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RESEARCH ARTICLE

The effect of Cued Speech on story retelling in late implanted prelingual hearing impaired students

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Abstract

Background and Aim: Cued Speech makes speech perception easier and improves both lip-reading ability and residual hearing usage. The purpose of the present study was to assess the effectiveness of using Cued Speech on story retelling as a rehabilitation tool for late cochlear implanted, prelingual, hearing-impaired students.

Methods: This was an experimental study with a pre- and post-test plan. Nine prelingually hearing impaired students were selected from Loghman Cochlear Implant Center. All were late cochlear implanted and were aged between 11 and 16 years and 9 months. The study tool involved a storytelling test. The Persian Cued Speech training program was conducted for eight weeks in sixteen 60 minute sessions. In this study we used a Z-test and t-test for analysis of dependent variable.

Results: After the Persian Cued Speech intervention all the narrative's macrostructural (topic maintenance, event sequencing, main information, ($p<0.01$) and microstructural (referencing, $p<0.05$ and mean length of utterances, ($p<0.01$) items were significantly improved. There were no significant differences in two microstructural items (conjunction cohesion, syntax complexity).

Conclusion: The study shows that using Cued Speech for the late cochlear implanted, prelingual, hearing impaired students can improve story retelling abilities and can be used in rehabilitation programs for these groups.

Keywords: Cued speech; story retelling; hearing impaired; cochlear implant; late implanted

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Introduction

Cochlear implant candidacy has greatly grown in recent years due to technological advances in cochlear implant and now also involves older children with prelingual hearing impairment [1]. According to Klop et al., speech perception is weaker in late cochlear implanted individuals than in prelingual hearing impaired children with early cochlear implants [2]. Nevertheless, results of some studies show that, after the implant, speech perception might progress in this group of late implanted individuals compared to before [2]. Schramm et al. suggest that at least some prelingual, late implanted,

hearing impaired individuals are able to achieve a significant amount of open-set speech perception after cochlear implant [1]. But it seems that if this group of individuals are to learn useful skills, their training programs should become more focused on educational guidelines [3]. Of the methods that can make speech perceptible for the hearing impaired, Cued Speech is the most significant and effective one, which was invented by Cornett in 1967 and was translated into Persian in 2009 by Movallali. Cued Speech is an oral method that has a multi-sensory nature that allows the hearing impaired to use both visual and auditory information. This method is a simple phonemic-based system that includes the use of lip patterns in natural speech and a series of complementary handshapes. Together, these two components develop unambiguous, clear visual symbols for oral language perception. Complementary handshapes in Cued Speech are a simultaneous combination of hand location, shape and motion that do not contain any linguistic meaning in and by themselves and are only used to eliminate lip reading ambiguities and make speech completely perceptible [4]. Cued Speech simplifies the perception of speech and improves the ability to use the residual hearing in hearing impaired children. Cued Speech increases the ability to communicate, perceive and recognize speech from childhood years and improves speech and the ability to benefit from the cochlear implant [5]. According to a study conducted by Caposecco et al., more than 90% of participants reported that the ability to perceive speech with visual cues was much better with the implant [6]. In a study conducted by Kos et al., the degree to which Cued Speech users benefited from cochlear implant was far greater than did sign language users. Although all subjects had similar hearing thresholds before and after the surgery, those who used Cued Speech before the surgery obtained higher scores than those who used sign language [7]. In another study, Hernades et al. showed that, of the various techniques of communication existing, Cued Speech is among the best for acquiring Spanish prepositions [8].

A method for the quick scanning of language structure is story retelling, which is faster than other methods in implementation and analysis and has a reliable scoring system [9]. The present study therefore uses story retelling to evaluate the effects of Cued Speech on cochlear implanted students' speech and language.

Storytelling is composed of a macro and a micro structure. The macro structure deals with general features of the story consisting of three fundamental components topic maintenance, main information and event sequencing. The micro structure involves more detailed features of the story such as referencing, mean length of utterance (MLU) and conjunctive cohesion. The use of prepositions, conjunctions, adverbs, complex noun phrases, verbs and proper nouns with reference pronouns indicate a more complex language style that is a major aspect of the micro structure of stories and can be a good indicator of a story's efficiency [10].

Hearing impaired children have many defects and deficiencies for story retelling, and prelingual, late implanted, hearing impaired children scored weaker in speech perception than early implanted hearing impaired children [2]. Although Cued Speech is an effective teaching-treatment method for hearing impaired children, there are only a limited number of studies on its effectiveness in the Persian language and in rehabilitation programs for hearing impaired children [5-11]. In addition, the study of language development in hearing impaired children is mainly focused on the development of early language skills and the effect of cochlear implant on complex cases is less known; yet, ecologically, story retelling creates a valid way for assessing the effects of cochlear implant on complex linguistic context [12]. The purpose of the present study was to evaluate the effect of Cued Speech on story retelling in prelingual, late implanted, hearing impaired children.

