Original Article

Evaluation of Children's Drawings as a Measure of Dental Anxiety Before and After Oral Health Education

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Abstract

Background: Drawing is an effective tool for evaluating dental anxiety and communicating with children. **Aim:** The aim of this study was to evaluate children's drawings as a measure of dental anxiety with two different assessment methods and their possible relationship with age, gender, and previous dental visits before and after education. **Methods:** A total of 129 children aged 4-6 years old were requested to draw a picture of the dentist and dental office perception before and after a 20-minute dental education at selected Kindergartens. Drawings were evaluated according to Child Drawing: Hospital (CD: H) and Massoni methodologies. **Results:** The difference in drawing groups between before and after oral health education was found to be statistically significant which meant children had less anxiety after education (P = 0.001). A statistical difference was observed in the scores before and after the education in the group of children who had previous dental visits and those who did not (P = 0.001). Statistically significant differences were observed in both groups of children who had previous dental visits and those who did not (P = 0.002). **Conclusion:** Oral health education at younger ages is effective in overcoming dental anxiety and improving the positivity of dental perception. Drawing is a suitable assessment tool for learning about the child's notions and feelings.

Keywords: *Dental anxiety, drawing, oral health education*

Introduction

Dental anxiety is a frequently observed problem in the majority of the children around the world.[1] About half of the children in an earlier study reported low to moderate dental anxiety, whereas 10% to 20% reported high dental anxiety.[1] There were significant relationships between dental anxiety and gender, age, painful experiences at previous dentist visits, and negative behaviors during dental examinations in a study by Alshoraim *et al*.[2]

Knowing how children perceive dental treatment helps to understand the causes of fear and anxiety during treatment. Numerous assessment tools exist for evaluating dental anxiety in children, including clinical observation of their behavior, self-report scales filled out by the children, and questionnaires completed by caregivers.[3] As children are affected by their parent's anxiety, research has shown moderate agreement between child and parent assessments.[4] Consequently, parents may not be able to reliably estimate the degrees of anxiety in their children.[4,5]

One study has concluded that drawing is an effective tool for assessing dental anxiety and communicating with children.[6] Using drawings as a tool is advantageous because of their open-ended nature, allowing for the identification of emotions that subjects may not consciously express verbally. Drawings also pose no threat.[7] Child psychiatrists and psychologists have extensively used drawings in clinical practice for decades to analyze emotions such as fear, anxiety, and anger in children.[8]

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Machover's Draw-a-Person test, initially a prominent tool for assessing unconscious aspects that children might struggle to articulate verbally through the analysis of drawings, body part sizes, and shapes, was the inaugural and extensively used test of its kind.[9] However, its effectiveness became limited, prompting Koppitz to enhance the evaluation process by incorporating additional indicators in a more scholarly manner in the development of her own drawing test.[8] This newly developed test evaluated all of a person's developmental characteristics, including head, arms, legs, facial features, and clothing, by gender and age.[8] However, the analysis of the drawing has become more valid and systematic.[10]

After various scoring systems were developed for drawings, the Child Drawing: Hospital (CD: H) handbook was developed in 1999 to assess the emotional state of hospitalized school-aged children.[10] The examination of drawings can unveil substantial insights into the emotional states of children, serving as a valuable nonverbal self-reported instrument for appraising anxiety within the pediatric dental context. Sheskin *et al*.[6] used drawings of children in the dental setting to assess dental anxiety and evaluated six criteria in their narratives.

Alleviation of the child's dental fear and anxiety and promoting the child's positive attitude are important for dentists to have an efficient treatment process. The identification of dental anxiety in a patient at an earlier stage is crucial. Therefore, this study aimed to evaluate the perception of children aged 4-6 years regarding dentistry and dental procedures before and after oral health education using drawings with two different assessment methods, as well as their possible relationship with age, gender, and previous dental visits.

Materials and Methods

Study population and ethical approval

This descriptive and observational study was carried out on children aged 4-6 years old enrolled in kindergartens. The minimum sample size of the study group was calculated as 125 for the medium class effect size, with the Odds Ratio of 2.5 and the proportion of mismatched pairs being 30%, by using G Power software (version 3.9.1.2).

