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RESEARCH PAPER

The Role of Early Cochlear Implantation in Child Language Development: An Action Research

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ABSTRACT

This action research study aims to investigate the impact Ling Sound production approach on child language development of children with early cochlear implant. This study followed action research design and the data was collected through interviews, observations and artifacts. Participants were included child parents and children with severe to profound hearing loss who received CI at an early age (2 years). A student who got CI at age of two was selected and his parents were also included. A total numbers of 40 speech therapy sessions were conducted with the child focusing on ling approach. The improvement made were related by the researcher.it was found that ling approach improved the auditory development , sound discrimination ability, and verbal production of the student.

Keywords: Early Cochlear Implant, Ling Sound, Oral Language , Speech Therapy

Introduction

According to current studies, insertion of cochlear implants before the age of two years has a considerable impact on oral language development, notably an enhanced rate of oral language development. (Supplee, 2009). Furthermore, children implanted early (between 12 months and 2 years of age) exhibit age-appropriate language skills, whereas children implanted later (after 2 years of age), or not implanted at all, do not. (Johanna Grant Nicholas, 2007) Because of the established benefits of early implantation, experts have recently advocated to lower the existing minimum age of implantation to less than 12 months of age. Although studies indicate that early implantation improves language development, surgery at such a young age is considered dangerous and controversial. (Holt, 2009)

People with bilateral severe to profound hearing loss who do not benefit from traditional amplification are currently eligible for cochlear implantation (National Institute on Deafness and Other Communication Disorders, 2008). Before cochlear implantation, a trial period with hearing aids is essential to ensure that traditional amplification has no advantage on speech and language. According to the American Speech-Language-Hearing Association (2008), children who are candidates for cochlear implantation must be healthy and have the support of their educational programmed. These children must also agree to participate in intense rehabilitation programmers (Niparko, 2010).

Implantation surgery

Implantation surgery is a surgical technique in which an artificial device or material is implanted into a patient's body. Implantation surgery is performed to either replace a damaged or defective body part or to improve the functionality of an existing body part. Cochlear implantation surgery is a medical process in which a small electronic device known

as a cochlear implant is implanted into the inner ear of a person who has severe hearing loss or deafness (Stephen Bowditch, 20009).

The cochlear implant is made up of two parts: an external component that is worn outside the ear and an internal component that is surgically inserted into the inner ear. The exterior component consists of a microphone and speech processor that takes up and processes sounds, as well as a transmitter that transfers electrical signals to the interior component. The internal component consists of an electrode array implanted into the cochlea (the region of the inner ear responsible for hearing) and a receiver-stimulator that receives electrical signals from the external component and stimulates the auditory nerve (Gail Baura).

Cochlear implantation surgery is widely regarded as safe and successful, and it has been shown to greatly enhance the hearing and quality of life of those suffering from severe hearing loss or deafness. However, like with any surgical operation, dangers such as infection, hemorrhage, and injury to neighboring structures exist. A qualified healthcare expert should be consulted before deciding to undertake cochlear implantation surgery (Garrada, 2021).

Literature Review

Language development and cochlear implantation Early cochlear implantation appears to have numerous advantages for children with hearing loss.; One advantage of having children implanted earlier is that they have more rapid oral language development since they start with a fewer language delay. In one study, conducted by Svirsky, Robbins, Kirk, Pisoni, and Miyamoto (2000), The Reynell Developmental Language Scale was used to assess language structure, vocabulary, and language content, as well as receptive capacity, in children with significant hearing loss before and after cochlear implantation. In comparison to other tests that solely measure single-word vocabulary skills, this test includes multiple problems of different length and complexity that resemble real-world conversation. (Kirk et al., 2002). Svirsky et. al (2000) examined twenty-three children at 6, 12, 18, 24, and 30 months post-implant. The data generated in the study were compared to normative data of 1,319 children with normal hearing. According to the findings of this study, there is a significant gap between expected language growth for children with hearing loss and observed improvements in children who have cochlear implants. (Svirksy et al., 2000). "The researcher found that, observed scores exceeded the predicted scores by a greater amount with each successive interval," (Svirsky et al., 2000, p. 155). The predicted scores were based on the data from a previous study (Svirsky, in press), generated from deaf children who were not implanted. This suggests that as the children aged, the difference between the predicted score and the observed score increased, and the actual difference between the language performance of the children with hearing loss and those children who has normal hearing loss decreased over time. Also, if language scores increase at successive intervals, the earlier a child is implanted, the more likely the child will obtain age-appropriate levels by the time they reach school-age. The researchers also found that children with hearing loss have a language deficit compared to normal hearing children, and that using the implant prevented this delay from developing with time. The data suggest, “Early implantation in deaf children would result in fewer delays in language development.” (Svirsky et al., 2000, p. 156).

