

# Remaining teeth in Finnish adults related to the frequency of tooth-brushing

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The number of teeth remaining in adults was evaluated with specific reference to the frequency of tooth-brushing. The sample consisted of 5028 dentate subjects, representing the Finnish population aged 30 years and older. Their mean age was 47.5 years. The presence or absence of each individual tooth was recorded. A total of 91,332 teeth was registered. Forty-eight per cent of the women had retained no fewer than 21 teeth, 20% had 20–11 teeth, and 32% had 10–1 teeth. For men the percentages were 52%, 23%, and 25%, respectively. The number of a subject's remaining teeth was strongly related to the frequency of tooth-brushing ( $p < 0.001$ ). The more frequent it had been, the more teeth the subjects, both women and men, had retained. This trend was also seen for the teeth in each jaw, and even for type of tooth. The trend was also present when the number of teeth was analyzed in accordance with a subject's income. □ *Community dentistry; epidemiology, oral; field study; preventive dentistry*

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Many nationwide studies of adult populations, for example in Scandinavia, Great Britain, and the United States, have shown that the mean number of teeth remaining is negatively correlated with age (1–5). In general, caries and periodontitis are the main reasons for tooth loss. It is widely accepted that, to a large extent, both of these diseases can be prevented by good home care, for example by regular tooth-brushing (2, 6, 7). However, few reports are available about differences in tooth-brushing habits in subjects with different numbers of teeth remaining. Because instruction in regular tooth-brushing is generally given, it would be interesting to know whether a subject's brushing habits are important for retaining his or her teeth.

This study evaluated the number of teeth remaining and the presence of individual teeth in adults with specific reference to the frequency of tooth-brushing.

## Materials and methods

This study was conducted as a field study in 40 communities in Finland and was part of

the large 1980s Health Survey, which included studies on the dental condition of adults. The sample represented the Finnish population aged 30 years and older, including institutionalized subjects. Ninety per cent of the subjects in the sample participated in the clinical dental examinations. Details about sampling and methods have been published elsewhere (8, 9).

The dentate subjects ( $n = 5028$ ) were included in this study. Their mean age was 47.3 years for men and 47.7 for women. One to 6 weeks before the health examination, professional interviewers made inquiries about the frequency of the participants' tooth-brushing and about his or her background factors. The clinical dental examinations were carried out by a specially trained dental assistant, using a standard operating light, a dental probe, and a mouth mirror. A total of 91,332 teeth were examined. To study the inter-examiner reliability of the clinical measurements, every sixth subject was re-examined by dentists 3½ months after the basic examination.

The presence or absence of each individual tooth was recorded. A tooth was defined as present when at least a part of it was visible

Table 1. Dental status of dentate participants ( $n = 5028$ ) by age and gender

Age (years)	Mean no. of teeth		% of dentate subjects with an edentulous upper jaw	
	Women	Men	Women	Men
30-39	21.5	22.5	19	17
40-49	18.4	19.7	30	21
50-59	15.8	16.8	41	31
60-69	12.0	13.9	46	31
70-91	9.4	11.5	44	30

or could be probed. The type of tooth was defined in accordance with its morphology and location. Each premolar situated no more than 2 mm distal to a canine was recorded as a first premolar. Correspondingly, each molar situated no more than 2 mm distal to a premolar was recorded as a first molar. The number of a subject's teeth included data on third molars.

Statistical analyses were conducted by comparing the means of each group by means of the *t* test. Frequencies in the groups were compared by chi-square statistics.

## Results

Table 1 presents the dentitions of dentate participants by age and gender. The number of teeth remaining decreased with age. Men had an average of 18.8 natural teeth, and women 17.5. The inter-examiner reliability of recording teeth as present and identifying them by type was high. In re-examinations the mean number of a subject's teeth differed by 0.1 teeth, varying from 0.01 to 0.06 for each type of tooth.

Twenty-three per cent of the men and 31% of the women had an edentulous upper jaw, whereas only 1% and 2%, respectively, had an edentulous lower jaw. Forty-eight per cent of women had retained no fewer than 21 teeth, 20% had 20-11 teeth, and 32% had 10-1 teeth. For men the percentages were 52%, 23%, and 25%, respectively. Two per cent of the subjects had only one tooth remaining, whereas 1% had retained all of their 32 teeth. The mode was 28 teeth, for both men and women, representing 8% of the subjects.

The presence of teeth appeared to be symmetrical. Table 2 shows the mean number of teeth on the right and on the left side in both arches. Table 3 shows the corresponding figures for each type of tooth. Because no asymmetry was found, the subsequent figures were calculated separately for each tooth pair. A tooth pair (for example, the first maxillary incisors) was formed by combining the data for both corresponding individual teeth from the right and left side of each jaw.

