Cochlear Implantation in Adults with Post-lingual Deafness: The Effects of Age and Duration of Deafness on Post-operative Speech Recognition

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Age and Duration of Deafness in Adult CI

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Outcomes of Adult CI

- Cochlear implants benefit adults with acquired SNHL
  - 60% spoken words; 70% words in sentences in quiet
- Substantial variability with outcomes
- Identified factors:
  - residual hearing
  - partial electrode insertion
  - congenital malformation / etiology
  - age
  - duration of deafness

Aging and Implantation

- Implanting older adults

- Older age = poorer performance

- However, this is not universal
  - Outcome methods vary (CNC, CID, HINT….)
  - Duration of deafness not accounted for in many studies

Duration of Deafness and Implantation

- When duration of deafness examined, it appears to affect outcomes more than age

- Limitations:
  - lack of sentence testing (mono/multi-syllabic words used)
  - Some adults may have pre-lingual deafness

Hypothesis

- Increasing age and duration of deafness would be independently associated with poorer speech recognition outcomes in post-lingually deafened adults
Study Methods

- Retrospective, single institution study examining cohort of adult CI recipients between 1983 – 2014

- Inclusion: Adults with bilateral severe-profound SNHL, post-lingual deafness
  - Post-lingual: defined as hearing loss after > 12
  - Post-operative testing > 12 months (mean 6.4 yrs)
  - Candidacy determined at the time of implant

- Exclusion:
  - Partial CI electrode insertion
  - Congenital inner ear malformation
Results

- 51 patients met inclusion criteria
  - HINT (31), AzBio (28)

- No differences in AzBIO, HINT
  - Gender, side of implant
  - Use of hearing aid prior to OR after surgery
  - Better or worse ear implanted
  - Unilateral vs. bilateral
  - Early vs. late implant (median, October 2005)
## Results

- Partial correlation
  - each analysis done controlling for the other

<table>
<thead>
<tr>
<th>Test</th>
<th>Age at testing</th>
<th>Duration of deafness</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>r</td>
<td>p</td>
</tr>
<tr>
<td>AzBio (n=28)</td>
<td>-0.66</td>
<td>0.001</td>
</tr>
<tr>
<td>HINT (n=31)</td>
<td>-0.18</td>
<td>0.412</td>
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</tbody>
</table>

- Increasing age = worse on challenging sentences
- Longer duration of deafness = better on challenging sentences
Findings

- Older adults performing more poorly is not surprising
  - Correlation on AzBio, “more difficult” test
    - “hang the air freshener from your rearview mirror”
  
- No correlation on HINT: “easier” test
  - “the fire was very hot”

- One factor that may explain = natural cognitive decline

Gifford et al. *Audiol Neurootol.* 2008
Findings

- Longer duration of deafness = better outcomes (AzBio)
  - Paradoxical? – Not entirely

- Adaptive strategies to cope with deafness
  - Better use of linguistic skills and context within sentences

Limitations

- Retrospective
- Small sample size
- Duration of deafness calculated from age at onset of hearing loss, not age at severe-profound loss
- Post-op testing measures changed during period (HINT → AzBIO)
Conclusions

- In post-lingually deafened adults:
  - Older age = poorer sentence recognition (AzBio), independent of duration of deafness
  - Duration of deafness = improved sentence recognition (AzBio), independent of age

Conclusions

- Consider normal aging process in CI
  - decline in working memory, processing abilities, and verbal memory recall
- May affect post-op outcomes and testing
- Prospective studies currently underway examining influence of age and cognition in normal hearing and CI adults