Kindergartens with similar socioeconomic and cultural levels were explored to form the convenience sample in Balçova District, Izmir, Turkey. Meetings were held with the principals of eleven schools that had the abovementioned criteria and indicated interest in the purpose and study of the research between March and July 2022. Only five of them accepted to participate in the study and approved access to the children. An explanatory letter and informed consent were sent to all parents or legal guardians, describing the aim, and design of the study and asking them if they were willing for their children to take part in the study. Despite the acceptance, children who had no eagerness to draw were excluded from the study population. A total of 129 children whose parents agreed to participate in the research composed the study population.

This study was approved by the Ethics Committee of Dokuz Eylul University (2022/03-15). Before enrollment, the parents or legal guardians signed a written informed consent of their own free will for their children's participation.

Methodology

This blind study was designed to draw a picture of dentist and dental office perception before and after dental education at the selected Kindergartens. One week before the education, the children were instructed to individually draw a picture according to their own knowledge in accordance with the above topic without a time limit. Each child was given an A4 sheet of paper placed directly in front of them, along with an open box of 12 colored pencils and an eraser, in their classroom, sitting in their usual desks and chairs.

The children were observed by one of the pediatric dentists (SEG) without wearing a doctor's uniform, so the kids would not know she was a doctor. Although the children were drawing, the dentist did not intervene in any way and did not answer their questions so that they would not be influenced. When the children finished the drawings, the dentist collected the papers and labeled the backside indicating they were pre-education pictures that only she knew.

One week later, the children were given interactive dental education for 20 minutes, conducted by another pediatric dentist (GK) in the same classroom. During the education, children were allowed to ask questions and express their opinions on the subject. The education was provided using a plastic jaw model, dental examination tools, and filling materials. They were taught how to brush their teeth properly, how oral and dental examinations are conducted, and how simple procedures such as fillings were performed. This hands-on approach aimed to enhance their understanding and reduce dental anxiety by making them more familiar with the dental environment and procedures.

After the education, the children were instructed to draw a picture in the same manner. The observer dentist labeled the paper backside as posteducation as before and noted the experienced children and how they viewed the dentist. The scoring of the drawings was done by two

blinded examiners; another pediatric dentist (GB) and a psychologist (EKA) who were not present during the education session and were blind to pre and posteducation pictures. With one week of training, the inter and intrareproducibility was calculated using Cohen-Kappa scores and were found to be 0.95 and 0.85, respectively.

Data about each child's name, age, gender, and previous dental visits were collected from parents and the school records.

Scoring of the drawings

The drawings were evaluated according to two self-report measure scales; CD: H[4] and Massoni methodology.[11] CD: H scoring test for drawing was validated by Clatworthy *et al*.[12] Examiners rated the drawings adhering to the CD: H manual, which includes the Scoring Guide, Rating Scale, and the CD: H Score Sheet [Figure 1a].[10] The scoring of this scale consists of three parts [Figure 1b]. Part A consists of 14 items, each is scored on a scale of 1 to 10, indicating that 1 is the lowest level of anxiety and 10 is the highest. Part B is calculated with the additional points given to each of the eight items accepted as pathological signs. Part C is a gestalt scoring that includes the total rating. The anxiety of the child shown in the picture was given a score which is scaled from 1 to 10 using specific identifiers by the rater. The total score is achieved by adding the scores of the three parts A, B, and C, and an overall rating range from 15 to 290. Level of anxiety according to the total score obtained from the CD: H score sheet was as follows: ≤43: very low stress, 44-83: low stress, 84-129: average stress, 130-167: above average, and 168 and over very high stress.[12]

An adopted script to construe the child's drawings was proposed and validated by Massoni *et al*., [Figure 2].[11] Drawings were recorded according to the general impression as being positive or negative. A positive impression was perceived with politeness, kindness, happiness, and empathy. A negative impression was considered a perception of hostility, aggressiveness, sadness, dislike, indifference, and authoritarianism. Examiners analyzed specific indicators and indicators of conflict. Relative to the specific indicators, corrections/retouching or shading and blotting in the drawings represent the expression of anxiety or conflict, in addition, differentiated treatment represents these expressions. In the drawing, the omission of body parts and faces indicate zones of tension. Emphasis on instruments or equipment shows experience progression or how the child views the dentist. Thus, small figures could give thoughts of insecurity, shyness, and feelings of discredit.

