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Cochlear Implantation and Assessment of Speech in Children

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ABSTRACT: *Cochlea is a hollow, spiral shaped bone in the inner ear that has sense of hearing and to produce sound. Cochlear problems, or its damage can result in loss of hearing. This study was designed to access intelligibility of speech in children with cochlear implants. A total of 30 subjects (7 to 42 months) from Fatima Memorial College of Medicine and Dentistry were considered which were implanted with cochlea from October 2012 to December 2012. A pre-designed questionnaire was used for the data collection in order to collect the views from the parents of children with cochlear implants regarding the intelligibility of conversational speech produced by their children. It was noticed a 26 (86.7%) of the 30 youngsters who had cochlear implants were able to understand what was being said by their speakers. Moreover, parents and other listeners try to understand the conversation that cochlear implant's recipients make. It was concluded cochlear implants found useful and recommended for improving hearing of impaired individuals.*

Keyword: *Verbal communication, speech, intelligibility, Cochlear implant*

INTRODUCTION

Communication is only means by which one person can share thoughts and feelings with others (Carlson, 2020). This mechanism is present in all people by nature (Rakhimova et al., 2022). All communication is a way to convey information from one person to another (Naples and Ruckenstein, 2020). An individual's everyday communication status is only be estimated by their speech intelligibility (Rakhimova et al., 2022). Variables like gender, nonverbal intelligence, communication style, educational context, and extensive

technology use are all related to speech intelligibility (Varadarajan et al., 2021). The issue of evaluating speech comprehensibility needs study despite the numerous difficulties outlined above because decreased intelligibility is a major concern for many population of speech impaired people. However, after cochlear implantation, this comprehension has significantly improved in audibly impaired youngsters (Snels et al., 2019; Sharma et al., 2020).

Deafness is a word which is usually used for little or no hearing its degree can range from mild to severe or profound (Dornhoffer et al., 2020). World Health Organization (WHO) in 1980 described the word "deaf" for those whose hearing loss is so profound that they cannot benefit from any kind of amplification (hearing aid fitting) (Sharma et al., 2020). WHO (1980) established a classification such as mild (26-40 dB), moderate (41-55 dB), moderately severe (56-70 dB), severe, (71-91 dB), profound (>91db) based on a pure tone audiogram. While, an average of the hearing thresholds is 500, 1000, and 2000 Hz (McRackan et al., 2019).

Children who are very deaf (>90 dB loss) or totally deaf do not learn to speak and are frequently referred to as deaf mute or deaf and dumb (Teagle et al., 2019). The biggest flaw is hearing loss and speech was not developed in them since they had never heard speech (Gagnon et al., 2020). Therefore, nowadays an intervene in the form cochlear implant is available for these people to develop speech and to make them as an important member of society (Buchman et al., 2020; Dazert et al., 2020). The members started to use visual, aural, or tactile senses to express themselves (Deep et al., 2019). So, it is noticed that children who receive Cochlear Implants before the age of 5 demonstrate higher growth in their speech production skills than children who receive cochlear implants after this age (Zeitler et al., 2019). However, various other factors like gender, non-verbal intelligence, communication style, educational background, and extensive technology use also

influenced the speech capabilities (Messersmith et al., 2019). The development of speech in Cochlear Implants' recipients substantially varies among different people (Hoff et al., 2019). Longevity of deafness, age at onset, age of implantation, duration of Cochlear Implants, physiological or device factors such as the number of surviving spiral ganglion cells, electrode placement, insertion depth, electrical dynamic range, signal processing techniques, as well as additional psychological, educational, and social factors all are factors that affect an individual's variability (Plontke et al., 2020). Despite a variety of probable causes for the high inter-subject variability in speech intelligibility, using Cochlear Implants devices can assist to improve speech intelligibility (Galvin III et al., 2019).

The present study was planned to see the intelligibility of the children with cochlear implant. Moreover, role of speech session and various other parameters are also assessed via filling a questionnaire.

MATERIAL AND METHODS

Study Site

A total of 30 subjects from age of (7 to 42 months) with cochlear implants were considered for this study. The study was carried out with the children of Fatima Memorial College of Medicine and Dentistry.

Study Period

The study was conducted from October 2022 to December 2022.

Pre-Consent

A pre-consent was taken from parents/ participants of all the selected subjects.

