

Full Length Research Paper

Using narrative to investigate language skills of children who are deaf and with hard of hearing

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The study group consisted of 30 children with cochlear implants (CI) and 30 children with normal hearing (NH), whose ages were 4 years and 7 years 11 months. Turkish Test of Early Language Development (TEDIL) was used to assess the language skills of the children. Language samples were gathered by using Edmonton Narrative Norms Instrument (ENNI). The study results indicated that the sum of receptive, expressive and verbal language scores of the children with CI was lower than the children with NH and the difference was statistically significant according to TEDIL. It was found that mean length of utterance (MLU) and number of different words (NDW) averages among MLU, NDW and total number of words (TNW) average scores showed statistically significant differences in all of the three stories in favour of the children with NH. However, there was no statistically significant difference between two groups except for the A1 story in TNW. It was found that children with CI used case suffixes, pronouns, conjunctions among part of speech and verbals which were necessary for creating complex sentences less often than the children with NH and the difference between them was statistically significant with regard to the occurrence frequency of case suffixes, pronouns, A1 and A3 stories, A1 story conjunction. Besides, it was observed that the children with CI made more statistically significant word omission, morpheme omission and substitution errors than the children with NH. It was found that the children who were implanted before the age of 2 scored higher. As a result of language sample evaluations, it was stated that TNW scores predicted the ones with CI and MLU and NDW scores predicted the children with NH.

Key word: Deaf and hard of hearing, cochlear implant, narrative, language assessment.

INTRODUCTION

Hearing loss, arising congenitally or in the pre-language period, affect child's language development, and lead to delays of his/her social, cognitive and emotional development fields when compared to his/her peers. As

the degree of hearing loss increases, children's speech production and vocabulary decrease, and their reading and writing skills decline (Davis et al., 1986; Diefendorf, 1996; Easterbrooks, 2010; Marschark et al., 2007).

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Easterbrooks (2010) and the specific linguistic considerations for deaf children learning a visual language like ASL. By connecting a hearing model of vocabulary instruction to the previous knowledge of the language learning of deaf children and the adult strategies used to promote that learning, the truly unique pedagogy used to promote learning for this population may be uncovered.

Cochlear implants (CI) have been widely applied to children who have severe to profound hearing loss in recent years. CI eliminates damaged or missing hair cells and directly stimulates the auditory nerve. Thus, the children who have severe and profound hearing loss benefit from CI and are able to improve their hearing, listening and speaking skills. It is observed today that early implantation is successful in children's acquiring spoken language, who have severe and profound hearing loss (Ertmer et al., 2003; Roeser and Bauer, 2004; Sennaroglu, 2003; Spencer and Marschark, 2003; Yoshinaga-Itano et al., 2010; Wie et al., 2007). Even though the children who underwent early implantation exhibit a rapid and generally appropriate improvement in compliance with their ages than the children who underwent later implantation, most of them have difficulty in the domains such as syntax, semantics, and pragmatics (Nicastri et al., 2014; Han et al., 2015). The best results following the CI implantation are obtained from the children whose cognitive development are normal and to whom early was performed, and from the children who are intensely subjected to the language and who are supported by their parents and by their caregivers (Geers, 2003; Kirk et al., 2002; Nicholas and Geers, 2007; Sharma et al., 2004; Sharma and Campbell, 2011; Tobey, Geers et al., 2003)

Language development can be described by separable domains, such as vocabulary, morphology, syntax and pragmatics (Topbaş, 2007). Generally, studies on language outcomes of children with CIs, language development are evaluated by means of vocabulary tests. However, vocabulary tests may not tell the whole language development (Mancini et al., 2015). Different components of the language come together in a story. Interaction of hearing and language at the quality of verbal stories which are an expression of opinion has an important role. The processes of a child's understanding the story cover cognitive and high-level language skills. These skills include the ability to sort events, to create coherent texts by means of distinct linguistic signs, to use whole words, to convey the opinions without having non-linguistic support, and to comprehend cause-effect relationship. The hearing-impaired children who have severe and so severe hearing loss that the issue is more that children with hearing loss experience language delays due more to not having access to a full language and are thus, unable to produce a story.

In the assessment of language development of children; a narrative which assesses different components of the

language in details has been started to be used in both clinical assessment and intervention programs. The analysis of the information gathered from the stories provides detailed information on how the children combine information about language rules (Soares et al., 2010). Narratives have been found to predict academic achievement of children at risk for language impairments (Fazio et al., 1996); for children with early language impairments, preschool narrative performance appears to predict later language development (Bishop and Edmondson, 1987) and reading comprehension (Bishop and Adams, 1990). Thus, narrative skills appear to discriminate between children with impairments making them valuable tools for assessment and intervention.

However, research rarely focuses on morphology, syntax, narrative skills, while these skills are important to structure speech and language and contribute to the effectiveness of children's language (Da Silva, Comerlatto-Junior et al., 2011). Few studies evaluated several language domains. Young and Killen (2002), Spencer (2004) and Duchesne et al. (2009) measured vocabulary, syntactic and morphological skills. Young and Killen (2002), and Spencer (2004) observed strong vocabulary skills and a good understanding of word order in sentences, but problems with syntactic and morphological skills, such as pronouns, possessive markers, and verb tense. Goberis et al. (2012) state that children who are deaf or with hard of hearing are significantly older than their normal hearing peers even at the age of 7 years, there are several forms that are not mastered by 75% of the deaf children or the children with hard of hearing. Yoshinaga-Itano et al. (2010) states that the objective of this investigation was to describe the language growth of children with cochlear implants and those children with the same degree of hearing loss using hearing aids. There were 87 children with a severe-to-profound hearing loss from 48 to 87 months of age. Average language estimates at 84 months of age were nearly identical to the normative sample for receptive language and 7 months delayed for expressive vocabulary. Children demonstrated a mean rate of growth that was equivalent to their normal-hearing peers from 4 years through 7 years on these 2 assessments. Examination of individual patterns by Duchesne et al. (2009) revealed four different language profiles. One profile consisted of language components within normal limits. The second profile demonstrated a general language delay on all tasks. The third profile showed normal lexical abilities with receptive grammar delay and the fourth one consisted of discrepancies across language domains. However, these studies were based on a relatively small sample size ($n < 30$) which hinders generalization of the findings to larger populations. A comprehensive study ($n = 153$) conducted by Geers et al. (2009) reported that fewer children with CIs achieved age-appropriate scores on measures of verbal intelligence,

language, and syntactic knowledge when compared to performance on vocabulary measures. Moreover, none of these studies included complex linguistic tasks involving pragmatic abilities such as narrative skills. However, analysis of different language development domains enables efficient rehabilitation (Geers et al., 2009).

