

The Reliability and Validity of the Three Modified Versions of the Children's Fear Survey Schedule-Dental Subscale of 9-12 Year Old Children in a Clinical Setting in Bosnia and Herzegovina

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Objectives. This study sought to obtain a comprehensive, reliable and valid instrument for evaluation of the presence of dental fear and anxiety (DFA) in children, through evaluation of the reliability and validity of three modified versions of the Children's Fear Survey Schedule-Dental Subscale (CFSS-DS). **Materials and Methods.** The study sample comprised children aged 9, 10, 11 and 12 years. The first sample group (200 patients) filled in a modified version of the CFSS-DS scale, the second sample group (100 patients) filled in a short form of the Dental Fear Survey Schedule, and the third sample group (100 patients) filled in a short version of the CFSS-DS scale, prior to dental treatment, respectively. In order to determine test-retest reliability, the 184 patients from the first sample group filled in the modified version of the CFSS-DS scale again, prior to their next scheduled dental appointment. **Results.** The modified version of the CFSS-DS scale had the best internal consistency reliability ($\alpha=0.907$), as well as validity results, compared to the other two instruments used. Test-retest reliability was moderate (Intraclass correlation coefficient: 0.58). **Conclusions.** Of the three psychometric instruments used for evaluation of DFA presence in children, the modified version of the CFSS-DS scale showed the most clinically adequate reliability and validity values. This study thus provides a new psychometric instrument that should be considered for clinical use in evaluation of DFA presence in 9-12 year-olds, in a clinical setting sample type of children.

Introduction

To date, the instrument most used for measuring dental fear and anxiety (DFA) in children has been the Children's Fear Survey Schedule-Dental Subscale (CFSS-DS), also known as the Dental Fear Survey Schedule for Children (DFSS-C). The CFSS-DS scale was designed by Cuthbert and Malamed

in 1982, and was based on a wider instrument for measuring fear in children, the Children's Fear Survey Schedule (CFSS) (1), designed in 1967 by Scherer and Nakamura, and also known as the Fear Survey Schedule for Children (FSS-FC) (2).

The CFSS-DS scale has 15 questions (items) covering dental (invasive and non-

invasive treatment procedures), medical and general situations. The answers range on a Likert scale from 1 (not afraid) to 5 (very afraid), with a total scale score between 15 and 75. There are parent and child versions of the CFSS-DS scale, depending on who answers the questions, the child or a parent (1). These two versions of the scale have been used in numerous studies, in patients aged from 3.5 to 19 years, for evaluation of DFA presence, in many countries (3-9). This scale was the most preferred in many studies compared with other measuring instruments for evaluation of DFA presence, due to its better psychometric characteristics and wider range of DFA related aspects. The CFSS-DS scale has good reliability but variable validity (4-9). In a previous study it was determined that the CFSS-DS scale had good internal consistency reliability (Cronbach $\alpha=0.861$). Factor analysis revealed four factors that together explained the 63.79% variance of results (6).

However, some CFSS-DS scale validity results in several studies conducted showed that some of the scale items did not contribute much to explaining the variance of results (4-9). As a result, some shortened modifications of the CFSS-DS scale have appeared. Carson and Freeman suggested a shorter form of the CFSS-DS scale with 8 scale items in 1997, and in 2005 Rantavuori et al. also published studies with a shortened CFSS-DS scale of 10 scale items, and in 2004 and 2012 there were studies with a shortened scale of 11 scale items. The solid variable normative value of these scales has been reported, with various limitations and suggestions for further research (4, 10-12). This showed that the authors tended to correct the disadvantages of the CFSS-DS scale and to create an instrument that covers all aspects of DFA presence, but mostly by shortening it (4, 10-12). Also, the previous research showed that there is room for managing the content of the scale to improve its

capability of differing between children with and those without DFA (6).

Therefore, the aim of this study was to obtain a single comprehensive, reliable and valid instrument for evaluation of DFA, in order to measure more precisely its presence in children, to determine its reliability and validity values, and to compare it with the other two shortened versions of the CFSS-DS scale.

