

Dental radiographic findings in the elderly in Helsinki, Finland

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A total of 169 dentate persons, aged 76, 81, and 86 years, living at home in Helsinki, Finland, were examined by means of panoramic radiography supplemented by intraoral radiographs. The older the age group, the fewer teeth remained. Altogether 75% of the subjects had radiographically detectable caries. A high proportion of the carious teeth (62%) was found in a relatively small number (24%) of subjects. The number of carious teeth and their percentage of the total number of teeth were greater in the older age groups. The proportion of endodontically treated teeth was 19% in the 76-year-olds and 26% in the 86-year-olds. Of the subjects 41% had periapical periodontitis, which was commoner in root-filled teeth (18%) than in other teeth (4%). Caries and periapical radiolucent and radiopaque findings were commoner in men. Vertical bone pockets (3 mm or deeper) were found in 51% and furcation lesions in 28% of the subjects. Compared with earlier Finnish studies, the results indicate an improving oral health status among elderly Finns. □ *Caries; endodontics; gerodontology; periodontitis*

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A rapid aging of the population in Finland has taken place in recent years. The number of persons more than 75 years old tripled between 1970 and 1990, and this trend is expected to continue until 2030. The fastest increase will be in the oldest age groups (those more than 85 years old), who need most medical care (1–3).

Concomitantly, in developed Western countries edentulousness is disappearing, and the number of retained permanent teeth is increasing (2). There is a similar trend in Finland, although there is a time lag compared with Sweden and Norway (2).

The retention of permanent teeth into old age is the result of successful dental care. On the other hand, a deterioration in dentition can increase the risk of oral infections with systemic complications at any age (4–9). In old age, increasing illness and medication usually reduce the salivary flow (10, 11), thus increasing the risk of dental diseases (12).

As a result, dentate elderly people need and demand more dental services than their edentulous counterparts (13–14). The dentate elderly also use more expensive and a greater variety of dental health services than their younger counterparts (13–15).

Several studies of the oral radiographic findings in the elderly have been performed in Scandinavia during recent years (16–20). In Finland, radiographic studies of the oral health status and the need for treatment of the non-institutionalized elderly have mainly concerned the need for prosthetic treatment (21–23). No detailed radiographic studies have so far been made of the oral health status of dentate old people living at home in Finland.

The aim of the present study was to perform the radiographic part of an extensive and detailed clinical oral health survey of dentate old people living at home in Helsinki, Finland.

