Factors Associated With Different Measures of Dental Fear among Children at Different Ages

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ABSTRACT

Purpose: This study's purpose was to determine the associations between 4 dental fear measures and treatment procedures, oral habits, and family characteristics at different ages.
Methods: Independent random samples of 6-, 9-, 12-, and 15-year-olds were drawn in 2 cities (N=180 per age group from both cities). The study group comprised 270, 283, 311, and 293 subjects who were 6, 9, 12, and 15 years old, respectively. The total inclusion rate was 80%. The data concerning dental treatment procedures during the 3 preceding years were collected from patient records. Four measures (treatment of dental decay, attending dentist, general dental fear, and peak value for dental fear) were drawn from the questionnaire, including 11 fear-related questions (a modified children's dental fear survey schedule). Oral health habits and family characteristics were also recorded. Age-specific logistic regression analyses were performed using different fear measures as dependent variables.
Results: The relationship between child's dental fear (**CDF**) and oral health habits, family characteristics, and earlier treatment procedures differed among different ages, even when the same CDF measure was used as the dependent variable.
Conclusions: When evaluating children's dental fear, dentists should understand that CDF-related factors vary at different ages and according to the fear type.
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According to Rachman's theory, 3 different pathways lead to fear direct conditioning; vicarious learning, and negative information.[1,2] In the dental literature, direct conditioning has been reported to be a major contributor to children's dental fear (**CDF**).[3-11] In some studies, the contribution of indirect conditioning and other pathways has been minor compared to direct experiences,[3,4] whereas others have suggested that direct and indirect experiences are equally important.[12,13] Not many studies, however, have reported a relationship between CDF/anxiety and the treatment procedures experienced.[3-5]

In these studies, dental anxiety was more common among those children who had experienced extractions, but no such relationship was found for restorations.[3-5] Children with caries experiences (dmft/DMFT>0) have, however, been reported to be more anxious than children without such experiences.[5-11,14] In a study by Klingberg et al,[15] however, children with behavior management problems had fewer filled surfaces than had children without behavior management problems. The role of nondirect conditioning factors has received less attention, but in 2 studies in which family characteristics were included with

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treatment experiences in multivariable analyses,[3,4] the results indicated that parental anxiety also could contribute to CDF. The former study covered a single age group,[3] and the latter used pooled samples with wide age ranges without reporting age-specific results.[4] In these 2 studies, CDF was measured with either a children's dental fear survey schedule (**CFSS-DS**)[4] or a single question,[3] but the associations between different aspects of dental fear were not studied.

Besides the etiology of CDF being multifactorial, the fear itself is multidimensional.[1-13,16,17] Children experience normative fears throughout childhood, and different fears arise at different developmental stages.[18,19] In our earlier study,[16] we showed 2 factors from a modified CFSS-DS. We found that CDF, as measured with these factors and 2 other single measures, differed at different ages. When we compared different age groups using 4 different fear measures, the younger children more often expressed general fears related to dentistry than did older children who, in turn, often had more fears related to invasive treatment than the younger children. We could not, however, identify any studies on age-specific association between different measures of fear and previous treatment and other factors simultaneously.

In the present study, our aim was to determine the associations between 4 CDF measures and treatment procedures, oral habits, and family characteristics at different ages.

METHODS

The data on CDF were collected as a part of a caries study that included dental examinations and questionnaire surveys in 2 middle-sized Finnish cities: Jyväskylä and Kuopio.[20] These cities are situated less than 150 km from each other, fairly equal in size, and similar regarding distribution of income sources of livelihood. Independent random samples (N=180 per age group from both cities) of 6-, 9-, 12-, and 15-year-olds were drawn in both cities. Since birth, all Finnish children are entitled to free comprehensive oral health care, including preventive services.

Children for whom data from the questionnaire and the clinical examination were available were included in the analyses. The study group comprised 270, 283, 311, and 293 subjects who were 6, 9, 12, and 15 years old, respectively, with the total inclusion rate being 80%. All subjects were examined clinically and radiographically by 2 calibrated dentists. A detailed description of the methods used in the clinical part of the study has been reported by Seppä et al.[20] Data concerning dental treatment procedures during the 3 years preceding the examination were collected from comprehensive patient records. During the clinical examination, the children received a questionnaire to be filled out at home by themselves, with the help of their parents if needed.

