Incidence of Tooth Loss among Elderly Iowans

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Abstract: This study investigated the 18-month incidence of tooth loss in a random sample of 451 dentate noninstitutionalized Iowans aged 65 and older residing in two rural counties. They had a mean of 19.0 teeth at baseline and lost an average of 0.4 teeth during the subsequent 18 months. Twenty-one per cent of the population lost at least one tooth. Four people had all their teeth extracted. Of the teeth present at baseline, 1.9 per cent subsequently were extracted. The highest incidence of tooth loss occurred among mandibular molars (3.7 per cent), followed by maxillary premolars and canines (3.1 per cent each). The best predictors of tooth loss were previous coronal and root caries. (*Am J Public Health* 1988; 78:1330–1332.)

Introduction

The prevalence of total tooth loss is greater among older age groups.[1,2] For example, in the 1983 National Health Interview Survey (NHIS), the prevalence of edentulousness ranged from only 14 per cent among adults aged 45 to 55, to 34 per cent for ages 65 to 74, and to 45 per cent among adults aged 75 and older.[2] Data such as these often lead to the inference that the incidence of tooth loss is age-related. However, these data actually reflect cross-sectional comparisons of different birth cohorts.

Different birth cohorts undergo markedly different life experiences and dental health care patterns that could affect the loss of teeth.[3] When data from cross-sectional surveys from different decades were compared, it was found that edentulism rates in the United States had declined by 30 to 40 per cent in all adult age groups since the late 1950s.[2,4] Similarly, the mean number of teeth missing had declined from 9.4 in the early 1960s to 7.4 in the early 1970s.[5] Therefore, the traditional finding of higher edentulism rates in older age groups may be due to differing life experiences of a succession of birth cohorts reaching age 65, rather than due to aging per se.

Although the prevalence of edentulism and tooth loss in the United States population is fairly well defined, very little is known about the incidence of tooth loss. To date, no study has reported the incidence of tooth loss in a representative sample of adults. This report describes the 18-month incidence of tooth loss in a cohort of noninstitutionalized Iowans aged 65 and older.

Methods

The sampling frame for this study consisted of the noninstitutionalized population aged 65 and older and residing in two rural Iowa counties. The data were collected during baseline interviews, baseline dental survey examinations, and 18-month follow-up dental survey examinations of 520 dentate people randomly selected from this population. The sampling procedures and examination methods have been reported previously.[4,6] Sixty per cent of the elderly in these two counties were dentate.[4]

Of the original sample of 520 dentate people, 25 had died during the 18 months between baseline and follow-up examinations. Another 13 had moved from the area or were too ill to participate in the follow-up examination. Of the 482 people available for follow-up, 451 participated in the second examination.

Participants first were interviewed in their homes by trained interviewers and examined later in their homes by dentists trained in survey examination methods. Four examiners conducted the baseline dental examinations. For the follow-up examinations, two of the previous examiners were not available. One new examiner was added and standardized with the two remaining examiners. During inter-examiner reliability assessment prior to the baseline and follow-up examinations, and midway through each examination period, the examiners never disagreed on the presence or absence of a particular tooth.

A variety of risk factors that were hypothesized to be related to the loss of teeth in this cohort of older adults first were analyzed using bivariate rank-order correlations. Logistic regression models then were used to investigate the joint effects of those risk factors having bivariate correlations with tooth loss less than .05 to identify the strongest predictors of tooth loss. For the logit models, the dependent variable, tooth loss, was coded "0" for people losing no teeth and "1" for people losing one or more teeth. A weighted least squares regression model then was constructed to calculate the estimated risk for tooth loss that was associated with varying levels of the strongest risk factors for tooth loss.

TABLE 1—Eighteen-month Incidence of Tooth Loss in Noninstitutionalized Adults Aged 65 and Older and Residing in Two Iowa Counties

Number of Teeth Lost	Per Cent of Population	Cumulative Percentage
0	79.2	100.0
1	14.0	20.8
2	4.2 (2)	6.8
3	1.1	2.6
4	0.1 (1)	1.5
5	0.0	1.4
6	0.1 (1)	1.4
7	0.5	1.3
8	0.3	0.8
9	0.3	0.5
10	0.2	0.2

N = 451
Number in parentheses is number in group who lost all their remaining teeth.