Collection of Data

A pre-designed questionnaire was used to collect information about the intelligibility of conversational speech from the parents of cochlear implanted children. The questionnaire was consist of eight major questions further divided into various sub sections (Table 1). The obtained data was used to determine the overall intelligibility scores of conversational speech that produced by children with cochlear implants.

RESULTS

It was noticed in the present study a total of 30 subjects were selected and 12 were female and 18 were male. All the subjects were between seven months to forty two months old and with bilateral hear loss. The used questionnaire was consist of eight major questions which was further divided into various sub sections (Table 1). It was noticed in the study that in answer to first question four (13.3%) participants reported acquired hear loss, while 26 (86.7%) participants had congenital hear loss. While, in order to time of diagnosis 27 (90%) participants told that the child was diagnosed between the ages of 1 and 12 months, while only 3 (10%) participants reported their child was diagnosed after 36 months. Upon answer to speech therapy the subjects gave four different answers: one (3.3%) stated that it started at four months after cochlear implantation, and other (3.3) reported six months after cochlear implantation, while, 19 (63.3%) reported it began two months after cochlear implantation, and nine (30%) reported it began three months after cochlear implantation (Table 1). When asked how many speech therapy sessions had followed for cochlear implantation, 21 (69.9%) participants reported they had more than 4 speech therapy session per month. A 03 respondents (10%) said they had only one speech therapy session per month. While 06 respondents (20%) said they had only four sessions per month. In answer to question about subject's communication after cochlear implantation, 30 (100%) respondents reported that their child communicated vocally; none of them mentioned their child's use of sign language or gesticulation. The participants reply about intelligibility of their child’s speech was also asked, and 26 (86.7.0%) reported that their child speech was intelligible for them and only 4 (13.3%) participants had reported that their child speech was non-intelligible for them (Table 1).

Table 1. A predesigned questionnaire and its response

Questions	Response	%Frequency
Is Hearing Loss (HL) of child Congenital or Acquired?	Yes	26 (86.7%)
	No	4(13.3%)
Is HL of patients Unilateral or Bilateral?	Yes	30(100.0%)
	No	0
When the HL was first diagnosed?	1-12	20 (66. 6%)
	13 -24	2 (6. 6%)
	25- 36	5 (16. 6%)
	after 36	3 (10.0%)
What was age at the time of cochlear implant?	1-12	2(6.7%)
	13 -24	2(6.7%)
	25- 36	6(20.0%)
	after 36	20(66.6%)
When was speech therapy started after Cochlear Implant?	After 1 month	0
	After 2 months	19(63.3%)
	After 3 months	9(30%)
	After 4 months	1(3.3%)
	After 5 months	0
	After 6 months	1(3.3%)
No. of speech therapy sessions after Cochlear Implant?	1 per month	3(10%)
	2 per month	0
	3 per month	0
	4 per month	6(20%)
	More than 4 per month	21(69.9%)
How does your child communicate after cochlear implantation?	Verbal communication	30(100%)
	Non Verbal communication	0

If verbal then conversational speech is intelligible for you and others?	Yes	26(86.7 %)
	No	4 (13.3%)

DISCUSSION

It was noticed in the current study that most of the problem in considered subjects were congenital (86.7%) and bilateral (100%) and also be reported in various literature studies (Maes et al., 2014; Rine et al., 2013; Kimura et al., 2018). The most probable reasons for congenital diseases are cousin marriages, pressure from the structure of the family, and genetic alterations are a few potential causes of inheriting deafness. The outcomes clearly showed that 86.7% of children with cochlear implants could be understood verbally by an untrained listener (Katongo, 2015; Rogers, 2012). The findings showed that children with cochlear implants had ability to understood conversational speech and also reported by Geers et al. (2003). A question to participants was asked about how they learned that their child was deaf and different response were noticed with 66.6% reply after 36 months and same question was also asked by (Sodiqovna et al., 2020), three (10%) respondents stated they discovered their

child's handicap after the age of 36 months, whereas 27 (90%) indicated they made the discovery when the child was younger than 12 months. According to the results, the majority of respondents discovered their child's deafness while they were under 12 months old (Deep et al., 2021). It demonstrates that the signs of deafness were extremely obvious. The outcomes also indicated that parents were more concerned about their kids. It is significant to note that, despite implanting their child to regain auditory skills, the majority of parents were discovered to be more concerned with their children's verbal communication (Tarabichi et al., 2021). These findings, however, showed that 20 (66.7%) infants had their implants placed after the age of 36 months from the time of diagnosis, which is relevant given that early implantation is more important for the development of verbal

