

ORIGINAL ARTICLE

Dental fear of Finnish children in the light of different measures of dental fear

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Abstract

Objectives. The aims were: (1) to examine the construct and reliability of the modified Dental Subscale of the Children's Fear Survey Schedule (CFSS-DS) among children of different ages and (2) to compare the correlations between fear measured with the modified CFSS-DS, the "peak value for dental fear" (PV), and "fear of dental treatment in general" (GF). **Methods.** The study sample consisted of 302, 299, 314, and 297 children aged 6, 9, 12, and 15 years, respectively. Each child received a questionnaire to be filled out at home. An explorative factor analysis with varimax rotation was performed for eight items taken from the CFSS-DS and questions on fear of pain and suction used in the mouth. For further age-specific analyses, mean values were calculated for the sum of items that loaded > 0.5 on each factor. The correlations between these values and PV and GF were studied. **Results.** The questionnaire was reliable. Two factors were revealed for each age: "treatment of dental decay" (TDD), which included fears related to invasive treatment, and "attending the dentist" (AD), which included fears related to dental visits in general. TDD explained over 50% of the variance, except among 9-year-olds. TDD mean values were higher among older children than among younger ones and correlated more strongly with PV than with GF. AD mean values were higher among younger children than among older ones and correlated more strongly with GF than with PV. **Conclusion.** The factor structures were fairly similar but the correlations between fear measures differed among children of different ages.

Key Words: Child, dental fear, factor analysis, measure

Introduction

Prevalence of dental fear has been studied using various measures, and some studies have evaluated the concordance between different dental fear measures [1–8]. Different measures of dental fear not only do not reveal the same study subjects as being anxious, they also measure different types of dental fear [1–3]. Locker et al. [1] compared the concordance of DAS [9], the single-item question used by Milgrom et al. [10] and Gatchel's 10-point fear scale [11] in adults. If the subjects were classified as anxious according to all three measures, the prevalence of fear was 5.4%. If the classification of anxious was based on any one of the measures, the prevalence was 25.6%. Extreme physiological response to dental treatment was more common among the subjects who reported being anxious on DAS and Gatchel's scale than among those

reporting anxiety according to Milgrom's single-item question [1]. When dental fear measures for children [2], adolescents, and adults [3] have been compared, each questionnaire has been shown to have its own restrictions. One measure of dental fear captures the aspect of state anxiety more, while another measure emphasizes the aspect of trait anxiety. These earlier studies suggest that dental fear should be studied using more than one measure [1,3].

The Dental Subscale of the Children's Fear Survey Schedule (CFSS-DS) is one commonly used measure of dental fear among children [6–8,12–19]. In studies exploring the construct of CFSS-DS [12–15], factors related to highly invasive procedures, less invasive aspects of dental treatment, and victimization have been revealed among 2.5 to 13-year-old children. Correlations between the total dental score of CFSS-DS and other dental fear measures have been studied

Table I. Mean values and standard deviations of the children's responses to the dental fear items among each age group

Fear of:	6-year-olds	9-year-olds	12-year-olds	15-year-olds	One-way analysis of variance	
	Mean (SD) <i>n</i> = 302	Mean (SD) <i>n</i> = 299	Mean (SD) <i>n</i> = 314	Mean (SD) <i>n</i> = 297	F	<i>p</i>
Keeping the mouth open	1.59 (1.06)	1.25 (0.64)	1.15 (0.43)	1.19 (0.56)	24.55	<0.001
Dentist	1.58 (0.93)	1.33 (0.76)	1.25 (0.64)	1.27 (0.69)	11.92	<0.001
Teeth being cleaned by a dentist or nurse	1.63 (1.01)	1.41 (0.73)	1.26 (0.62)	1.26 (0.75)	14.51	<0.001
Drilling	1.73 (1.29)	1.88 (1.14)	2.10 (1.24)	2.18 (1.31)	8.33	<0.001
Local anesthesia	1.44 (1.02)	1.63 (1.14)	1.80 (1.14)	1.91 (1.24)	10.03	<0.001
Hearing the sound of drilling	1.52 (1.08)	1.50 (0.94)	1.66 (1.05)	1.75 (1.13)	3.83	0.010
Being unable to breathe	1.87 (1.30)	1.92 (1.24)	1.87 (1.09)	1.92 (1.23)	0.17	0.918
Instruments put in the mouth	1.98 (1.26)	1.67 (1.01)	1.53 (0.91)	1.56 (0.95)	12.25	<0.001
Suction used in the mouth	1.56 (1.09)	1.29 (0.74)	1.15 (0.46)	1.20 (0.62)	17.68	<0.001
Dental treatment causing pain	1.96 (1.39)	2.18 (1.27)	2.25 (1.22)	2.50 (1.33)	8.92	<0.001

