IJMS
Vol 29, No 2, June 2004

Original Article

Emotional Changes in Children Undergoing Cochlear Implantation through Evaluation of Their Drawings

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Abstract

Background: The emotional changes of patients undergoing cochlear implantation (CI) has been addressed in a few studies. To date, no special test has been developed to measure these changes**.**

Objective: To measure the emotional status of children undergoing CI by interpreting their drawings.

Methods: A prospective longitudinal study on prelingually deafened children from 4-14 years of age undergoing CI and sex and age-matched non-CI candidate deaf children comprised the study population. Drawings were produced before implantation and after 1, 3, 6, and 12-month intervals. These were scored with regard to a questionnaire developed in Amir Aalam Hospital Hearing Research Center, Tehran, Iran.

Results: The prevalence of drawings with cues of rage/anxiety decreased from 35% to 21.9%. Similarly, sadness prevalence dropped from 36.8% to 20% and the prevalence of immaturity was reduced from 20% to 7.1%.

Conclusion: We recommend drawing to be included in the rehabilitation program of children undergoing CI and used as a practical measure of their emotional progress.
Iran J Med Sci 2004; 29(2):62-66.

Keywords • Cochlear implantation • child • projective techniques • emotion • anxiety

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Introduction

Any major medical illness or intervention can be the maker of a major emotional tempest.[1] Cochlear implantation (CI) is a miracle with a vast variety of effects. Chil-Children undergoing CI learn to hear, listen and talk in the midst of an emotional storm caused by introduction of the entirely new sense of hearing. Moreover, their anxieties and repressed feelings, caused by disability which is different from normal, fade away as their abilities grow. The emotional changes of patients undergoing CI has been addressed in a few studies,[2-4] and the corresponding accounts are found on personal patient's reports on internet rather than in scientific papers. To date, no special test has been developed to measure these changes and no means for evaluating the effects of this impact is

Table 1: Possible scores for each measurement as appear in sample questionare.

Measurement	Possible Scoring		
	A	B	C
Pressure of pencil	light	normal	high
Use of red color	none or little	normal	over use
Number of objects	small	multiple	multiple objects
Drawing	careless	normal	meticulous
Attention to details	low	high	high
Use of colors	mostly flat	balance	mostly vivid
Coloring	complete	unfinished	not colored
Angulations	mostly sharp	balanced	mostly soft/obtuse
Dissociation of drawings	none	signs present	apparent
Immature drawing	none	signs present	apparent
Disproportionate parts/limbs	none	signs present	apparent
Size of self picture	large	balanced	small
Position of self picture	normal/center	on the edge	on the edge
Ears	not drawn	normally drawn	exaggerated
Other children/school	not drawn	drawn	main theme

available. Most children love drawing. It helps them express their feelings, fears and anxieties; they use it as an emotional outlet, a channel from subconscious.[5-8] Drawings, as an emotional outlet, can also be a part of treatment-rehabilitation program for the stressed or traumatized child.[9]

Children's drawings are well-known to reflect their inner selves or how they perceive their relatives, surroundings or even musical intervals.[5-13] Children's drawings have been used for assessment of their emotional status in many studies. Children with physical defects, those hospitalized, those in pain and children with war experiences together with normal counterparts have all been on this list.[5,12,13]

Studies have used standard tests like Draw-A-Person test (DAP),[14] Kinetic Family Drawing test (KFD) or evaluated drawings with arbitrary measures.[5-7,10,11] However, there is little evidence for the reliability and validity of drawing assessments.[5,12] This is mostly because a given feature could plausibly support several and various interpretations.[12] Moreover, many possible processes, events, trivial or momentarily, can affect the quality of the drawings.[12]

We still believe that children's drawings are valuable tools for investigating their emotional status. In addition, working as emotional outlet, drawings can relieve children from much tension, giving them a better chance of expressing themselves and preparing them to learn more efficiently.

In order to practically measure the emotional status of children with CI, we have conducted this longitudinal study to compare the drawings of children receiving CI with those of deaf children not having this device.

Patients and Methods

The study population comprised of 38 prelingually deaf children from 7 to14 years of age, undergoing CI in the Cochlear Implantation Clinic (CIC) of Amir Aalam Hospital, Tehran, Iran, a tertiary care center, with 41 sex and age-matched deaf children not having CI as control. They were students of a special school for training of the deaf children. In order to keep the population as homogenous as possible, all subjects having defects other than deafness, apparent emotional disturbances or mental problems were excluded from the study.

All CI children drew their pictures in the same room in CIC and all control subjects drew theirs at the school. All subjects were given similar color pencils of the same brand. The subject of all drawings was "*anything with your own picture in it*." Pictures were drawn in the presence of a tutor who added brief comments such as specifying the self picture, if many persons have been drawn, recording the age and gender of the child and encoding the drawings as described later.

All children made their drawings at the start of the study. As for the CI group, this was done before implantation. The next drawings were made at 1, 3, 6 and 12-month intervals after implantation (or after the first drawings for the control group). The settings and the topic of the drawings remained the same throughout the study. Children were instructed to paint two drawings in each session.