Patients and methods

Participants and study design

The study sample was clinical and comprised of a specific population of children, who were randomly selected patients who attended the Clinic of Preventive and Pediatric Dentistry of the Faculty of Dentistry of Sarajevo University, in the period between January and October 2013. The reason for their visit to the Clinic was a permanent tooth carious lesion of medium depth (dental depth of the lesion corresponded with ICDAS code 5), which had to be resolved according to the dental treatment plan. This reason was the main criterion for inclusion in the study, in order to avoid other potential biases in the clinical setting. The patients were aged 9, 10, 11 and 12 years. The reason for choosing this age group was the general cognitive and psychosocial development of the children (13, 14). In order to avoid selection bias, child behavior in the dental office was evaluated and medical history was determined where it was necessary, so that children with general psychological problems could be excluded from the study sample. The patients' parents signed an informed consent form for the participation of their children in this study, and the assent of the child patients was also obtained.

Prior to the scheduled dental treatment, clear instructions were given to the child participants regarding participation in the

study, and the patients provided answers to the three modifications of the CSSS-DS scale in the dental office, as follows: a modified version of the Children's Fear Survey Schedule-Dental Subscale, the Carson and Freeman Short Form of the CFSS-DS scale (4) and the 10-item Short Version of CFSS-DS scale designed by Rantavuori et al. (10), respectively. This was undertaken in order to compare the reliability and validity values of these three modifications of the CFSS-DS scale. Accordingly, the sample consisted of three groups, where the patients were assigned randomly to one of them. The number of patients in the groups was determined according to the statistical minimum that was sufficient for conducting analyses of the reliability and validity values of these scales (15). So, the child participants responded to the scale questions by themselves, without any help from the researchers or their parents. When the children finished, the researchers immediately collected the questionnaires from the child participants, just before the scheduled dental treatment started.

The first sample group of 200 patients filled in the modified version of the Children's Fear Survey Schedule-Dental Subscale (CFSS-DS-mod scale). The CFSS-DS-mod scale was revised in its design in comparison with the original CFSS-DS scale as follows: it was reduced by removing items that were not related to the dentist or the treatment, and at the same time extended with new dental (treatment) situations which were not in it originally. The reason for this modification was the previous research with the original CFSS-DS scale, where it was determined that some of the scale items did not improve its normative value, and also the fact that not all clinical dental situations were included in this instrument (6). The previous studies by others had also led to this conclusion (4-5, 7-9). As a result, a new scale was created, the CFSS-DS-mod scale, originally in the Bosnian language. For the

purpose of this publication, the scale items were translated into English by a licensed translator (Table 1), and back-translated into Bosnian in order to avoid any bias in the meaning of the items.

The CFSS-DS mod scale had 17 items (questions) which were adapted to the patients according to their meaning. The idea was to include all situations related to the dentist, the dental office and dental treatment. So, the CFSS-DS-mod scale design comprised four categories, as follows: general terms (dentist), being in the waiting room and in the dental office itself, various forms and stages of dental treatment, as well as the notion of dental pain. Eight items from the original CFSS-DS scale remained, but two of these were combined in the new scale. The meaning of two of the original items was changed, so that eight new items were added to the scale. These items were also first translated by a licensed translator for English language, and back-translated into Bosnian prior to their use. The answers to this new scale questions ranged on a 5-point Likert scale from 1 (not afraid) to 5 (very afraid). The total CFSS-DS-mod scale score ranged from 17 to 85.

The second sample group of 100 patients filled in the Short Form of the Dental Fear Survey Schedule (DFSS-SF) (4). It consisted of eight items. For the purpose of this study the DFSS-SF scale items were first translated into English and back-translated into Bosnian by a licensed translator, prior to their use, in order to avoid any potential bias in the meaning of the items. Similarly to the previous scale, eight items of the DFSS-SF scale were excluded from the original CFSS-DS scale, and one item about tooth extraction was added (4). The answers to the questions were coded by the 5-point Likert scale, from 1 (not afraid) to 5 (very afraid). The total score ranged from 8 to 40 (4).