Statistical analysis was performed using the IBM SPSS Statistics 25.0 Program (SPSS Inc., Chicago, IL). Mean and standard deviation or median (min-max) values were given for descriptive statistical analyses. A repeated measures Analysis of Variance was used to examine pre-post treatment differences according to gender differences, previous dental experience, and age differences on CD: H. Analysis consisted of cross-tabulations, with McNemar tests for paired data, to examine the difference between pre-and postMassoni scores according to age, previous dental experience and gender. The statistical level of significance was set at $P < .05$.

Results

The study consisted of 69 girls (54%) and 60 boys (46%) with a mean age of 5.23 ± 0.70 of 129 children. The number of children who had previous dental visits was 67 (52%). The average time spent for drawings was 14 minutes. The samples of children's drawings are shown in Figure 3.

The mean scores for the CD: H method (mean ± SD) were 84.27 ± 31.54 before education and 68.07 ± 29.61 after education. The difference in drawing groups between before and after education was found to be statistically significant, which meant children had less anxiety after education (F (1,127) = 34.57, P = 0.001, ω^2= 0.78). However, there were no associations in both drawing groups regarding gender (P = 0.896).

A statistical difference was observed in the scores before and after the education in the group of children

Table 1: Comparison of pre and posteducation drawing according to gender

Gender	CD: H			Massoni		
	Mean	Standard Deviation	*F*	Negative	Positive	*P*
Before education						
Girls	83.74	35.47	34.57*	28	39	0.001*
Boys	84.89	26.36		34	24	
After education						
Girls	67.22	30.50		18	49	
Boys	69.08	28.74		15	43	

*Indicated a statistically significant difference (P<0.05)

Section A	1	2	3	4	5	6	7	8	9	10
Position of person	Standing-grounded	Standing-not grounded	Standing		Sitting in chair			Lying in chair	Lying in chair, covered	Floating or no person
Action	Visibly moving		Person or Picture lively		Shows some life		Potential for movement	No movement but life		Rigid, no life
Length of person	Body tall, occupies whole paper	Tall body, appropriate to picture	Short body, appropriate to picture		Short people, bodies exposed		Very small, constricted people	Upper torso only	Head only, covered body	Floating head, no body
Width of person	Width appropriate to length	Width slightly reduced compared to length	Width thin compared to length, clothed	Body thin not clothedor appropriate but not clothed	Appropriate body size, covered	Stick figures with clothing	Stick figures, not clothing	Very thin body or stick figure, covered	Ambiguous body shapes	No body, floating head, no evidence of body under covers
Facial expression	Smile		Half smile		Neutral		Half frown		Frown	No face, no expression
Eyes/pupils	Appropriate size		Slightly bigger		Unmatched size of pair	Piercing	Pinpoint	Closed	Vacant,unseeing	No eyes
Size of person in comparison to environment	Appropriate size		Medium to small		Small			Very small		Tiny, overwhelmed
Color predominance	Yellow		Green		Blue	Orange	Purple	Brown	Red	Black
Number colors used	8	7	6		5	4	3		2	1
Use of paper	All		3/4		1/2			1/4		Restricted 1/8
Placement on paper	In the fullcenter,	In the half center	Right half of the paper	Left half of the paper	Bottom half of the paper	Upper half of the paper	Right bottom quarter of the paper, near to the edges	Left bottom quarter of the paper, near to the edges	Right upper quarter of the paper, near to the edges	Left upper quarter of thepaper, near to the edges
Quality of strokes	Firm, dark		Dark, some lights		Medium, equal light and dark			Light		Very light
Dental equipment	None included		Proportional in size		Slight increase in size			Larger equipment		Large and threatening
Developmental level	Above normal		Normal		Slightly below normal		Below normal			Markedly below normal

a

Number:

Age: **Gender:**

SECTION A

1. Person: Position .....
2. Action: .....
3. Length of Person .....
4. Width of Person .....
5. Facial expression .....
6. Eyes .....
7. Size of person to environment. .....
8. Color: Predominance .....
9. Color: Number used .....
10. Usage of paper .....
11. Placement .....
12. Strokes: Quality .....
13. Dental Equipment .....
14. Developmental Level .....
Section A – Total Score: .....

