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ORIGINAL ARTICLE

Dental and oral radiographic findings in first-year university students in 1982 and 2002 in Helsinki, Finland

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Abstract

Objective. This study is part of a larger research program, at the Finnish Student Health Service in Helsinki, in which changes in the dental and oral health of first-year university students (born in Helsinki) in the years 1982 and 2002 were compared. ***Material and Methods***. Panoramic radiographs were taken of 176 students in 1982, mean age 19.8 years (SD ± 0.7), and of 231 in 2002, mean age 20.2 (SD ± 0.7). DMFT index, caries and periapical changes, alveolar bone resorption, wisdom teeth, supernumerary, missing, and persisting deciduous teeth were evaluated from the radiographs. The chi-squared test and non-parametric tests were used to analyze the statistical significance of differences between the study groups and between genders. ***Results***. The DMFT index diminished from 11.0 (SD ± 4.2) to 2.9 (SD ± 3.3) ($p < 0.0001$). In 2002, 27.9% of the students had a DMFT index of zero (in 1982, 0%, $p < 0.000$). The mean number of endodontically treated teeth diminished from 0.1 to 0.03 ($p < 0.05$). The number of impacted wisdom teeth increased in males from mean 0.41 to 0.69 ($p < 0.05$). ***Conclusions***. An improvement in dental health was obvious in the year 2002. The favorable change in DMFT index is a trend that has been going on for several decades in Finland, probably as a result of the use of fluorides and better education in dental hygiene. The change might also be connected with improved general health.

Key Words: *Caries, dental health, epidemiology, panoramic radiography*

Introduction

Modern epidemiological caries studies started in the 1950s, since which time several studies have been conducted in this field [1]. According to these studies, the frequency of caries, which had previously been high, started to fall in the 1970s [1]. This favorable trend has continued to the present day [1]. However, some studies show that caries prevalence may be on the rise again [2,3]. The Finnish Student Health Service (FSHS) has sought to take these changes into consideration in its own research programs in order to be able to apply them in practice.

The FSHS was founded in 1954 to take care of the general and oral health of university students. Research has been an important part of its activities right from the outset. Today, the FSHS has offices in 16 cities in Finland. In Helsinki it caters for the health needs of about 41,200 students at the University of Helsinki and other university-level institutions in the greater Helsinki area. The Dental division has about 46,500 visits each year. All first-year students are invited for a dental check-up. Because of problems in the eruption of wisdom tooth, almost all first-year students are radiographed using panoramic radiography (PR). Altogether about 5,500 PRs are taken at the Helsinki health center each year.

There are only a few studies concerning a particular age class of students in different faculties [4–7]. Some study populations have consisted of dental students [8–11]. Longitudinal studies of this age group are also rare [12], and most of the studies about caries prevalence concern children and young adolescents. The results differ considerably depending on population and year. A recent study in Finland, examining the caries situation in populations born in 1965, 1970, 1975, and 1980 [2], shows

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that the number of caries lesions is rising again and that about 20% of individuals account for most of the caries findings.

The present study is part of a larger research program designed to compare the changes that have taken place in the dental and oral health of first-year university students between 1982 and 2002 in two successive generations of students.

Material and methods

The study material in 1982 consisted of 176 students, mean age 19.8 years (SD ± 0.7 years). They comprised 58 males (mean age 19.6, SD ± 0.6) and 118 females (mean age 19.8, SD ± 0.7). In 2002, there were 231 students, mean age 20.2 (SD ± 0.7 years), comprising 48 males (mean age 20.3, SD ± 0.6) and 183 females (mean age 20.2, SD ± 0.6). All had been born in Helsinki and were still living there when examined, and were patients at the Department of Dentistry of the Finnish Student Health Service (FSHS) in Helsinki. Informed consent was obtained from each student.

One PR was taken of students using an Orthopantomograph OP-5 (Palomex Co, Tuusula, Finland) unit in 1982 and a Cranex-Tome (Soredex Co, Helsinki, Finland) unit in 2002. The radiographs of both groups were evaluated by an experienced consultant in oral radiology (JP) in 2002. The evaluation was performed using a normal light-table and viewer according to Mattsson [13].

The following dental and oral findings were recorded from the PRs: DMFT index, dentine caries, endodontically treated teeth, apical rarefactions, radicular cysts, resorption of the alveolar bone, impacted and missing wisdom teeth, wisdom teeth with pericoronitis, supernumerary and missing teeth, persisting deciduous teeth, mandibular condyles, maxillary sinuses and changes in bone structure.

Caries was judged to be present in the radiograph when a clearly defined reduction in mineral content of the proximal, occlusal, and/or restored surface was seen extending into the dentine. A radiolucency measuring ≥ 2 mm in the apical bone was considered to be an apical rarefaction. A radiolucent periapical lesion was classed as a radicular cyst if it was more than 1 cm in diameter and had well-defined roundish opaque margins. A diagnosis of pericoronitis was made when sclerosis and/or erosion was present in the bone beside the crown of a wisdom tooth. Alveolar bone resorption was diagnosed when the marginal bone level had retreated over 2 mm apically from the cement–enamel junction.

