

# Procedural Pain and Anxiety in Pediatric Patients in a Mexican Dental Clinic

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## Abstract

**Background:** In dental examining rooms, children experience diagnostic and therapeutic pain related to dental procedures that may be associated with anxiety. Therefore, the main objective of the present study was to evaluate anxiety and pain levels related to dental procedures in children.

**Methods:** Children in a Mexican pediatric dental clinic rated their dental anxiety using the Modified Dental Anxiety Scale (MDAS), the Children's Fear Survey Schedule Dental Subscale (CFSS-DS) and a 100-mm Visual Analogue Scale (VAS). Pain was evaluated with the VAS.

**Results:** A total of 437 children with a mean age of 9.8 ( $\pm 2.2$ ) years were evaluated. Four hundred eighty-one dental procedures were completed. The averages in the MDAS and the CFSS-DS were 8.5 ( $\pm 3.4$ ) and 22.7 ( $\pm 7.6$ ), respectively. Of all dental procedures, 275 (57.2 %) were rated as stressful prior to their realization, 222 (46.2 %) were stressful during their realization and 175 (36.4 %) were rated as painful. Overall, 12.6 % of the painful events were rated as severe, 25.1 % were rated as moderate, and 62.3 % were rated as slight.

**Conclusion:** This study provides data on common procedures performed in dental clinics that cause pain and anxiety in children and young adolescents. Dentistry must consider the best non-pharmacological and pharmacological interventions to reduce dental anxiety and pain.

*Key words: Pain, Anxiety, Dental procedures, Pediatric patients*

## Introduction

Dental procedural pain involves the anticipation of pain and the anxiety that is associated with the unknown. This anxiety may be magnified if a child has had a previous unpleasant experience, which increases the pain response [1-3]. Child dental fear is a factor that can significantly affect children's oral health as well as the quality of dental treatment received. Anxious children tend to avoid dental care and tend to have worse oral health compared with their less anxious and more cooperative peers [4,5]. The frequency of dental anxiety among children has been reported to range between 3 and 43.4% [6,7]. Several factors can influence dental anxiety in children; examples include age, sex, temperament, internalizing and externalizing problems, and previous dental experience. Anticipation is crucial for the management of dental pain and distress. The prevention of dental pain and anxiety should be multidimensional and include environmental, nonpharmacological, and pharmacological interventions [3, 6,8-10]. Environmental methods for the reduction of pain and distress include adequate preparation of the parent and the child; the creation of a calm, nonthreatening environment; anticipation of and planning for each child's expected distress, and staff training in coping-promotion behaviors. Nonpharmacological and behavioral approaches to pediatric dental pain and anxiety are rooted in the gate-control theory, which suggests that descending nerve impulses from the brain, such as thoughts, beliefs, emotions, and attention, influence the ascending pain signal from the damaged tissue [11,12]. Distraction, hypnosis, deep breathing, blowing, suggestion, superhero imagery, rewards, and cognitive behavioral therapy effectively reduce the pain and distress of dental procedures [10,13-16]. The effect of parental presence on children's pain and distress responses has been mixed and likely depends on

the parent's own anxiety level, parent-child interactions and the parent's ability to help the child cope effectively [1,17-21].

As mentioned in a previous investigation, neither the Mexican government nor any Mexican medical or dental society has issued or published a policy statement for the treatment of dental procedural pain and anxiety in children. Consequently, the assessment and treatment of dental pain and anxiety in dental clinics are performed at the discretion of each public and private healthcare institution. Therefore, our hypothesis is that children suffer considerable pain and anxiety in dental clinics. The present study examined dental pain and anxiety in children and adolescents (8–16-year olds) who were admitted to the dental clinic of a Mexican pediatric hospital.

## Materials and Methods

The aim of this study was to evaluate dental procedural pain and anxiety in children and adolescents in a Mexican dental clinic. A prospective, descriptive, analytical, and cross-sectional study was conducted to investigate the prevalence of procedures or situations that likely induced anxiety and/or pain in children in an examining room. All of the children and adolescents who attended the dental clinic at the Mexican pediatric hospital were registered, and the researchers were contacted. The study recruited and followed eligible children and adolescents. Children and adolescents who met the following criteria were included: 8-16 years old, conscious, able to respond adequately and appropriately to dentistry staff questions, and who, together with their parents, agreed to participate in the study. The study was performed in a Mexican public pediatric tertiary referral hospital, which is an adolescent and children's hospital that cares for newborns to patients 17 years of age. The hospital is in an urban area, and it

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receives patients of low and middle socioeconomic status. The dental clinic has seven examining chairs and approximately ten pediatric dentists. These personnel performed all of the procedures. The researchers explained the objective of the study to the children and their parents, obtained written consent, and gathered baseline information about the patient's medical history. The researchers collected all of the data.

