



Original Article

## Dental Anxiety and Behavior in Young Children Undergoing Different Distraction Techniques

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### Abstract

**Objective:** To evaluate anxiety and behavior in groups of children undergoing various distraction techniques during dental treatment in a public clinic. **Material and Methods:** The research was a randomized study with a systematic convenience sample consisting of 62 children with 4-6 years ( $5.18 \pm 0.77$ ) in both genders; they were divided in four groups (G1 - control group and three experimental Groups: G2 - mirror and conversation, G3 - toys and G4 - children's stories) and evaluated in the first 2 visits to the dentist. Age and previous experience were also evaluated. The Facial Image Scale (FIS) and the Behavior Rating Scale (BRS) were applied, the data was analyzed using the Chi-square test with a significance level of  $p < 0.05$  and the Spearman correlation coefficient. **Results:** In comparison to the studied variables (anxiety and behavior), the distraction technique during dental care could not reduce anxiety and improve the behavior in all groups in the first visit, but the group receiving the distraction technique with a hand mirror reached the best results in behavior in the second visit ( $p=0.022$ ;  $Raj:-2.68$ ). There is no influence on anxiety among children with or without previous experience ( $p = 0.603$ ), but the age of 4 years showed higher levels of anxiety ( $p=0.039$ ). **Conclusion:** Only the distraction technique with the mirror was able to reduce anxiety and improve behavior in the second visit.

**Keywords:** Dental Anxiety; Behavior; Pediatric Dentistry.

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## Introduction

Children's dental care is a challenge to the professional especially when the child at preschool age presenting with dental anxiety and fear. Child's uncooperative behavior during dental attendance may account for dental anxiety, resulting in stress for the child, the parents and the dentist [1]. In this case, the team needs to understand the psychological aspects of child development and techniques that enable the reduction of these emotions to achieve behavior control [2].

The child that will visit the dentist for the first time creates an expectation of how the treatment will be even before the consultation [3]. The degree of anxiety varies greatly among children depending on several factors [4], such as distorted information about what a dental treatment is, the temperament of the child [5], age range, parental anxiety, maturity, personality, intellectual and cognitive capacity, the day's emotions, traumatic experience, socio-economic context, among others [6].

Children with dental experiences were usually taken to the dentist for restorative or rehabilitative treatments that may have been painful. If the first dental experience happens in a traumatic way for the child, this event can cause fear and anxiety [7].

Some children are strong and tolerant in stressful situations, which usually transforms the patient to a collaborator. By contrast, others are vulnerable and may need more attention and time to feel at ease to cooperate with the dental treatment [6]. The distraction technique can be considered a strategy to encourage change in the focus of attention of the patient, in which case, stimuli would be perceived as more pleasant than the dental treatment [8].

The aim of the present study was to evaluate anxiety and behavior in groups of children undergoing several distraction techniques during dental treatment in the Dental Public Clinic.

## Material and Methods

### Pilot Study

The pilot study was conducted with 16 patients divided into 4 groups containing 4 children in each. This sample was not included at the end of the study.

The study allowed for the choice of the form of the distribution of the children in groups and the times elected for application of the Scales - Facial Image Scale [9] and Behavior Rating Scale [10]. Only one oral health assistant was selected to assist in Group 4, to tell stories during the dental treatment, which lasted the average of 12 minutes. The moments were filmed to standardize and calibrate the two observers of the Behavior Pattern Scale. Calibration to check the inter-examiner agreement was considered satisfactory (Kappa = 0.92).

The pilot test carried out before the research was critical in determining how many staff members would be required to carry out the study. The clinical care of all children have been performed by a single dentist in order to avoid different approaches and languages, which could promote varying degrees of anxiety and sample bias.

### Study Plan

The research was a randomized study with a systematic convenience sample consisting of 62 children of  $5,18 \pm 0,77$  years old, who sought the public dental services in the municipality of Gurupi. Gurupi is located in the watershed between the rivers Araguaia and Tocantins, latitude  $11^{\circ}43'45''$  south and a longitude  $49^{\circ}04'07''$  west, at an altitude of 287 meters. Region of Bananal Island, Legal Amazon, in the south of the State of Tocantins, Brazil. The municipality has an area of 28,445 square miles with a population of 76,755 people, data from the Brazilian Institute of Geography and Statistics. The sample comprised 62 children referred by general dental practitioners and community dentists to the Department of Pediatric Dentistry at Gurupi Municipal Polyclinic over period of 06 months (February to July 2012). The children were accompanied by their parents or guardians.

