

Speech Intelligibility of Malayalam Speaking Cochlear Implant Children

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Abstract

Cochlear implant (CI) is an electronic device that is designed to provide hearing to those with profound deafness. Part of the device is surgically implanted into the inner ear and part is worn externally. As a prosthetic device, the cochlear implant stimulates the auditory nerve directly bypassing the damaged part of the inner ear or cochlea. Many viable nerve fibers remain in the auditory nerve even in cases of profound deafness, and the cochlear implant can restore activity to this nerve and hearing pathway. That much of the speech signal is redundant explains why cochlear implant only needs to transmit a small fraction of the information that is contained in speech sounds to achieve good speech intelligibility, Susan (2011).

Studies on speech intelligibility of cochlear implant have been attempted in western countries and few studies in India have been attempted in different language like Telugu, etc. In Kerala the cochlear implantation program have made a drastic change. By providing adequate speech and language therapy after cochlear implantation will enhance the speech and measuring the speech intelligibility gives an insight of rehabilitation program in these children. No attempts have been made to study speech intelligibility in Malayalam cochlear implant children.

Three groups of listeners participated in the study. First group of listeners consisted of ten Speech Language Pathologist. Second group consisted of individual who were not experienced with hearing impaired. The third group of listeners were mothers of implanted children. The cochlear implant children were given 5 tasks to repeat familiar words, unfamiliar words, and nonsense words said by the tester, to describe a picture given and general conversation. These were recorded using PRAAT software and saved as WAV files.

Result showed that familiar persons – mothers and Speech language pathologist rated speech intelligibility better when compared to NON SLPs. Familiar topics like repetition of familiar words were rated better when compared to all other tasks.

Keywords: Cochlear implant, Malayalam speaking children, speech intelligibility.

Introduction

Speech is the fundamental communication method of human kind. It is crucial to have a good understanding of speech, not only in daily communication but also in emergency situation. The percentage of speech correctly understood is speech intelligibility. Speech intelligibility is the measure of the effectiveness of speech. The measurement is usually expressed as a percentage of a message that is understood correctly. Speech intelligibility does not imply speech quality. There are many factors affecting speech intelligibility including interference, noise, reverberation, echoes, etc.

Cochlear Implants

There are many reasons why cochlear implants are successful in providing speech intelligibility and identification of environmental sounds despite they do not replace all the function of normal cochlea. Much natural speech signals are redundant. Much of the normal processing capabilities of the ear are redundant. Much of the processing that normally occurs in the auditory nervous system is redundant. The central nervous system has an enormous ability to adapt to changing demands through expression of neural plasticity. That much of the speech signal is redundant explains why cochlear implant only needs to transmit a small fraction of the information that is contained in speech sounds to achieve good speech intelligibility, Susan (2011).

Cochlear implant (CI) is an electronic device that is designed to provide hearing to those with profound deafness. Part of the device is surgically implanted into the inner ear and part is worn externally. As a prosthetic device, the cochlear implant stimulates the auditory nerve directly bypassing the damaged part of the inner ear or cochlea. Many viable nerve fibers remain in the auditory nerve even in cases of profound deafness, and the cochlear implant can restore

activity to this nerve and hearing pathway. One of the first rehabilitation decisions that parents of the children with hearing impairment must face is whether or not to select a cochlear implant as the sensory aid of choice for their child.

Speech Intelligibility

Cochlear implant rehabilitation is a preferred choice of speech rehabilitation of hearing impaired because it allows children to use the natural aural-oral method of developing speech. Some factors that affect the outcome of language comprehension are early fitting, training duration, additional amplification, etc. All these factors indicate the success of speech intelligibility in cochlear implantation (Clark 2003).

Speech Intelligibility of Profoundly Deaf Children

Several studies have compared the speech intelligibility of profoundly deaf children before and after implantation Tobey (2011) examined speech intelligibility of children with CI using sentences and result shows that speech intelligibility was significantly higher after implantation. Osberger compared speech intelligibility in pediatric users of single channel multichannel CI and tactile aids. Materials used were sentences. Children with early – onset deafness (before 4 year) who received CI before age 10 had the highest intelligibility scores whereas children who do not receive CI until after 10 year had lowest score.

The “speech intelligibility” refers to the degree to which a speaker intended message can be recovered by other listener (Kent & Duffy, 2001)

Abijith (2010) examined post-treatment rating of speech intelligibility in cochlear implanted children. Results indicated there is a significant difference between rating done by mothers and other group for general conversation and picture description and there is a significant difference between general conversation and picture description. Hence it is concluded that there is a significant improvement in speech intelligibility after cochlear implantation.

Patil, Sindhura & Reddy (2010) examined acoustic features of speech stress fundamental frequency, duration and intensity in children using cochlear implant and compared these features with those in normal hearing. Children with cochlear implant distinctly produced sentence stress but the acoustic correlates of stress are significantly different from those produced by individual with normal hearing.

From the above review of literature it could be said that, speech intelligibility plays a crucial role in understanding once speech. Speech intelligibility of cochlear implantee will apparently make an impact on listeners.

Cochlear Implantation in Kerala for Malayalam Speaking Children

Studies on speech intelligibility of cochlear implant have been attempted in western countries and few studies in India have been attempted in different language like Telugu etc.

In Kerala the cochlear implantation program have made a drastic change. By providing adequate speech and language therapy after cochlear implantation will enhance the speech and measuring the speech intelligibility gives an insight of rehabilitation program in these children. No attempts have been made to study speech intelligibility in Malayalam cochlear implant children.