SECTION B

Add 5 points for each

15. Omission: For one part .....
16. Exaggeration of a part. .....
17. Deemphasis of a part .....

Add 10 points for each

18. Distortion .....
19. Omission: Two or more parts .....
20. Transparency .....
21. Mixed profile .....
22. Shading

Section B – Total Score: .....

SECTION C:

Circle the number which most clearly describes the Gestalt (form, shape, integrity) of the drawing

1 2 3 4 5 6 7 8 9 10

Section C – Total Score: .....

Total Score: A .... +B .... + C .... = ...

b

Figure 1: (a) CD: H rating scale, (b) CD:H Scoring Sheet

Table 2: Comparison of pre and posteducation drawing according to previous dental visits

Previous dental visit	CD: H			Massoni		
	Mean	Standard Deviation	*F*	Negative	Positive	*P*
Before education						
Yes	86.55	33.25	36.75*	32	29	0.001*
No	84.33	30.45		33	35	
After education						
Yes	71.53	30.04		18	43	
No	66.33	29.85		16	52	

*Indicated a statistically significant difference ($P<0.05$)

Table 3: Comparison of pre and posteducation drawing according to ages

Age	CD: H			Massoni		
	Mean	Standard Deviation	*F*	Negative	Positive	*P*
Before education						
4	95.89	30.86	33.92*	13	7	0.23
5	82.59	30.95		29	30	
6	84.62	32.67		23	27	0.004*
After education						
4	73.53	32.21		8	12	
5	67.53	32.32		14	45	0.02*
6	68.44	30.04		12	52	

*Indicated a statistically significant difference ($P<0.05$)

who had previous dental experience and those who did not (F (1,125) =36,75, P = 0.001, ω^2=0.77). However, the statistical differences within groups were not significant for before and after education regarding previous dental experience (P = 0.585).

There was no significant difference in pre-education scores in terms of 4-, 5-, and 6-year-old age groups, the same result was also detected in posteducation scores (P = 0.660). When each age group was evaluated within itself, an association was noticed between pre and

GENERAL IMPRESSION OF DRAWING				
Negative: ( )		Positive: ( )		
Hostility, agresiveness, sadness, antipathy, indifference, authoritarianism		Politeness, sympathy, happiness, affectiveness		
SPECIFIC INDICATORS				
Indicators of conflict	Corrections and/or retouching		Shadowing and/or blotting ( )	
Areas with differentiated treatment	Yes ( )	No ( )	Area: …….	
Omission of parts of the human figure	Yes ( )	No ( )	Part omitted: …….	
Emphasis on equipment/instruments	Yes ( )	No ( )	Equipment/instrument: ……	
Patients's face (if present)	Happy, cheerful ( )	Sad ( )	Indifferent ( )	Other:
Dentist's face	Happy, cheerful ( )	Sad ( )	Indifferent ( )	Other:
Small patient (in relation to the dental chair)	Yes ( )	No ( )	There is no patient ( ) There is no dental chair ( )	
Small patient (in relation to the dentist)	Yes ( )	No ( )	There is no patient ( ) There is no dentist ( )	
Conclusion:				

Figure 2: Children's drawings sheet adapted from Massoni *et al*.[11]

