Working hard to make out speech: listening effort in children with cochlear implants

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Hearing & Implants
The Netherlands
Introduction

- Increase in entering mainstream education
- Demanding listening conditions
- Increase in listening effort
- Less cognitive resources to perform tasks simultaneously
Introduction

Reimbursement BiClCs in children in the Netherlands:

- 2005: in children with meningitis
- 2012: in children <5 years of age
- 2014: in children between 5-18 years of age
Introduction

Reimbursement BiCIs in children in the Netherlands:

- 2005: in children with meningitis
- 2012: in children <5 years of age
- 2014: in children between 5-18 years of age
Objective

Measuring listening effort in challenging listening conditions in children with cochlear implants before and after sequential bilateral cochlear implantation.
Methods: listening effort

Dual task paradigm

Primary task:
speech recognition (NVA children’s test – CVC words)
in quiet at 45 dB SPL
in noise (SNR 0dB – S0°N0°)

Secondary task:
— Digit recall task
## Subject characteristics (n=28)

<table>
<thead>
<tr>
<th></th>
<th>mean (range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age@Cl1</td>
<td>5.4 yrs (0.9 – 16.9 yrs)</td>
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<tr>
<td>Age@Cl2</td>
<td>11.2 yrs (5.3 – 18.8 yrs)</td>
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<tr>
<td>Inter-implant delay</td>
<td>5.8 yrs (0.5 – 10.0 yrs)</td>
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<tr>
<td>PTA (0.5, 1, 2 kHz)</td>
<td>99 dB HL (72 - &gt;120dB HL)</td>
</tr>
<tr>
<td>Etiology</td>
<td>Unknown 54%</td>
</tr>
<tr>
<td></td>
<td>Acquired 7%</td>
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<tr>
<td></td>
<td>Syndromic 21%</td>
</tr>
<tr>
<td></td>
<td>Non-syndromic 18%</td>
</tr>
<tr>
<td>Age at testing</td>
<td>11.4 yrs (5.5 – 18.9 yrs)</td>
</tr>
<tr>
<td>Mainstream education preoperatively</td>
<td>75%</td>
</tr>
<tr>
<td>Bimodal preoperatively</td>
<td>54%</td>
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</tbody>
</table>
Results

Children with CI

Correct phoneme score -%

NVA 45 dB SPL  NVA SNR 0 dB

**

- Single task
- Dual task

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Results

Children with CI

Digit recall - %

NVA 45 dB SPL

NVA SNR 0 dB

Single task

Dual task

**

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Results

Children with NH

Correct phoneme score - %

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<td>dual task</td>
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Results

Children with NH

Digit recall - %

![Bar chart showing digit recall for children with NH under different conditions.](chart.png)

- **NVA 45 dB SPL**
  - Single task: ~50%
  - Dual task: ~40%

- **NVA SNR 0 dB**
  - Single task: ~55%
  - Dual task: ~45%
Conclusion

☑ Demanding listening conditions have a significant effect on cognitive resources in children prior to sequential bilateral cochlear implantation.

☑ Preliminary results indicate that in children with normal hearing the drop on cognitive resources is far less than in children with a CI.