communication (Homans and Vroegop, 2021). Possible explanations for the delay in cochlear implantation include financial circumstances. The children with cochlear implants have speech therapy sessions and results revealed that the majority of parents began speech therapy for their children three months after cochlear implants, highlighting their concerns regarding verbal communication. It is important to keep in mind that rigorous speech treatment is more important for the development of verbal communication than interpreting conversational discourse (Clyne and Clyne, 1996). The results showed that 23 children (76.7%) reported receiving more than 4 speech therapy sessions per month, while 4 children (13.3%) reported receiving just 1 session per month and 3 children (10%) reported receiving only 4 sessions per month. Speech session bring more improvement as reported by Fuller et al. (2018). The participants were verbally communicating despite a delay in the cochlear implantation of young patients also reported by Binos et al. (2021). Only 4 (13.3%) respondents said their child was interacting with them using sign language, whereas nearly 26 (86.7%) said their child was verbally conversing. Those who were verbally communicating had speech that was understandable to both parents and strangers.

CONCLUSION

It was concluded in the study that cochlear implant was a way to treat congenital deafness. Moreover, conversational speech produced by the children with cochlear implant was intelligible for their parents and a significant progress was observed in it with an increased number of speech sessions. So, it is suggested by the more speech therapy sessions and proper care by the therapist and parents help to improve the intelligibility of the child and they can move towards normal quality of life.

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CONFLICT OF INTEREST

The authors declared no conflict of interest.

REFERENCES

1. Binos P, Nirgianaki E, Psillas G (2021). How effective is auditory–verbal therapy (AVT) for building language development of children with cochlear implants? A systematic review. Life. 11(3): 239.
2. Buchman CA, Gifford RH, Haynes DS, Lenarz T, O'Donoghue G, Adunka O, Biever A, Briggs RJ, Carlson ML, Dai P (2020). Unilateral cochlear implants for severe, profound, or moderate sloping to profound bilateral sensorineural hearing loss: a systematic review and consensus statements. JAMA Otolaryngol. Head and Neck Surg. 146(10): 942-953.
3. Carlson ML (2020). Cochlear implantation in adults. New Engl. J. Med. 382(16): 1531-1542.
4. Clyne M, Clyne MG (1996). Inter-cultural communication at work: Cultural values in discourse. Cambridge University Press.
5. Dazert S, Thomas JP, Loth A, Zahnert T, Stöver T (2020). Cochlear Implantation: Diagnosis, Indications, and Auditory Rehabilitation Results. Deut. Ärzteblatt Int. 117(41): 690.
6. Deep NL, Dowling EM, Jethanamest D, Carlson ML (2019). Cochlear implantation: an overview. J. Neurol. Surg. Part B: Skull Base. 80(02): 169-177.
7. Deep NL, Gordon SA, Shapiro WH, Waltzman SB, Roland Jr J T, Friedmann DR (2021). Cochlear implantation in children with single-sided deafness. The Laryngoscope. 131(1): E271-E277.
8. Dornhoffer JR, Holcomb MA, Meyer TA, Dubno JR, McRackan TR (2020). Factors influencing time to cochlear implantation. Otology & neurotology: official publication of the American Otological Society, American Neurotology Society and

European Academy of Otology and Neurotol. 41(2): 173.

