Frequent exposure to invasive medical care in early childhood and operative dental treatment associated with dental apprehension of children at 9 years of age

S. KARJALAINEN*, J. OLAK**, E. SÖDERLING*, K. PIENIHÄKKINEN*, O. SIMELL***

ABSTRACT

Aim  This was to study prospectively a cohort of children as to whether behaviour at a 3-year examination, exposure to medical care and operative dental treatment are associated with each other, and with the level of dental apprehension at 9 years of age. Methods  Data were collected at three subsequent dental examinations of 126 children (67 boys, 59 girls). Cooperation, general health condition and operative dental treatment during the preceding 3 years were obtained at dental examinations with 3-year intervals, i.e. at 3, 6 and 9 years of age. Children’s dental apprehension was assessed at the age of 9 years. The data were analysed using an ordinal logistic regression model. Results  Dental apprehension at 9 years of age was associated with frequent exposure to invasive medical care (p<0.001) and past experience of operative dental care (p<0.002), but not with cooperation at 3 years of age (p=0.124). Conclusion  Frequent invasive medical care in early childhood and operative dental treatment, tooth extractions in particular, are associated with dental apprehension at 9 years of age.

KEYWORDS: Children, Dental apprehension, Dental health, Recurrent otitis media.

Introduction

Rational use of dental health care resources means, among others, prevention of missed appointments and unsuccessful treatment attempts. Factors leading to missed dental appointments and failure to complete treatment have been studied intensely, and associations with poor dental health and poor cooperation have been found [Mejäre et al., 1989, Klingberg et al., 1994, Skaret et al., 2000]. Uncooperative behaviour and dental anxiety are more common among children exposed frequently to operative dental care than among those with none or limited exposure [Alvesalo et al., 1993; Klingberg et al., 1994; Varsio et al., 1999; Raadal et al., 2002]. Maternal anxiety is one additional factor which can influence the behaviour of young children with no previous dental visits [Johnsson and Baldwin, 1968; Wright and Alpern, 1971; Bailey et al., 1973; Holst et al., 1988]. Recently, non-dental factors such as personality traits, low social status and parental education level have also been connected with dental anxiety in children [Raadal et al., 1995]. Clearly the most important factors with regard to the risks of behavioural problems in the dental office are negative experiences of dental treatment [Holst and Crossner, 1984; Raadal et al., 2002], but in children negative experiences from medical treatment may also be involved [Wright and Alpern, 1971; Bailey et al., 1973; Holst et al., 1988]. The long-term effect of medical problems on children’s dental behaviour has not adequately been studied, though the number of children with one particular medical problem, i.e. recurrent middle ear infection, has increased heavily during the past two decades [Joki-Erkkilä et al., 1998]. As recurrent otitis media episodes before the age of 3 years have been shown to have adverse effects on children’s school performance [Luotonen et al., 1998], it is important to study if this condition has short- and/or long-term consequences on children’s dental behaviour and cooperation.

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Our aim was, therefore, to study prospectively a cohort of children as to whether behaviours at a) an examination at 3 years of age, b) exposure to medical care and c) operative dental treatment are associated with each other and with the level of dental apprehension at 9 years of age.

**Materials and methods**

**Subjects.** The children of this study were participants of the long-term, prospective randomised STRIP baby trial (Special Turku Coronary Risk Factor Intervention Project; recruitment at 7 months of age; n=1,062), designed to reduce exposure of the intervention children to known environmental risk factors of atherosclerosis [Lapinleimu et al., 1995; Rask-Nissilä et al., 2000]. The dietary intervention aimed at restricting a child’s daily fat and cholesterol intake to 30-35% of energy (E%) and to ≤200 mg, respectively. At 3 years of age, every fifth child of the main study (n=889) was invited (n=179) to a thorough dental examination; 148 families (83%) agreed to participate. As 13 and 9 families discontinued trial participation during the two subsequent 3-year periods, 135 and 126 children (67 boys, 59 girls) were restudied at 6 and at 9 years of age, respectively. The dental health of those children who discontinued participation did not differ from that of children who continued in the study. As the dietary intervention, as such, caused no differences in dental health [Karjalainen et al., 1997], the intervention and the control children were here analyzed together. At the onset of the study, all children were residents of the city of Turku, where the fluoride concentration in tap water is 0.3 mg/L. Since 1995, when the recommendations of fluoride prophylaxis were changed in Finland, the daily use of fluoride toothpaste has been considered adequate for basic prevention of caries in small children.