Fig. 1 shows the presence of teeth in each tooth pair among the dentate population by

Table 2. Symmetry of the presence of teeth remaining, by site, in the adult Finnish dentate population. Number of teeth examined ( $n = 91,322$ )

	Mean no. of teeth in each category			
	Women ( $n = 2460$ ), side of jaw		Men ( $n = 2568$ ), side of jaw	
	Right	Left	Right	Left
Maxilla	3.80	3.81	4.19	4.15
Mandible	4.94	4.91	5.26	5.22

Test for asymmetry by the *t* test, NS.

Table 3. Symmetry of the presence of teeth remaining by tooth type, in the adult Finnish dentate population

	Mean no. of teeth in each category			
	Women (n = 2460), side of jaw		Men (n = 2568), side of jaw	
	Right	Left	Right	Left
Maxilla				
Incisor	1.21	1.20	1.29	1.27
Canine	0.62	0.62	0.69	0.67
Premolar	0.98	0.99	1.05	1.04
Molar	0.99	0.99	1.17	1.16
Mandible				
Incisor	1.81	1.81	1.79	1.79
Canine	0.91	0.91	0.94	0.93
Premolar	1.36	1.38	1.46	1.45
Molar	0.86	0.81	1.08	1.05

Test for asymmetry by the *t* test, NS.

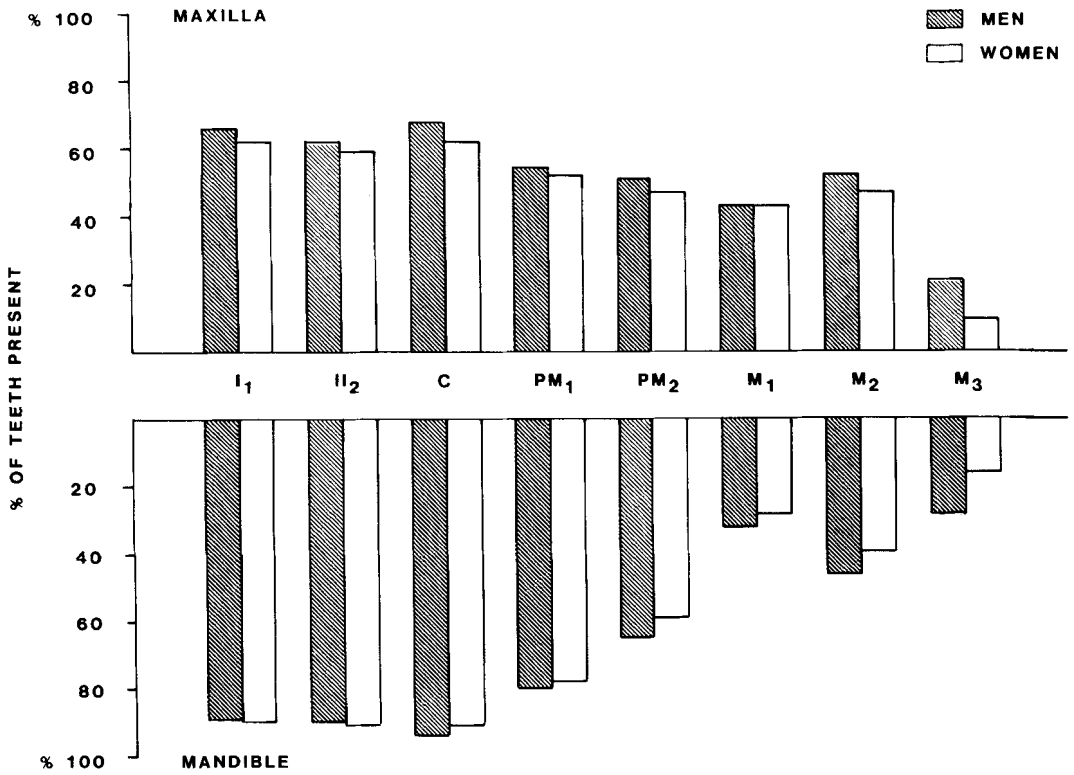


Fig. 1. Percentage of individual teeth present in each jaw in the Finnish dentate population aged 30 years and older.

Table 4. Number of teeth in relation to the reported frequency of tooth-brushing in the adult Finnish dentate population

Frequency of tooth-brushing	No. of subjects and mean no. of teeth					
	Women			Men		
	<i>n</i>	Mean	(SD)	<i>n</i>	Mean	(SD)
More than once a day	1634	18.6	(8.6)	868	19.9	(8.9)
Once a day	634	15.7	(8.6)	933	19.0	(8.6)
Less frequently	177	13.0	(8.6)	758	17.3	(8.3)

Statistical differences by the frequency of tooth-brushing: \* $p < 0.05$ ; all others,  $p < 0.001$ .