### **Anxiety and pain scales**

A Case Report Form (CRF) was used to obtain the individual patient data required by the study. Data were acquired in three different sections of the CRFs.

The first section collected data using nineteen questions from two tests (the Modified Dental Anxiety Scale (MDAS) and the Children's Fear Survey Schedule Dental Subscale (CFSS-DS)) regarding fear or distress in different situations related to visiting the hospital's dental clinic [22-25]. The CFSS-DS consisted of 14 items, and the MDAS comprised 5 items to be answered on a 5-point scale ranging from 1 (not afraid at all) to 5 (very afraid). One item from the CFSS-DS was eliminated (Having the nurse clean your teeth). This item is related to the fear of any unfamiliar person who helps the dentist. However, in our hospital, dentists perform oral prophylaxis.

In the second section of the CRF, the researchers ascertained the children's fear and anxiety prior to and during the procedures with the pediatric dentist. The patients were asked to rate their procedure-induced anxiety or fear level on a visual analogue scale (VAS; 0-100 mm, where 0 indicates no fear or anxiety and 100 indicates maximum fear or anxiety). Procedural anxiety was defined as a specific phobia in which an individual fears situations or objects. A blood-injection-injury type of phobia was diagnosed if an individual's fear was cued by seeing an injury, blood or a needle or other invasive medical treatment [26]. In this same section, the researchers ascertained the children's pain during and after the dental procedures. The children were asked to rate dental procedure-induced pain on a VAS (0-100 mm, where 0 indicates no pain and 100 indicate maximum pain). The same process was repeated when children received more than one dental procedure. Procedural pain is defined as an unpleasant sensory and emotional experience that is produced by an act or activity directed at or performed on an individual with the objective of improving health, treating dental disease or injury, or making a dental diagnosis [14,27-29].

In the third section of the CRF, the VAS was used by parents to rate the dental procedure-induced anxiety and pain levels suffered by their children. Our data included demographic and clinical information. The VAS is a useful and valid tool for dental pain and anxiety assessment in routine clinical practice with children [4,30-34]. The Ethics and Investigation Committees approved the study protocol, and the study was performed according to the guidelines delineated by the Declaration of Helsinki.

### **Data analysis**

Data were entered into a computerized database. SPSS version 17 for Windows (SPSS Inc., Chicago, IL, USA) was used for descriptive and inferential statistical analyses. An exploratory analysis was performed using the Pearson Chi-squared test. Pearson correlation coefficients were calculated to determine the association between relevant

variables. Dental procedural pain and anxiety were analyzed using logistic regression analysis. Pain and anxiety were the dependent variables, and gender, age, and diagnosis were potential predictors. A stepwise logistic regression analysis was used for multivariable analyses. The significance level was set at  $p < 0.05$ .

## **Results**

### **Participants**

A total of 452 children were evaluated between January and December 2012. Of these children, 437 had complete data and were retained in the analysis. Two hundred and fifty children were boys (57.2%); and 187 were girls (42.8%). The children had a mean age ( $\pm$ SD) of 9.8 ( $\pm$ 2.2) years. The main reasons for dental clinic admissions were caries (46.2%), healthy child visits (32.0%), cleft lip and palate (10.1%), and others (11.7%).

