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Original Research Article

Syntactic abilities among Marathi speaking children with hearing impairment using cochlear implant

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ABSTRACT

Background: Syntax is an important aspect of language. It is very important to study syntax development in the children with hearing impairment (HI). The aim of study was to compare syntactic abilities of Marathi speaking children with hearing impairment using cochlear implant and typical developing children in the age range of 4 to 7 years.
Methods: Ninety typically developing children, 26 language age matched children using cochlear implants were included in this study. They were grouped into three age groups: 4-5, 5-6 and 6-7 years. Syntax test in Marathi which has six subtests in comprehension: wh-questions, negations/yes/no questions, post-positions, plurals, tenses, person, number, gender markers and five subtests in expression: negation/yes/no questions, post-positions, plurals, tenses, person, number, gender markers was administered through a laptop to children in each group.
Results: Results showed typically developing children performed significantly better than children with hearing impairment using cochlear implant I the age range of 4 to 5 years. Except postposition and PNG markers of comprehensive syntactic abilities all other syntactic abilities were significantly poor in children using cochlear implants. Only expressive syntactic abilities were significantly poor among children using cochlear implants in the age range of 6 to 7 years.
Conclusions: Overall, the findings of this study showed that that Syntax test in Marathi can identify impairment in the syntactic ability in Marathi speaking children with hearing impairment. Children with hearing impairment using cochlear implants showed poor syntactic abilities.

Keywords: Syntactic abilities, Syntax, Cochlear implantation, Hearing impairment

INTRODUCTION

Hearing is one of the most important senses for humans to be connected to their world. Speech and language development is highly dependent on hearing acuity for humans. The adequate listening abilities are very critical in the early years of child's life to acquire and to use appropriate speech and language skills. When children have hearing impairment, they have difficulties in hearing sound consistently, and the child's ability to learn language may be hindered. Children struggle to hear soft or quiet speech sounds and speech may be difficult to understand for them. They also exhibit problems in development of their vocabulary, they struggle to comprehend words with multiple meanings, proper use of tenses and sentence structure. Children with hearing impairment use short and simple sentences to communicate. The additional barriers can be poor academic performance, with problems in reading, writing and mathematics.

Census of India 2011, shows that 26,78,584 males and 23,94,330 females were found having hearing impairment while 11,22,987 males and 8,75,705 females having difficulty in speech. In India, 19% population has hearing disabilities. The number of disabled persons is highest in the age group 0-19 years (46.2 lakh) and about 20% are having hearing difficulties in this age group and 23% of the hearing disabled children are between 0-6 years.

Syntax is the form or structure of a sentence that is governed by rules. These rules specify the word order, sentence organization and the relationships between words, word classes and other sentence elements. Sentences are organized according to their overall function. The main elements, or constituent parts of a sentence are noun and verb phrases, each composed of various classes i.e., word types such as nouns, verbs, adjectives. Syntax specifies which word combinations are acceptable, or grammatical, and which are not. In addition to word order rules, syntax specifies which word classes appear in noun and verb phrases and the relationship of these two types of phrases. Hence syntax can be defined as the arrangement of words in a sentence. The term syntax is also used to mean the study of the syntactic properties of a language. Children do not instantly use correct syntax on acquiring speech. According to studies, the most active period for learning syntax is from 18 months to 4 years and there will be different levels of linguistic development in this period.[1] It was thought that the child master's syntax of his or her native language by about 5 years.[2] They acquire syntax in particular sequence pattern starting with simple one-word utterances. Succeeding stages take them to more complex sentence types.

