Timing of first fillings in the primary dentition and permanent first molars of asthmatic children

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The aim of this study was to analyze the timing of first fillings posteruptively in a cohort comprising 51 asthmatic children receiving inhaled corticosteroids and living in three communities in Ostrobothnia, Finland. They had all been born in the 1980s and had had asthma check-ups in the local asthma policlinic. A group of 102 healthy age- and sex-matched children served as controls. A longitudinal survival analysis of the timing of the first filling in the primary teeth and first permanent molars was conducted retrospectively using data from the annual dental health records. The timing of the first fillings in permanent first molars showed no statistically significant differences between asthmatic and healthy children, but the filling increments in the primary molars were consistently higher in the asthmatic group; the difference for the upper first primary molars was, for instance, statistically significant (risk ratio = 2.565; 95% confidence interval = 1.333–4.935). More extractions because of caries were also performed on primary molars in the asthmatic children. The findings support the hypothesis that factors related to the asthmatic condition might increase the risk of caries. A longer surveillance time would be needed to evaluate the effect of asthma on the permanent dentition. □ *Asthma; corticosteroids; dental restoration; pedodontics*

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Extrinsic-type bronchial asthma is a common chronic medical condition, the prevalence of which has been reported to be 3.8–6.0% among children aged 6–12 years in northern Finland (1). Earlier asthma treatment was palliative suppression of asthma attacks. As asthma is related to an allergic inflammatory condition of the bronchial walls, children with moderate to severe asthma often require long-term inhaled corticosteroids as prophylaxis against asthmatic symptoms (2–4). The modern preventive treatment policy is to use regular antiasthma medication to reduce allergic inflammation instead of merely coping with acute asthma attacks or wheezing. The inhaled route of drug administration does not completely suppress the possible local and systemic adverse effects of corticosteroids (2–4), and this has led to attempts to improve drug preparations and delivery devices (2, 4).

Several authors have studied the caries prevalence in asthmatic children, with some variation in the results. In some cross-sectional studies no differences in caries experience have been found between asthmatic and healthy subjects in the primary (5) or permanent dentition (5, 6), whereas others have shown increased caries prevalences in medically compromised preschool children with asthma, congenital heart disease, or cystic fibrosis (7) or pediatric inpatients with asthma (8) as compared with other chronically sick subjects. Adolescents and young adults previously treated frequently with β-adrenoceptor agonists showed increased caries susceptibility when compared with healthy subjects (9). The variation in results can partly be explained by differences in asthma severity or medication types, which have numerous mechanisms of action.

Asthmatic children are recommended to be considered a group of special interest in dental care (7–10), but no longitudinal reports are available on dental caries in a large group of children receiving modern medication with inhaled prophylactic corticosteroids. Our aim in this pilot study was to analyze the timing of first retorations in the primary and permanent dentition of asthmatic children by applying a longitudinal survival analysis method to that used earlier of the permanent dentition (11, 12), to test the hypothesis that there is an increase in caries incidence in children with moderate to severe asthma treated with preventive local inhaled corticosteroids.

Materials and methods

The study cohort comprised all asthmatic children ($N = 51$), born in the 1980s and living in three communities (Merijärvi, Oulainen, and Vihanti), whose asthma (ICD-10 code J45.0) had been diagnosed and monitored at the Pediatric Policlinic of Oulaskangas Hospital, a regional hospital in Ostrobothnia. All subjects were treated daily with inhaled corticosteroids: budesonide (Cortivent®, Leiras, Turku, Finland, or Pulmicort®, Astra Pharmaceuticals, Kirkkonummi, Finland) or beclomethasone dipropionate (Beclomet®, Orion-Farmos, Espoo, Finland), at a dose range of 100–500 μg/day. None of the children had started receiving this medication before the age of 3 years. The mean length of corticosteroid use was 14.5 ± 13.8 months at the time of the investigation in 1995 (one patient had been receiving treatment for 96 months). In addition to this preventive corticosteroid medication, all the