### **MDAS and CFSS-DS tests**

Anxiety levels in different situations related to the visit to the dental clinic are shown in *Table 1*. The general averages in the MDAS (5 items) and the CFSS-DS (14 items) were 8.5 ( $\pm$ 3.4) and 22.7 ( $\pm$ 7.6), respectively. The averages in the MDAS in girls and boys were 8.5  $\pm$  3.3 and 8.5  $\pm$  3.5, respectively; in children  $\geq$  12 years and  $<$ 12 years, the averages were 8.7  $\pm$  3.6 and 8.3  $\pm$  2.4, respectively. The anxiety level in the MDAS was not significantly different between genders or the two age groups ( $p > 0.05$ ). The averages in the CFSS-DS in girls and boys were 23.3  $\pm$  7.6 and 22.2  $\pm$  7.6, respectively; in children  $<$ 12 years and  $\geq$  12 years, the averages were 23.2  $\pm$  8.0 and 21.3  $\pm$  6.0, respectively. The  $\geq$  12 years group presented a minor significant difference in the anxiety level in the CFSS-DS compared with the  $<$ 12 years group ( $p = 0.03$ ). The anxiety level in the CFSS-DS was not significantly different between genders ( $p > 0.05$ ).

Waiting for an anesthetic injection in the dental chair, injections, the dentist using the drill, the sight of the dentist drilling and the noise of the dentist drilling were significantly different from the other variables ( $p < 0.05$ ) (*Table 1*). Female gender was associated with the fear "someone will observe you" ( $p < 0.05$ ; Pearson Chi-squared test).

### **Dental pain and anxiety rated by children with the VAS**

Dental procedures were grouped into 6 different classes of procedures (*Tables 2-4*). The children underwent a total of 481 dental procedures, with an average (SD) of 1.1 (0.3) events/child; 275 of these procedures (57.2%) produced anxiety prior to their realization; 222 of the procedures (46.2%) were stressful during their realization, and 175 (36.4%) were painful. The averages with on the VAS were 38.9 ( $\pm$ 24.02) mm, 42.6 ( $\pm$ 26.9) mm and 40.2 ( $\pm$ 7.6) mm for anxiety prior to, stressful during, and painful during the procedures, respectively.

Operative dentistry (45.7%), prevention (22.3%), and dental extraction (21.1%) were the most frequently reported procedural pain episodes. Similarly, prevention (prior to= 35.3% and during=30.2%) and operative dentistry (prior to= 27.6% and during=31.5%) were the most frequently reported stressful procedures (*Tables 2-4*). Before the procedures, 8.4% of the stressful events were rated as severe, 32.0% were rated as moderate, and 59.6% were rated as slight. After

**Table 1.** Fear or anxiety in different situations related to visiting the hospital dental clinic (n=437). The first 5 items correspond to the Modified Dental Anxiety Scale (MDAS), and the other 14 items correspond to the Children's Fear Survey Schedule Dental Subscale (CFSS-DS).

	All Children	Boys	Girls	<12 years	≥12 years
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
<b>1. Visiting the dentist</b>	1.5 (0.9)	1.6 (0.9)	1.5 (0.9)	1.6 (0.9)	1.4 (0.7)
<b>2. Waiting for consultation</b>	1.4 (0.8)	1.4 (0.8)	1.4 (0.7)	1.4 (0.8)	1.4 (0.7)
<b>3. Awaiting treatment in the dental chair</b>	1.7 (1.0)	1.7 (1.0)	1.7 (1.0)	1.7 (1.1)	1.7 (0.9)
<b>4. Waiting for cleaning or prophylaxis in the dental chair</b>	1.5 (0.9)	1.6 (1.0)	1.5 (0.9)	1.5 (0.9)	1.5 (0.9)
<b>5. Waiting for anesthetic injection in the dental chair</b>	2.4 (1.4)	2.3 (1.4)	2.4 (1.5)	2.3 (1.5)	2.4 (1.3)
<b>1. Dentists</b>	1.2 (0.7)	1.2 (0.7)	1.2 (0.6)	1.2 (0.7)	1.2 (0.6)
<b>2. Physicians</b>	1.3 (0.8)	1.3 (0.8)	1.3 (0.7)	1.3 (0.8)	1.1 (0.5)
<b>3. Injections (shots)</b>	3.0 (1.5)	2.9 (1.5)	3.0 (1.5)	3.0 (1.6)	2.8 (1.4)
<b>4. Having somebody examine your mouth</b>	1.4 (1.0)	1.3 (0.9)	1.6 (1.1)	1.5 (1.0)	1.2 (0.7)
<b>5. Having to open your mouth</b>	1.3 (0.8)	1.3 (0.8)	1.3 (0.9)	1.4 (0.9)	1.1 (0.4)
<b>6. Having a stranger (dentist) touch your face or mouth</b>	1.6 (1.2)	1.6 (1.1)	1.7 (1.3)	1.8 (1.3)	1.2 (0.6)
<b>7. Having someone look at you</b>	1.5 (1.1)	1.4 (0.9)	1.7 (1.2)	1.6 (1.2)	1.2 (0.6)
<b>8. The dentist drilling</b>	2.1 (1.3)	2.1 (1.3)	2.1 (1.2)	2.0 (1.3)	2.2 (1.1)
<b>9. The sight of the dentist drilling</b>	1.8 (1.2)	1.7 (1.1)	1.8 (1.2)	1.7 (1.2)	1.9 (1.0)
<b>10. The noise of the dentist drilling</b>	1.8 (1.2)	1.8 (1.2)	1.9 (1.2)	1.8 (1.2)	1.9 (1.1)
<b>11. Having somebody put instruments in your mouth</b>	1.6 (1.0)	1.5 (1.0)	1.6 (1.0)	1.6 (1.1)	1.5 (0.8)
<b>12. Choking</b>	1.6 (1.1)	1.6 (1.1)	1.7 (1.1)	1.7 (1.2)	1.4 (0.8)
<b>13. Having to go to the hospital</b>	1.4 (0.9)	1.4 (0.9)	1.4 (0.8)	1.4 (0.9)	1.4 (0.9)
<b>14. People in white uniforms</b>	1.1 (0.5)	1.1 (0.5)	1.1 (0.6)	1.2 (0.6)	1.1 (0.3)

