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Communication skills in preschool children with normal hearing and cochlear implant users

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Abstract

Pragmatic language development encompasses a range of skills that are necessary for communication to take place, such as initiating and maintaining communication, following rules and taking turns, but these skills can take time to develop in children with hearing loss. The aim of this study was to compare the communication skills of 5-6-year-old children with normal hearing and cochlear implant users. The study included 7 females and 14 males aged 60-72 months (M: 68.66±4.27) with cochlear implants and 8 females and 16 males aged 60-72 months (M: 68.41±4.65) with normal hearing. Responses to the 5-6 Years Communication Skills Scale, consisting of 4 subfactors and 46 items, were collected from the parents of all children. The mean scores of the 4 sub-dimensions of the scale, namely active communication, consideration, following rules and positive response, and the mean total score of the children with normal hearing were significantly higher than their peers with cochlear implants ($p<0.05$). In conclusion, it is important to evaluate hearing-impaired children not only for language development but also for development in all stages of communication, especially in the pragmatic aspect.

Keywords: Cochlear implant, communication skills, pragmatic language

Introduction

Effective communication, which consists of many social skills and is an important component of social success [1] is one of the most important areas of development that should be supported in early childhood [2]. Effective communication is important for socially acceptable behaviors, coexistence, and public health. These skills acquired in early childhood also contribute to other areas of development [3]. For example, verbal communication, which begins to develop with nonverbal expressions such as crying and chirping, continues to increase in speed at age 2 and beyond in healthy hearing children [4-6], and this developmental feature contributes to all types of communication.

In children with hearing loss, the clarity and quality of the stimulus in auditory processing processes are impaired, making it difficult and sometimes impossible to understand speech, which is a complex stimulus, in noisy and reverberant acoustic conditions [7]. This situation, which causes problems in the "verbal communication" pillar of communication, also affects other communication skills.

With today's technology, hearing aids, bone conduction systems, cochlear implants or brainstem implants allow hearing impaired children to develop close to or similar to their hearing peers. The choice of amplification technology depends on the type and degree of the child's hearing loss. Cochlear implants (CI) are biomedical devices for severe to profound sensorineural hearing loss that does not benefit from traditional hearing

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aids. The improvement in verbal performance of children who begin to receive auditory stimuli with a CI is reflected in their social functioning. Bat-Chava et al. showed in their study that implantation is effective in improving communication and socialization according to parents' responses to questions about psychological criteria [8]. Daily social relationships and quality of life should be assessed with different scales in children who use CI regularly and continue their auditory-verbal education [9,10]. This provides an opportunity to see how other communication skills besides verbal communication change.

The aim of this study is to determine the communication skills of healthy 5-6 year old children who use CI at an early age and healthy children who use Communication Skills For Scale 5-6 Aged Children.

Material and Methods

This study was conducted between February and June 2022 with the approval of Üsküdar University Non-Interventional Research Ethics Committee 61351342/January 2022-31. The study comprised 24 children with normal hearing (8 girls, 16 boys), 23 children with cochlear implants (9 girls, 14 boys), and one parent for each child. Two children with cochlear implants were excluded due to inner ear anomalies.

Inclusion criteria for children with normal hearing;

- Being in preschool education,
- Bilateral type A tympanogram and bilateral ipsilateral and contralateral reflexes in the 500-4000 Hz range,
- Pure tone average of air conduction thresholds at frequencies ≤ 25 dB HL at 500, 1000, 2000, 4000 Hz,
- Free from physical, neurological, psychiatric and systemic problems.

Inclusion Criteria for Children with Cochlear Implants;

- Receiving auditory-verbal education with preschool education,
- Diagnosed with severe or profound hearing loss,
- Single or bilateral cochlear implant users,
- With bilateral type A tympanograms,
- Pure-tone average of cochlear implant thresholds in free field at frequencies ≤ 35 dB HL at 500, 1000, 2000 and 4000 Hz,
- No disability other than hearing loss.

Common inclusion criteria for both groups were that the mother tongue was Turkish, the child was 5 or 6 years old, and the parents had healthy hearing. All children with hearing loss wore their implants regularly for at least 8 hours per day and lived with their families. All parents signed an informed consent form and completed a form requesting demographic information about themselves and their children (Table 1). Mothers then completed the Communication Skills Scale for Preschool Children at 5-6 years of age. Results were compared between children with normal hearing and children with cochlear implants.