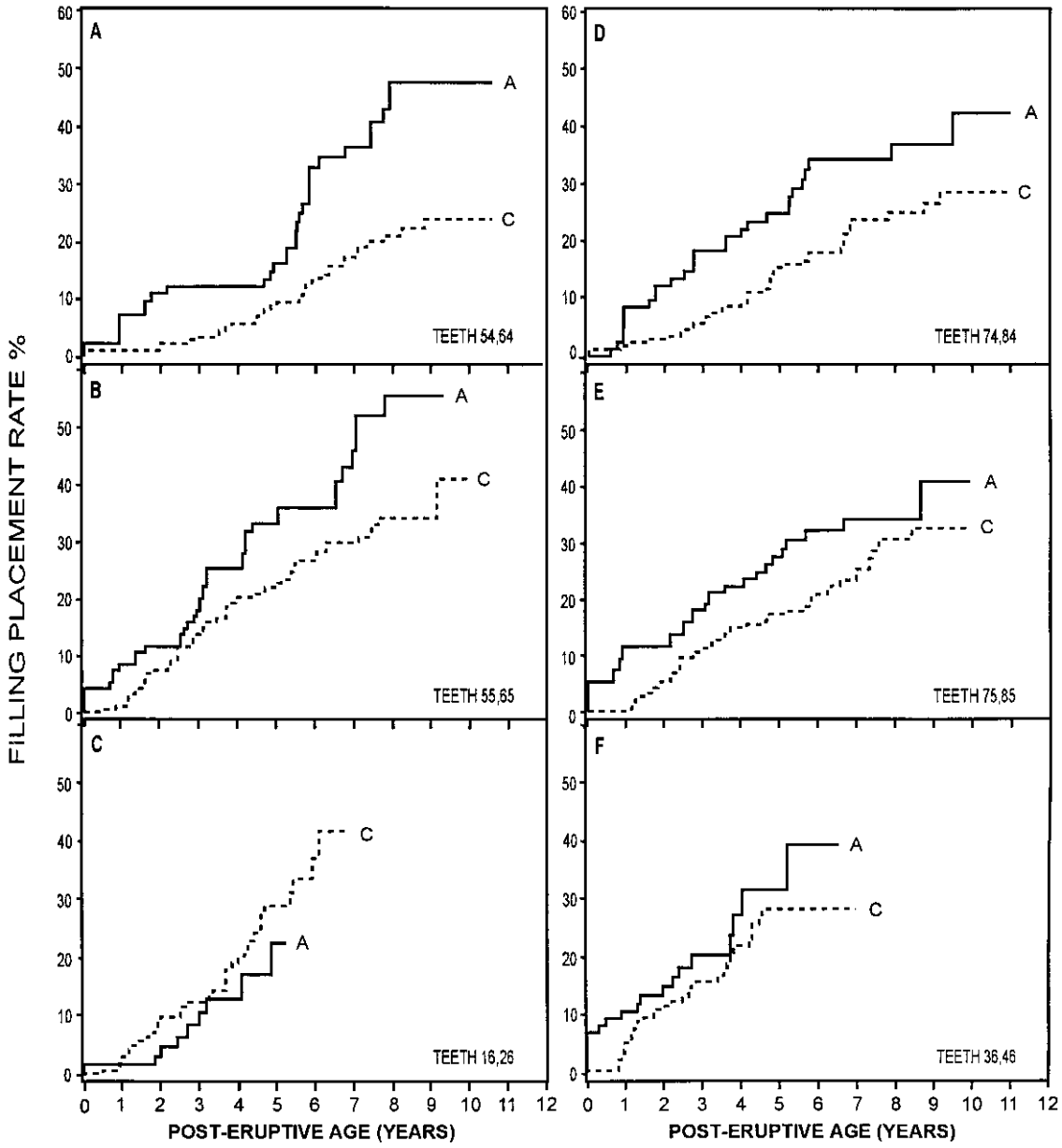

Fig. 1. Annual filling placement rates calculated posteruptively for the asthma group (A) and the control group (C). 1A and D) First primary molars. 1B and E) Second primary molars. 1C and F) First permanent molars.

patients occasionally used inhaled β-adrenoceptor agonists as needed—for example, before exercise or to relieve acute asthma attacks.

For the cohort of 51 asthmatic subjects, 35 boys and 16 girls, an age-, sex-, and school-matched control group of 102 children comprising the nearest older and younger pupil in the same grade was chosen. The dental records for all the children were collected from the local dental health centers for analysis. The children had usually been examined at the ages of 0.5, 1, 2, and 3 years, mostly by one pedodontically oriented dentist and thereafter annually by their own dentists. Three dental records were excluded because of lack of sufficient information.