Table 5. Mean number of teeth remaining by jaw in accordance with the frequency of tooth-brushing in the adult Finnish dentate population

Jaw	Mean no. of teeth in each category			
	Women, tooth-brushing		Men, tooth-brushing	
	Frequent*, mean (SD)	Sporadic*, mean (SD)	Frequent*, mean (SD)	Sporadic*, mean (SD)
Maxilla	7.8 (5.9)	5.6 (5.1)	8.6 (5.8)	7.8 (5.2)
Mandible	10.1 (3.5)	7.4 (4.1)	10.9 (3.5)	9.5 (3.8)

\* Frequent = once a day or more; sporadic = less than once a day. Difference by the frequency of tooth-brushing (*t* test),  $p < 0.001$ .

gender. Each mandibular tooth, excluding molars, was retained more often than the corresponding tooth in maxilla, the differences being 12–32%. For the first and second molars in the maxilla the differences were 14% and 6%, respectively. Both in the maxilla and in the mandible, the anteriors remained most frequently. Among women, 91% of the lower canines were present, and among men 94%, and, respectively, 62%, and 68% of the upper canines. Among women 90%, and among men 89%, of the lower incisors were present and, respectively, 60%, and 64% of the upper incisors. Excluding the third molars the teeth least likely to be retained were the lower first molars: for women 29% of them remained, whereas for men the figure was 33%.

The number of a subject's remaining teeth was strongly related to the frequency of tooth-brushing (Table 4). The more frequent

it had been, the more teeth the subjects, both women and men, had retained. This trend was also seen for the teeth in each jaw (Table 5) and even for each type of tooth, except for third molars in women and upper central incisors and upper canines in men (Table 6). Among frequent brushers 45–65% of teeth of each tooth type were retained, and among those brushing sporadically 25–55%.

The number of a subject's remaining teeth was related to his or her income, as was the frequency of tooth-brushing. The higher the income, the more prevalent were frequent brushers and the greater was the number of teeth subjects had retained (Table 7). In each of the income categories the effect of tooth-brushing still existed: the more frequent the tooth-brushing, the more prevalent was a dentition with no fewer than 25 teeth remaining.

Table 6. Number of teeth by tooth pair in accordance with the frequency of tooth-brushing in the adult Finnish dentate population

Tooth pair	Mean no. of teeth in each tooth pair			
	Women, tooth-brushing		Men, tooth-brushing	
	Frequent*, mean (SD)	Sporadic*, mean (SD)	Frequent*, mean (SD)	Sporadic*, mean (SD)
<b>Maxilla</b>				
First incisor	1.3 (1.0)	1.0 (1.0)	1.3 (0.9)	1.3 (0.9) <sup>NS</sup>
Second incisor	1.2 (1.0)	0.9 (0.9)	1.3 (0.9)	1.2 (0.9)**
Canine	1.3 (0.9)	1.1 (0.9)**	1.4 (0.9)	1.4 (0.9) <sup>NS</sup>
First premolar	1.1 (0.9)	0.6 (0.8)	1.1 (0.9)	0.9 (0.9)
Second premolar	1.0 (0.9)	0.6 (0.8)	1.1 (0.9)	0.9 (0.9)
First molar	0.9 (0.9)	0.5 (0.8)	0.9 (0.9)	0.7 (0.8)
Second molar	1.0 (0.9)	0.7 (0.8)	1.1 (0.9)	1.0 (0.9)*
Third molar	0.2 (0.5)	0.2 (0.6) <sup>NS</sup>	0.4 (0.7)	0.5 (0.7)
<b>Mandible</b>				
First incisor	1.8 (0.5)	1.4 (0.9)	1.8 (0.6)	1.7 (0.7)
Second incisor	1.8 (0.5)	1.5 (0.8)	1.8 (0.5)	1.7 (0.6)
Canine	1.8 (0.5)	1.6 (0.7)	1.9 (0.4)	1.8 (0.5)
First premolar	1.6 (0.7)	1.2 (0.9)	1.7 (0.6)	1.5 (0.7)
Second premolar	1.2 (0.8)	0.9 (0.9)	1.4 (0.8)	1.2 (0.8)
First molar	0.6 (0.8)	0.2 (0.5)	0.7 (0.8)	0.5 (0.7)
Second molar	0.8 (0.9)	0.4 (0.6)	1.0 (0.9)	0.7 (0.8)
Third molar	0.3 (0.6)	0.3 (0.6) <sup>NS</sup>	0.6 (0.8)	0.5 (0.7)**

\*Frequent = once a day or more; sporadic = less than once a day. Differences in accordance with the frequency of tooth-brushing (*t* test): NS = not significant; \**p* < 0.05; \*\**p* < 0.01; all others, *p* < 0.001.

