Decline in dental caries and public oral health care of adolescents

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The adequacy and appropriateness of the oral health service were evaluated from patient records of 15-year-olds in Helsinki in 1976 and 1986. The subjects selected for the study represented the whole age group participating in public oral health service in the 2 years in question. During the 10 years, substantial decreases were seen in the mean numbers of dental visits (from 4.0 to 2.4) and fillings (from 2.9 to 1.2). The greatest decrease was seen in the number of fillings made in incisors. Slightly fewer preventive measures were carried out in 1986 than 10 years earlier, but no focusing on risk patients was seen. In the 2 years studied, 15-year-olds in the high-risk group received applications of topical fluorides and instructions on oral hygiene as often as those in the low-risk group. A major problem seemed to be the increasing number of unfinished courses of treatment among high-risk patients. We conclude that patients with a higher risk of caries should receive more attention with regard to both the preventive treatment given and ways of motivating them to complete their treatment courses. □ *Preventive treatment; public oral health care; risk of caries*

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In Finland, all persons less than 17 years old are entitled to regular oral health care, free of charge. Helsinki City Health Centre is responsible for providing free public oral health services for about 100,000 children and adolescents living in Helsinki. The services include an annual examination, the teaching of preventive measures, fluoride application, and any operative treatment needed. An appreciable decline in the prevalence of caries has been seen in Finland and in the Helsinki area in recent years (1, 2). In Finland as a whole, 15-year-olds had an average of 7.5 DMF teeth in 1981 and 4.3 in 1988 (3, 4). However, in 1986 half of the 15-year-olds in Helsinki had some decayed teeth (18% had three or more DT), and only 9% had an intact dentition (5).

Participation in public oral health services is high. In 1981 about 95% of the 7- to 16-year-olds in Finland used these services, their mean number of dental visits being 3.6 (6). The distribution of patients by the number of dental visits is skewed, as 20% of children used 50% of all services. Half of the patients had visited a dentist no more than once or twice during 1981, but 21% had as many as 5 to 29 visits.

The consumption of oral health care by adolescents is mainly due to caries. Most lesions could be prevented or arrested by means of effective preventive treatment for patients at higher risk of caries. This would diminish the need for restorative treatment and thus save considerably on oral health resources. The present study evaluated the adequacy and appropriateness of the treatment of 15-year-olds in Helsinki in 1976 and in 1986, with special reference to caries risk patients.

Materials and methods

We compared cross-sectional data for 1976 and 1986. Data were collected from each subject's personal oral health record. Two samples were drawn to represent all 15-year-olds using municipal oral health service in Helsinki in 1976 and 1986. The numbers

of 15-year-olds visiting municipal dentists in these two years were 4300 and 3700, respectively. From these basic population groups 1 person in 10 was drawn by systematic random sampling. A total of 396 patient records were received for the 1976 sample, and 367 for the 1986 sample. The former group consisted of 196 boys and 200 girls, and the latter of 183 boys and 184 girls.

Each oral health record includes information on dental check-ups, oral health status, and the treatment given. Standardized charts are used throughout in public health service. This chart requires recording of the condition of each tooth by surface. Detailed information on the treatment given at each visit is also required. The present study included information on a) preventive procedures, such as oral hygiene instructions, dietary advice and application of topical fluorides; b) the periodontal treatment given, including information on gingival treatment and scaling; c) any fillings recorded by tooth and by surface; and d) the number of dental visits in each year, excluding visits made for orthodontic reasons.

We compared the treatment given in 1976 with that given in 1986, with regard to all 15-year-old patients. The treatment given to patients in the high-risk group was compared by year, and within each year, and compared with the treatment given to the low-risk patients.

The high-risk group was defined as patients with unusually high caries experience on the basis of the number of DMF teeth, which has been reported to be a useful predictor of future caries development (7). In both years the group at higher risk of caries was defined to include the subjects belonging to the highest quintile of the distribution by the number of DMF teeth. Owing to the discrete nature of this variable the final cutting point was taken as 22% in both years. The low-risk group consisted of subjects belonging to the lowest quintile of the corresponding distributions, the cutting point being taken as 18%.

The statistical significance of differences between groups was evaluated with the chi-squared test and the *t* test.

Results

Table 1 presents the oral health services received by 15-year-olds in 1976 and in 1986. A significant decrease was seen in the mean number of dental visits, which fell from 4.0 to 2.4 during the 10 years. Clear decreases were also seen in periodontal treatment and in the number of fillings made. Slightly fewer preventive measures were taken in 1986 than 10 years earlier. Endodontic therapy and extraction of permanent teeth due to caries had been extremely rare in both years, totalling 16 teeth in 1976 and 4 in 1986.