**General health.** Information on children’s general health was obtained from the parents and updated at each dental visit. The information was confirmed by recordings collected by the paediatricians of the main study. No information on the quality of the paediatric treatment visits, whether negative or positive, was available. The most common medical problem of the 3-year olds was recurrent middle ear infection (≥3 episodes/year) with or without adenoidectomy and ear tube insertions. These, together with a few cases of pharyngitis, sinusitis, juvenile diabetes and thrombocytopenia, were classified as ‘invasive medical conditions’. Allergy and asthma were classified as ‘non-invasive medical conditions’, as neither the examination nor the treatment of these involve painful procedures. Children who have been healthy throughout the follow-up period were classified as ‘healthy’ (Level 1), those who had had a non-invasive medical condition at any stage of the follow-up were classified as children with ‘non-invasive medical condition’ (Level 2), and those who had had an invasive condition at any stage during the follow-up period were classified as children with ‘invasive medical condition’ (Level 3). The cumulative health condition from 0 to 9 years of age was used to study the effect of invasive medical conditions on dental apprehension.

**Cooperation at 3 years of age.** The 3-year examination was the first dental visit for most of the children and each was examined between 8 and 11 a.m., while sitting in an upright position in the dental chair or in the lap of an accompanying parent. A dichotomized classification was used. Children whose dentition was examined easily were classified as ‘problem free’, while those whose examination required extra time or effort were classified as ‘time consuming’. At the 6- and 9-year checkups all children were examined without problems.

**Dental apprehension and past operative treatment.** With the help of their parents the children were asked to fill in a questionnaire which had been sent to them beforehand. There were 8 multiple-choice questions. Children’s dental apprehension had four alternatives: ‘not apprehensive’, ‘slightly apprehensive’, ‘moderately apprehensive’, and ‘severely apprehensive’. To evaluate these questions every other child, with parental assistance, responded to the dental anxiety scale (DAS) questionnaire [Corah, 1969]. A positive correlation was found between the DAS-score and the present classification of dental apprehension (r=0.326, p<0.005).

Information on past operative treatment was obtained by questioning experiences of restorative treatment, and/or tooth extraction(s) due to space management. This information was added to the dental health findings (vide infra) to complete the data of past operative treatment, which was divided in three categories: no operative treatment and no tooth extraction experience (Level 1), experience of restorative treatment (Level 2), and experience of tooth extractions with or without restorative treatment (Level 3).

Children also responded to questions related to current dental health habits, tooth brushing frequency, use of fluoridated toothpaste, as well as frequency of intake of xylitol products, sweets and soft drinks. All questionnaires were checked by the examining dentist at the dental visit.
Dental health at 3, 6 and 9 years of age. A visual and tactile assessment of dental health was made in the dental chair using a dental mirror, probe and artificial light by an experienced paediatric dentist (SK), according to the WHO criteria [WHO, 1979]. Caries was recorded at the level of cavitation. No radiographs were taken. Dental health was expressed as the sum of decayed, missed due to caries, and filled teeth in the primary (dmft) and permanent teeth (DMFT).

A written summary of the examination was mailed to the parents. Children in need of dental care were referred for treatment to a public health care centre where regular dental care was provided for all children free of charge.

Data processing and statistical analyses. Data were processed by the program package of SPSS 10.0 for Windows. Spearman’s correlation, and the Mann-Whitney U-tests were used when applicable, and a logistic regression model for ordinal response variable to estimate the significance of the variables of interest for the development of dental apprehension was used. The latter, with 4 categories, was the dependent variable. Cumulative general health and operative treatment, both with 3 categories, were the independent variables. Cooperation at 3 years of age with 2 categories was the covariate. At first all main effects and their two-factor interaction terms were included in the model. Then the non-significant 2-way interaction terms (p>0.05) were removed one after the other. Finally, only the main effects remained in the model.

Results

The proportions of children with a history of non-invasive condition at the 3-, 6- and 9-year examinations were 14%, 20% and 10%, while for invasive medical conditions they were 33%, 13% and 7%, respectively (Table 1). The distribution of children into the three levels of cumulative general health showed that 42% of the children had been completely healthy between 0 and 9 years of age, 20% had only non-invasive medical condition, while a total of 38% had experience of invasive medical condition. The highest frequency of invasive medical condition occurred prior to 3 years of age (Table 1).

