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Reliability and validity of the Italian versions of the Children's Fear Survey Schedule - Dental Subscale and the Modified Child Dental Anxiety Scale

ABSTRACT

Aim Children's dental fear and anxiety (DFA) causes significant problems in clinical practice. The 15-item Children's Fear Survey Schedule - Dental Subscale (CFSS-DS) and the 8-item Modified Child Dental Anxiety Scale (MCDAS) are the most widely used measures of dental fear in children. The aim of this study is to examine the reliability and validity of the Italian versions of the CFSS-DS and MCDAS, also in comparison with a simple visual analogue scale (VAS).

Materials and methods The CFSS-DS and MCDAS were translated into Italian by a consensus panel of experts and administered to 210 dental patients aged 4–11 years from three Italian Institutions. Internal

reliability was assessed using the Cronbach's alpha correlation. A sub-sample of 60 children was selected for test-retest analysis. CFSS-DS and MCDAS, plus a VAS scale, rated both by children and parents, were validated using as gold standard the 4-item Frankl scale for behaviours assessed by dentists.

Results Mean CFSS-DS score was 30.8 (SD: 11.1) and mean MCDAS score was 17.9 (SD: 7.2), significantly higher among children aged 4–7 years and among children at their first dental visit. The alpha value for internal reliability was 0.90 (95% CI= 0.88–0.92) for CFSS-DS and 0.87 (95% CI=0.85–0.90) for MCDAS. Both CFSS-DS and MCDAS showed good test-retest reliability ($r_{sp}=0.80$; $p<0.001$ for both scales). CFSS-DS and MCDAS predicted a Frankl score ≤ 2 (i.e., indicating children with an uncooperative behaviour) with a fair accuracy (AUC=0.69 and AUC=0.68, respectively). The VAS scale was more effective in predicting a negative behaviour (AUC=0.78). The scales self-reported by children were only slightly more accurate than those reported by parents.

Conclusions The Italian versions of the CFSS-DS and MCDAS are valid and reliable tools for the assessment of dental fear in Italian children aged 4–11 years. A simple, one-item VAS, and dental fear and anxiety evaluation by parents may be valid and quick alternatives to multi-item indices to predict an uncooperative children behaviour.

Keywords Children; Children's Fear Survey Schedule - Dental Subscale; Modified Child Dental Anxiety Scale; Dental fear; Validity; Reliability; Italy.

Introduction

Dental fear denotes a normal but unpleasant emotional reaction to specific stimuli perceived as threatening occurring during the usual clinical practice in dentistry. Dental anxiety indicates an excessive and unreasonable negative emotional state experienced by selected susceptible dental patients [Brogardh-Roth et al., 2010; Klingberg and Broberg, 2007]. Although being two different psychological states, dental fear and dental anxiety are closely related, both entities indicating the perception that something alarming is going to happen due to dental treatment, and the term dental fear and anxiety (DFA) is used to combine the two states. Although being relatively common also among adults, DFA is particularly frequent among young children and decreases with increasing age [Appukuttan et al., 2014; Blomqvist et al., 2013; Gustafsson et al., 2010; Hakeberg et al., 1992; Klingberg and Broberg, 2007]. Prevalence of DFA substantially varies, mainly depending, besides

population age, also by how DFA is measured [Klingberg and Broberg, 2007; Van Meurs et al., 2005]. A review of the literature based on 32 papers showed a pooled DFA among children and adolescents of 9% [Klingberg and Broberg, 2007]. An update of such review reported pooled estimates for DFA ranging between 10% and 20%, according to the measurement used to assess it [Cianetti et al., 2017a].