[6–8]. However, correlations between subscales of CFSS-DS obtained by factor analyses and other measures of dental fear have not been studied previously.

The overall aim of this study was to explore various aspects of dental fear among children at different ages. More specifically, the aim was to address the following questions: (1) What is the construct and reliability of the modified CFSS-DS among 6-, 9-, 12-, and 15-year-old children? and (2) What are the correlations between the subscales of the modified CFSS-DS and the fear of dental treatment in general [10] and the highest value for dental fear taken from individual questions of modified CFSS-DS [20]?

Material and methods

The data were obtained from a survey in which the occurrence and distribution of caries were studied after discontinuation of water fluoridation [21]. Independent random samples (*n* = 180) of 6-, 9-, 12-, and 15-year-olds were drawn in two middle-sized Finnish cities in 1998. The children who took part in the clinical examination and who filled out the questionnaire, 302, 299, 314, and 297 aged 6, 9, 12, and 15 years, respectively, were included in the analyses. The response rate was 83%. Of the study subjects, 50.7% were girls and 49.3% were boys. The children received a questionnaire during clinical examination to be filled out at home. If the children were not capable of answering the questions by themselves, they were advised to get help from their parents. The questionnaire included questions about social background, oral hygiene habits, diet, and dental fear. The number of fear-related questions that could be included in the

study was limited. Eight questions therefore related to dental treatment from the Finnish version of the Dental Fear Survey Schedule for children (DFSS-C), more commonly known as CFSS-DS [14], were selected for this study. In addition, questions about fear of suction used in the mouth, fear of dental treatment causing pain, and fear of dental treatment in general were included. The last-mentioned was included in the study as a commonly used single question for measuring dental fear [10]. All questions had 5-point Likert-scale reply alternatives from 1 = not afraid to 5 = very afraid. The details of data collection have been reported previously [20,21]. The study was approved by the Ethics Committee of the University of Kuopio.

For all ages, explorative factor analysis was performed on the fear items, except for the question about fear of dental treatment in general. Before the analysis, the children who did not answer these questions were considered as not being anxious, and their responses were coded as 1. This was done because missing replies were considered to represent a case where a child had no experience, or no fear-related behavior had been observed by the parents in these situations. Factors were extracted using principal component analysis with an eigenvalue of 1 as the cut-off point. When different rotation methods were compared, they seemed to result in similar solutions. Varimax rotation was used in the final solution because in this way the coefficients load high on one group of items and low on others [22]. Reliability of the questionnaire and the factor solutions in terms of internal consistency was studied separately for each age with Cronbach's alpha.

Instead of using factor scores for further age-specific analyses, we calculated summary values for items that

loaded higher than 0.5 for each factor. Means of the summary values were calculated, which in the comparisons made the analyses easier to interpret. For each age, Pearson's correlation coefficients were used to compare means of the summary values for factors with "peak value for dental fear" and "fear of dental treatment in general" [10]. The variable "peak value for dental fear" described the highest value the individual child had on the 11 fear questions, and this was used as a clinically relevant indicator that the child was afraid of something in dental treatment [20] and might thus show fear-related behavior. The statistical significance of the gender differences between means was evaluated with *t*-tests, while the statistical significance of the differences in means among age groups was evaluated with one-way analysis of variance.