Hence the present study has been taken up to measure the speech intelligibility of Malayalam speaking cochlear implanted children

Review of Literature

Intelligibility refers to the recoverability of a speaker's linguistic message, differing from articulatory or phonological measures in that some aspects of meaning is involved. In cochlear implantation research, intelligibility range from morpheme to whole sentence, intelligibility is most often measured with rating scales (Yan 2006).

Cochlear implant is an electronic device that is designed to provide hearing to those with profound deafness. Part of the device is surgically implanted into the inner ear and part is worn

externally. As a prosthetic device, the cochlear implant stimulates the auditory nerve directly bypassing the damaged part of the inner ear or cochlea. Many viable nerve fibers remain in the auditory nerve even in cases of profound deafness, and the cochlear implant can restore activity to this nerve and hearing pathway. One of the first rehabilitation decisions that parents of the children with hearing impairment must face is whether or not to select a cochlear implant as the sensory aid of choice for their child.

Cochlear implant rehabilitation is a preferred choice of speech rehabilitation of hearing impaired because it allows children to use the natural aural-oral method of developing speech. Some factors that affect the outcome of language comprehension are early fitting, training duration, additional amplification, etc. All these factors indicate the success of speech intelligibility in cochlear implantation.

Speech intelligibility of hearing impaired individuals has long been the platform of discussion on how they should be educated. Although there may be considerable difference of opinion as to whether good speech intelligibility is in fact achieved for a given hearing impaired individual or as to how speech may best be achieved in the broad context of other educational objectives, the overall importance of oral speech intelligibility for success in the hearing world is difficult to deny. However, competent a person may be it is usually only through oral performance that is competence becomes apparent. In fact good speech intelligibility is stated goal of most of or all contemporary educational methodologies (Susan 2011).

It is generally accepted that degree of hearing loss is one of the most important factors affecting the speech intelligibility of hearing impaired children. Hudgins and number (1924). As hearing loss increases, articulation error increases and overall speech intelligibility become worse.

Western studies

Gao (2003) compared the connected speech intelligibility of children who use cochlear implants with children who have normal hearing. Results showed that for children with CI greater intelligibility associated with both increased chronological age and increased duration of

cochlear implant use. As a whole children with cochlear implant were significantly less intelligible than children with normal hearing.

Peng (2004) investigated speech intelligibility of 24 prelingually deaf pediatric cochlear implant recipients with 84 months of device experience by Each CI participant's speech sample was judged by a panel of 3 listeners. Both age at implantation and different speech coding strategies contribute to the variability of CI participant's speech intelligibility. Implantation at a younger age and use of the spectral peak speech coding strategy yielded higher intelligibility scores than implantation at an older age and the use of multipeak speech - coding strategy. These results serve for clinical applications of long term advancements in spoken language development are considered for pediatric CI recipients.

Musselman (1990) studied the relationship between hearing loss and speech intelligibility was investigated in a sample of 121 young deaf children. Significant independent effects were associated with the unaided hearing threshold level (HTL), but not with the aided HTL or with shape. Further analysis of the data suggested the existence of 3 distinct groups. Most children with losses of 70-89 dB developed some intelligible speech and unaided HTL had additional predictive validity. Between 90 and 104 dB, considerable variability occurred, and the aided HTL had additional predictive validity. Above 105 dB, few children developed any intelligible speech.

Osberger (1994) studied the speech intelligibility of 18 children with pre lingual deafness using cochlear implants for an average of 3 year. The average speech intelligibility score of 9 children using oral communication was significantly higher than that of 9 children using total communication.

Nikolopoulos (2009) assessed the influence of age at implantation on speech perception and speech intelligibility following pediatric cochlear implantation. Age at implantation positively correlated with pre implantation assessment performance and with most of the outcome measures up to 24 months following implantation. However, at the 3 and 4 year intervals following implantation, age at implantation was found to be a strong negative predictor

of all the outcomes studied. The result of the present study provide strong evidence that pre linguallly deaf children should receive implants as early as possible to facilitate the later development of speech perception skills and speech intelligibility and thus maximize the health gain from the intervention. However, because of the wide variation in individual outcomes, age alone should not be used as a criterion to decide implant candidacy.

Osberger, Maso & Sam (2010) Speech intelligibility was measured in 31 children who used the single-channel implant (n=12), the Nucleus 22-Channel Cochlear Implant System (n=15), or the Tactile aid and two-channel vibro tactile aid (n=4). The subjects were divided into subgroups based on age at onset of deafness. The speech intelligibility of the experimental subjects was compared to that of children who were profoundly hearing impaired who used conventional hearing aids (n=12) or no sensory aid (n=2). The subjects with early onset of deafness who received their single- or multichannel cochlear implant before age 10 demonstrated the highest speech intelligibility, whereas subjects who did not receive their device until after age 10 had the poorest speech intelligibility. There was no obvious difference in the speech intelligibility scores of these subjects as a function of type of device (implant or tactile aid). On the average, the post implant or tactile aid speech intelligibility of the subjects with early onset of deafness was similar to that of hearing aid users with hearing levels between 100 and 110 dB HL and limited hearing in the high frequencies. The speech intelligibility of subjects with late onset of deafness showed marked deterioration after the onset of deafness with relatively large improvements by most subjects after they received a single- or multichannel implant. The one subject with late onset of deafness who used a tactile aid showed no improvement in speech intelligibility.

Allen & Nikolopoulos (2008) evaluated the long-term speech intelligibility of young deaf children after cochlear implantation. All children were congenitally deaf before 3 years of age. They each received a Nucleus multichannel cochlear implant before the age of 7 years. 44 subjects were evaluated up to 5 years after cochlear implantation. Cochlear implantation followed by an intensive program of local and center-based assessment and rehabilitation was performed. A speech intelligibility rating scale evaluated the spontaneous speech of each child before and at yearly intervals for 5 years after implantation. Result concluded that after cochlear implantation, the difference between the speech intelligibility ratings increased significantly each year for 4 years. For the first 2 years, the average rating remained "unintelligible speech At the 4-

year 85% of children had some intelligible connected speech. This improvement continued, and at the 5-year.