The questionnaire consisted of questions on oral health habits, social background, and CDF. As the number of questionnaire items was large, only limited number of fear-related questions could be included. Eight questions related to CDF were taken from the Finnish version of the CFSS-DS.[21] These included questions on fear of keeping the mouth open, the dentist, the teeth being cleaned by the dentist or nurse, drilling; local anesthesia, hearing the sound of drilling, being unable to breath; instruments put in the mouth, suction used in the mouth; dental treatment causing pain, and dental treatment in general. Family members' dental fears were addressed with the question: "There might be members in your family who have dental fear. Please estimate how much each of the following is afraid of dentistry: mother, father, sibling, other, who." A Likert-

Table 1. Mean Values for the Children's Fears for "Treatment of Dental Decay" (TDD), "Attending Dentist" (AD), "Peak Value for Dental Fear" (PV), and "Dental Treatment in General" (GF), According to Number of Treatment Procedures among Each Age Group (P–value For Analysis of Variance)

Age (ys)	Fear	No. of treatment procedures					
		0	1	2-4	5+	**Total**	*P*-value
6	PV	2.89	3.05	3.41	3.50	**3.04**	.049
	TDD	1.44	1.64	2.18	2.34	**1.66**	.000
	AD	1.64	1.62	1.80	1.88	**1.69**	.427
	GF	1.91	1.70	1.97	2.16	**1.93**	.448
	N	181	23	35	31	**270**	—
9	PV	2.33	2.81	2.86	3.12	**2.78**	.001
	TDD	1.46	1.80	1.85	2.15	**1.82**	.000
	AD	1.31	1.52	1.33	1.45	**1.39**	.173
	GF	1.53	1.79	1.63	1.81	**1.68**	.158
	N	80	42	76	85	**283**	—
12	PV	2.22	2.79	2.86	3.02	**2.76**	.000
	TDD	1.48	1.90	1.96	2.04	**1.87**	.000
	AD	1.09	1.25	1.25	1.23	**1.20**	.074
	GF	1.31	1.54	1.67	1.59	**1.53**	.030
	N	78	28	78	127	**311**	—
15	PV	2.56	3.00	3.07	2.99	**2.88**	.051
	TDD	1.65	2.18	2.13	2.06	**1.97**	.002
	AD	1.17	1.36	1.23	1.22	**1.23**	.331
	GF	1.53	1.55	1.67	1.61	**1.59**	.728
	N	91	42	83	77	**293**	—

scale with 5 reply alternatives (1="not afraid" to 5="very afraid") was used for each of the fear-related questions. The nonresponders were considered as not being anxious, and their replies were coded as 1.

In our earlier article,[16] we revealed 4 different measures of CDF from the 11 fear-related questions. "Dental treatment in general" (**GF**) was drawn from a single question: "Are you afraid of dental treatment in general?" that was used also by Milgrom et al.[22] "Peak value for dental fear" (**PV**) described the highest value a child had on the 11 fear-related questions, and this was used as a clinically relevant indicator that the child was afraid of something in dental treatment[14] and, thus, might show fear-related behavior. The latter 2, "treatment of dental decay" (**TDD**) and "attending dentist" (**AD**) were shown by factor analyses and consisted of the summary mean values of the items loading high on each factor. In the first factor, TDD, items loading high included situations related to invasive treatment of decay (ie, drilling, hearing the sound of drilling, local anaesthesia, and pain). In the second factor, AD, the high-loading items described less invasive situations related to dental visits in general (ie, fear of the dentist, keeping the mouth open, teeth being cleaned by a dentist or nurse, and suction used in the mouth). The internal reliabilities for the total set of questions and for the 2 factors were high, varying from 0.81 to 0.89 among different age groups.[16]

The number of restorations, extractions, pulpal treatments, local anesthesias, and orthodontic, periodontal, and preventive procedures during the 3 years preceding the clinical examination were included in the bivariate analyses with GF, PV, TDD, and AD using Spearman's correlation coefficients and comparisons of mean values. The numbers of different treatment procedures were rather small, and many did not correlate with any measure of dental fear. Among 6-year-olds, PV correlated with the number of pulpal treatments (r=0.20, $P<.01$) and TDD correlated with the number of: restorations (r=0.31, $P<.001$); local anesthesias (r=0.30, $P<.001$); and pulpal treatments (r=0.24, $P<.001$). Among 9-year-olds, TDD correlated with the number of restorations (r=0.29, $P<.001$). Among 12-year-olds, TDD and PV correlated with the number of restorations (r=0.25, $P<.001$; and r=0.20, $P<.001$, respectively). Therefore, the number of restorations, extractions, pulpal treatments, and local anesthesias were summarized into the variable "treatment procedures." Associations between the numbers of treatment procedures and different measures of dental fear were studied by analysis of variance separately for different ages. For further analyses, the number of treatment procedures experienced was evaluated as: 0=no previous treatment procedures; and 1=1 or more treatment procedures. As we did not examine children's own experiences of earlier dental procedures, this evaluation was chosen because each individual treatment procedure was considered a potential negative, although not necessarily painful, experience that might lead to CDF.

