Radiographic findings in the teeth and jaws of 14- to 17-year-old Estonian schoolchildren in Tartu and Tallinn

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Panoramic radiographs were taken of 392 Estonian schoolchildren (33% boys and 67% girls) aged 14–17 years, 197 in Tartu and 195 in Tallinn. The mean number of permanent teeth was 31.5. In 14% of the children one to four teeth (excluding wisdom teeth) were missing. The frequencies of missing wisdom teeth and supernumerary teeth agreed with those in the literature, being 17% and 3%, respectively. The mean number of radiographically detected carious teeth was 1.9 in Tartu and 3.3 in Tallinn. Secondary caries was common, being found radiographically in half of the schoolchildren. Endodontic treatment had been given to 13% of the subjects in Tartu and to 46% in Tallinn, the success rates being 47% and 44%, respectively. The percentage of radiographic signs in the mandibular condyles of girls (5%) was greater than that of boys (1%). Changes in the maxillary sinuses were found in 16% of the children. Eight odontogenic cysts, one cyst of the incisal canal, and one solitary bone cyst were found. Tumors included two odontomas, two cemento-ossifying lesions, and one osteoma in the maxillary sinus. The health status of the jaws of the Estonian schoolchildren was considered to be fairly good. □ *Dental health; epidemiology, oral; panoramic radiography*

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Very little information on the scientific work reported in the dental literature in the Baltic states reaches Western countries, where English is the main language of scientific papers. This is because most of their scientific reports have been published in Russian in the journals of the former USSR or in local journals in local languages.

The study by Bjerner et al. (1) of the caries situation in the province of Viljandi was the first to be conducted together with the Estonians. Results showed that caries is common today in Estonia. The mean DMFT value in 12-year-olds in Viljandi was 4.6. On the other hand, another Estonian study concerning the prevalence of caries among 12-year-olds in the western parts of Estonia showed quite low DMFT values, ranging from 1.3 to 3.2. The mean value for children aged 15–18 years varied from 3.3 to 8.6 (2).

Although the relatively high prevalence of dental diseases seems to be a problem in Estonia, little is known about the dental condition of Estonian schoolchildren. No information about the occurrence of periapical lesions and other diseases of the jawbones was found in the literature. This gave the Department of Dental Radiology of the University of Helsinki the impetus to contact the Estonian authorities to arrange a detailed study, including clinical and radiographic investigations, together with Estonian dentists.

This part of the study deals with the radiographic dental, periapical, and bone findings.

Subjects and Methods

The subjects of the present study were 392 schoolchildren, comprising 128 boys and 264 girls from schools for Estonian-speaking children in Tartu and Tallinn. The children were aged from 14 to 17 years (mean, 15.5; *s*, 1.1), and 197 of them were residents of Tartu and 195 of Tallinn. The subjects are described in more detail in our previous article (3).

The radiographic investigation included one panoramic radiograph from each pupil. The panoramic radiographs were taken by one of the authors (J. Wolf), using modern X-ray units with DC generators: a Cranex DC I (Soredex Co., Finland) in Tartu and a PM 2002 CC (Planmeca Co., Finland) in Tallinn. Trimax T-16 (3M) intensifying screens and Trimax GTU films were used. The radiographs were developed with an automatic developer and chemicals manufactured by Dürr. The radiographs were studied by two of the authors, 50% each (J. Peltola and J. Wolf), both of whom are specialists in oral radiology. The radiographs were studied under standardized conditions using Matsson's binoculars (4) with a 2× magnification and viewing light of adjustable brightness.

The following dental radiographic findings were recorded: number of teeth, radiographic caries, endodontic treatments, and periapical lesions. Missing and supernumerary teeth, persisting primary teeth, and roots of primary teeth were also recorded. Caries was

Table 1. Numbers of children and percentages of missing wisdom teeth and missing permanent teeth (including extracted teeth) (n = 392)

	No. of teeth per child	Missing wisdom teeth		Missing teeth (except wisdom teeth)	
		n	%	*n*	%
	4	8	2	2	1
	3	4	1	4	1
	2	26	7	13	3
	1	30	8	35	9
	0	324	83	338	86
Total	4–1	68	17	54	14
Mean		0.3 ± 0.8		0.2 ± 0.6	

judged to be present in the radiograph when a clearly defined reduction in the mineral content of the proximal, occlusal, and/or restored surfaces was seen. A radiolucent periapical lesion was interpreted as a radicular cyst if it was more than 1 cm in diameter and had well-defined roundish opaque margins. Sclerotic, ill-defined periapical lesions in carious or root-filled teeth were interpreted as condensing osteitis.

