Dental fear and oral health and family characteristics of Finnish children

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Objectives: Our aim was to describe the occurrence of dental fear among Finnish children of different ages and to ascertain how oral health and family characteristics are associated with dental fear. *Methods:* The subject groups were aged 3, 6, 9, 12, and 15 years in two middle-sized cities, and the 1474 participants were distributed over fairly equal samples of each age. A questionnaire given to each child to be filled out at home enquired about social background, oral hygiene habits, diet, and dental fear. Oral health status was examined clinically and radiographically by two calibrated dentists. Multiple logistic regression analyses were performed for each age group in order to study the associations between dental fear and selected factors. *Results:* Dental fear was higher among 12- and 15-year-old children than among the younger ones. Pain, drilling, and local anesthesia were reported to be the most frightening aspects. Excluding the 12-year-olds, children whose family members reported dental fear were more likely to report dental fear than children whose family members did not report dental fear. Six- and 12-year-olds who had experienced caries were more likely to report dental fear than were caries-free children. Among 6-year-olds, father's education modified the effect of a child's caries experience on child dental fear. Frequent intake of sugary items and a limit on eating candies to only one day per week were associated with higher dental fear. *Conclusions:* Fear of dental treatment is still fairly common among Finnish children, and the factors associated with it differ with the age of the child. □ *Caries; child; dental fear; social class*

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Several factors, especially direct and indirect conditioning experiences, have been reported to contribute to dental fear and dental anxiety in children (1–10). Direct conditioning through adverse dental experiences plays a major role in its development (3, 6–10), but indirect experiences are also important. Many studies have supported a positive relationship between dental fear or anxiety of a child and his/her family members that may be due to indirect conditioning (1, 2, 4, 5). Associations between a child's dental fear or dental anxiety, oral health status, and factors related to the child's family have also been reported (1, 2, 4, 5, 11–13). Dental fear or dental anxiety among parents has been associated with increased caries occurrence in their children (1, 4) and poorer dental attendance (5). The direction and strength of the association between the guardian's socio-economic status, child's dental fear, or dental anxiety and dental status have differed in different studies (2, 6). Children's and adolescents' dental fear or dental anxiety has been related to increased occurrence of caries (6, 11, 12). This may be at least partly explained by negative experiences related to restorative treatment.

In the 1970s, a considerably higher percentage of Finnish children had experienced caries than in the 1990s (14–16), which means lower numbers of restorative procedures in recent years. According to local studies, the prevalence of dental fear has also decreased during the same period (17, 18). In 1977, 56% of 7- to 10-year-old children in Finland were reported to be afraid of the dentist (17). In 1991, among 10- to 14-year-old children the figure was 30% (18, 19). In studies conducted in 1985 and in 1991, drilling and local anesthesia were reported to be the most frightening procedures (17, 18). In the 1990s, the declining trend in the occurrence of caries among Finnish children leveled off (14). The number of children experiencing restorative procedures is therefore no longer declining, which in turn might also reflect a leveling off of the decline in reported dental fear. Our aim was to describe the occurrence of dental fear and what children are afraid of in dental treatment at different ages. In addition, we wanted to ascertain how Finnish children's oral health and family characteristics are associated with dental fear.

Materials and methods

The study was part of a larger study examining the occurrence and distribution of dental caries (14). The subjects were 3-, 6-, 9-, 12-, and 15-year-olds in two middle-sized Finnish cities (Jyväskylä and Kuopio) in 1998. These cities are situated less than 150 km apart; they are of fairly equal size and are similar with regard to distribution of sources of livelihood (20). The original random sample in both cities was 180 for each age group and the total response rate was 82%. The numbers of respondents and the response rates in each age group in Jyväskylä and in Kuopio are presented in Table 1. Caries experience was

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Table 1. Numbers of respondents and response rates among each age group in Jyväskylä and Kuopio

	3-year-olds		6-year-olds		9-year-olds		12-year-olds		15-year-olds	
	n	(%)	*n*	(%)	*n*	(%)	*n*	(%)	*n*	(%)
Jyväskylä	142	79	148	82	142	79	148	82	142	79
Kuopio	147	82	152	84	154	86	152	84	147	82
Total	289	80	300	83	296	82	300	83	289	80