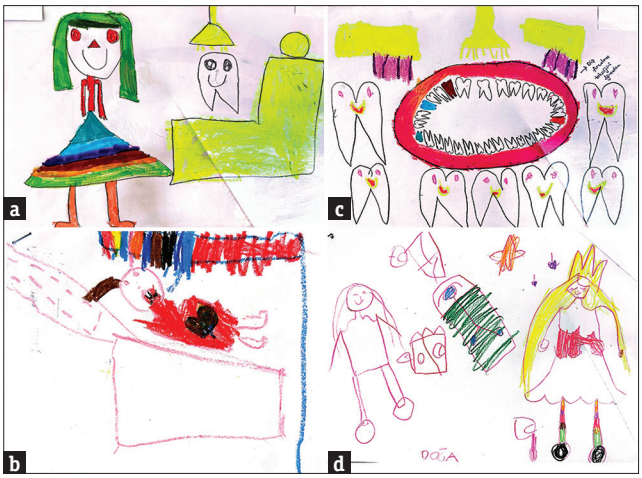

Figure 3: Samples of children's drawings. (a) The pre-education drawing of a five-year-old boy shows a dentist and a tooth lying on a dental unit with a happy face. The color of the drawing is very bright (CD: H =30; Massoni = positive), (b) The posteducation drawing of the same boy shows an exaggeration of a big mouth but with happy teeth. The drawing depicts a healthy mouth. Many teeth are arranged properly in the mouth and there are many smiling white teeth outside the mouth (CD: H =33; Massoni = positive). Besides, there are some toothbrushes in the drawing, (c) The pre-education drawing of a 5-year-old girl shows a child lying on a dental unit with a terribly scared face, piercing pupils, and a dominant color of red (CD: H =77; Massoni = negative), (d) The postdrawing of the same girl depicts positive people. The drawing shows two happy dentists near the child, one wearing a princess crown. There is less exaggeration of fear than the first drawing (CD: H =29; Massoni = positive)

posteducation scores in each group (F (2,126) =33.92, P = 0.001, ω^2=0.78).

Massoni's method showed that 64 positive perceptions among children before education increased to 95 after education, demonstrating a statistical difference between the pre and posteducation drawings ($P < 0.001$). In terms of gender, a higher frequency of positive perception among boys was observed after education compared with before education ($P < 0.001$) [Table 1]. Although there was an increase in positive perception after education in girls, the difference did not reach the level of significance ($P = 0.09$) [Table 2]. Statistically significant differences were observed in both groups of children who had previous dental experience and those who did not ($P = 0.002$; $P = 0.006$, respectively) [Table 3]. As regards the age group, while in the 4-year-old group, there was no association in positive perception between pre and posteducation, statistical differences were found in the 5-year-old and 6-year-old group, separately ($P = 0.004$; $P = 0.019$).

Discussion

Anxiety is one of the major problems that makes the child negative for dental treatment, thus, it is essential to overcome the distress and understand the child's perception of dentistry. Drawing as a projective self-report technique is an advantageous method for getting information about children's feelings and experiences.[8] This nonverbal method can be easily used without any special training and allows children to express themselves individually. In addition, it is a useful method for children who have difficulty in expression, cultural problems, and language limitations.[13] In this respect, we aimed to learn children's initial dental insights as well as distress and to reduce anxiety by providing education and preferred to achieve the gains through drawings with two different analyzing methods. The results of this study revealed that posteducation drawing scores had a higher success rate in both methods, which was significant for the efficacy of the education.

Different methodologies for the analysis of drawing were described by many authors.[6,10,11,14-17] Some researchers evaluated the children's drawings with verbal expressions, conducting the study in a dental school or hospital,[14,18] differently, De Mendonça *et al*.[19] performed their study in the school and assessed the drawings by using the Massoni Method, which is a subjective method and analyzes the drawings according to specific indicators. Several authors have analyzed the drawings with the CD: H method and compared them with SEM and Frankl as objective behavioral anxiety measures and found a significant positive direct linear correlation between them.[4,10,13] Although the CD: H method is recommended to be used in the hospital environment, we preferred to use it as well as the Massoni Method in a school environment in our

study; because its reliability and effectiveness have been proven and it offers a categorical evaluation.