Speech and language development in children with cochlear implantation has been widely documented. A strong language foundation is essential for the development of vocabulary and comprehension, which are a significant determinant of academic achievement (Archbold, 2008). Thus, maximizing language development in cochlear implant patients is critical for boosting academic performance and professional prospects. Speech and language can be assessed using a wide range of clinical assessments. The Ling-6 sound test is a basic method for assessing a patient's auditory perception of six different spoken

sounds at different speech frequencies. Although it was originally designed to aid in the measurement of auditory thresholds for infants using simple speech sounds, speech and language pathologists at our center use it as a fundamental measure of a child's ability to hear and, more importantly, imitate the six simple speech sounds included in the questionnaire (Robertson, 2013). Despite the fact that this is not a functional language acquisition test, a child's capacity to identify, discriminate, and reproduce these sounds is a precursor to the development of speech and language skills. If children do not complete this process properly, there is a good chance that their speech-language skills will be delayed or disrupted as they get older (Bochner, 2008).

A study conducted by Dettman, Pinder, Briggs, Dowell, and Leigh (2007) In terms of rate of language growth, the findings were similar to those of Colletti et al. (2005). This study included 106 children, all of whom had undergone implants before the age of 24 months. The participants were split into two groups. Group 1 consisted of 19 children who had implants placed before the age of 12 months, with an average implantation age of 0.88 years. Group 2 included 87 children with an average implantation age of 1.6 years. Language was assessed using the Rhode Island Test of Language Structure, including characteristics of preverbal and verbal interaction such as pragmatics, attachment, play, gesture, and 93 language expressive stages. The researchers found the rate of language growth for Group 1 was expressively improved than the rate of growth for Group 2 (Dettman et al., 2007). In accumulation, the poorest growth rate in Group 1 was equal to the average Group 2 growth rate (Dettman et al., 2007). Again, as in Colletti and colleagues' study, no surgical complications were seen in those implanted before 12months of age. The results from these two studies show that the language and developmental benefits of implantation before 12 months be greater than the risks.

One study conducted by Hammes et al. (2002) investigated how children who are implanted early (before 30 months of age) obtain age-appropriate skills, focusing on auditory pathway maturation and the key age of spoken language development. The study hypothesized that auditory stimulation supplied by a cochlear implant in infancy allows for proper growth of auditory circuits. This study comprised 47 children implanted between the ages of 9 and 48 months. Several linguistic assessments were utilized in this study, depending on the child's age, attention span, and general ability levels. These measures included the Skills for Hearing Impaired Children, Preschool Language Scales-3, Clinical Evaluation of Language Fundamentals P or III, and the Oral and Written Language Scales. (Hammes et al., 2002, p. 77).

Late cochlear implantation in children with severe hearing loss can still have a great impact on their language development, but the results may not be as favorable as those seen with early implantation (Supplee, 2009).

Children who receive cochlear implants later in life may have missed important stages of language development and may already have established alternate communication skills such as sign language or lip reading. Despite these obstacles, studies have shown that children who acquire cochlear implants later in life can still make considerable gains in language development, especially if adequate intervention and support are provided. Some studies have found that children who received cochlear implants after the age of five can develop speech and language skills comparable to hearing children, though the rate of progress may be slower and the outcomes may vary depending on individual factors such as age, severity of hearing loss, and pre-implantation language skills.

It is worth emphasising that the advantages of late cochlear implantation are not restricted to language development. Cochlear implantation can also benefit a child's social and emotional development, quality of life, and educational outcomes. While early cochlear implantation is generally suggested for children with severe hearing loss, late cochlear implantation can still benefit their language development and overall well-being. The choice

to undergo cochlear implantation should be decided in consultation with a skilled healthcare expert, taking into account the child's unique needs and circumstances (Holt, 2009).

The context of the study; setting, participant, researcher

Community and school

The private center located in Johar Town, Lahore, Pakistan, specializes in providing a range of services related to special needs education. Their primary focus is on offering therapeutic support to individuals with various needs and social difficulties such as Autism, ADHD, dyslexia, Down syndrome, social communication difficulties, and other developmental disorders. Additionally, they aim to prepare these individuals for mainstream education by providing quality Individualized Educational Plans (IEPs) tailored to their academic requirements. The center also offers awareness and counseling to parents and families who are dealing with individuals with special needs. Their comprehensive health and educational services encompass Applied Behavior Therapy, Speech and Language Therapy, Sensory Integration Therapy, Physiotherapy, Art Therapy, Occupational Therapy, Vocational and Provocation programs, Learning Support, Family Support Services, and a Specialist School Program. Through their dedicated efforts, they strive to enhance the lives of children and families in need.