registered both clinically and radiographically by two trained and calibrated dentists. The children received a questionnaire at the clinical examination to be filled out at home with the help of their parents if needed. It enquired about social background, oral hygiene habits, diet, and dental fear. As there were many items in the questionnaire, only a limited number of fear-related questions could be included. General dental fear of the children and their family members was measured with single 5-point Likert-scale questions with alternatives 'not afraid', 'a little afraid', 'afraid to some degree', 'quite afraid' or 'very afraid'. In addition, ten 5-point Likert-scale questions related to dental treatment were included, 7 of which were selected from the Finnish version of the DFSS-C tested by Alvesalo et al. (19). One question on pain and one on using suction in the mouth were included, as these were considered to have clinical importance. The internal consistency of the questions tested by Crohnbach's alpha was found appropriate, the alpha values being 0.836, 0.865, 0.866, 0.868, and 0.886 for 3-, 6-, 9-, 12-, and 15-year-olds, respectively. A detailed description of the methods used in the clinical part of the study has been given by Seppä et al. (14), and the study was approved by the ethics committee of the University of Kuopio.

Two variables describing dental fear were formed for each child. The value for one of them, 'total score for dental fear', was calculated by adding up the scores (from not afraid = 1 to very afraid = 5) from each of the 11 fear questions—the maximum score being 55. Another variable, 'peak value for dental fear', was formed to describe the highest value the individual child had within the 11 fear questions. To describe how each of the 11 items contributed to the variable 'peak value for dental fear', we counted the frequencies (%) with which each of the items was given the highest value for this variable. Table 2 presents the percentages at which each of the 11 fear items were given the highest value among those children who were 'quite afraid' or 'very afraid' of at least one of these items.

Since a number of factors have been shown to be associated with children's dental fear and anxiety (1–10), we decided to use exploratory multivariable modeling for the data analyses. Among the available candidates for independent variables we chose those that, based on previous studies, were related to children's dental fear. The variables included in the modeling were 'child's dental fear', 'family members' dental fear', 'parents' education', 'child's sex', 'oral health habits', 'caries experience' and 'city of residence'. Age-specific multiple logistic regression analyses were used to explore the associations between dental fear and the independent variables. In addition to the main effects, we considered first-order interactions. Child's 'peak value for dental fear' was the dependent variable and was selected for modeling because it was the most practical to interpret; it is an indicator that the child is (quite or very) afraid of something in dental treatment. The sum of the dmfs and DMFS was used to describe past and present caries experience. To further improve the interpretability of the models, we decided to dichotomize all variables. Before dichotomization, however, the missing system values were marked as 0 for all questions related to dental fear. The variables used and their coding for dichotomizations are presented in Table 3. The final models were constructed using a manual backward method. At the first stage, the interaction terms that did not reach the significance level of $P < 0.05$ were eliminated. The main effects that did not reach $P < 0.05$ or were not part of an interaction term included in the model were then eliminated. Differences between boys and girls were analyzed by cross-tabulation. Statistical significances were evaluated by chi-square tests. *P*-values lower than 0.05 were considered significant. The SPSS 11.5 program was used for all analyses.

Results

Age-specific percentages of subjects in different categories of the independent variables, including the percentage of children with dmfs + DMFS >0, are given in Table 4. The occurrence of dental fear at each age was expressed in two ways: first, by percentages of children who reported general dental fear, and second, as the mean 'total score for dental fear' values. Table 5 presents the percentages of children who were afraid of specific procedures and/or dental treatment in general in each age group. The mean 'total scores for dental fear' values were 8.5 ($s = 9.2$, range = 51), 14.6 (10.2, 55), 15.7 (8.4, 50), 16.3 (7.7, 44), 17.2 (8.6, 48) for 3-, 6-, 9-, 12-, and 15-year-olds, respectively. In each age group, dental fear of specific procedures was reported more often than general dental fear. Children's general dental fear was higher among 3- and 6-year-olds than among older children. Children in all age groups except 3-year-olds reported being most often 'quite afraid' or 'very afraid' of pain. Drilling and local anesthesia were reported second and third most often among 12- and 15-year-olds and being unable to breath second most often among 6- and 9-year-olds. For 3-year-olds, the most frequently reported procedures they were quite afraid or very afraid of were keeping the mouth open, instruments put in the mouth, and being unable to breath. The mean 'total score for dental fear' values was higher among 12- and 15-year-old children than among younger ones.

