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Hearing with a cochlear implant: from bionic to bimodal listening

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Background

Currently, cochlear implantation (CI) is the standard procedure for bilateral severe hearing loss in both children and adults. However, a considerable number of hearing-impaired patients, who are candidates for CI, have residual hearing in the low-frequency range.

In addition to the refinement of the surgical techniques by the application of the principles of soft surgery, the design of particular, atraumatic electrodes, which are thinner, shorter and more flexible, has contributed to electroacoustic stimulation (EAS). The use of these atraumatic electrodes has resulted in preservation of residual hearing in up to 90% of cases.

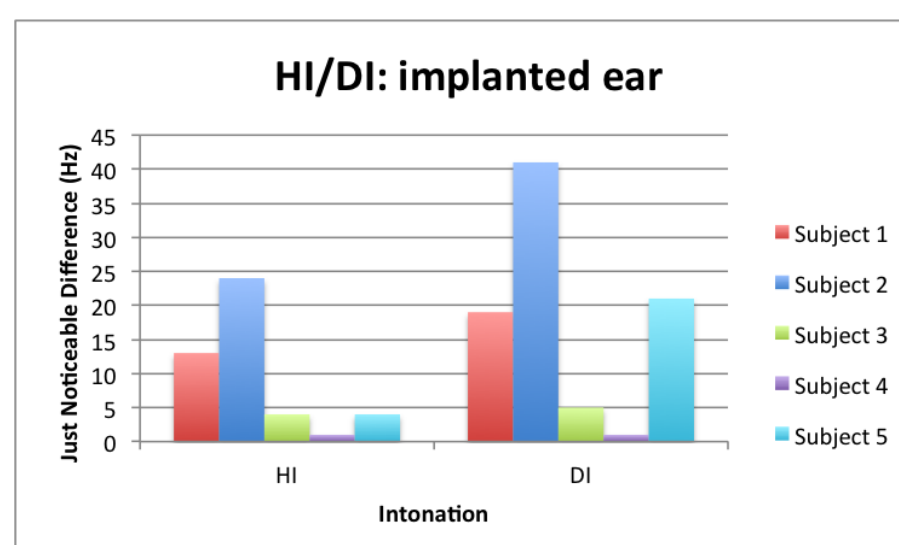
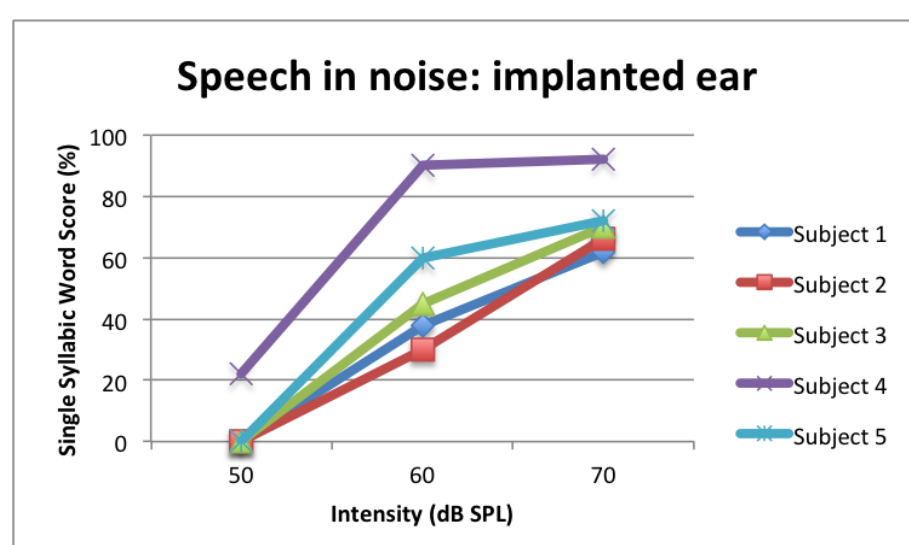
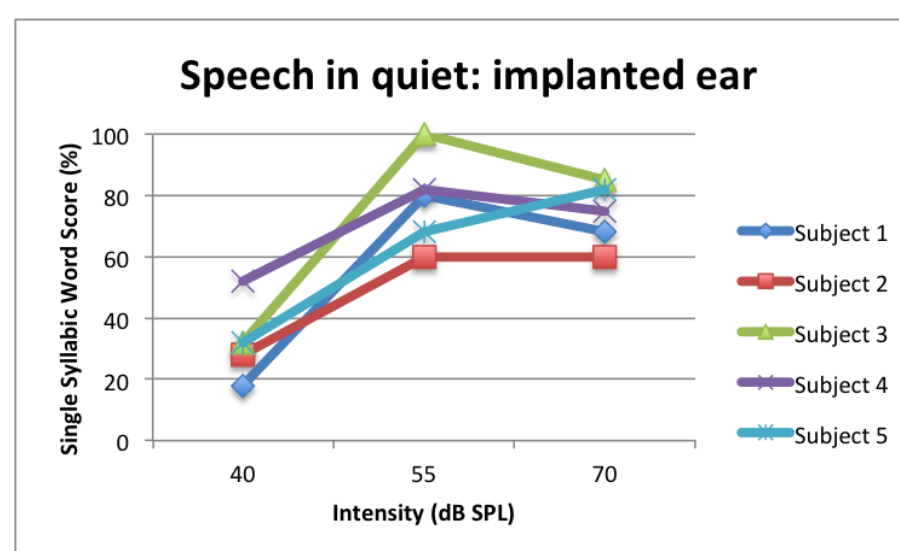
Electroacoustic hearing is associated with potential advantages over pure electric hearing: better speech understanding in noise, and superior music appreciation and sound quality. In addition, patients with EAS have awareness of sound, even when not wearing their CI.

Methods

- **5 adults** with severe postlingual hearing loss and residual low-frequency hearing
 - Cochlear® Nucleus Hybrid-L24 implant
 - Round window insertion
- Fitting of Cochlear® N6 speech processor
- Postoperative audiological measurements with CI (contralateral ear occluded):
 - Pure-tone audiometry (aided and unaided)
 - Speech audiometry in quiet at 40, 55 and 70dB SPL (phoneme score)
 - Speech audiometry in noise @ +10, 0 and -10 SNR (speech weighted noise at 60dB SPL)
 - Harmonic and disharmonic intonation (JND in Hz, A&E®)

Results

- subject 5 suffered from a full loss of the residual low-frequency hearing after surgery. Within the other subjects deteriorations from 8 up to 25dBHL (average on 125-250 and 500 Hz) were found 1-yr postop.
- subjects 1 and 2 made use of the acoustical component (custom made earmould)
- subjects 3, 4 and 5 were full-electrical users



Conclusion

The outcome of 5 Cochlear® Nucleus Hybrid implant users was evaluated making use of tonal and speech audiometry and harmonic and disharmonic intonation. Hearing thresholds were partially preserved in four patients, while one patient suffered from a full loss of residual hearing after surgery. Better JNDs were obtained for the harmonic intonation task, compared to the disharmonic intonation task.