
Understanding the relationship between hearing experiences, music listening behaviours and chord discrimination abilities for adult cochlear implant users

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Abstract

Cochlear implants (CIs) are neural prostheses that can partially restore hearing to individuals who suffer from severe-to-profound hearing loss (1). However, CIs have been primarily designed to facilitate speech perception, and other aspects of listening via CIs need to be improved. One example is music perception. Most adult CI users report a reduction in music enjoyment and time spent listening to music post-implantation relative to before implantation at a time when their hearing was better (2). Commonly reported problems are poor sound quality and low clarity of music, especially difficulty in hearing out individual notes or instruments in a mixture. Correlations have been found between enjoyment, sound quality and listening habits before and after implantation (3), as well as between the amount of time spent on music listening and enjoyment after implantation. The nature of pre-implant hearing experiences, such as residual hearing levels, use of hearing aids and duration of deafness, could affect post-implant music enjoyment. The exploration of these factors formed the basis of the current study, which aimed to explore and assess the relationship between self-reported pre-implant hearing and music experiences and post-implant chord discrimination and music enjoyment.

An online platform was used to: deliver questions from the validated Munich Music Questionnaire (MUMU); run a chord discrimination task (developed by Griffin 2017, ref 4); and ask demographic questions. Twenty-three CI users participated, aged 29-86 years. The chord discrimination task involved detection of an upward change of 1, 2 or 3 semitones in the third note, or a downward change of 1, 2, or 3 semitones in the middle note of a three-note major chord, generated using synthesised piano tones.

An exploratory factor analysis (EFA) was conducted on the demographic information and responses to the MUMU to determine hearing-experience and music-experience variables. The EFA revealed three hearing-related variables (two latent and one direct), namely, duration of hearing difficulty, age-related factors and years of hearing with a CI, and three music-related latent variables, namely, music quality from the CI, depth of music engagement and music

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listening habits. The relationship of these hearing- and music-related variables to scores for the chord discrimination task was analyzed with a generalized linear mixed model. Chord discrimination scores were related to chord changes, music quality from the CI and to an interaction between age-related factors and years of hearing with a CI.

These results suggest that there are relationships between hearing- and music-related variables that can affect music perception for CI users. We will explore the effect of these hearing and music-related latent variables on reported music enjoyment (also derived from MUMU responses). Our future research will explore what cues CI listeners use to perform the chord discrimination task, whether the cues used differ across CI listeners, and whether the ability to use the available cues is related to overall performance and music enjoyment. We will also explore how information on pre-implant hearing experiences and music experiences can be incorporated into clinical approaches to improve music engagement for CI users.

References

1. G. Dritsakis, et al. (2017) *American Journal of Audiology* 26, no. 3. 268-82.
2. L. Lassaletta, et al. (2008) *Acta Otorrinolaringologica Espanola* 59, no. 5. 228-34.
3. V. Looi, G. Kate, and D. Virginia (2012) *Seminars in Hearing* 33, no. 4. 307-34.
4. S. Griffin. (2017) University College London, PhD Thesis.