

Perception Development of Complex Syntactic Construction in Children with Hearing Impairment

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Objectives: Auditory perception or hearing ability is critical for children in acquisition of language and speech; hence hearing loss has different effects on individuals' linguistic perception, and also on their functions. It seems that deaf people suffer from language and speech impairments such as in perception of complex linguistic constructions. This research was aimed to study the perception of complex syntactic constructions in children with hearing-impairment.

Methods: The study design was case-control. According to the inclusion and exclusion criteria, twenty children with severe to profound hearing impairment, aged 8-12 years and twenty normal-hearing children, aged 6-7 years were selected in a simple random sampling from exceptional schools for deaf people and from normal kindergartens and schools for normal cases. The perception of sentences was tested by using a researcher-made task called sentence-picture matching task. At first the content validity was determined and then the reliability was confirmed with Cronbach Alpha Test. Data were analyzed by statistical tests such as Independent Samples T-Test and Mann-Whitney U Test using SPSS.

Results: Perception of the group with hearing-impairment was significantly lower than the normal control group. The hearing-impaired children failed to perceive complex syntactic structures. Linguistic function of the group with hearing-impairment on perception of sentences with simple word order was better than on complex sentences.

Discussion: If rich linguistic inputs are not available for children during the critical period of the first language acquisition, the syntactic skill, especially in complex syntactic constructions, will not normally develop. In order to establish a foundation for a healthy perfect development of syntax, at the early years of life, children should be exposed to a natural language.

Keywords: hearing impairment, normal hearing, complex syntactic constructions, perception, development

Submitted: 10 Sep. 2014

Accepted: 22 Oct. 2014

Introduction

Hearing impairment in children is considered as an important public health problem. Auditory function in these children is poor and it depends on their hearing aids efficacy and also their ears status (1). Lower scores of hearing impaired children in syntax tests represent the deficiencies in production and perception of many syntactic aspects (2). It seems that differences in syntactic production and perception between hearing-impaired children and people with normal hearing can be classified based on the degree (instead of the type), because older children show less problems in the production and comprehension of simple syntactic constructions. It seems that the

deviations in perception and production of sentences result from insufficient language inputs in an appropriate development age. Hearing-impaired children use innate linguistic capability for rule production to hear things. Therefore, they create functional but deviation strategies, for which provide the possibility of the production and perception of complex syntactic constructions. In face to face communication, they can choose their own strategies; and basic and effective language exchanges can occur (3). When hearing-impaired children are asked to understand complex syntactic structures, a lot of them will have problems with the construction of auxiliary verbs and passive sentences (4).

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Syntactic disorders among hearing-impaired children trained orally, have been reported over the last forty years. The implemented studies showed that the syntactic abilities of hearing-impaired children are different from that of normal-hearing children (5,6). In the field of the syntactic perception of object relative clauses, the performance of hearing-impaired children has been significantly reported to be lower than that of normal-hearing children (7-9). Davis and Blasdel examined the problem of hearing-impaired children on more complex constructions. They encountered children with perception task of sentences containing embedded relative clauses in the middle position. The analysis of their responses showed that the children chose a strategy of processing that focused on the final part of sentence. So when the children were shown four pictures and they were asked to refer any of these images which indicate the sentence: "The sheep that chased the man ate the grass", they often selected the picture in which a man was eating grass, despite the selected picture was meaningless and was not understandable. This implies that the children's strategy in processing such a sentence was to interpret sentences containing all the embedded clauses in a middle position in terms of sequence of subject, verb and object. In this special study, hearing-impaired children almost, in 50% of cases, did not well understand the tense of complex sentences. Other syntactic structures in which hearing-impaired children had problems on their perception included: constructions of relativization, complementation, verb conjugation and pronominalization (10). Levitt, McGarr, and Geffner tested the syntactic abilities on a large number of hearing-impaired children. The results revealed a wide range of performance among children. This range included hearing-impaired children in normal and common conditions to hearing-impaired children in specific situations. One of the remarkable observations of this study was that the children who received early special education, had better language performance than children who had lacked such training (11).