Data on the time of eruption of each individual primary and permanent tooth, the placement of restorations on each tooth and tooth surface, and extractions because of caries (excluding restorations caused by crown fractures, for example) were obtained from the dental records. The age of each subject was recorded with an accuracy of 1 day, and the date of examination when the above diagnoses were made with an accuracy of 1 month. Survival analysis methods were used. The survival time

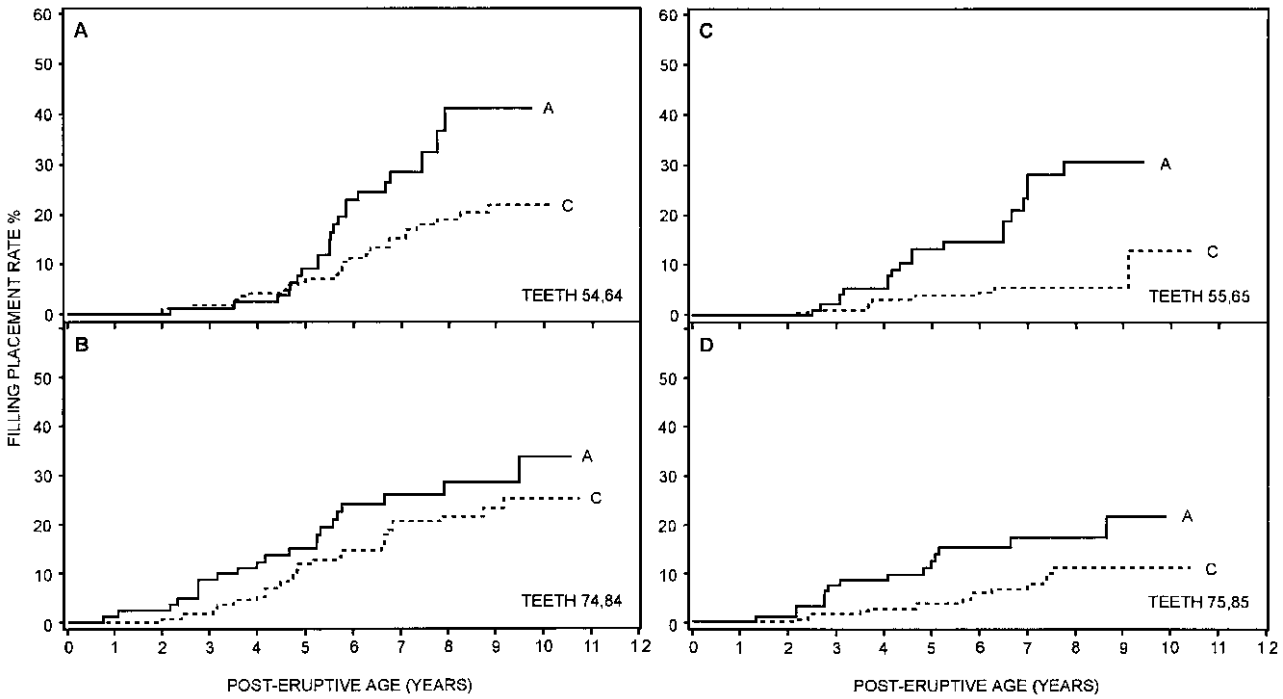

Fig. 2. Annual filling placement rates calculated posteruptively for proximal surfaces of the primary molars in the asthma (A) and control (C) groups. 2A and B) Distal surfaces of first molars. 2C and D) Mesial surfaces of second molars.

was the time elapsing between eruption of teeth (11) and the first filling owing to dental caries—that is, the time when caries had progressed to a stage when a dentist made a decision to perform a restoration (12, 13). The age of the mother and the regular use of fluoride tablets before school age were also recorded. The drinking water fluoride level in all the communities was less than 0.1 ppm.

A special computer program was developed to process the material. The SAS statistical software program (14) was used for the survival analyses, and a cumulative distribution function (CDF) was estimated for each primary or permanent tooth and tooth surface. The CDF curves for contralateral teeth were found to be similar and were combined in the figures. The CDF curves were compared by means of the log-rank test and the Wilcoxon test. Cox's proportional hazards model was used for the analyses of the proportional effects of asthma and sex relative to the base-line hazards (15). Confidence intervals (95% CI) were used when comparing the risk ratios (RR) for the variables.