At 3 years of age none of the children had yet had any experience of operative dental treatment. However, at the 9-year examination the proportion of children with no experience of tooth extractions or restorative dentistry was 40% (n=50), of those with past experience of restorative treatment was 32% (n=41), and those with past experience of tooth extractions with or without restorative treatment was 28% (n=35). The level of dental health, expressed as the means (SD) of the dmft+DMFT scores of children were: not apprehensive (n=48), 1.75 (2.38); slightly (n=64), 2.11 (2.93); moderately (n=8), 1.63 (1.99) and severely apprehensive (n=6), 4.00 (5.06). The differences between groups were not significant (p=0.793).

Exposure to invasive medical condition (p<0.001), and tooth extractions with or without restorative dental treatment (p=0.001) were associated with dental apprehension at 9 years of age (Table 2). In the modelling, all two-factor interaction terms were found insignificant and removed from the model (Table 2). Cooperation at 3 years of age was not associated with dental apprehension of the 9-year-old children (p=0.124).

Children’s mean (SD) xylitol intake was 4.0 (2.7) times a week, and their sweet, soft drink and juice intakes were 2.2 (1.3) and 3.2 (1.2) times a week, respectively. Apprehension showed no association with the reported dental habits.

Discussion

We found that exposure to invasive medical conditions, mainly recurrent middle ear infections, was associated with a child’s dental apprehension at 9 years of age. The peak incidence was usually prior to 2 years of age [Sipilä et al., 1987]. Thus, in addition to economic costs [Gates, 1996], recurrent otitis media may cause low performance at school [Luotonen et al., 1998] and problems in the acceptance of any operative dental treatment needed later in life. During the past 20 years, the effect of medical care experiences on a child’s future dental apprehension has been little studied. Yet, at the same time, the incidence of recurrent otitis media among small children has markedly increased [Joki-Erkkilä et al., 1998] due partly to the daycare systems currently prevailing in many western societies [Pukander et al., 1985; Joki-Erkkilä et al., 1998]. Frequent exposure to recurrent middle ear infection should so be taken into account if the aim is to prevent dental anxiety and its consequences in children and adults. Missed dental appointments
and unsuccessful treatment attempts may perhaps be reduced by addressing special attention and care to child patients with a history of frequent exposure to invasive medical care. Interestingly, the history of frequent episodes of middle ear infection is poorly associated with a child’s behaviour at the 3-year examination, possibly because maternal anxiety at this early age may still strongly modify child behaviour [Johnson and Baldwin, 1968; Wright and Alpern, 1971; Bailey et al., 1973; Holst et al., 1988] and mask child’s personal experiences.

We found that children with past experience of tooth extractions, with or without restorative treatment, had a greater risk of dental apprehension than children with experience of restorative treatment only. Interestingly, almost half of the children in our cohort who had experienced tooth extractions were caries-free. Indeed, a major reason for extractions of primary teeth today in Finland is due to crowding and space management problems. Tooth extraction is known to be a traumatic experience and, if carried out without properly

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<th>95% CI</th>
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The levels from 1 to 3 of cumulative general health are indicated in Table 1, and the levels of operative dental treatment are: 1=no experience of operative treatment; 2=restorative treatment; 3=restorative treatment and/or extractions

CI=confidence interval.

Table 2 - The effect of frequent exposure to medical care and operative dental treatment on dental apprehension of 126 9-year-old Finnish children. The main effects are shown (logistic regression model for ordinal response variable).
preparing the child in advance, the development of dental anxiety is almost inevitable. This we believe should be born in mind when attempting to prevent dental anxiety in the future.

It is known that dental anxiety is associated with poor oral hygiene, missing of dental appointments and deterioration of dental health [Klingberg et al., 1994; Varsio et al., 1999]. Interestingly, the home care habits, i.e. tooth brushing habits, xylitol and sweet intake frequency, use of soft drinks of children, with different levels of dental apprehension, were similar to those who were not apprehensive at all.

**Conclusion**

Frequent exposure to invasive medical care in early childhood and operative dental treatment, especially tooth extractions, have long-term impact on children’s dental apprehension. If left unattended, these in turn may lead to undesirable consequences to the dental health.

The Ethics Committee of the Turku University and the Turku University Hospital have approved the study. Informed consent was obtained from the parents or guardians of the children.

**References**