Friedmann and Szterman investigated perception of subject relative clauses and object relative clauses in hearing impaired Hebrew-speaking children with age range of 7.7 to 3.11 years studied. They found that the function of all children with hearing impairment was significantly poorer than peers with normal development. Despite their performances in the subject relative

clauses were completely intact; however, their performances on the object relative clauses were significantly weaker. Friedmann and Szterman related the problem of hearing impaired children to several steps needed to interpret long-distance dependencies; establishing a trace after movement, assigning a thematic role to the trace, and forming a chain between trace and the moved constituent. They found that Children who had received auditory rehabilitation before the age of 8 months (using a hearing aid or cochlear implants) had better performance than other children (9). Adani studied the 3 right branch restrictive relative clauses (RCs) - the OS, OO with preverbal subject and postverbal subject. He studied 116 Italian-speaking children aged from 3 to 5 years old. The most important findings of his research were that perception of the subject relative clauses was more accurate than the object relative clauses. Object relatives with preverbal subject had higher accuracy than ones with postverbal subject. Although the three-year-old children were not consistent developmentally, they were able to understand relative clauses. Errors analysis revealed that children, with this interpretation where arguments were reversed, especially about the object relatives, responded in most cases to the perception test. Adani, due to temporary overload calculations of the underdeveloped system of language that affect the perception of object relative clauses in three years old, proposed an explanation for his findings according to the intervention effect (12-15).

Volpato and Adani examined the perception of subject and object relative clauses between hearing-impaired (HI) children using a cochlear implant and hearing children, by using an agent selection task. They showed that performance of HI children was significantly poorer than their typically-developing peers. Although they performed low results, however the HI children's gradient of difficulty was typical; subject relatives (OS) were easier to comprehend than object relatives with preverbal subject (OO), and these latter were easier than object relatives with postverbal subject (OOp). Volpato and Adani explained the asymmetries in terms of some minimalist approaches on locality theory and on the fragility of Agreement occurring with postverbal subjects (16). TAM Kit Ying studied acquisition of Cantonese relative clauses by deaf and hard of hearing (D/HH) children in Hong Kong. He concentrated on the production and

perception of relative clauses by 54 mainstream and 15 sign bilingual D/HH students (aged 8-12). The results showed difficulties in producing and comprehending of this syntactic construction by D/HH subjects, and they tended to produce a simple declarative sentence where no movement occurs. He believed that the incomplete or absence acquisition in the syntactic movement in relative clauses structure had caused the unsatisfactory results of the subjects with a significant level of delay (17).

Perception of complex syntactic constructions is an important linguistic ability. The present study is aimed to clarify whether lack of enough exposure to a natural language in critical ages makes difficult the ability of perception of non-canonical sentences such as relative clauses in hearing-impaired children.

Methods

The study design was case-control. According to the inclusion and exclusion criteria, twenty children with severe to profound hearing impairment, aged 8-12 years and twenty normal-hearing children, aged 6-7 years were selected in a simple random sampling from exceptional schools for deaf people and from normal kindergartens and schools for normal cases. Subjects in both groups spoke Persian language. Considering delays of hearing-impaired children in various aspects of acquiring speech and language, the control group was almost 3.5 years younger than those children. The mean age of hearing-impaired students was 10.5 years. 65% of the hearing-impaired students were boys, and 35% were girls. The children didn't have any confirmed diseases or neurological disorders, except hearing loss in students with hearing impairment. The children's aural records and also the confirmation of the audiologist in the exceptional schools for hearing-impaired people were considered to determine the type and degree of hearing loss. Type of hearing loss among all hearing-impaired children was sensorineural. This type of hearing impairments is not curable, and in the best situations, the most appropriate method is using hearing aids and aural habilitation (18). All these children suffered hearing loss in both ears. Neither of these children had received cochlear implant. Among 20 children in the control group,

10 were male, and 10 were female. Their mean age was 6.5 years; 50 percent were studying in pre-school level and 50 percent were in the first grade of primary school.

