Reading and Writing Abilities of Deaf Pupils with Cochlear Implants

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Acknowledgements and Thanks
To Advanced Bionics and the Ovingdean Trust for funding the project
To our data collectors – Tina Wakefield, Angela Wootten, and Catherine Healey
To the deaf children and their families
Further reading


A summary report also available on the Ear Foundation website. [www.earfoundation.org.uk](http://www.earfoundation.org.uk)
Cochlear implants and literacy

A search on PubMed yielded:
- 11,303 citations that included the term CI
- 25 if the search was narrowed to CI and literacy

Most under-studied aspect of cochlear implantation
- Education not medicine?
- Need to track learners over time?
- Outcomes realized later in the child’s development?
Research Goals

- To investigate the reading and writing levels of a cohort of deaf learners with cochlear implants
- To compare these outcomes to hearing age peers
- To identify additional variables that impact outcomes including demographic characteristics and use of the device
Participants

33 students (18 male) with CIs from across England

- age range – 9.0 years to 16.1 years
- 26 born deaf, 6 deafened by meningitis, 1 with auditory neuropathy
- mean age of identification 1.2 yrs (0.1 - 3.2)
- 19 bilateral implants – 2 simultaneous, 17 sequential
- mean age of implantation of first CI = 3.5 yrs (1.1 - 15.1)
- mean age for second CI = 6.8 yrs (1.9 - 15.1)
- 5 reported as having an additional disability
- 23 in mainstream schools
- 28 spoken language only
## Assessment Protocol: Measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Domain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Questionnaire</td>
<td>Demographic Info</td>
</tr>
<tr>
<td>Categories of Auditory Performance (CAP)</td>
<td>Auditory Perception</td>
</tr>
<tr>
<td>Meaningful Auditory Integration Scale (MAIS)</td>
<td>Adaptation to the Device</td>
</tr>
<tr>
<td>Speech Intelligibility Rating (SIR)</td>
<td>Speech Production</td>
</tr>
<tr>
<td>Test of Nonverbal Intelligence (TONI)</td>
<td>Cognition</td>
</tr>
<tr>
<td>Test of Word Knowledge (TOWK)</td>
<td>Expressive/Receptive Vocabulary</td>
</tr>
<tr>
<td>York Assessment of Reading Comprehension (YARC) – Primary and Secondary</td>
<td>Reading accuracy, rate and comprehension</td>
</tr>
<tr>
<td>Writing Sample – “Me and My Implant”</td>
<td>Writing</td>
</tr>
</tbody>
</table>
Use of the cochlear implant

Based on data from the MAIS
- 90% use device consistently with no reminders

Based on data from the CAP
- 91% understand conversation without speechreading
- 72% can use a telephone with known speaker

Based on data from the SIR
- 67% can be fully understood in everyday contexts
### Comparison to hearing peers

<table>
<thead>
<tr>
<th>Measure</th>
<th>Below Average</th>
<th>Average</th>
<th>Above Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>TONI</td>
<td></td>
<td>84.85%</td>
<td>15.15%</td>
</tr>
<tr>
<td>Receptive Vocabulary</td>
<td>25%</td>
<td>68.76%</td>
<td>6.25%</td>
</tr>
<tr>
<td>Expressive Vocabulary</td>
<td>33.33%</td>
<td>63.64%</td>
<td>3.03%</td>
</tr>
</tbody>
</table>
## Comparison to hearing peers

<table>
<thead>
<tr>
<th>Measure</th>
<th>Below Average</th>
<th>Average</th>
<th>Above Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Word Reading</td>
<td>24.24%</td>
<td>54.55%</td>
<td>21.21%</td>
</tr>
<tr>
<td>Reading Rate</td>
<td>18.76%</td>
<td>71.88%</td>
<td>9.38%</td>
</tr>
<tr>
<td>Reading Comprehension</td>
<td>12.5%</td>
<td>75%</td>
<td>12.5%</td>
</tr>
<tr>
<td>Writing</td>
<td>56.25%</td>
<td>25%</td>
<td>18.75%</td>
</tr>
</tbody>
</table>
Writing Performance

Writing outcomes not as strong as those in reading

- only 44% writing at or above grade level

However it is important to note pupils

- did not evidence the use of non-standard English typical of deaf learners in the past
- used the same strategies (e.g., invented spelling) as hearing children reflecting their increased access to audition
Influencing factors

Age at implantation
- earlier implantation (before 24 months) related to higher literacy outcomes including writing

Age at testing
- younger age (9-11 year old group) related to higher scores in both vocabulary measures, single word reading, writing

Number of implants
- two implants related to better performance in expressive vocabulary and writing

Higher reading comprehension related to better writing
The current situation

CIs have impacted literacy learning in ways that no shifts in pedagogy or communication approach have previously achieved (Mayer & Leigh, 2010)

Children with cochlear implants are:

- Doing better as a group
- Mostly in mainstream settings using mainstream curriculum
- Showing significantly improved reading attainments
- Demonstrating better writing performance but delayed compared to reading

Moving forward

A larger number in the at risk categories

- identify reasons? maybe not the CI and hearing loss?
- phonological processing or language?
- level of support required?
- appropriate interventions or remediation?

Need for more research

- impact of advances in hearing technologies on literacy development
- longitudinal, standardized measures, include writing