Results

Table I presents the age-specific mean values for the fear-related questions. The fear of dental treatment causing pain had the highest mean value among 9-, 12-, and 15-year-olds and second highest among 6-year-olds. The fear of drilling, local anesthesia, hearing the sound of drilling, and dental treatment causing pain had higher mean values among older children than among younger ones. All differences among age groups were statistically significant besides for being unable to breathe when evaluated with one-way analysis of variance.

The results of the factor analyses are presented in Table II. Two factors were revealed for children at different ages. The first was named "treatment of dental decay", because items loading high on that factor mainly included situations related to invasive treatment of decay, for example, drilling, hearing the sound of drilling, local anesthesia, and pain. The second factor was named "attending the dentist" as the high loading items described less invasive situations related to dental visits in general, for example, fear of the dentist, keeping the mouth open, teeth being cleaned by a dentist or nurse, and suction used in the mouth. In general, the factor structures were similar among children at different ages, but with the following exceptions: fear of instruments used in the mouth was included in the "attending the dentist" factor among 6- and 9-year-olds and in the "treatment of dental decay" factor among 12- and 15-year-olds. Among 6-year-olds, fear of suction in the mouth was included in the "treatment of dental decay" factor; while being unable to breathe did not fulfill the inclusion criteria for either factor. For each age, except for 9-year-olds, the "treatment of dental decay" factor explained more than half of the variance.

The age-specific internal reliabilities of the total set of 10 questions were high. Cronbach's alphas were 0.87, 0.87, 0.87, 0.89 for 6-, 9-, 12-, and 15-year-olds, respectively. Cronbach's alphas for items loading high on the "treatment of dental decay" factor were 0.82,

Table II. Factor names and factor loadings for dental fear items among 6-, 9-, 12-, and 15-year-olds. Percentage of common variance explained (% of com var) by each factor and the whole model

	Factor loading	% com var
6-year-olds		
"Treatment of decay"		
Drilling	0.842	
Pain	0.771	
Hearing the sound of drilling	0.742	
Local anesthesia	0.717	
Suction used in the mouth	0.590	44.70
"Attending the dentist"		
Keeping the mouth open	0.863	
Dentist	0.795	
Teeth being cleaned by a dentist or nurse	0.769	
Instruments in the mouth	0.653	16.05
Total		60.75
9-year-olds		
"Attending the dentist"		
Keeping the mouth open	0.791	
Instruments in the mouth	0.763	
Teeth being cleaned by a dentist or nurse	0.726	
Dentist	0.706	
Suction used in the mouth	0.670	47.30
"Treatment of decay"		
Drilling	0.843	
Pain	0.805	
Local anesthesia	0.745	
Hearing the sound of drilling	0.693	
Being unable to breathe	0.520	15.17
Total		60.65
12-year-olds		
"Treatment of decay"		
Hearing the sound of drilling	0.798	
Drilling	0.779	
Local anesthesia	0.770	
Pain	0.754	
Instruments in the mouth	0.616	
Being unable to breathe	0.569	49.95
"Attending the dentist"		
Suction used in the mouth	0.776	
Keeping the mouth open	0.758	
Teeth being cleaned by a dentist or nurse	0.717	
Dentist	0.525	10.64
Total		60.59
15-year-olds		
"Treatment of decay"		
Pain	0.837	
Drilling	0.818	
Hearing the sound of drilling	0.814	
Local anesthesia	0.741	
Being unable to breathe	0.610	
Instruments in the mouth	0.593	51.95
"Attending the dentist"		
Teeth being cleaned by a dentist of nurse	0.774	
Keeping the mouth open	0.758	
Dentist	0.728	
Suction used in the mouth	0.715	11.91
Total		63.85

Loadings for fear of being unable to breathe among 6-year-olds: F1 = 0.468, F2 = 0.475.

