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Long-Term Speech Perception in Children With Cochlear Implants Compared With Children With Conventional Hearing Aids

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Objective: To determine the speech perception of children with cochlear implants.
Subjects and Methods: Speech perception results of seven children with cochlear implants (excellent performers), who showed stable speech recognition scores in the long term, were compared with those of severely hearing-impaired children with conventional hearing aids (reference group). The groups of children were matched according to their mean free-field aided thresholds.
Results: The results of the open-set word recognition test were comparable in the two groups.
Conclusion: If we consider the results of the hearing aid users as the gold standard, the results suggest that speech recognition in selected children with a cochlear implant is close to optimal. **Key Words:** Cochlear implants—Speech perception.
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Speech perception tests are widely used to evaluate the progress of children with cochlear implants (1,2) In several children who received cochlear implants at our department and whose cause of deafness was meningitis, significant improvements over time were found, and a plateau in speech perception was reached somewhere between 1 and 3 years later (2). Full insertion of the electrode array and consistent aural-oral communication training seemed to be major positive factors for reaching a plateau within this period (2). The present paper deals with speech perception scores of children with cochlear implants who had reached a plateau. A plateau was defined as being present if improvement in the phoneme recognition score on an open-set word recognition test was 5% or less per year (arbitrary value). The relation between the phoneme score and the aided thresholds, when a plateau score was achieved, was studied. For the present study, the results of the open-set recognition test were used because several of the children showed ceiling effects on speech discrimination and identification tests, but not on the open-set word recognition test.

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SUBJECTS AND METHODS

The experimental group comprised seven selected children who were using a Nucleus multichannel cochlear implant (all with an MSP processor and with common ground stimulation). The selection criteria were as follows: acquired total deafness because of meningitis, full insertion of the electrode array, aural-oral communication, and plateau scores on the speech perception tests. The ages at onset of deafness varied between 2 and 4 years; the ages at implantation ranged from 4 to 10 years. The average aided free-field threshold at 0.5, 1, and 2 kHz with the cochlear implant varied between 37 and 47 dB hearing loss.

To enable a comparison, the tests were applied to a group of 11 severely hearing-impaired children with acquired deafness who were between 4 and 7.9 years old and who were using conventional hearing aids binaurally. These children were selected with regard to their aided thresholds, which were in the same range as those of the cochlear implant users. The average (unaided) hearing loss at 0.5, 1, and 2 kHz in the better ear ranged from 67 to 90 dB HL. The hearing aid fitting procedure has been described in detail elsewhere (3). All the children (cochlear implant and hearing aid users) had been using hearing devices for over 2.5 years.

The speech perception test battery comprised nine subtests, presented at a level of 70 dB sound pressure level. Evaluations were performed 3, 6, 12, 18, 24, and 36 months after the speech processor had been fitted. In the present analysis, only the phoneme scores obtained from the open-set word recognition test were used. Three lists of monosyllables, taken from a standard Dutch test for speech audiometry in children, were presented. These lists comprised ten words (30 phonemes) each.

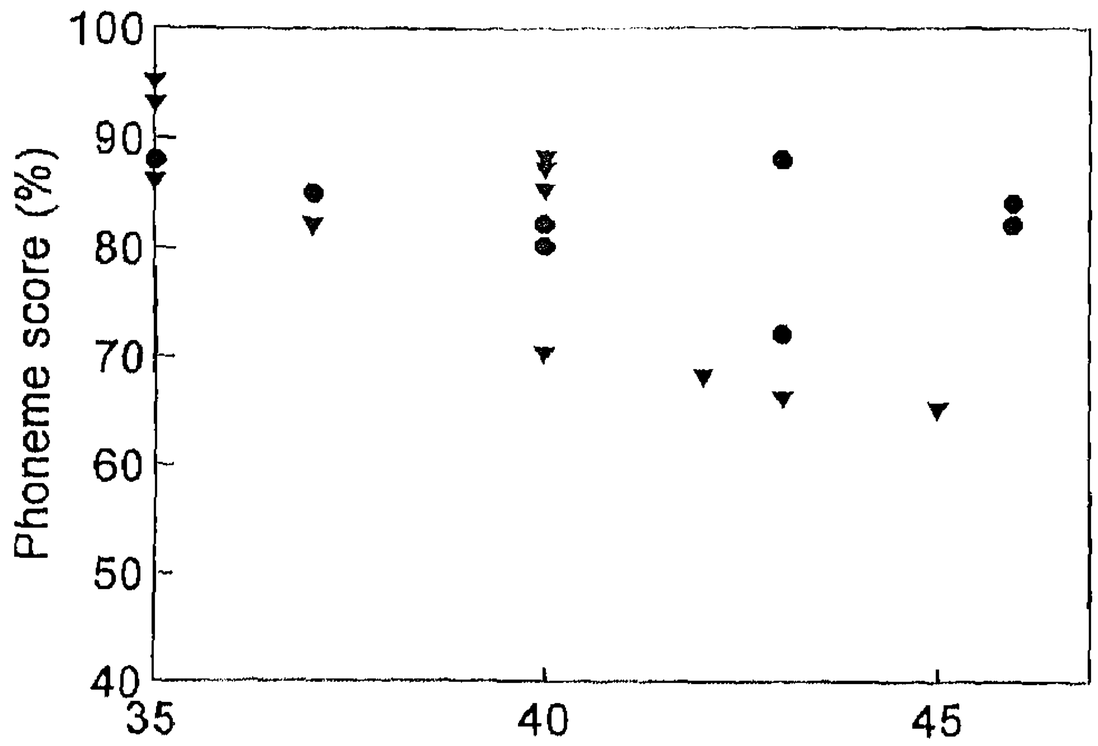

FIG. 1. Individual phoneme scores as a function of the mean aided thresholds of children with conventional hearing aids (▼) or cochlear implants (●).

RESULTS AND DISCUSSION

In Figure 1, the most recent phoneme scores (obtained at least 3 years after implantation) of the seven children with cochlear implants are presented as a function of the average aided thresholds valid at that time. High phoneme scores were found (mean value 82%). The same figure also presents the results of the group of hearing-aid users. Surprisingly, the phoneme scores of the children with a cochlear implant were similar to those of the children with conventional hearing aids.

In principle, speech perception at conversation level is related to the aided thresholds. If we accept the relation between the phoneme score and aided thresholds of the hearing aid group as the gold standard, it can be concluded that the aided threshold levels seem to be the main cause for the plateau in speech recognition performance in "good" cochlear implant performers.

It can be disputed whether our group of hearing aid users is representative. Lamore et al. (4) determined the relation between phoneme scores and hearing loss in a group of adolescents with severe postlingual hearing impairment (n = 32). If we compare the measured phoneme scores of our children with hearing aids with the values derived from the study of Lamore et al., an average difference of only 3.1% (SD 9.4%) is found, which is negligible. This suggests that our reference data are adequate.

CONCLUSION

Long-term speech recognition scores in children with a cochlear implant may reach a plateau, which seems to be caused by the aided hearing threshold levels.

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