Journal of Advanced Medical and Dental Sciences Research

@Society of Scientific Research and Studies

Journal home page: www.jamdsr.com doi: 10.21276/jamdsr Index Copernicus value = 85.10

(e) ISSN Online: 2321-9599; (p) ISSN Print: 2348-6805

Original Research

Assessment of outcome of cochlear implant in children with hearing loss

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ABSTRACT:

Background: Cochlear implants have considerably improved speech and language outcomes in children with bilateral severe to profound hearing loss. The present study was conducted to assess outcome of cochlear implant in children. **Materials & Methods:** 64 children with hearing loss of both genders were given cochlear implant. Open-set word scores, listening progress profile score and auditory performance score were evaluated pre- operatively, after 6 months and 12 months. **Results:** The mean age of patients was 7.4 years. Pre-implant hearing aid experience was 5.8 years. The duration of implant use was 4.5 years. The mean pure-tone-average in implanted ear was – 97.5 dB HL and in non-implanted ear was – 91.1 dB HL. Open-set word scores pre- operatively was 4 at 6 months was 6 and at 12 months was 9, listening progress profile score pre- operatively was 1, at 6 months was 24 and at 12 months was 40. Auditory performance score pre-operatively was 0, at 6 months was 3 and at 12 months was 6. The difference was significant (P< 0.05). **Conclusion:** There was significant improvement in hearing in children who received cochlear implants.

Key words: Cochlear implant, Children, Hearing

Received: 2 April, 2018 Accepted: 6 May, 2018

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This article may be cited as: Sheikh S, Bajaj A, Vaze V, Paikay B. Assessment of outcome of cochlear implant in children with hearing loss. J Adv Med Dent Scie Res 2018;6(6):159-162.

INTRODUCTION

Increasing numbers of patients referred to cochlear implantation centers are hearing impaired children and adults with significant residual hearing.[1] The improvement in cochlear implant technology and positive outcomes have encouraged users of hearing aids to consider the implantation procedure for improving their auditory skills.[2] Cochlear implants have considerably improved speech and language outcomes in children with bilateral severe to profound hearing loss.[3] Cochlear implantation is typically offered to individuals who receive limited benefit from conventional stimulation with well-fitted hearing aids. The definition of "limited benefit" for children has changed appreciably in the past 15 years. Early criteria for paediatric cochlear implantation restricted the procedure to children with profound hearing loss who derived essentially no benefit from conventional hearing aids.[4]

A significant benefit of cochlear implant (CI) surgery in adult patients with single-sided deafness (SSD) and asymmetric hearing loss (AHL) has been seen.[5] Initially, CI were used to treat intractable tinnitus in patients with SSD, which is the most extreme case of AHL where the poorer ear presents with total deafness while the contralateral ear exhibits normal hearing. Apart from the suppression of tinnitus, many of the tinnitus patients treated with a CI derived additional hearing benefit from binaural hearing.[6]

A good cochlear implant outcome is likely to provide benefit to a large proportion of candidates with severe hearing loss. On the other hand, a poor outcome may lead to a decrement in auditory skills for some candidates. Clinical experience suggests that this scenario is rare, but even a small number of such cases could lead to serious consequences for a clinical program.[7] The present study was conducted to assess outcome of cochlear implant in children.

MATERIALS & METHODS

The present study comprised of 64 children with hearing loss of both genders. Parental consent was obtained before starting the study.

Demographic data of each patient such as name, age, gender etc. was recorded. Patients classified as borderline" as following criteria: 1) bilateral sensorineural hearing loss with a pure-tone-average (500, 1000, 2000 Hz) of < 90 dB, 2) significant preimplant open-set speech perception results (≥ 20% on monosyllabic tests or ≥ 50% on sentence tests). Patients with a clinical diagnosis of auditory neuropathy were excluded. A thorough clinical evaluation was performed by trained ENT surgeon followed by cochlear implant surgery.