The third sample group of 100 patients filled in the Short Version of the CFSS-DS

Table 1. The Modified Version of the Children's Fear Survey Schedule-Dental Subscale

Questions	Not afraid	Slightly afraid	Fairly afraid	Quite afraid	Very afraid
1. Are you afraid of being in the waiting room before entering the dental office?	1	2	3	4	5
2. Are you afraid of being in the dental office?	1	2	3	4	5
3. Are you afraid of the dentist?	1	2	3	4	5
4. Are you afraid of people in white uniforms?	1	2	3	4	5
5. Are you afraid of sitting in the dental chair?	1	2	3	4	5
6. Are you afraid when the dentist examines your mouth with dental instruments?	1	2	3	4	5
7. Are you afraid when you keep your mouth open?	1	2	3	4	5
8. Are you afraid of the suction device in your mouth?	1	2	3	4	5
9. Are you afraid when the dentist cleans your teeth from dental plaque?	1	2	3	4	5
10. Are you afraid when your teeth are being drilled?	1	2	3	4	5
11. Are you afraid of the sound of dental drilling devices?	1	2	3	4	5
12. Are you afraid of the sight of dental drilling devices?	1	2	3	4	5
13. Are you afraid of the dental syringe?	1	2	3	4	5
14. Are you afraid of the dental syringe needle?	1	2	3	4	5
15. Are you afraid of tooth extraction?	1	2	3	4	5
16. Are you afraid of dental treatment that causes pain?	1	2	3	4	5
17. Are you afraid when you are unable to breathe during dental treatment?	1	2	3	4	5

scale (CFSS-SV) (10). It consisted of 10 items. For the same reasons as with the other two scales used in this study, translation into English language and back translation into Bosnian was undertaken by a licensed translator. In the design of the CFSS-SV scale seven items were excluded from the original CFSS-DS scale, and two items were added about pain during dental treatment and the presence of a suction device in the mouth (10). The answers to the questions were coded by the 5-point Likert scale, from 1 (not afraid) to 5 (very afraid). The total score ranged from 10 to 50 (10).

In order to determine the test-retest reliability of the CFSS-DS-mod scale, a retest evaluation of DFA presence by this scale had to be conducted. According to the previously established dental treatment plan, 184

patients from the first group of 200 patients, who came back to resolve a carious lesion of a permanent tooth of medium depth, answered the same CFSS-DS-mod scale questions again, under the same dental office conditions, prior to their scheduled treatment. This was undertaken after one month from their first study test sample visit, consecutively for each patient. The rest of the 16 patients missed their scheduled appointment and were excluded from the study re-test sample.

Ethics statement

This research was approved by the Ethical Committee of the Faculty of Dentistry of Sarajevo University, and also was conducted according to the Declaration of Helsinki (16).

Statistical analysis

The results obtained from this study were statistically processed as follows:

- Descriptive values were presented by descriptive statistics (frequency of the study participants by their age in percentages, mean values and standard deviations of age, and of the scores of the different scales used in the study sample groups);
- The Cronbach α coefficient was calculated as the internal consistency reliability of the three scales, altogether with the corrected item-total correlations presented for each of scale items;
- The test-retest reliability of the CFSS-DS-mod scale was determined by calculating an intra-class correlation coefficient (ICC);
- The construct validity of the three scales was determined by explorative factor analysis (EFA) applying varimax rotation. The criteria for proper factor

analysis were determined by the Kaiser-Meyer-Olkin test of sampling adequacy (KMO) and the Bartlett test of sphericity (Bartlett). Percentage and cumulative percentage of explained variance, as well as determined Eigen values, were presented.

All statistical analyses were obtained for a $P < 0.05$ significance level in the IBM Statistical Package for Social Science software (version 23.0) for the Windows operative system.

Results

The descriptives of the study sample were as follows: The first sample group contained 58 (29%), 44 (22%), 53 (26.5%) and 45 (22.5%) patients aged 9, 10, 11 and 12 years, respectively. The mean group age was 10.43 ± 1.13 years. The mean CFSS-DS-mod scale score was 27.52 ± 9.21 . The second sample group

Table 2. Internal consistency reliability of CFSS-DS-mod, DFSS-SF and CFSS-SV scales