The majority of children with DFA have uncooperative behaviours, which may substantially increase the time needed to treat them or even threaten the outcome of the dental visit [Cianetti et al., 2017a; Ma et al., 2015]. Moreover, the troublesome behaviour of children with dental fear is a major cause of stress for many paediatric dentists [Gustafsson et al., 2010; Moore and Brodsgaard, 2001]. Therefore, the identification of children with DFA before the dental visit is extremely important, since dentists have the possibility to preventively use adequate countermeasures (i.e., both pharmacological and non-pharmacological), allowing them to obtain an effective dental treatment also for susceptible patients [Cianetti et al., 2017b; Goumans et al., 2004]. DFA in children may be measured using various methods, including behavioural ratings scales, such as the Frankl scale assessed by the dentist during the visits, physiological measurements (e.g., heart rate and muscle tension), projective tests and psychometric assessments [Al-Namankany et al., 2012; Aminabadi et al., 2011; Beck and Weaver, 1981; Guinot Jimeno et al., 2011; Ma et al., 2015]. The latter tools refer to a number of self-reported questionnaires that have been administered to measure DFA [Al-Namankany et al., 2012; Armfield, 2010]. These questionnaires range from single-item scales, such as the visual analogue scale (VAS), to indices based on multiple items, completed either by the children or by their parents [Al-Namankany et al., 2012; Armfield, 2010]. These tools represent the only types of measurements permitting to predict the state of anxiety under stressful situations, such as dental procedures [Li and Lopez, 2005]. Among psychometric tools, those most widely used in children are the 15-item Children's Fear Survey Schedule - Dental Subscale (CFSS-DS) and the 8-item Modified Children Dental Anxiety Scale (MCDAS) [Cuthbert and Melamed, 1982; Wong et al., 1998]. Compared to other indices, these two scales are considered relatively simple and cost-effective. Moreover, the English version of the CFSS-DS and MCDAS have been tested for validity and reproducibility [Cianetti et al., 2016]. Consequently, they have been translated in several languages and studied in several countries, generally reporting good validity and reproducibility [Cianetti et al., 2016 (Cianetti et al., 2016; Ma et al., 2015)]. As cultural and social norms of behaviour may affect the development and expression of children's fear, specific data are needed for each population [(Cianetti et al., 2016; Folayan et al., 2004; Ma et al., 2015; Nakai et al., 2005)]. No validated tool to detect DFA is available in the Italian language and scanty information is available

on DFA among Italian children [Cianetti et al., 2016; Paglia, 2016].

We conducted this study with the following multiple aims:

- to develop the Italian version of the CFSS-DS and the MCDAS;
- to test their internal consistency and test-retest reliability;
- to evaluate the validity of the two scales plus a simple one-item VAS scale to predict child behaviour during the dental visit among Italian children;
- to compare the scales reported by children with those evaluated by their parents;
- to quantify the prevalence of DFA in our Italian child population according to the two indices.

Patients and methods

All consecutive patients aged 4–11 years of three paediatric dental clinics from northern (Milan), central (Perugia), and southern (L'Aquila) Italy, regardless of their dental status, number of visits or types of treatment previously received, were invited to participate in this study. Patients with symptoms of acute toothache or any other emergency (bleeding, swelling, dental trauma) were excluded from the study. Children with systemic diseases and/or major disabilities were also excluded. Overall, 210 paediatric patients (i.e., 70 for each institution) were enrolled between August 2016 and January 2017. Parents provided written consent and children provided verbal assent to participate to the study. This research was approved by the Ethics Committee of Umbria Region (CEAS Umbria), Italy (Ref. Nr.: 2805/16).

CFSS-DS consists of 15 items to be answered with a Likert scale ranging from 1 (not afraid at all) to 5 (very afraid). Consequently, total score ranges between 15 and 75 [Cianetti et al., 2016; Ma et al., 2015]. MCDAS consists of 8 questions; also for this scale, each item is scored on a Likert scale from 1 (not afraid at all) to 5 (very afraid). Total score ranges between 8 and 40 [Cianetti et al., 2016].

CFSS-DS and MCDAS were translated from English into Italian by a single native Italian speaker. The Italian versions of the two questionnaires were pretested in a small group of Italian children. A panel of Italian experts of different disciplines, including all the authors of the present publication, met before the starting of the fieldwork to carefully review the questionnaires, on the basis of the results of the pilot study. No major changes were required from the original translation. Only a few slight changes were made by the panel to further ensure comparability with the English version. The panel agreed by consensus with the final version of the Italian questionnaires (available as Supplementary Figure 1 of EJPD 2017 4 at: <https://goo.gl/tj1Gxr>).

The translated CFSS-DS and MCDAS questionnaires

were distributed to the 210 children and collected by three trained operators (EL, S Caruso, SdG) prior to treatment in the waiting rooms of each dental clinic. Children were trained to complete the questionnaires by themselves. Young children who could not read, or those who had difficulties to read, were assisted by the dentists in reading the items. Parents were not allowed to participate or help their children to complete the questionnaires. Besides CFSS-DS and MCDAS, children were also asked to describe their dental fear in general and the dental fear due to the current visit using two simplified single-item VAS scales. One, referring to the fear for the dentist, was formulated as follows: "In a scale from 0 (low fear) to 100 (high fear) how much fear do you have of the dentist?" The second VAS, measuring the DFA perceived due to the current visit, was formulated as follows: "In a scale from 0 (low fear) to 100 (high fear) how much fear do you have for today's visit?" (available as Supplementary Figure 2 of EJPD 2017 4 at: <https://goo.gl/tj1Gxr>) DFA of children using those four scales (i.e., CFSS-DS, MCDAS and VAS scales) was also evaluated by their parents using the same questionnaires.