Age-specific logistic regression analyses were performed using the GF, PV, TDD, and AD as dependent variables. TDD and AD were coded as follows, based on their distribution: mean values 1.00-1.99 represented no fear (=0) and mean values 2.00 to 5.00 represented fear (=1). For PV, subjects who reported to be not at all, a little, or to some degree afraid were coded as not fearful (=0) and those who reported to be quite or very afraid were coded as fearful (=1). For GF, subjects who reported not being at all or a little afraid were coded as not fearful (=0) and those who were to some degree, quite, or very afraid were coded as fearful (=1).

Because caries experience (dmft/DMFT) correlated strongly with the number of treatment procedures, this variable was excluded from the analyses to avoid problems caused by collinearity. In addition, parents' educational levels were combined into 1 variable. The following independent variables that in our earlier study were associated with dental fear[14] were used in the logistic regression models and coded to 0 and 1 as: gender (girl=1), parents' education (parents' combined education lowest quartile=1), treatment experiences (at least 1 procedure =1), family members' dental fear (quite or very afraid=1, included separately for mother, father, and sibling); limitation on eating candy to only 1 day per week (limitation=1); and child's tooth-brushing frequency (≤1 a day). The latter and tooth-brushing frequency were included since they were considered as proxies for family's attitudes towards oral health. Families may use scaring children with dental treatment as negative motivators to brush teeth or not to eat candy.

The initial models were full models that included all independent variables and their first-order interactions. We then proceeded with the manual backward elimination method, excluding all interaction terms for which the regression coefficients did not reach statistical significance at the level $P<.02$. After elimination of nonsignificant interaction terms, the main effects that did not reach statistical significance at the level $P<.05$ or were not part of a significant interaction term were eliminated manually, resulting in a model that was parsimonious and fit sufficiently well. The data were analyzed using SPSS 12.0 (SPSS Inc., Chicago, Illinois). This study was approved by the Ethics Committee of the University of Kuopio, Kuopio, Finland.

RESULTS

The percentages of girls were 49, 51, 52, and 52 among 6-, 9-, 12-, and 15-year-olds, respectively. For other independent variables, the corresponding age-specific percentages were: 23, 33, 38, and 49 for tooth-brushing twice a day or more; 55, 55, 33, and 9 for eating candy only 1 day per week; and 49, 47, 39, and 43 for parents' combined education (high), respectively. The percentages and mean values for CDF-related items and percentages for family members' fears have been reported earlier.[14,16] Among respondents eligible for the analyses, on average 6% and 20% of item-specific values were missing for independent and dependent variables, respectively.

Table 2. Summary of the Results of the Final Logistic Regression Analyses among 6–, 9–, 12–, and 15–year–olds Using the Fears "Peak Value for Dental Fear" (PV), "Treatment of Dental Decay" (TDD), "Attending Dentist" (AD), and "Dental Treatment in General" (GF) as Dependent Variables