Children with or without previous dental experience were included, aged 4-6 years, both genders with need for restoration. Exclusion criteria were children with visual, hearing or mental limitations and dental emergency visits. Three children declined to participate in the study and four did not return to the second appointment. As a result, only 62 children were in the inclusion criteria and the subjects were randomly divided into four groups.

### Data Collecting

The children were evaluated in the first 2 visits to the dentist. The first visit consisted of a clinical examination and dental prophylaxis with the use of a micro-motor and Robinson brush, and on the second visit, the participants received the necessary restorative care (Figure 1).

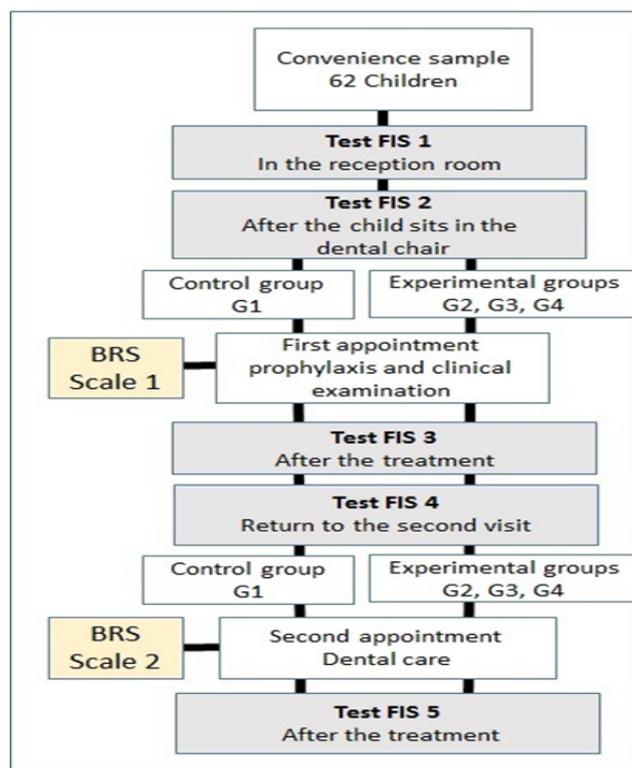


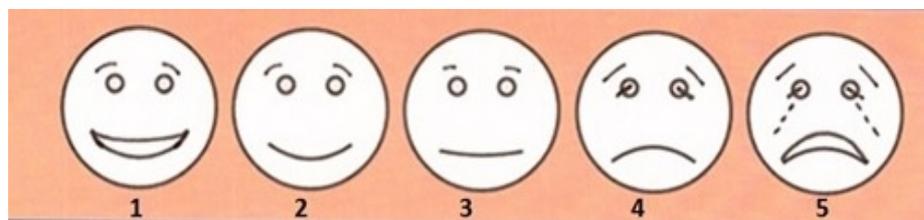
Figure 1. Diagram showing test application moments.

For the restorations, glass ionomer cement (Maxxion R, FGM Produtos Odontológicos, Joinville, SC, Brazil) and light-cured composite resins (Z100, 3M, Sumaré, SP, Brazil) were used. In some cases, the use of local anesthetic was needed. The anesthesia was used after topical anesthesia for 3 minutes and the injection was given slowly. Of the 62 children, 20% (n=12) received local anesthetic, distributed as follows: G1 (n=2), G2 (n=4), G3 (n=2) and G4 (n=4).

Only the control group (G1) received no tool for distraction use. During the treatment, the experimental group (G2) handed a mirror and monitored their own treatment. However, this instrument was collected at the time of application of anesthesia and the professional distracted the child by talking about matters of interest for the child. G3 received a toy (aqua-play) for use throughout the dental care. In G4, an auxiliary presented a book with illustrations and told the children's story throughout the dental treatment.