In the literature, there have been some studies in which the language skills of the children with severe loss of hearing by using narrative. Crosson and Geers (2001) found out that there is a statistically significant relation between narrative skills scores and speech perception, syntax and reading test scores of the children with CI; and usage of the words that connect sentences is not as improved as their normally hearing peers. In a study in which the language and narrative skills of the children implanted at early ages examined together, it was shown that more than the half of the children who received the implant before the age of 5 showed similar performances with the normal hearing children in narrative skills, length of utterance and vocabulary evaluations (Geers et al., 2003). Boons et al. (2013) who compared the language and narrative skills of the children with CI and their normally hearing peers (using the retell method) found that nearly the half of the children with CI has a language level appropriate for their age while the other half has a language performance lower than their peers. In this study, it was stated that the children with CI had difficulty in the syntax as the result of error analysis and that their narrative skills were insufficient (Boons et al., 2013). The results of the research support that there is a relation between hearing, language and narrative skills in children with CI.

The purpose of this study was to investigate language and narrative skills of children with cochlear implants and to compare their outcomes with normally hearing peers. This study seeks answers for these sub-questions regarding the purpose:

1. Is there a statistically significant difference between the receptive language, expressive language and verbal language scores of children with CI and children with NH?
2. According to Mean Length of Utterance (MLU), Number of Different Words (NDW) and Total Number of Words (TNW) scores obtained from language samples, is there a statistically significant difference between the groups?
3. Is there a statistically significant difference between two groups relating conjunction and pronouns, suffixes and verbals?
4. Is there any statistically significant difference between the children with CI and NH group for the frequency of skipped words, morpheme omission substitution errors and utterance error.
5. Do the receptive language, expressive language and expressive language sum of scores obtained from the

language test differ in accordance with the age of implantation?

6. Do the MLU, NDW and TNW results obtained from A1, A2 and A3 stories differ in accordance with the age of implantation?

7. Which of the Mean Length of Utterance (MLU), Number of Different Words (NDW) and Total Number of Words (TNW) scores does predict the group with CI in A1, A2 and A3 stories?

METHODS

Study groups

The research group consisted of 60 children (monolingual, whose native language is Turkish), 30 with CI and 30 with NH, between the ages of 4 years and 7 years 11 months, who continued inclusive education in special education and rehabilitation centers and preschool and primary education institutions in Izmir. The gender and chronological age were matched considering (± 3 months) (Boons et al., 2013; Le Normand et al., 2003; Schorr et al., 2008). The distribution of the children according to the age and gender of the study group was shown in Table 1.

In the study group, 28 of the children were male and 32 of them were female. The average age of the children with CI was 4.05 for the age of 4, 5.06 for the age of 5, 6.06 for the age of 6 and 7.08 for the age of 7. The average age of the children with NH was 4.05 for the age of 4, 5.06 for the age of 5, and 7.08 for the age of 7.

This study included the children with congenital bilateral severe or very severe sensorineural hearing loss, who had been using CI for at least one year, who used auditory-verbal communication method at home, school and special education and rehabilitation centers, who did not have any other disability except for the hearing loss (information was collected from the student files and their families) and whose language developments were the age norms.

Among the normally hearing children, the study included the ones who showed normal development (there was no problem with their development according to the teacher), whose hearing was below 20 dB HL at frequencies between 500 and 4000 Hz (the hearing test was done in a silent room at the children's school by the researcher using audiometer), who did not have any language disorders.

All children who were included in the study group were the children who had CI operation based on the severe sensorineural hearing loss diagnosis. The children had used hearing aids for 2 months to 3 years (Mean=1.21) before the operation. The age of the operation differed from 1 year of age to 5 years (Mean 2.13).

The special education centers in which all the children who were included in the research are the centers which give auditory verbal therapy, educate families for auditory-verbal education and support the families to give auditory-verbal education to their children at home. It was found that the difference between the educational levels of the mother of the children with CI and the children with NH ($X^2(2)=5.96$, $p=.051$) and their fathers' educational level ($X^2(2)=4.589$, $p=.101$), which is an important element of the child's language development was not statistically significant.

Data collection

The school principals and teachers of the deaf were contacted by determining the special education centers (focused on family

Table 1. The distribution of chronological age and gender of the study group.

Age (Years)	Sex	CI (n:30)				NH (n:30)			
		n	Mean	SD	Min-Max	n	Mean	SD	Min-Max
4	Males	3	4.05	0.05	4.00-4.10	3	4.05	0.05	4.00-4.10
	Females	3	4.05	0.04	4.02-4.10	3	4.05	0.04	4.02-4.10
	Totals	6	4.05	0.04	4.00-4.10	6	4.05	0.04	4.00-4.10
5	Males	3	5.05	0.05	5.00-5.10	3	5.05	0.05	5.00-5.10
	Females	4	5.06	0.04	5.03-5.11	4	5.06	0.03	5.03-5.10
	Totals	7	5.06	0.04	5.00-5.11	7	5.06	0.04	5.00-5.10
6	Males	4	6.06	0.04	6.00-6.10	4	6.06	0.05	6.00-6.11
	Females	3	6.07	0.03	6.04-6.09	3	6.07	0.03	6.04-6.09
	Totals	7	6.06	0.03	6.00-6.10	7	6.07	0.04	6.00-6.11
7	Males	4	7.10	0.02	7.07-7.11	4	7.09	0.02	7.07-7.11
	Females	6	7.07	0.04	7.00-7.11	6	7.07	0.04	7.01-7.11
	Totals	10	7.08	0.04	7.00-7.11	10	7.08	0.03	7.01-7.11

supporting auditory-verbal language) of the children. General information related to the child and the family was gathered from the families who volunteer to participate in the study after the children who took TEDIL in the first session and the language samples were taken in the second session. After the normally hearing children who matched the children with CI were determined from the classroom lists of their schools and they were tested with hearing test audiometer (amplaid 171 S Type 3 IEC 645) and earphones (amplaid) for the frequencies of 500-1000-2000-4000 Hz in a silent room, the children whose hearing thresholds were lower than 20 dB HL were included in the study. Besides, the language test was applied in this session. Then, the language sample was taken in the second session.

