Neurological & Behavioral Responses to Musical Features in Adolescent Cochlear Implant Users Before and After Intensive Music Training

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BACKGROUND & AIMS
Cochlear implants (CIs) are designed to provide deaf individuals with speech comprehension. Perception of music is challenging1,2,3, but neural correlates of residual prerequisites for music perception have been found in postlingually deaf adult CI users and in children with CIs4,5. By contrast, little is known about music perception in the new generation of prelingually deaf adolescents who grew up with CIs. Recent studies, however, indicate that to keep pace with their normal hearing (NH) peers, supplementary measures of rehabilitation are important throughout adolescence6. Music training may provide a beneficial method of strengthening not only music perception, but also linguistic skills, particularly prosody. This study aimed to investigate 1) the behavioral and neural correlates of music perception in prelingually deaf adolescent CI users and 2) the potential effects of an intensive musical ear training program on adolescent CI users’ discrimination of music and speech.

PARTICIPANTS & METHODS
Eleven adolescent CI users (6 girls, Mage = 17.0 y) participated in a short intensive music training program formed by three elements: rhythm-training, singing and ear training. The active music making was supplemented with daily computer based listening exercises. Ten NH peers (2 girls, Mage = 16.2 y) formed a reference group, which followed standard school schedule and received no music training (Table 1).

RESULTS & STATS
For the adolescent CI users we found significant and consistent MMNs for timbre, intensity and rhythm deviants, but not for pitch. NH listeners produced significant MMNs for all six deviants. We found a significant main effect of Group (F=8.4; p=0.009), mainly driven by larger mean amplitudes in the NH participants for deviants Pitch (t=-2.5; p=0.02), Guitar (t=-2.3; p=0.04) and Rhythm (t=-2.4; p=0.03), compared to CI users (Figure 2). The analysis on MMN latencies showed a significant main effect of Group, (F=83.6; p<0.001), driven by overall shorter NH mean latencies in CI users than in the NH participants. We found no effect of training on either MMN amplitude or latency. Behaviorally, the CI users improved their discrimination skills within all musical domains after training, resulting in a significant overall progress. In particular, discrimination of melodic contour and rhythm showed a significant progress. The NH group produced significantly higher average scores than the CI group at both sessions (Figure 3). We found no effect of the music training on discrimination of emotional prosody.

REFERENCES

DISCUSSION
The findings of this study are novel, indicating residual neural discrimination prerequisites for musical feature changes in prelingually deaf adolescent CI users, who are late implanted and have only experienced the degraded sound from the implant. Moreover, behavioral discrimination of rhythm and melodic contour may be significantly improved, even from short term training. By contrast, detection of changes in pitch is poor and unaffected by music training. Finally, the multifeature MMN paradigm could be a useful tool for assessing auditory rehabilitation following cochlear implantation, also in a clinical context.