### Anxiety Rating

Since anxiety is an unobservable internal emotional state, but of great importance in the cognitive process, the self-description of this subjective and individual event, by the child, supplies valuable inaccessible data compared to other more objective techniques [11]. The projective method covers a multitude of processes that allow a child to reveal their perception of things, their fantasies, thoughts and feelings without speaking directly about themselves, offering ways to discover hidden emotions stored in the subconscious [8]. The Facial Image Scale (FIS) consists of 5 phases portraying the "very happy" to "very sad", which are assigned values from 1 to 5. The FIS was validated previously in a study that included 100 children 3-18 years old, where the FIS projective and the Venham Picture tests (VPT) were compared, and the FIS proved to be more efficient [3]. According to the authors, the FIS scale is simple and offers a "feedback" from the immediate emotional state of the child, allowing the professional to plan treatment more safely. In this study, it was decided that the figures of "faces" 1 (very happy), 2 (happy) and 3 (neutral) would be considered absence of anxiety, and the faces 4 (sad) and 5 (very sad) were scored as anxiety emotions (Figure 2).



**Figure 2. The Facial Image Scale (FIS) self-analysis projective test.**

Anxiety in the present study was assessed with the FIS self-analysis projective test. The tests were applied in all groups, with 5 applications for every child. On the first visit, the child answered the following tests: FIS 1: before the child comes to dental care, in waiting room; FIS 2: after the child sits in the dental chair; FIS 3: after ending the service on the first visit. Already sitting

in the dental chair, the children answered the FIS 4 test, which is done before the treatment. Still in the dental chair, the FIS 5 was answered by the children after the treatment.

### Behavioral Assessment During Service

The Behavior Rating Scale (BRS) is an observational test and can be used for the infant age range, since it represents with propriety, the reactions of children during dental interventions. One of the biggest advantages of this scale is that the viewer can identify reactions of children naturally, considering the motor pattern and psychological state according to the age, not interpreted as negative or non-cooperative, and the very natural manifestations of age [10].

The BRS was used by the observers in two stages in dental care. At the first visit (BRS 1), during the prophylaxis using a micro-motor and saliva suction. On the second visit (BRS 2), while using the high-speed pen and saliva suction in the restorative procedure. The six-point scales used to rate anxiety and uncooperative behavior are shown in BRS:

0. Total cooperation, best possible working conditions, no crying or physical protest.
1. Mild, soft verbal protest or (quiet) crying as a signal of discomfort, but does not obstruct progress. Appropriate behavior for procedure, i.e., slight start at injection, "ow" during drilling if hurting, etc.
2. Protest more prominent. Both crying and hand signals. May move head around making it hard to administer treatment. Protest more distracting and troublesome. However, child still complies with request to cooperate.
3. Protest presents real problem to dentist. Complies with demands reluctantly, requiring extra effort by dentist. Body movement.
4. Protest disrupts procedure, requires that all of the dentist's attention be directed toward the child's behavior. Compliance eventually achieved after considerable effort by dentist, but without much actual physical restraint. (May require holding child's hands or the like to start). More prominent body movement.
5. General protest, no compliance or cooperation. Physical restraint is required.

The authors defined that the scale "0" and "1" would be considered absence of anxiety, and the scale "2" to "5" were scored as anxiety emotions.

### Statistical Analysis

The data obtained from application of the FIS and BRS in G1, G2, G3 and G4 was analyzed using the chi-square test with a significance level of  $p < 0.05$ . The comparison between the FIS and VBRS tests were analyzed with the Spearman correlation coefficient, the overall analysis was performed by the SPSS Statistical Software (22.0).

### Ethical Aspects

The Ethics Committee of the Unirg University Center approved this research (Protocol n°. 0172/2010) according to the Helsinki Declaration. Parents or guardians of the children were informed of the purpose of the research, and written informed consent was obtained.

### Results

The Table 1 represents the characteristics of the sample regarding the gender, age and previous dental experience.

**Table 1. Distribution of sample by gender, age and dental experience in groups.**

Variables	G1		G2		G3		G4		Total		p-value
	n	%	n	%	n	%	n	%	n	%	
Gender											
Female	7	43.7	10	62.5	9	60.0	8	53.3	34	54.8	0.717
Male	9	56.3	6	37.5	6	40.0	7	46.7	28	45.2	
Age											
4	3	18.7	4	25.0	5	33.3	3	20	15	24.2	0.829
5	7	43.7	4	25.0	5	33.3	7	46.7	23	37.0	
6	6	37.6	8	50.0	5	33.3	5	33.3	24	38.8	
Dental Experience											
Yes	9	56.2	6	37.5	8	53.3	9	60	32	51.6	0.603
No	7	43.8	10	62.5	7	46.7	6	40	30	48.3	

\*Chi-square test with a significance level of  $p < 0.05$ .