To be able to study the polarization of caries, the students were divided into three equally large groups according to their DMFT index. This was done to compare the slight increase that had occurred in caries lesions between 1982 and 2002.

The chi-squared test was used to test if the DMFT index differed from zero. Non-parametric tests (Mann-Whitney U and Wilcoxon W) were used (because these assume nothing regarding the distribution of the material) to analyze the changes in all other findings in 1982 and 2002. The level of significance was set at $p < 0.05$.

In an earlier study, the interpreters' intra-examiner kappa index for radiographic caries was 0.75, for apical rarefactions and maxillary sinuses 0.75, and for condyles 1.00 [14].

Results

The results are given for males and females together (except the mean number of impacted wisdom teeth) because there were no statistically significant differences between the sexes. The DMFT index had decreased statistically significantly between 1982 and 2002 (Table I). The mean number of endodontically treated teeth had also decreased statistically significantly (Table I). Endodontically treated teeth were found in 8.5% of the students in 1982 and in 3% in 2002. The results regarding DMFT index, dentine caries, endodontically treated teeth, and apical rarefactions are given in Table I.

In the three equally large student groups in both 1982 and 2002 the number of caries lesions decreased in the lowest DMFT group and increased in the highest DMFT group (Table II).

The mean number of impacted wisdom teeth had increased statistically significantly in males. The mean numbers of impacted and missing wisdom teeth, wisdom teeth with changes indicative of pericoronitis, other congenitally missing and supernumerary teeth, and persisting deciduous teeth are given in Table III.

One odontogenic tumor (odontoma) was found on both occasions. Two follicular cysts were found in 1982 and one in 2002. Findings in the maxillary sinuses in 1982 included thickened antral mucosa (10 cases) and mucous retention cysts (15 cases), the corresponding numbers in 2002 being 14 and 11. Four students were found to have a flattened

Table I. Mean DMFT index, mean number of dentine caries lesions, endodontically treated teeth, and apical rarefactions per student in 1982 and 2002 and percentages of students with a zero DMFT index

	1982	2002	*p*
DMFT index	11.0 (SD ± 4.2)	2.9 (SD ± 3.23)	$p < 0.0001$
DMFT index = 0 (%)	0	27.9	$p < 0.0000$
Carious lesions	0.7 (SD ± 1.20)	0.8 (SD ± 1.6)	NS
Endodontically treated teeth	0.1 (SD ± 0.5)	0.03 (SD ± 0.2)	$p < 0.05$
Apical rarefactions	0.02 (SD ± 0.2)	0.01 (SD ± 0.1)	NS

Table II. Occurrence of dentine caries lesions in the three equally large student groups divided according to DMFT index (in 1982, $n = 59+59+58$ and in 2002, $n = 78+78+77$)

	DMFT 1982	DMFT 2002	Caries 1982	Caries 2002	p
Lowest third (n)	6.6 (SD±2.1) (59)	0.1 (SD±0.5) (78)	0.2 (SD±0.6) (59)	0.04 (SD±0.2) (78)	$p < 0.01$
Middle third (n)	10.9 (SD±1.1) (59)	2.1 (SD±0.7) (78)	0.6 (SD±1.1) (59)	0.7 (SD±0.8) (78)	NS
Highest third (n)	15.7 (SD±2.3) (58)	6.5 (SD±3.2) (77)	1.2 (SD±1.6) (57)	1.8 (SD±2.2) (77)	NS

articular surface of the mandibular condyle in 1982, while in 2002 there was one case of ventral osteophyte and two deformed condyles (one student suffered from juvenile chronic arthritis). Minor changes (remodeling of the articular surface) in the condyles were seen in 1982 in 2 and in 2002 in 3 students. One male student (1982) had changes typical of cleidocranial dysostosis in his dentition.

Discussion

We have no information about the socio-economic background of the students in the present study. All came from an urban environment, and because all had been born and raised in Helsinki they had had more or less the same opportunities to obtain education and health care, including dental care. In the study by Läärä [15], the prevalence of caries in Finnish conscripts could be explained by socio-economic factors: the subjects' own education, their fathers' occupation, interestedness, psychic energy, and considerateness. It has to be remembered, however, that the conscripts came from all over the country and from very different backgrounds compared to the students, who were born and raised in the capital. In the USA, the caries experience was found to be lower in high-income groups [16]. In a recent article, Bratthall and Petersson point out that individuals living in difficult socio-economic conditions often tend to develop more lesions than those in a better situation [17].