0.82, 0.87, 0.88 for 6-, 9-, 12- and 15-year-olds, respectively. For the items loading high on the "attending the dentist" factor, Cronbach's alphas were

Table III. Mean values and standard deviations of “treatment of dental decay” and “attending the dentist” summary means, “peak value for dental fear”, and “fear of dental treatment in general” among each age group

	6-year-olds	9-year-olds	12-year-olds	15-year-olds	One-way analysis of variance	
	Mean (SD) <i>n</i> = 302	Mean (SD) <i>n</i> = 299	Mean (SD) <i>n</i> = 314	Mean (SD) <i>n</i> = 297	F	<i>p</i>
“Treatment of dental decay”	1.64 (0.90)	1.82 (0.88)	1.87 (0.86)	1.97 (0.96)	28.33	<0.001
“Attending the dentist”	1.69 (0.86)	1.39 (0.60)	1.20 (0.41)	1.22 (0.52)	63.20	<0.001
“Peak value for dental fear”	3.02 (1.38)	2.78 (1.29)	2.77 (1.27)	2.87 (1.34)	2.26	0.080
“Dental treatment in general”	1.93 (1.09)	1.67 (0.87)	1.53 (0.80)	1.59 (0.89)	11.30	<0.001

0.81, 0.82, 0.74, 0.79 for 6-, 9-, 12- and 15-year-olds, respectively.

The mean values for the “treatment of dental decay” and “attending the dentist” variables, “peak value for dental fear” and “fear of dental treatment in general” are presented in Table III. Mean values for “treatment of dental decay” were higher among older children than among younger ones, whereas mean values for “attending the dentist” and “fear of dental treatment in general” were lower among older children than among younger ones. The differences among age groups were statistically significant when evaluated with one-way analysis of variance. Mean values of “peak value for dental fear” seemed to remain fairly constant across age groups and had clearly higher mean values than did “fear of dental treatment in general”.

Pearson’s correlation coefficients between the mean factor summary values, “peak value for dental fear” and “fear of dental treatment in general”, are presented in Tables IV and V. “Treatment of dental decay” correlated more strongly with both “peak value for dental fear” and “fear of dental treatment in general” among older children than among younger ones. In contrast, “attending the dentist” correlated more strongly with “peak value for dental fear” and “fear of dental treatment in general” among younger children than among older ones. “Treatment of dental decay” correlation coefficients were higher for “peak value for dental fear” than for “fear of dental treatment in general”, whereas “attending the dentist” correlation coefficients were higher for “fear of dental treatment in general” than for “peak value for dental fear”.

For the following fear measures, higher mean values were observed for girls than for boys: among 9-year-olds for “fear of dental treatment in general” (girls 1.77

versus boys 1.56, $p < 0.05$), among 12-year-olds for “peak value for dental fear” (girls 2.92 versus boys 2.58, $p < 0.01$), and among 15-year-olds for “treatment of dental decay” (girls 2.15 versus boys 1.77, $p < 0.01$), for “peak value for dental fear” (girls 3.25 versus boys 2.46, $p < 0.01$), and for “fear of dental treatment in general” (girls 1.76 versus boys 1.41, $p < 0.01$).

Discussion

The children comprised a representative sample of the four age groups and included the low anxious children. The level of dental fear might have been higher if the children who did not take part in the clinical examination had participated in this study. The age-specific internal consistencies according to Cronbach’s alpha values were high, which indicates that the questionnaire was reliable. For the 10 items, a 2-factor solution was obtained for children at different ages, while previous studies on CFSS-DS with 15 items have resulted in 3- or 4-factor solutions. The third factor obtained from CFSS-DS has differed in previous studies [12–15] but is missing in our study, probably because our questionnaire contained fewer questions; we did not include questions related to general fears, such as fear of having someone look at you, having a stranger touch you, or people in white uniforms. The fear of dental treatment causing pain was included in the questionnaire because this has been shown to be common and clearly related to dental fear [23]. It loaded high on the “treatment of dental decay” factor. The factor structures obtained in this study were not exactly the same as those in the studies of ten Berge et al. [13] and Alvesalo et al. [14]. The factor structure of “treatment of dental decay” was similar at each age