Syntax is a component of grammar that governs ordering of words in sentences. Structures of syntax differ language to language. Various studies have been done in Indian context among typically developing children and children with various communication disorders. Various test material was developed to assess syntactic abilities of children in different Indian languages. Some of the formal language tests in the Indian context that help in evaluating syntax include Syntax test in Marathi, screening test for acquisition of syntax in Kannada, test for screening syntax in Hindi, Syntax screening test in Tamil, Malayalam language test, comprehensive language assessment tool for children.[3-7]

Very few tests used to study syntax in Marathi language are linguistic profile test in Marathi, Syntax test in Marathi.[1,8] Number comprehension-production, oblique form comprehension- production, tenses comprehension-production by Karbhari and Vasanta.[9] Therefore, limited tests are available to study syntax among children with hearing impairment in Marathi.

Recent advancement in hearing devices industry, early identification of hearing impairment, increased awareness about hearing impairment and its intervention, increased availability of aural rehabilitation are factors that seems to have impact on the syntax development. So, there is strong need to explore syntactic development in children with hearing impairment, so that it will help in planning and execution of language therapy.

Most of children with hearing impairment have language impairment. Syntax is an important aspect of language. It is very important to study syntax development in the children with hearing impairment (HI). Review of literature showed that there are studies available on syntactic development in the children with hearing impairment. Many studies are done in western countries. No recent studies available on syntactic development in Marathi speaking children with hearing impairment in early age.

Hence present study was designed to compare the syntactic abilities among Marathi speaking children with hearing impairment who using cochlear implantation (HI-CI) and typically developing children. The aim of this study was to compare the syntactic abilities in Marathi speaking children with HI-CI and language age matched typically developing children in the age range of 4 to 7 year.

METHODS

The present comparative study used Syntax test in Marathi to investigate syntactic abilities among Marathi speaking typically developing children and children with HI-CI.[1] Children participated in this study were selected from preschools and primary schools in Maharashtra, India.

Participants

A total of 116 participants were included in the present study. Group A included 90 Marathi speaking typically developing children and Group B included 26 children with HI-CI. Children in Group A were language age matched based on modified receptive expressive language test (M-RELT) with group B. Further, both groups included three sub-groups based on the combined language age. Group I, II and III included children with combined language age 4 to 5, 5 to 6 and 6 to 7 years respectively.

Participant's inclusion and exclusion criteria

All participants in Group A were Marathi speaking typically developing children within the language age ranging from 4 to 7 years. It was ensured that they passed the hearing screening at 25 dB HL for 4 frequencies (500 Hz, 1 kHz, 2 kHz and 4 kHz). The academic performance of all children in this group was average or above average. Children with history of neurological, psychological, emotional and attention deficits, any communication disorders, any known middle ear pathology were excluded in the study. Children in Group

B were Marathi speaking children with congenital severe to profound sensorineural hearing loss. Language age of all children were more than 4 years on M-RELT. All children have been using Cochlear implant at least from age of two years. Children with comorbid issues like neurological, psychological, emotional and attention deficits were excluded.

Material and equipment

A laptop (DELL, INSPIRON N5010) was used with syntax test in Marathi installed to elicit responses from the children. Otoscope and diagnostic audiometer were used for detailed audiological evaluation. Participant's information sheet, consent form, case history form for HI children (Developed at school of audiology and speech and language pathology) modified receptive expressive language test (M-RELT) used in present study.[10]

Procedure

Informed written consent was taken from the parents of the participants. REELS was administered on all the children. Hearing screening was done at 4 frequencies (500 Hz, 1 KHz, 2 KHz, 4 KHz). For children HI-CI detailed case history (developed at SASLP) was taken along with administration of M-RELT. Detailed audiological evaluation for children with HI was done. Syntax test in Marathi was administered through a laptop to each child individually in classroom which was quiet without noise and distraction.

Syntax test in Marathi included 2 section i.e., comprehension and expression. Comprehension section consist of 6 subtests while expression has 5 subtests and 5 test items in each subtest. Comprehension section consist of Wh-questions, negation/yes-no questions, post-positions, plurals, tenses, and person, number, gender (PNG). Expression section consist of negation/yes-no questions, post-positions, plurals, tenses, and person, number, gender (PNG).