Of all teeth present, 10.7% were treated with fillings in 1976, compared with 4.5% in 1986. Table 2 shows the 10-year changes in the filling treatment given. In 1976 a total of 1159 fillings were made, one-third of them in second molars. Ten years later adolescents of the same age received only 456 fillings, but 41% of them were in second molars. The decrease during the 10 years was greatest for

Table 1. Dental visits and treatment provided for 15-year-olds in 1976 and 1986

	1976		1986	
Treatment procedures	Mean	(SD)	Mean	(SD)
Dental visits	4.0	(3.2)	2.4	(1.9)***
Periodontal	1.1	(0.3)	0.3	(0.5)***
Fillings	2.9	(3.1)	1.2	(2.1)***
Application of topical fluorides	0.7	(0.7)	0.6	(0.6)*
Oral hygiene instructions	0.6	(0.7)	0.5	(0.7)*
n	396		367	

Statistical evaluation using the *t* test. Difference between the years: *** $p < 001$; * $p < 0.05$.

Table 2. Distribution of filling therapy by tooth type in 15-year-old patients in 1976 ($n = 396$) and 1986 ($n = 367$)

Type of tooth	1976, %	1986, %
Incisor	21.0	7.9
Canine	2.6	3.3
Premolar	23.1	21.6
First molar	19.7	26.0
Second molar	33.6	41.1
Total (%)	100.0	99.9
No. of fillings	1159	456

Statistical evaluation using the chi-squared test. Chi-square = 44.07, d.f. = 4; difference between the years = $p < 0.001$.

Table 3. Distribution of surfaces filled by type of tooth surface in 15-year-old patients in 1976 ($n = 396$) and 1986 ($n = 367$)

Type of tooth surface	1976, %	1986, %
Occlusal	54.7	59.7
Proximal	39.7	31.5
Buccal and oral	5.6	8.7
Total (%)	100.0	99.9
No. of surfaces filled	1535	596

Statistical evaluation using the chi-squared test. Chi-square = 15.97, d.f. = 2; difference between the years = $p < 0.001$.

incisors, in which 21% of all fillings were made in 1976, as against only 8% in 1986. The proportions of premolars and canines treated with fillings in 1986 were the same as in 1976, whereas the proportion of first molars treated with fillings increased from 20% to 26%. In 1976, 53% of all fillings were made in molars, compared with 67% in 1986.

In 1976, 69% of all fillings were one-surface fillings, 28% class-II fillings, and 3% other types. Ten years later the corresponding figures were 71%, 25%, and 4%. Table 3 shows the distribution of surfaces filled each year by the type of surface. In 1976, a total of 1535 surfaces were filled. Fifty-five per cent of them were occlusal, and 40% were proximal. Ten years later the proportion of occlusal surfaces was even greater, whereas that of proximal surfaces had fallen to 31%.

Patients included in the high-risk group in 1976 had 16 to 26 DMF teeth. Ten years later the corresponding group had 8 to 19 DMF teeth. Table 4 presents the mean numbers of DMF teeth and decayed teeth (DT) for all patients and for those judged as high- or low-risk patients in each year.

Table 5 shows the oral health care given to patients in the high- and low-risk groups in each year. Both groups showed a significant drop in the mean number of dental visits during the 10-year period. In 1986 high-risk patients made, on average, 2.5 fewer visits than the corresponding group 10 years earlier. For low-risk patients this change was 1.0 visit. All types of restorative treatment were given less often in 1986 than in 1976, whereas preventive treatment remained unchanged between 1976 and 1986.

During both years the treatment given to high-risk patients differed from that given to low-risk patients with regard to the number of visits and fillings. In 1976 oral hygiene

Table 4. Indices describing dental health of all 15-year-old patients and of those in high-risk and low-risk groups in 1976 and 1986

	1976					1986				
		DMF		DT			DMF		DT	
Patients	n	Mean	(SD)	Mean	(SD)	n	Mean	(SD)	Mean	(SD)
High-risk group*	87	19.5	(2.3)	5.5	(3.8)	79	10.8	(3.1)	3.7	(3.3)
Low-risk group*	73	5.3	(1.8)	1.0	(1.3)	64	0.5	(0.5)	0.1	(0.3)
All 15-year-olds	396	12.1	(5.1)	3.0	(3.0)	367	5.1	(3.8)	1.4	(2.1)

* Defined as the highest or lowest quintile of subjects' distribution by the number of DMF teeth. Statistical evaluation using the t test. Each difference between the years: $p < 0.001$.

Table 5. Dental visits and treatment given in high-risk and low-risk groups of 15-year-old patients in 1976 and 1986

Visits and treatment given	1976 Mean	1976 (SD)	1986 Mean	1986 (SD)
High-risk group				
Dental visits	6.4	(4.4)	3.9	(2.9)***
Periodontal	1.1	(0.3)	0.3	(0.5)***
Fillings	5.3	(4.0)	3.3	(3.5)***
Application of topical fluorides	0.6	(0.6)	0.7	(0.6) NS
Oral hygiene instructions	0.8	(0.8)	0.6	(0.8) NS
No. of high-risk patients	87		79	
Low-risk group				
Dental visits	2.4	(1.7)[a]	1.4	(0.7)[a]***
Periodontal	1.1	(0.4)[b]	0.3	(0.5)[b]***
Fillings	1.1	(1.7)[a]	0.1	(0.3)[a]***
Application of topical fluorides	0.7	(0.6)[b]	0.6	(0.6)[b] NS
Oral hygiene instructions	0.4	(0.7)[a]	0.5	(0.7)[b] NS
No. of low-risk patients	73		64	