**Table 2.** Anxiety levels rated by children with the VAS prior to the procedures (n=275).

Type of procedure	N (%)	Anxiety level		
		Slight N (%)	Moderate N (%)	Severe N (%)
Preventive dental care	97 (35.3)	65 (67.0)	21 (21.6)	11 (11.3)
Operative dentistry	76 (27.6)	42 (55.3)	27 (35.5)	7 (9.2)
Clinical history	37 (13.5)	21 (56.8)	14 (37.8)	2 (5.4)
Extraction	35 (12.7)	14 (40.0)	18 (51.4)	3 (8.6)
Orthopedic and dental devices	24 (8.7)	18 (75.0)	6 (25.0)	0 (0.0)
Maxillofacial surgery	6 (2.2)	4 (66.7)	2 (33.3)	0 (0.0)
All procedures	275 (100)	164 (59.6)	88 (32.0)	23 (8.4)

**Table 3.** Anxiety levels rated by children with the VAS after the procedures (n=222).

Type of procedure	N (%)	Anxiety level		
		Slight N (%)	Moderate N (%)	Severe N (%)
Preventive dental care	70 (31.5)	40 (57.1)	19 (27.1)	11 (15.7)
Operative dentistry	67 (30.2)	43 (64.2)	20 (29.9)	4 (6.0)
Clinical history	36 (16.2)	11 (30.6)	16 (44.4)	9 (25.0)
Extraction	25 (11.3)	14 (56.0)	6 (24.0)	5 (20.0)
Orthopedic and dental devices	18 (8.1)	14 (77.8)	3 (16.7)	1 (5.6)
Oral surgery	6 (2.7)	2 (33.3)	0 (0.0)	4 (66.7)
All procedures	222 (100)	124 (59.9)	64 (28.8)	34 (15.3)

the procedures, 15.3% of the stressful events were rated as severe, 28.8% were rated as moderate, and 59.9% were rated as slight. Overall, 12.6% of the painful events were rated as severe, 25.1 % were rated as moderate, and 62.3 % were rated as slight.

None of the independent variables (gender, age, diagnostics, or procedures) predicted the presence of anxiety prior to and pain during the dental procedure ( $p>0.05$ ; Pearson Chi-squared test). However, the variable age (<12 years) ( $p<0.05$ ; Pearson Chi-squared test), but not gender,

diagnostics, or procedures, was related to the presence of anxiety during the procedures. Likewise, the presence of anxiety prior to and during the dental procedures predicted the presence of pain in the children ( $p<0.05$ ; Pearson Chi-squared test).