9. Fuller CD, Galvin III JJ, Maat B, Başkent D, Free RH (2018). Comparison of two music training approaches on music and speech perception in cochlear implant users. Trends Hear. 22.
10. Gagnon EB, Eskridge H, Brown KD (2020). Pediatric cochlear implant wear time and early language development. Cochlear Implan. int. 21(2): 92-97.
11. Galvin III, JJ, Fu QJ, Wilkinson, EP, Mills D, Hagan SC, Lupo J E, Padilla M, Shannon RV (2019). Benefits of cochlear implantation for single-sided deafness: data from the House Clinic-University of Southern California-University of California, Los Angeles Clinical Trial. Ear and Hearing. 40(4): 766-781.
12. Geers AE, Nicholas JG, Sedey AL (2003). Language skills of children with early cochlear implantation. Ear and hear. 24(1): 46S-58S.
13. Hoff S, Ryan M, Thomas D, Tournis E, Kenny H, Hajduk J, Young NM (2019). Safety and effectiveness of cochlear implantation of young children, including those with complicating conditions. Otol. Neurotol. 40(4): 454.
14. Homans NC, Vroegop JL (2021). Impact of face masks in public spaces during COVID-19 pandemic on daily life communication of cochlear implant users. Laryngos. Investig. Otolaryngol. 6(3): 531-539.
15. Katongo ME (2015). The role of music in selected speech intelligibility of learners with post lingual hearing impairment in selected special units in Lusaka District (Doctoral dissertation).
16. Kimura Y, Masuda T, Kaga K (2018). Vestibular function and gross motor development in 195 children with congenital hearing loss—assessment of inner ear malformations. Otol. Neurotol. 39(2): 196-205.
17. Maes L, De Kegel A, Van Waelvelde H, Dhooge I (2014). Association between vestibular function and motor performance in

hearing-impaired children. Otol. Neurotol. 35(10): e343-e347.

18. McRackan TR, Hand BN, Consortium CIQLD, Velozo C A, Dubno JR (2019). Cochlear implant quality of life (CIQOL): development of a profile instrument (CIQOL-35 Profile) and a global measure (CIQOL-10 Global). J. Speech Lang. Hear. Res. 62(9): 3554-3563.
19. Messersmith JJ, Entwisle L, Warren S, Scott M (2019). Clinical practice guidelines: Cochlear implants. J. Am. Acad. Audiol. 30(10): 827-844.
20. Naples JG, Ruckenstein MJ (2020). Cochlear implant. Otolaryngologic Clin. North Am. 53(1): 87-102.
21. Plontke SK, Fröhlich L, Wagner L, Kösling S, Götze G, Siebolts U, Liebau A, Rahne T (2020). How much cochlea do you need for cochlear implantation? Otol. Neurotol. 41(5): 694-703.
22. Rine RM, Wiener-Vacher S (2013). Evaluation and treatment of vestibular dysfunction in children. Neuro.Rehabilit. 32(3): 507-518.
23. Rogers E 2012. Thesis. Development and Evaluation Of The New Zealand. CHILDREN'S-BUILD-A-SENTENCE TEST (NZ Ch-BAS)
24. Sadikovna RK (2022). Hearing-speech rehabilitation of children with cochlear implants as a socio-pedagogical problem. Asian J. Multidimensional Res. 11(11): 6-9.
25. Sadikovna RK (2022). Objectives and tasks of cochlear implantation. Web of Scientist: Int. Scientific Res. J. 3(4): 1250-1255.
26. Sharma SD, Cushing SL, Papsin BC, Gordon KA (2020). Hearing and speech benefits of cochlear implantation in children: A review of the literature. Int. J. Pediat. Otorhinolaryngol. 133: 109984.
27. Snels C, IntHout J, Mylanus E, Huinck W, Dhooge I (2019). Hearing preservation in cochlear implant surgery: a meta-analysis. Otol. Neurotol. 40(2): 145-153.
28. Sodiqovna RK, Zulfiya A (2020). Formation of Independence Motivation Based on Rehabilitation Work with Children with Cochlear

Implants. Int. J. Integrat. Edu. 3(10): 310-312.

29. Tarabichi O, Jensen M, Hansen MR (2021). Advances in hearing preservation in cochlear implant surgery. Curr. Opi. Otolaryngol. Head Neck Surg. 29(5): 385-390.
30. Teagle HF, Park LR, Brown K D, Zdanski C, Pillsbury HC (2019). Pediatric cochlear implantation: A quarter century in review. Coch. Impl. Int. 20(6): 288-298.
31. Varadarajan VV, Sydlowski SA, Li MM, Anne S, Adunka OF (2021). Evolving criteria for adult and pediatric cochlear implantation. 100(1): 31-37.
32. Zeitler DM, Sladen DP, DeJong MD, Torres JH, Dorman MF, Carlson ML (2019). Cochlear implantation for single-sided deafness in children and adolescents. Int. J. Ped. Otorhinolaryngol. 118(1): 128-133.