Differences in Perception of Musical Stimuli Among Acoustic, Electric and Combined Modality Listeners

Sandra Prentiss, PhD, David Friedland, PhD, MD, John Nash, MD, Christina Runge, PhD

Department of Otolaryngology and Communication Sciences
Medical College of Wisconsin, Milwaukee, WI
Disclosures

• Dr. Christina Runge is a research consultant for MED-EL and Novartis

• Dr. David Friedland is a member of MED-EL surgical advisory board
Introduction

• Cochlear implants are effective for speech understanding
• Music perception remains challenging
• Music is rated as the second most important aspect to hearing next to speech
• Pitch-related tasks and instrument identification are the most difficult for cochlear implant users
Study Goals

- Identify differences in music perception among CI users, bimodal users, bilateral hearing aid users and normal hearing controls
Hypothesis

• Performance will increase as more acoustic information is available
Subjects

- 56 adults evenly represented in 4 listening configurations
  1. Unilateral cochlear implant (CI)
  2. Bimodal listeners – hearing aid on the contralateral ear (CIHA)
  3. Bilateral hearing aids (HAHA)
  4. Normal hearing listeners (NH)
Subjects

- All implant participants were post-lingually deafened with at least 6 months of listening experience
- None of the participants were professionally trained musicians
Methods

- IRB approved
- Mu.S.I.C. – Musical Sound in Cochlear implants software (Fitzgerald et. al, 2006)
- Chord discrimination
  - Listen to two chords (55 Hz – 1174 Hz)
  - Same or different task
- Instrument identification
  - Listen to a C-major scale
  - 10 instrument forced-choice identification task
Chord Discrimination
Timbre Perception
Results

Chord Discrimination

% Correct

Listening Configuration

CI  CIHA  HAHA  NH
Results

Timbre Perception

% Correct

Listening Configuration

CI  CIHA  HAHA  NH
Results

Chords and Timbre

% Correct

Listening Configuration

CI  CIHA  HAHA  NH

Mean Chords
Mean Timbre
Discussion

• Chord discrimination and timbre perception are reduced in groups with hearing loss

• Timbre perception was easiest with normal hearing yet most difficult with electric hearing
Discussion

• Further analysis of timbre characteristics may help identify components of music that are poorly represented in electric hearing

• May contribute to advancements in programming strategies