When analyzing the FIS tests in relation to the groups (Table 2), the test revealed no association with the G1, G2, G3 and G4 groups in the FIS moments, but the FIS 5, after the second dental care, there was a significant change between the groups regarding anxiety ( $p = 0.031$ ;  $\chi^2 = 10.59$ ). The analysis was also performed isolated for each group at all times of the FIS test, in which only G2 presented a significant difference ( $p = 0.022$ ).

**Table 2. The distribution of number and percentage results, according to the temporal evolution of FIS tests (1, 2, 3, 4 and 5) applied in the control (G1) and experimental groups (G2, G3, and G4).**

Tests	Anxiety	G1		G2		G3		G4		p-value
		n	%	n	%	n	%	n	%	
FIS 1	Yes	3	18.7	5	31.2	3	20.0	5	33.3	0.712
	No	13	81.3	11	68.5	12	80.0	10	66.7	
FIS 2	Yes	2	12.5	5	31.2	7	46.6	5	33.3	0.226
	No	14	87.5	11	68.5	8	53.4	10	66.7	
FIS 3	Yes	3	18.7	1	6.2	2	13.3	5	33.3	0.224
	No	13	81.3	15	93.8	13	86.7	10	66.7	
FIS 4	Yes	3	18.7	1	6.2	4	26.6	7	46.6	0.064
	No	13	81.3	15	93.8	11	73.4	8	53.4	
FIS 5	Yes	3	18.7	0	0.0	2	13.3	1	6.6	0.031*
	No	13	81.3	16	100.0	13	86.7	14	93.4	
p-value		0.814		0.022*		0.178		0.197		

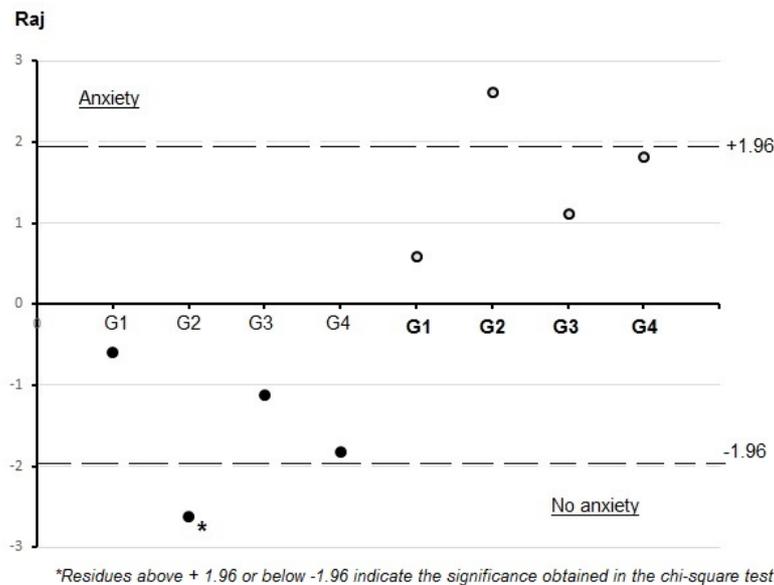
\*Chi-square test with a significance level of  $p < 0.05$ .

For a satisfactory conclusion about the associations observed between the FIS versus the groups, the residue analysis technique was applied to aid in the data's interpretation in Table 2 and also to evaluate how the different counts of children contributed to the significance obtained in the FIS 5 test (Figure 3).

The positive residue found in G2 ( $*Raj = -2.62$ ) points to the significance obtained in this test and evidence number of Individuals with lower anxiety levels than would be expected if they were casual. Thus, there is evidence that the level of anxiety perception decreased significantly in the

experimental group (G2) after the second treatment, as shown by the value of the negative residual (below -1.96) obtained in the FIS 5 trial. However, the same did not occurred in groups G1, G3 and G4.

The results distribution with the observational Behavior Rating Scale (BRS) test during the children's care, showed that there was no significant difference (BRS1:  $p = 0.277$  and BRS2:  $p = 0.144$ ) in anxiety in each group and even in the G1, G2, G3 and G4 groups.



