Semi-objective cochlear implant fitting with electrically evoked auditory steady-state responses results in good speech perception

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Cochlear implant (CI) fitting, i.e., the tuning of the stimulation parameters of the CI, is performed in an interactive procedure between the CI recipient and a healthcare professional. Effective communication between both parties is essential to ensure time efficiency and achieve optimal fitting results, such as improved speech perception with the CI. Although there are more than one million CI recipients worldwide, all of whom require regular fitting sessions throughout their hearing restoration journey, identifying the fitting parameters that lead to optimal CI performance remains challenging. The variability in CI recipients, and 'fitting philosophies' of different healthcare professionals have so far prevented the definition of a systematic fitting protocol with reliable results in CI performance. Consequently, there is a great interest in using neural responses to systematically determine and verify CI stimulation parameters, even more so in populations where communication is challenging, such as children.

Electrically evoked auditory steady-state responses (EASSRs) are neural responses following continuous CI stimulation. They are particularly interesting, as they can be used to quantify the responsiveness of the auditory pathway to the temporal envelope modulations of the CI stimulation [Luke et al. (2015) - 10.1016/j.heares.2015.02.006], which has shown to be correlated with speech perception in noise conditions of CI recipients [Gransier et al. (2020) - 10.1097/AUD.0000000000000783].

Recent advances in CI stimulation artifact removal have enabled the use of EASSRs, evoked with clinically relevant stimulation parameters, for objective fitting [Schott et al. (2023) - 10.1109/TBME.2023.3316838]. In this study, we present a semi-objective fitting protocol that utilizes EASSRs to determine the threshold stimulation levels of CI recipients. We applied the protocol to eight CI recipients and analyzed the results using various performance indicators. Furthermore, we created CI maps (a structure, summarizing CI stimulation parameters) based on the determined 'EASSR thresholds' and tested speech perception in both quiet and noisy conditions. Preliminary results indicate that, even without any training period, the CI recipients performed equally well with the systematically and objectively created maps compared to their optimized daily CI maps.

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