Encoding included the children's name, record number, the date of drawing and the session number. Using a prepared list of random numbers, the tutor picked up a code and assigned it to the drawing which specified the age of the children, their gender and the self picture, if appropriate.

Table 2: The comparison of abnormal results for each question across the sessions in each group.

Measurement		Start of the study	1-month interval	3-month interval	6-month interval	12-month interval
Pressure of pencil	*CI*	10.0%	26.3%	19.0%	0%	14.3%
	Control	37.7%	50.0%	30.2%	43.3%	26.5%
Overusing red color	*CI*	8.4%	7.2%	2.9%	5.4%	3.8%
	Control	6.6%	8.3%	1.9%	6.7%	4.1%
Multiple objects	*CI*	30.0%	36.8%	38.1%	36.7%	46.4%
	Control	41.0%	35.4%	34.0%	31.7%	20.4%
Incomplete or careless coloring	*CI*	10.0%	5.3%	10.8%	6.7%	7.1%
	Control	4.9%	2.1%	3.8%	5.0%	8.2%
Dissociated drawing	*CI*	6.2%	5.3%	4.2%	3.3%	3.6%
	Control	4.9%	5.8%	6.3%	3.7%	2.8%
Immature drawing	*CI*	5.0%	6.1%	9.5%	3.3%	7.1%
	Control	21.3%	27.1%	20.8%	20.0%	24.5%
disproportionate parts	*CI*	20.0%	12.1%	5.6%	3.3%	3.6%
	Control	26.2%	31.3%	18.9%	23.3%	28.6%
Small self picture	*CI*	10.0%	15.8%	19.0%	3.3%	14.3%
	Control	19.7%	27.1%	15.1%	15.0%	16.3%
Careless drawing	*CI*	10.0%	21.1%	23.8%	6.7%	21.4%
	Control	29.5%	47.9%	26.4%	31.7%	40.8%
Low attention to details	*CI*	20.0%	10.5%	14.3%	10.0%	15.0%
	Control	39.3%	47.9%	41.5%	46.7%	49.0%
Flat coloring	*CI*	15.0%	21.1%	14.3%	6.7%	10.7%
	Control	6.6%	14.6%	7.5%	11.7%	6.1%
Sharp angulations	*CI*	25.0%	26.3%	14.3%	6.7%	3.6%
	Control	34.4%	39.6%	20.8%	26.7%	32.7%
Drawing other people	*CI*	50.0%	31.6%	38.1%	50.0%	39.3%
	Control	27.9%	18.8%	20.8%	23.3%	14.3%
Not drawing ears or overemphasis	*CI*	15.0%	10.5%	23.8%	26.7%	14.3%
	Control	11.5%	8.3%	11.3%	15.0%	12.2%

The drawings were blinded and passed to two independent psychologists with experience in evaluating children's drawings, as referees, for scoring according to the aforementioned questionnaire. As for scoring, we have tried to select the most objectively measurable items in the drawings while trying to address the aspects of the emotions of the children most affected by undergoing CI. All items included in our questionnaire. Table 1 displays sample questionnaire by which all drawings were scored. The validity of this method has been confirmed previously.[15]

Statistical Analysis

After the completion of data collection and scoring, the corresponding values were matched with relevant ID number and analyzed using SPSS software. Descriptive statistics were utilized using Chi-squares and nonparametric tests as convenient.

Results

Drawings were obtained from 38 children undergoing CI and 41 age and sex-matched control subjects at the aforementioned intervals. None of the children produced drawings for all follow-up sessions. This left us with 118 drawings in the CI group and 271 in the control group.

The crude results of each question were compared across the sessions and among the groups. In order to make comparisons easier, the results of each question were recoded as *'normal'* or *'abnormal'* (*e.g.*, for pressure of pencil only overuse was considered to be 'abnormal' and low pressure as normal. Next, the prevalence of *abnormal* results for each question was compared across the sessions for each group as presented in Table 2.

Analysis of single variables was not informative enough, so we tried to group these into variables seeking cues of rage and anxiety, sadness, low self-esteem and immaturity. *Rage/anxiety* was defined as having either high pressure of pencil, over-using the red color or sharp angulations. An inattentive drawing with either careless, flat or no coloring or with low attention to details was considered to have cues of *sadness*. *Low self-esteem* was discerned in drawings with a small self picture on the edge of the paper. The *immaturity* was defined as drawing disproportionate parts, dissociated or immature drawing with regard to the chronological age of the child.