Managing dental anxiety in preschool children and bringing positivity to the child's perception would make the experience for the child undergoing treatment more pleasant.[20] This study was conducted in children's environment with the idea that dental clinics pose a risk of fear and was aimed to gain their opinions without their parents. We managed to reduce anxiety via oral health promotion education. The results of this study revealed a significant positive improvement in posteducation drawings regarding the child's dental perception. Similar to our study, Pacheco *et al.*[21] demonstrated an understanding of children's tooth care through drawings. In their study, children participated in an Oral Health Education Program (OHEP) at the school, and data were collected after one academic year. The children showed satisfactory learning on tooth care, indicating the importance of oral health education programs. Kiran *et al*.[15] observed significant reductions in dental stress levels in the drawings that were made after play therapy. Several authors confirmed the benefit of oral care education in their studies conducted on children.[22-24] However, the majority of the studies regarding oral health education interventions were performed among mothers or caregivers for their child's well-being oral health.[25-27] It is important to note that dental and oral health promotion education must be encouraged in children at an early age to reduce dental fear and disassociate oral care from negative situations. According to Mueller *et al*.,[28] dental distress was related to current negative feelings when visiting a dentist and negative dental-related experiences during childhood. Parallel to this aspect, the results of our study indicate the need for policies designed to promote asymptomatic visits to the dentist for kindergarten children since it is not known if the same effect would be achieved in a clinical environment.

In this study, according to pre-education drawings, the CD: H score of the children was at the least level of average stress. Based on the Massoni method, we found a positive perception in half of the children whereas several authors demonstrated it in the majority of the children.[18,19] In our study, children who had visited a dentist before had no less anxiety compared with those with no previous dental experience before education, in contrast, De Mendoça *et al*.[19] stated four times more likely to have a positive perception of dental experienced children. According to Costa and Arriaga,[29] dental experiences could encourage more confidence in the child, and consequently a positive perception.

In this study, statistically significant differences were observed between pre and posteducation drawings in 4-year-old and 6-year-old children. Older children improved themselves more than younger ones. A similar result was obtained by Stafstorm *et al.*[17] which headache types were diagnosed with drawings. However, another study found that 6-year-old children had a more negative perception of the dentist compared with 4-year-old ones.

In the literature, there were controversial results regarding gender as was found in this study. According to CD: H method results between genders, we perceived no significant difference, whereas the more positive perception was seen in boys in the Massoni method. Although the difference between gender scores was found to be significant by some researchers,[18,19] was not observed by others.[4,13]

Drawings were determined to have a positive or negative relationship evaluating according to specific criteria. Shades/botting and dark colors are leading to the thought of anxiety. Enlarging the size of the limbs or omitting body parts and faces characterizes a higher tension.[8,11] In addition, equipment or instruments drawn as larger and threatening indicate high anxiety. In this study, children with high levels of anxiety drew pictures with very big mouths, poor proportion of body, poor integration of limbs, shading, unhappy faces, and an inharmonious and asymmetrical aspect. In contrast, in the drawings of children with low anxiety or positive perception were observed a harmonious and symmetrical aspect, proper body portions, depictions of friends or family members, happy expressions, and centralized location. These findings were in the same direction as the results published by De Mendonça *et al.,*[19] Guner Onur *et al*.,[13] and Aminabadi *et al.*[4]

The strength of our study is that it is the first study in the literature that evaluated children's perception of dentists with drawings by providing oral education. Secondly, as the children expressed their opinions on paper without restrictions and parents, the collected data through drawings were the pure opinions of the children who showed dental distress. Thirdly, in our study, sociocultural levels were similar which was important in order not to make a significant difference in the individual expressions' children gave.

The limitation of this study is that the author did not collect any data regarding which dental treatment was performed on children who had previously visited the dentists.

Although in this study children exhibited a significant positive perception of dentists and dental offices after education, however, Kilinc *et al.*[30] in their study stated that oral healthcare education given to children

at younger ages in the kindergarten environment is not enough to reduce dental anxiety levels. Further studies regarding education in a dental clinic are crucial to disabling children's anxiety.

Based on the results of this study, it can be concluded that oral health education at younger ages is effective in overcoming dental anxiety and improving the positivity of dental perception. Drawing is a proper assessment tool for learning about the child's notions and feelings.

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Conflicts of interest

There are no conflicts of interest.

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