Test materials

Turkish test of early language development (TEDIL)

Test of Early Language Development (TELD-3) test which was developed by Hresko et al. (1999) is a test that was adapted to Turkish as Turkish Test of Early Development by Topbaş and Güven (2011). The test is conducted on an individual basis; it is norm referenced and it aims at measuring receptive and expressive verbal language skills of the children between 2 years 0 months and 7 years 11 months of age. The test can be used for the purposes such as early diagnosis of children with language disorders, to show strong and weak aspects of language development, to provide information regarding development process and to research. The Cronbach alpha values of the test are identified as between 86 and 98 in different age groups for TEDIL receptive language test, between 87 and 98 for expressive language subtest. The reliability among the potential users of the test is stated as 99 (Topbaş and Güven, 2013). In this study, TEDIL was used to determine if the language development of the children with normal hearing was appropriate for their age in the selection of the study group, to determine the language development levels of the children with CI and to include the children whose language development is age norms with the children with NH into the research. As the result of the application of the test, out of 36 children with CI, 6 children whose TEDIL expressive and verbal language sum of scores were 2 SS below the average were

removed from the study.

In this study, another purpose of using TEDIL was to determine general language skills of the children. Sum of receptive language, expressive language, verbal language standard scores of the children and the standard deviations are given in Table 2.

It is seen in Table 2 that the children with CI had lower scores in all of the three TEDIL subtests than the children with NH. For the children with CI; 11 (36.7%) in receptive language test, 15 (50%) in expressive language test, 14 (46.7%) in verbal language test sum of performances scored below 1 and 1.5 SD.

The Edmonton narrative norms instrument (ENNI)

In this study, "The Edmonton narrative norms instrument (ENNI)" which was developed by Schneider et al. (2005) was used to evaluate the language skills by means of narrative. Before the application, the necessary permission and information regarding application process were received from Alberta University, Dr. Phyllis Schneider. ENNI contains storyboards without writing; 1 educational story and 3 test story. Three picture sets with animal characters were used to elicit stories, in three levels of complexity. These picture stories were provided a range of narrative complexity. Table 3 provides a summary of the characteristics of the story sets.

The pictures for each story were placed in page protectors in a binder. Each story was in its own binder. The narrative is submitted to the child by pictures and the child is asked to tell a story by looking at the pictures.

It is seen in Table 3 that picture sets proceed from a basic story with two characters to a complex story with four characters. The stories are the ones that were arranged systematically in accordance with length, amount of the story information, the number of the characters and gender. Before the test stories were applied, the educational story was applied to the children to phase them in the stories. The child was first given a training story, which was similar to the simple stories in the A1 story in terms of length (5 pictures, 1 episode) and the number of characters (2). The purpose of the training story was to familiarize the child with the procedure and to allow the examiner to give more explicit prompts if the child was having difficulty with the task, such as providing the story beginning (e.g., "Once upon a time ... there was a ..."). For the A

Table 2. TEDIL test scores of the children included in the study group.

Study group	CI (n:30)			NH (n:30)		
	Mean	SD	Min-Max	Mean	SD	Min-Max
Receptive language scores	91.63	6.35	81.00-106.00	105.67	7.08	94.00-116.00
Expressive Language Scores	90.90	8.83	77.00-112.00	105.43	8.11	90.00-120.00
Verbal Language Scores	90.13	8.43	75.00-111.00	106.87	8.05	93.00-120.00

Table 3. Characteristics of the story sets.

Story	Number of episodes	Setting	Number of characters	Character description	Number of pages
A1	1	Swimming pool	2	Young female elephant young male giraffe	5
A2	2	Swimming pool	3	Same As A1 adult female lifeguard	8
A3	3	Swimming pool	4	Same as A2 adult female elephant	13

story sets, the examiner was restricted to less explicit assistance such as general encouragement, repetition of the child's previous utterance, or if the child did not say anything, a request to tell what was happening in the story. In the study, the pictures are shown to the child one by one and the child is asked to tell a story by looking at the pictures.

After the training story, the child viewed the pictures for each story in turn and was asked to tell the story to the examiner. When presenting the stories, the examiner held the binder in such a way that she could not see the pictures as the child told the story, which meant that the child needed to use language rather than pointing or gesturing if the examiner was to understand the story. The instructions emphasized that the examiner would not be able to see the pictures, so the child would have to tell a really good story so the examiner could understand it.

The examiner first went through all the pages so that the child could preview the story, after that the examiner turned the pages again so that the child told the story. The examiner turned the page when the child appeared to be finished with telling the story for a particular picture. Stories were audio recorded using Olympus VN 8600 PC recorders.

In this study, out of 32 normally hearing children, 2 children who told two short stories in ENNI Narrative Instrument (who said only the action in every page) were excluded from the study group. Two children with normal hearing were not included into the research because they behaved timid, used only one word for the pictures and did not form a story when they were asked to narrate the pictures and they only looked at the A1 story of the ENNI and did not want to see the others.

After stories were collected into the recorder, Turkish SALT (Systematic Analysis of Language Transcripts) computer program (Acarlar et al., 2006) was used for the transcription of the language sample and calculation of the measurements of language samples. Three developmental measurements which increase with age are found in the children who show normal development, which is calculated from the language samples. Mean Length of Utterance (MLU), Number of Different Words (NDW) and Total Number of Words (TNW) inform about the different components of the language.

MLU is calculated by dividing the number of all the morphemes in language samples to the total number of utterance. MLU is a measurement that is used to assess the morpheme and syntax

development. NDW and TNW are used as vocabulary diversity index among quantitative measurements that can be taken from the language sample regarding the semantics. NDW which is related to age is determined by calculating different word stems of language samples with a certain length. As the number of the utterance increases, the number of different words in the language sample increases correspondingly. NDW, which is considered to show the extent of vocabulary, informs about the problems to come up with words and vocabulary. Another age-related measurement, TNW is obtained by calculating the total numbers of the words in a language sample taken within the context of conversation or narrative. In this study, MLU, NDW, and TNW which are among the developmental measurements were calculated for every one of the three stories. Besides developmental measurements, some measurements were obtained regarding skipped words, the omission of morpheme and substitution word omission and error usage frequencies from disordered performance measurements. The errors arose at the level of word or sentence refers to morphology and syntax difficulties as well as the difficulties regarding finding the appropriate word and the insufficient vocabulary. Besides, developmental measurements were obtained regarding usage frequencies of conjunction, pronoun, suffixes and verbals.