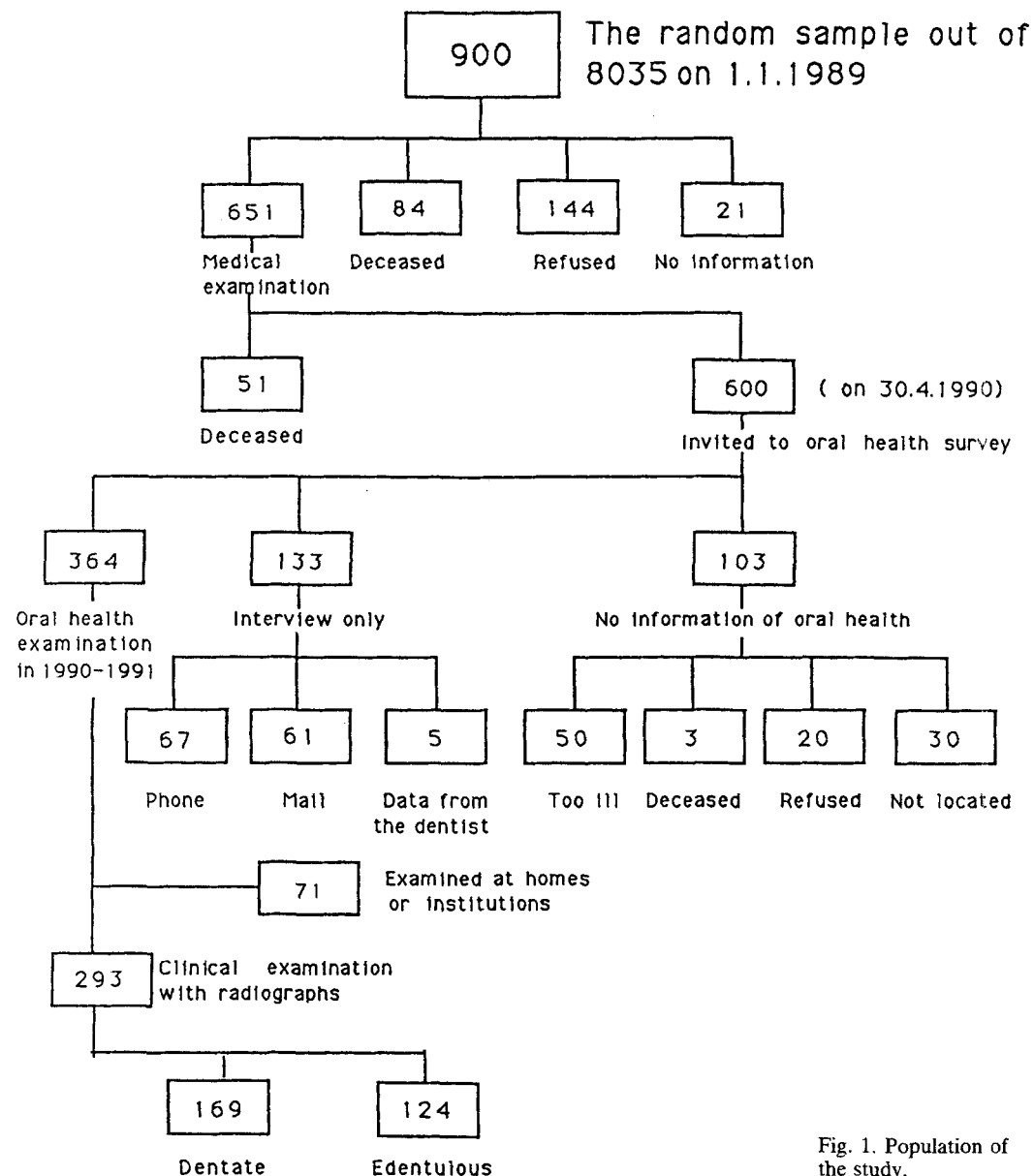


Fig. 1. Population of the study.

Materials and methods

This investigation is part of a large medical survey of a random sample of subjects (total, 8035) born in 1904, 1909, and 1914 and living in Helsinki in January 1989 (Fig. 1) (24). The response rate for the medical survey from

the invited random sample of 795 old people was 81.8% ($n = 651$) (24). Between 1989 and 1990, 651 subjects participated in the medical examination. Before 31 May 1990 the mortality among the participants in the medical survey was 8.0% ($n = 51$). In 1990-1991, 600 subjects who were still alive were invited to

Table 1. Clinically dentate persons in different age groups

	Age group			Total	
	76 years, <i>n</i>	81 years, <i>n</i>	86 years, <i>n</i>	<i>n</i>	%
Men	29	15	10	54	32
Women	65	34	16	115	68
Total	94	49	26	169	100

the Institute of Dentistry for a comprehensive dental examination. A total of 133 persons were interviewed by phone or by mail, and no dental data were available for 103 subjects. Altogether 364 subjects, of whom 28% were male and 72% female, were examined in 1990–1991 (25). The response rate for the rest ($n = 600$) was 60.7% ($n = 364$). The participation rate for invited men was 69% and for women 58%.

Of the 364 subjects, 293 attended the Institute of Dentistry and were examined clinically and radiographically, whereas 71 subjects were examined clinically only at homes or institutions.

Of the 293 subjects radiographed, 169 (54 men and 115 women) had one or more clinically visible natural teeth left, and they formed the subjects of the present series (Table 1). Another series, comprising the 124 edentulous subjects, has been reported on separately (26). Thus 42% of the sample was edentulous and 58% dentate.

Panoramic radiographs were taken with a PM 2002 radiographic apparatus (Planmeca Oy, Finland). Trimax T16 intensifying screens and GTU X-ray film (3M) were used. Intraoral radiographs of areas poorly visible in the panoramic radiograph were taken with a Siemens Heliodont 70 dental radiographic unit and Kodak Ultra-speed X-ray film. In all, 169 panoramic and 109 intraoral radiographs were taken. All films were developed by automatic processing. Intraoral films were mounted in frames. The radiographs were studied by one dental radiologist under standardized conditions using Mattson's binoculars with a magnification of 2× and a

viewing light of adjustable brightness when necessary.

The total number of teeth, carious teeth, impacted teeth, intrabony roots, root canal fillings, and periapical and periodontal lesions was recorded.

Statistical methods

The Student two-tailed test was used to determine the statistical significance of the differences between groups.

Results

In all, 2355 teeth, 1367 in the mandible and 988 in the maxilla, were found in the 169 dentate subjects studied. The mean number of teeth was highest (15.2) in the youngest age group and lowest (11.6) in the oldest age group ($p < 0.05$). In men no clear difference in the mean number of teeth was observed. In women the mean number of teeth was highest (14.2) in the youngest age group and lowest (9.5) in 86-year-olds ($p < 0.05$). Thus the difference in the mean number of teeth in the total material was mainly due to the women. In all age groups and in both men and women more teeth had been lost from the maxilla than from the mandible.