Methods

The present study was an interventional-experimental study with a pre- and posttest

design. The study population consisted of hearing impaired children who had received cochlear implants and were admitted to Loghman Hospital of Tehran in 2012 and had experienced no positive results. Sampling was conducted through the convenience sampling method. Nine hearing impaired children who had received cochlear implants and had been admitted to Loghman Hospital for receiving rehabilitation services, speech therapy, auditory training and cochlear implant adjustments were selected. The study inclusion criteria consisted of being between 11 to 16 years of age, having severe to profound sensorineural hearing loss, having prelingual hearing loss (congenital or acquired prelingual hearing impairment), using the cochlear implant hearing aid and having received a minimum of six months and a maximum of one year of rehabilitation services after the implant and still not experiencing desired results. Exclusion criteria consisted of having any other disorder in addition to hearing impairment (such as intellectual disability or cerebral palsy), being an under school age child with early cochlear implant before received before age 3 and experiencing hearing loss after having learnt the language.

The present study used two instruments for data collection, including (a) demographic characteristics questionnaire: the study used the demographic characteristics questionnaire to investigate and collect information on the demographic characteristics of the subjects, including questions on age, number and gender; and (b) story retelling test: this test was developed by Jafari et al. in 2009 and has two stories -an experimental story and a main story for retelling. The main story is analyzed only for the intended purposes and the first story is merely designed for familiarizing the subjects. Two tests, namely the narrative assessment protocol (NAP) and the Bus Story Test (BST), were used for developing this test, which includes two main parts of its own - a macro and a micro structure. The macro structure evaluates language features including topic maintenance, main information and event sequencing in the form of test variables. The macro structure has a total of 33 scores; the topic maintenance subtest contains five topics (5 scores), the main information subtest relays 18 pieces of important information to the listener (18 scores) and event sequencing includes 10 events with both logical and time sequencing between them (10 scores). The micro structure has elements that evaluate more detailed features and includes the subtests of conjunctions, referencing, syntax complexity and length of utterance. The conjunctions subtest includes eight conjunctions and scores are given based on the number of conjunctions retold (8 scores). The referencing subtest includes ten references and scores are given based on the number of references retold (10 scores). The syntax complexity subtest includes ten complex sentences and scores are given based on the number of complex sentences retold (10 scores). Length of utterance subtest is scored based on the number of morphemes used in sentences (15 scores). This part has a total of 43 scores and the total test score is 76 [9]. According to previous studies, the content and face validity of the story retelling test was 89% and 100% and its test-retest reliability was 83%. The internal consistency reliability of the test had a mean Cronbach's alpha of 77.6% [13].

For data collection, the researchers selected 9 children who met the inclusion criteria from the children under training and used a live story retelling test to evaluate their speech/language skills. The study implementation consisted of 3 stages; 1. the pre-test story retelling, 2. the speech and language training intervention using Cued Speech and 3. the post-test story retelling.

In the first stage, the narrative speech test (story retelling) was conducted for each child individually in a suitable environment on a CD. At first, the examiner told the children a story with pictures and then, in the next stage, asked them to retell it. All retold versions were recorded and written verbatim. In the next stage, the parents and children under study participated in an introductory training session about Cued Speech which was held by Movallali, who has translated Cued Speech into Persian language in 2009. During the session

Table 1. Comparing the mean and standard deviation of scores obtained for components of story retelling in prelingual, late implanted, hearing impaired students admitted to Loghman Hospital of Tehran

	Mean (SD) of scores			
	pretest	post test	p	test criteria
topic maintenance	2.11(0.60)	3.66 (1)	0.01	-4.13
explicitness	5.78 (2.77)	11 (3.12)	0.01	-9.13
event sequencing	3.67(1.12)	6.44 (2.35)	0.01	-3.75
referencing	0.56 (0.72)	1.78 (1.30)	0.03	-2.75
conjunction cohesion	0.66 (0.86)	0.67 (0.71)	1	0
syntax complexity	0 (0)	0.22 (0.44)	0.17	-1.51
mean length of utterance	19.22 (5.83)	27.33 (3.74)	0.01	-6.02

held, the parents received full training on the Cued Speech and then were given answers for the questions they had about the effectiveness of this method in speech and language development. The educational intervention stage was performed in 2 one-hour training sessions per week for a period of 5 months. During these sessions, speech and language practices, including storytelling and story retelling in each session, were presented by the therapist through Cued Speech and the children and the parents were asked to practice the course material using Cued Speech both during the sessions and at home.

In the post-test stage, two months after the educational intervention using cued speech, the examiner conducted the storytelling test, which was similar to the pre-test in implementation, only with the difference that, this time, the main story was recounted to the children along with the use of Cued Speech and then the children were asked to retell the story they had heard the therapist tell with the use of Cued Speech but without themselves using cued speech. The scores were once again recorded to measure the effect of Cued Speech on storytelling.

To analyze the data statistically, descriptive statistics (mean and standard deviation) and inferential statistics (bivariate ANOVA test and independent t-test) were used. The analyses were performed in SPSS-21.