Participants were made to sit comfortably on a chair in front of the investigator. To get the co-operation from child, rapport was developed by giving tangible reinforcements and verbal reinforcement. Child was asked to point to the picture as instructed by clinician in comprehension task whereas child was asked to name the picture shown by clinician using appropriate syntactic structures in expression task.

Responses were noted down by test administrator. Further analysis was done using three-point rating scale. The responses were scored based on 3-point scoring scale. (2-was given for syntactically complete sentence or structure. 1-was given when inaccurate responses were received from child at task or any vague response. 0-was given for no response). Further each subtest wise scoring calculated and tabulated for further analysis. Statistical analysis was done using SPSS software version 20.

RESULTS

Present study was designed to compare syntactic abilities between Marathi speaking children and children with HI-CI in the age range of 4-7 years. Descriptive analysis was done for typically developing children and children with HI-CI (Table 1). It shows that mean scores in all subtests improved with increasing age from 4 to 5 years to 6 to 7 years. This indicate that older children performed better on all the subtests than younger children. Normality test was done using Shapiro Wilk's test. Results of Shapiro Wilk's test showed that data was not homogeneous and hence non-parametric tests were used for analysis.

Comparison of syntactic abilities (comprehension and expression) were done between language age matched typically developing children and children with HI-CI using Mann-Whitney U test (Table 2). Result showed that there is significant difference in scores of syntactic abilities (comprehension and expression) among children with and without hearing impairment in the age range of 4 to 5 years. Children in the age range of 5 to 6 years, no significant difference observed for the scores of postposition and PNG subtest of comprehension among typically developing children and children with HI-CI. Whereas all other subtests showed significant difference among both groups. When children in the age range of 6 to 7 years were compared, no significant difference observed for the all subtests of comprehension but there was significant difference observed for all the subtests of expression task.

DISCUSSION

In present study better performance on syntactical abilities was observed in older children than younger children in both groups. This indicates the developmental pattern in syntactical abilities. All children showed better performance for comprehension task when compared with expression task. Similar trend observed by various studies done different languages for syntactic abilities.[1,4-7]

Children with HI-CI in the age range of 4 to 5 years showed poor performance on all syntactic ability tasks. Children with HI-CI in the age range of 5 to 6 years performed similar to their language age matched children on postposition and PNG subtest of comprehension. This indicates that comprehension of postposition and PNG markers are developed earlier than other syntactic abilities in children with HI-CI. No significant difference among children with HI-CI and language matched typically developing in the age range of 6 to 7 years for all the comprehension task of the syntactic abilities. Children with HI-CI performed poorly on all the expressive syntactic abilities task. This indicate that children at the language age of 7 years develops the compressive syntactic abilities but continues to show the impairment in the expressive syntactic abilities.

Table 1: Performance of Marathi speaking typically developing children (TD) and children with hearing impairment using cochlear implant (HI-CI) on syntax test in Marathi.

Subtests		4-5 years				5-6 years				6-7 years			
		TD		HI-CI		TD		HI-CI		TD		HI-CI	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Comprehension	Wh-question	9.90	0.30	6.66	1.87	10.00	0.00	7.88	1.83	10.00	0.00	9.37	0.91
	Negation	10.00	0.00	8.00	1.58	10.00	0.00	9.22	1.30	10.00	0.00	9.87	0.35
	Post-position	10.00	0.00	8.44	1.01	10.00	0.00	9.33	1.11	10.00	0.00	9.62	0.51
	Plurals	10.00	0.00	8.44	1.42	10.00	0.00	9.11	0.78	10.00	0.00	9.62	0.51
	Tense	10.00	0.00	9.33	1.00	10.00	0.00	9.33	0.70	10.00	0.00	9.87	0.35
	PNG	10.00	0.00	9.00	1.32	10.00	0.00	9.55	0.72	10.00	0.00	10.00	0.00
Expression	Negation	9.97	0.18	8.33	1.93	10.00	0.00	8.77	1.64	10.00	0.00	9.25	0.88
	Post-position	9.70	0.53	5.33	1.50	9.86	0.34	6.77	1.71	10.00	0.00	8.12	1.35
	Plurals	9.97	0.18	6.44	1.87	9.96	0.18	8.00	1.80	10.00	0.00	8.12	0.99
	Tense	10.00	0.00	7.11	2.02	9.96	0.18	7.55	1.87	10.00	0.00	9.00	0.92
	PNG	9.90	0.30	5.44	1.66	9.96	0.18	6.77	1.30	10.00	0.00	8.50	1.06