Statistical evaluation using the t test. Difference within the high-risk or the low-risk group by year: *** $p < 0.001$; NS = not significant. Difference between high-risk group and low-risk group within each year: [a] = $p < 0.001$; [b] = NS.

instructions were given twice as often to patients in the high-risk group as to those in the low-risk group. No such difference was seen in 1986. There was no difference in the number of fluoride applications given to high-risk and low-risk patients in either 1976 or 1986.

High-risk patients accounted for 35% of all dental visits in 1976 and for 36% in 1986. The corresponding percentages for low-risk patients were 11% and 10%. Of all fillings made in 1976, high-risk patients received 40%, compared with 57% 10 years later. Low-risk patients received 7% of all fillings made in 1976, compared with only 2% in 1986. In 1976, 19.5% of the teeth of high-risk patients were treated with fillings, as against 11.8% in 1986. The corresponding figures for the low-risk patients were 4.2% and 0.4%.

Among high-risk patients the course of treatment had been completed in 88% of cases in 1976 but in only 70% in 1986. The corresponding figures for low-risk patients were 92% and 98%. In the high-risk group about 4% of all carious lesions remained untreated in 1976, compared with 11% in 1986. No such failing was seen in the low-risk group.

Discussion

The adequacy and appropriateness of the oral health service were evaluated from the patient records of 15-year-olds in Helsinki in 1976 and 1986. The subjects selected for the study represented the age group of 15-year-olds in each year because 95% of 7- to 16-year-olds participate in public oral health care (6) and because complete patient charts were available in municipal dental clinics for most subjects. Recordings of the different treatments given can be considered reliable because all health centres use a standardized chart. In the Helsinki City Health Centre diagnoses and decisions about therapeutic strategies are calibrated and discussed at dentists' meetings.

Our results showed that the number of fillings made followed closely the decline in caries prevalence. Fewer cavities were filled in 1986, when the mean number of decayed teeth was smaller than it had been 10 years earlier. The decrease in the number of fillings applied to all patients and was seen in both high-risk and low-risk groups. A dramatic change was also seen in terms of the teeth treated: in 1986 most fillings were made in molars and on occlusal surfaces. This con-

firms the findings of Heidmann et al. (8) and is in accordance with the knowledge of caries distribution in the teenage dentition (9–12).

In recent years, treatment strategies have changed (8) as the slow progression of caries and ways of arresting lesions (9, 13–15) have become more widely known. This should have been reflected as an intensification of fluoride therapy, especially in high-risk patients. However, no such changes were found over the 10-year period studied here. In both years 15-year-olds in both high-risk and low-risk groups received applications of topical fluoride equally seldom. Regardless of the obvious decline in the prevalence of caries, fluoride treatment remained just as infrequent in 1986 as it had been in 1976, nor was any focusing on high-risk patients seen. If the fluoride treatment given to low-risk patients was adequate for them, then a similar use of fluorides in high-risk patients should be judged as undertreatment.

Routine preventive treatment given in disregard of the patient's individual needs suggests alternative explanations for the obvious decline in caries. Many reasons can certainly be suggested (16). According to the present results, the preventive treatment given during dental visits could play a minor role. One major contributor could be optimal home care. The greater availability of fluoride dentifrices has been suggested as the main reason for the decline in caries in adolescents on the Scottish Isle of Lewis, where dental treatment included no prevention (17). In Finland earlier reports have shown that most adolescents brush their teeth once or twice a day, nearly always with a toothpaste containing fluoride (18).

The treatment given in public oral health service was predominantly fillings in 1976 and 1986. Dentists may have been unable to see indications of caries development and to identify the risk factors of caries as, year after year, they found the need for restorative treatment to be diminishing, even among high-risk patients. However, the role of past and present caries in predicting the future development of decay should have been known. At the Helsinki City Health Centre detailed written instructions related to identifying high-risk patients in different age groups and to planning their treatment are available in each clinic. Unfortunately, these instructions seemed to be disregarded in everyday practice. Similar findings have been reported from Denmark when dentists were capable of identifying carious lesions at early stages but preferred to choose restorative treatment instead of arresting therapy (19).

One major problem seemed to be the unfinished courses of treatment among high-risk patients, among whom 11% of caries lesions were left untreated in 1986. Combined with the inadequate preventive treatment, this will lead to more serious caries problems and to more time-consuming dental treatment among these patients in the near future.

According to the present results, public oral health care is to be judged as inadequate in providing and focusing of preventive treatment. We conclude that more attention should be paid to high-risk patients with regard to both the preventive treatment given and improving their motivation to complete the treatment courses.

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