**Figure 3.** Adjusted residuals (Raj) from standardized residues using data from the children's perception in all groups (G1, G2, G3, G4) related to anxiety, and correlated to FIS 5 test (after finishing the second visit care).

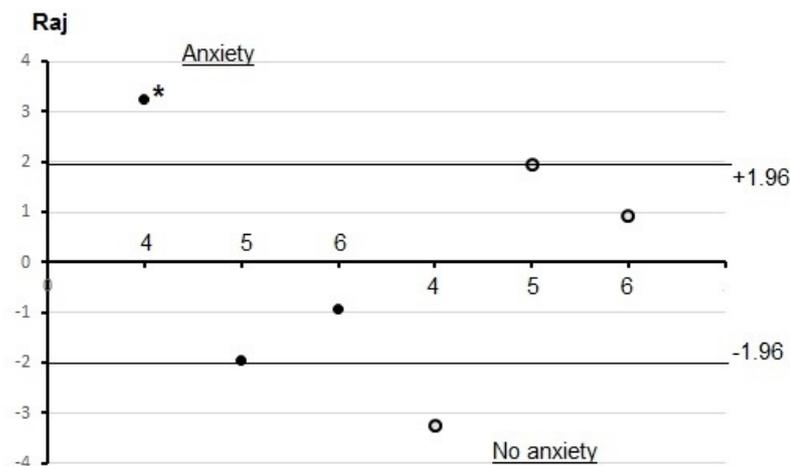
The Spearman correlation index ( $r_s$ ) was used to measure the association's degree between the two test variables (BRS and FIS), where values close to zero indicate no association and near-extreme values (-1 or 1) indicate a great association between the variables (Table 3). Thus, for BRS 1 versus FIS 2 in G2 and G3, they reached values of 0.733 and 0.678, which confirm the association with the data found (G2,  $p = 0.003$ ) between the two measurements and also a significant correlation between the BRS measurements 1 versus FIS 2. However, for BRS 2 versus FIS 4, only G2 ( $p=0.702$ ) indicated an association between the two measures, and the descriptive level ( $p = 0.005$ ) indicated a significant correlation between BRS 2 and FIS 4. In the other groups, G1 and G4, the correlations between the tests were not significant, which indicates that the behavior may not be associated in all groups.

**Table 3. Correlation of the Facial Image Scale (FIS) versus Behavior Rating Scale (BRS) in the two moments of dental care, in all groups.**

Groups	BRS 1 x FIS 2		BRS 2 x FIS 4	
	$r_s$	p-value	$r_s$	p-value
G1	0.104	0.696	0.268	0.268
G2	0.733	0.0039**	0.702	0.005**
G3	0.678	0.007**	0.224	0.422
G4	0.256	0.355	0.333	0.252

\*Spearman's correlation ( $-1 \leq r_s \leq 1$ ); \*\*Significance level of  $p < 0.05$ .

In order to understand if there is a correlation between age and anxiety, the data of the evaluations with the instrument BRS 1 and BRS 2 were analyzed with chi-square test (BRS1:  $p = 0.004$ ; BRS2:  $p = 0.08$ ), and in the first attendance the presence of association was verified. The technique of residue analysis was applied to help in the interpretation of the data found and to evaluate how the different counts of children contributed to the significance obtained in the BRS1 evaluation (Figure 4).



\*Residues above + 1.96 or below -1.96 indicate the significance obtained in the chi-square test.

Figure 4. Adjusted residuals (Raj) from standardized residues using data obtained from the BRS 1 assessment of behavior in children correlated at ages 4, 5 and 6 years.

The positive residue (\*Raj=3.24) in 4-year-old children points to the significance obtained in the chi-square test and shows a higher number of individuals with anxiety levels than would have been expected if they were casual. Therefore, this age showed more anxiety at the first visit, with BRS 1 ( $p=0.004$ ;  $\chi^2=10.91$ ) than those at 5 and 6 years, but the chi-square test showed no significant difference in behavior ( $p=0.08$ ;  $\chi^2=5.02$ ), showing that 4-year-old children improved their behavior in the second dental care.

Regarding previous dental experience, the data showed that there was no significant difference in the behavior between the groups, with BRS 1 ( $p = 0.48$ ,  $\chi^2 = 0.487$ ) or VBRS 2 ( $p = 0.24$ ,  $\chi^2 = 1.35$ ).