Age (ys)	PV		TDD		AD		GF	
	Independent variables*	Odds ratio (95% confidence interval)	Independent variables*	OR (95% CI)	Independent variables*	OR (95% CI)	Independent variables*	OR (95% CI)
6	Sibling's dental fear	6.55 (2.28-18.77)	Sibling's dental fear	5.44 (2.05-14.39)			Candy limitation	
	Father's dental fear	2.99 (1.08-8.25)	≥1 procedures	4.60 (2.55-8.32)			among girls	2.06 (0.91-4.65)
	≥1 procedures	1.75 (1.02-3.01)					among boys	0.55 (0.26-1.15)
9	Father's dental fear	3.57 (1.30-9.78)	Father's dental fear	5.86 (2.04-16.81)			Candy limitation	
	≥1 procedures	3.10 (1.57-6.13)	≥1 procedures	4.15 (2.09-8.21)			among girls	3.48 (1.21-10.03)
	Candy limitation						among boys	0.58 (0.19-1.73)
	among girls	2.54 (1.14-5.86)					Parent's low education	2.41 (1.19-4.90)
	among boys	0.62 (0.28-1.37)						
12	≥1 procedures	4.07 (1.86-8.89)	≥1 procedures	2.92 (1.56-5.44)	≥1 procedures	8.02 (1.06-60.48)		
			Mother's dental fear	2.08 (1.06-4.09)				
15	Sibling's dental fear	4.90 (2.01-11.96)	Sibling's dental fear	3.48 (1.45-8.37)	≤1x/day tooth-brushing	5.71 (1.82-17.89)	Sibling's dental fear	2.95 (1.14-7.68)
	Girl	3.65 (2.09-6.40)	Girl	2.67 (1.61-4.42)	Girl	2.84 (1.82-17.89)	Girl	2.19 (1.05-4.58)
	Mother's dental fear	2.41 (1.19-4.87)	Mother's dental fear	2.37 (1.19-4.72)				
	≥1 procedures	2.22 (1.21-4.08)	≥1 procedures	1.79 (1.03-3.09)				

**** Independent variables were dichotomized to 0 and 1 as follows: treatment experiences (≥1 procedure=1) and family characteristics: gender (girl=1); limitation for eating candy only 1x/day per week (limitation=1); child's tooth–brushing frequency (≤1x/day=1); parents' education (parents' combined education low=1); and family members' dental fear (quite or very afraid=1) for the mother, father, and sibling separately.***

Among children in all age groups, the mean values for PV and TDD were greater as the children received more treatment procedures (Table 1). Except for PV, among 15-year-olds, the differences were statistically significant. At all ages, the mean values for the other 2 measures of fear (ie, AD and GF) were rather low and did not vary according to the number of treatment procedures. Among 12-year-olds, however, GF peaked at 2 to 4 treatment procedures.

The logistic regression analyses results differed among children at different ages (Table 2). At all ages, however,

some similarities were found. When fear was measured as PV or TDD, those children who had experienced treatment procedures were more likely to be afraid than those with no experiences of treatment procedures. Conversely, GF was not associated with treatment procedures at any age and AD was associated with treatment experiences only among 12-year-olds.

At all ages, either the mother's, father's, or sibling's dental fear was associated with TDD and with PV, except for PV in 12-year-olds (Table 2). For GF and AD, however, the family members' dental fear was associated only with GF among 15-year-olds. The family member whose fear was most strongly associated with CDF varied at different ages for fear measures TDD and PV.

In addition to treatment procedures and family members' dental fear, gender and some other factors entered some of the models. Among 15-year-olds, girls were more likely than boys to report CDF with all 4 fear measures, and tooth-brushing once a day or less often was associated with AD. Gender was not associated with any of the fears among 12-year-olds. Gender modified the effect of limiting candy eating on the GF fears in 6- and 9-year-olds and PV in 9-year-olds. Girls limited to eating candy once a week were more likely to report these CDFs, while no such association was observed among boys. All these statistically significant interactions were interpreted in the same direction, even though the 95% confidence intervals would have been narrower when using another interpretation. Among 9-year-olds, children of parents with a low educational attainment were more likely to report GF than children of parents with higher educational attainment (Table 2).

DISCUSSION

Factors related to different measures of CDF varied considerably among different ages. These results support our previous findings[16] that CDF can take various forms and that the CDF characteristics are associated with different measures of fear, thus supporting CDF's multidimensional etiology. PV and TDD were associated with treatment procedures and the mother's, father's, or sibling's dental fear at each age. In general, however, no such associations were found with GF or AD. In this study, earlier treatment procedures from the 3 preceding years were not very strong predictors of any of the measured aspects of dental fear. On the contrary, the mother's, father's, or sibling's dental fear assessed by the child was more strongly associated with the fear measures TDD and PV than were the earlier treatment procedures, except for 12-year-olds.

Although the role of direct conditioning in the acquisition of dental fear is well established,[3-11] the family characteristics may have been underestimated. One reason for the discrepancy with earlier studies[5-11] might be that few studies have included both treatment procedures and family related characteristics in the multivariable analyses.[3, 4] Nondental factors also contribute to the acquisition of dental fear,[3,17,23,24] such as subjective experience of pain.[23,24] This study further shows that both direct dental and indirect family related factors play a role in the presence of CDF, but their effect seems to vary at different ages.