#### Dental pain and anxiety rated by parents with the VAS

Four hundred and three mothers and thirty-four fathers participated in the study. According to the opinion of the parents, 143 of the procedures (29.7 %) were stressful to their children, and 175 (36.4 %) were painful (Tables 5 and 6). Of

**Table 4.** Pain levels rated by children with the VAS according to the type of procedure (n=175).

Type of procedure	N (%)	Pain level		
		Slight N (%)	Moderate N (%)	Severe N (%)
Preventive dental care	80 (45.7)	51 (63.8)	21 (26.3)	8 (10.0)
Operative dentistry	39 (22.3)	25 (64.1)	12 (30.8)	2 (5.1)
Clinical history	37 (21.1)	19 (51.4)	9 (24.3)	9 (24.3)
Extraction	10 (5.7)	7 (70.0)	1 (10.0)	2 (20.0)
Orthopedic and dental devices	6 (3.4)	5 (83.3)	1 (16.7)	0 (0.0)
Oral surgery	3 (1.7)	2 (66.7)	0 (0.0)	1 (33.3)
All procedures	175 (100)	109 (62.3)	44 (25.1)	22 (12.6)

**Table 5.** Anxiety levels in children according to the type of procedure, scored by parents (n=143).

Type of procedure	N (%)	Anxiety level		
		Slight N (%)	Moderate N (%)	Severe N (%)
Preventive dental care	51 (35.7)	33 (64.7)	16 (31.4)	2 (3.9)
Operative dentistry	37 (25.9)	23 (62.2)	10 (27.0)	4 (10.8)
Clinical history	22 (15.4)	10 (45.5)	10 (45.5)	2 (9.1)
Extraction	16 (11.2)	9 (56.3)	6 (37.5)	1 (6.3)
Orthopedic and dental devices	12 (8.4)	9 (75.0)	3 (25.0)	0 (0.0)
Oral surgery	5 (3.5)	1 (20.0)	2 (40.0)	2 (40.0)
All procedures	143 (100)	85 (59.4)	47 (32.9)	11 (7.7)

**Table 6.** Pain levels in children according to the type of procedure, scored by parents (n=175).

Type of procedure	N (%)	Pain level		
		Slight N (%)	Moderate N (%)	Severe N (%)
Preventive dental care	68 (38.9)	47 (69.1)	16 (23.5)	5 (7.4)
Operative dentistry	43 (24.6)	32 (74.4)	5 (11.6)	6 (14.0)
Clinical history	39 (22.3)	20 (51.3)	15 (38.5)	4 (10.3)
Extraction	11 (6.3)	9 (81.8)	2 (18.2)	0 (0.0)
Orthopedic and dental devices	9 (5.1)	8 (88.9)	1 (11.1)	0 (0.0)
Oral surgery	5 (2.9)	1 (20.0)	2 (40.0)	2 (40.0)
All procedures	175 (100)	117 (66.9)	41 (23.4)	17 (9.7)

the stressful procedures, 138 (96.5 %) were rated by mothers and 5 (3.5%) were rated by fathers. There is no significant difference between the averages on the VAS rated by the mothers (38.4 ( $\pm$ 23.2) mm) and by the fathers (25.4 ( $\pm$ 19.7) mm) for anxiety ( $p=0.22$ ). Of the painful procedures, 162 (92.6 %) were rated by mothers, and 13 (7.4 %) were rated by fathers. There is no significant difference between the averages on the VAS rated by the mothers (35.2 ( $\pm$ 25.7) mm) and by the fathers (38.5 ( $\pm$ 28.1) mm) for pain ( $p=0.72$ ).

Of all the stressful procedures (n=143), 7.7 % were rated as severe, 32.9 % were rated as moderate, and 59.4 % were rated as slight. Likewise, 9.7 % of all painful procedures (n=175) were rated as severe, 23.4 % were rated as moderate, and 66.9 % were rated as slight (Tables 5 and 6).

The variable gender of the parents (mothers) was related to the VAS scores for dental anxiety and pain ( $p<0.017$ ; Pearson Chi-squared test). Significant correlation coefficients were found for the VAS scores of parents and children for dental anxiety and pain ( $p<0.05$ ) (Table 7). However, the following variables did not present significant correlation coefficients ( $p>0.05$ ): “amount of anxiety rated by children prior to the procedure” on “amount of pain rated by children”,

“presence of anxiety rated by parents” on “presence of pain rated by children”, “amount of anxiety rated by parents” on “amount of pain rated by children”, and “amount of pain rated by parents” on “amount of anxiety rated by children prior to the procedure”.