Persons with teeth in one jaw only numbered 60 (36%). The maxilla was edentulous in 54 (32%) and the mandible in 6 (4%) cases. Although women (39%) had one edentulous jaw more often than men (28%), the difference was not statistically significant.

A total of 33 intrabony roots were detected radiographically in 25 subjects (15%). Nineteen impacted teeth were found in 14 persons (7%): 12 wisdom teeth, 4 canines, 2 supernumerary teeth, and 1 premolar.

Altogether 126 persons (75%) had radiographically detectable caries. Of the 2355 teeth studied, 507 (22%) were diagnosed as carious. A high proportion of carious teeth (62%) was found in a relatively small number of subjects (24%). Carious roots were found in 17% of the subjects, constituting 14% of all carious teeth ($n = 70$). However, only 3% of all the teeth examined were carious roots.

Table 2. Mean number of carious teeth and their percentage of the total number of teeth in each group

	Age group									Total		
	76 years			81 years			86 years					
	Mean	SD	%	Mean	SD	%	Mean	SD	%	Mean	SD	%
Men	3.5	3.2	20	4.2	4.0	35	7.2	4.6	48	4.4	4.0	28
Women	2.1	2.2	15	2.5	3.0	20	2.8	3.7	30	2.4	2.7	18
Total	2.5	2.6	17	3.0	3.4	24	4.5	4.6	39	3.0	3.3	22

Statistical significance of the differences: men/women in the total material ($p < 0.001$) and in 76- and 86-year-olds ($p < 0.05$); age groups 76/86 in the total material and in men ($p < 0.01$).

The mean number of carious teeth was 2.5 for the 76-year-olds and 4.5 for the 86-year-olds ($p < 0.05$). The increasing difference with age was statistically significant among men ($p < 0.01$) but not among women (Table 2). Caries was commoner in men than in women ($p < 0.001$).

Endodontically filled teeth were found in 129 persons (76%). Of all teeth, 21% were root-filled. The mean number of teeth with an endodontic filling was 2.9. Men had slightly more endodontic fillings (mean, 3.4) than women (mean, 2.8), but the difference was not statistically significant. The percentage of endodontically filled teeth of the total number of teeth in different age groups increased from 19% in the 76-year-olds to 26% in 86-year-olds. However, this increase was not statistically significant. In addition to numerous root-filled teeth, only 13 teeth with a pulp amputation were found.

Periapical radiolucencies indicating periapical periodontitis were found in 70 persons (41%). Radiolucencies were present in 7% of all teeth studied, being commoner in root-filled teeth (18%) than in other teeth (4%). The mean number of radiolucencies per person was 1.0; they were commoner in men, who had more teeth and root remains, than in women (Table 3). Moreover, sclerotic periapical lesions indicating condensing osteitis were found in 35 teeth (1.5% of the teeth), being commoner in men than in women ($p < 0.001$).

Teeth with vertical bone pockets (pocket depth, 3 mm or more) were found in 88 persons (51%) and teeth with furcation lesions in 47 subjects (28%). The mean number of teeth with vertical bony pockets was 1.5 per person, and the mean number of teeth with furcation lesions was 0.5 per person. The periodontal condition was

Table 3. Mean number of teeth with a periapical radiolucency indicating periapical periodontitis and their percentage of the total number of teeth in each group

	Age group											
	76 years			81 years			86 years			Total		
	Mean	SD	%	Mean	SD	%	Mean	SD	%	Mean	SD	%
Men	1.8	2.0	10	1.7	1.9	14	1.9	2.1	13	1.8	1.9	11
Women	0.6	1.5	5	0.5	1.0	4	0.8	1.4	8	0.6	1.3	5
Total	1.0	1.7	7	0.9	1.4	7	1.2	1.7	10	1.0	1.6	7

Statistical significance of the differences: men/women in the total material ($p < 0.001$) and in age groups 76 and 81 years ($p < 0.01$).