Table 2. Frequencies (%) at which each of the fear items was given the highest value among those children who were 'quite afraid' or 'very afraid' of at least one of them. The highest value formed the variable 'peak value for dental fear' for each child

Afraid of	3-year-olds (%)	6-year-olds (%)	9-year-olds (%)	12-year-olds (%)	15-year-olds (%)
Pain	15	45	51	51	67
Drilling	7	35	26	46	46
Local anesthesia	7	18	32	35	35
Being unable to breath	29	31	36	25	35
Hearing the sound of drilling	8	16	14	21	19
Instruments in the mouth	31	31	17	12	12
Teeth being cleaned by dentist or nurse	21	11	3	2	6
Dentist	18	7	5	4	4
Dental treatment in general	32	14	6	0	4
Suction used in the mouth	7	18	7	1	2
Keeping the mouth open	42	16	2	0	1

The only statistically significant differences found between boys and girls were the following: 9-year-old girls were more often quite or very afraid of dental treatment in general (G = 7%, B = 1%, $P = 0.012$) and of being unable to breath (G = 17%, B = 8%, $P = 0.019$) than were boys of the same age. Among 12-year olds, boys were more often quite or very afraid of the dentist than were girls (G = 3%, B = 9%, $P = 0.009$). On the other hand, girls were more likely to be afraid of drilling than were boys (G = 34%, B = 23%, $P = 0.039$). The 15-year-old girls were more often to quite or very afraid of drilling (G = 23%, B = 14%, $P = 0.053$), local anesthesia (G = 19%, B = 8%, $P = 0.005$), and pain (G = 33%, B = 16%, $P = 0.001$) than were boys of the same age.

The results of the logistic regression analyses for 6-, 9-, 12-, and 15-year-olds are shown in Tables 6–9. Among 3-year-olds, no significant associations were found between fear and the variables studied.

Among 6-year-olds, children whose siblings had dental fear, who had a daily intake of sugary items, and lived in the city of Jyväskylä were more likely to have dental fear than children whose siblings did not have dental fear, who did not consume sugary items daily, and who lived in Kuopio. Father's education modified the effect of his child's caries experience on children's dental fear. Among children of fathers with lower than secondary school education, children with caries experience were more likely to report dental fear than were caries-free children. Among children whose fathers had at least secondary school education, children with caries experience were less likely to report dental fear than caries-free children were (Table 6).

Among 9-year-olds, those whose father had dental fear were more likely to have dental fear than those whose fathers did not have dental fear. City of residence affected the relationship between the limitation of eating candies to only one day per week and child dental fear. In Kuopio, the children who did not have a limitation on eating candies to only one day per week were less likely to report dental fear than children who did have a limitation on eating candies. In Jyväskylä, the children with no limitation on eating candies to only one day per week

Table 3. List of variables and their coding for the analyses

Variable	Description	Value = 0	Value = 1
Child dental fear	Peak value for general dental fear or for fear for any specific treatment procedure	Not afraid, a little afraid, afraid to some degree	Quite afraid, very afraid
Family member's dental fear • Mother's • Father's • Sibling's	Peak value for general dental fear	Not afraid, a little afraid, afraid to some degree	Quite afraid, very afraid
Brushing	Tooth-brushing frequency	Twice a day or more often	Once a day or more seldom
Intake of sugary items	Highest frequency of the use of any of following: soft drinks, sugared juices, cookies or sweets	Used less than daily	Used daily or more often
Caries experience	dmfs + DMFS	0	≥ 1
Candy limitation	Family has limited intake of candies to one day per week	Yes	No
Education • Mother's • Father's	Basic education of parents	Lower than secondary school	Secondary school or higher
City	City of residence	Kuopio	Jyväskylä

Table 4. Age-specific percentages of subjects in different categories of the independent variables

Variable	3-year-olds (%)	6-year-olds (%)	9-year-olds (%)	12-year-olds (%)	15-year-olds (%)
Boys	50	51	49	48	48
Mother quite or very afraid of dentistry	12	14	12	13	15
Father quite or very afraid of dentistry	6	7	8	4	4
Sibling quite or very afraid of dentistry	4	8	11	6	9
Tooth-brushing once a day or less	8	6	5	11	11
At least daily intake of soft drinks	0	1	3	5	13
At least daily intake of sweets	2	3	4	13	18
At least daily intake of sugared juices	29	23	26	27	24
At least daily intake of cookies	19	17	17	16	20
Caries experience (dmfs + DMFS >0)	4	32	58	38	30
Family has agreed upon one candy day per week	45	55	55	33	9
Mother's education secondary school or higher	69	66	65	63	57
Father's education secondary school or higher	56	56	55	45	49

were more likely to report dental fear than children with the limitation. The coefficient of the interaction term was statistically significant, but the corresponding 95% confidence intervals for odds ratios (OR) in both cities included null value (=1). The sex of the child affected the relationship between the limitation of eating candies to only one day per week and dental fear. Girls who had no limitation on eating candies were less likely to report dental fear than girls with the limitation (Table 7).