George, Judith & Olivier (2013) study aimed to evaluate the long-term speech perception and speech intelligibility of congenitally and pre linguallly deaf children after cochlear implantation. They each received a nucleus multichannel cochlear implant before they were 10 years old. Perception is evaluated using the Test for the Evaluation of Voice Perception and Production (TEPP) and concerns closed- and open-set word and sentence perception without lip-reading. The intelligibility is classified according to the Speech Intelligibility Rating (SIR). The evaluations have been made every 3 months for 1 year, then at 18 months, 2 years, 3 years and 5 years after the cochlear implantation. Result revealed, congenitally and pre linguallly deaf children who receive cochlear implant before the age of 10 years develop speech perception and speech intelligibility abilities. The closed-set perception progresses quickly and seems to reaching a plateau at 5 years post implantation. The improvement of open-sentence perception is not significant until the first year post implantation. The speech intelligibility improves regularly the five first year post implantation.

Indian Studies

Abijith (2008) examined post treatment rating of speech intelligibility in cochlear implanted children. Results indicated there is a significant difference between rating done by mothers and other group for general conversation and picture description and there is a significant difference between general conversation and picture description. Hence it is concluded that there is a significant improvement in speech intelligibility after cochlear implantation.

Patil, Sindhura & Reddy (2010) examined acoustic features of speech stress fundamental frequency, duration and intensity in children using cochlear implant and compared these features with those in normal hearing. Children with cochlear implant distinctly produced sentence stress but the acoustic correlates of stress are significantly different from those produced by individual with normal hearing.

Kameswaran (2006) conducted assessment of outcomes of cochlear implantation taking into account various scoring system like Category of Auditory Performance (CAP) and Speech Intelligibility Rating (SIR). There is a significant improvement in auditory performance and speech intelligibility in the first few years after implantation

Sindhu (2011) compared the communication development in children who receive cochlear implant before the age of 12 months and 12 to 24 months. Result showed that mean rates of receptive (1.12) and expressive (1.01) language growth of children receiving implants before the age of 12 months were significantly greater than the rates achieved by children receiving implants between 12 and 24 months matched growth rates achieved by normal hearing children.

Shashikanth & Kumaraswamy (2009) studied speech intelligibility of 23 cochlear implant children and result shows that speech intelligibility is better for familiar words and poorer for conversation. And also speech was more intelligible for speech language pathologist.

Need of the Study

From the above review of literature it could be said that, speech intelligibility plays a crucial role in understanding once speech. Speech intelligibility of cochlear implantee will apparently make an impact on listeners.

Studies on speech intelligibility of cochlear implant have been attempted in western countries and few studies in India have been attempted in different language like Telugu etc.

In Kerala the cochlear implantation program have made a drastic change. By providing adequate speech and language therapy after cochlear implantation will enhance the speech and measuring the speech intelligibility gives an insight of rehabilitation program in these children. No attempts have been made to study speech intelligibility in Malayalam cochlear implant children.

Hence the present study has been taken up to measure the speech intelligibility of Malayalam speaking cochlear implanted children

Aim of the Study

The aim of the present study is two folded,

1. To compare the speech intelligibility rating of cochlear implant individuals for 5 different task, familiar words, unfamiliar words, nonsense words, picture description and general conversation.
2. To compare speech intelligibility rating of cochlear implant children between 3 group SLP, Non- SLP, and mother of cochlear implant children

Methodology

The aim of the present study was to compare the speech intelligibility rating of cochlear implant individuals for 5 different task, i.e., familiar words, unfamiliar words, nonsense words, picture description and general conversation and to compare speech intelligibility rating of cochlear implant children between 3 group Speech Language Pathologist (SLP), Non- Speech Language Pathologist (Non SLP), and mother of cochlear implant children

Subject Selection Criteria

Ten cochlear implanted children whose pure tone average was above 90dB before surgery and who have undergone surgery before 2 year.

Three group of listeners participated in the study. First group of listeners consisted of ten Speech Language Pathologist. Second group consisted of individual who were not experienced with hearing impaired. The third group of listeners were mothers of implanted children.

Procedure

The cochlear implant children were given 5 tasks to repeat familiar words, unfamiliar words, and nonsense words said by the tester, to describe a picture given and general conversation. These were recorded using PRAAT software and saved as WAV files.

Recording

The recording was done using PRAAT software (version 5.1.3.7). A constant mic to mouth distance of 15 cm was maintained. All the recording lasted 10 min for 5 different tasks.

1. **Familiar words:** this task included few familiar words which should be repeated after clinician. The recording was done for 2 minutes.
2. **Unfamiliar words:** This task included few non familiar words which should be repeated after clinician. The recording was done for 2 minutes.
3. **Non sense words:** this task included few nonsense words which should be repeated after clinician. The recording was done for 2 minutes.
4. **Picture description:** This include child describing the pictures shown by clinician. The recording was done for 2 minutes.
5. **General conversation:** this task include conversation of the child with clinician for 2 minutes

Analysis

Three group of listeners participated in the study. The first group of listeners participated in the study consist of 10 speech language pathologist with same educational background of masters in speech and hearing. Second group consist of individuals who are not experienced participated in the study.

All participants hearing sensitivities are in normal limits. Speech samples collected from cochlear implanted children was given to listeners for intelligibility rating. A 5 point rating scale was used where 1 indicates complete intelligibility and 5 indicates complete unintelligible

Result and Discussion

The aim of the present study was two folded to compare the speech intelligibility rating of cochlear implant individuals for 5 different task, familiar words, unfamiliar words, nonsense words, picture description and general conversation and to compare speech intelligibility rating of cochlear implant children between 3 groups: SLP, Non- SLP, and mother of cochlear implant children.