Pre-implant speech recognition testing to assess candidacy and establish baseline functioning was done. Post-implant testing, typically using recorded speech materials was conducted at 6 and 12 months interval. Clinical speech recognition measures were selected on the basis of the child's linguistic abilities and ranged from parent questionnaires on auditory functioning to tests of open-set speech perception. The open-set word scores, listening progress profile score and auditory performance score were evaluated. Outcome of the treatment was assessed. Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Table I Distribution of patients

Total- 62		
Gender	**Male**	**Female**
Number	32	30

Table I shows that out of 62 patients, males were 32 and females were 30.

Table II Assessment of parameters

Parameters	Mean
Mean age	7.4 years
Pre-implant hearing aid experience	5.8 years
Mean duration of implant use	4.5 years
Mean pure-tone-average in implanted ear	– 97.5 dB HL
Non- implanted ear	– 91.1 dB HL

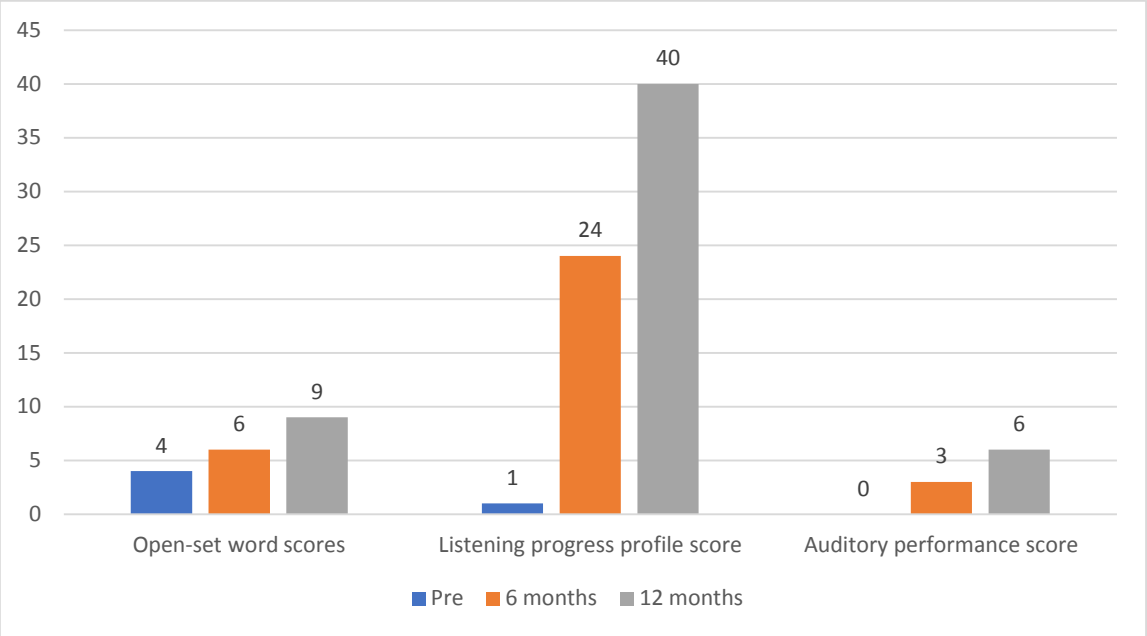
Table II shows that the mean age of patients was 7.4 years. Pre-implant hearing aid experience was 5.8 years. The duration of implant use was 4.5 years. The mean pure-tone-average in implanted ear was – 97.5 dB HL and in non-implanted ear was – 91.1 dB HL.

Table III Assessment of scoring

Parameters	Pre- pre- operatively	6 months	12 months	P value
Open-set word scores	4	6	9	0.03
Listening progress profile score	1	24	40	0.01
Auditory performance score	0	3	6	0.02

Table III, graph I shows that open-set word scores pre- operatively was 4 at 6 months was 6 and at 12 months was 9, listening progress profile score pre- operatively was 1, at 6 months was 24 and at 12 months was 40. Auditory performance score pre- operatively was 0, at 6 months was 3 and at 12 months was 6. The difference was significant (P< 0.05).

