The Role of Early Auditory Experience on the Development of Word-Learning Skills After Cochlear Implantation

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IU DeVault Otologic Research Laboratory

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CI < 1 year?
CI < 1 year vs. 1-2 years

- Better outcomes for CI<1
  - Colletti et al., 2005, 2009, 2011
  - Dettman et al., 2007
  - Holman et al 2013
  - Holt & Svirsky, 2008
  - Houston et al., 2003
  - Houston et al., 2012
  - Houston & Miyamoto, 2010
  - Leigh et al., 2013
  - Miyamoto et al., 2005
  - Nicholas & Geers, 2013
  - Schauwers et al., 2004

- No Differences
  - Holt & Svirsky, 2008
  - Horn et al., 2007
  - Houston & Miyamoto, 2010
  - Leigh et al., 2013
  - Lesinski-Schiedat et al., 2004
  - Miyamoto et al., 2005
  - Schauwers et al., 2004
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CI < 1 year vs. 1-2 years

- Better outcomes for CI<1
  - Reynell Receptive
  - PLS Receptive and Expressive
  - RITLS Receptive and Expressive
  - Oral and Written Language Skills
  - Peabody Picture Vocabulary Test
  - Categories of Auditory Performance IT-MAIS
  - Audiovisual Association
  - Babbling
  - DEAP
  - Speech Intelligibility Rating

- No Differences
  - CNC
  - LNT
  - Mr. Potato Head Task
  - Speech Discrimination
  - Reynell Expressive
Word Learning Experiment
(Houston, Stewart, Moberly, Hollich, & Miyamoto, 2012, Dev Sci)

• Does early auditory experience lead to better word learning?

• Subjects
  – Age at CI: 6.4 – 20.6 mos
  – Pre-CI aided PTA: 58 – 90 dB

• Findings
  – More residual hearing $\rightarrow$ better word learning
  – Controlling for residual hearing, age at implantation $\rightarrow$ better word learning
Today’s Analyses

• Narrower age-at-CI range
  – Early (10): 6.4 – 11.8
  – Late (10): 12.2 – 15.6
• Groups equated for pre-CI PTA and other demographic variables
# Demographic Variables for Early and Late CI

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<th>Early CI (10)</th>
<th>Late CI (10)</th>
<th>Sig diff?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at CI (mos)</td>
<td>9.6 (6.4-11.8)</td>
<td>14.3 (12.2-15.6)</td>
<td>Yes</td>
</tr>
<tr>
<td>Pre-CI aided PTA (dB)</td>
<td>87 (82-90)</td>
<td>88 (82-90)</td>
<td>No</td>
</tr>
<tr>
<td>Communication Mode</td>
<td>7 OC 3 TC</td>
<td>6 OC 4 TC</td>
<td>No</td>
</tr>
<tr>
<td># Bilateral at test</td>
<td>2</td>
<td>2</td>
<td>No</td>
</tr>
<tr>
<td>Hearing age at test (mos)</td>
<td>15.8 (10.8-20.8)</td>
<td>14.8 (10.3-20.3)</td>
<td>No</td>
</tr>
<tr>
<td>Maternal Education (yrs)</td>
<td>15.0 (12-20)</td>
<td>13.8 (12-18)</td>
<td>No</td>
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IUSM Infant Language Lab
Stimuli & Procedure
Performance on Word-Learning Task

- Mean Longest Look (s)
  - Target
  - Nontarget

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<td>Nontarget</td>
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* indicates a significant difference.
## Correlations 3-4 yrs post-CI

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<th>Rec Lang (PLS-aud)</th>
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<td>Pearson’s r</td>
<td>.50*</td>
<td>.53*</td>
<td>.47*</td>
<td>.19</td>
</tr>
<tr>
<td>N</td>
<td>18</td>
<td>16</td>
<td>16</td>
<td>18</td>
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* p<.05  + p<.1
Partial Correlations
( controlling for age at CI and residual hearing)

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<td>.60*</td>
<td>.70**</td>
<td>.59*</td>
<td>.21</td>
</tr>
<tr>
<td>N</td>
<td>18</td>
<td>16</td>
<td>16</td>
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** p<.01  * p<.05
Conclusions

• No evidence so far that CI < 1 year leads to better hearing or speech perception than CI 1 – 2 years
• CI < 1 year leads to better novel word-learning skills and probably other auditory integration skills
• Early word-learning skills are important for language outcomes
Future Directions

- Keep looking at speech perception but don’t stop there.
- Investigate why CI < 1 year leads to better word learning
  - Better auditory-visual integration?
    - How might that relate to their communicative interactions?
Parent-Infant Eyetracking (PIE)
35 mos old; 15 mos CI use
Parent-Infant Eyetracking (PIE)

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  - Tonya Bergeson, PhD
  - David Pisoni, PhD
  - Heidi Neuburger, MA, CCC-A

- IU – Bloomington Psychology and Computer Science
  - Chen Yu, PhD
  - Linda Smith, PhD
  - David Crandall, PhD
  - Seth Foster
  - Steven Elmlinger