The obtained data was analyzed statistically and results are discussed below.

Familiar Words

	N	Minimum	Maximum	Mean	Std. Deviation	Median	Mean (%)	Kruskal Wallis test value	P value
SLP	10	11	19	12.90	2.283	12.00	25.80	22.852	.000 HS
Mothers	10	21	30	25.00	2.582	25.00	50.00		
Non SLP	10	24	42	31.40	6.022	30.50	62.80		

Table 1: Showing the mean, standard deviation and significant value for familiar words among SLP mothers and NON SLP

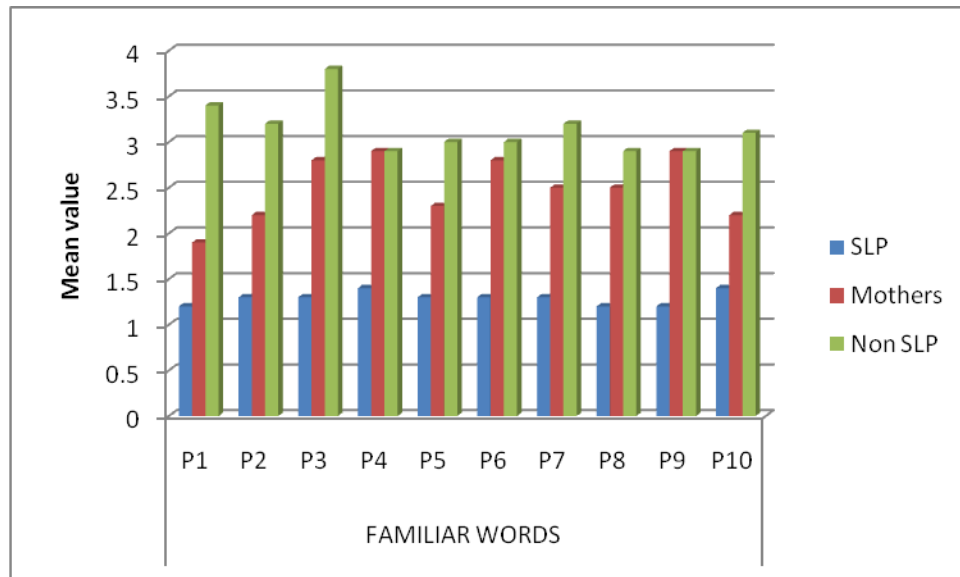


Figure 1: showing the rating of SLP mothers and NON SLPs for familiar words.

From the above table 1 and figure 1 it can be seen that, the SLP rated the speech intelligibility better with mean of 12.90 whereas mothers rated second best with the mean of 25.00 followed by NON SLP rated the speech intelligibility very poorly with the mean of 31.40. It may be noted on a 5 point clinical judgment scale of speech intelligibility, which was converted to percentage for better calculation and the comparison between three groups for their rating for familiar words shows highly significant difference ($p = .000$).

Unfamiliar Words

Unfamiliar	N	Minimum	Maximum	Mean	Std. Deviation	Median	Mean (%)	Kruskal wallis test value	P value
SLP	10	19	22	20.80	.919	21.00	41.60	17.275	0.00 HS
Mothers	10	18	29	23.30	3.713	22.50	46.60		
Non SLP	10	24	33	28.10	2.961	29.00	56.20		

Table 2: showing the mean, standard deviation and significant value for unfamiliar words among SLP Mothers and NON SLPs

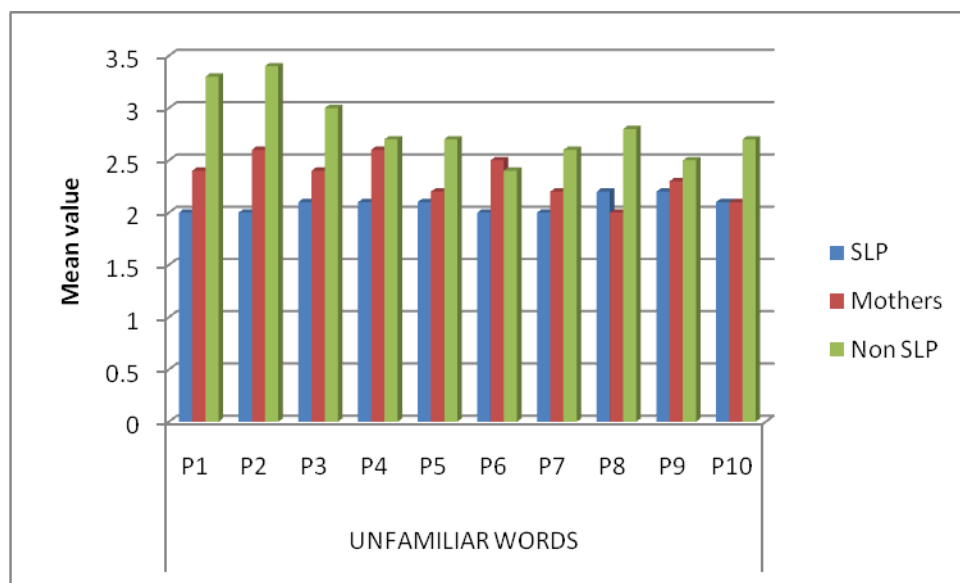


Figure 2 : showing the ratings of SLP, mothers and NON SLPs for unfamiliar words.