## Discussion

It is very common that the terms “dental anxiety” and “dental fear” are used interchangeably. Some authors define “dental anxiety” as a feeling of apprehension about dental treatment not necessarily related to a specific stimulus, while “dental fear” is a normal emotional reaction to one or more specific threatening stimuli in a dental situation [6,7]. A comparison of anxious and non-anxious children demonstrated that, fear was more strongly associated with children’s experience of pain and trauma than with objective dental pathology [4]. Worldwide statistical analysis has demonstrated that between 3 and 43.4% of children exhibit dental anxiety [6,7]. In our study, 57.2% of children presented anxiety prior to the dental procedures, and 46.2% of patients were anxious during the procedures. Several studies have

Table 7. Correlation coefficients for parents' and children's VAS scores for dental anxiety and pain.

	r	p
Children: anxiety prior on anxiety during	0.460	0.0001
Children: anxiety prior on presence of pain	0.143	0.0030
Children: anxiety during on presence of pain	0.328	0.0001
Children: amount of anxiety prior on amount of anxiety during	0.409	0.0001
Children: amount of anxiety prior on amount of pain	0.091	0.2490
Children: amount of anxiety during on amount of pain	0.298	0.0001
Parents: presence of anxiety on anxiety prior in children	0.145	0.0020
Parents: presence of anxiety on anxiety during in children	0.243	0.0001
Parents: presence of anxiety on pain in children	0.091	0.0570
Parents: amount of anxiety on amount of anxiety prior in children	0.104	0.0290
Parents: amount of anxiety on amount of anxiety during in children	0.187	0.0001
Parents: amount of anxiety on amount of pain in children	0.083	0.2950
Parents: amount of pain on amount of anxiety prior in children	0.086	0.2790
Parents: amount of pain on amount of anxiety during in children	0.212	0.0070
Parents: amount of pain on amount of pain in children	0.402	0.0001

shown a strong correlation between child dental anxiety and age, with anxiety being more pronounced in younger children compared to older children [2,6,7]. In our study, we found a correlation between dental anxiety and age, with the <12 years group being more affected according to both the CFSS-DS and the anxiety scored by the VAS. Similarly, girls have been shown to be more fearful than boys [35,36]. In our study, in children, the female gender was associated with the fear “someone will observe you” ( $p < 0.05$ ; Pearson Chi-squared test). However, no significant differences in total fear scores (CFSS-DS, MDAS or VAS) were found between girls and boys. Likewise, the variable gender of the parents (mothers) was related to the VAS scores for dental anxiety and pain. This result is in accord with the results of the study by Olak [37], where there was a strong correlation between children's dental fears and maternal dental fear ( $p < 0.01$ ). Unfortunately, children of anxious mothers are more likely to present untreated caries [38]. Therefore, it is important to identify this type of problem to improve the dental health of all members of the family.

There are several scales to evaluate the level of dental anxiety in children. The MDAS and the CFSS-DS estimate anxiety about different situations related to visiting the hospital's dental clinic [22-24]. The CFSS-DS consists of 15 items, and the MDAS comprises five items to be answered on a 5-point scale ranging from 1 (not afraid at all) to 5 (very afraid). The sum of the scores may range from 15 to 75, with higher scores indicating higher dental anxiety. Both scales have been widely used in different populations, and they have good reliability and validity. However, there is a lack of consensus about the cutoff scores for high dental anxiety. In the case of the CFSS-DS, these values range between 32 and 45 [23,35,39]. In our study, the mean CFSS-DS score was 22.7 ( $\pm 7.6$ ). The score found in the present study was lower than those cutoff scores for high dental anxiety. However, our results cannot be compared with scores found in other studies because we eliminated one item from the CFSS-DS (Having the nurse clean your teeth). This item was eliminated because in our dental clinic, the dentist cleans the patient's teeth. We

did not find any study in the literature without that item.

On the other hand, a score of 13 on the MDAS means that children have dental anxiety, and a score  $\geq 15$  means a high level of anxiety in children [23,40]. In our study, the mean MDAS score was 8.5 ( $\pm 3.4$ ). This result is lower than the scores found in other studies [40-42]. We believe that our study population presented a low level of dental anxiety according to the MDAS.

