Using the Functional Listening Index following Cochlear Implantation in Young Children: The Precursor to Speech and Language

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• 45 years of service to >2000 children
• Focus on Listening and Spoken Language
• Family-centred Transdisciplinary
• Integrated Implant and Early Intervention Program
• Families from diverse cultural and linguistic background
• Individual, Group and Teleintervention Programs
• 5 Centres with services across ACT, NSW, Tasmania
• Children with all range of needs, all levels and types of hearing, all devices options
• Currently 250 children 0-6yrs, 135 children 7yrs plus
## Identification, Amplification, Intervention

<table>
<thead>
<tr>
<th>UHNS referred</th>
<th>EHDI Guidelines (Modified from CDC Early Hearing Detection &amp; Intervention)</th>
<th>Bilateral HL (median)</th>
<th>Unilateral HL (median)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification</td>
<td>1mth</td>
<td>1mth</td>
<td>1mth (range 0-4mths)</td>
</tr>
<tr>
<td></td>
<td>(range 0-13mths)</td>
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<tr>
<td>Amplification</td>
<td>3mths</td>
<td>4mths (range 3-61mths)</td>
<td>31mths (range 3-74mths)</td>
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<tr>
<td>Intervention</td>
<td>6mths</td>
<td>5mths (range 0-55mths)</td>
<td>18mths (range 3-46mths)</td>
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<tr>
<td>Cochlear Implant</td>
<td></td>
<td>7mths (range 4-13mths)</td>
<td>6.5yrs (range 3-11yrs)</td>
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</tbody>
</table>
Staying in the average range, from birth

1. Early to EI, Fit and Implant < 12 months
2. Implant > 12 months

Age of Implant in months
How do we measure transition from one level to the next?
Identification

Detection

Discrimination

Speech Perception, Standard Speech & Language Assessments

Functional (Real world listening skills) – what children can DO with the sounds they can detect and perceive

Discrimination CAEPs

UNHS (AABR)
ABR Diagnostic, ASSR, DPOAE’s, +CM, Reflexes, Tympanometry

Estimated thresholds form the basis of device fitting
CAEPs - Verification of device fitting for infants

The Shepherd Centre
Giving deaf children a voice
How can we identify progress before it shows in speech and language outcomes?

“Although children make use of visual cues when learning language, **audition** is of primary importance for language acquisition”

What starts as a DETECTION response, swiftly becomes DISCRIMINATION and IDENTIFICATION responses so COMPREHENSION responses become possible
Began with formative tools we rely upon

- **Ling 6** (Ling & Ling 1978)
- **Categories of Auditory Performance (CAP) / CAP - Revised**
- Supplement to the JCIH 2007 **Position Statement**: Principles and Guidelines for Early Intervention After Confirmation That a Child Is Deaf or Hard of Hearing.
- **Integrated Scales of Development**, Cochlear Limited
- **Cottage Acquisition Scales for Listening, Language and Speech.** Simple Sentence Level (Wilkes, E.M. 1999)
Thinking outside the box

Functional Listening Index

6 Phases/60 items

1. Sound Awareness
2. Associating Sound with Meaning
3. Comprehending Simple Spoken Language
4. Comprehending Language in Different Listening Conditions
5. Listening Through Discourse and Narratives
6. Advanced Open Listening Set
Thinking outside the box

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Demographics

310 children 0-7yrs
937 Data points
All levels of hearing loss

Including CI Group

56 Children with CI
104 devices
- CI <12mths
- children with significant residual hearing
- UHL
- ANSD
- Simultaneous and Sequential
Listening Index for whole group n=310

Number of Observed Listening Skills by Age of Child

Age in Months

Listening skills observed (from checklist of 60 items)

0 10 20 30 40 50 60

0 12 24 36 48 60 72 84

Normal Hearing
Auditory progress following Early implantation

All have had speech and language in the typical range from birth.
Standard language score by HA fitting (early/late) age of implant and entry into EI

Evidence for early implantation, but how can it guide evaluation and intervention?
How does functional listening compare?
HA mod & mod/sev loss

5 children with 4FA 55-64dBHL using HAs with poorer functional listening than normal hearing children
Direct impact on auditory progress following implantation

Functional Listening Index Results

- Normal Hearing
- CI 1 at 53 months
- 55-64 dBHL PTA in the better ear
- 65-74 dBHL PTA in the better ear
- Bilateral SNHL
- Later CI implantation
- Currently CI + HA
- No additional needs
- English speaking
Functional listening for all children

The best listeners have CI under 12 months in either profound or residual hearing group: TIMING STILL MATTERS

<table>
<thead>
<tr>
<th>Age in Months</th>
<th>Profound (CI &lt;= 12 months)</th>
<th>Profound (CI &gt; 12 months)</th>
<th>Residual (CI now, pre-CI score)</th>
<th>Residual (CI &lt;= 12 months, post CI score)</th>
<th>Normal Hearing</th>
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<tbody>
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Not waiting to dip out

Scores not dropping out of the normal range, decision made before they ‘fail’ & based on functional access
Benefits beyond Outcomes: Supporting complex families

Progress on the Functional Listening Index

- Expected Typical Hearing Trajectory
- 50th Percentile TSC Program
- Child
- Child 2

Normal Hearing
ANSD

Number of Observed Listening Skills by Age of Child with no diagnosed additional needs (n = 252)

- Normal Hearing

- ANSD with O (both Bilateral and Unilateral hearing loss)
- ANSD No CI (all unilateral hearing loss)
- No ANSD

Age in Months

Number of Observed Listening Skills
Bilateral vs UHL

Number of Observed Listening Skills by Age: no diagnosed additional needs (n = 244)

- **Bilateral**
- **Unilateral**

Normal Hearing

Expected trajectory for typically

Age in Months

Number of Observed Listening Skills

0 12 24 36 48 60 72 84
Impacts on practice

- Children with more hearing implanted earlier
- Not having to ‘catch up’ from out of normal range of speech and language
- Tracks through discrimination and identification necessary for higher level comprehension
- Shifting our focus to broader communication skills
- Practice changing from 1-1 ‘rehabilitation in quiet with adults’ to functional real world practice listening environments from the earliest age
The Shepherd Centre team

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The Shepherd Centre
Giving deaf children a voice
References

FIRST YEARS (Training Program University of North Carolina),
Integrated Scales of Development, Cochlear Limited