The following radiographic findings were recorded from the jaws: divergence in the bone structure, mandibular condyles, and maxillary sinuses. Radiopaque areas in the bone structure, which were usually round or elliptic in shape, were classified as enostoses. The mandibular condyles were graded as follows: 0 = sound, 1 = flattened articular surface only, 2 = signs typical of arthrosis (flattened articular surface and/or cortical and/or subcortical sclerosis, osteophyte, microcyst), 3 = signs typical of arthritis (erosion), and 4 = other. The findings in maxillary sinuses were classified as follows: 0 = sound, 1 = mucous cyst, 2 = thickened antral mucosa, and 3 = other.

The chi-squared test and Fisher's exact test were used to analyze the statistical significance of differences. In statistical analysis of differences between the sexes, age groups, and cities, multivariate analysis was used. Agreement percentages and kappa indices (5) for inter- and intra-examiner variations were calculated from a set of 50 radiographs.

The present study was approved by the ethical committees of the Universities of Tartu and Helsinki. Informed consent was obtained from all schoolchildren and their parents.

Results

Reliability tests

The kappa index (5) was 0.90–0.96 for the intra-examiner agreement in diagnosing apical rarefactions, maxillary sinuses, and mandibular condyles. The kappa values for the intra-examiner variation for radiographic caries were 0.75 and 0.74. Kappa indices for the inter-examiner variation for radiographic caries, maxillary sinuses, and periapical radiolucencies were 0.75–0.79, and for mandibular condyles 1.00.

Number of teeth

The mean number of permanent teeth was 31.5 (95% CI for mean, 31.4–31.6) (27.8 excluding wisdom teeth). In 14% of the children one to four permanent teeth (in 27% including wisdom teeth) were missing. The number of permanent teeth was higher in Tartu than in Tallinn ($P < 0.001$). Numbers and percentages of missing wisdom teeth and missing permanent teeth (excluding wisdom teeth) are given in Table 1. Numbers and percentages of supernumerary teeth, unerupted permanent teeth (excluding wisdom teeth), persisting deciduous teeth, and persisting roots of deciduous teeth are given in Table 2.

Radiographic caries

The mean number of decayed teeth detected radiographically was 1.9 (95% CI for mean, 1.6–2.1) in Tartu and 3.3 (95% CI for mean, 2.9–3.7) in Tallinn ($P < 0.001$).

Secondary caries was found radiographically in half

Table 2. Numbers of children and percentages of supernumerary teeth, unerupted permanent teeth, persisting deciduous teeth, and persisting roots of deciduous teeth (n = 392)

	No. of teeth per child	Supernumerary teeth		Unerupted teeth (except wisdom teeth)		Persisting deciduous teeth		roots	
		n	%	*n*	%	*n*	%	*n*	%
	4	1	0	1	0	0	0	0	0
	3	0	0	1	0	16	4	2	1
	2	5	1	5	1	7	2	2	1
	1	5	1	12	3	2	1	29	7
	0	381	97	373	95	367	94	359	92
Total	4–1	11	3	19	5	25	6	33	8
Mean		0.05 ± 0.3		0.07 ± 0.4		0.09 ± 0.4		0.1 ± 0.4	

No statistically significant differences existed between the two cities or between sexes.

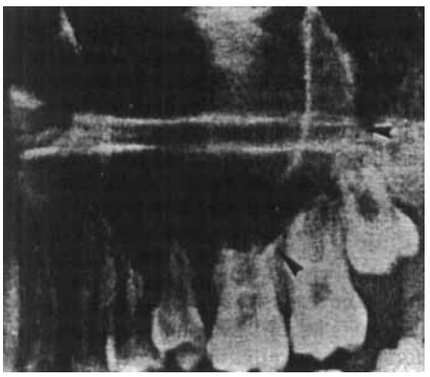

Fig. 1. Large intrasinusal bone cyst (unspecified, probably an odontogenic ceratocyst) in the left maxillary sinus of a 16-year-old boy in Tartu.