Fillings and missing teeth are readily detected from PRs. However, PRs are not as good in the diagnosis of caries as bitewing radiographs, especially in finding enamel caries [18–23]. No difference has been found in the detection of occlusal caries [24,25]. Hansen [26] reported that panoramic radiographs reveal more caries lesions than a clinical examination. In the study by Åkesson et al. [27], panoramic radiography presented a slightly lower mean accuracy than bitewing radiography. There was no statistically significant difference in caries occurrence between 1982 and 2002, so the diagnosis of caries did not influence the results. PRs are as good a diagnostic tool as intraoral radiographs in finding other pathoses in the jaws [20,21,28,29].

Table III. Mean numbers of impacted and missing wisdom teeth, wisdom teeth with changes indicative of pericoronitis, other missing and supernumerary teeth, and persisting deciduous teeth

	1982	2002	$p <$
Impacted wisdom teeth all	0.4 (SD±0.7)	0.4 (SD±0.7)	NS
Impacted wisdom teeth male	0.4 (SD±0.9)	0.7 (SD±0.9)	0.045
Missing wisdom teeth	0.3 (SD±0.8)	0.4 (SD±0.8)	NS
Pericoronitis	0.06 (SD±0.2)	0.1 (SD±0.4)	NS
Congenitally missing teeth (other)	0.3 (SD±0.8)	0.2 (SD±0.6)	NS
Supernumerary teeth	0.06 (SD±0.4)	0.03 (SD±0.2)	NS
Persisting deciduous teeth	0.04 (SD±0.3)	0.06 (SD±0.3)	NS

It was not possible to evaluate the radiographs totally "blind", because the 20-year-old radiographs could be identified by changes in their color and because of the different X-ray unit used in 1982.

The most prominent change occurred in the DMFT index, which had diminished from a mean of 11.0 to 2.9. The decrease had occurred in the number of fillings (F) because the number of caries lesions (D) and missing teeth (M) was almost the same in both years. So the differences in treatment principles between the two years may have affected the number of fillings (F) in 1982 compared with 2002. It is noteworthy that in 2002 more than one-fourth of the students had intact dentitions, whereas in 1982 there were none. Compared with an earlier Finnish study by the FSHS [7], the percentage of students with intact dentition in 2002 was over twice as high as in 1990 (12.7%). Another Finnish study found that the percentage of zero DMF in 18-year-old subjects had increased from that in 1961 (1.6%) to 8.0% in 1970–71 and to 17.2% in 1980–81 [30]. In the study by Hopcraft & Morgan [31], the DMFT index for 17 to 20-year-old army recruits (3.6) was about the same as for the males in the present study (2.9).

In the present study, the mean number of caries lesions had increased slightly. When the students were divided into three equally large groups according to their DMFT index, it was found that the increase had occurred in the highest third, although not statistically significantly, whereas in the lowest third the mean number of caries lesions had actually diminished. The increasing polarization of tooth decay reflects the fact that 75% of the decayed, filled, and missing teeth were found in 56.1% of the students in 1982 and in 37.1% of the students in

2002. This agrees with the findings of Macek [32], who claimed that the statement "75% of caries is found in X percent of the population" must be applied to a particular age. Meriläinen [2] also found that polarization is increasing and that most caries is now found in 20% of an age group, and that one-fifth of the age group imposes the biggest load on the health-care system. In Finnish military conscripts aged 19 and 20 years, the worst 10% of the subjects accounted for 50% of all decayed teeth, and the worst 100 (3.5%) comprised 24% of all decayed teeth [15]. High polarization of caries lesions has also been reported by other authors recently [33–35].

Results showing high polarization of caries have been taken into account in the education of FSHS dentists. Measures to prevent caries and improve health are directed at high-risk groups. The examination and attendance intervals can now be optimized in response to the caries experience of each individual. Examinations are arranged at intervals of between 6 months and 3 years. Thus, needless calls can be avoided and attention focused on those who need care.

The decrease in the mean numbers of endodontically treated teeth and apical rarefactions, which are probably dependent on each other, is clearly attributable to the marked decrease in DMFT index. Some of the rarefactions may comprise healing in progress. Compared with a recent study by Ridell et al. [36] in Malmö, the percentage of endodontically treated teeth (9.1%) was almost the same as in the present study population in 1982 (8.5%), but in 2002 the percentage was much smaller (3.5) in the Finnish study population. In the study by Peltola [7], the percentage of endodontically treated teeth in 1990 for Finnish university students (aged 19 to 25 years) in the FSHS was 9.3.

The incidences of findings in bone structure, maxillary sinuses, and mandibular condyles were almost the same in both of the present study groups and were comparable with those found in the FSHS in 1990 [7].

The improvement in dental health was obvious in 2002. The favorable change in caries risk is a trend that started several decades ago in Finland [37] and in the majority of industrialized countries [1] due to better education in dental hygiene [38] and the use of fluoride toothpaste [39], although it might also be connected with an improvement in general health as well. A contradictory finding is that the number of carious lesions increased slightly, although not statistically significantly, due possibly to sugar consumption [2], which has been found to be on the increase again [3], or to diminished dental care opportunities. Also, parents accustomed to having healthy teeth do not always understand the importance of looking after their children's oral hygiene practices [2].

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