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Comparison of auditory comprehension skills in children with cochlear implant and typically developing children



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ABSTRACT

Objective: The main goal of this study was to obtain auditory comprehension skills of native Hindi speaking children with cochlear implant and typically developing children across the age of 3–7 years and compare the scores between two groups.

Methodology: A total of sixty Hindi speaking participants were selected for the study. They were divided into two groups- Group-A consisted of thirty children with normal hearing and Group-B thirty children using cochlear implants. To assess the auditory comprehension skills, Test of auditory comprehension in Hindi (TACH) was used. The participant was required to point to one of three pictures which would best correspond to the stimulus presented. Correct answers were scored as 1 and incorrect answers as 0.

Results: TACH was administered on for both groups. Independent *t*-test was applied and it was found that auditory comprehension scores of children using cochlear implant were significantly poorer than the score of children with normal hearing for all three subtests. Pearson's correlation coefficient revealed poor correlation between the scores of children with normal hearing and children using cochlear implant.

Conclusion: The results of this study suggest that children using cochlear implant have poor auditory comprehension skills than children with normal hearing.

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1. Introduction

Assessment of children's language skills includes an evaluation of auditory comprehension skills because they are important for both normal language development and successful participation in a formal educational system [1].

Children who are born without hearing have limited exposure to oral language owing to the auditory deprivation imposed by their hearing loss. As a result, these children typically experience delays in the development of spoken language [2].

Over the past two decades there has been remarkable progress in the clinical treatment of profound hearing loss for individuals unable to derive significant benefit from hearing aids. Now many individuals who were unable to communicate effectively prior to receiving a cochlear implant are able to do so, even over the telephone without any supplementary visual cues from lip reading. The

advent of cochlear implants has had a dramatic effect on the achievements of young, profoundly deaf children. Spoken language competence is now possible for many children who previously depended primarily on sign language for communication.

Children who receive an implant early in life, followed by a period of appropriate rehabilitation, achieve speech and language skills that exceed levels observed in profoundly deaf children with hearing aids. However, there continue to be large differences in the performance outcomes of individual children, and many do not achieve speech and language skills that are commensurate with their age-matched peers with normal hearing. There are at least 2 reasons for the observed lags in development. First, the auditory information some children receive from the implant may be insufficient for normal speech development. Second, the period of profound deafness before the child receives an implant may make speech so inaccessible that a critical for spoken language development is lost. There is ample evidence for the critical period hypothesis. Prelingually deaf children who undergo implantation at younger ages reportedly achieve greater speech perception skills than those who undergo implantation at a later age [3].

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When cochlear implant users receive their implant, they typically already have a language delay with respect to normal-hearing children. On average, the implant keeps this delay from increasing further [4]. This finding suggests that earlier implantation would result in smaller delays in language development. Analysis of language growth indicated that, regardless of program type (oral or total communication), children who received the implant before the age of five achieved better outcomes over time, on average, than children who received their implants after the age of five [5].

Children with cochlear implant seem to face an extra challenge because even if the using a cochlear implant differs in implant provides sufficient acoustic information to support spoken language development, it does not restore normal hearing. The processing of sounds at least two important ways from processing by the human biological ears namely reduced spectral resolution and shifted frequency-to-place mapping in the cochlea [6]. Despite these two fundamental differences in sound processing by the human ear and a cochlear implant, it appears that speech recognition with a cochlear implant in quiet listening conditions can be quite good given that temporal and amplitude information in the speech signal is transmitted relatively accurately by the implant and only minimal spectral information is required to perceive words and sentences in quiet [6,7]. The aim of the present study is to obtain auditory comprehension skills in Hindi speaking children with Cochlear Implant and typically developing children. The objective is to compare auditory skills of native Hindi speaking children with cochlear implant and typically developing children across the age of 3–7 years.

2. Need of the study

Documenting the pattern of language abilities in children using cochlear implant will help to clarify how language acquisition in this population is similar or different than in children with normal hearing. This information may help to illuminate the specific needs of hearing impaired children using cochlear implants which may differ both from children with normal hearing and from other hearing impaired children. The findings will also contribute to general understanding of language development. In typically hearing children there is a relatively predictable pattern of language growth which includes simultaneous development in vocabulary, use of grammatical morphology, and the complexity of syntactic constructions. Observing whether growth in these areas disassociates in cochlear implant users gives us additional clues about which typically concurrent developments are coincidental or caused by extralinguistic factors, and which may be causal in nature. Szagun [8] observed a disassociation in the spontaneous speech of younger German speaking children who received implants between 1 and 4 years of age. In comparison to language matched peers, the children showed a slower rate of grammatical development, measured by the use of inflectional forms, and a faster rate of vocabulary growth during the first 18 months of implant use. This apparent asynchrony in abilities or rate of acquisition suggests that there may be differences in the language acquisition of children with cochlear implants compared to hearing children.

As there is a dearth of study pertaining to auditory comprehension skills of children using cochlear implant, this brings to the need to assess auditory comprehension skills in children using cochlear implant.

3. Methodology

Comprehension is the ultimate aim of reading and listening. Comprehension helps the people to acquire information, to

experience and be aware of other worlds, to communicate successfully, and to achieve academic success. The goal when listening (or reading to) a discourse (or text) is usually to derive an overall interpretation of the state of affairs described, rather than simply to retrieve the meanings of words or sentences [9].

Assessment of children's language skills includes an evaluation of auditory comprehension skills because they are important for both normal language development and successful participation in a formal educational system. The aim of the present study is to assess auditory comprehension skills in Hindi speaking children with Cochlear Implant and typically developing children and compare the scores between two groups.

3.1. Participants'

The study comprised of total 60 children (Group-A-30 typically developing children, hereinafter children with normal hearing and Group-B-30 children using cochlear implant.)

In case of Group-A, Thirty typically developing children (15 male and 15 female) between age ranges of 3–7 years were included. The participants who met the following criteria were included as participants of the present study: Their native language was Hindi, hearing sensitivity was within normal limits (below 15 dBHL), speech and language development was age appropriate, and there were no reports of any medical condition related to hearing and no reports of any clinically relevant developmental medical condition.

In case of Group-B, Thirty children (15 male and 15 female) using cochlear implant between age ranges of 3–7 years (Hearing age has been considered). The participants who met the following criteria were included as participants of the present study: Their native language was Hindi. There were no reports of any clinically relevant developmental medical condition and children have unilateral cochlear implantation. All participants had congenital deafness with average hearing loss above 95 dBHL. They were gone through CT-Scan test which revealed normal report. Average age of implantation was around 3years. Participants had used binaural hearing aid for about 18–24 months prior to cochlear implantation.

3.2. Tools used

Test of Auditory Comprehension in Hindi was used for the study [10]. This test was administrated by a single clinician.

During standardization of this test, children between 3 and 7 year age ranges were selected randomly as participants and were divided into eight group of six month age interval. Each group comprised of 20 children including 10 boys and 10 girls. Thus, the groups representing the final sample size of 160 participants were as follows:

- Group I - Between 3 years & 3years 6months.
- Group II - Between 3years 6months & 4years.
- Group III - Between 4 years & 4years 6months.
- Group IV - Between 4years 6months & 5years.
- Group V - Between 5 years & 5years 6months.
- Group VI - Between 5years 6months & 6years.
- Group VII - Between 6 years & 6years 6months.
- Group VIII - Between 6years 6months & 7years.

This test is composed of the following items:

3.2.1. Subtest 1, vocabulary

TAC-H consists of 45 items of vocabulary and examines the understanding of the literal and most common meanings of word

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