CFSS-DS-mod scale (n=200)		DFSS-SF scale (n=100)		CFSS-SV scale (n=100)	
<i>Cronbach</i> $\alpha=0.907$	Corrected item- total correlations	<i>Cronbach</i> $\alpha=0.650$	Corrected item- total correlations	<i>Cronbach</i> $\alpha=0.800$	Corrected item- total correlations
Item 1	0.536	Item 1	0.592	Item 1	0.553
Item 2	0.672	Item 2	0.311	Item 2	0.420
Item 3	0.421	Item 3	0.497	Item 3	0.335
Item 4	0.243	Item 4	0.342	Item 4	0.618
Item 5	0.655	Item 5	0.113	Item 5	0.573
Item 6	0.657	Item 6	0.267	Item 6	0.427
Item 7	0.465	Item 7	0.475	Item 7	0.177
Item 8	0.445	Item 8	0.474	Item 8	0.658
Item 9	0.595	-	-	Item 9	0.410
Item 10	0.670	-	-	Item 10	0.671
Item 11	0.687	-	-	-	-
Item 12	0.652	-	-	-	-
Item 13	0.510	-	-	-	-
Item 14	0.583	-	-	-	-
Item 15	0.582	-	-	-	-
Item 16	0.763	-	-	-	-
Item 17	0.618	-	-	-	-

Table 3. Validity results of the three modifications of the CFSS-DS scale

CFSS-DS-mod scale			DFSS-SF scale			CFSS-SV scale		
(n=200)			(n=100)			(n=100)		
KMO=0.880			KMO=0.562			KMO=0.763		
Bartlett P<0.0005			Bartlett P<0.0005			Bartlett P<0.0005		
Items	Factors:*		Items	Factors:*		Items	Factors:*	
	1	2		1	2		1	2
Item 10	0.795	0.212	Item 7	0.835	0.099	Item 10	0.776	-0.127
Item 9	0.716	0.195	Item 8	0.791	0.109	Item 8	0.772	0.172
Item 2	0.710	0.309	Item 1	0.626	0.237	Item 4	0.744	-0.094
Item 6	0.658	0.339	Item 4	0.618	-0.017	Item 1	0.693	0.291
Item 5	0.621	0.382	Item 2	0.449	-0.046	Item 5	0.684	-0.029
Item 16	0.617	0.520	Item 5	-0.193	0.750	Item 6	0.572	0.091
Item 11	0.595	0.459	Item 3	0.455	0.715	Item 2	0.518	-0.098
Item 12	0.549	0.454	Item 6	0.101	0.673	Item 9	0.510	-0.276
Item 3	0.511	0.140	-	-	-	Item 7	0.254	0.694
Item 1	0.503	0.344	-	-	-	Item 3	0.422	-0.615
Item 4	0.455	-0.074	-	-	-	-	-	-
Item 14	0.099	0.828	-	-	-	-	-	-
Item 13	0.014	0.817	-	-	-	-	-	-
Item 15	0.252	0.667	-	-	-	-	-	-
Item 17	0.422	0.539	-	-	-	-	-	-
Item 7	0.277	0.483	-	-	-	-	-	-
Item 8	0.242	0.482	-	-	-	-	-	-
% Variance	27.122	22.490	-	31.910	20.084	-	37.973	10.934
% Cumulative	27.122	49.613	-	31.910	51.995	-	37.973	48.907
Eigen value	7.027	1.407	-	2.794	1.366	-	3.799	1.091

KMO=Kaiser-Meyer-Olkin test of sampling adequacy; *The loading factors of scales Items are presented by their descending value.

contained 26 (26%), 15 (15%), 24 (24%) and 35 (35%) patients aged 9, 10, 11 and 12 years, respectively. The mean group age was 10.68 ± 1.21 years. The mean DFSS-SF scale score was 10.71 ± 2.83 . The third sample group contained 25 (25%), 27 (27%), 25 (25%) and 23 (23%) patients aged 9, 10, 11 and 12 years, respectively. The mean group age was 10.46 ± 1.1 years. The mean CFSS-SV scale score was 15.82 ± 5.17 .

Table 2 shows the results of internal consistency reliability, with corrected item-total correlations for the three modifications of

the CFSS-DS scale. It was shown that the Cronbach coefficient had the highest value in the CFSS-DS-mod scale ($\alpha=0.907$). The corrected item-total correlations also had the highest values in this scale. The lowest internal consistency reliability was found using the DFSS-SF scale ($\alpha=0.650$), and in the CFSS-DS-mod scale the lowest corrected item total correlation was for the 4th item (fear of people in white uniforms; $r=0.243$). The first retest sample group showed dropout of 8% (16 of the 200 patients). Test-retest reliability showed a value of $ICC=0.58$,

$P < 0.0005$. No statistically significant differences were determined between the study participants and those who dropped out.