Parents were also asked to provide information on socio-demographic characteristics of children, anthropometric characteristics, composition of the family and previous dental treatment of children. From height and weight of the children, reported by parents, we derived the children's body mass index (BMI; kg/m²). To discriminate children who were underweight or normal weight from those being overweight or obese we used the age-specific international cut-off points of BMI for minors [Cole et al., 2000; Cole et al., 2007].

The first 60 children (i.e., 20 for each centre) returning for dental treatment after 4 weeks were re-administered the four scales a second time, using the same approach of the first visit.

During the first dental appointment, the behaviour of all the 210 children enrolled in the study was also assessed by three dentists (LP, SCianetti, RG), one for each institution, using the Frankl Scale considered at several different phases of the treatment. The children overall Frankl score was defined as their lowest Frankl score for any segment of the treatment. The Frankl scale consists of a 4-point scale in which 1 represents 'definitely negative' (i.e., the child is crying forcefully, behaving in a fearful manner), 2 represents 'negative' (i.e., the child is reluctant, uncooperative), 3 represents 'positive' (i.e., the child may be cautious but willing to comply) and 4 represents 'definitely positive' (i.e., the child is laughing and enjoying the situation) [El-Housseiny et al., 2016]. The values of the CFSS-DS, MCDAS and VAS scores were unknown to the observers performing the behaviour rating.

Statistical analyses

We reported mean and standard deviation (SD) of CFSS-DS and MCDAS total score, overall and according

to selected characteristics of the children and of their families. Differences of scores among the considered characteristics were evaluated using the t-test for dichotomous variables, or ANOVA for variables with more than two levels. Prevalence of DFA was estimated using both scales, defining children suffering of DFA as those having a score exceeding the mean scale score + 1 SD (i.e., CFSS-DS score ≥ 42 and MCDAS score ≥ 25) [Cianetti et al., 2017a; Klingberg and Broberg, 2007; Wogelius et al., 2003a]. Reliability of the Italian version of CFSS-DS and MCDAS scales was evaluated using Cronbach's alpha using the total sample of 210 children [Cronbach, 1951]. Corrected item-total correlations (i.e., the correlations between each item and various corresponding total scores) were also computed. Test-retest reliability of CFSS-DS, MCDAS, and the two VAS scales was assessed by means of Spearman's correlation coefficients between the scores obtained at the first and at the second visit among 60 children who returned for dental treatment 4 weeks after the first visit. Validity of the CFSS-DS, MCDAS and the VAS scales was investigated by means of Spearman's correlation coefficients between each scale (i.e., evaluated both by the children and by their parents) and the Frankl scale evaluated by dentists, used as a gold standard measure [El-Housseiny et al., 2016]. Receiver-operating-characteristic (ROC) curve analysis – and corresponding Area Under the Curve (AUC) – was performed to investigate the utility of these scales to predict a Frankl score ≤ 2 (i.e., denoting "a negative or definitely negative behaviour") or a Frankl score = 1 (i.e., denoting "a definitely negative behaviour"). For validity, we considered as the "optimum" cut-off point the value of each scale which minimises the Youden index (i.e., sensitivity+specificity-1) and provided the value of sensitivity and specificity for this optimum cut-off point found for each scale [Youden, 1950]. The VAS measuring the DFA for the dentist and the one measuring the DFA due to the current visit were highly correlated (Spearman's correlation coefficient was 0.74 between scales reported by children and 0.67 between those reported by parents). Moreover, the two scales reported similar results. Therefore, in the Results section and Tables, we only showed findings for the VAS referring to the DFA for the dentist. Statistical analyses were performed using R (R Core Team, 2013) and SAS version 9.4 (SAS Institute, Cary, NC, USA).

Results

Of a total of 210 children who completed the questionnaires, 54.8% were males and 52.4% were aged 4-7 years (Table 1). The total score of the CFSS-DS ranged between 15 and 75 with a mean value of 30.8 (SD: 11.1). MCDAS total score ranged between 8 and 40 with a mean value of 17.9 (SD: 7.2). Both CFSS-DS and MCDAS scores were significantly higher (denoting a

