

Development and Clinical Application of a Cochlear Implant Mapping Assistance System

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Abstract : Objective: To overcome the communication barriers that audiologists encounter during cochlear implant mapping, particularly the challenge of eliciting subjective feedback from recipients regarding electrical stimulation, and to enhance the capabilities of existing technologies, we teamed up with software engineers to design an interactive approach for patient-audiologist communication. This approach employs a tablet (PAD) as the interface for a communication and feedback system between patients and audiologists during the mapping process, known as the Cochlear Implant Mapping Assistance System. Methods: Capitalizing on the touchscreen functionality of the PAD, the recipients' subjective feedback during cochlear implant mapping is instantly transmitted to the audiologist's mapping computer. The system acts as a platform for auditory assessment instruments, facilitating immediate evaluation of recipients' post-mapping hearing and speech discrimination capabilities. Furthermore, the system is designed to augment the visual reinforcement audiometry (VRA) process. The system consists of six modules, including three testing projects: loudness testing, hearing threshold testing, and loudness balance testing; two assessment projects: warble tone testing and digit speech testing; and one VRA animation project. It also incorporates speech-to-text and text input display functions tailored to accommodate speech communication difficulties in hearing-impaired individuals, with pre-installed common exchange content between audiologists and recipients. Audiologists can input sentences by selecting options. The system supports switching between Chinese and English versions, suitable for audiologists and recipients who use English, facilitating international application of the system. Results: The Cochlear Implant Mapping Assistance System has been in use for over a year in the Auditory Implant Center of the Department of Otolaryngology and Neurotology, Medical Center of Otolaryngology and Head & Neck Surgery, Chinese PLA General Hospital, with more than 300 recipients using this mapping system. Currently, the system operates stably, with both audiologists and recipients providing positive feedback, indicating a significant improvement over previous methods. It is particularly well-received by pediatric recipients, significantly enhancing the work efficiency of audiologists and improving the feedback efficiency and accuracy of recipients. The system enhances the comprehensibility for cochlear implant recipients, improves wearing comfort and user experience, facilitates cochlear implant auditory mapping, and increases the collection of previously challenging-to-obtain data during the existing assisted mapping process, such as loudness testing data, electrical stimulation testing data, warble tone testing data, loudness balance testing data, digit speech testing data, and visual reinforcement audiometry testing data. Real-time data recording improves the accuracy of assisted mapping. The interface design is meticulously crafted to accommodate patients of varying ages and cognitive abilities, featuring an intuitive design that allows for effortless, guidance-free use by patients.

Keywords : audiologist, subjective feedback, mapping, cochlear implant

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