



Application of electric-acoustic stimulation in patients with profound hearing loss—case study

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Abstract

Improvement of cochlear implant technology has resulted in the extension of the selection criteria for cochlear implant candidates. Prelingually deafened children are considered for the implantation even if they still demonstrate some benefits from the use of hearing aids. The aim of the study was to examine speech perception skills in patients with cochlear implant and the hearing aid in contralateral ear. Positive results obtained indicate that patients with combined stimulation perform better than with cochlear implant or hearing aids only.

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Keywords: Cochlear implants; Binaural hearing; Bimodal stimulation

1. Introduction

Extension of selection criteria for cochlear implant candidacy results in higher number of implanting individuals not only totally deaf but with residual hearing [1,2].

The purpose of the present study was to assess the possible benefits for speech perception in quiet and in noise in two patients with severe hearing loss who utilise a cochlear implant plus a hearing aid on the non-implanted ear.

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2. Material and method

Patient L.L.:

- 52 years old
- onset of deafness—23 years of age
- aetiology of deafness—ototoxicity
- left ear implanted with Med-El Combi 40 at the age of 50.

Patient M.T.:

- 8-year-old child
- onset of deafness—8 months of age
- aetiology of deafness—meningitis
- right ear implanted with Med-El Combi 40+ at the age of 6.

Tests performed:

- pure tone audiometry (before and after the surgery)
- free field audiometry (hearing aid, cochlear implant, both CI and HA)
- speech perception test—numbers and monosyllabic words (hearing aid, cochlear implant, both CI and HA)—in quiet and in noise (SNR + 10dB).

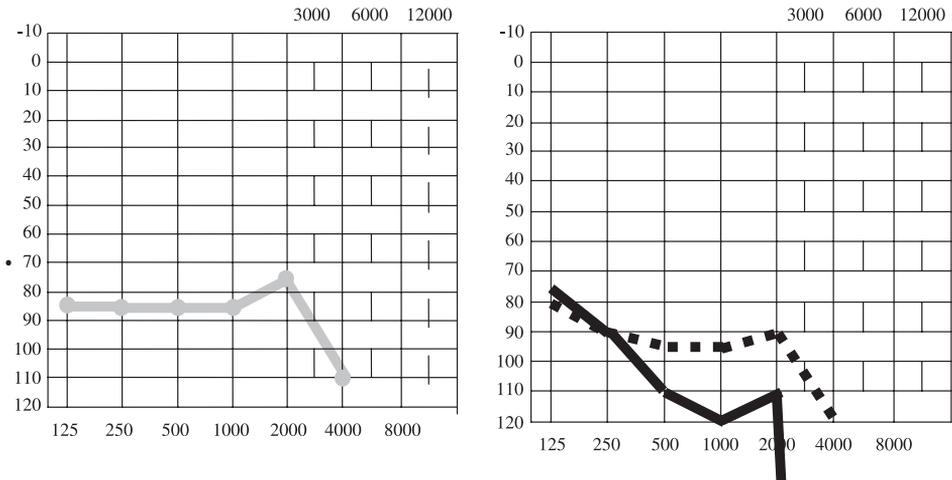


Fig. 1. Patient L.L. Pure tone audiometry. — right ear, ■■■■ left ear before the surgery, — left ear after the surgery.

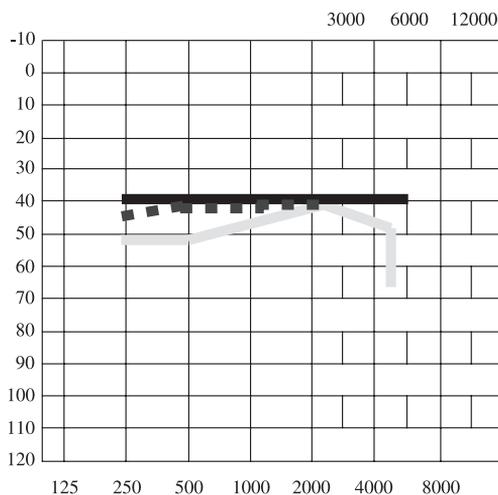


Fig. 2. Patient L.L. Free field audiometry. — cochlear implant, - - - hearing aid (right ear), — bimodal stimulation.

3. Results

Results of patient L.L. are presented in Figs. 1–3.

Results of patient M.T. are presented in Figs. 4–6.