Table 3 shows the results of explorative factor analysis (EFA) with Varimax rotation for the three modifications of the CFSS-DS scale, with KMO and Bartlett test values. All three scales obtained two-factor solutions, with the Eigen values of extracted factors which were greater than 1. The total variance explained was around 50% (from 48.907% to 51.995%). Although the DFSS-SF and CFSS-SV scales showed two-factor solutions with a solid percentage of the variance of its results explained, in the case of the DFSS-SF scale, KMO was 0.576, and also in the CFSS-SV scale, in the second factor, the 3rd item had negative factor loading ($r = -0.615$). On the other hand, in the CFSS-DS-mod scale, two factors were also extracted, which explained 49.613% of the variance of results obtained with this scale. The first factor was related mostly to the dentist and dental staff, the dental office and its contents, as well as non-invasive dental procedures. The second factor was mostly related to invasive dental procedures.

Discussion

The internal consistency reliability estimated with the CFSS-DS-mod scale demonstrate its excellent reliability value according to the α ranking evaluation (≥ 0.9). However, the relatively low corrected item-total correlation for question no. 4. "Fear of people in white uniforms", would suggest that this item was perhaps in disparity with the list of factors for DFA appearance in the CFSS-DS-mod scale. All the other items had a value above 0.3. On the basis of this and the results of factor analysis, we suggest that the CFSS-DS-mod scale measures mostly the same underlying concept, the presence of DFA in children. Test-retest reliability in contrast showed a moderate ICC value. The test reli-

ability and reproducibility in general usually depends upon many factors, such as sample size and quality, instrument design and its homogeneity, the retest period, etc. Although this reliability should be considered as questionable, since the usual acceptable threshold value is 0.7, sometimes authors regard a test-retest reliability threshold value of 0.6 as possible (15, 17).

Although the DFSS-SF and CFSS-SV scales served more as controls, they did show lower internal consistency reliability values. They also had a few corrected item-total correlations values below 0.3, and this decreased with the increase of the number of items per scale.

We have already emphasized that the situations related to the dentist and the staff, the dental office and its contents, as well as non-invasive dental procedures mostly had two-factor solutions of the CFSS-DS-mod scale as the first factor. So, it seemed that the most provoking factors for the presence of DFA tended to create one side of its two-dimensional concept, putting every other component on the other side. However, the high first factor loadings also had items such as fear of tooth drilling, as well as fear of pain caused by dental treatment. Preparation of a carious lesion is certainly an invasive dental procedure, but it affects body integrity less than two other well-known dental interventions – tooth extraction and dental local anesthesia administration. So, it should not be surprising that these three were separated from one another. The fear of pain caused by dental procedures also had high second factor loadings, so this item by nature should probably belong to the second factor.

The results of EFA for the DFSS-SF and CFSS-SV scales were questionable. In order for the conditions for proper conduct of the EFA to be met, KMO had to be ≥ 0.6 , and the Bartlett test of sphericity (Bartlett) had to be $P < 0.05$ (15). In the case of the DFSS-SF scale this condition of the KMO minimal value

Table 4. Review of the studies where the CFSS-DS scale and its modifications were used and its reliability and validity values were determined