For the 30% of the language samples, interjudge reliability was calculated. Interjudge reliability was calculated by agreement / (agreement+disagreement) x 100 formula (Kircaali-Iftar and Tekin, 1997). As the result of the interjudge reliability calculations, division into utterances reliability was 98% (93 to 100%); division into morphemes reliability was 98% (between 94 and 100%) and coding reliability was 92% (between 87 and 100%).

Data analysis

The data collected from language sample was transformed into transcription first and then it was analyzed by using SALT language sample analysis program. Then, statistical analyses were performed using the SPSS software.

If the children with CI differed from normally hearing children with regards to the quantitative measurements obtained from language development test TEDIL and language sample by using independent sample test and Mann-Whitney U test was

Table 4. Independent samples t test results regarding the receptive language, expressive language and verbal language scores in the study group.

Groups		n	Mean	SD	df	t	p	
TEDIL	Receptive Language	CI	30	91.63	6.35	58	-8.07	0.000***
		NH	30	105.66	7.10			
	Expressive Language	CI	30	90.90	8.83	58	-6.64	0.000***
		NH	30	105.43	8.11			
	Verbal Language Scores	CI	30	90.13	8.43	58	-7.86	0.000***
		NH	30	106.87	8.05			

*, p<0.05; **, p<0.01; ***, p<0.001.

investigated.

The children were grouped according to the age that they were implanted and it was investigated if there were any differences between these groups regarding the qualitative measurements obtained from language development test and language sample with Mann-Whitney U test. To determine which MLU, NDW and TNW scores of language sample measurements predict the group with CI, logistic regression analysis was utilized.

Hosmer-Lemne show goodness of fit statistics was used to assess model fit. A 5% type-I error level was used to infer statistical significance.

RESULTS

Dependent variables of the study are the sum of the receptive language, expressive language and verbal language scores obtained from TEDIL test and MLU, NDW and TNW obtained from language sample. The CI and NH groups including children are the independent variables.

Is there a statistically significant difference between the receptive language, expressive language and verbal language scores of children with CI and children with NH?

Independent sample t test was applied to determine if there is a difference between the groups with regard to the sum of the receptive language, expressive language and verbal language scores obtained from TEDIL language test.

It is seen that the sum of receptive language, expressive language, and verbal language scores average of the children in the CI group on Table 4 is lower than the averages of the normally hearing children. According to the results of independent sample t test, there are statistically significant differences in TEDIL receptive language [t(58)=-8.07, p=0.000], expressive language [t(58)=-6.64, p=0.000] and verbal language [t(58)=-7.86, p=0.000] sum of scores in favour of the children with NH.

According to MLU, NDW and TNW scores obtained from language samples, is there a statistically significant difference between the groups?

Mann-Whitney U test was applied to determine if there is a difference between the groups regarding MLU, NDW and TNW measurements calculated for A1, A2 and A3 stories in the language samples of the children who were in the study group.

It is stated in Table 5 that MLU and NDW scores taken from the three stories show statistical significance in favor of the children with NH. While TNW scores differ statistically significant in A1 story, it is seen that there is not a statistically significant difference between the groups in A2 and A3 stories.

Is there a statistically significant difference between two groups relating conjunction and pronouns, case suffixes and verbals?

If there is a difference between the usage frequencies of conjunction, pronoun, suffixes, verbals calculated from the language samples of the children in the study group according to independent sample t test was investigated and the results are shown in Table 5.

In accordance with the Mann-Whitney U test results that was conducted to determine the conjunction usage frequency in Table 6 regarding the conjunction usage frequency; while there is a statistically significant difference in A1 story (U=-.06, p=.010) between the groups, it was found that there is not any statistically significant difference for A2 story (U=-0.83, p=.408) and A3 story (U=-1.35, p=.177).

It was found that there is a statistically significant difference for all of the three stories (A1 story (U=-3.76, p=.000), A2 story (U=-4.17, p=.000), A3 story (U=-3.67, p=.000)) in terms of the usage frequency of the pronouns in favor of the normal children.

It is seen that there is a statistically significant difference between two groups for all of the three stories (A1 story (U=-2.55, p=0.003), A2 story (U=-2.30, p=.006)

Table 5. Mann-Whitney U tests results regarding MLU, NDW, and TNW calculated in the language samples of the children who were in the study group.

Variable	Groups	n	Mean rank	Sum of rank	U	p	
MLU	A1 Story	CI	30	20.47	614.00	-4.45	0.000***
		NH	30	40.53	1216.00		
	A2 Story	CI	30	22.47	674.00	-3.56	0.000***
		NH	30	38.53	1156.00		
	A3 Story	CI	30	21.45	643.50	-4.01	0.000***
		NH	30	39.55	1186.50		
NDW	A1 Story	CI	30	23.55	706.50	-3.09	0.000***
		NH	30	37.45	1123.50		
	A2 Story	CI	30	22.47	674.00	-3.57	0.000***
		NH	30	38.53	1156.00		
	A3 Story	CI	30	23.43	703.00	-3.14	0.001**
		NH	30	37.57	1127.00		
TNW	A1 Story	CI	30	25.92	777.50	-2.04	0.014*
		NH	30	35.08	1052.50		
	A2 Story	CI	30	28.35	850.50	-0.95	0.340
		NH	30	32.65	979.50		
	A3 Story	CI	30	27.47	824.00	-1.35	0.178
		NH	30	33.53	1006.00		

*p<0.05; **p<0.01; ***p<0.001.

Table 6. Mann-Whitney U test results regarding conjunction, pronoun, suffixes and verbal from language sample measurements of the children in the study group.

