Preoperative Residual Hearing as a Predictor of Postoperative Speech Scores for Adult Cochlear Implant Users

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The development of multiple channel cochlear implants has been a significant advance in the rehabilitation of profound hearing loss. Speech perception benefits have been particularly evident for postlinguistically deafened adults, who as a group have shown not only supplementation of lipreading scores but also significant comprehension of words and sentences using an implant alone, without the aid of lipreading. In many cases, patients are able to use their implant for telephone conversation. Speech perception benefits for adult users have increased with advances in speech processing and improved means of habilitation. These improvements in open-set speech benefits for adult users have resulted in a steady increase in group mean scores and a reevaluation of selection criteria for cochlear implantation. In the initial development of cochlear implants, only those with little or no residual hearing were considered as candidates. Current selection criteria now include those with substantial residual hearing, who may score up to 40% in the best-aided condition on word and sentence speech perception tests. In order to provide realistic expectations for prospective cochlear implant patients, it is important to establish the relationship of many preimplant factors to postimplant speech perception benefits. For severely hearing impaired adults, the relationship between preoperative residual hearing, as measured by aided word and sentence speech perception test scores, and postoperative speech perception benefits is of significant interest. Analysis of data collected over a 15 year period for adult patients is presented. The rationale for conducting full speech perception assessments for all potential cochlear implant patients is stressed.

Signal Processing for Multichannel Cochlear Implants Past, Present and Future

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Since the late 1970's, many groups have worked on developing effective signal processing for multichannel cochlear implants. The main aim of such schemes has been to provide the best possible speech perception for those using the device. Secondary aims of providing awareness and discrimination of environmental sounds and appreciation of music have also been considered. Early designs included some that attempted to simulate the normal cochlea. The application of such complex processing schemes was limited by the technology of the times. In some cases, researchers reverted to the use of single channel systems which could be controlled reliably with the existing technology. In other cases, as with the Australian implant, a simple multichannel processing scheme was devised that allowed a reliable implementation with available electronics. Over the next 15 years, largely due to the improvements in integrated circuit technology, the signal processors have slowly become more complex. Further psychophysical research has shown how additional information can be transferred effectively to implant users via electrical stimulation of the cochlea. This has lead to rapid improvement in the speech perception abilities
of adults using cochlear implants. Some of the main developments in signal processing over the last 15 years will be discussed along with the latest speech perception results obtained with the new SPEAK processing scheme for the Australian 22-channel cochlear implant. Initial results for SPEAK show mean scores of 70% (equivalent to 85-90% phoneme scores) for open set monosyllabic word testing for experienced adult users. Although there remains a large range of performance for all users of cochlear implants, average speech perception scores for all implanted adults have also improved significantly with the developments in signal processing. It appears likely that multichannel cochlear implants will be a viable alternative for the treatment of severe hearing loss in the future.
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