	N	%	CFSS-DS				MCDAS			
			Mean	SD	P-value	Prevalence of DFA ^o (%)	Mean	SD	P-value	Prevalence of DFA ^o (%)
Total			30.8	11.1	-	13.8	17.9	7.2	-	17.6
Sex										
Males	115	54.8	30.5	11.1	0.680	10.4	17.6	7.4	0.593	15.7
Females	95	45.2	31.1	11.1		17.9	18.2	6.9		20.0
Age (years)										
4-7	110	52.4	32.6	11.1	0.013	17.3	18.9	7.0	0.033	22.7
8-11	100	47.6	28.8	10.7		10.0	16.8	7.2		12.0
Marital status of parents										
Married/cohabiting	187	89.1	31.1	11.1	0.324	13.9	18.1	7.1	0.309	17.1
Divorced/separated	23	11.0	28.7	10.6		13.0	16.4	7.6		21.7
Body mass index†										
Under/normal weight	93	66.4	34.6	12.5	0.467	19.4	20.1	7.7	0.993	23.7
Overweight/obese	47	33.6	33.3	8.6		19.2	20.1	4.8		21.3
Brothers and sisters (N)										
0	71	33.8	32.2	12.5	0.418	14.1	18.7	7.9	0.377	19.7
1	86	41.0	30.1	10.4		10.5	17.1	6.5		14.0
≥2	53	25.2	30.0	10.0		18.9	18.1	7.3		20.8
Birth ordert										
No brothers/sisters	70	33.7	32.4	12.5	0.241	14.3	18.7	7.9	0.476	20.0
First	51	24.5	28.9	12.2		13.7	17.4	8.2		23.6
Second/third/fourth	87	41.8	30.6	8.9		13.8	17.5	5.9		12.6
Times to dentist										
First time	44	21.0	34.4	10.7	0.011	18.2	20.8	7.0	0.002	27.3
Second time	53	25.2	32.0	8.0		9.4	18.4	5.2		13.2
More than two times	113	53.8	28.8	12.0		14.2	16.5	7.7		13.9

SD: Standard Deviation.

^o Dental fear and anxiety (DFA) prevalence defined as the proportion of children reporting a scale score exceeding the mean scale score plus 1 SD (i.e., CFSS-DS score ≥ 42 and MCDAS score ≥ 25, respectively). * The sum does not add up to the total because of some missing values.

TABLE 1 Mean values of Children’s Fear Survey Schedule-Dental Subscale (CFSS-DS) and Modified Children Dental Anxiety Scale (MCDAS) among 210 children according to selected characteristics of the children and their family.

higher DFA) among children aged 4-7 years (mean CFSS-DS: 32.6; mean MCDAS: 18.9) as compared to children aged 8–11 years (28.8 and 16.8, respectively). Children at their first dental visit had higher scores of CFSS-DS (mean: 34.4) and MCDAS (mean: 20.8) as compared to those at their second (32.0 and 18.4, respectively) or subsequent visit (mean CFSS-DS: 28.8; mean MCDAS: 16.5). No significant differences in total score of CFSS-DS and MCDAS scales was observed according to sex, marital status of parents, BMI, number of brothers and sisters, and birth order. Prevalence of DFA was 13.8% (10.4% among males and 17.9% among females, non significant, NS); 17.3% in children aged 4-7 years, 10.0% among children aged 8–11 years, NS), according to CFSS-DS. When considering MCDAS, the prevalence of DFA was 17.6% overall, 15.7% among males and 20.0% among females (NS); 22.7% in children aged

4-7 years and 12.0% among children aged 8–11 years (p<0.05).

Table 2 shows the mean values for all items of CFSS-DS and MCDAS scales. According to CFSS-DS, children were mainly scared by dentist drilling, its sight and noise, and receiving dental injections. Regarding MCDAS, having injection in the gum, having a tooth taken out, having a filling, and being put to sleep to have a treatment were the most fearful items.

Reliability of CFSS-DS, measured by Cronbach’s alpha correlation, was 0.90 (95% CI=0.88-0.92). Corrected item–total correlations ranged between 0.47 and 0.70 (Table 3). Reliability of MCDAS was 0.87 (95% CI=0.85-0.90). Corrected item-total correlations ranged between 0.59 and 0.77.

Overall, 60.0% of children who returned for a second appointment were boys and 51.7% were aged 4-7

Items		Mean	SD
CFSS-DS			
1	Dentists	1.73	0.96
2	Doctors	1.52	0.86
3	Injections	2.61	1.40
4	Having someone examine your mouth	1.72	1.01
5	Having to open your mouth	1.65	1.01
6	Having a stranger touch you	1.93	1.13
7	Having somebody look at you	1.72	0.94
8	The dentist drilling	2.72	1.46
9	The sight of the dentist drilling	2.49	1.28
10	The noise of the dentist drilling	2.41	1.27
11	Having somebody put instruments in your mouth	2.40	1.34
12	Choking	2.40	1.25
13	Having to go to the hospital	2.30	1.36
14	People in white uniforms	1.48	0.81
15	Having the nurse clean your teeth	1.72	0.98
MCDAS			
1	Going to the dentist generally	1.67	0.93
2	Having you teeth looked at	1.71	1.00
3	Having your teeth scraped and polished	1.74	1.00
4	Having an injection in the gum	3.10	1.44
5	Having a filling	2.50	1.35
6	Having a tooth taken out	3.01	1.47
7	Being put to sleep to have a treatment	2.21	1.33
8	Having a mixture of gas and air which will help you to feel comfortable for treatment but cannot put you to sleep	1.95	1.23

SD: Standard Deviation.