Variable	Groups	n	Mean rank	Sum of rank	U	p	
Conjunction	A1 Story	CI	30	25.97	799.00	-2.06	0.010*
		NH	30	35.03	1051.00		
	A2 Story	CI	30	28.65	859.50	-0.83	0.408
		NH	30	32.35	970.50		
	A3 Story	CI	30	27.47	824.00	-1.35	0.177
		NH	30	33.53	1006.00		
Pronoun	A1 Story	CI	30	22.23	667.00	-3.76	0.000***
		NH	30	38.77	1163.00		
	A2 Story	CI	30	21.28	638.50	-4.17	0.000***
		NH	30	39.72	1191.50		
	A3 Story	CI	30	22.28	668.50	-3.67	0.000***
		NH	30	38.72	1161.50		
Suffixes	A1 Story	CI	30	24.77	743.00	-2.55	0.003**
		NH	30	36.23	1087.00		
	A2 Story	CI	30	25.35	760.50	-2.30	0.006**
		NH	30	35.65	1069.50		
	A3 Story	CI	30	23.28	698.50	-3.21	0.000***
		NH	30	37.72	1131.50		
Verbal	A1 Story	CI	30	24.63	739.00	-2.72	0.002**
		NH	30	36.37	1091.00		
	A2 Story	CI	30	28.42	852.50	-0.94	0.346
		NH	30	32.58	977.50		
	A3 Story	CI	30	21.07	632.00	-4.24	0.000***
		NH	30	39.93	1198.00		

and A3 story ($U=-3.21$, $p=.000$) in terms of the usage frequency of suffixes which are obtained in early periods in Turkish in favour of the normal children.

For the usage frequency of verbals, it shows statistically significant difference between the groups for A1 story ($U=-2.72$, $p=.002$) and A3 story ($U=-4.24$, $p=.000$), while there is no statistically significant difference for A2 story ($U=-0.94$, $p=.346$).

Is there any statistically significant difference between the children with CI and NH group for the frequency of morpheme omission and substitution and utterance error?

Mann-Whitney U test was applied to determine if there is a difference between the groups regarding the score averages for the morpheme omission and substitution errors frequency and error frequency at the level of utterance obtained from the error analysis results in language samples.

When Table 7 is examined, for the A1, A2, and A3 stories, it is seen that there is a statistically significant difference between the groups in A1 story ($U=-2.28$, $p=.004$) and A3 story ($U=-2.05$, $p=.007$) in terms of the word omission. Morpheme omission frequency shows statistically significant difference for each story [A1 story ($U=-3.17$, $p=0.000$), A2 story ($U=-2.64$, $p=0.001$) and A3 story ($U=-3.86$, $p=0.000$)], morpheme substitution error frequency shows statistically significant difference between the groups for A1 story ($U=-2.16$, $p=0.005$) and A3 story ($U=-2.73$, $p=0.001$), utterance error frequency for the children with CI shows statistically significant difference for A2 story ($U=-2.29$, $p=0.004$) and A3 story ($U=-2.27$, $p=0.006$).

Do the receptive language, expressive language and verbal language sum of scores obtained from the language test differ in accordance with the age of implantation?

Mann-Whitney U test was applied to determine if there is a difference between the groups regarding the receptive language, expressive language and verbal language sum of scores according to the age of implantation in the CI group. The results were given in Table 8.

When Table 8 is examined, it has been seen that the children who had the operation before the age of 2 got higher scores in expressive language skills than the children who had the operation after the age of 2. It is seen that there is a difference only in the expressive language skills ($U=45.00$, $p=.005$) among the TEDIL test measurements of the children who were implanted before the age of 2.

However, according to the chronologic age when they

were younger at 4 years compared to 7 years old. It is seen that there is a not difference receptive language skills ($U=11.00$, $p=0.310$) and expressive ($U=9.00$, $p=0.180$) among the TEDIL test measurements of the children who the age of 4. It is seen that there is a difference in receptive language skills ($U=0.50$, $p=0.001$) but no difference in expressive language skills ($U=15.00$, $p=0.259$) of the children at the age of 5. It is seen that there is a difference both receptive language skills ($U=0.00$, $p=0.001$) and expressive language skills ($U=2.00$, $p=0.002$) the age of 6. It is seen that there is a difference both receptive language skills ($U=1.00$, $p=0.000$) and expressive language skills ($U=0.00$, $p=0.000$) the age of 7.

Do the MLU, NDW and TNW results obtained from A1, A2 and A3 stories differ in accordance with the age of implantation?

Mann-Whitney U test was applied to determine if there was a difference between the groups regarding the MLU, NDW and TNW results for A1, A2 and A3 stories according to the age of implantation in the CI group. The results were given in Table 9. The table shows that MLU, NDW and TNW averages of the children who had the CI operation before the age of 2 and after the age of 2 for A1, A2 and A3 stories differed between the groups only in the A3 story and for the TNW ($U=62.00$, $p<0.05$). It has been found that there has not been statistically significant differences between the groups in terms of other variables.

Which of the MLU, NDW, and TNW scores does predict the group with CI in A1, A2 and A3 stories?

Table 10 shows results of the logistic regression analysis that is conducted regarding the predictor variables' (MLU, NDW, TNW scores) predicting the group with CI. Logistics regression was conducted to assess whether three predictor variables, MLU, NDW, and TNW, significantly predicted the children CI groups or not. [The assumptions of observation as being independent and independent variables being linearly related to the logic were checked and met]. When all three predictor variables are considered together, they significantly predict whether or not a children CI groups, A1 story: $\chi^2 =29.65$, $df=3$, $n=60$, $p<.000$, A2 story: $\chi^2 =23.09$, $df=3$, $n=60$, $p <.000$, A3 story $\chi^2 =21.34$, $df=3$, $n=60$, $p <.000$. Table 7 presents TNW in CI recipient children and MLU and NDW in NH group were found to be predictors to group the children. For the correct classification ratio of the groups which include the children with CI by the MLU, NDW, and TNW averages; while correct classification ratio for the NH group was 80% for A1 story, its correct classification

Table 7. Mann-Whitney U test results regarding the usage frequencies of word omission, morpheme omission, morpheme substitution and utterance error obtained from the error analyses in the language samples.

