

Critical Review: The Impact of Structured Auditory Training on Musical Pitch and Melody Perception in Individuals with a Unilateral Cochlear Implant

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This critical review examines whether structured auditory training with unilateral cochlear implant users results in improved performance in the skills of pitch and melody perception. Study designs considered include: a randomized clinical trial (RCT), two single-subject research designs (SSRD), a longitudinal cohort study, and a critical review. Overall, the research provides suggestive evidence in support of structured auditory training to improve pitch and melody perception for the

field or via a laptop computer with custom software. Subjects were allowed to train for as long as they felt it beneficial and thus the time course and amount of training varied among subjects, ranging from one week to two months of training and between one and three hours of training per day. Post-training measures of the metric tests were then obtained periodically for each subject during the training period.

Results indicated that moderate regular training with the MCI task significantly improved all trained subjects' MCI performance ($p=0.004$). FMI re-testing following the period of training showed that FMI performance, with and without rhythm cues, was also improved with MCI training, however this result was not statistically significant ($p=0.373$). Training significantly reduced inter-subject variability in MCI performance. Follow-up measures conducted for three subjects one month after training had stopped revealed that performance on the MCI task was largely retained. Overall, the investigators concluded that training with the MCI task helped C.I users, once capable of only limited MCI, to significantly improve their MCI performance, suggesting that C.I users' music perception may be improved with training and music listening experience. Moreover, the MCI training did generalize to improved FMI performance, a skill that was not specifically trained, highlighting the importance of training to develop better music perception skills.

This study is an example of a non-randomized, controlled, concurrent multiple baseline design providing level two evidence for a SSRD (Logan, Hickman, Harris & Heriza, 2007). The authors incorporated various design elements that served to strengthen the quality of their findings within the SSRD framework including: baseline, intervention, and follow-up phases during which repeated outcomes were measured, inclusion of greater than three subjects, and manipulation of exposure. According to Logan et al., (2007) this study provides limited causal inferences for the effect of MCI training on melody and pitch perception. A criticism of this study design is that the authors fail to explain how they selected their six adult C.I subjects for training. In addition, the authors mention that there was high inter and intra-subject

Longitudinal Cohort Study. Yucel, Sennaroglu, and Belgin (2009) investigated whether children with a unilateral C.I would benefit from training in pitch and music perception. 18 profoundly hearing impaired children with unilateral cochlear implantation aged 8 months to 8 years were included in the study. Nine of the children were trained from the outset while nine children received no training. Both the training and

the current findings. McDermott (2004) provides a comprehensive review of music perception with cochlear implants in which he states that auditory training programs devised to provide implant users with structured musical listening experiences may improve the subjective acceptability of music heard through a C.I. From a more qualitative perspective, anecdotal reports of C.I users have provided encouraging reports of how listening experience, sometimes over years, results in improved listening comfort and acceptability of music (McDermott, 2004). A recent anecdote recited by a C.I user to a class of Audiology students revealed that pitch and melody perception did greatly improve for this particular C.I user over time, with concentrated listening practice. This anecdote perhaps eludes to the brain's remarkable ability to reorganize with experience, a phenomenon that has been described in studies related to auditory plasticity and training (Dorman, Sharma, Gilley, Martin, Roland, 2007). Overall, the evidence while suggestive from a research standpoint is compelling from a clinical standpoint. As long as there is no risk of harm to the C.I user, the provision of structured auditory training targeted towards improving aspects of musical perception may provide many potential benefits, not only in music perception but other auditory skill areas, and should be carefully considered by the rehabilitative Audiologist as a treatment option within the clinical setting. Whether or not prolonged periods of training or listening may cause harm to the C.I user is another issue that requires investigation.

Conclusion & Clinical Implications

Based on the existing literature, there is evidence in support of prescribing auditory training for improving pitch and melody perception in the unilateral C.I user. Auditory training in certain skills related to music perception may also lead to benefits such as improved liking and subjective appraisal of sound quality through the prosthesis. Thus, barring risk of harm, the rehabilitative Audiologist may assist implant recipients interested in greater musical enjoyment by suggesting listening experiences that target certain

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