Methodology

Participants

The participant in the study is a four-year-old child who received a cochlear implant at the age of three, initially having severe hearing loss. With regular speech therapy sessions, the child's auditory discrimination skills have improved significantly, allowing him to recognize sounds such as knocking doors, ball rings, his name being called, drum beats, clippings, and various toy sounds. However, the child still faces unique challenges in the classroom and requires specialized assistance and a standardized environment to fully participate. The school or center provides resources like one-on-one sessions, an acoustic speaking room, and appropriate lighting. It's important to note that the impact of cochlear implants on speech development can vary based on individual factors, and while they improve hearing and communication, they may not result in "normal" speech. Ongoing therapy and support may still be necessary for continued skill development

The following phases made up the qualitative methodology applied to this practical action research project:

Stage 1: Assessment of participant

The first stage involved conducting a needs assessment to identify the specific needs and challenges faced by the cochlear implant student. In this current study the 4 years old cochlear implant child participate, the data was collected through the observation, video recording, child previous academic record and practical test that was done by the participant.

Stage: 2 parent's interview

During the interview with the parents regarding their child's speech and language development, we discusses various aspects. The parents shared their observations of their child's communication skills, after the ling six sound speech therapy sessions

Stage 3: Evaluation

The effectiveness of the speech therapy was evaluated through academic records of students. Data was analyzed using qualitative methods to identify the most effective strategies for cochlear implant child for developing ling six sound.

Validity and Reliability

Ensuring validity and reliability are essential components of effective research. Validity ensures that the collected data accurately represents the intended description. To ensure both reliability and validity in this study, we utilized multiple data collection methods, such as observation interviews and students' academic record (artifacts). This method, known as triangulation ensured the strength and credibility of the data. Using a variety of data gathering techniques decreased the possibility of misunderstandings and misinterpretations, and the recorded audio preserved the participants' original viewpoints, further boosting the quality and reliability of the data.

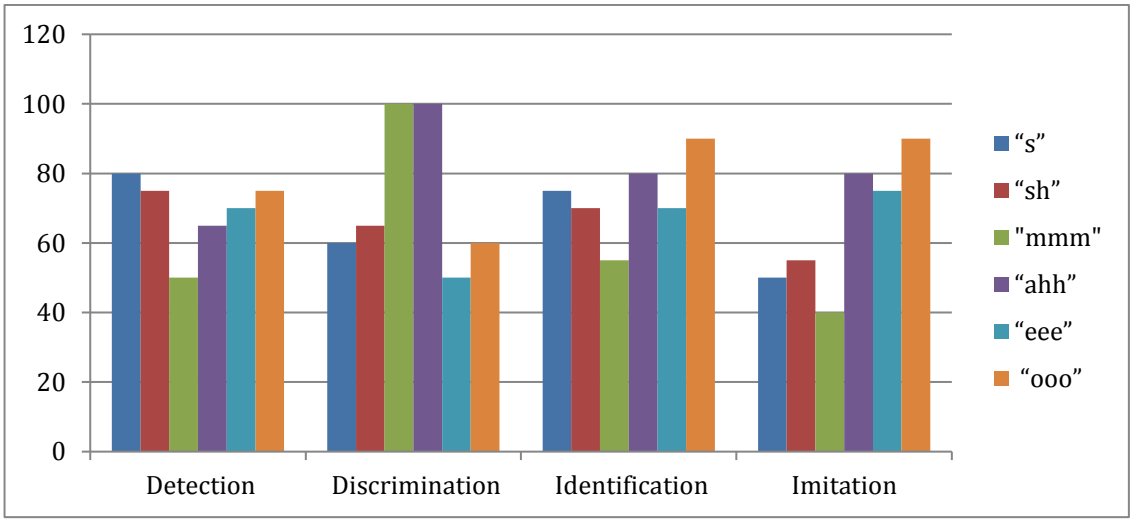
Ethical Considerations

It's important to keep the information and identities of participants private to protect their privacy. To do this, we used fake names for participants and got permission from both participant's child parents and the school's principal before conducting the study and interviews. We made sure to respect the privacy of the participants, which made them more comfortable and willing to provide relevant information. Once the information noted, we deleted the audio recording. We explained the study's method to the participants, and let them know that they could choose to leave the study at any time.