4. Conclusions

- Audiometric data prove the presence of residual hearing that can be used for acoustic stimulation with hearing aid;

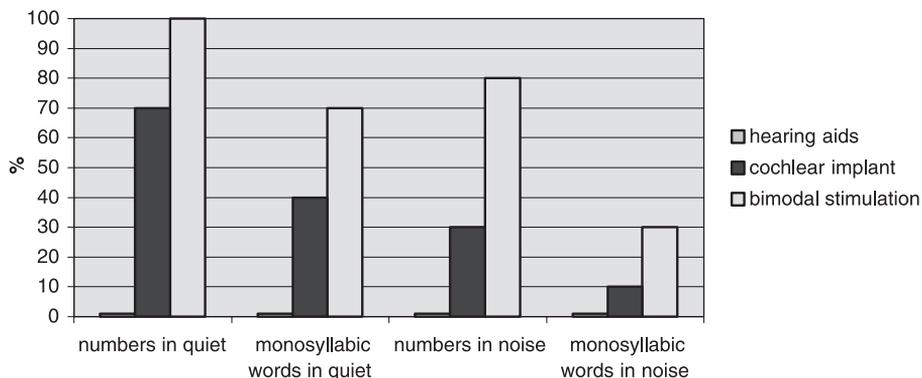


Fig. 3. Patient L.L. Performance for each aided conditions.

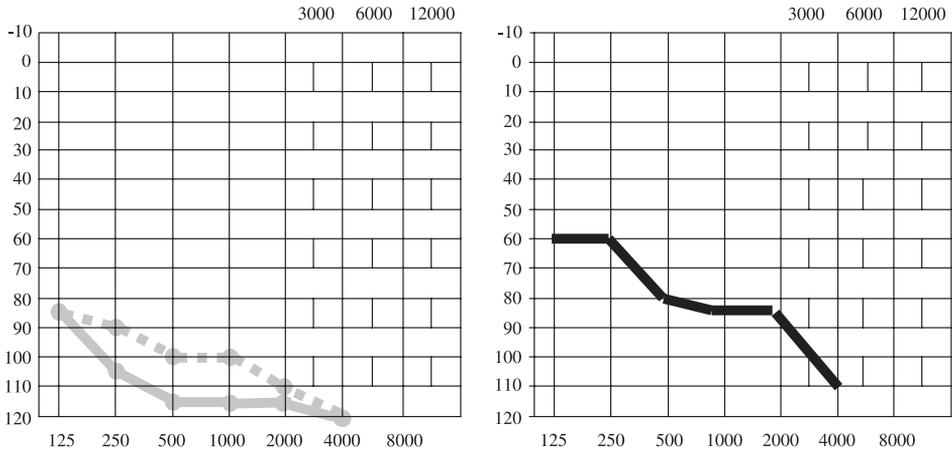


Fig. 4. Patient M.T. Pure tone audiometry. ■■■■■ right ear before the surgery, ——— right ear after the surgery, ——— left ear.

- open set understanding in both quiet and noise achieved by examined patients in bimodal condition was significantly greater (better) than that achieved using the cochlear implant or hearing aid alone.

5. Discussion

Support for binaural amplification is based on a listener’s ability to localise sound and recognise speech in the presence of competing background noise, which strongly depends on the use of two ears [3].

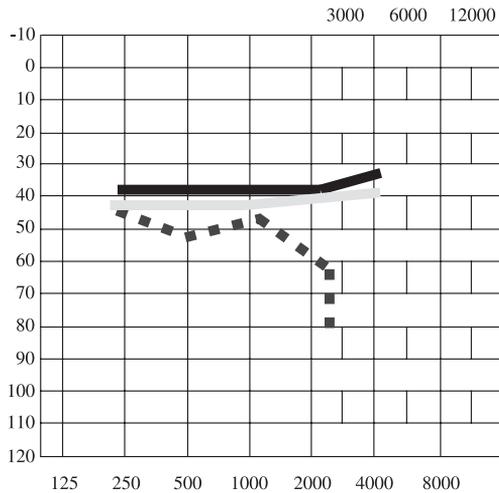


Fig. 5. Patient M.T. Free field audiometry. ——— cochlear implant, ■■■■■ hearing aid (left ear), ——— bimodal stimulation.

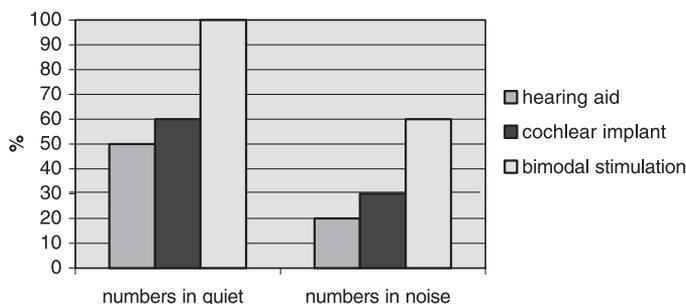


Fig. 6. Patient M.T. Performance for each aided condition.

It seems that patients may derive more benefit from using bimodal stimulation in the situation where there is some residual hearing. Even the limited information obtained by hearing aid may provide additional help in speech understanding [4]. Combined, binaural stimulation may provide a significant advantage, especially in very young children with high flexibility of the central neural system that enables them to agglomerate the information from the acoustic signal and that from electric stimulation [5,6].

However, many clinicians have questioned the possibility that the electrical stimulation of one ear and acoustic stimulation of the other ear may actually impact listening ability, i.e. a negative effect. Neither empirical data nor anecdotal reports suggest that binaural amplification would be contraindicated.

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