Does Hearing Preservation Matter for Speech Perception Performance with Slim Modiolar Electrode?

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Author Disclosure Information

• **A. Walia, M. Shew, C. Valenzuela, N. Durakovic:** None
• **C. Wick:** Consulting Fee (Stryker)
• **J. McJunkin:** Consulting Fee (Stryker)
• **C. Buchman:** Consulting Fee (Advanced Bionics, Cochlear Ltd., Envoy, IotaMotion); Ownership Interest (Advanced Cochlear Diagnostics, LLC.)
• **J. Herzog:** Consulting Fee (Cochlear Ltd)
Background - Hearing Preservation (HP)

- Continued expansion of criteria for CI and HP has become feasible

- CI HP candidates defined by preop LFPTA \((125, 250, 500 \text{ Hz}) \leq 80 \text{ dB HL}\) (AAO-HNS minimum reporting guidelines\(^2\))

- Hearing preservation is a \textit{modifiable factor} that has not been fully explored
  - Role of electrode design, surgical techniques, and electroacoustic stimulation (EAS)

Background - Electrode Design

• **Lateral wall (LW)**\(^1\):
  - Avoid scalar translocation
  - Potentially preserve hearing for use of electro-acoustic stimulation (EAS)
  - Less discrete stimulation

• **Perimodiolar (PM)**\(^2\):
  - Minimize distance between electrode contact and spiral ganglion cells
  - Predisposition to scalar translocation and potential loss of residual hearing

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Current Literature

• Few studies have assessed the newer, less traumatic slim modiolar electrode (SME; CI532/632) in terms of HP and its impact on speech recognition scores.

• No studies to date have evaluated long-term speech performance outcomes using SME.
Objective

**Purpose:**
- To discuss the SME in the context of HP and speech perception scores
- To critically appraise the recent AAO-HNS definition of HP candidacy using LFPTA ≤80 dB HL and its impact on reporting outcomes

**Hypothesis:** Long-term HP is feasible with the SME, but HP may not impact final speech perception performance.
Study Design

**Inclusion Criteria:**
- Preop LFPTA ≤80 dB HL
- Age: ≥18 yrs
- Post-lingual onset of severe to profound SNHL
- Compliance with daily device usage (≥7 h)
- ≥1 speech perception testing appt
- ≥1 postop audiogram
- Absence of retrocochlear pathology
- ≥6 m of follow-up data
Surgical approach

- Standard CI approach including mastoidectomy-facial recess approach to RW
- Standard RW insertion technique vs anteroinferior extended RW cochleostomy
### Audiometric Outcomes Reporting

<table>
<thead>
<tr>
<th></th>
<th>“Early” 1 and 3 months</th>
<th>“Late” 6 and 12 months</th>
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<tbody>
<tr>
<td><strong>Speech Perception Testing</strong></td>
<td>• CNC</td>
<td>• AzBio in Quiet</td>
</tr>
<tr>
<td></td>
<td>• AzBio in Noise</td>
<td></td>
</tr>
<tr>
<td><strong>Residual Hearing</strong></td>
<td></td>
<td>Behavioral audiogram</td>
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</tbody>
</table>
Methods - AAO-HNS minimum reporting standards

- Patients were divided into 3 groups based on preop LFPTA:
  1) ≤80 dB HL
  2) ≤60 dB HL
  3) 61-80 dB HL

- HP was considered unsuccessful if postop LFPTA >80 dB HL
Data Analysis

• Postop LFPTA was evaluated for both “early” (1 & 3 month) & “late” (6 and 12 months) time periods and the worst LFPTA for each time period was selected.

• Student t-test was used to compare speech outcomes between the hearing preserved cohort and the hearing not preserved at 3, 6, and 12 months.

• Two-sided testing with p-value <0.05 for statistical significance.

• Analysis performed in R, SPSS, & Microsoft Excel.
## Results

<table>
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<tbody>
<tr>
<td>Age (Years; Mean +/- STD)</td>
<td>71.8 ± 13.2</td>
</tr>
<tr>
<td>Gender (% male)</td>
<td>122 (60%)</td>
</tr>
<tr>
<td>Duration of HL (Years; Mean +/- STD)</td>
<td>24.6 ± 16.2</td>
</tr>
<tr>
<td>Laterality (% right)</td>
<td>102 (50%)</td>
</tr>
<tr>
<td>Etiology</td>
<td></td>
</tr>
<tr>
<td>Family History</td>
<td>42 (21%)</td>
</tr>
<tr>
<td>Noise Exposure</td>
<td>32 (16%)</td>
</tr>
<tr>
<td>Progressive</td>
<td>15 (7%)</td>
</tr>
<tr>
<td>Unknown</td>
<td>85 (42%)</td>
</tr>
<tr>
<td>Other</td>
<td>29 (14%)</td>
</tr>
<tr>
<td>Tip Fold-Over</td>
<td>15 (7%)</td>
</tr>
<tr>
<td>Translocation into Scala Vestibuli</td>
<td>1 (2%)</td>
</tr>
</tbody>
</table>
Hearing Preservation Outcomes

61% hearing preserved
Hearing Preservation Outcomes

51% hearing preserved
Speech-Perception Outcomes — 3 months

Student 2-sided, t-test
p > 0.05
Speech-Perception Outcomes – 6 months

Student 2-sided, t-test
p > 0.05
Speech-Perception Outcomes – 12 months

Student 2-sided, t-test
p>0.05
## AAO-HNS Reporting Guidelines Analysis

<table>
<thead>
<tr>
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<th>Audiogram Analysis at Activation</th>
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<tbody>
<tr>
<td><strong>60 dB HL HP Candidates</strong></td>
<td></td>
</tr>
<tr>
<td>Hearing Preserved</td>
<td>55 (61%)</td>
</tr>
<tr>
<td>Hearing Not Preserved</td>
<td>35 (39%)</td>
</tr>
<tr>
<td><strong>80 dB HL HP Candidates</strong></td>
<td></td>
</tr>
<tr>
<td>Hearing Preserved</td>
<td>66 (46%)</td>
</tr>
<tr>
<td>Hearing Not Preserved</td>
<td>79 (54%)</td>
</tr>
<tr>
<td><strong>61 – 80 dB HL HP Candidates</strong></td>
<td></td>
</tr>
<tr>
<td>Hearing Preserved</td>
<td>11 (20%)</td>
</tr>
<tr>
<td>Hearing Not Preserved</td>
<td>44 (80%)</td>
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</table>
Limitations

- Retrospective study and risk of bias with timing of audiograms and data collection
- EAS was not evaluated
- No quality of life analysis for subjective benefit of hearing preservation
Conclusions

1. Largest series to show **SME is an atraumatic electrode** with HP rates 60-71% in the short-term and >50% in the long-term

2. **No difference in speech perception performance** whether hearing was preserved

3. Average decrease in LFPTA following CI is approximately 20 dB HL rendering it unlikely that those with LFPTA >60 dB HL will preserve functional acoustic hearing → may need to revisit AAO-HNS hearing preservation minimum reporting guidelines