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TABLE 2—Mean Number of Teeth Present at Baseline, Mean Number of Teeth Lost in 18 Months, and Proportion of People Age 65 and Older Losing at least One Tooth, by Age Group and Sex

		Males (N = 176)				Females (N = 275)			
			Teeth Lost				Teeth Lost		
Age Group	N	Mean Teeth Present	Mean	(SD)	% losing at least one tooth	Mean Teeth Present	Mean	(SD)	% losing at least one tooth
65–69	142	20.3	0.4	(0.6)	28%	20.2	0.3	(1.1)	13%
70–74	130	20.9	0.5	(1.4)	26%	18.8	0.4	(1.0)	21%
75–79	97	18.2	0.3	(0.7)	17%	19.1	0.3	(1.0)	14%
80+	82	15.7	0.4	(1.2)	21%	16.9	0.5	(1.4)	24%
Total	451	19.3	0.4	(7.4)	24%	18.9	0.4	(7.6)	19%

SD = standard deviation

Results

As shown in Table 1, the distribution of tooth loss among those examined was highly skewed. Seventy-nine per cent of the subjects did not lose a tooth during the 18 months between baseline and follow-up examinations. Only 6.8 per cent of the population lost more than one tooth, accounting for 62 per cent of the teeth lost. Four people (1 per cent of the population) who became completely edentulous accounted for the loss of a total of 14 teeth (8 per cent of the teeth lost).

Table 2 shows the distribution of tooth loss by age group and by sex. The subjects examined had an overall average of 19.0 teeth per person at baseline and subsequently lost an average of 0.4 teeth per person. Twenty-four per cent of the males and 19 per cent of the females lost at least one tooth during the 18 months between examinations. The prevalence of teeth present was negatively associated with age, but there was no age-associated trends in the incidence of tooth loss. There were no differences between male and females in the number of teeth present or the number of teeth lost. There were no consistent age- or sex-associated trends in the proportion losing some teeth, although males overall were slightly more likely to have lost at least one tooth than were females, except among people aged 80 and older.

Table 3 shows the breakdown, by tooth type, of the distribution of teeth present at baseline, the number of teeth lost, and the proportion of each tooth type that was lost. Of the teeth present at baseline, 1.9 per cent subsequently were extracted. The proportion of teeth lost in any particular tooth type was greatest for mandibular molars (3.7 per cent), followed by maxillary premolars and canines (3.1 per cent each). The smallest proportion of teeth lost occurred among mandibular canines and incisors, 0.9 per cent and 1.0 per cent, respectively.

A number of risk factors were hypothesized to be related to the loss of teeth in this cohort of older adults. The rank-order correlations between these baseline factors and the number of teeth lost are shown in Table 4. Risk factors with the highest correlations were: the number of years of education, the number of negative life events of a social nature in the past year, the number of teeth with 6 mm or deeper periodontal pockets, the number of teeth with excessive mobility, the number of carious coronal tooth surfaces, the number of carious root surfaces, and the number of decayed and filled root surfaces.

Logistic regression procedures showed that the best baseline predictors of the subsequent loss of at least one tooth were the number of decayed coronal tooth surfaces and the number of decayed and filled root surfaces. Table 5 shows the expected relative risk of losing at least one tooth for people with different combinations of coronal and root caries. People with no unrestored coronal caries and no previous root caries had the lowest risk of losing a tooth and were used as the reference group. The relative risk of losing a tooth increased consistently with increasing numbers of tooth surfaces with either coronal caries or root caries. The two caries risk factors combined to result in a relative risk of tooth loss of 5.6 for people who had five or more surfaces of untreated coronal caries and four or more decayed or filled root surfaces.

Discussion

The incidence of tooth loss among the noninstitutional-

TABLE 3—Teeth Present at Baseline, Teeth Lost in 18 Months, and Proportion of the Tooth Type Lost, by Tooth Type

	Teeth Present at Baseline		Teeth Lost in 18 Months		
Tooth Type	Total	Mean (SD)	Total	Mean (SD)	% of Tooth Type Lost
Maxillary Molar	989	2.2 (1.6)	23	0.05 (0.26)	2.0
Premolar	963	2.1 (1.6)	30	0.07 (0.32)	3.1
Canine	655	1.5 (0.9)	10	0.02 (0.17)	3.1
Incisor	1217	2.7 (1.7)	26	0.06 (0.38)	2.1
Mandibular Molar	928	2.1 (1.7)	34	0.08 (0.29)	3.7
Premolar	1343	3.0 (1.3)	21	0.05 (0.22)	1.6
Canine	864	1.9 (0.3)	8	0.02 (0.17)	0.9
Incisor	1636	3.6 (1.0)	16	0.04 (0.25)	1.0
Total	8596	19.0 (7.5)	167	0.37 (1.08)	1.9

