Clinical Evaluation of the Nucleus 6 Sound Processor

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Disclosures

• The Clinical Evaluation of the N6 was supported by a grant from Cochlear Corporation
The Problem

• Many cochlear implant recipients experience difficulty with understanding speech in the presence of background noise

• There is a paucity of published reports describing the potential benefit of acoustic scene classification and fully adaptive signal processing
Study Objective

• Evaluate new signal processing features of the Nucleus 6 sound processor in a large group of adult & pediatric recipients
  – Evaluate the benefit obtained from an acoustic scene classifier (SCAN) that automatically selects signal processing features (e.g., directionality, digital noise reduction, etc.) based on the acoustical characteristics of the environment
  – Evaluate the benefit of noise reduction/speech enhancement signal processing (SNR-NR)
Study Overview

- Multi-site trial
- 93 subjects recruited
- Experienced Nucleus 5 users
- Single subject, acute testing
- SmartSound iQ evaluation including SNR-NR, WNR, and SCAN
- Randomized test order
# Subjects

<table>
<thead>
<tr>
<th>NUMBER OF SUBJECTS</th>
<th>93 (82 adults, 11 children)</th>
<th>50 MALE, 43 FEMALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEAN AGE ADULTS</td>
<td>57.9 yrs</td>
<td>RANGE 22-91 yrs</td>
</tr>
<tr>
<td>MEAN AGE CHILDREN</td>
<td>12.2 yrs</td>
<td>RANGE 8-21 yrs</td>
</tr>
<tr>
<td>IMPLANT TYPE</td>
<td>CI24RE, CI512, CI422</td>
<td>N=66, N=24, N=3</td>
</tr>
<tr>
<td>OWN PROCESSOR</td>
<td>Nucleus 5 CP810</td>
<td>ALL</td>
</tr>
</tbody>
</table>
Equipment

Nucleus 6 Sound Processor (CI920)

Nucleus CR230 Remote Assistant
Nucleus 6 Signal Processing

• SmartSound iQ
  – SCAN: Acoustic scene classifier that automatically selects signal processing features (Beam, Zoom, etc.) based on acoustic characteristics of the environment
  – SNR-NR: Calculates SNR in each channel and adjusts channel gain to reduce competing noise and enhance speech recognition in noise
  – Wind Noise Reduction
Assessment

AzBio Sentences (two full lists per condition)

• Initially evaluated Nucleus 6 with ASC+ADRO & SNR-NR
  – Determine SNR necessary for 40-60% correct performance
    • “Established SNR”

• Evaluate multiple conditions at established SNR
  – Nucleus 5 ASC+ADRO
  – Nucleus 6 ASC+ADRO
  – Nucleus 6 SCAN

• Speech 0° – Noise 90°/−90°
• Results
AzBio Sentence Recognition

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Percent Correct Score</th>
</tr>
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<tbody>
<tr>
<td>N5: ASC + ADRO</td>
<td>45.7</td>
</tr>
<tr>
<td>N6: ASC + ADRO</td>
<td>46.0</td>
</tr>
<tr>
<td>N6: ASC + ADRO + SNR</td>
<td>54.5</td>
</tr>
<tr>
<td>N6: SCAN + ASC + ADRO + SNR</td>
<td>72.3</td>
</tr>
</tbody>
</table>
N5 ASC+ADRO vs. N6 ASC+ADRO

AzBio Sentences in Noise (N=93)
N5 ASC+ADRO vs. N6 ASC+ADRO+SNR-NR

AzBio Sentences in Noise (N=93)
N5 ASC+ADRO vs. N6 ASC+ADRO/SNR-NR & SCAN

AzBio Sentences in Noise (N=93)
Conclusions

• SNR-NR in the Nucleus 6 sound processor provides significant improvement in speech recognition in noise (mean improvement = 9%)

• SCAN in the Nucleus 6 sound processor provides substantial improvement in speech recognition in noise (mean improvement = 27%)

• SCAN and SNR-NR may be considered for routine use for Nucleus 6 recipients
• Thank you for your attention!