From the above table 2 and figure 2 it can be seen that the SLP rated the speech intelligibility better with mean of 20.80 whereas mothers rated second best with the mean of 23.30 followed by NON SLP rated the speech intelligibility very poorly with the mean of 28.10. It may be noted on a 5 point clinical judgment scale of speech intelligibility, which was converted to percentage for better calculation and the comparison between three groups for their rating for unfamiliar words shows highly significant difference. ($p = .000$)

Nonsense Words

Nonsense words	N	Minimum	Maximum	Mean	Std. Deviation	Median	Mean (%)	Kruskal wallis test value	P value
SLP	10	22	27	25.00	1.764	25.50	50.00	23.836	.000 HS
Mothers	10	24	32	28.60	2.319	28.50	57.20		
Non SLP	10	36	40	37.90	1.729	37.50	75.80		

Table 3: showing the mean, standard deviation and significant for nonsense words among SLP Mothers and NON SLPs

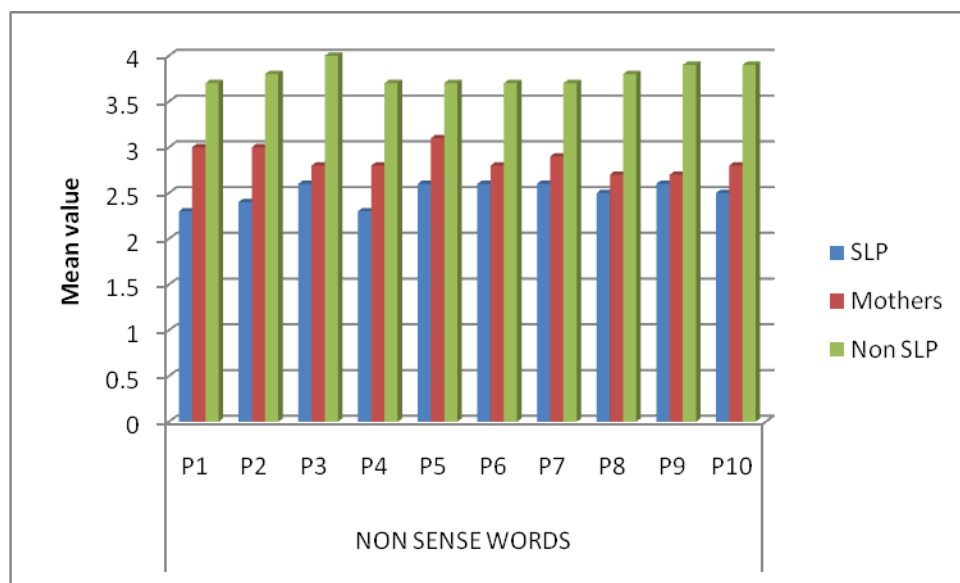


Figure 3: showing the ratings of SLP mothers and NON SLPs for nonsense words.

From the above table 3 and figure 3 it can be seen that the SLP rated the speech intelligibility better with mean of 25.00 whereas mothers rated second best with the mean of 28.60 followed by NON SLP rated the speech intelligibility very poorly with the mean of 37.90. It may be noted on a 5 point clinical judgment scale of speech intelligibility, which was converted to percentage for better calculation and the comparison between three groups for their rating for nonsense words shows highly significant difference ($p = .000$)

Picture Description

Picture description	N	Minimum	Maximum	Mean	Std. Deviation	Median	Mean (%)	Kruskal wallis test value	P Value
SLP	10	24	34	27.70	2.908	28.00	55.40	23.807	.000 HS
Mothers	10	34	43	38.80	2.781	38.50	77.60		
Non SLP	10	42	44	42.60	.699	42.50	85.20		

Table 4: showing the mean, standard deviation and significant value for picture description among SLP Mothers and NON SLPs.

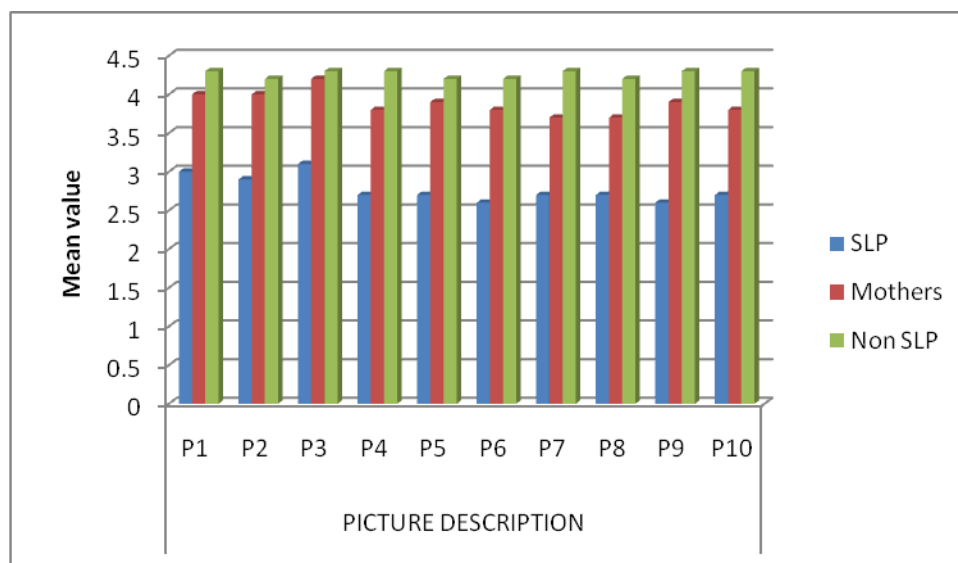


Figure 4: showing the rating of SLP mothers and NON SLPs for picture description.