Table 1. Demographic variables

Demographic variables	Cochlear implant users	Normal hearing
N	21	24
Female (n)	7	8
Male (n)	14	16
Chronological age (months, average)	68.66	68.41
Number of people attending preschool education	21	24
Number of people receiving special education	21	-
Number of unilateral cochlear implant users	5	-
Number of bilateral (consecutive) cochlear implant users	7	-
Number of bilateral (simultaneous) cochlear implant users	9	-
1st cochlear implant age (months, mean)	21.33	-
2nd cochlear implant age (months, mean)	22.56	-
Time since first cochlear implant (months, mean)	43.22	-
Number of mothers with university education	10	16
Number of mothers without university education	11	8

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Data collection tools

Tympanometry test

An otoscopic examination was performed prior to the tympanometric evaluation. Tympanometry was performed using the Interacoustics® Titan Handheld (Denmark). Bilateral type A tympanogram (0.3-1.6 cc compliance; ±100 daPa) [11] was considered normal for both groups. Bilateral type A tympanogram (0.3-1.4 cc compliance; ±50 daPa) [12] was considered normal for all mothers also.

Acoustic reflex test

Acoustic reflex testing was performed with the Interacoustics® Titan Handheld (Denmark). Obtaining ipsilateral and contralateral reflexes in the range of 500-4000 Hz bilaterally was considered normal for all mothers and children with normal hearing [13].

Pure tone audiometry test

Pure tone audiometry was performed with an Interacoustics® AC40 clinical audiometer (Denmark).

- The pure tone mean of the air conduction hearing thresholds of normal hearing children measured with supraaural headphones at the frequencies of 500, 1000, 2000, and 4000 Hz, bilaterally, ≤25 dB HL [14] was considered normal.
- A pure-tone average of air conduction thresholds at the frequencies 500, 1000, 2000, and 4000 Hz bilaterally ≤25 dB HL [15] measured with supraaural headphones in all mothers was considered normal.
- For children with cochlear implants, the pure-tone mean of air conduction thresholds at the frequencies of 500, 1000, 2000 and 4000 Hz, measured with CI in the free field, was considered normal if ≤35 dB HL bilaterally [16].

Communication skills scale for 5-6 year old children

The Communication Skills Scale for 5-6 Year Old Children was developed by Önder et al. and validity and reliability studies were conducted [17]. The scale, which is used to assess children's general communication skills, consists of 4 sub-dimensions and 46 items. The subdimensions of the scale are: 1) active communication, 2) considering others in communication, 3) following rules in communication, 4) showing positive reaction to others. The scale is a 5-point Likert scale (1=never, 2=rarely, 3=sometimes, 4=often, 5=always) and there are no reverse-scored items. The total score is calculated by averaging the scores from each sub-dimension. All items were answered by the mothers of the children in the study.

Statistical analysis

In this study, G*Power 3.1.9.4 programme was used to calculate the sample size. According to the programme, assuming effect size=0.8, significance level=0.05 and power=0.80, the minimum sample size was found to be 21 for each group. Firstly, it was evaluated whether the numerical data obtained showed normal distribution. Kurtosis and skewness values between ±1.0 are considered perfect, but values between ±2.0 are also acceptable in many cases depending on specific applications [18]. In this study, when the skewness and kurtosis values are between -2 and +2, it is accepted that the data are normally distributed.

SPSS v.23 programme was used for statistical analysis. "Independent Sample T Test" was used for paired group comparisons with normal distribution, and "Mann-Whitney U Test" was used for comparisons of non-normally distributed data [18]. The significance value was accepted as $p<0.05$.

Results

This study included 7 female and 14 male aged 60-72 months (M: 68.66±4.27) with cochlear implant and 8 female and 16 male aged 60-72 months (M: 68.41±4.65) with normal hearing. The groups were matched in terms of age factor.

The results of the questionnaire completed by the mothers of all participants and comparisons between groups are shown in Table 2.

Table 2. Sub-factor and total score comparison of communication skills of children with normal hearing and cochlear implant users

	Groups (Mean±SD)		
Sub-factors	**CI (n=21)**	**N (n=24)**	**p**
Active communication	57.80±8.18	66.79±6.45	**<0.001****
Considering others in communication	45.95±10.25	54.50±4.79	**.001****
Obeying the rules in communication	61.38±9.39	68.79±5.02	**.003****
Reacting positively to others	7.80±1.36	8.70±1.12	**.020***
Total score (mean)	43.23±6.79	49.69±3.88	**.001****

SD: standard deviation, CI: cochlear implant, N: normal, *: p<0.05, **: p<0.01

All sub-factors and total score of the questionnaire showed a significant difference between the groups ($p<0.05$). The mean scores of active communication, considering others in communication, obeying the rules in communication, reacting positively to others and total score of children with normal hearing were higher than their peers with cochlear implants.