Results

According to Table 1, there was a difference between the mean of story retelling components in the pre-test and the post-test (after learning Cued Speech) in prelingual, late implanted, hearing impaired children admitted to Loghman Hospital in Tehran, indicating that, in the macro structure subtests of storytelling (topic maintenance, explicitness and event sequencing), there was a significant difference between the post-test and the pre-test ($p<0.01$). The mean of post-test increased, that is, using Cued Speech improved the subtests.

In the subtest of referencing, which is a micro structure subtest of storytelling, there was a significant difference between the post-test and the pre-test ($p<0.01$), indicating that the post-test increased at the level below 0.05. In the mean length of utterance, there was a significant difference between the post-test and the pre-test, indicating that Cued Speech improved these two micro structure subtests of story retelling. But there were no significant differences between the pretest-posttest means in the conjunctions and syntax complexity subtests ($p>0.05$), indicating that the use of Cued Speech did not improve these two micro structure subtests.

Discussion

The present study aimed to investigate the effect of Cued Speech on story retelling skills that are among the more complex skills that develop later in life in prelingual, late implanted, hearing impaired students. Findings showed that Cued Speech increased story retelling skills in the macro structure and also the two components of micro structure, namely referencing and the length of utterance; however, it had no effect on the two other components of micro structure, namely conjunctions and syntax complexity.

Although the authors did not find studies similar to the present one, there were studies on the effectiveness of Cued Speech on perceptive and expressive skills in late cochlear implanted hearing impaired individuals that were all consistent with the present study in results; the studies conducted by Vieu et al., Hernadez et al., Caposecco et al., Kos, and Champoux et al. [6-8, 14,15].

Vieu et al. studied speech production in 12 profoundly hearing impaired French-speaking children. By comparing the children's speech production skills and their communication method used, the researchers evaluated the children's ability to understand words and their sentence syntaxes and sentence patterns used through repeated measurements intended to compare each child's speech perception and syntax abilities against his previous state. The group that had used Cued Speech obtained a mean score of 66.8% for speech perception abilities 36 months after their cochlear implant, which was higher than the scores obtained by other children who had received used oral-auditory training or sign language [15].

Hernadez et al. studied the role of Cued Speech in language development in prelingual, profoundly hearing impaired students, especially in the acquisition and use of Spanish prepositions. The researchers investigated the proficiency of hearing impaired students in using prepositions and its correlation with their communication system used -either the oral method, Cued Speech and sign language. Results indicated that various communication methods help the acquisition of Spanish prepositions to varying degrees and the best results were obtained from Cued Speech [8].

Caposecco et al. studied late implanted, prelingual, profoundly bilateral hearing impaired adolescents and adults (aged 40 and above) and showed that speech perception ability with visual clues improved to a great extent in more than 90% of the subjects with cochlear implant, which is consistent with results of the present study [6].

Kos et al. investigated prelingual, late implanted, profoundly hearing impaired individuals and divided the subjects into the two groups of sign language users and Cued Speech users. Results showed that the group that had used Cued Speech benefited more from cochlear implant than the group that had used sign language [7].

As noted in the study conducted by Champoux et al., the effectiveness of this method owes to how visual stimulation can activate cortical areas assigned to auditory processing in hearing impaired people. This neural activity can persist even when hearing is reconstructed through cochlear implant; the major part of speech perception occurs in a multi-sensory environment with both visual and auditory cues involved [15].

Visual sensory function is related to auditory retrieval skills. Based on the positive relationship between visual activity and improved speech-auditory activity, it seems that the visual sensory pathway facilitates the auditory perception of the word in different contexts of communication. The communication link between visual activity and speech perception suggests that the both auditory and visual senses are vital for cross modal plasticity and improvement of speech perception in hearing impaired adults with cochlear implants [16].

In their study of 2013, Boons et al. compared linguistic storytelling skills in 66 prelingual, severely hearing impaired school children who had received a cochlear implant before age 5 with a mean age of 8 years and 3 months to their hearing counterparts. Results showed that implanted children obtained good scores for the

number and consistency of their statements, which is inconsistent with results of the present study and might be due to the subjects' lower age of receiving cochlear implant compared to students participating in the present study [12].
Limitations of this study included the resistance of parents and children in using this method and time constraints. Also, limitations in the selection of subjects that was conducted using the convenience sampling method problematize the generalization of results to other hearing impaired students.
It is recommended for future studies intending to examine the effectiveness of Cued Speech on hearing impaired children to adopt more reliable sampling methods. It is also recommended to apply the same research subject to other groups of exceptional children, such as children with intellectual disability and children with stuttering.

Conclusion

Results of the present study showed that cued speech can improve story retelling skills in prelingual, late implanted, hearing impaired children. Cued speech can therefore be used in schools and centers for hearing impaired students to improve their speech perception.
Cued speech can also be helpful in rehabilitation programs for prelingual, late implanted, hearing impaired children.

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