From the above table 4 and figure 4 it can be seen that the SLP rated the speech intelligibility better with mean of 27.70 whereas mothers rated second best with the mean of 38.80 followed by NON SLP rated the speech intelligibility very poorly with the mean of 42.60. It may be noted on a 5 point clinical judgment scale of speech intelligibility, which was converted to percentage for better calculation and the comparison between three groups for their rating for picture description, shows highly significant difference between ratings in all three groups for picture description

General Conversation

	N	Minimum	Maximum	Mean	Std. Deviation	Median	Mean (%)	Kruskal wallis test value	P value
SLP	10	32	41	35.40	2.547	35.00	70.80	22.713	.000 HS
Mothers	10	35	43	38.70	2.111	39.00	77.40		
Non SLP	10	44	50	47.10	2.183	47.00	94.20		

Table 5: showing the mean standard deviation and significant value for general conversation among SLP Mothers and NON SLPs.

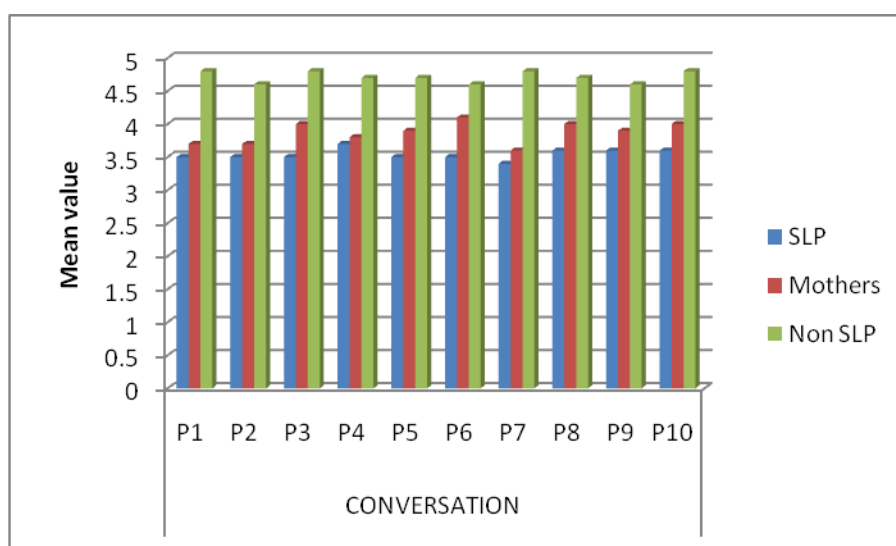


Figure 5: showing the rating of SLP mothers and NON SLPs for general conversation.

From the above table 5 and figure 5 it can be seen that the SLP rated the speech intelligibility better with mean of 35.40 whereas mothers rated second best with the mean of 38.70 followed by NON SLP rated the speech intelligibility very poorly with the mean of 47.10. It may be noted on a 5 point clinical judgment scale of speech intelligibility, which was converted to percentage for better calculation and the comparison between three groups for their rating for general conversation, shows highly significant difference. ($p = .000$)

Results in this section shows that there is a significant difference between the speech intelligibility rating between SLPs and Mothers. The SLP have rated better when compared with mothers the reason which attributed is that since the SLP are having more experienced in assessing hearing impaired speech. One more reason is that this could be due to the over expectations of the mother regarding the child's speech. The NON SLP have rated the speech intelligibility poorer compared to SLPs and mothers since the NON SLPs are not experienced with the disordered speech.

Speech Language Pathologist

SLP	N	Minimum	Maximum	Mean	Std. Deviation	Median	Mean (%)	Kruskal wallis test value	P value
Familiar words	10	11	19	12.90	2.283	12.00	25.80	45.361	.000 HS
Unfamiliar words	10	19	22	20.80	.919	21.00	41.60		
Non sense words	10	22	27	25.00	1.764	25.50	50.00		
Picture description	10	24	34	27.70	2.908	28.00	55.40		
Conversation	10	32	41	35.40	2.547	35.00	70.80		

Table 6: showing the mean standard deviation and significant value of different task among SLP

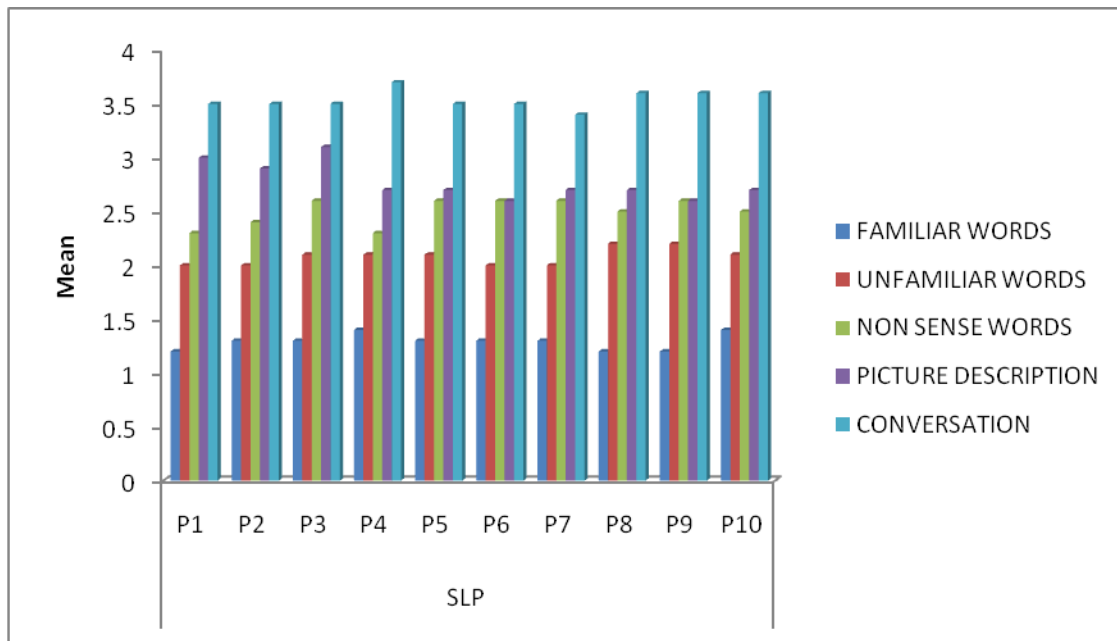


Figure 6: showing the rating of SLP for all tasks (Familiar words, unfamiliar words, nonsense words picture description and conversation)

