

Objectives

Adult cochlear implant (CI) recipients obtain varying levels of speech perception from their device. Adult CI users adapt quickly to their CI if they have no peripheral “bottom-up” or neurocognitive “top-down” limiting factors. Our objective here was to understand the influence of limiting factors on the progression of sentence understanding in quiet and in noise, initially and over time. We hypothesized that the presence of limiting factors, detected using a short test battery, would predictably influence sentence recognition with practical consequences. We aimed to validate the test battery by comparing the presence of limiting factors and the success criteria of >90% sentence understanding in quiet 1 month after activation.

Design and methods

The study was a single-clinic, cross-sectional, retrospective design incorporating 32 adult unilateral Nucleus® CI users aged 27 to 90 years (mean = 70, SD = 13.5). Postoperative outcome was assessed through French MBAA2 sentence recognition scores in quiet and in varying signal to noise ratios at 1 day, 1 to 2 months, and up to 2 years. Our clinic’s standard test battery comprises physiological and neurocognitive measures. Physiological measures included electrically evoked compound action potentials for recovery function, spread of excitation, and polarity effect. To evaluate general cognitive function, inhibition, and phonological awareness, the Montreal Cognitive Assessment screening test, the Stroop Color-Word Test, and tests 3 and 4 of the French Assessment of Reading Skills in Adults over 16 years of age, respectively were performed. Physiological scores were considered abnormal, and therefore limiting, when total neural recovery periods and polarity effects, for both apical and basal electrode positions, were >1.65 SDs from the population mean. A spread of excitation of >6 electrode units was also considered limiting. For the neurocognitive tests, scores poorer than 1.65 SDs from published normal population means were considered limiting.

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Results and conclusions

At 1 month, 13 out of 32 CI users scored $\geq 90\%$ sentence recognition in quiet with no significant dependence on age. Subjects with no limiting peripheral or neurocognitive factors were 8.5 times more likely to achieve $\geq 90\%$ score in quiet at 1 month after CI switch-on ($p = 0.010$) as shown in the figure below. Early sentence recognition scores were predictive of long-term sentence recognition thresholds in noise such that limiting factors appeared to be of continuous influence. Understanding the measurable covariables that limit CI performance may inform follow-up and improve counseling. A score of $\geq 90\%$ for sentence recognition in quiet at 1 month may be used to define successful progress; whereas lower scores indicate the need for diagnostic testing and ongoing rehabilitation. Our findings also suggested that sentence test scores as early as 1 day after activation may provide vital information for the new CI user and indicate the need for rehabilitation follow-up.