At this stage, the *kappa* statistics for determination of agreement between the two referees were in good and satisfactory range. The lowest *kappa* of 0.65 indicated *immaturity* and the highest of 0.87showed *rage/anxiety*. In the case of disagreement, we included both results as two separate entities. The prevalence of

Table 3: The comparison of abnormal results for each question across the sessions in each group.*

Question	Groups	Start of the study	1-month interval	3-month interval	6-month interval	12-month interval
Rage/Anxiety	*CI*	35.0%	*36.8%	23.8%	*16.7%	*21.4%
	Control	55.7%	*68.8%	39.6%	*58.3%	*49.0%
Sadness	*CI*	36.8%	25.0%	47.6%	*28.6%	20.0%
	Control	50.0%	32.8%	30.2%	*36.7%	44.9%
Low self- esteem	*CI*	15.0%	21.1%	42.9%	30.0%	21.4%
	Control	24.6%	29.2%	24.5%	25.0%	26.5%
Immaturity	*CI*	20.0%	*5.3%	*9.5%	*3.3%	*7.1%
	Control	27.9%	*35.4%	*24.5%	*25.0%	*28.6%

* The difference between the case and control groups were proved to be significant ($p<0.05$)

drawings with cues of *rage/anxiety* dropped from 35% at the start of the study to 21.9% after one year in the CI group, while these figures were 55.7% and 49% for the control group, respectively.

The prevalence of drawings with cues of *sadness* dropped from 36.8% at the start of the study to 20% after one year in the CI group, while corresponding values for the control group were 50% and 44.9%. The prevalence of drawings with cues of *low self-esteem* declined from 42.9% in the 3rd month of the study to 21.4% after one year in the CI group, whereas respective figures for the control group were 24.5% and 36.5%. Even the prevalence of drawings with cues of *immaturity* dropped from 20% at the start of the study to 7.1% after one year in the CI group, while these figures were 27.9% and 28.6% for the control group, respectively. The results of these comparisons are summarized in Table 3.

Discussion

The results of this study showed that scores for *rage/anxiety*, *sadness*, *low self-esteem*, and *immaturity* decreased during the first year of implantation. This was in contrast to control children whose scores remained essentially unchanged or even increased.

The importance of emotional changes was realized in our study of children undergoing CI. We have also noticed that when children are more stable emotionally, they are willing to learn more. This fact has already been confirmed for normal,[16,17] and emotionally disabled children.[18] Thus, in an attempt to improve the results of this investigation, we embarked on a clinical research to provide the children with means of expressing themselves in order to measure and address their emotions. The results of this flexible program were summarized into guidelines, based on the experiences gained from clinical practice.[3]

In another study on drawing in prelingually deaf children, the investigator used the Koppitz scoring technique and found that the score correlated with emotional status, especially impulsive and passive-aggressive types of response modes.[19]

Based on our experience with children undergoing CI, we believe that anxiety, rage, sadness, self-esteem, and ability and willingness for social interaction are the emotions through which the child experiences the stormiest changes. For each of the emotions mentioned above, we searched for measurable cues for the drawings. In order to do this, we have considered high pressure of pencil, overuse of red color and drawing sharp angulations as cues for anxiety and/or rage. Incomplete and/or careless drawing and/or coloring, using flat colors or drawing black and white drawings were considered as cues for sadness. We have considered a small self-picture on the edge of the drawing indicative of low self-esteem. On the other hand, drawing scenes from school, other children, or household members were regarded as a sign of good social interaction and acceptable self-esteem.

In addition to the questions included in the study questionnaire (Table 1), our referee also added comments for each drawing which were not considered in his analysis of the results. These comments which were addressed in another questionnaire, included being provocative, need for expanding social relations, seclusion, bashfulness, being over imaginative, need for tranquility, lack of patience, restlessness, need to be in control, feeling weak, suffering family conflicts and desire for drawing attention. We recommended free scoring system which also comprised all of these topics.

Pair-wise comparison of the scores of the drawings yielded unreliable results. This can be explained by the fact that many factors such as momentarily disappointment or anxiety or any incident with emotional consequences immediately prior to the time of drawing affected the content of drawing.[12] We, therefore, compared the prevalence of any result of interest for such questions as high pressure of pencil or drawing a self picture on the edge across the sessions and between the two groups. This can make up for the confounding effect of aforementioned factors to some de-

gree since the momentarily effective confounding factors tend to happen equally for groups and across sessions.

Our results illustrated the feasibility of using drawings for measuring the emotions of children undergoing CI as well as showing the reduction of unwanted emotions like rage, sadness and *immaturity* in these children. During this experience we learned that drawing can be used as an excellent emotional outlet for children undergoing CI. Children become more prone to learning and behave more naturally by expressing their emotions. They become more self-confident by being able to express themselves through their drawings. They also turn more attentive to environment, paying more attention to details and becoming more meticulous. Children learn concepts more efficiently, thus teaching words become much easier. Moreover, this program can provide an opportunity for some talents to be discovered. However, the value of the habilitation and therapeutic effects of incorporating regular drawings in the program for children undergoing CI has not been the objective of this preliminary study and remains to be investigated.

In conclusion, we recommend drawing be included in the rehabilitation program of children undergoing CI and used as a practical measurement of their emotional progress.

Acknowledgement

The authors wish to express their gratitude to Ms. Elham Fadaie for her competence and precision in helping us to score the drawings.

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