Variable	Groups	n	Mean rank	Sum of rank	U	p	
word omission	A1 Story	CI	30	33.53	1006.00	-2.28	0.004**
		NH	30	27.47	824.00		
	A2 Story	CI	30	33.75	1012.50	-1.86	0.063
		NH	30	27.25	817.50		
	A3 Story	CI	30	34.15	1024.50	-2.05	0.007**
		NH	30	26.85	805.50		
Omission of morphemes	A1 Story	CI	30	36.15	1084.50	-3.17	0.000***
		NH	30	24.85	745.50		
	A2 Story	CI	30	34.90	1047.00	-2.64	0.001***
		NH	30	26.10	783.00		
	A3 Story	CI	30	38.33	1150.00	-3.86	0.000***
		NH	30	22.67	680.00		
Substitution of morphemes	A1 Story	CI	30	34.35	1030.50	-2.16	0.005**
		NH	30	26.65	799.50		
	A2 Story	CI	30	32.20	966.00	-0.86	0.390
		NH	30	28.80	864.00		
	A3 Story	CI	30	36.20	1086.00	-2.73	0.001**
		NH	30	24.80	744.00		
Utterance error	A1 Story	CI	30	30.50	915.00	0.00	1.00
		NH	30	30.50	915.00		
	A2 Story	CI	30	33.55	1006.00	-2.29	0.004**
		NH	30	27.45	823.50		
	A3 Story	CI	30	33.95	1018.50	-2.27	0.006**
		NH	30	27.05	811.50		

*p<0.05 **p<0.01 ***p<0.001.

Table 8. Mann-Whitney U test results regarding the language test scores of the children with ci who are implanted before the age of 2 and after the age of 2.

Variable	Groups	n	Mean rank	Sum of rank	U	p	
TEDIL	Receptive language	Below age of 2	16	16.31	261.00	99.00	0.588
		Above age of 2	14	14.57	204.00		
	Expressive language	Below age of 2	16	19.69	315.00	45.00	0.005**
		Above age of 2	14	10.71	150.00		
	Verbal language	Below age of 2	16	18.34	293.00	66.50	0.058
		Above age of 2	14	12.25	171.50		

*p<.05 **p<.01 ***p<.001.

ratio for predicting the group with CI is 86.7% according to the analysis results. The correct classification ratio of the both groups by these scores is 83.3%. Correct classification ratio in NH group for A2 story is 80%, correct classification ratio of the group including children with CI is 76.7%. The correct classification ratio of the language sample measures for both of the groups is

78.3%. For the A3 story, correct classification ratio in NH group is 70% and correct classification ratio for CI Group is 76.7%. The correct classification ratio by the language sample measurements for both of the groups is 73.3. It is seen that TNW scores predict the group with CI and NDW scores predict the group with NH among the language sample measurements in each of the three

Table 9. Mann-Whitney U test results regarding the MLU, NDW and TNW results for A1, A2 and A3 stories of the children with CI implanted before the age of 2 and after the age of 2.

Variable	Groups	n	Mean rank	Sum of rank	U	p	
MLU	A1 Story	Below age of 2	16	13.78	220.50	84.50	0.253
		Above age of 2	14	17.46	244.50		
	A2 Story	Below age of 2	16	15.50	248.00	112.00	1.000
		Above age of 2	14	15.50	217.00		
	A3 Story	Below age of 2	16	15.25	244.00	108.00	0.868
		Above age of 2	14	15.79	221.00		
NDW	A1 Story	Below age of 2	16	15.47	247.50	111.50	0.983
		Above age of 2	14	15.54	217.50		
	A2 Story	Below age of 2	16	15.72	251.50	108.50	0.884
		Above age of 2	14	15.25	213.50		
	A3 Story	Below age of 2	16	14.38	230.00	94.00	0.453
		Above age of 2	14	16.79	235.00		
TNW	A1 Story	Below age of 2	16	14.66	234.50	98.50	0.574
		Above age of 2	14	16.46	230.50		
	A2 Story	Below age of 2	16	15.03	240.50	104.50	0.755
		Above age of 2	14	16.04	224.50		
	A3 Story	Below age of 2	16	12.38	198.00	62.00	0.013*
		Above age of 2	14	19.07	267.00		

Table 10. The Distribution of the MLU, NDW and TNW results for A1, A2 and A3 stories according to the logistic regression analysis.

Variable		B	SE	Odds ratio	p	95.0 % C.I. for EXP(B)	
						Lower	Upper
A1 Story	MLU	- 0.888	0.260	0.412	0.001	247	0.685
	NDW	- 0.348	0.152	0.706	0.022	0.524	951
	TNW	0.174	0.076	1.19	0.022	1.026	1.38
	Constant	6.536	1.731	689.503	0.000		
A2 Story	MLU	-0.538	0.301	0.584	0.074	.324	1.054
	NDW	-0.447	0.127	0.639	0.000	.499	0.819
	TNW	0.189	0.060	1.208	0.002	1.073	1.359
	Constant	6.423	2.010	615.771	0.001		
A3 Story	MLU	-0.756	0.294	0.469	0.010	0.264	0.835
	NDW	-0.154	.068	0.857	0.022	0.751	0.978
	TNW	0.058	.025	1.060	0.022	1.008	1.114
	Constant	5.786	1.813	325.642	0.001		

*, p<0.05; **, p<0.01; ***, p<0.001.

stories.

DISCUSSION

The first step in this study was to compare the children with CI to the NH children according to sum of receptive language, expressive language, and verbal language

scores and it was found that the average of sum of the receptive language, expressive language and verbal language scores of the children with CI was lower than the NH children and there was a statistically significant difference between the groups. As the result of TEDIL language test; 63% of the children with CI showed performances appropriate for their age in receptive language, 50% of them in expressive language and 53%

in verbal language scores; all children with NH showed performances appropriate for their ages in all fields. These results show that nearly the half of the general language skills of the children with CI is below their age.