Table IV. Pearson’s correlation coefficients ($p < 0.001$) between “fear of dental treatment in general” and the means of summary values of the factors “treatment of dental decay” and “attending the dentist” among each age group

	“Fear of dental treatment in general”			
	6-year-olds	9-year-olds	12-year-olds	15-year-olds
“Treatment of dental decay”	0.31	0.49	0.56	0.61
“Attending the dentist”	0.71	0.68	0.67	0.63

Table V. Pearson's correlation coefficients ($p < 0.001$) for "peak value for dental fear" and "fear of dental treatment in general" and the means of summary values of the factors "treatment of dental decay" and "attending the dentist" among each age group

	"Peak value for dental fear"			
	6-year-olds	9-year-olds	12-year-olds	15-year-olds
"Treatment of dental decay"	0.67	0.78	0.80	0.84
"Attending the dentist"	0.64	0.66	0.60	0.55
"Fear of dental treatment in general"	0.60	0.62	0.60	0.61

compared to the factor structures reported in previous studies [12–14], except that of ten Berge et al. (2002), who studied highly anxious children [15]. The factor structure of the second factor in the study by ten Berge et al. [13] was similar to ours but differed from that of Alvesalo et al. [14]. These differences between studies may have been due to differences in the ages of the study subjects [12–15].

In our study, the two factors differed between younger and older children. Among 9-year-olds, the percentage of common variance explained by "attending the dentist" was higher than in children of other ages. This may have been due to the concrete operational development stage of 9-year-olds [24] when they start to learn logical reasoning while still anxious about the unknown, like dental treatment, that they have not experienced. The fact that among 6-year-olds the "treatment of dental decay" explained most of the common variance might be caused by the fact that the questionnaire was filled out by their parents, who may have replied on the basis of observed fear-related behaviour or on the basis of their own experiences rather than those of their children. This assumption is also supported by the fact that 68% of the 6-year-olds were caries-free compared to the 42%, 38%, and 30% among 9-, 12-, and 15-year-olds, respectively [20], and the 6-year-olds had very little experience of the treatment of dental caries. The differences in treatment experiences among different ages might also explain the differences in the mean values of fear measures. Children's fears concerning "treatment of dental decay" were higher in older children than in younger ones, whereas the latent inhibition theory [16,17,25] might, in turn, partly explain the lower summary means of "attending the dentist" among older children. The "peak value for dental fear" had higher mean values than "fear of dental treatment in general", as "peak value for dental fear" measures any specific fear towards something in dental treatment. "Fear of dental treatment in general" in turn may reflect more the anxiousness towards dental treatment.

Before the analysis, the missing values were coded as 1 (not anxious). The numbers of missing values were lower in older age groups than in younger ones. The coding of missing values to 1 naturally affected the mean values (Tables I and IV). The mean values of single items among 12- and 15-year-olds were in accordance with the findings of Alvesalo et al. [14], who studied 12 to 14-year-old Finnish children and

were slightly lower than in other studies of younger children [13,15,18,19]. When we replaced missing values with the mean value of the corresponding item, as had also been done by ten Berge et al. [18], the mean values were similar to those reported in previous studies for younger children [13,15,18,19] and were slightly higher than in the study of Alvesalo et al. [14] for older children. Replacement of the missing values with the mean value did not change the results of the factor analysis. In our previous study, we found that when we used 0 to replace missing values, the total scores for the questionnaire were higher among older children than among younger children [20]. When we replaced missing values with 1 or with mean values, the total scores were lower among older than among younger children.

In conclusion, the factor structures were similar among children of different ages and were fairly comparable to those found in previous studies. However, the correlations between fear measures differed across ages.

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