From the above table 6 and figure 6 it can be seen that speech intelligibility rating for 5 different task (familiar words, unfamiliar words, nonsense words, picture description and general conversation), where SLP scores was better for familiar words and intelligibility scores observed to reduce for following hierarchy, unfamiliar words, nonsense words, picture description and general conversation. The speech intelligibility is better in familiar words for SLP with mean 12.90 and poorer in general conversation with a mean of 35.40. It is noted that on the 5 point clinical judgment scale of speech intelligibility, it converted to percentage for better calculation and the comparison of between 5 different task with SLP shows very high significant difference ($p = .000$)

Mothers

Mothers	N	Minimum	Maximum	Mean	Std. Deviation	Median	Mean (%)	Kruskal wallis test value	P value
Familiar words	10	21	30	25.00	2.582	25.00	50.00	39.733	.000 HS
Unfamiliar words	10	18	29	23.30	3.713	22.50	46.60		
Non sense words	10	24	32	28.60	2.319	28.50	57.20		
Picture description	10	34	43	38.80	2.781	38.50	77.60		
Conversation	10	35	43	38.70	2.111	39.00	77.40		

Table 7: showing the mean standard deviation and significant value of different task among Mothers

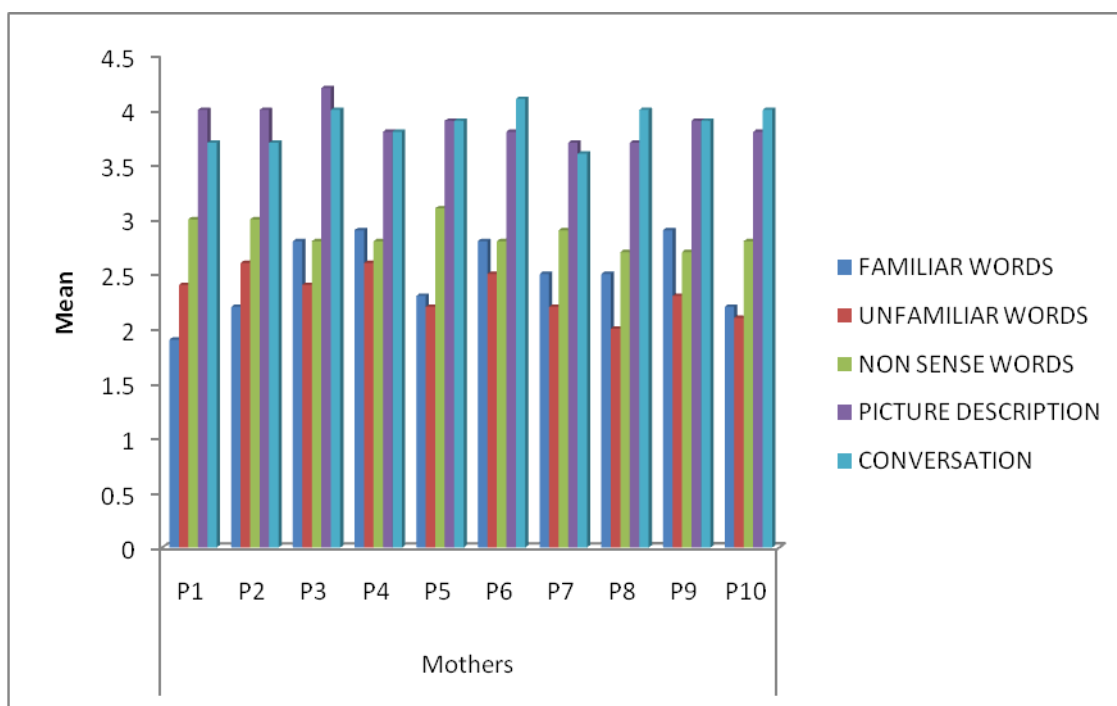


Figure 7: showing the rating of Mothers for all tasks

From the above table 7 and figure 7 that describes the rating of speech intelligibility rating between 5 different task with Mothers the scores of speech intelligibility was better for familiar words and intelligibility scores observed to reduce for following hierarchy, unfamiliar words, nonsense words, picture description and general conversation. The speech intelligibility is better in familiar words for mothers with mean 25.00 and poorer in general conversation with a mean of 38.70. It is noted that on the 5 point clinical judgment scale of speech intelligibility, it converted to percentage for better calculation higher the score poorer the rating of speech intelligibility and the comparison of between 5 different tasks with mothers shows very high significant difference.

