An Updated Comparison of Outcomes and Programming Parameters for Precurved Versus Straight Electrode Arrays

532 vs. 522

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Disclosures

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• Vanderbilt University IRB Approval: 140152
• Conflict of Interest:
  • Jourdan Holder: Consultant for Advanced Bionics
  • René Gifford: Advisory board for Advanced Bionics, Cochlear, and Frequency Therapeutics
  • Robert Labadie: Consultant for Advanced Bionics, Johnson & Johnson, and Ototonix
  • Alejandro Rivas: Consultant for Med-El, Advanced Bionics, Cochlear, Grace Medical, Stryker, and Cook Medical
Straight Arrays

• Less likely to translocate
  ➢ Better rates of hearing preservation\textsuperscript{8-9,15}

• Greater electrode to modiolus distance
  ➢ Higher upper stimulation levels and reduced stimulation specificity\textsuperscript{2-4,10-14}
Precurved Arrays

- Historically prone to translocation (Wanna et al., 42%)
  - Intracochlear trauma and poorer hearing preservation\(^6\)-\(^9\),\(^{15}\)
- Shorter electrode to modiolus distance
  - Improved stimulation specificity and reduced charge required for upper stimulation levels\(^1\)-\(^5\)
Cochlear 532

- Non-stylet precurved electrode array
- Lower rates of translocation (7%, 4/56)
- Higher rates of tip foldover (5%, 3/56)
  - Resolved at our center with intraoperative imaging
- Previous reports of low-frequency hearing preservation\textsuperscript{16-19}
Research Question:
With similar rates of translocation, how does the 532 compare to the 522 in terms of speech recognition, hearing preservation outcomes, and programming parameters?
Hypotheses

1. Comparable hearing preservation between groups due to low translocation rates of 532
2. Better speech understanding with 532 due to closer electrode to modiolus distance (i.e. better spectral resolution)
Design

• N = 58

• Each 532 was *individually* matched to a 522 recipient in terms of age, preoperative hearing, and daily CI use to control for other factors known to affect outcomes

<table>
<thead>
<tr>
<th></th>
<th>522 (n=29)</th>
<th>532 (n=29)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>66.9 years</td>
<td>67.0 years</td>
</tr>
<tr>
<td>Preoperative LFPTA</td>
<td>84.5 dB HL</td>
<td>83.6 dB HL</td>
</tr>
<tr>
<td>Preoperative CNC</td>
<td>5.5%</td>
<td>7.3%</td>
</tr>
<tr>
<td>Daily CI Use</td>
<td>12.2 hrs</td>
<td>12.3 hrs</td>
</tr>
</tbody>
</table>

Holder et al, 2019
<table>
<thead>
<tr>
<th></th>
<th>422/522 (n=29)</th>
<th>532 (n=29)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at Implant (years)</td>
<td>66.90 (34.84)</td>
<td>67.00 (32.87)</td>
<td>-</td>
</tr>
<tr>
<td>Male/Female</td>
<td>19/10</td>
<td>17/12</td>
<td>-</td>
</tr>
<tr>
<td>Preoperative LFPTA (dB HL)</td>
<td>84.54 (53.33-106.67)</td>
<td>83.62 (48.33-106.67)</td>
<td>-</td>
</tr>
<tr>
<td>Preoperative CNC (%)</td>
<td>5.51 (0.25)</td>
<td>7.31 (0.40)</td>
<td>-</td>
</tr>
<tr>
<td>Datalogging (hours/day)</td>
<td>12.75 (3.90-17.00)</td>
<td>12.27 (6.20-15.30)</td>
<td>-</td>
</tr>
<tr>
<td>Overall Charge (nC)</td>
<td>13.08 (6.73-35.73)</td>
<td>12.30 (5.47-22.55)</td>
<td>0.225</td>
</tr>
<tr>
<td>Pulse Width (micro sec)</td>
<td>36.00 (25.88)</td>
<td>28.79 (22.50)</td>
<td><strong>0.005</strong></td>
</tr>
<tr>
<td>Maxima</td>
<td>9.59 (5.16)</td>
<td>11.79 (5.16)</td>
<td><strong>0.003</strong></td>
</tr>
<tr>
<td>Average Impedance (kΩ)</td>
<td>9.06 (5.41-19.91)</td>
<td>7.39 (7.04-20.01)</td>
<td><strong>0.001</strong></td>
</tr>
<tr>
<td>Postoperative LFPTA (dB HL)</td>
<td>102.13 (68.33-106.67)</td>
<td>94.71 (66.67 - 106.67)</td>
<td><strong>0.028</strong></td>
</tr>
<tr>
<td>CNC (%)</td>
<td>43.34 (4-80)</td>
<td>56.97 (8-80)</td>
<td><strong>0.016</strong></td>
</tr>
<tr>
<td>AzBio (%)</td>
<td>54.44 (5-92)</td>
<td>67.17 (0-100)</td>
<td>0.065</td>
</tr>
<tr>
<td>AzBio +5 (%)</td>
<td>15.93 (0-68)</td>
<td>21.48 (0-57)</td>
<td>0.404</td>
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<tr>
<td>SSQ</td>
<td>4.87 (0.82-8.17)</td>
<td>4.76 (0.58-8.30)</td>
<td>0.889</td>
</tr>
</tbody>
</table>
Speech Recognition

Holder et al, 2019
• 532: Significantly lower impedances overall
• 522: Significantly higher impedances at 6 months than at 3 months

Holder et al, 2019
522 required higher charge, but the difference was not significant.
CI Programming Parameters

<table>
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<th>532</th>
<th>p-value</th>
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- Higher pulse width for 522
  - May be related to software defaults (522 default = 37 micro sec)

- Lower maxima for 522
  - Higher pulse width prohibits highest maxima
  - Important in light of recent work by Berg and colleagues (2019)
    - Higher performance for adults in background noise using 16 maxima

Holder et al, 2019
Summary: 522 vs. 532 matched cohorts

Key Takeaways:
• 532 showed equal or better outcomes on all measures including hearing preservation
• Suggests that 532 may be an advantageous substitute for the 522 that results in decreased modiolar distance

Caveats:
• Given a tip fold-over rate of 5% intraoperative imaging is highly recommended
• Note that preoperative LFPTA in this group was 84 dB HL; further investigation is needed for patients with better preoperative hearing
Key References

Thank you for your attention!
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