Results and Discussion

Observation

We conducted observations of ling six sound of participant. The observation contains the four steps first one is Detection: when a sound is heard, a participant could raise a hand, clap or drop something into a box. The second step was Discrimination: where a participant discriminates two or more sounds as being the same or different. Third step was Identification: where a participant points to a picture of the sound or produces the sound they heard and the fourth step was Imitation in which the participant tries to copy the same sound which is produce by speech therapist.



Implementation of the Ling Sound Test

Since the sound test's introduction in 1967, several foundations, specialised practices, and schools have updated or adapted it to reflect their ideas or type of practice. The essential elements of the test, however, have not changed. It takes time to adequately establish and conduct the Ling Sound Test. It takes time to show a child what is required or needed. In addition, the child's age and developmental stage must be considered. Once this is done, a baseline of what is expected on a daily basis is established.

1. Sit or stand 1 meter (3 feet) away from a child's face, either next to or behind the child. This excludes any visual clues for the child.

2-First, say the sounds 20cm away from the child at a normal conversational level (50-65 dB). Once the child has responded to all of the sounds, increase the distance to one meter. The six sounds must be random and contain various pauses to guarantee that no known pattern emerges and to reduce the child's ability to predict a sound

3-Distances should be increased to two and three meters. Make a note of any accurate and/or no responses, as well as any notes that may be relevant.

Analysis and interpretation of interviews of parents cochlear implant child

Theme: perception about speech therapy

Speech therapy is extremely beneficial for child with cochlear implants because it equips them with the skills they need to enhance communication and express themselves clearly. As parents of a cochlear implant child, I have witnessed firsthand the transformative power of speech therapy in improving my child's speaking and listening abilities. I want to encourage and promote the value of speech therapy in enabling cochlear implant child to realize their full potential by recognizing the hard work of committed experts and the tremendous consequences that go beyond speaking and listening.

A child's speaking and listening skills can be significantly enhanced by speech and language therapy, which is a transformative intervention. Speech therapists tackle areas including articulation, phonological awareness, and auditory discrimination to meet the unique needs of each child using specialized approaches and tactics. Children who participate in treatment sessions acquire crucial communication skills such as improved auditory perception, vocabulary growth, and speech production. Speech and language therapy helps children communicate more successfully by enhancing their active listening, understanding, and overall communication skills in addition to helping them express themselves more clearly. Children can overcome speech and language difficulties with the assistance of qualified specialists, realizing their full potential and empowering them to take an active part in social interactions, academic endeavors, and everyday life with self-assurance and success.

Theme: Main concern of Parents

The primary worries that parents may have about their cochlear implant child's speech and language abilities. In order to maximize their communication potential, it goes deep into understanding the particular difficulties faced by cochlear implant patients, emphasising the significance of early intervention, specialised therapy, and building a supportive atmosphere.

She’s most worried about her child's expressive and receptive language abilities as the mother of a child with a cochlear implant. She can be concerned with making sure her child can express their ideas, feelings, and opinions to others. This includes their capacity for verbal expression, the use of age-appropriate terminology, and the ability to put sentences together properly.

Theme: Developing Language and Social Skills

In addition to continuing to develop emotionally and cognitively, I want them to accept their independence and speak out for themselves. I want child to be happy, content, and have the abilities they need to succeed in life in the end. I was hoping that in two years, my four-year-old cochlear implant child will have improved their language and communication abilities, feel comfortable interacting with others, and be prepared to move on to the next level of their academic path. He has good language and communication skills now that he is four years old. He also has good auditory and social skills.

Auditory listing skill: Parents want their child to develop their auditory and listening abilities. We want children to be able to distinguish between different sounds, comprehend spoken language in a variety of settings, and build powerful auditory processing skills.

Social interaction: Parents want their child to succeed in social situations. Parents aim is for children to have the skills and self-assurance needed to strike up discussions, form friendships, and effectively express their needs and wants to their peers and adults.

Academic readiness: The goal of parents is to get their kids ready for school. They want them to develop the fundamental abilities in literacy, numeracy, and critical thinking that will prepare them for success as they transition into formal education

Theme: Nurturing Vowel and Consonant Sounds

The child parent's part in home practice of vowel and consonant sounds for a cochlear implant the development of a child's Ling Six sound takes many different forms. They create a supportive and interesting environment and attends regular practice sessions.