Items		Mean
CFSS-DS		
1	Dentists	0.60
2	Doctors	0.61
3	Injections	0.63
4	Having someone examine your mouth	0.68
5	Having to open your mouth	0.64
6	Having a stranger touch you	0.70
7	Having somebody look at you	0.51
8	The dentist drilling	0.63
9	The sight of the dentist drilling	0.66
10	The noise of the dentist drilling	0.60
11	Having somebody put instruments in your mouth	0.59
12	Choking	0.60
13	Having to go to the hospital	0.64
14	People in white uniforms	0.47
15	Having the nurse clean your teeth	0.62
MCDAS		
1	Going to the dentist generally	0.77
2	Having you teeth looked at	0.74
3	Having your teeth scraped and polished	0.67
4	Having an injection in the gum	0.71
5	Having a filling	0.71
6	Having a tooth taken out	0.77
7	Being put to sleep to have a treatment	0.61
8	Having a mixture of gas and air which will help you to feel comfortable for treatment but cannot put you to sleep	0.59

TABLE 2 Mean Children’s Fear Survey Schedule-Dental Subscale (CFSS-DS) and Modified Children Dental Anxiety Scale (MCDAS) item scores among 210 children.

TABLE 3 Corrected item-total correlations for Children’s Fear Survey Schedule-Dental Subscale (CFSS-DS) and Modified Children Dental Anxiety Scale (MCDAS) among 210 children.

years. Both CFSS-DS and MCDAS showed good test-retest reliability (rsp=0.80; p<0.001 for both scales). A good test-retest reliability was also observed for the VAS measuring the fear for the dentist (rsp=0.78; p<0.001), being the mean VAS score 40.4 for all the 210 children at baseline, and 24.0 for the 60 children who were retested at the second appointment (Data not shown).

According to the Frankl scale, 34.3% of children had a negative behaviour (i.e., Frankl ≤2), 35.5% among children aged 4-7 years and 33.0% among those aged 8-11 years. The corresponding percentages of children with a definitely negative behaviour (i.e., Frankl=1) were 7.6% overall, 8.2% among the youngest and 7.0% among the oldest children. Table 4 shows the predictive capacity of different scales to detect a negative behaviour of the child. Both CFSS-DS (AUC=0.69; 95% CI=0.60-0.76; sensitivity=0.61; specificity=0.72; cut-

off score: 32) and MCDAS (AUC=0.68; 95% CI=0.60-0.76; sensitivity=0.58; specificity=0.76; cut-off score: 20) reported by children predicted a Frankl score ≤2 with a relatively fair accuracy. The best predictive capacity was found with VAS reported by children (AUC=0.78; 95% CI=0.71-0.85; sensitivity=0.71; specificity=0.78; cut-off score: 50). CFSS-DS (AUC=0.81; 95% CI=0.68-0.93; sensitivity=0.69; specificity=0.86; cut-off score: 41) showed a higher ability to predict a Frankl score of 1, as compared to MCDAS (AUC=0.74; 95% CI=0.64-0.85; sensitivity=0.94; specificity=0.53; cut-off score: 18). Consistent results were observed for scales reported by children’s parents. Also in this case, VAS had a good predictive capacity to detect definitely negative behaviours (AUC=0.78; 95% CI=0.62-0.94; sensitivity=0.81; specificity=0.76; cut-off score: 60).

Table 5 shows the Spearman’s correlation between

	Ability of various scale to detect children with a negative or definitely negative behavior (i.e., Frankl scale ≤ 2)				Ability of various scale to detect children with a definitely negative behavior (i.e., Frankl scale =1)			
	AUC (95% CI)	Sensitivity	Specificity	Cut-off score	AUC (95% CI)	Sensitivity	Specificity	Cut-off score
Reported by children								
CFSS-DS	0.69 (0.60-0.76)	0.61	0.72	32	0.81 (0.68-0.93)	0.69	0.86	41
MCDAS	0.68 (0.60-0.76)	0.58	0.76	20	0.74 (0.64-0.85)	0.94	0.53	18
VAS	0.78 (0.71-0.85)	0.71	0.78	50	0.78 (0.66-0.91)	0.81	0.76	60
Evaluated by parents								
CFSS-DS	0.68 (0.60-0.77)	0.63	0.75	35	0.74 (0.56-0.92)	0.75	0.85	42
MCDAS	0.67 (0.59-0.75)	0.63	0.75	20	0.75 (0.61-0.88)	0.50	0.92	27
VAS	0.77 (0.69-0.84)	0.58	0.87	60	0.78 (0.62-0.94)	0.81	0.76	60

AUC: Area Under the Curve; CI: Confidence Interval.