Table 7. Number of teeth in relation to the reported frequency of tooth-brushing and to a subject's income in the adult Finnish dentate population

Income category	Mean no. of teeth remaining	The frequency of tooth-brushing					
		Twice a day		Once a day		Sporadic	
		<i>n</i>	% of full* dentitions	<i>n</i>	% of full* dentitions	<i>n</i>	% of full* dentitions
Very low	12.9	216	11	225	13	253	11
Low	15.6	287	21	289	20	238	16
Medium	17.8	537	31	356	28	182	24
High	20.1	730	44	351	40	140	31
Very high	21.3	732	52	346	43	122	39

\* Full dentition = no fewer than 25 teeth remaining. Difference by income (*t* test): *p* < 0.001; by the frequency of tooth-brushing (chi-square test): in the lowest income category, NS; other categories, *p* < 0.01–*p* < 0.001.

## Discussion

The present results support earlier findings that the mean number of teeth remaining decreased with age (Table 1). The symmetrical localization of teeth remaining

(Tables 2 and 3) shows that diseases resulting in tooth loss occur symmetrically in the dentition. This finding has not been accentuated previously, although it has been seen in the diagrams of some earlier reports concerning dental health in adults (2, 10).

The mean number of teeth was lower for the maxillary teeth than for the mandibular ones. This difference was due to the great frequency of edentulous upper jaws (Table 1), also reported earlier (4). This evidence may not refer a greater susceptibility to dental diseases in maxillary teeth, because it may have resulted from a greater tendency on the part of dentists to recommend a full denture for the upper jaw (11) and from the patients' greater demand for and acceptance of this kind of treatment.

The difference in the presence of individual teeth and groups of teeth in each jaw did not seem to be logical. Anteriors and premolars in the mandible were retained more frequently than the corresponding teeth in maxilla, but the opposite situation held for the molars (Fig. 1). Especially the first molars showed this disparity. In the United Kingdom, Todd et al. (2) demonstrated an analogous condition with regard to the first molars among young adults. No explanation was given for this finding, since similar differences were seen among regular dental attenders and among those who attended only for emergency treatment.

The presence of individual teeth (Fig. 1) indicates the natural course and mortality of dental diseases resulting in tooth loss. However, some of the teeth situated behind the spaces of removed first premolars or molars may have drifted mesially, making identification of each type of tooth difficult.

The present results show that the subjects had most frequently retained their anterior teeth (Table 3, Fig. 1). Presumably, they are the easiest to clean. Their morphology may also be the least predisposed to disease. From a patient's point of view, they may also be the most valuable teeth owing to their importance for esthetics and speech. This seems to be in disagreement with the results of a questionnaire which investigated reasons for tooth extraction among 222 Finnish dentists (12). Of a total of 3883 extractions the majority were anteriors. However, in every fourth patient the indication for anterior extraction had been for prosthetic reasons, sometimes as part of full mouth clearance.

Congenitally missing teeth can cause

underestimation for the proportion of teeth remaining. The second upper incisors and the second premolars are reported to be missing in 1–3% of permanent dentitions (13–15). These figures are so small that they cannot affect the present results. In contrast, a third molar is missing in 10–16% of dentitions (15). This must be kept in mind when evaluating the results concerning these teeth.

The present results showed that a greater number of teeth remaining was unambiguously related to a subject's regular tooth-brushing habits, although the presence of individual teeth with regard to similar brushing habits was not equal (Tables 4–6). The survival of a particular tooth also seemed to depend on other factors, demonstrating a different mortality of each type of tooth in spite of a subject's similar tooth-brushing habit.

Even though a subject's number of teeth is age-dependent, the effect of age depends on many factors; some are the disease-related, whereas others concern the prevention and treatment of disease. With time, many dental diseases, and also failures in their treatment, can result in tooth loss. While a disease may appear and progress at different rates in different teeth, some teeth may survive longer than others. The older the individual is, the longer his or her health habits and the treatment received have affected the dental condition.

The present results confirm earlier reports (16) of a relationship between the number of teeth and a subject's income (Table 7). Earlier reports have shown that oral self-care habits are closely related to treatment patterns (17), which correlate with income (16). The present results support this finding, and frequent tooth-brushers were more prevalent in higher income categories (Table 7). In each income category, however, the significance of frequent tooth-brushing for the maximum number of teeth remaining was quite obvious.

The present results do not provide evidence that regular tooth-brushing has prevented tooth loss, and yet they prove that subjects who brush their teeth regularly are more capable of retaining a greater number of their teeth than the sporadic brushers,

possibly because the regularity of tooth-brushing describes a subject's health behavior in general.

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