## Discussion

On the first visit, before entering the dentist's office and after the child sits in the dental chair, the projective tests demonstrated that the children showed a similar degree of anxiety in all groups, without anxiety. Children with low socioeconomic levels, 4-12 years of age, in three visits to public clinics, responded well to behavioral management techniques on the first visit [12]. After several visits to the clinic, the child begins a process of adaptation [13]. However, some authors claimed that regardless of age, the children's behavior worsened in future visits [14].

Studies have been conducted among preschool children seeking to find new methods of prevention, diagnosis and better standards of dental treatment, in which the focus of the present research has been the behavior, avoiding the physical and pharmacological interventions [6,15].

The distraction technique can be considered a strategy to encourage change in the focus of attention of the patient, in which case, stimuli would be perceived as more pleasant than the dental treatment. Among the tested distractions, the TV program produces the desired effect in which distraction was associated with quieter behavior [16-18].

In 2007, music and audiovisuals were compared as distraction techniques in 60 eager children, aged 4 and 8 years. The visual technique was more effective in relation to the music [19]. In another study, a meta-analysis was performed in 2009 with 19 randomized clinical tests that included 1513 patients, from 8 months to 20 years; It was concluded that a song could reduce the pain and anxiety for children undergoing the dental procedure, and when associated with pharmacological agents can produce a more effective action [20]. Comedy programs and the use of video games were able to distract children during dental care, however, they were physiological arousals and not effects of relaxation [21].

In this study, three distraction instruments were selected for 4-6 years-old children, which presented low cost and simplicity of implementation. The mirror tool with conversation was applied to Group 2 and they showed a reduction in anxiety and an improvement in behavior. While the dentist was talking and explaining the procedures, the child was following with a hand mirror to have a better participation in the treatment, so the child was aware of the procedures that were being made [22].

We used to believe that experimental groups would also reduce the anxiety, but despite of G3 and G4 received toy (*waterfall game*) and a colorful book, these groups did not improve the reduction in anxiety. Noises and objects are sufficient reasons for the child to be on high alert, which support their fantasies about what would happen next, making them get anxious and frightened during the treatment [23].

Inadequate dental management is strongly associated with dental fear in children, where anxiety levels may increase in children and parents [24]. However, the previous experience of an unpleasant situation can raise fear and anxiety of the child's emotions. In our study, there was no influence on anxiety among children with or without previous experience, probably because it was a dental care with prophylaxis and clinical examination in the first visit.

The age of 4 years seems to be more anxious than children of 5 and 6 years on the first visit, corroborating the results of several studies [12,25-27], the younger children had a higher level of anxiety. The relationship between chronological age, dental anxiety and behavior in the procedures are relevant factors in predicting children's reaction to the dental treatment [28].

The validity of Facial Image Scale (FIS) and the Venham Picture Test (VPT) in the dental hospital waiting room and the authors found a strong correlation between the two scales [3]. In our study, among FIS and BRS tests there was no correlation in all groups, which demonstrated that

children may perceive themselves as not anxious, even when their behavior evidences the presence of fear and anxiety during dental care.

There were some limitations in our study. Firstly, the measure of self-analysis of child anxiety in only 2 visits to the dentist was an authors' choice, perhaps there were more visits the results could be better. Secondly, the study could have adopted different methods to evaluate the anxiety, such as, the physiological tests indicated for assessing anxiety that are: respiratory, pulse, muscle tension, blood pressure, sweaty palms [29] and salivary cortisol [30]. However, these different methods to evaluate the anxiety level could have been used which aren't realistic, reliable nor are all Pediatric dentists trained to use or monitor these alternative methods. Among the limitations of the present study, there was the inability to standardize restorative procedures, since some children presented active caries lesions, others inactive with fractures or tooth hypoplasia.

The lack of consistent and current scientific evidence, together with the children's needs in oral health, encourage further studies to reduce anxiety with techniques approached and simple and practical child management, seeking to achieve a good quality of life for children, parents and professionals in the area.

## Conclusion

The distraction technique during dental care could not reduce anxiety and improve the behavior in all groups in the first visit, only the technique with the mirror was able to reduce anxiety and improve behavior in the second visit. There is no influence on anxiety among children with or without previous experience, and the age of 4 years showed higher levels of anxiety on the first visit.

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