TABLE 4 Diagnostic values for Children’s Fear Survey Schedule-Dental Subscale (CFSS-DS), Modified Children Dental Anxiety Scale (MCDAS), visual analogue scale (VAS) measuring Dental Fear Anxiety for the dentist, reported by children or evaluated by parents, considering the Frankl scale as the gold standard.

	Reported by children			Evaluated by parents			Evaluated by dentist
	CFSS-DS	MCDAS	VAS	CFSS-DS	MCDAS	VAS	Frankl
Reported by children							
CFSS-DS	1.00						
MCDAS	0.82	1.00					
VAS	0.39	0.32	1.00				
Evaluated by parents							
CFSS-DS	0.62	0.59	0.13*	1.00			
MCDAS	0.65	0.64	0.11*	0.87	1.00		
VAS	0.46	0.36	0.52	0.42	0.40	1.00	
Evaluated by dentist							
Frankl	-0.25	-0.25	-0.50	-0.25	-0.21	-0.39	1.00

* Estimates not statistically significant. All the other correlations were statistically significant (p ≤0.05).

TABLE 5 Spearman’s correlation coefficients between the Children’s Fear Survey Schedule-Dental Subscale (CFSS-DS), the Modified Children Dental Anxiety Scale (MCDAS), the visual analogue scale (VAS) measuring Dental Fear Anxiety for the dentist, reported by children or evaluated by parents, and the Frankl scale evaluated by the dentist.

various scales to measure DFA. All the scales were significantly correlated, with the exception of the CFSS-DS evaluated by parents and the VAS evaluated by children, and the MCDAS evaluated by parents and the VAS reported by children. The highest correlations were observed between CFSS-DS and MCDAS reported by children (rsp=0.82; p<0.001) and between CFSS-DS and MCDAS evaluated by parents (rsp=0.87; p<0.001).

Discussion

In our population of young children with relatively high DFA prevalence estimates, we found that the Italian version of the CFSS-DS and the MCDAS, developed by a panel of native Italian language experts of different disciplines, showed good internal consistency and test-retest reliability, and satisfactory validity. We also confirmed that

the scales reported by children and those evaluated by parents were very similar and highly correlated. Moreover, we suggested that, given the satisfactorily fair test-retest reliability and validity, a simple VAS may be considered a suitable, quick and valid alternative to the other scales to predict child behaviour during the dental visit.

The mean scores of the CFSS-DS and MCDAS for all Italian children were 30.8 and 17.9 respectively, which represent among the highest estimates reported in Europe and other high income countries [Cianetti et al., 2017a; Klingberg and Broberg, 2007]. The prevalence of DFA in our Italian population ranged between 14% and 18%. These estimates are consistent with those found in a recent systematic review based on 36 publications [Cianetti et al., 2017a]. In our Italian population, mean CFSS-DS and MCDAS scores did not differ according to sex. However, DFA prevalence estimates obtained using both scales appeared higher among females, in

accordance with the available scientific literature [Cianetti et al., 2017a; Klingberg and Broberg, 2007]. The relatively limited sample size did not allow us to find statistically significant difference according to sex. In agreement with most, but not all, the studies, DFA decreases with increasing of age [Boka et al., 2017; Cianetti et al., 2017a; Klingberg and Broberg, 2007]. Whereas family characteristics and anthropometric factors have no role in childhood DFA, dental fear decreases with increasing number of dental visits. This finding should not be attributable to children's age, being mean age similar in various categories of number of times to dentist. The relation between dental fear and previous dental experience is still controversial [El-Housseiny et al., 2016]. Whereas some studies found no difference in terms of DFA in children with or without previous dental experience, at least another study found that children with previous dental experience had significantly lower DFA [El-Housseiny et al., 2014; El-Housseiny et al., 2016; Ma et al., 2015; Nicolas et al., 2010]. Our findings support the latter study, suggesting that patients with dental experience will develop coping mechanisms enabling them to reduce DFA.

The Italian versions of the CFSS-DS and MCDAS showed a good level of internal consistency, the alpha of Cronbach being 0.90 for CFSS-DS and 0.87 for MCDAS. These estimates are consistent with most of the versions in other languages, where alpha has been reported to range between 0.85 and 0.92 [Ma et al., 2015; Nakai et al., 2005]. As in most countries and cultures, also in Italy the most fearful and anxious aspects of the dental visit include the sight and the noise of the dentist drilling and receiving injections in the mouth, thus suggesting that invasive dental procedures are major sources of DFA [Ma et al., 2015; Wogelius et al., 2003b].