The graph obtained from the sub-factor values and the mean of the questionnaire in cochlear implant users and children with normal hearing is shown in Figure 1.

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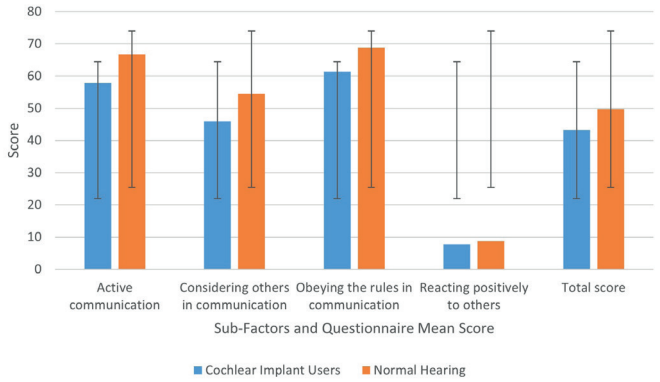

Figure 1. Questionnaire scores of cochlear implant users and children with normal hearing (Mean±1 SD)

In children with cochlear implants, the sub-scores of the questionnaire and the total score did not differ significantly between the groups (p>0.05) when consecutive implantees (n=7) and simultaneous implantees (n=9) were compared. Communication skills were similar in children with cochlear implant users who were sequentially or simultaneously implanted.

In our study, the educational status of the mothers of children with cochlear implants was divided into two groups as those with and without university education (Table 3).

According to Table 3, all questionnaire scores of the children of mothers who received university education were higher than the children of mothers who did not receive university education. However, no significance was found (p>0.05).

Table 3. Sub-factor and total score comparison of communication skills in cochlear implant user children of mothers with and without university education

	Groups (Mean±SD)		
Sub-factors	**University education (n=11)**	**No university education (n=10)**	**p**
Active communication	56.09±10.33	59.7±4.76	.698
Considering others in communication	43.18±12.97	49.00±5.18	.525
Obeying the rules in communication	60.00±11.81	62.90±6.00	.621
Reacting positively to others	7.63±1.74	8.00±0.81	.827
Total score (mean)	41.72±8.64	44.90±3.71	.503

SD: standard deviation

Discussion

The natural and tragic consequence of reduced audibility in the communication environment is delayed language development in children [19]. Pragmatic language development is an umbrella concept that covers a series of skills necessary for communication to take place, such as initiating and maintaining communication, following rules, and taking turns [20]. The first condition for active communication is to be able to initiate and maintain communication. Toe et al. investigated the communication between children with CI and normal hearing children in order to evaluate the pragmatic skills of school-age children with CI in terms of being able to maintain a conversation; they reported that children with CI tended to initiate more topics, ask more questions, and express their feelings and thoughts more than their hearing peers in an effort to dominate the conversation [21]. These efforts could be attributed to their desire to make friends in school. In our study, the performance of hearing impaired children with CI was worse. The reason for this can be thought to be the perspective of society and family members in developed countries. In developing countries, disability is seen as a weakness despite all the technologies that can eliminate disability and this situation is made felt to the disabled individual by the society. Introversion can also be observed in the social behavior of an individual whose disability is made felt especially at an early age. A study comparing children with normal hearing and children with hearing loss (children with hearing aids and children with cochlear implants) in terms of their communication abilities reported that children with hearing loss performed worse than children with normal hearing in categories such as maintaining a topic in conversation and responding to the speech act as a listener, which are necessary for active communication [19]. This report is similar to the results of our study.

Empathy in communication involves communicating feelings and thoughts in a way that is appropriate to the other person's feelings and thoughts and is therefore important for communication to continue [22]. However, hearing loss, which can also affect other elements of communication, causes difficulties in emotion recognition compared to healthy hearing individuals [23]. The fact that children with hearing loss lack the empathy necessary to initiate and maintain communication puts them at a social disadvantage. In a study comparing (pre-)adolescents with hearing loss to their hearing peers, parent reports revealed that participants with hearing loss performed worse than their hearing peers in understanding the other person's emotions [24]. Failure to fully develop empathy in children with hearing loss leads to behavioral problems. A study conducted on children aged 3-6 years to investigate the relationship between empathy and behavioral problems in children with hearing loss showed that empathy plays an important role in emotional resilience and positive behavior in social settings [25,26]. When the empathy skills of the hearing impaired children included in our study were assessed, it was found that they scored lower than their normal hearing peers, which is consistent with other studies in the literature.