Mothers Play a Critical Role in Ling Six Sound Cochlear Implant Practice Children at Home" reputations and highlights the significant contribution mothers make to foster their child's Ling Six sound development.

Vowel and consonant sounds should be practiced at home to help children with cochlear implants develop clear, correct speech. Parents can support their child's path towards mastering vowel and consonant sounds by practicing focused speech activities, providing an encouraging auditory environment, and working with professionals. Parents may strengthen their child's communication abilities and prepare them for expressive and self-assured speech through frequent practice and encouragement

Theme: Well-Equipped Classroom with Good Acoustics

As the father of a child with a cochlear implant, he was pleased with the school placement of his child based on his own evaluation of a number of variables. It's crucial to take into account his child's specific demands, their growth of speech and language, and their general educational experience.

Child mother has particular criteria to make sure her child's educational setting is suitable for their needs as a mother of a child with a cochlear implant. She requires that there be some extra considerations made while aiming for an acoustic classroom that is suitable for a child who has a cochlear implant, as well as a staff that is fully trained and skilled.

As a parent of a child with a cochlear implant, it is natural to have certain expectations for their child's educational environment, including a well-equipped classroom with acceptable acoustics. Advocating for your child's needs requires excellent communication and teamwork. Try to come up with solutions with the school that will give your child with a cochlear implant a welcoming and encouraging learning environment.

Theme 6: Enhancing Parental Satisfaction

As father satisfied with my cochlear implant child's progress in speech and language development is a positive reflection of their growth and the role speech therapist is very important he is hardworking and caring towards his students. Now my child progress day by day improving as a mother, I feel satisfied with my cochlear implant child's speech and language development report, which is a significant and positive reflection of my child's growth. It reflects the success of their involvement, your dedication, and the support offered by professionals and the educational environment.

The development of a child's speech and language is a unique path for each child. Numerous aspects influence parental satisfaction, including milestones reached, communication abilities, academic performance, independence, and joint efforts. Parents must maintain open contact with specialists, set realistic expectations, and celebrate each step forward in order to foster a supportive atmosphere for their child's continuous development.

Findings

Ling Six Sound Therapy is a well-known and efficient method for assisting children with cochlear implants in their auditory development. It focuses on developing the child's ability to perceive and distinguish between different frequencies of speech sounds.

1. Auditory development is critical for children with cochlear implants to learn speech and language abilities. The goal of Ling Six Sound Therapy is to improve their ability to perceive and differentiate the six fundamental speech sounds (ah, ee, oo, sh, s, m) across the entire frequency range.
2. During the therapy sessions, Ling Six Sound Therapy uses the child's cochlear implant or hearing aid for providing auditory feedback. The therapist plays the target sounds at different intensities and frequencies, helping a child to improve their listening skills.
3. The therapy focuses on teaching a child to distinguish between the target speech sounds. It also helps in the development of phonemic awareness, which is necessary for language and speech development.
4. Ling Six Sound Therapy also includes speech production activities to strengthen the link between auditory perception and speech production. This includes saying the target sounds and words out loud.
5. Research studies have demonstrated the usefulness of Ling Six Sound Therapy in increasing speech perception, speech output, and overall auditory skills in children with cochlear implants.
6. Ling Six Sound Therapy is frequently utilized alongside other interventions such as speech therapy and auditory-verbal therapy. These combined treatments have the potential to improve the child's auditory development and language acquisition.

Recommendations:

Based on the study's findings, here are some recommendations for supporting child language development (ling sound) following early cochlear implantation.

- Auditory Verbal Therapy (AVT): it is recommended that the therapist apply the AVT on Early cochlear implant child. AVT focuses on developing auditory and spoken language abilities through the use of the cochlear implant to the greatest extent possible. The therapist collaborates closely with the child and family to establish a hearing and spoken language environment that emphasizes the child's listening abilities, speech production, and comprehension.

- It is also recommended that speech therapist apply on child Speech Production activities: These activities assist the kid acquire clear articulation by focusing on the production of certain speech sounds. In helping the child in creating accurate speech sounds, the therapist can use techniques such as auditory discrimination, imitation, and articulatory placing cues.
- It is recommended that Parents should be educated about the speech therapy It is critical for the child's language development to involve parents in the therapy process. The therapist can advise and coach parents on how to create a language-rich environment at home.
- It is recommended that the therapist should be used the vocabulary cards for enhancing Vocabulary and Language Expansion of child. Such activities like labeling items, describing visuals, and conversing assist the child to develop a large vocabulary and improve their general language comprehension and expression.

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