The test-retest reliability was also satisfactory for both CFSS-DS and MCDAS, being the answer to the same item questions of the scale, at different times, highly correlated and reproducible. The correlation coefficients ($r_{sp}=0.80$ for both CFSS-DS and MCDAS) was in broad agreement to those found for the same scales in other countries [Howard and Freeman, 2007].

Previous studies showed how children with uncooperative behaviours had significantly higher DFA scores than cooperative ones [El-Housseiny et al., 2016; Ma et al., 2015; Nakai et al., 2005; Salem et al., 2012]. Accordingly, we found a significant inverse relation between various scales and the Frankl score. Moreover, we found that the Italian version of the CFSS-DS and MCDAS had a moderately good accuracy in predicting uncooperative behaviour during the dental visit, assessed through the Frankl scale (used as the gold standard). In fact, when used to predict patients with a negative behaviour (Frankl score ≤ 2), the AUC was 0.69 for CFSS-DS and 0.68 for MCDAS. When used to predict a definitely negative behaviour (i.e., Frankl score =1), the AUC was 0.81 for CFSS-DS and 0.74 for MCDAS. This suggests that CFSS-DS, contrary to MCDAS, is an accurate tool to

predict patients with a highly uncooperative behaviour.

A simple, one-item VAS scale has already been used to measure DFA [(Appukuttan et al., 2014; Luyk et al., 1988; Nicolas et al., 2010)]. More importantly, some studies found that VAS, besides being easier to administer, faster, and less burdensome for patients, thus resulting in higher response rates, is a valid alternative to several multi-item scales [Appukuttan et al., 2014; Luyk et al., 1988]. In our study, a simplified VAS scale, requesting to the children their level of fear for the dentist, besides providing fairly good test-retest reliability, was able to better predict uncooperative behaviours than both CFSS-DS and MCDAS. On the basis of the ROC curve analysis, a simple VAS reported by children is able to predict 71% of uncooperative children (i.e., Frankl score ≤ 2) using a cut-off value of 50, and 81% of highly uncooperative children (i.e., Frankl score =1) using a cut-off value of 60, with a relatively limited number of false negatives (i.e., <25%).

Study limitations include the relatively limited sample size, which is not adequate to derive prevalence estimates in a population and which did not allow us to perform stratified analyses with a satisfactory statistical power. Moreover, the sample population came from an institutional context. Findings may therefore be non-representative of the general Italian population aged 4–11 years. Moreover, we did not consider a back-translation to develop the Italian versions of the CFSS-DS and the MCDAS questionnaires. However, both questionnaires have been developed by consensus of a panel of native Italian language experts of different disciplines, including dentists, physicians, paediatricians, psychologists, epidemiologists and biostatisticians.

In most studies on the prevalence of DFA, dental fear scale questionnaires were self-administered by parents, and not directly by children [Cianetti et al., 2017a; Klingberg and Broberg, 2007]. However, some studies found the validity and the reliability of parental ratings to be questionable, suggesting to prefer children ratings to parental ones [Gustafsson et al., 2010; Verhulst and van der Ende, 1992]. We systematically found children self-rated scales as more accurate than those assessed by parents. However, parental ratings remain reliable and reproducible, and may represent a valid alternative, when children assessment results difficult.

Conclusion

In conclusion, the Italian versions of the CFSS-DS and the MCDAS are both reliable and valid tools for dental fear evaluation in young children. Given the higher ability of CFSS-DS to predict a negative –and, particularly, definitely negative– child behaviour during the dental visit, the CFSS-DS, although based on more items, appears to be a more appropriate scale than MCDAS. A simple, one-item VAS, and DFA evaluation self-administered by parents may be valid and concise alternatives to multi-

item indices, and scales assessed by children, respectively.

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Competing interests

None declared.