The 100-mm VAS is a useful and valid tool for the assessment of pain and anxiety in clinical dental practice [4,30-34]. In our study, the VAS was used to evaluate the anxiety level prior to and during the dental procedures. Using the VAS to evaluate dental anxiety, Townend [4] classified “anxious children” as having scores from 50 to 100 mm and “nonanxious children” as having scores from zero to 50 mm. In our study, children presented a score of 38.9 mm for anxiety prior to the dental procedure and 42.6 mm for anxiety during the dental procedure. These values are lower than the scores suggested by Townend [4] to classify anxious children.

Choking, injections and drilling have been found to be among the most feared items in several studies [35,39,43-46]. In this sense, avoidance of regularly visiting the dentist is strongly attributed to severe dental anxiety or fear of painful procedures, particularly the administration of local anesthesia (injections) and drilling [35,39,43-46]. For example, two studies reported on pain experienced during injection; pain was commonly experienced during needle insertion, needle placement, and solution deposition [9,47]. In accord with the previous findings, our study demonstrated that “Injections”, “The dentist drilling”, “The sight of the dentist drilling” and “The noise of the dentist drilling” were the most common procedures that produced anxiety in children. The child's behavior may be viewed as the outcome of his/her dental fear, temperament and ability to cope with invasive situations. For some children, their behavior might also depend on factors such as the individual dentist or the nature or invasiveness of the dental visit. Children may learn to control the way they exhibit their fear as they grow older, and subsequently, this may lead to a decrease of inappropriate behavior perceived and reported

by others. The development of high levels of dental fear may be prevented or halted by providing these children with extra attention and a proper behavioral management approach, and they may thus be guided towards a more adequate coping style. The provision of information about sensations and procedures reduced the rated anxiety about and painfulness of dental procedures to negligible levels [8]. The American Academy of Pediatric Dentistry (AAPD) published guidelines for behavior management of the pediatric dental patient, which may be used to decrease the dental anxiety and pain in children. Communication and communicative guidance, tell-show-do, nonverbal communication, positive reinforcement, distraction, parental presence/absence and nitrous oxide/oxygen inhalation are mentioned in the guidelines [3]. Here, distraction is the technique of diverting the patient's attention from what may be perceived as an unpleasant procedure. Giving the patient a short break during a stressful procedure can be an effective use of distraction prior to considering more advanced behavior guidance techniques. For example, a study demonstrated that a magic trick can facilitate the movement of the child into the dental chair, and it enables the dentist to take radiographs more easily [48]. Likewise, studies have demonstrated the utility of audiovisual distraction techniques, such as the use of virtual reality eyeglasses or video clips, in successfully decreasing pain perception and anxiety during dental treatment [49, 50].

The effective management of pain in children is a major priority for children, parents and healthcare providers, and this issue has been highlighted as a priority in several countries. An abundance of acute pain research in children performed over the last 20 years has led to the development of international

pediatric pain standards and guidelines [27,51,52]. Environmental, pharmacological and nonpharmacological strategies are suggested for the treatment of dental procedure-related pain in children.

Unfortunately, dental pain and anxiety in children remain inadequately and poorly managed, which leads to unnecessary suffering in the pediatric population [9,31,34,47]. This problem was in the present study: 57.2% of the procedures produced anxiety prior to their realization; 46.2% of the procedures were stressful during their realization, and 36.4% were painful. Therefore, an evaluation of different strategies to decrease procedural pain and anxiety in this population is required.

There are three main limitations to our study design that should be noted. First, our global total score in the CFSS-DS (22.7) cannot be compared with the total scores of other studies because we eliminated question 15 (Having the nurse clean your teeth). Second, our sample was based on a single hospital; thus, our results may not be representative of all children in our urban area or country. Finally, the last limitation was the lack of data on educational levels and socioeconomic status of the parents. The dental anxiety and pain levels in children may be explained in part by these variables.

This study provides data on common dental procedures that cause pain and anxiety in children and young adolescents. Healthcare providers must consider the best psychological (communication and communicative guidance, tell-show-do, nonverbal communication, positive reinforcement, distraction, parental presence/absence) and pharmacological (nitrous oxide/oxygen inhalation) interventions to reduce dental anxiety and pain in children.

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