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Plural concept in children with cochlear implant

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Abstract
Language development does not follow pattern similar to their hearing peers in children with cochlear implants. The main objectives of the study were to assess comprehension, expression and generalization of plural concept in children with CI and its relation with various factors. 15 children using cochlear implants in the age range of 6-14 years participated in the present study. All of them were having severe to profound hearing loss and using cochlear implants since 2-6 years. Participants were first assessed and later training was given for 1 month for plural concept. Results revealed limited comprehension & expression of plural at the time of assessment. Post training there was a significant improvement seen in comprehension and expression of plural concept. There was a significant relation of age of implantation and home training to better outcome. Thus, this paper focuses on plural concept abilities in children with cochlear implant.

Keywords: plural concept, cochlear implant, post training assessment, home training

Introduction
Early cochlear implantation is important for age appropriate speech and language development. This can be helpful in early auditory stimulation a well as early cochlear implantation**.** Grammar is a very important language aspect that needs to be considered for overall language development of children with Cochlear Implant (CI). Plural concept deficits have been seen in children with cochlear implants compared to their age matched hearing peers. Study done by Nikolopoulos TP, Dyar D, Archbold S, O'Donoghue GM (2004) [1] showed that grammar development of children with CI improves over time; closer to age matched hearing peers. In particular, very few studies have been found for plural concept in the Indian context. Also, grammar deficits have been known to affect the overall language in children with CI. Due to language diversity in Indian context, plural concept studies are very limited. This greatly depends on the age of implantation, amount of therapy taken, Language exposure. The main objective of this paper was to study comprehension, expression and generalization of plural concept at different levels i.e. word level, phrase level and sentence level. Another aim was to study the pre versus post training effects of plural concepts in children with cochlear implants.

Materials and Methods
The data for the present study was collected from Shabda Brahma speech and hearing clinic, Cochlear Implant centre, Ahmedabad, Gujarat.

Participants
In this study, 15 children using cochlear implants aged 6 – 13 years participated in the study. All were prelingually hearing impaired and received cochlear implants before the age of 5.5 years. Majority of the children (80%) used bilateral hearing aids before implantation. None of the participants had intellectual impairments, mental retardation or any other additional disabilities. The inclusion criteria was prelingual onset of deafness, having bilateral severe to profound hearing loss. Implant usage of 2 to 6 years. Participants taken were those who regularly attended speech therapy at the centre (Shabda Brahma Clinic).

Test Materials
Data were obtained using the Linguistic Profile Test (LPT) administered on the participants. Linguistic Profile Test (LPT) used was in Gujarati language (developed & standardized by AYJNIHH).
This test had different subparts to it:
A. At word level- Comprehension, Expression
B. At phrase level- Comprehension, Expression
C. At sentence level- Comprehension, Expression

Further, story books were used for analysis of generalization of the concept. The tester first explained through an example to the participant before beginning to administer any particular subtest. During the training phase, the UWO (The University of Western Ontario Plurals Test version 1.4) was used for word level training and stories, picture description tasks were used for phrase level and sentence level training. After administration, a training period of 1 month was given. LPT was again administered in the post training phase. During training phase, the UWO Test (The University of Western Ontario Plurals Test version 1.4) was used for word level training and stories, picture description tasks were used for phrase level and sentence level training. Training was done at clinic as well as parents were counselled for effective home training. A score of +1 was given for correct response and a score of 0 was given for incorrect response. As per this, total scores for each child were calculated for comprehension and expression respectively. This was carried out in both pre as well as post

training phases. This further helped in the analysis and test result. Post 1 month training period, LPT was again administered on the subjects. Post training and pre training scores were compared & further analysis was done.

Data Analysis

We took mean scores, Wilcoxon sign rank test for pre versus post therapy performance analysis. Comparisons were done at phrase level as well as sentence level.

Results

Results of the present study are discussed under the following sections.

Performance in Pre training phase

When the plural concept was introduced, very few children (<10%) had the knowledge about this concept. On introduction to the concept, less than 30% children could comprehend and very few (<10%) children had expression of plurals at word level initially, followed by other levels.

Performance in post training phase

This phase was assessed one month after the training phase. During the training phase, parents and children were given training at all the different levels for plural concept at clinic. Along with that, appropriate material was provided for home training. A significant difference was noted in the performance post training in comprehension as well as expression. 80% improvement in comprehension and 90% improvement in expression was noted post training. Phrase level and sentence level performances were improved as context base made the task easier.

Comparison of pre vs post training phase

Significant improvement was noted in the scores post training as compared to pre training scores as shown in figure 1. Also, table 1 shows the pre vs post scores of all the subjects for comprension, expression, at phrase level and sentence level. Wilcoxon sign rank test was administered for analysis of the results. Results showed a significant difference in comprehension (Z= -3.4078, p value- 0.00064, p<.05) as well as expression (-3.4078, p value- 0.00064, p<.05). Generalization in sentences and stories was noted to be much better in post training phase, due to lack of knowledge of the concept this could not be assessed in the initial phase.

Comparison of comprehension vs Expression at different levels

Figure 2 shows generalization effects at phrase level as compared to sentence level in post training phase. Children performed better in comprehension as compared to expression; phrase level (20-100%) & sentence level (0-80%) in comprehension. This was monitored by activities at clinic, at home and school. Activities such as story telling/ re-telling, picture description were used for the same. In pre training phase, limited performance was noted only at word level.

Other Factors

Performance was affected by various factors such as age of implantation, pre implant therapy, home training, frequency of therapy, languages used, follow up. It was observed that children with early implantation, proper follow up, practice at home alongwith regular therapy showed better outcomes. Also, generalization activities in various settings such as school, outings, home improved their performance.