Table 2: Results of Mann-Whitney U test.

Subtests		4-5 years			5-6 years			6-7 years		
		U	Z	P	U	Z	P	U	Z	P
Comprehension	Wh-question	1.50	5.45	<0.001	15.00	5.67	<0.001	75.00	3.44	0.11
	Negation	30.00	5.23	<0.001	75.00	3.80	<0.001	105.00	1.93	0.61
	Post-position	15.00	5.67	<0.001	90.00	3.24	0.14	75.00	3.44	0.11
	Plurals	45.00	4.78	<0.001	45.00	4.78	<0.001	75.00	3.44	0.11
	Tense	75.00	3.80	<0.001	60.00	4.30	<0.001	105.00	1.93	0.61
	PNG	60.00	4.30	<0.001	90.00	3.24	0.14	120.00	0.00	1.00
Expression	Negation	62.50	3.84	<0.001	60.00	4.30	<0.001	60.00	4.03	<0.001
	Post-position	0.50	4.96	<0.001	4.00	5.21	<0.001	15.00	5.56	<0.001
	Plurals	0.50	5.84	<0.001	31.50	4.89	<0.001	0.00	6.03	<0.001
	Tense	15.00	5.67	<0.001	31.50	4.89	<0.001	30.00	5.09	<0.001
	PNG	0.00	5.50	<0.001	0.50	5.84	<0.001	15.00	5.56	<0.001

Pattern of performance of children with hearing impairment on different subsection of syntax test in Marathi were explored using the cut off scores obtained from the study done by Jadhav.[11] Number of children with hearing impairment using cochlear implant failed on different subtests of syntax test in Marathi were calculated based on 2 SD of the mean score as a cut-off criterion. In the age range of 4-5 years, wh-question, negation task of comprehensive syntactic abilities and all expressive syntactic abilities showed most affected syntactic ability (More than 75% children showed difficulty). Comprehension of post-position, plurals, tenses and PNG markers were less affected (less than 60% children showed difficulty). In the age range of 5 to 6 years, all expressive syntactic abilities and comprehension of wh-question were the most affected syntactic abilities. Whereas comprehension of negation, post-position, PNG markers were less affected syntactic abilities (less than 45% children failed) In the age range of 6 to 7 years, expression of plurals and tenses were most affected task (more than 75% children failed), whereas all comprehensive syntactic abilities were less affected (less than 40% children failed). Comprehension of PNG markers all children in this age range could pass the test. This indicates that, comprehensive syntactic abilities develop prior to the expressive syntactic abilities. Comprehension of post-position, plurals, tenses and PNG markers develops prior to the other comprehensive syntactic abilities in children with HI-CI. Expression of negation, post-position, PNG markers develops prior to the other expressive syntactic abilities. Present study showed poor syntactic abilities among children with hearing impairment using cochlear implantation. Further studies needed to explore the impact of implantation age on the syntactic abilities.

CONCLUSION

Present study concludes that Syntax test in Marathi can identify impairment in the syntactic ability in Marathi speaking children with hearing impairment. Children with HI-CI showed poor syntactic abilities when compared with language age matched children. They showed a pattern of development of the syntactic abilities. Comprehensive syntactic abilities develop prior to the expressive syntactic abilities among children with HI-CI. Post-positions and PNG markers are developed prior to the other syntactic abilities.

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