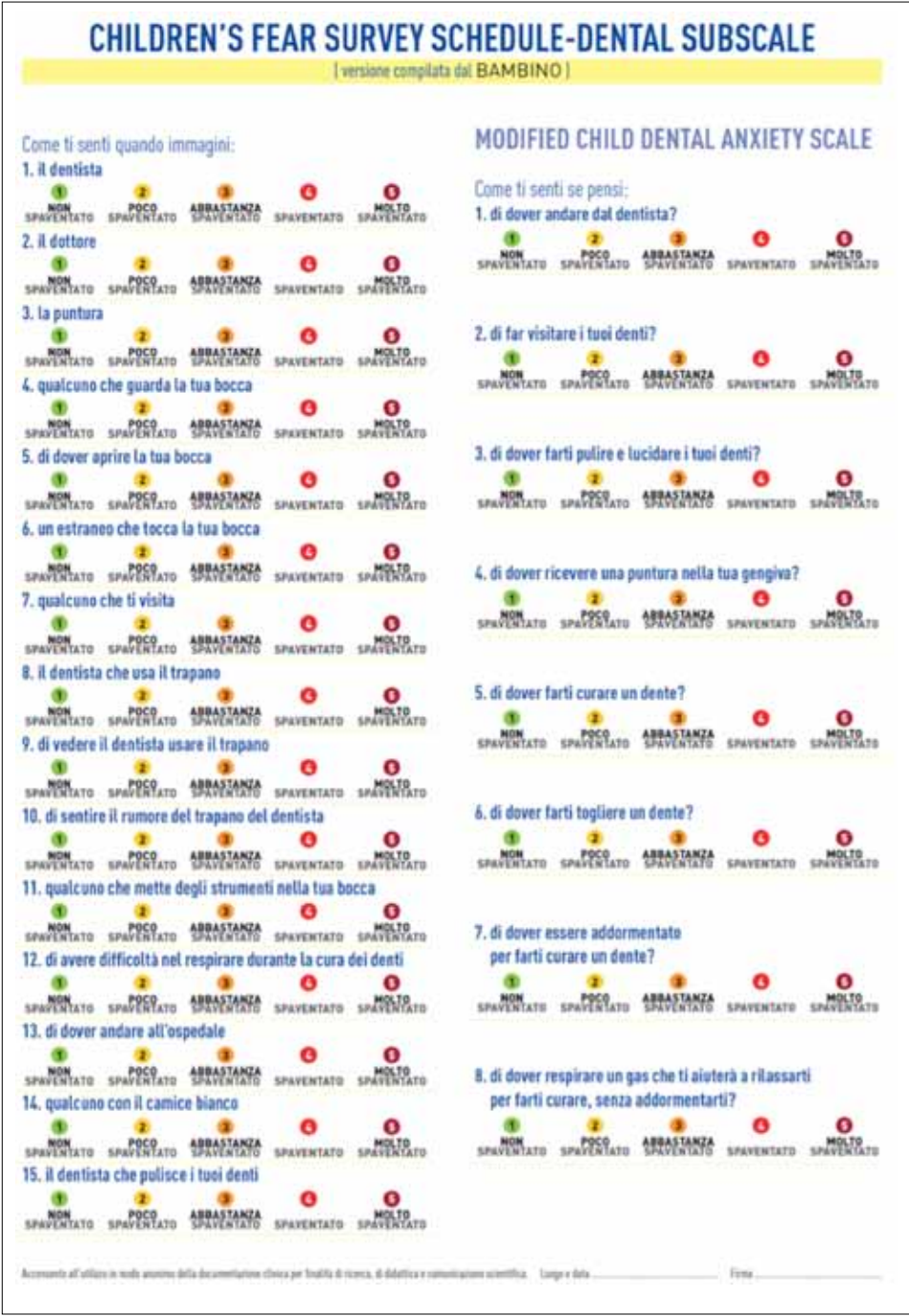
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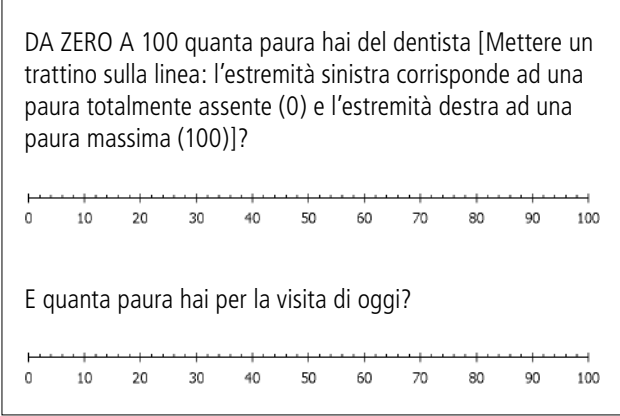
SUPPLEMENTARY MATERIAL

Paglia L., Gallus S., de Giorgio S., Cianetti S., Lupatelli E., Lombardo G., Montedori A., Eusebi P., Gatto R., Caruso S.

Reliability and validity of the Italian versions of the Children's Fear Survey Schedule - Dental Subscale and the Modified Child Dental Anxiety Scale



SUPPLEMENTARY FIGURE 1 Italian versions of the Children's Fear Survey Schedule-Dental Subscale (CFSS-DS) and the Modified Children Dental Anxiety Scale (MCDAS).



SUPPLEMENTARY FIGURE 2 Two simplified single-item VAS scales.