The finding among 12-year-olds that earlier treatment procedures were associated with all measures, except for GF, suggests that direct conditioning in this age period is important. At this stage of development, children are able to develop cognitive abilities and different coping styles, thus possibly affecting their perception of dental treatment and fear development.[4,25,26] At this time, the children may be able to comprehend between treatment phases and more sophisticated cognitive abilities may make them more sensitive to fears, such as worrying about the dentist's competence, for example.[4,25,27]

Children at different developmental stages may experience different aspects of fear in a treatment situation.[4] This might explain, for example, the effect of gender on the role of candy limitation in our logistic regression models among 9- and 6-year-olds. Possibly, girls at this age might be more prone than boys to indirect negative information such as associating the candy-eating limits with a threat of future dental treatment. In addition, using avoidance of candies to motivate children to brush their teeth might reflect the family's attitudes towards oral health and fears related to it. Fifteen-year-old girls were more likely to be anxious than 15-year-old boys when any fear measure was used. Similar findings among adolescents have been reported earlier.[28, 29] Interestingly the gender difference in dental anxiety, reported consistently among adults, appeared only at this age.[30,31]

For several reasons the current results should be interpreted with caution. First, we asked only about current fear, not the point of time when the fear was acquired. The family member's dental fear was estimated by the children, and, if needed, the help of their parents was used. The phrasing of the question may have affected fearful children to overestimate their parent's dental fear. Based on this study's design, it cannot be concluded who provided the information to the study: the child, parent, or both. This makes the theoretical assessment of the modeling vs informational pathway difficult. It may also have affected the assessment's validity.

Secondly, only the numbers of treatment procedures during 3 years preceding the examination were available, which was due to fact that the data on them were not primarily collected for this study. If the treatment procedures had been available for the subjects' whole dental history, the associations of different fear measures with the treatment procedures might have been different. The number of treatment experiences, however, was strongly correlated with the children's dmft/DMFT that reflects the children's treatment history. In addition, we did not examine the subjects' own experiences and interpretation of the treatment situation. The associations with the children's own experiences of the treatment might have been stronger, but the recollection of experiences may vary in the course of time.[32]

Thirdly, some possible nondental factors, such as psychopathological factors, temperament, and parenting,[3,17,33-35] were not taken into account in this study. These factors may also play an additional role in the acquisition of CDF. Candy limitation, parents' education, and tooth-brushing habits, however, might reflect some indirect pathways that affect the learning of attitudes towards dental treatment.

Additionally, we did not examine the quality of the procedures children had experienced (ie, whether sufficient local anesthesia was used during the treatment). Klingberg et al[15] found that children who received restorative treatment without local anesthesia were more likely to show dental behavior management problems than children who received local anesthesia. Positive experiences may protect children against developing dental fears or, despite negative experiences, the fear may subside with later positive experiences.[36] It may be that most study subjects who had experienced treatment had undergone simple procedures with sufficient local anesthesia, possibly with positive experiences.

The etiological factors behind dental fear form a complex system, and factors other than dental treatment are also related to the existence of the fear. This might partly explain the rather high prevalence of dental fear even among children who were caries-free.[16] It has been suggested that the family's functionality and the parents' ability to form positive, consistent, and nurturing interactions with their children is essential for the child's ability to cope with dental treatment.[37-39] Thus, information about the importance of indirect experiences on the development of dental fear, together with positive approach to oral health, should be more often provided to families at their first dental visits. This information could be easily provided and may decisively help in preventing and decreasing CDF. A more holistic approach should be taken in treating CDF. In pediatric dental clinics, the family should not be excluded from CDF treatment. By contrast, the family is vital in creating and maintaining CDF, improving negative attitudes towards oral health, and preventing fear. The issue should be more often discussed with families (ie, by asking if the parents are also willing to change their oral health attitudes to help their fearful child with the treatment). Furthermore, other health personnel should be more often consulted and involved during the treatment of dental fear in the family.

CONCLUSIONS

When evaluating and treating children's dental fear (CDF), dentists should:

1. Understand that factors related to CDF vary at different ages and according to the fear measure used. Dentists using different questionnaires for assessing CDF should be acquainted with the type of fear being measured. Besides using the scales' total scores, subscales and individual questionnaire items should be considered before approaching fearful children in dental settings.
2. Besides providing positive and painless treatment experiences, consider the role of family members' fears. In addition to discussing the prevention of dental diseases, parents should be also informed of the possible effects of dental anxiety by their children's first dental visits. More emphasis should be placed on providing positive information on oral health, both in dental clinics and at home. This could prevent the creation of CDF.

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