Optimizing Hearing Performance with a Wireless Remote Microphone Audio Streaming Accessory

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The Problem

• Cochlear implant recipients experience difficulty with:
  – Understanding speech in noise
  – Understanding speech in reverberant environments
  – Understanding speech from a distance
Previous research has shown up to a 60 percentage point improvement in sentence recognition in noise with use of the Cochlear Mini Mic.

Can performance improve with changes in Nucleus 6 mixing ratio and/or Mini Mic volume control?
Study Objective

• Evaluate the effect of two parameters on sentence recognition in noise with Cochlear Mini Mic
  – Accessory Mixing Ratio
  – Mini Mic Volume Control Setting
Subjects

- 10 Nucleus 6 Users
  - Age:
    - Range: 10-77 years old; Mean: 60.7 years old
  - Unilateral and Bilateral CI Users
    - Nucleus CI24R, CI24RE, CI422, and CI512.
    - Unilateral recipients did not use hearing aid (ear plugged).
  - Average Duration of Hearing Loss: 24.8
  - Average Duration of Severe to Profound Hearing Loss: 10.4
Equipment

Nucleus 6 Sound Processor (CI920)

Cochlear Mini Mic
Equipment

- Nucleus 6 sound processor programmed with participant’s program
  - ASC+ADRO (No SCAN or SNR-NR)
  - Volume Control set to participant’s MCL
Assessment

• Measured sentence recognition in quiet and in noise with and without Cochlear Mini Mic
  – AzBio Sentences (Spahr et al., 2012):
    • Presentation Level
      – 85 dBA at Mini Mic (6 inches from loudspeaker used to present sentences)
      – 65 dBA at location of participant
  – Uncorrelated Classroom Noise (Schafer & Thibodeau, 2006)
    • Quiet & Noise at 60, 65, 70, and 75 dBA
    • Noise level identical at Mini Mic and at subject location
  – One list per condition (20 sentences)
Equipment Setup

24 ft, 8 in

17 ft

8 ft, 6 in

15 ft, 6 in

25 ft, 3 in

schematic diagram
Equipment Setup

- Ambient Noise Level: 44 dBA
- Reverberation: 0.6 sec
Conditions

• **Accessory Mixing Ratio** *(Mini Mic at default VC)*
  – 1:1
  – 2:1
  – Accessory Only

• **Mini Mic Volume Control Setting** *(Mixing Ratio at 1:1)*
  – Default Volume Control Setting
  – +6 dB
  – +12 dB
RESULTS
No Remote Mic

AzBio Sentence Recognition
% Correct

Noise Level (dBA)

- Quiet: 95% Correct
- 60 dBA: 10% Correct
- 65 dBA: 0%
- 70 dBA: 0%
- 75 dBA: 0%
Mini Mic Benefit

1:1 Mixing Ratio/Default VC Setting

AzBio Sentence Recognition

% Correct

Noise Level (dBA)

Quiet  60 dBA  65 dBA  70 dBA  75 dBA

Nucleus 6 Alone  Nucleus 6 + Mini Mic
Mixing Ratio Effect
Default Mini Mic VC

No significant difference
Mini Mic VC Effect

1:1 Mixing Ratio

No significant difference
Attenuates noise at N6 microphone
Further decreases with mixing ratio have little effect

Mini Mic VC increases are being compressed by ASC and/or AGC
Conclusions

• Use of the Cochlear Mini Mic provides significant improvement in hearing performance in noise

• Adjusting the accessory mixing ratio appears to have little effect on speech recognition in noise for recipients using ASC

• Increasing the Mini Mic volume control from the default setting appears to have little effect on speech recognition in noise
  – These findings may be attributed to compression from ASC and/or AGC

• Research is ongoing to explore strategies to further improve speech recognition in noise for Nucleus 6/Mini Mic users
Shoot for the Moon!

• THANK YOU FOR YOUR ATTENTION