Authors:	Year	Country	Scale		Examinees			Reliability	Construct validity	
			Name:	Informant	Number	Age (years)	Sample type:	Type	Number of factors	% of explained variance
Alvesalo et al. (18)	1993	Finland	CFSS-DS	Child	828	11-14	School	$\alpha=0.85$	3	54
Klingberg (19)	1994	Sweden	CFSS-DS	Parent	52	4-14	Clinical (with DBMP)	$\rho=0.97^{(***)}$	–	–
Milgrom et al. (20)	1994	Canada	CFSS-DS	Parent	70	5-15	Clinical	$\alpha=0.87$	4	67.6
		China			99	2.5-7		$\alpha=0.90$	3	64.5
Ten Berge et al. (21)	1998	Holland	CFSS-DS	Parent	150	4-12	Clinical	$\alpha=0.90$	3	65
Majstorović et al. (22)	2003	Croatia	CFSS-DS	Parent	165	5-15	Clinical (with DFA)	$\alpha=0.83$	–	–
Nakai et al. (23)	2005	Japan	CFSS-DS	Child	134	8-15	Clinical	$\alpha=0.91$	–	–
					532		Clinical	$\alpha=0.86$	3	54.8
					1250		School	$\alpha=0.89$	–	–
Arapostathis et al. (24)	2008	Greece	CFSS-DS	Parent	260	4-12	Clinical	$\alpha=0.85$; $\rho=0.71^{(***)}$	–	–
Lee et al. (25)	2009	Taiwan	CFSS-DS	Parent	1819	5-8	Preschool, school	$\alpha=0.90$	3	–
Bajrić et al. (6)	2010	B&H	CFSS-DS	Child	120	8, 12, 15	Clinical	$\alpha=0.86$	4	63.79
Singh et al. (8)	2010	India	CFSS-DS	Child	197	7-12	Clinical	$\alpha=0.92$	3	64.7
Ma et al. (7)	2014	China	CFSS-DS	Child	206	6-10	Clinical	$\alpha=0.85$; $\rho=0.71^{(***)}$	3	53.7
El-Housseiny et al. (9)	2016	Saudi Arabia	CFSS-DS	Child	1546	6-12	School	$\alpha=0.88$ ICC=0.83 ^(***)	3	53.47
Carson and Freeman (4)	1997	Northern Ireland	DFSS-SF	Child	100	5-11	Clinical	K=0.69-0.96	2	62-64
Folayan and Otuyemi (26)	2002	Nigeria	DFSS-SF	Child	30	8-13	School Clinical	$\alpha=0.82$; $\rho=0.73^{(***)}$	–	–
Rantavuori et al. (10)	2005	Finland	CFSS-SV	Parent	1212	6, 9, 12, 15	Clinical	–	2	60.59-63.85

DBMP=Dental Behavior Management Problems; *** $P<0.0005$.

was not achieved, so there were no minimal statistical reasons for this factor analysis to be considered appropriate. On the other hand, the negative second factor loading of one of two items made the CFSS-SV scale two-factor solution unsustainable for at least two reasons. The first reason is that the loading was negative, which meant that this item explained the second factor in the opposite way. If we were to exclude it from the second factor, then only one 7th item would remain. The extracted factor with only one item in it would not be statistically possible (15). These

are the reasons why we should not consider the construct validities of the DFSS-SF and CFSS-SV scales as proper ones.

In Table 4 several studies are shown of evaluation of DFA presence, where the reliability and validity values of the CFSS-DS scale used and its modifications are presented. Besides different methodologies (sample size, age and type, type of informant), compared to the original CFSS-DS scale, the modified scale version from this study had mostly higher α values of internal consistency reliability (6-9, 18-25). This

was also the case compared to the DFSS-SF and CFSS-SV scales (which we confirmed), although fewer studies have been conducted (4, 10, 26). In contrast, the original scale and its two modifications showed better construct validity concerning the % of total variance explained, but the number of extracted factors remained variable (4, 6-10, 18, 20-21, 23). Nevertheless, the over 50% of variance in our scale remained unexplained. Although the original design of the CFSS-DS-mod scale had four categories, the scale items were latently grouped into two factors. The number of 200 cases for conducting the EFA was statistically minimal, and sample size is one of the most important conditions for its proper execution (15).

Limitations and improvements

The results obtained from this study showed some limitations (possible selection bias of patients in the clinical setting, and no comparison with the original design of the CFSS-DS scale, for example), as well as ways of improving and further analysis of the CFSS-DS-mod scale, in terms of a larger and wider sample size with a non-clinical setting sample type, type of informant, conducting confirmatory factor analysis, cut-off score evaluation, socio-economic state, etc., so that the normative values of this scale could be evaluated in the general population.

Conclusion

This study provided a new psychometric instrument for evaluation of DFA presence in 9-12 year olds, in a clinically setting sample type of children, in the form of the CFSS-DS-mod scale. This instrument showed good reliability and validity values, and therefore should be considered for clinical use in determining DFA presence in children.

What is already known on this topic

Dental fear and anxiety is a widespread clinical phenomenon which may seriously interfere with dental treatment. The instrument used by far the most for measuring dental fear and anxiety in children is the Children's Fear Survey Schedule-Dental Subscale.

What this study adds

The results from our study provide a new instrument based on the Children's Fear Survey Schedule-Dental Subscale, for evaluation and validation of the presence of dental fear and anxiety in children.

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