Among 12-year-olds, only caries experience was associated with dental fear (Table 8). Among 15-year-olds, if the siblings and mothers reported dental fear, the child was more likely to report dental fear. If the father had secondary school or higher education, the child was less likely to be afraid. However, if the mother had secondary school education or higher, the child was more likely to be afraid (Table 9).

Discussion

In Finland, children's dental fear as measured with a single-item question in local studies using convenience samples seems to have decreased between 1977 and 1991 (17–19). According to our study, in which similar single-item questions were used, children's dental fear seems to have further decreased until 1998. In this study, mean values for 'total score for dental fear' were higher among older children than among younger ones, which is inconsistent with previous findings (6, 21, 22). On the other hand, the general dental fear in our study was less prevalent among 12- and 15-year-old children than among younger ones. This discrepancy might be explained by the fact that children are more precise when reporting fear related to specific procedures than to dental treatment in general. On the other hand, the discrepancy might reflect differences in the culture, oral health, or oral health care system.

Children in our study were afraid of specific procedures more than dental treatment in general. These same fears were also frequent in the study by Alvesalo et al. (18, 19). Although fear of drilling and local anesthesia seem to have decreased since 1991 (18, 19), in our study these were still the most commonly reported anxieties. In 6- and 12-year-

Table 5. Percentages of children who were afraid of specific procedures and/or dental treatment in general in each age group. (A = quite or very afraid, B = a little or to some degree afraid

	3-year-olds (%)		6-year-olds (%)		9-year-olds (%)		12-year-olds (%)		15-year-olds (%)	
Afraid of	A	*B*	A	*B*	A	*B*	A	*B*	A	*B*
Dental treatment in general	9	*39*	9	*46*	4	*42*	4	*33*	6	*34*
Keeping the mouth open	11	*37*	8	*23*	2	*15*	0	*14*	2	*11*
Dentist	7	*32*	5	*30*	3	*17*	2	*15*	2	*15*
Teeth being cleaned by dentist or nurse	7	*27*	6	*30*	2	*27*	1	*18*	3	*11*
Drilling	2	*4*	14	*15*	10	*37*	15	*43*	19	*40*
Local anesthesia	2	*2*	8	*12*	11	*20*	12	*31*	14	*34*
Hearing the sound of drilling	2	*5*	8	*16*	4	*25*	9	*28*	9	*31*
Being unable to breath	7	*4*	14	*35*	13	*33*	9	*41*	13	*36*
Instruments put in the mouth	8	*24*	14	*35*	7	*33*	6	*28*	5	*29*
Suction used in the mouth	2	*10*	9	*19*	3	*15*	1	*12*	3	*10*
Pain	4	*6*	17	*22*	16	*43*	15	*53*	25	*48*
Dental treatment in general or any of the specific procedures	21	*46*	36	*44*	30	*52*	27	*55*	32	*52*

Table 6. Relationship between children's dental fear (0 = not afraid, a little afraid, afraid to some degree; 1 = quite afraid, very afraid) and factors remaining in the final model of logistic regression analysis among 6-year-olds (including their first-order interaction terms)

Variables and their dichotomization	OR	95% CI lower	95% CI upper
Caries experience *0 = dmfs value = 0, 1 = dmfs value* ≥ 1			
father's education lower than secondary school	2.56	1.14	5.70
father' education secondary school or higher	0.25	0.09	0.69
Siblings' dental fear *0 = not afraid—afraid to some degree, 1 = quite or very afraid*	3.28	1.27	8.46
Intake of sugary items (soft drinks, sugared juices, cookies or sweets) *0 = used less than daily, 1 = used daily or more often*	1.87	1.09	3.20
City of residence *0 = Kuopio, 1 = Jyväskylä*	1.81	1.06	3.10
Goodness-of-fit test $\chi^2 = 6.077$	d.f. = 8	$P = 0.639$	Nagelkerke $R^2 = 0.120$

olds, children's caries experience was associated with dental fear. However, this is contrary to the findings of Poulton et al. (23). A history of caries treatment in the primary rather than in the permanent teeth is likely to have contributed to this association. Among 15-year-olds, childhood caries experience in primary dentition may have contributed to dental fear, but their dmfs scores were available only for the 3 years preceding the examination. The association between a child's caries experience and dental fear, along with the high frequency of fears related to pain, drilling, and local anesthesia reported in our study, support previous findings where direct conditioning has been reported to be a major contributor to children's dental fear and anxiety (6, 9, 10).