There are different results regarding language skills of the children with CI when they are compared to the NH children in the literature. In their study that supports that study, Schorr et al. (2008) found that the 36% of the CI group and 92% of the NH group showed age-appropriate performances appropriate in all tests. In another study, Geers et al. (2009) stated that 50% of the children with CI in receptive language vocabulary, 58% in expressive vocabulary, 47% in receptive language scores and 39% in expressive language scores that were appropriate for their ages. Yoshinaga-Itano et al. (2010)'s investigation was to describe the language growth of children with severe or profound hearing loss with cochlear. Average language estimates at 84 months of age were nearly identical to the normative sample for receptive language and 7 months delayed for expressive vocabulary. Children demonstrated a mean rate of growth from 4 years through 7 years on these 2 assessments that were equivalent to their normal-hearing peers. The results of these studies and the previous studies showed that while nearly the half of the children with CI shows language characteristics appropriate for their age, the other half's language skills are below their ages. In another study that shows that there are different language profiles in the children with CI, Duchesne et al. (2009) compared the vocabulary, morpheme and usage of the syntactic structure of 27 French speaking children. As a result of the study, four different language profile was determined: The profile that shows normal language development, the one with language delay in every area, the one with appropriate word/meaning information for the age but with a delay in receptive grammar and the one with inconsistency between language components. In their study, they found out that children with CIs may be able to use spoken language structure in a manner similar to their normally hearing counterparts, despite the differences in the quality of the input. The differences in the effects of phonotactic probability and word length imply a difficulty in initiating word learning and limit the working memory ability in children with CIs (Han et al., 2015). In their study that they observed 17 children with CI, Le Normand et al. (2003) stated that some children achieved normal or near normal language level 2 or 3 years after the implantation, some children has difficulty in learning new words and a group of children could not create any words and showed serious delay. As a result, it was found that the general language skills were examined in these studies, nearly half of the children with CI scored similarly with their NH peers, but the other half of the children did not show language skills appropriate to their ages. This finding shows that the results of the CI operations differ from person to person and the factors

such as the age of the operation, auditory-verbal education received by the children and inclusive education affects the language skills of the children. Moreover, vocabulary tests and general language tests do not provide comprehensive information about the fields of the language in which the children who have difficulty in language development. So, it is important to make detailed evaluations regarding the components of the language such as vocabulary, morpheme, and syntax.

In this study, it has been found that MLU, NDW and TNW averages among the developmental measurements which were obtained from the language sample of the children with CI and NH by means of narrative were lower in the CI group than in the NH group for each of the three stories, that the highest MLU, NDW, and TNW averages are in A3 story, which is longer in terms of the number of the characters and events. When these two groups are compared, while MLU and NDW scores obtained from the three story and TNW scores of A1 story show statistically significant difference, there is not any statistically significant difference between the group for TNW scores in A2 and A3 story. Children with NH showing better performances than the children with CI in each of the three stories provide information on the difficulties in different parts of the language. The differences in MLU show that children with CI have difficulty in suffixes and sentences, in other words, in morpheme knowledge and syntax components. The difficulties that the children with CI have in NDW refers to the insufficient vocabulary such as deficiency in finding words and vocabulary. It is thought that the reason why there is a difference between two groups in only the basic story A1 and not in A2 and A3 story is that the children with CI mainly tell the stories by means of naming. As the stories get more complex, the children with CI the stories with less NDW and more MLU, and with respect to TNW, they told similar stories with NH children.

There have been some studies regarding the investigation of the component of the language in the children with CI in the literature. Geers et al. (2003) stated that more than half of the 181 children whose ages were between 8 and 9 and who were implanted below the age of 5 showed similar results with the normally hearing children in the measurements of verbal receptive deduction, narrative skill, the length of utterance and vocabulary. Similarly, in one of the studies that investigate the language skills through narrative, Paul and Smith (1993) stated that the children with hearing impairment were weak in narrative skills and syntax; Boons et al. (2013) stated that their narrative skills are insufficient. It was shown in the studies that compared the children with CI to their NH peers that there was a statistically significant difference between two groups (Crossan and Geers, 2001; Pae et al., 2009).

In the studies in which the language skills of the

children with CI were investigated by using the test, it was shown that the children with CI had difficulty in vocabulary, syntax and morpheme skills (Geers et al., 2009) and they have difficulty in semantics (Le Normand et al., 2003). Schorr et al., (2008) showed that the children with CI scored appropriately to their chronological ages in receptive vocabulary and phonetic memory, but their general performances were significantly below their NH peers. Nott et al. (2009) stated that there is not any statistically significant between CI group and NH group in terms of single words, but they differ statistically significantly in combining words.

When the usage frequency of case suffixes, conjunctions, it was found that children with CI used case suffixes, pronoun, conjunction calculated from the language samples among part of speech and verbals which are necessary for creating complex sentences less often than the children with NH and the difference between them was significant with regard to the occurrence frequency of case suffixes, pronoun, A1 and A3 stories verbals. A1 story conjunction. Similarly, Boons et al. (2013) found that most of the children with CI used the conjunctions correctly and the difference between them and their pair was not statistically significant. Young and Killen (2002) and Spencer (2004) stated that the children with CI used the possessive suffixes and tense suffixes insufficiently in syntax and pronoun use. In another study, Le Normand et al. (2003) stated that the children with CI showed statistically significant difference in noun and verb words, bound morpheme 2 years after the CI operation, in pronouns, infinitives, possessive suffixes, prepositions, verbs of communication, adverbs and negative adverbs after 3 years compared to normally hearing children.

In this study, it was found that the difference between the two group was statistically significant for the skipped word frequency in A1 and A3 story, for morpheme omission frequency in each of the stories, for morpheme substitution in A1 and A3 stories, for utterance errors in A2 and A3 stories from the measurements that provided information about the structure of the language disorder in the language samples of the children with CI and NH. These errors are accepted as the indicators of morpheme and syntax difficulties (Acarlar and Johnston, 2006; Pae et al., 2009; Boons et al., 2013). There have been some studies that provide information on that CI children's MLU, which is a measurement that provides information about syntax and morpheme development similar to this study, is lower than the children with normal hearing (Boons et al., 2009; Geers et al., 2003, 2009; Pae et al., 2009). MLU being below the normal level, skipped morphemes, use of different morpheme instead of the necessary one and utterance errors being above the normal hearing children show that the children with CI have difficulty in syntax and morpheme.

As the NDW averages of the children with CI show,

they use a different word when they do not know the appropriate word because their vocabulary is insufficient. For example:

C And then, (from the giraffe) the elephant drove his plane from the giraffe [took] (7; 6 years old)

C Sonra da (zürafanın) fil zürafanın elinden uçağını sürüyordu[alıyor].

C Then the elephant fell his ball from the sea [took] (7; 0 years old)

C Sonra fil topunu denizden düştü[aldı].

In this study, it was also seen that the children with CI used the morphemes that are added to actions and nouns less than the children with normal hearing and it was found that the number of the word omission and morphemes in each of the three stories showed statistically significant difference between the groups. The children with CI make morpheme errors in the forms of putting another suffix or omitting the suffix. For example:

C The plane sea/acc(*dat) fall/past. *=omission (6;0 years old)

C Uçak deniz/i düş/müş.