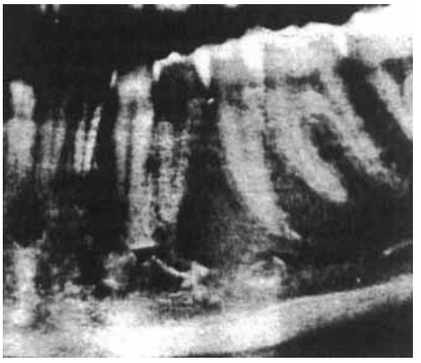

Fig. 2. Solitary (traumatic) bone cyst between the roots of dd. 34 and 35 in a 14-year-old girl in Tallinn.

of the pupils: 35% in Tartu and 66% in Tallinn. The mean number of radiographically detected secondary carious lesions was 0.6 (95% CI for mean, 0.4–0.7) in Tartu and 1.4 (95% CI for mean, 1.2–1.6) in Tallinn ($P < 0.001$).

Endodontic treatments and periapical findings

In Tartu the number of subjects with endodontically treated teeth was 26 (13%) and in Tallinn 90 (46%) (Table 3).

Of the 34 endodontically treated teeth in Tartu, 17 (50%) were root-filled, in 4 teeth (12%) some of the root canals were root-filled and some amputated, and 13 teeth (38%) were amputated only. The corresponding figures found in Tallinn were 158, 64 (41%), 51 (32%), and 43 (27%).

In Tartu periapical (or juxtaradicular) lesions were found in 23 subjects (12%) in altogether 29 teeth (0.5% of all permanent teeth). Correspondingly, in Tallinn 74 subjects (38%) had periapical lesions in altogether 111 (2%) teeth. Six of the periapical lesions were diagnosed as radicular cysts.

Periapical lesions were most frequent in endodontically treated teeth in both Tartu (18 of 29, 62%) and Tallinn (88 of 111, 79%). Successful endodontic treatment had been achieved in 47% of the cases in Tartu; in 18 (53%) of the 34 endodontically treated teeth there was a periapical lesion. Correspondingly, the success rate in Tallinn was 44%: in 88 (56%) of the 158 endodontically treated teeth there was a periapical lesion.

Findings in the bone structure of the jaws

Radiopaque areas, which were interpreted as enostoses (idiopathic sclerosis), were seen in 32 (8%) pupils, and their number increased with age ($P < 0.005$). No difference was found between the sexes. Eight lesions were diagnosed as odontogenic cysts: six were radicular cysts, one a ceratocyst (Fig. 1), and one a dentigerous cyst. Two other cystic lesions were interpreted as a cyst of the incisal canal and a solitary bone cyst (Fig. 2). Radiographic evidence of benign tumors was found in five children: two were odontomas and two cementoossifying lesions; the fifth was a small osteoma in the maxillary sinus.

Mandibular condyles and maxillary sinuses

Radiographic condylar signs were seen in 13 (3%)

Table 3. Number and percentage of subjects with one or more endodontic treatments in four age groups in Tartu and Tallinn

	Tartu						Tallinn					
	Boys		Girls		Total		Boys		Girls		Total	
Age, years	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
14	1	5	4	15	5	11	6	29	15	44	21	38
15	2	10	4	13	6	11	4	50	17	49	21	49
16	1	6	5	9	6	13	3	33	17	45	20	43
17	5	29	4	12	9	18	6	40	22	63	28	56
Total	9	12	17	14	26	13	19	36	71	50	90	46

Statistical significance of differences: Tartu/Tallinn ($P < 0.001$); Age groups, 14/17 years ($P < 0.05$).

children: 1 boy (1%) and 12 girls (5%). In 3 pupils the signs were bilateral and in 10 unilateral. The finding was flattening of the articular surface in 0.7%, arthrotic type in 1.3%, erosion in 0.1%, and other in 0.3% of the condyles. The condylar signs were commoner in girls than in boys ($P < 0.05$).