Among all age groups except the 12-year-olds, mother's dental fear was statistically significantly associated with children's dental fear. For the 12-year-olds, too, the *P* value for this association was $P = 0.064$ with OR = 1.96 (CI 95% = 0.96–3.98). This supports the findings that models obtained from family members seem to have a significant effect on the development of child dental fear and anxiety (1, 2, 4, 6). The significance of the association between individual family member's dental fear and the child's dental fear varied according to age group. This might reflect the developmental stage of children, which has been shown to be related to the dental anxiety of children (24). The effects of father's education and father's dental fear on his child's dental fear were more evident in this study than in most previous studies (1, 2, 4, 6). In Finland, however, father's dental fear has been reported to affect children's dental fear and caries experience (1, 2). Modification of these associations by father's socio-economic status has also been reported earlier (2).

The *P* value of the association between the limitation of eating candies to only one day per week and the city of residence in relation to child's dental fear was only marginally significant, and thus no great importance should be attached to this interaction. However, the difference between the cities could be explained by different treatment philosophies. In Kuopio, the mean number of preventive procedures per child (such as application of fluoride varnish and sealants as well as diet and oral hygiene instruction) has been reported to be higher than in Jyväskylä (25). Children from Kuopio might have been exposed to more non-invasive procedures and thus might have been better acquainted with dental treatment through positive experiences. This is in accordance with application of the latent inhibition theory to the dental situation, as suggested by Davey (26), de Jongh et al. (27), and ten Berge et al. (28). Similarly, the effect of city of residence on the association between the limitation of eating candies to only one day per week and dental fear might reflect differences in dietary instruction (25). The association between frequent intake of sugary items and dental fear was not modified by the child's caries experience. Thus, the association might rather reflect the general dietary habits or attitudes toward candies in the family.

Table 7. Relationship between children's dental fear (0 = not afraid, a little afraid, afraid to some degree; 1 = quite or very afraid) and factors remaining in the final model of logistic regression analysis among 9-year-olds (including their first-order interaction terms)

Variables and their dichotomization	OR	95% CI lower	95% CI upper
Family has limited intake of candies to one day per week *0 = agreed to be once a week, 1 = not agreed at all*			
Kuopio	0.52	0.26	1.07
Jyväskylä	2.19	0.96	6.06
Gender girl	0.44	0.22	0.95
Gender boy	1.78	0.77	4.10
Father's dental fear *0 = not afraid—afraid to some degree, 1 = quite or very afraid*	3.30	1.34	8.28
Goodness-of-fit test $\chi^2 = 2.263$	d.f. = 7	$P = 0.944$	Nagelkerke $R^2 = 0.093$

Table 8. Relationship between children's dental fear (0 = not afraid, a little afraid, afraid to some degree; 1 = quite or very afraid) and factors remaining in the final model of logistic regression analysis among 12-year-olds

Variables and their dichotomization	OR	95% CI lower	95% CI upper
Caries experience *0 = dmfs + DMFS value = 0, 1 = dmfs + DMFS value ≥ 1*	1.88	1.12	3.14
Goodness-of-fit test χ^2 = n.a.	d.f. = 1	P = n.a.	Nagelkerke $R^2 = 0.027$

Table 9. Relationship between children's dental fear (0 = not afraid, a little afraid, afraid to some degree; 1 = quite or very afraid) and factors remaining in the final model of logistic regression analysis among 15-year-olds

Variables and their dichotomization	OR	95% CI Lower	95% CI Upper
Siblings' dental fear *0 = not afraid—afraid to some degree, 1 = quite or very afraid*	5.96	2.28	15.62
Mother's dental fear *0 = not afraid—afraid to some degree, 1 = quite or very afraid*	2.28	1.04	4.68
Father's education *0 = lower than secondary school, 1 = secondary school or higher*	0.41	0.21	0.82
Mother's education *0 = lower than secondary school, 1 = secondary school or higher*	2.43	1.19	4.97
Goodness-of-fit test $\chi^2 = 5.768$	d.f. = 5	$P = 0.329$	Nagelkerke $R^2 = 0.157$

Although several associations between children's dental fear, oral health, and family characteristics were found, the logistic regression analyses only partly explained the dental fear problem. In addition, these associations were not consistent between the age groups and could reflect the multidimensional nature of dental fear and possibly the fluctuation of dental fear across time that cannot be evaluated with this kind of cross-sectional design. Nevertheless, these results can be generalized to the Finnish child population with caution. In the future, follow-up cohort studies will be needed to examine the development and changes in dental fear from childhood through adolescence to adulthood.

In conclusion, treatment fears are still common among Finnish children. The factors most strongly associated with dental fear are family members' fear and caries experience. The associations differed according to age.

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