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Age at implantation and development of vocal and auditory preverbal skills in implanted deaf children

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Outcome

Summary

Background: Preverbal vocal and auditory skills are essential precursors of spoken language development and they have been shown previously to predict later speech perception and production outcomes in young implanted deaf children.
Objectives: To assess the effect of age at implantation on the development of vocal and auditory preverbal skills in implanted children.
Methods: The study assessed 99 children, 33 in each of three groups (those implanted between 1 and 2 years; 2 and 3 years; and 3 and 4 years). Preverbal skills were measured in three areas: turn taking, autonomy and auditory awareness of spoken language, using the Tait video analysis method.
Results: The youngest implanted group made an exceptional progress outperforming in all measures the two other groups ($p < 0.01$), 6 and 12 months post-implantation, whereas there was no such difference before implantation. In the youngest group there was also significantly greater use of an auditory/oral style of communication: 85% of the group by 12 months post-implantation compared with 30% and 18% of the two older groups.
Conclusions: Vocal and auditory preverbal skills develop much more rapidly in children implanted between 1 and 2 years in comparison with older implanted children and reach a significantly higher level by 6 and 12 months post-implantation. In addition, younger implanted children are significantly more likely by 12 months post-implantation to adopt an auditory/oral mode of communication. These findings favour cochlear implantation as early as between 1 and 2 years, provided that correct diagnosis and adequate hearing-aid trial have been achieved.

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1. Introduction

It is now widely recognised that age at implantation is an important factor in the successful development of spoken language. There have been many studies showing the relationship between young age at implantation and speech perception and intelligibility outcomes [1—6]. Although it is valuable to investigate long-term results, it is equally important to gain some insight at an earlier stage as to the progress that is being made in the listening and vocal skills that will underpin auditory development.

Moreover, the current trend to implant very young children, especially under 2 years of age, needs well designed studies to convince health systems and parents. However, the numbers of very young implanted children, in most cochlear implant centres, are still too small to allow valid statistical comparisons.

Use of parent-interview schedules such as the ITMAIS and the MUSS in the first year after implantation enables a useful and detailed picture to be formed of these aspects [7,8]. Parent interviews yield information on children's behaviour at an age when it is difficult to get it in other ways, the children being too young to perform listening tasks. However, parental interviews have the limitations that they are subjective and that the parents act as proxies for their children.

An alternative approach for very young children is the assessment of video recordings of children's behaviour and developing skills. Colletti et al. [9] and Schauwers et al. [10] have studied the effect of early implantation by looking at the age of onset of babbling and babbling spurt. Another aspect that can be observed on video recordings is the development of the child's communication as shown in their preverbal skills, which is explored in the present paper.

Preverbal skills are essential precursors to the understanding and use of spoken language in all young children, whether deaf or normally hearing. They are also related to later outcome measures of speech perception [11,12] and can therefore give us in the first year after implantation both an assessment of present listening ability and a forecast of later development. Preverbal skills include appropriate eye contact, conversational-style turn taking, and auditory awareness of the appropriate time to take a turn in the interaction.

The method of video analysis used in this paper looks at the communication of young deaf children in a natural conversational-style interaction. In this context we wanted to know whether the children in the different groups were becoming more vocal over time, and paying more auditory attention to the adult's speech; and also what mode of communication was being used by them and by their carers. It has already been reported that children implanted under the age of 3 years are mostly oral/aural 5 years after implantation [13]. We were interested in whether this trend can be identified at an earlier stage, for example 6 or 12 months after implantation, and it would be very helpful to explore if it is more pronounced in those implanted younger.

Hence, the aim of the present study was to compare these preverbal skills in three groups of young children implanted at the following ages: under 2 years, between 2 and 3 years, and between 3 and 4 years. Such comparisons and the derived results are very important for parents, cochlear implant centres, and health systems.

2. Methods

2.1. Participants

The study assessed 99 children, 33 in each of 3 groups: the 1+ group received their implants between 1 and 2 years, the 2+ group between 2 and 3 years, and the 3+ group between 3 and 4 years (Table 1). All the children were implanted using the nucleus cochlear implant device, and all had full insertion of the electrode array. Apart from one autistic child who was excluded, the 1+ group was continuous and unselected. In the 2+ and 3+ groups the 33 most recently implanted children were recorded (again in a continuous and unselected way).

There was no statistically significant difference in the proportions of boys and girls in the three groups:

Table 1 Mean age at implantation and aetiology of deafness in the three groups of implanted deaf children

	Mean age at implantation (years)	Aetiology of deafness (no. of children)	
		Congenital	Acquired
Group 1+ (implanted between 1 and 2 years old)	1.5	24	9
Group 2+ (implanted between 2 and 3 years old)	2.5	29	4
Group 3+ (implanted between 3 and 4 years old)	3.4	26	7