstance that an implant provides no benefit. There has also been the belief that one ear should be preserved in order to benefit from future (i.e. better) technologies. In addition, there are also cost-benefit issues associated with the implantation of a second device that need to be considered.

With the success of unilateral cochlear implantation and the numerous benefits demonstrated by bilateral hearing aid fittings, many cochlear implant recipients and their clinicians have started to question whether

significantly enhanced speech understanding and improved localization may be achieved through bilateral implantation. Results to date with adult bilateral implant recipients have shown benefits for hearing in noise, for localization in the horizontal plane, as well as subjective benefits related to improved sound quality.

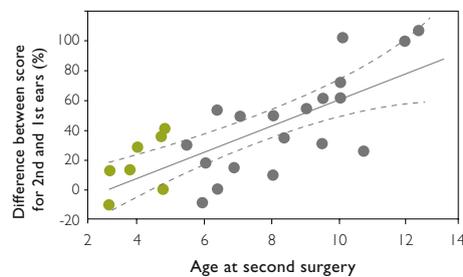
For the above reasons, a study was initiated in the North Americas region to investigate whether children might also benefit from bilateral electrical stimulation. Of particular interest was hearing benefit in background noise and enhancement of localization abilities. There are good reasons to expect that children might benefit even more than adults from bilateral implantation. Young children's cognitive and physiologic faculties are more plastic, and children may better accommodate and make use of the two inputs from bilateral cochlear implants. Thirty children have been implanted sequentially for this study all having a minimum of six months experience with unilateral cochlear implantation prior to receiving the second implant. The children were aged between three and 13 years at the time they received the second implant. Surgeries and postoperative recoveries were generally uneventful. There were cases of mild postoperative dizziness/imbalance but all resolved quickly. While the sound for the second system was initially strange, the children usually adapted well to the second side after a period of adjustment, although

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older children tended to have more trouble than younger children.

In general, similar results were seen for the children as for adult bilateral cochlear implant recipients. That is, children have shown improved hearing for speech in noise as well as improved localization abilities. A notable difference when compared with postlingually deafened adult bilateral users was that the children needed several months' experience with the second device activated before improved localization abilities become apparent^{1,2}. Another notable observation was that younger children (under the age of about eight years) acquired open-set speech recognition in the second ear more rapidly than older children. Figure 1 shows the difference in word scores obtained for the first-implanted ear and second-implanted ear as a function of age at second-side implantation. A difference of 0% means that the children score the same with the second implant alone as they do with the first implant. As shown, after six months of device use the gap in scores between the two ears widens as a function of age at second surgery. This trend was still evident even after 12 months of experience with the second device. These results suggest that for the children to make optimal use of the second cochlear implant, surgery on the second side should be earlier rather than later.

Figure 1
Difference in word recognition scores between the first-implanted ear and the second-implanted ear as a function of age at second surgery for 26 sequentially bilaterally implanted children. Green circles indicate children tested with the Multisyllabic Lexical Neighborhood Test (MLNT) and grey indicate children tested with the Lexical Neighborhood Test (LNT). Higher difference scores indicate that the first ear was better than the second ear.



Reference notes

- 1 Litovsky RY, Johnstone P, Parkinson A, Peters R, Lake J (2004) "Bilateral cochlear implants in children: effect of experience" International Congress Series, 1273, 451-454.
- 2 Litovsky RY, Johnstone PM, Godar S, Agrawal S, Parkinson A, Peters R, Lake J (in press) "Bilateral cochlear implants in children: localization acuity measured with minimum audible angle" Ear and Hearing.