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During the first year of life, communication rules such as turn-taking, reciprocal commenting, and daily interactions between parent and child are established [27,28]. The dynamics of these interactive behaviors change significantly when a child has a severe hearing loss [29]. In the preschool years, the intensity of child-parent communication also shifts to child-teacher and child-peer communication. One study has shown that hearing impaired preschool children communicate more with their teachers than with their peers. Teachers' visual (e.g., nodding, gesturing) and verbal (e.g., "hmm," "okay," "yes," "right") feedback helped hearing-impaired students maintain appropriate classroom communication. Other evidence has shown that children with hearing loss are more likely to initiate and maintain communication with children with hearing loss than with their hearing peers. In addition, this increased the communication success of the children [30]. Unfortunately, this study did not include an analysis of compliance with communication rules. Kretschmer et al. reported that hearing-impaired children who attended school and communicated with children with normal hearing had no problems with communication rules [31]. It is noticeable that there are certain rules (such as eye contact, facial expression and posture) in communication between even profoundly and profoundly deaf people who use sign language [32]. In 2021, among the answers of healthy children who were asked about the rules related to interpersonal communication, the items "listening to their parents and teachers, not upsetting them" and "getting along well with their friends" took the first places; even at the bottom of the list, rules such as "listening to their friends when they are talking" and "not crying when we don't get what we want - not shouting at home" were included in the list [33]. However, a similar study conducted with hearing impaired children could not be found. Our study is one of the few studies investigating the compliance of hearing impaired children with communication rules and the first study evaluating hearing impaired 5-6 year old children in this regard, but the performance of compliance with communication rules was found to be higher in healthy children. It has been suggested that this may be due to educational methods that may cause behavioral problems. This incomplete or incorrect approach may be due to the sadness of the parents due to the disability of their children and the difficulties they experience in adapting to the situation. In this sense, parents in particular should be supported and sensitized.

People can also initiate and maintain communication by showing positive reactions to another person's efforts and attempts to communicate with them [17].This step in communication is closely related to empathy. This is because empathy also includes feelings of sympathy and compassion [34]. A study showed that children with hearing loss have a positive attitude when communicating with their peers with normal hearing, but a negative attitude when communicating with their peers with hearing loss [35]. In our study, the ability of children with hearing loss to respond positively to others was found to be low, as was empathy. This may be due to behavioral problems that may arise from the social perspective and deficiencies and/or inaccuracies in the way parents raise their hearing impaired children, as we mentioned in the other 3 sub-factors we studied.

The mother is often the first and primary social communicator in life; she plays a role in establishing the milestones of communication. Maternal verbal and emotional sensitivity [36,37] and maternal involvement, including social interaction and intellectual stimulation [38], have been shown to influence language development in hearing children. Mothers with higher levels of education are also known to use a greater number and variety of words, more complex sentences, and more positive feedback [4,39]. Therefore, it is expected that the rate and level of development of children's social communication skills will increase as the mother's educational level increases. In our study, when the educational status and questionnaire scores of mothers of children with cochlear implants were examined, the children of mothers with university education had higher scores in all sub-items than the children of mothers without university education. However, statistical analysis did not show a significant difference ($p>0.05$). This may be explained by the fact that our sample size was not large enough to represent the relationship between age at implantation and the level of development of pragmatic skills.

Conclusion

In conclusion, there is a need for more studies that examine the active communication skills of all hearing impaired children, whether they are hearing aid users or cochlear implant users, as well as their characteristics such as empathy in communication, rule following, and positive responding. With this study it is necessary to ensure the re/habilitation of the hearing impaired child and the counseling and education of the parents. Thus, it is important to guide the hearing impaired children to the truth and stability not only for language development but also for development in all stages of communication in order to be a useful individual for the society.

Limitations

The social behavior scale was not administered to the participants; therefore, no correlation was established between them and the scale data evaluating communication skills. In our study, the data collected according to the age at implantation, bilateral and unilateral use, and sequential and simultaneous implantation results of children with cochlear implants did not show a homogeneous distribution due to insufficient sample size. In addition, the participants' maternal education levels were not equally distributed. Therefore, both intergroup comparison and separate analysis according to each education level could not be performed.

Conflict of Interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical Approval
This study was conducted between February and June 2022 with the approval of Üsküdar University Non-Interventional Research Ethics Committee 61351342/ January 2022-31.

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