Early spoken language development following pediatric cochlear implantation: Direct comparison of non-tonal and tonal language development

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Overview

• Pediatric outcome assessment
  – Extended Outcome Study (EOS)
  – Objective assessment of speech/language development

• Practical assessment of language development
  – Simplified Short Forms of Mandarin CDI
  – Normal equivalent age

• Mandarin language development after pediatric CI
  – Study design
  – Normalized vocabulary growth rates

• Direct comparisons of Mandarin and English results
Pediatric outcome assessment

• Extended Outcome Study
  – 5-year follow-up after early CI/HA intervention
  – 250 subjects from West China Hospital

• Norm-referenced outcome measures
  – Early prelingual auditory development (Zheng et al., 2009, A&N)
  – Early speech perception (Zheng et al., 2009, E&H; 2009, IJA; Wong et al., 2007, E&H)
  – Early language development (Soli et al., 2012, IJPO; Bei et al., IJPO in press)

Test software available through Chinese Academy of Audiological Rehabilitation (CAAR)
Practical assessment of language development

• Mandarin CDI (MCDI) (Tardif & Fletcher, 2008, PMU Press)
  – Words & Gestures (411 items)
    • Receptive and expressive vocabulary
    • 8-16 months of age for normals
  – Words & Sentences (799 items)
    • Expressive vocabulary
    • 16-30 months of age for normals

• Simplified Short Form (SSF) MCDI (Soli et al., 2012, IJPO)
  – 50 items for W&G and W&S
  – Assessment of vocabulary growth rates
Practical assessment of language development

- Norms for MCDI (dashed) and SSF MCDI (solid)
  - Vocabulary growth rates are comparable
  - Normal Equivalent Age (NEA) = chronological age for score in norming sample
  - Example:
    75% item score $\Rightarrow$ 24 months NEA

- Comparable norms for SSF Words & Gestures expressive and receptive vocabulary

Words & Sentences: Expressive vocabulary (Soli et al., 2012, IJPO)
Mandarin language development after pediatric CI

• **Study design** (based on Niparko et al., 2010, JAMA)
  – N = 112 pediatric CIs implanted at 1-5 years of age
  – Outcome assessment at baseline and 3, 6, 12, 24 months post-implant

• **Outcome measures**
  – NEAs for SSF Words & Gestures and Words & Sentences inventories
  – NEAs displayed as a function of chronological age
  – Normalized vocabulary growth rate (NVGR):

\[
NVGR = \frac{\Delta \text{NEA}}{\Delta \text{chronological age}}
\]
Words & Gestures:
Receptive vocabulary

- Results are asymptotic at 24 months
- NVGRs greater than normal
- Vocabulary growth in first 12 months after CI \( \cong \) growth in first 18 months in normals
- NVGRs not dependent on implant age
- W&G not appropriate beyond 12 months after CI
Words & Gestures:
Expressive vocabulary

- Results again asymptotic at 24 months (and at 12 mo. for oldest implant group)
- NVGRs greater than normal
- Vocabulary growth in first 12 months after CI \( \approx \) growth in first 18 months in normals
- NVGRs not dependent on implant age
- Receptive and expressive NEAs comparable
- W&G not appropriate beyond 12 months after CI
Words & Sentences: Expressive vocabulary

- Results not asymptotic at 24 months
- NVGRs significantly less than normal
  - 1-2 yr: growth after 6 months
  - 2-3 yr: growth after 3 months
  - >3 yr: growth after baseline
- NVGR for oldest implant group significantly lower
Direct comparisons of Mandarin and English vocabulary growth

• Express Niparko et al. (2010) data as NVGRs
  – Reynell Development Language Scales (RDLS)
  – Average of comprehension and expression

• Compare Mandarin and English
  – NS differences for 1-2 year and >3 year implant age groups
  – English NVGR significantly lower for 2-3 year olds
  – NVGR significant lower for >3 year implant age for both Mandarin and English
Conclusions

• Practical assessment of early language development is possible in a clinical setting with SSF version of MCDI
• Normalized vocabulary growth rates allow direct comparisons of language development across languages
• Mandarin and English results suggest that, despite linguistic and cultural diversity, early language development after CI is comparable
• The plasticity of the developing auditory system, as seen in early language development, reveals its universal nature