Changes in the maxillary sinuses were seen in 16% of the children (boys 20% and girls 14%). Thickened antral mucosa was seen in 7% of the sinuses and mucous cysts in 2%.

Discussion

Kappa indices for inter- and intra-examiner variations were perfect in the evaluation of mandibular condyles, almost perfect in the evaluation of maxillary sinuses and apical rarefactions, and substantial in radiographic caries diagnosis (6). This indicates that the results are highly reliable.

The number of subjects was too small to enable direct comparisons with other studies with regard to the prevalence of missing and supernumerary teeth and bone findings, although it is interesting to see how the present results compare generally with other studies, especially those conducted in Scandinavia.

The panoramic tomography used in the present investigation has well-known limitations in detecting caries. Despite this, panoramic tomography has been found to be a useful tool in epidemiologic studies of oral health (7, 8).

The mean number of existing teeth (wisdom teeth excluded) and the percentages of missing wisdom teeth and supernumerary teeth were similar to those found in previous studies in Sweden and Finland (9–11).

The mean number of decayed teeth detected radiographically was higher than that diagnosed clinically (1.9 versus 1.0 in Tartu and 3.3 versus 2.6 in Tallinn) (3). If bitewing radiographs had been used, more primary and secondary caries would probably have been found. The prevalence of radiographic caries was lower than that found clinically in Lithuanian children aged 15 years (DT = 3.9) (12). Secondary caries, which is uncommon among 14- to 17-year-olds in Scandinavia today (7), was a common finding in both Tartu and Tallinn. A similar finding was reported by Bjerner et al. (1) among 12-year-olds in Viljandi. Most of the secondary caries was found in the radiographic examination, which has so far only occasionally been used in caries diagnosis in Estonia. More secondary caries was found radiographically than clinically in 31% of the pupils in Tartu and 56% in Tallinn. In only one pupil did radiographic evaluation show less secondary caries.

The high number of endodontic fillings and periapical lesions may be considered to be a direct result of the high caries values, especially in Tallinn. For comparison, in 1983 in Jönköping, Sweden, the percentage of endodontically treated teeth in 15-year-olds was 0.2 (7) as against 2.9 in 14- to 17-year-olds in Tallinn.

The present finding that periapical lesions are most often related to endodontically treated teeth is a common finding in studies conducted in other countries (13, 14). The success rates for endodontic treatment reported in the literature vary in most investigations from 70% to 97%, which is noticeably better than in the present study (15–19). The low success rate for endodontic treatment cannot be explained by the young age of the subjects. For example, Hugosson et al. (9) found fewer periapical lesions in endodontically treated teeth among young individuals than among old people.

The percentage of enostoses was much the same as in some other studies (20–23). The number of enostoses seems to be higher in the Asiatic population (20) and in blacks (22) than in Caucasians. Kawai et al. (23) found that the frequency of enostoses also increases during the first three decades of life. Enostoses are harmless thickenings of the bone, but large numbers in one patient may indicate the Gardner syndrome (21).

The frequency of radicular cysts was higher than in the somewhat older Finnish student population (8), 1.5% versus 0.2%, probably due to the higher caries rate and unsuccessful endodontic treatment. Odontogenic ceratocysts, dentigerous cysts, and solitary (traumatic) bone cysts are usually found in patients of this age, but cysts of the incisive canal are cysts of older persons (30–50 years) (24). Odontomas are the commonest odontogenic tumors (25), and two were found in this population. The number of subjects was so small that we cannot draw any epidemiologic conclusions about the frequencies of the cysts and tumors found in the present study.

The rate of radiographic signs in mandibular condyles (3%) was a little lower than in the Finnish population of the same age (5%) (26) and lower than in 19- to 25-year-old Finnish students (11%) (27). The finding that girls have more condylar changes than boys appears in many studies (27–29).

The incidence of changes in maxillary sinuses did not differ much from that of Finnish students (8), which was 19%. Boys showed these changes more often than girls, but the difference was not statistically significant, as it was in the Finnish student population.

The radiographic findings in the jaws of Estonian schoolchildren were much the same as those found in studies in other countries. No serious inflammations such as large osteitis or osteomyelitis were found, as might have been expected in view of the caries situation in earlier studies (1, 2).

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