

# Receiving a cochlear implant at 2: are language gains uniform?

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## Background

Profoundly deaf children born to hearing parents are likely to demonstrate significant delays in language acquisition. During the past few years, technological advances and younger age at implantation have allowed deaf children who receive a cochlear implant (CI) to have access to spoken language input during a sensitive period of language acquisition. It is believed that an earlier implantation, by providing an early exposure to sound, would lead to greater benefits regarding language outcomes. Recent research reported substantial benefits of cochlear implantation at a very early age (Connor et al., 2006). Based on these encouraging results, some investigators have speculated that implantation around age 2 would allow children to show near-normal language skills at age 6 (Svirsky, Teoh, & Neuburger, 2004). Some research reports on language acquisition in children who received a CI included measures of vocabulary and syntax, but many studies failed to report various measures of both receptive and expressive vocabulary and grammar that would permit examination of associations between global language skills and more specific measures of receptive and expressive abilities.

## Goal

To determine whether the use of a cochlear implant for 4 to 5 years in early implanted children has a global impact on language development or whether it tends to influence a particular aspect of language. We assessed more than one aspect of language in order to examine in more detail linguistic outcomes for young children receiving cochlear implants.

## Research questions

1. Do prelingually deafened children implanted around 2 years-old indeed catch-up with hearing peers after 4-5 years of implant experience or is a delay still present?
2. Is the language performance uniform across comprehension and production of vocabulary and grammar?
3. Is there an association between receptive and expressive language skills and "meaningful" use of speech and of hearing?

## Methods

### Participants

- 14 children with CI (6 girls, 8 boys)
- Chronological age: 5:11 to 8:3 years (mean = 7 years)
- Age at initial stimulation: 14 to 28 months ( $M = 23$  months)
- Duration of CI use: 47 to 71 months ( $M = 61$  months)
- 13/14 had congenital deafness – 1/14 had meningitis at 12 months old
- 13/14 had a Clarion device – 1/14 had a Nucleus device
- Leiter-R Brief IQ standard score: 98 to 127 ( $M = 115$ )

### Inclusion criteria

- French as first language
- No other known disability

All children used oral communication except one who used signed language (LSQ)

### Procedure

#### Language assessment

- Reynell Developmental Language Scales (Reynell & Gruber, 1991)
- French-Canadian version of Peabody Picture Vocabulary Test (Dunn, Thériault-Whalen, & Dunn, 1993)
- Quebec adaptation of Expressive One-Word Picture Vocabulary Test-Revised (Gardner, 1990)
- Quebec adaptation of Test of Auditory Comprehension of Language-Revised (Carrow-Woolfolk, 1985)

- (EOWPVT-R and TACL-R adaptations provide norms for grades K, 1 and 2)

#### Use of speech and hearing assessment

- Meaningful Auditory Integration Scale (MAIS) (Robbins & Osberger, 1991)
- Quebec adaptation of Meaningful Use of Speech Scale (MUSS) (Gobeil, Bourdages & Bergeron, 1996)

### Data analyses

- Total MAIS (/40) and MUSS (/32) scores were translated into % correct
- RDLs raw scores were translated into % correct (no available norms in French)
- Percentile ranks were used as a mean of comparison with normally-hearing children of same chronological age (PPVT) or same grade (EOWPVT-R, TACL-R)

## Results – descriptive analysis

Measures that allowed comparison with language development in normally-hearing (NH) children showed:

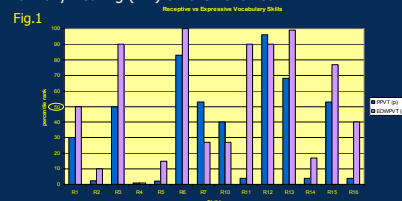


Figure 1 reveals that a majority of children attained expressive (10/14) and receptive (8/14) vocabulary levels within normal limits (percentile above 20); 10 out of 14 children exhibited greater expressive skills than receptive skills

Fig. 2

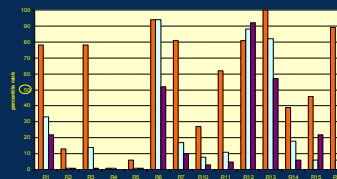


Figure 2 shows discrepancies among subtests:

- Word classes subtest: 11/14 reached average levels (percentile above 20)
- Grammatical morphology subtest: 6/14 reached average levels
- Elaborated sentences subtest: 5/14 reached average levels

Table 1 Non-standardized assessment  
Speech and hearing performance (% correct)  
Reynell results (% correct)

	N =	min	max	mean	SD
MUSS	13	87,5	100	96,6	3,7
MAIS	14	92,5	100	96,7	2,4
Expressive RDLs	13	73,1	95,5	89,5	6,6
Receptive RDLs	13	67,1	100	91	8,4

Table 1 shows that the Reynell performance was similar for receptive and expressive aspects (in terms of proportion of correct responses) AND an apparent ceiling effect in MAIS and MUSS results (MUSS extremely low result for R4 (signed language child) was removed)

## Results – statistical analyses (non-parametric correlations) – summary

- Statistically significant correlation between receptive and expressive **vocabulary results** ( $r = .794 / p < 0.01$ )
- Statistically significant correlation between **receptive and expressive Reynell** ( $r = .556 / p < 0.05$ )
- Significant correlations between **PPVT** and other **receptive results** (table 2)

Table 2 Correlation Table (Spearman) for receptive skills

	Receptive RDLs	TACL-R Word Classes	TACL-R Grammatical Morphology	TACL-R Elaborated Sentences
PPVT	.792*	.761**	.794**	.787**

\*  $p < 0.05$   
\*\*  $p < 0.01$

- **MAIS** is significantly correlated with **receptive grammatical morphology** (TACL-R subtest 2) ( $r = .591 / p < 0.05$ )

- **MUSS** is not significantly correlated with **expressive Reynell** ( $r = .523$ )

## Discussion

Question 1: Did they catch-up?

- Around 2/3 of the children in this sample exhibited average performance at a **WORD LEVEL**

- Less than half the children obtained average performance at a **MORPHOSYNTACTIC LEVEL**; **hypothesis of a specific morphosyntactic deficit?** This issue has been raised in studies which reported on children with SLI and children with mild-to-moderate deafness (Norbury, Bishop & Briscoe, 2001)

Question 2: Is receptive and expressive performance similar?

- Expressive vocabulary skills are greater than receptive; such results are rarely reported but Brackett & Zara (1998) established 35 months of gain on PPVT and 53 months of gain on EOWPVT over a three-year period

Question 3: Is speech and hearing associated with language performance?

- Use of speech is not strongly associated with expressive skills
- Use of auditory skills is associated with the comprehension of grammatical morphemes; **hypothesis of perceptual prominence?** This issue has been raised by Svirsky et al. (2002) **Language gains do not appear to be uniform; studies involving larger samples and more accurate descriptions of language achievement need to be conducted.**

## References

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