N = 451
SD = standard deviation

TABLE 4—Spearman's Correlations between Number of Teeth Extracted and Potential Risk Factors among Older Adults

Risk Factor	Correlation	p-value
Age	−.01	.441
Sex (males = 1, females = 0)	.05	.144
Education, in years	.09	.035*
Residence, nonfluoridated community	.03	.285
Lived alone (yes = 1)	.05	.141
Diabetes (yes = 1)	.02	.318
Hypertension (yes = 1)	.02	.379
Number of xerostomic drugs	−.05	.266
Salivary flow (light = 1, normal = 2)	−.04	.191
Negative life events, social	.09	.043*
Negative life events, physical	.05	.183
Number of teeth remaining	.00	.476
Teeth with gingival bleeding	.05	.182
Teeth with calculus	.05	.183
Teeth with 3+mm pockets	.05	.378
Teeth with 6+ mm pockets	.20	.001*
Teeth with mobility	.14	.003*
Coronal surfaces with caries (DS)	.16	.001*
Root surfaces with caries (DS-R)	.27	.001*
Root surfaces, decayed or filled	.20	.001*
Root surfaces, gingival recession	.02	.327

N = 451
Dependent variable = number of teeth extracted.
*Selected for inclusion in multivariate model.

ized older adults examined in this study was not related to age or sex, even though older people had fewer teeth at baseline. The participants lost an average of 0.4 teeth per person overall, but the distribution of tooth loss was highly skewed. The four people (1 per cent of the population) who became completely edentulous accounted for the loss of a total of only 14 teeth (8 per cent of the teeth lost). Less than 7 per cent of the population accounted for 62 per cent of the teeth lost. So in this cohort of older adults, the risk of tooth loss was not widely distributed. The data indicate that tooth loss was a problem limited to a relatively small proportion of the population who are at higher risk.

Tooth loss also was distributed unevenly across various tooth types. On an empirical basis, it would be expected that maxillary teeth would be lost earlier than mandibular teeth, and posterior teeth would be lost before anterior teeth. The distribution of teeth remaining at baseline in this cohort of older adults followed the expected pattern. However, the incidence of tooth loss was highest among mandibular molars (3.7 per cent) and was fairly low among maxillary molars (2.0 per cent), even though the participants had equal numbers of maxillary and mandibular molars present at baseline. The reason for this unexpected pattern among molars is unclear, but may be due to the study's being limited to 18 months duration. Over a longer period of time, the expected pattern may emerge. The distribution of tooth loss among other tooth types did follow the expected pattern, with the lowest incidence of tooth loss occurring among mandibular anterior teeth (about 1 per cent).

The loss of teeth was not related to the number of teeth present at baseline. The strongest predictors of tooth loss were the amount of coronal caries and root caries. Until recently, on the basis of empirical evidence, most dentists agreed that the primary cause of tooth loss after age 35 was

TABLE 5—Expected Relative Risk Ratios for Having at least One Tooth Extracted from Weighted Least Squares Model Including Decayed Coronal Tooth Surfaces and Decayed and Filled Root Surfaces

Decayed Coronal Surfaces (DS)	Decayed and Filled Root Surfaces (DFS-R)		
	None	1–3	4 or more
None	1.0	1.7 (1.0, 2.8)	2.2 (1.3, 3.7)
1	1.4 (0.8, 2.4)	2.4 (1.1, 5.1)	3.1 (1.4, 6.8)
2–4	1.9 (1.2, 3.0)	3.2 (1.8, 6.0)	4.2 (2.3, 7.8)
5 or more	2.5 (1.6, 4.0)	4.3 (2.3, 8.0)	5.6 (2.9, 10.7)

N = 451
Q_W = 7.12; df = 6; p = .35
Numbers in parentheses are 95% confidence intervals for risk ratios.

periodontal disease.[7] However, in this study, advanced periodontal conditions were much weaker predictors of tooth loss than were coronal or root caries. These findings provide indirect evidence that appears to corroborate several recent studies reporting more teeth are lost to caries than to periodontal disease.[8–11]

Findings from this study of older dentate adults indicate that the majority of tooth loss occurs primarily in a relatively few people. However, 18 months may be too short a period to investigate fully the true distribution of tooth loss in older adults. Longer observation of this cohort will show whether the pattern and distribution of tooth loss observed over 18 months will persist. Similar studies are needed to determine whether similar patterns of tooth loss occur in other populations.

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