C Elephant ball sea/*dat throw/past. (6;4 years old)

C Fil top deniz/*e at/miş.

In this study, while the utterance error averages of the children with CI and NH children were the same in A1 short story which consists of 2 characters, the children with CI made more utterance errors than the children with NH as the number of the characters in the story increased and there was a statistically significant difference between the two group for A2 and A3 stories. The examples of the utterance errors and word finding difficulties of the children with CI are listed below:

C (Cow)Elephant water tennis throw/past. (7;7 years old)

C (İnek)Fil su tenis at/tı.

C Uçak düştüğünü söylemiş.

C (It Ummm what was the name of this huh) One thing/prep. plane/acc. take/past. (7;11 years old)

C (O da hıı neydi bunun adı)Bir tane şey/le uçağ/ı al/miş.

It is seen that standard language tests were used in most of the studies in the literature and error analyses are not included. Although the comparison studies conducted with one norm group are beneficial, they do not provide information about sub-skills and errors. Morpheme and syntax error analyses provide important information for determining the purposes of intervention programs (Da Silva et al., 2011). Similar to this study, Boons et al. (2013) stated that the children with CI had difficulty in the

use of the suffixes and they made more errors in organizing the syntactic structures than the normally hearing children and their narrative skills were insufficient. They stated that the answers of the children with CI for the questions they were asked were limited to single words and this situation could possibly result from lack of information.

The TNW average of the children who were implanted under the age of 2 for the A3 story whose character and event number was more complex were higher than the children who were implanted after the age of 2. Being implanted in early ages is only one of the factors that affect the CI success. Several factors such as the education of the children, family characteristics, and inclusive education affect the success of the implantation. So, it is thought that the indifference in MLU, NDW for each of the three stories and in TNW for A1 and A2 stories can be resulted from the variables except for the age that the children were implanted and it is needed to conduct a study to investigate the other factors that affect the success of the implantation. Similarly, it is emphasized in the literature that the age of implantation is an important factor that affects the post-operation success and as the age of the children decreases, the development after the operation increases, the children who are implanted before the age of 2 reach an age appropriate language level (Hayes et al., 2009; Kirk, et al., 2002; Nicholas and Geers, 2007).

This study had sought an answer to the question if the language test results in language samples and MLU, NDW and TNW averages differ or not. It has been found that there is a statistically significant difference between the two groups in the expressive language scores of the children who were implanted before the age of 2 and there is no statistical significant difference in the receptive language and verbal language composite scores. Besides, in terms of the age of the operation, a statistically significant difference for TNW average in A3 story was found. The TNW average used in the complex story with more characters and events by the children who were implanted before the age of 2 is higher than the children who had the operation after the age of 2. Having the operation at early ages is only one of the factors that affect the success of CI. Several factors such as the education of the child, family characteristics, and inclusive education affect the success of the implant. So, it has been thought that the differences in all the stories for MLU, NDW and TNW and in A1, A2 stories for TNW can be the result of the factors other than the age of the implantation. Accordingly, it has been emphasized in the literature that the age of the operation of the child is a significant factor that affects the post-operation success, the earlier the operation of the child, the faster the post-operation development observed, and the children who were implanted with CI before the age of 2 reach the language level appropriate for their ages (Hammes et al.,

2002; Hayes et al., 2009; Kirk et al., 2002; Miyamoto et al., 2003; Nicholas and Geers, 2007). Yoshinaga-Itano et al., 1998), emphasized that receiving the auditory information early or late and the duration of implant use affect the benefits of the implant for the children. Niparko et al. (2010) stated that the children who had CI operation showed a significant development in expressive language and understanding the language, and the best predictor of the post-operation language scores is the pre-operation language skills. According to the findings of Svirsky et al. (2004), as the age of the CI implantation, the expressive language scores decrease. Akin et al. (2009) stated that the factors such as the aid use before the operation, pre-operation language skills and regular education affect the success of the children with CI.

In this study, which of the MLU, NDW and TNW averages calculated from A1, A2, and A3 stories predicted the CI group was also investigated that. It is founded that TNW predicted the CI group and MLU and NDW predicted the NH group for all of the three stories. It is thought that TNW which is a measurement that provides information about the different aspects of the language such as the speed of the speech, utterance length, motor maturation, utterance formation skill and word formation efficiency predicts CI group; it shows a global language difficulty that affects all of the sub-traits of the language. At the present time, as a result of the different approaches and the improvement of the technology, the number of the children who are implanted at early ages, verbal intervention and inclusive education increase and accordingly, the results expected from the hearing impaired children and the intervention needs of these children change. This situation shows that it is of great importance that the language and academic skills of the children with CI, which is a distinctive group, shall be investigated consistently and in detail and these language skills shall be supported in education and shall be observed. Despite the range of conceptual frameworks employed to understand what constitutes effective instruction for deaf children, the number of available studies is relatively few (Easterbrooks, 2010; Easterbrooks and Stephenson, 2006; Easterbrooks et al., 2006; Marshark and Spencer, 2010). Geers et al., (2008) stated that the early intervention is important for syntax, morpheme and narrative development, the intervention programs should be created according to the fields that the children are strong and weak. Besides, Easterbrooks (2010) points out that this aspect of instruction has been acknowledged for general education, special education, and deaf education alike. It is thought that the findings of this study will significantly contribute to the determination of the purposes regarding the language skills in early intervention programs, using the narrative in intervention programs more often and use of the narrative as a means of evaluation in evaluation studies. Because it is important that deaf children have strong language role

models in their classrooms (Easterbrooks, 2010).

The suggestions which were developed regarding the further researches and practices in accordance with the findings of the research are listed as follows:

1. By determining the auditory perception, speech perception of the children with cochlear implant besides language tests, narrative tool, and the relations between them can be examined.
2. More children with CI and other control groups (with language disorders, with mental incompetence) can be compared.
3. By planning the same research in longitudinal design, the assessments can be made at regular intervals. Thus, the language development of the children can be observed and the effects of the factors regarding the language development can be revealed. The longitudinal studies are significant in term of determining the effect of the applied intervention and determining the areas in which the children have difficulty and supporting these areas.

Conflict of Interests

The authors have not declared any conflict of interests.

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