Non-SLP

	N	Minimum	Maximum	Mean	Std. Deviation	Median	Mean (%)	Kruskal wallis test value	P value
Familiar words	10	24	42	31.40	6.022	30.50	62.8 0	42.582	.000 HS
Unfamiliar words	10	24	33	28.10	2.961	29.00	56.2 0		
Non sense words	10	36	40	37.90	1.729	37.50	75.8 0		
Picture description	10	42	44	42.60	.699	42.50	85.2 0		
Conversation	10	44	50	47.10	2.183	47.00	94.2 0		

Table 8: showing the mean standard deviation and significant value of different task among NON SLPs

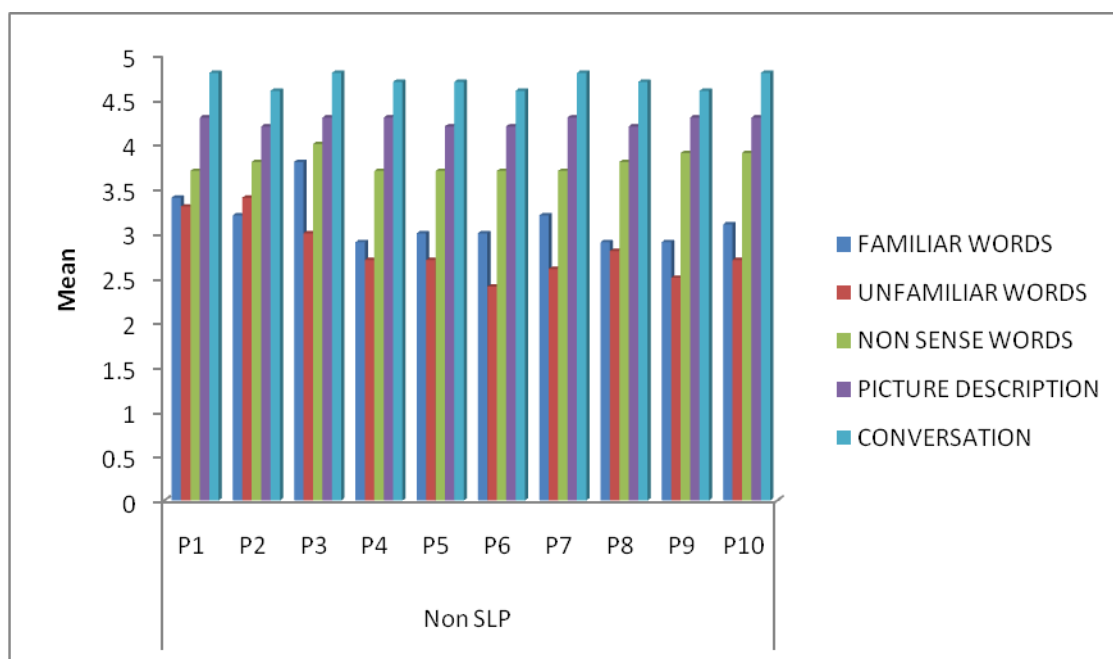


Figure 8: showing rating of NON SLPs for all tasks

From the above table and figure describes the rating of speech intelligibility rating between 5 different task (familiar words, unfamiliar words, nonsense words, picture description and general conversation) with NONSLPs the scores of speech intelligibility was better for familiar words and intelligibility scores observed to reduce for following hierarchy, unfamiliar words, nonsense words, picture description and general conversation. The speech intelligibility is better in familiar words for NONSLPs with mean 31.40 and poorer in general conversation with a mean of 47.10. It is noted that on the 5 point clinical judgment scale of speech intelligibility, it converted to percentage for better calculation and the comparison of between 5 different task with mothers shows high significant difference ($p=.000$)

Discussion

The five different tasks were rated by Speech Language Pathologist Non speech language pathologist and mothers using 5 point scale and the obtained data was statistically analyzed and result indicated that familiar words was rated better followed by unfamiliar words, nonsense words, picture description and general conversation and yielded significant difference. Speech language pathologist rated better followed by mothers and non speech language pathologist with high significant difference.

Speech language pathologist rated better because they are professionally trained and have vast knowledge about cochlear implantee speech. As mothers had high expectations speech intelligibility rating was poorer compared to that of Speech language pathologist. Non Speech language pathologist rated poor score as they were lacking knowledge of the field speech and hearing

The present study is in accordance with Shashikanth and Kumaraswamy(2009) who studied speech intelligibility in 23 cochlear implanted children showed that speech intelligibility is better for familiar words and poorer for conversation. And also speech was more intelligible for speech language pathologist when compared with mothers and Non SLP.

Summary and Conclusion

The present study aimed at evaluating the outcome after the cochlear implant surgery through rating the speech intelligibility by 3 different groups of listeners ie; SLP, NON SLP and mothers of the implanted children using 5 different task(familiar words, unfamiliar words, non sense words, picture description, and general conversation)

Ten cochlear implanted children who were implanted before the age of 3 years and having a device experience of more than 3 years were selected as subjects. All the subjects had a pre surgical hearing threshold above 90 dB and were attending auditory training.

The speech samples were recorded for 10 minutes which was divided into five different tasks in a sound treated room using PRAAT software (version 5.1.37) and were saved as WAV files: familiar words, Unfamiliar words, Nonsense words, Picture description, General conversation.

Three group of evaluators 5 SLP, 5 NON SLP, 5 Mothers of cochlear implanted child - rated the speech samples on a 5 point intelligibility rating scale. They were asked to rate separately for the five tasks. The data has been subjected to relevant for statistical analysis.

Result showed that familiar persons – mothers and Speech language pathologist rated speech intelligibility better when compared to NON SLPs. Familiar topics like repetition of familiar words were rated better when compared to all other tasks.

This indicates that general public, mostly unfamiliar listeners may not be finding the intelligibility of speech in cochlear implanted children easy to understand. We need larger studies in different cultural context to validate. The smaller number of subjects and the number of trials provided to listeners can be increased in future studies.

Limitation of the Study

- The number of participants for the study was less
- The material used was less

Future Directions

- Video recording of the responses of cochlear implant children can be used for better rating.
- The number of task can be increased
- The number of participants can be increased
- Duration of cochlear implant usage can be taken to consideration
- Different language of cochlear implant children can be used in the study

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