

# **The phonological development in young hearing-impaired children with a cochlear implant.**

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## **Keywords**

cochlear implant children, phoneme acquisition, PMLU

## **Abstract**

### Introduction

How well do hearing-impaired children speak after a Cochlear Implantation (CI) and how does their language acquisition proceed? The answer to these questions is inevitably that success depends on a number of factors: one of the critical factors is the age at implantation.

In this paper we provide an overview of the phonological results of a longitudinal study of nine early-implanted Dutch speaking CI children. The youngest child was five months of age when implanted, the oldest child 19 months. Video recordings of spontaneous unstructured parent-child interactions were made on a monthly basis, from the month before the implantation up to 24 months after the surgery, and cross-sectionally at 3 and 4 years of age. The corpus was transcribed orthographically and phonemically, and detailed linguistic analyses were performed with regard to the sequence of segment acquisition. Additionally, a whole-word production measure of phonological proficiency, the PMLU (Ingram 2002), was applied.

### Sequence of phoneme acquisition

The children's consonant inventories were computed according to the procedure described by Beers (1995). More specifically, a consonant is considered to be acquired when it is produced correctly in 75% of the cases. We indicated the children's level of phonological proficiency according to the criteria of Beers (1995). The highest level (5) was assigned to a system that contained at least one of the two liquids /l/ or /r/ in syllable-initial position. The criterion for level 4 was the mastery of both glides /j/ and /w/. Level 3 was determined by the presence of at least one fricative. Level 2 referred to a system with the dorsal stop /k/, and level 1 required the features [sonorant], [labial] and [coronal]. At least half of the hearing (NH) children of Beers (1995) reached level 5 at the age of 2;6-2;8.

The results for the CI children showed that, except for level 4 (because of the very early acquisition of the bilabial glide /w/ in the CI group), 8 out of 9 CI children displayed the expected sequence in the attainment of the levels. The CI group fulfilled the minimum criterion for level 5 with a median delay of 6 months in comparison with the NH group. The

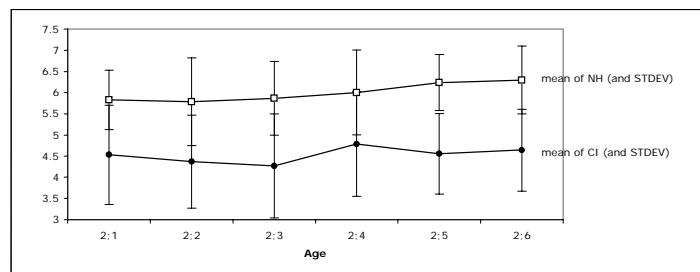
interindividual variation was large, however. One CI child mastered the /l/ already 6 months before the NH children, while 2 other CI children were delayed by more than 18 months when compared to the NH children. Preliminary inspection of the results revealed an effect of the age at implantation: children implanted in their first year of life were able to acquire at least one liquid within 6 months after the normal age, while children implanted in their second year of life needed at least an additional 12 months to attain level 5 in comparison with the NH children.

## PMLU

The children's whole word phonological proficiency was measured by means of the PMLU (Ingram, 2002; Taelman, Durieux, & Gillis, in press), which reflects the length of the child's words and the number of consonants correct.

Since there are no norms established yet, we compared the PMLU values of the CI children with a group of 12 NH children. The data of these children stem from the Dutch longitudinal CLPF database (Fikkert, 1994; Levelt, 1994; available through CHILDES, MacWhinney, 2000). We focussed on the age range 2;1 to 2;6, as these were the only ages at which minimum 4 children in each group fulfilled the sample size criteria for computing PMLU (Taelman et al., in press).

The figure below displays the average values of the NH and the CI children in this time span. It can be seen that the average score of the CI children is about 1.5 points lower than the average of the NH children. We found that the CI children needed much time in order to bridge this gap. Consider the average PMLU score of the NH children at age 2;2 (PMLU=5.8). All CI children except one obtained a lower score at that age. Three CI children reached this level between age 2;9 and 3;0. Two other children reached it at age 4;0. Three other children had not yet surpassed PMLU 5.8 at age 4;0. On the whole earlier-implanted CI children appeared to be faster than later-implanted CI children.



## Conclusion

We found that most CI children were delayed in their phonological development compared to the average NH child, both in the acquisition of segments as well as in their whole-word phonological proficiency. Preliminary analyses revealed that earlier-implanted children were more proficient than later-implanted children.

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