Results

The CDF curves for the first and second primary molars reached a level of 40–60% in 7–8 posteruptive years in the asthma group and about 20–40% in the control group (Fig. 1). The filling placement curves for the primary teeth were consistently higher for the asthma patients than for the control group. The levels for the first permanent molars were about 20–40% in the asthma and control groups, without any consistent difference between them in 6–7 posteruptive years (Fig. 1). Cox's proportional hazards model for the proportional effect of asthma, taking sex into account, resulted in a difference for the upper first primary molars, for example, that was statistically significant: RR = 2.565; 95% CI = 1.333–4.935 (Fig. 1).

Because of the small number of subjects the statistical significances were weak, but when the upper and lower teeth were analyzed separately, the results came closer to reaching significance. The proportional effect of sex did not show statistical significance in Cox's proportional hazards model, although there was a slight trend for the RR to be higher in the asthmatic boys.

When the timing of first restorations was analyzed for each tooth surface, it was found that mainly occlusal fissures had been restored in the first permanent molars, but both occlusal and approximal fillings had been placed in the primary molars. The highest CDF values were detected for the proximal surfaces of the primary molars—that is, for the mesial surfaces of the second molars and the distal surfaces of the first molars, the asthma patients having consistently higher filling increments than the controls (Fig. 2). A markedly similar difference was also seen between the groups in the mesial surfaces of the upper primary incisors (not shown in the figures).

When the timing of extractions of primary molars owing to caries was analyzed, the same consistent difference was

observed: the asthma patients had had more extractions than the controls (not shown in the figures). No statistically significant differences were found between the asthmatic and healthy groups in the timing of eruption of teeth or in the ages of the mothers or the use of fluoride tablets.

Discussion

The results of this longitudinal study support the hypothesis that factors related to chronic asthmatic condition and/or asthma medication might increase the risk of caries. The filling increments were consistently higher in the primary dentition, but a longer surveillance time would be needed to study the caries risk in the permanent dentition. The results are in agreement with earlier findings of higher caries rates in asthmatic patients than in healthy subjects (7, 9, 16), although these should be verified in more extensive materials. Inhaled corticosteroids have been used as a part of asthma medication during recent decades, but the more general prophylactic use of inhaled corticosteroids started in the 1980s, and therefore the present results are not fully comparable with the earlier studies. The fact that inhaled β-adrenoceptor agonists have been shown to induce higher caries risk (9) should not have a major effect in this study because none of the patients used them regularly. No significant effect on the timing of eruption of teeth was observed in this study.

The observation that only a few girls were found among the asthmatic children is in agreement with recent epidemiologic studies in Great Britain (17, 18), which show a male predominance in young children with asthmatic symptoms. The sex ratio changes later, when children reach their teens (17). In the present cohort both sexes had the same kinds of difference in caries rates between asthmatics and healthy subjects, and they were therefore combined to form one large group of medically compromised children. The asthmatic boys had a weak tendency towards a higher caries risk, but this was not statistically significant. No differences have been found between Finnish boys and girls in terms of caries risk (19, 20) or the eruption time of the deciduous teeth (19, 21), and our results are in line with these observations.

When analyzing the possible causes of the increased risk of caries in medically compromised children, Paunio et al. (19) observed that they are not brought in for dental health counseling as often as healthy children. This was not the case here, however. Young mothers have been found to neglect their children's dental care visits (19), and low age of the mother is also correlated with a high caries risk for the child (22), but no significant differences were observed between the ages of the mothers in the present asthmatic and control groups. Similarly, no differences were seen between the healthy and asthmatic groups with regard to the anamnestic recordings of fluoride tablet use. Possible variations in other health habits could not be analyzed in this retrospective study.

Low social class is a strong predictor of caries experience in children (22, 23), which cannot be totally eliminated by differences in oral health habits (23), and maternal education (22, 24) and immigrant background (24, 25) have also been reported to correlate with oral health. The children in this study came from an area where socioeconomic status is homogeneous, however, and none of them had an immigrant background. The control group was chosen from the same schools (town/rural), to confirm this homogeneity and avoid the possible effect of area of residence. Furthermore, asthma or persistent wheezing is one of the few illnesses that have been found to show socioeconomic equality (17) or even to be more common in the upper social classes (18, 26).

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