Children participated voluntarily in this study; and they were told that they can stop the implementation whenever they want. There was no time limit on any of the tests; and the tester repeated several times each sentence, as the subject wanted. Perception of complex constructions was tested by using a researcher-made task called sentence-picture matching task. The subject heard a sentence that was read by the native Persian-speaking tester. Then, he/she saw two pictures on one page. The subject was asked to refer to the picture that accurately describes the sentence. The content validity and the reliability of the task were confirmed (19). Types of syntactic constructions of sentence-picture matching task are classified in terms of word order in two general groups:

- 1- Sentences with canonical word order
- 2- Sentences with complex and noncanonical word order.

Data were analyzed using independent T and Mann-Whitney U tests and the software SPSS. To determine the difference between deaf and normal-hearing children in understanding the complex syntactic constructions, Mann-Whitney U Test was used for those series of scores that were not normally distributed; and Independent T-Test was used for those scores that had normal distribution.

Results

Based on results obtained from the test of perceiving the sentence-picture matching, the highest scores obtained from hearing-impaired students belonged to sentences with canonical word order (active construction, dative construction, object-subject relative construction, It-clefts modifying subject in complement clause, scrambled dative construction), and the lowest scores obtained belonged to sentences with noncanonical word order (subject-object relative construction, It-clefts modifying object in complement clause, scrambled active construction). Tables (1) indicate the difference of the perception scores between hearing-impaired children and normal hearing children by Mann-Whitney U test these results.

Table 1. The difference of perception scores between hearing-impaired and normal hearing children

index	group	number	mean rank	standard deviation	value of statistic	p value
active construction	deaf	20	19.5	0.91	-1.4	0.150
	Normal hearing	20	21.5	0		
scrambled dative construction	deaf	20	15.4	1.92	-3.03	0.002
	Normal hearing	20	25.6	0.57		
dative construction	deaf	20	18.5	1.31	-2.07	0.030
	Normal hearing	20	22.5	0		
object-subject relative construction	deaf	20	17.45	1.03	-2.17	0.029
	Normal hearing	20	23.55	0.489		
It-clefts modifying Subject	deaf	20	17	2.07	-2.86	0.004
	Normal hearing	20	24	0		

Tables (2) determines the difference between the scores of perception among hearing-impaired

children and normal hearing children by Independent T Test.

Table 2. The scores of perception among hearing-impaired and normal hearing children

index	group	number	mean rank	standard deviation	t value	p value
scrambled active construction	deaf	20	3.25	3.6	-4.24	0.001<
	normal hearing	20	7.15	2.0		
subject-object relative construction	deaf	20	4.1	3.2	-5.17	0.001<
	normal hearing	20	8.3	1.7		
It-clefts modifying Object	deaf	20	4.45	3.7	-4.41	0.001<
	normal hearing	20	8.4	1.6		

Figure (1) shows the comparison of normal and hearing impaired children in eight complex

syntactic constructions of Sentence-Picture Matching Test.

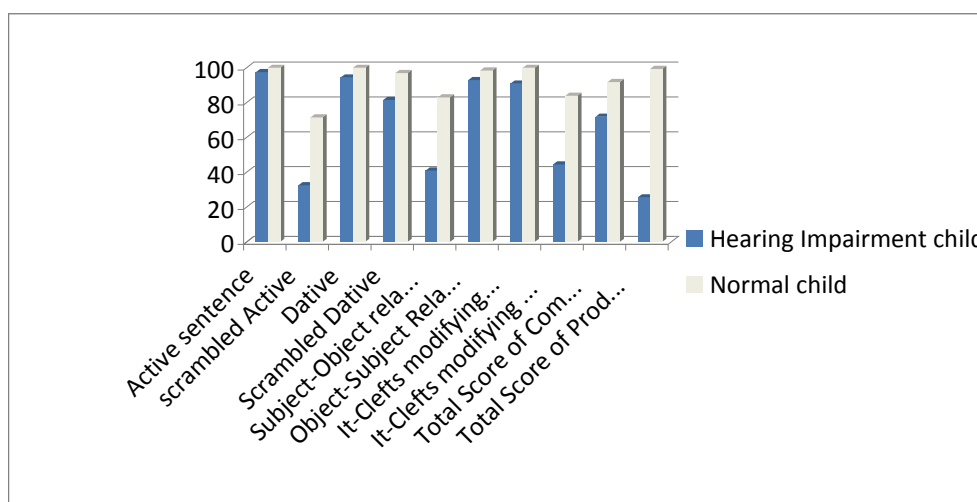


Fig 1. Comparison of normal and hearing impaired children in eight complex syntactic constructions