Table 4. Mean number of teeth with vertical bone pockets and furcation lesions and their percentage of the total number of teeth in each group

	Age group											
	76 years			81 years			86 years			Total		
	Mean	SD	%	Mean	SD	%	Mean	SD	%	Mean	SD	%
Vertical bone pockets												
Men	2.3	3.2	13	1.7	2.1	14	0.8	1.1	5	1.8	2.7	12
Women	1.2	1.9	9	1.2	1.4	10	1.6	1.5	17	1.3	1.8	11
Total	1.6	2.5	10	1.4	1.7	11	1.3	1.4	13	1.5	2.1	11
Furcation lesions												
Men	1.1	1.8	6	0.7	1.2	5	0.4	1.3	3	0.9	1.6	6
Women	0.3	0.8	2	0.6	1.3	4	0.3	0.4	3	0.4	0.9	3
Total	0.6	1.2	4	0.6	1.3	5	0.3	0.8	3	0.5	1.2	4

Statistical significance of the differences: vertical bone pockets: men/women in 76-year-olds ($p < 0.05$); furcation lesions: men/women in 76-year-olds ($p < 0.01$) and in the total material ($p < 0.05$).

slightly poorer in men than in women. However, the only statistically significant differences were in the number of teeth with vertical bone pockets and furcation lesions in the 76-year-old group and furcation lesions in the whole material (Table 4).

Discussion

Considering the advanced age and frail condition of many of the subjects, the participation rate (49%) in the oral health study was high (24–26).

The randomized sample of 900 old inhabitants in Helsinki was drawn on 1 January 1989. The clinical dental examination was performed between 1 June 1990 and 31 May 1991 (Fig. 1). The background of the 364 participants has been evaluated with regard to age, sex, educational level, and residential area and was found to be representative of the original basis population of 8035 (unpublished results).

However, subjects with a better physical condition tended to participate more actively in the clinical examinations. The radiographed population ($n = 293$) included only subjects able to arrive to the Institute of Dentistry. Compared with other studies on very old populations, the participation rate and representativeness of the sample can be considered reasonable.

Panoramic radiography, supplemented by additional radiographs, is the method of choice in screening both edentulous and dentate patients (27). This method is especially well tolerated by old and frail subjects as it is quick and easy and is thus well suited for screening the oldest age cohorts. Panoramic and intraoral techniques have both been shown to be suitable methods for diagnosing periapical periodontitis (19, 28, 29), sclerotic lesions (27, 29), and marginal bone loss (30, 31).

Currently, panoramic radiography is also the method of choice for screening infectious foci in hospitalized patients. Mattila et al. (7), Syrjänen et al. (8), and DeStefano et al. (9) have shown that dental infections are risk factors for cardiovascular diseases in young and middle-aged men.

The proportion of dentate subjects (57%) in the radiography series (293) and the number of teeth were higher than expected but are in accordance with the current trend towards increasing numbers of old people retaining their teeth until old age in all Scandinavian countries (2).

In the present study as many as 25% of the subjects were radiographically caries-free. However, radiographic methods alone are not reliable in diagnosing caries. The intraoral tube method, normal intraoral radiography, and panoramic radiography all have

quite poor agreement rates in this respect (27, 28). The validity is also questionable because buccal and lingual carious lesions may overlap, and many radiolucent fillings are diagnosed as caries.

The number of carious teeth and their percentage of the total number of teeth in women seemed to be slightly lower than in women in the Mini-Finland study (14) but higher in men than in Mini-Finland. However, in the Mini-Finland study the oldest group examined was 65 years and older, and as they were examined only clinically, the results concerning caries are not directly comparable with those in the present study. In the present study approximately one carious tooth less per subject was found in the clinical examination (25) than in the radiographic examination.

The small number of carious roots (only 3% of all teeth examined) is a significant improvement compared with earlier studies in Finland. In the seventies nearly 25% of all teeth were carious roots in 65- to 80-year-olds, and nearly one-third in non-institutionalized dentate persons more than 80 years old in Turku (23).

No studies of the number of root-filled teeth in the elderly in Finland have been published so far. The percentage of root-filled teeth in Scandinavian studies from 1973 to 1990 has been 11% on an average (17, 32), increasing with age to nearly 25% in 70-year-olds (33). These figures agree quite well with those in the present study and may reflect the elderly's effort to maintain their natural teeth.

Periapical radiolucencies were found in 64% of the men and 30% of the women (together, 41%). Seven per cent of all teeth examined had a periapical lesion, and 18% of root-filled teeth had a lesion. In studies of periapical radiolucencies, figures ranging from 1.4% to 9.6% for all teeth (18, 28) and from 18% to 31% for endodontically treated teeth (28, 33) have been reported.

As recent studies (7–9) have shown that dental diseases are a risk factor for coronary heart disease and mortality in young and middle-aged populations, the high number of different signs of infectious processes in the elderly dentate subjects is surprising.

However, having been born at the beginning of the century, when there were still many potentially fatal infectious diseases, including tuberculosis, the present elderly population may have excellent resistance to infections, and they represent the healthy survivors of their age cohorts.

The overall trend as compared with earlier Finnish studies (14, 21–23) seems to be towards larger numbers of retained teeth and improving oral health status, as in other Scandinavian countries (16–20).

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