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Language performance in prelingual children with Combi-40+ medel cochlear implant system

Motassim roosan, Hussein Qasem, Sohaib almomani

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ABSTRACT

Objectives: To compare the functional language performance of Jordanian speaking children in different age group who received Combi-40+ cochlear implant system at 2004-2009 at royal medical services . **Subjects:** parents of the children who received a cochlear implant (CI) before 4 years of age, between 4 and 6 and above 7 years of age were included in the present study. **Methodology:** functional language of was evaluated by interviewing parents using the adapted Parents' Evaluation of Aural/Oral Performance (PEACH) of Children Questionnaire in Arabic. **Results:** On average, all groups of children had difficulties in everyday language functioning. However, functional results of children less than 4 years were better than those of the age group between 4 and 6 years poor functional language were in the age group above 7 years. In addition significant correlations were found between age at intervention and PEACH score. **Conclusion:** An early intervention increasing the functional performance of the children fitted with CI. PEACH can be a clinically feasible evaluation tool to implement in practice for clinicians to obtain meaningful information regarding children's auditory performance in real life at childhood.

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1. Introduction

Children with severe to profound sensorineural hearing loss face challenges in developing spoken language, literacy, psychological functioning, and academic achievement (1) Parents, educators, clinicians, and researchers also agreed that language acquisition in young children with severe to profound hearing loss represents a major challenging issue for them .They reported that children with permanent hearing loss are unable to detect acoustic-phonetic cues essential for speech recognition, even when fitted with traditional amplification devices(2).

Studies reported that, in children with severe to profound hearing loss, cochlear implant (CI) provides significant gain in auditory perception and speech production , Osberger(3) claimed that the cochlear implant has a dramatic impact on improving the acquisition and use of spoken language by deaf children, with positive ripple effects socially and psychologically. Therefore improvement in speech and language skills has been considered as an essential goal in children having cochlear implantation (4).

Most of the studies to date examined language development on a group of children who received their implants by the age of 36 months or slightly above (5). Few studies have examined language development on a group of children who underwent cochlear implantation around the age of 2 and above. Functional language performance is difficult to assess in young infants and toddlers with hearing impairment due to their immature developmental level and language abilities. Thus researchers rely on parent report to ascertain functional performance in these populations to assess spontaneous responses to sound in everyday environment.

The present study aimed at comparing the effect of age at intervention of children fitted with cochlear implants on everyday functional language performance in different situations. The functional language performance was assessed using adapted PEACH in Arabic language.

2. Methodology

The parents of children with cochlear implant of different age group were included in this study. Participants were grouped according to age at cochlear implantation.

PEACH scale was translated and adapted into Arabic language with the help of an audiologist and a linguist. The questionnaires in Arabic version were seen for syntactic structure, semanticity,

* Corresponding Author : **Dr sohaib almomani**
E-mail : almomani.sohaib@yahoo.com
Mobile : 00962 77774852

familiarity, and ambiguity. Therefore the original meaning and concepts of the questionnaires were unchanged and also culturally appropriate. The translated and modified material was judged by five experienced audiologists.

The adapted items were administered on participants. At first participants signed an informed consent form. This document aimed at informing the participants about the objectives, justifications, and procedures of this investigation. The PEACH includes 13 questionnaires that assess (a) use of amplification and loudness discomfort, (c) listening and communicating in quiet and noise, (d) use of telephone, and (e) responses to environmental sounds.

The first researchers scored each response of the question based on the information provided by parents. Each response to a question was scored on a five-point rating scale ranging from 0 to 4. The descriptive criteria for rating were as follows. (0) No examples were given or child did not demonstrate any auditory response. (1) If one or two examples were provided or auditory response occurred 25% of the time. (2) If three or four examples were provided or auditory response occurred 50% of the time. (3) If four or five examples were provided or auditory response occurred 75% of the time. (4) If more than six examples were provided or response occurred more than 75% of the time.

3. Results

Table 1 showed the number of children implanted from 2004 - 2009 according to age group using Medel Combi-40+ cochlear implant system.

Age at implantation	Number of patient
Before 4 years	30
4-6 years old	62
Above 7 years old	27
Total	119

Table 2 shows the mean PEACH score, range, and standard deviation (SD) for three groups. Age group before 4 years obtained higher PEACH score than age group between 4 and 6 years and higher than the age group above 7 years

Table 2: Mean PEACH scores, standard deviation (SD), and range.

Age group	Mean	Sd	Number of children
Before 4 years	39.8	0.98	30
4-6 years	19.12	0.27	62
Above 7 years	9.2	2.7	27

4. Discussion

The present study used outcome measures designed to compare the everyday functional language performance of children who received cochlear implant before 4 years of age, between 4 and 6 years of age and age group after 7 years of age.

The result reveal that children who received implants before 4 years showed significant higher language ability to function in daily life as compared to those received at after 4 and 7 years

Developmental studies signify the importance of critical or sensitive period for development of linguistic structure (6) during critical period the developing central nervous system can most readily use sensory information to form linguistic structure. However, it may vary according to the different elements of language. For example, 6 months of fetal life through the age of 12 months is critical for phonetic factors, up to the age of 4 years is for syntax, and up to the age of 16 years for semantics (7).

Studies also reported that language development after cochlear implantation before the age of 3 showed that some children with CIs appear to learn language at a normal or near-normal rate, allowing the gap between language age and chronological age to narrow, or at least to remain constant (8)

. Novak et al.(9) found that children who received a CI between 9 and 25 months of age obtained language scores equal to or above chronological age than who received the implant between 20 and 25 months. Manrique et al found that children who received a CI by the age of 2 years showed an expressive delay of approximately 1 year despite a normal growth rate, whereas a greater expressive delay was found in children who received a CI after the age of 2. In addition, children with CIs may have learned language at a faster rate than normal, thus enabling them to demonstrate language levels on par with their same-age hearing peers after up to 5 years of implant use. Contrary to the above findings, children above 7 years in the present study did not obtain maximum score. This may be because of only one year of implant experience

Although a number of factors other than age of intervention might influence the functional language performance. Parental/caregivers' involvement in early communication is also associated with spoken language performances (10). In early life, a parent-child interaction in natural communication environment influences the comprehension and expression of a child. The early interaction provides a cue for language learning and neuronal development. Therefore, language exposure and proper monitoring by caregivers provide the context for language learning in early developmental stages. Although language exposure was not quantified in the present study, medical history reported by the parents revealed no particular medical condition that might affect functional language performance.

5. Conclusion

CI before 4 years of age provides better functional language performance than older age at implant. Considering significant correlation of PEACH scores with language ability measured using standardized language tools, it can be used to a population where standardized tools cannot be easily administered. Thus in an early period of life they are very useful tools for clinicians to obtain meaningful information regarding children's auditory performance in real life. In addition PEACH measure is also useful in evaluating functional language performance of children whose primary mode of communication is not English.

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