Music Training of CI Recipients: The Impact of Stimuli and CI User Characteristics on Benefit

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Disclosure Statement
I have no financial or nonfinancial interest in any organization whose products or services are described, reviewed, evaluated or compared in the presentation.

Learning Outcomes
At the end of this presentation, attendees will be able to:
• explain those musical structures most and least effectively transmitted through a cochlear implant;
• describe different aspects of music training;
• describe characteristics of CI recipients that impact benefit of training

I. Music is a pervasive and highly valued acoustical sound and art form.

A. Next to spoken communication, music listening and enjoyment is the 2nd most commonly expressed desire of CI recipients.

B. Because music is such a common acoustic form, CI recipients are likely to have regular exposure to musical sounds in everyday life.

II. Speech recognition improves significantly with everyday experience, but music perception and enjoyment do not improve from incidental exposure

III. CI users face several impediments to music listening

A. Salient aspects of music listening (pitch, timbre) are poorly suited to CI technology. Music and speech differ in regard to signal processing requirements
1. Speech recognition requires as few as 4 bands of coarse spectral cues in quiet (Shannon, Zeng, Kamath, Wygonski, & Ekelid).

2. A greater number of functional channels and better encoding of the fine structure information are required for transmitting melody and timbre (Smith, Delgutte, & Oxenham, 2002).

IV. CIs recipients have similar perceptual accuracy as normal hearing (NH) adults for rhythm, but not for timbre (tone quality) or pitch and melody. Many CI recipients complain that music sounds like noise or does not make sense. However, there is considerable variability among CI recipients, and some have developed music appreciation as a result of focused practice.

V. Multiple regression analyses (Gfeller et al., 2007) reveal the following factors as best predictors of perceptual accuracy and enjoyment of music:
   A. use of hearing aids in conjunction with the CI,
   B. efficient cognitive processing,
   C. extended musical training (high school level and beyond) and
   D. focused music listening.

These findings suggest that music training can be an important factor in enhanced music enjoyment.

VI. Prior research on auditory training indicates the following factors considered to be beneficial in adult auditory learning and training for speech (Robinson and Summerfield, 1996):
   A. Familiar stimulus materials increases the rate of learning
   B. Training stimuli that exemplifies acoustic variability in real-life sounds facilitates transfer to everyday life.
   C. Visual cues enhance learning.
   D. When acoustic information is limited, little or no evidence of learning is observed.

VII. We considered the following principles in designing a music training program:
   A. “The brain is remarkably capable of extracting useful information from seemingly sparse input.” (Ryuogo, Limb, & Redd, 2001)
   B. Distributed rehearsal over time is generally superior to massed rehearsal.
   C. Emphasize structural features most effectively represented by the CI.
   D. Utilize previously familiar music, contextual cues.
   E. Pair sounds with visual cues and other extra-musical associations. (Gfeller et al., 1999, 2000, 2001)
VIII. In order to increase the clinical significance and compliance, we integrated the following aspects into our music training program

A. Content that promote realistic expectations for music listening
B. Include musical sounds that would be heard regularly in everyday life
C. Include a continuum or balance of
   1. Strictly to loosely structured tasks
   2. Simple to complex sounds
   3. Little context to high context
D. Listening tasks designed to enhance awareness, discrimination, recognition, and improved sound quality
E. Listening tasks that would be realistic for adult learners, non-musicians, and most importantly, implant recipients

IX. From field testing our music training program, we determined that
A. some aspects of perception and appraisal are more amenable to training than others.
B. Implant recipients make use of prior listening experiences in perception and appraisal.
C. CI recipients can learn new songs with adequately transmitted features.

X. From follow up studies (Driscoll et al., 2006), we have determined that recognition of musical instruments can be improved significantly with only a few short training sessions as long as feedback and direct instruction are provided. Mere repetition is not sufficient to result in significant improvement.

XI. Practical Recommendations for Music Training

A. Establish realistic expectations for listening
B. Begin practice in a quiet listening environment with good sound equipment.
C. Begin with short (10-15 minutes or less) but frequently spaced rehearsals.
D. Provide lots of repetition
E. Exploit those musical features best represented in the initial listening practice—Rhythm > lyrics > timbre > pitch/melody
F. Whenever possible, use visual aids to facilitate understanding, such as watch the musician, or reading the lyrics or notes
G. Practice listening to songs familiar prior to implantation. However, keep in mind that the music will not have the same tone quality.
H. Keep a listening diary and make a list of music that sounds best and listening circumstances that are best.
I. Vary the types of music chosen for listening practice.
J. Use context and other cues to make sense of the sound.
K. Don’t be afraid to experiment.
References