Graph I Assessment of scoring



DISCUSSION

Cochlear implant treatment has been introduced in children with AHL. AHL or even SSD in children can have a negative impact upon the normal development of the auditory cortex in the young child.[8] Furthermore, the ability to develop and use binaural hearing and its subsequent hearing abilities in daily life can be affected.[9] Especially when entering full-time education, children with SSD display behavioural problems and academic weaknesses, as well as increased needs for speech therapy in comparison to their normal-hearing peers.[10] The effectiveness of cochlear implantation for children with bilateral severe to profound hearing loss is well documented. However, clinical decisions regarding selection criteria for children with pre-implant residual hearing are complicated by the fact that a wide range of performance has been documented after implantation.[11] The present study was conducted to assess outcome of cochlear implant in children.

In present study, out of 62 patients, males were 32 and females were 30. Dowell et al[12] in their study a modified selection criteria were derived from an analysis of the postoperative performance for a large group of adult cochlear implant users. The distributions of results for implant users with significant preoperative open-set speech perception were reviewed. This suggested that the candidates had a good chance (>75%) of overall improvement if they obtained open-set sentence scores in quiet of up to 70% in the best-aided condition and scores of up to 40% in the ear to undergo implantation. The speech perception results showed that 36 subjects (80%) had improved open-set sentence scores with the cochlear implant compared with their best aided preoperative performance (mean improvement, 20.5%). Forty-four (98%) had improved open-set sentence scores for the ear undergoing implantation (mean improvement, 65.3%).

We found that the mean age of patients was 7.4 years. Pre-implant hearing aid experience was 5.8 years. The duration of implant use was 4.5 years. The mean pure-tone-average in implanted ear was – 97.5 dB HL and in non-implanted ear was – 91.1 dB HL. Fitzpatrick et al[13] undertook a retrospective study to identify children implanted at age 4 or older with a pure-tone-average of 90 dB or better and speech recognition of 30% or greater. Pre-implant and post-implant open-set word and sentence test scores were analyzed. Eleven children of 195 paediatric cochlear implant recipients met the inclusion criteria for this study. Speech recognition results for the10 English-speaking children indicated significant gains in both open-set word and sentence understanding within the first 6 to 12 months of implant use. Seven of 9 children achieved 80% open-set sentence recognition within 12 months post-surgery

We found that open-set word scores pre- operatively was 4 at 6 months was 6 and at 12 months was 9, listening progress profile score pre- operatively was 1, at 6 months was 24 and at 12 months was 40. Auditory performance score pre- operatively was 0, at 6 months was 3 and at 12 months was 6. A recent systematic review by research group analyzed prospective studies of children implanted during the preschool years, found that average open-set speech recognition results ranged between 40% and 70% after 4 -5 years of implant experience. Furthermore, the boundary beyond which a cochlear implant offers greater benefit than conventional amplification may also be influenced by other child and family factors such as age of implantation, family involvement, post-implant rehabilitation.[14]

Walton et al[15] examined the outcome of cochlear implantation in children with auditory neuropathy (AN) and cochlear nerve deficiency (Group A). Results were compared with a cohort of children with AN and normal cochlear nerves (Group B). Magnetic resonance imaging was examined for deficiency of the vestibulocochlear nerve. Brain and inner ear abnormalities were recorded. Cochlear implant outcomes and demographic variables were compared. Melbourne speech perception score (MSPS) at 1 year and implant evoked electric auditory brainstem response (EABR). Group A performed significantly worse on both parameters than Group B. In Group A, median MSPS was 1, compared with a median score of 4 in Group B. EABR was abnormal in 13 of 15 (87%) children in Group A, compared with 9 of 39 (23%) in Group B. Children in both groups with abnormal EABR had significantly worse MSPS. Fourteen of 15 children with cochlear nerve deficiency had associated inner ear abnormalities.

CONCLUSION

Authors found that there was significant improvement in hearing in children who received cochlear implants.

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