Discussion

Present study shows that very few children (<10%) had the knowledge about plural concept in the pre training phase, only 2-3 children had comprehension and expression for the same. In the post training analysis, a significant improvement was seen in the performance both comprehension as well as expression. 80% & 90% improvement was noted respectively in comprehension and expression (Figure 1). Similar results were found by Laaha S. Blineder M. & Gillis S. (2015) [2]. They studied noun plural production in preschoolers with early cochlear implantation and found better performance of children post training, age appropriate performance was noted 3 years after implantation. When studied at different levels, sentence level performance was noted best followed by phrase level & lastly word level performance (Figure 2). Similar results were found in a study by Boons *et al* (2013) [3]. The study showed that half of the cochlear implanted children achieved age appropriate language levels (Morphology, syntax, narrative skills). Thus, it affected their overall language skills.

Better performance in post training phase was observed in younger implantees perform than older implantees. In the present study, 5 early implanted children performed better than the other late implanted children. A study done by Tomblin *et al* (2005) [4].

Also showed better results in early implanted children. Children implanted between 10 and 40 months of age showed much better performance in the expressive language as compared to late implantees.

Tables and figures

Table 1: Table showing scores of all subjects

Sr. No.	Subjects	Pre training score (out of 3)		post training score (out of 3)		Generalization	
		Comprehension	Expression	Compr.	Expres	At phrase level	At sentence level
1	Subject 1	0	0	3	2	50	70
2	Subject 2	0	0	3	3	50	70
3	Subject 3	0	0	3	2	50	70
4	Subject 4	0	0	3	2	50	70
5	Subject 5	2	0	3	3	100	50
6	Subject 6	0	0	2	3	70	70
7	Subject 7	0	0	3	3	80	70
8	Subject 8	0	0	3	3	90	80
9	Subject 9	0	0	3	3	80	80
10	Subject 10	0	0	3	3	70	70

11	Subject 11	1	0	3	3	70	70
12	Subject 12	1	0	3	3	80	70
13	Subject 13	0	0	3	3	70	70
14	Subject 14	1	0	3	3	80	80
15	Subject 15	1	0	3	2	90	80

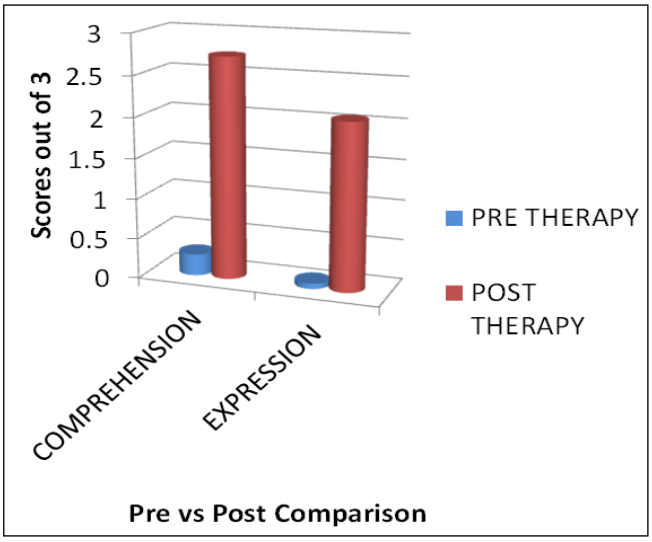
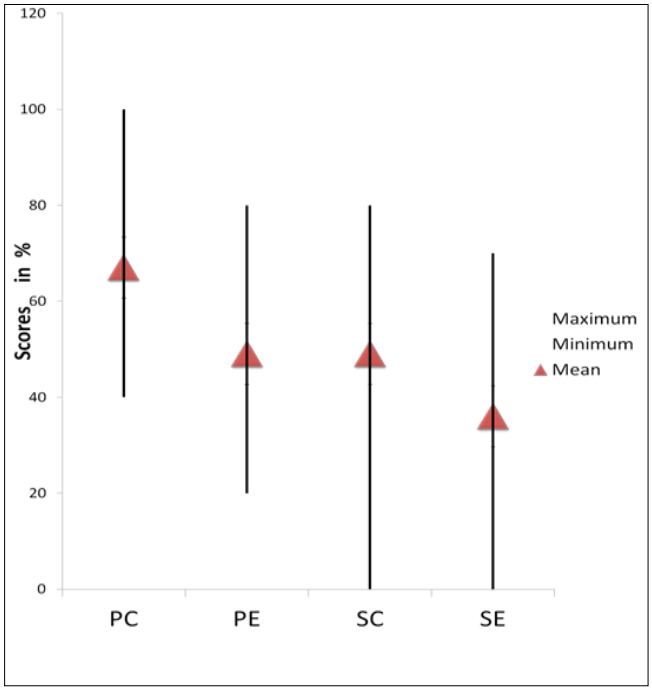


Fig 1: Mean Scores of pre vs post Therapy performance



Key:
PC: Phrase Level Comprehension,
PE: Phrase Level Expression,
SC: Sentence Level Comprehension,
SE: Sentence Level Expression

Fig 2: Generalization performance post therapy

Conclusion

The present study shows significant improvement in the plural concept of children with cochlear implant post training. Results also showed good generalization skills which could not be assessed in the initial phase. This has shown to improve overall language and better results observed in early implantation. Plural concept is important in the speech and language skills of a child. It helps in the overall receptive as well as expressive language. Plural concept should be a part of speech therapy sessions since the beginning. Typical and non-typical plurals both should be included.

Future Directions

In future, larger samples may be studied for other aspects. Plural concept studies should also be done in combination with other syntactical researches to have more evidence based researches. This will help clinicians and professionals in therapeutic as well a clinical work.

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