Discussion

Learning the relative clauses construction had a significant delay in language development of hearing-impaired children. These children, in many cases, had not gained proficiency in these constructions even in older ages. This study made clear the impact of hearing impairment on perception of relative clauses construction. In this

study, hearing-impaired children demonstrated extremely poor ability to comprehend relative clauses construction. This impairment effects were particularly evident in the incomplete perception of subject-object relative clauses and It-clefts modifying object. The results of this research correspond with the findings of Adani (14,15), Volpato and Adani (16), Friedmann and Szterman

(9) and Tam Kit Ying (17). As it was mentioned, compared to normal students, hearing-impaired students had difficulty in perception of the relative constructions in which canonical word order of the sentences is disrupted and the sentences will have complex structures. This finding indicates that hearing impairment and lack of adequate exposure to a natural auditory language in the critical ages of language acquisition has a direct impact on the ability of Persian-speaking hearing-impaired children (between 8-12 years) to comprehend relative clause constructions; and the children's perception of these constructions decreases.

The performance of the subjects with hearing impairment was different in understanding the types of relative clauses construction. They understood the object-subject relatives much better than the subject-object relatives. As the word order in Persian language follows the Subject + Object + Verb pattern; in relative constructions, the main clause of the object-subject relative has the canonical word order and the complementiser [ke] comes after the NP object; then relative clauses that are embedded sentences are modifying the NP object. But in the subject-object relative, the main clause does not have the canonical word order and the complementiser [ke] comes after the NP subject; then relative clauses are modifying the NP subject. What is important is following up the origin and source of this difference. Normal children have tendency to comprehend and produce the (English) relative clauses with Subject+Verb+Object pattern (20-22). According to the NVN-Schema hypothesis, subject relative clauses in general have the word order of NVN that is a canonical word order (SVO) in (English) sentences. As children acquire early canonical word order structures, in process of language acquisition, subject relative clauses will be acquired relatively earlier than object relative clauses (17,23). Some researchers believe that hearing-impaired children impose NVN schema on the (English) sentences; and use of this strategy leads to wrong interpretation of some sentences (9,24,25). Based on this approach, people with hearing impairment prefer linear processing of the sentences to their hierarchical processing. In

addition, it is expected that imposing a SVO structure on OSV relative clauses will lead to a reversed and inverted interpretation.

As the research subjects have not heard and acquired any relative clause construction, and they have not received such stimuli. Therefore, the lack of suitable linguistic inputs in hearing impaired children conduces to the absence of linguistic competence of such constructions that imply syntactic movement or wh-movement (17,26). Children with impaired hearing have more difficulties in perceiving and acquiring many important grammatical markers that depend on the identification of high frequency and unstressed speech sounds (2). As Mc Gurk and Mac Donald (1976) showed that audition and sight contribute to the perception of speech (27), It seems that children with hearing impairment failed in perceiving the sounds whose production manner are invisible. In the early months of life, children have to meet a natural language to create the bases for development of syntax. If linguistic inputs are not adequate and available during the critical ages for acquisition of the first language, the syntactic competence will not develop normally. In other words the flexible auditory system of infants can develop naturally by receiving different stimulations (28).

Conclusion

Incorrect answers of the children with hearing impairment to the perception task denote the immature understanding of relative clause structures by these students and the significant difference between two groups indicates that deaf children need the special training for learning such constructions.

Acknowledgment

Author and her colleagues in this paper express their appreciation and thanks to the respected authorities in Tehran Education Organization, Tehran Exceptional Education Department, managers, teachers, therapists, and speech audiometer colleagues as well as students participating in this study and their families for their cooperation.

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