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Original Article

Cohort Study on Incidence of Coronal and Root Caries in Japanese Adults

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Abstract

The purpose of this study was to investigate the incidence of coronal and root caries in participants aged 20–59 years in Japan. The participants comprised 118 men and 23 women undergoing a re-examination 5 years after an initial examination. Lesions were classified as gingival recession, decayed root caries, or filled surfaces. The rates of incidence of coronal caries over the 5 years were 87% in women aged 20–29 years, 77% in men aged 20–29 years, 62% in men aged 30–39 years, 64% in men aged 40–49 years, and 60% in men aged 50–59 years. The rates for those observed to be at risk for the incidence of root caries were 25% for women aged 20–29 years, 16% for men aged 20–29 years, 11% for men aged 30–39 years, 43% for men aged 40–49 years, and 35% for men aged 50–59 years. The distribution for the number of new coronal and root caries lesions was 68.8% and 24.1%, respectively. Univariate logistic regression analyses for new coronal caries revealed that the risk factors were age group at baseline (OR = 0.702, $p = 0.0440$), number of coronal decayed and filled surfaces at baseline (OR = 2.893, $p = 0.0107$), and number of sound teeth at baseline (OR = 3.381, $p = 0.0013$). Moreover, univariate logistic regression analyses for new root caries revealed that the risk factors were age group at baseline (OR = 1.787, $p = 0.0039$), presence or absence of gingival recession at baseline (OR = 3.288, $p = 0.0062$), and presence or absence of root decayed and filled surfaces at baseline (OR = 11.00, $p < 0.0001$). It was concluded from these results that the target of caries prevention in adults should not only be focused on root surfaces, especially in those aged 40 years or over, but also on the coronal surfaces of the dentition in those in their twenties.

Key words: Coronal caries — Root caries — Cohort study — Japanese adults — Risk factors

Introduction

Dental caries has been extensively discussed

in recent years^{3,8)} as an aging population has meant that teeth are being retained later into adulthood than before. A number of epide-

miological studies have investigated dental caries in Japan, and especially root caries in older adults^{5,9,11,13,14}. However, few studies have investigated the incidence of coronal or root caries in adults less than 60 years old, indicating the urgent need to obtain reliable longitudinal data on these phenomena in order to predict the future development of dental caries in the Japanese population. We previously reported the prevalence of root caries in a Japanese adult population aged 20–59 years^{4,10}. Prevalence usually refers to a situation at a specified point in time, and is considered an important indicator in discussing health issues in any given population. However, determining prevalence alone is not necessarily sufficient to determine temporal sequences of cause and effect.

The purpose of the present study was to investigate the incidence of coronal and root caries in an adult population in Japan together with its associated risk factors.

Participants and Methods

1. Participant characteristics and methods

The participants in the present study comprised workers at a chemical company in Tokyo, all of whom were either business or engineering staff. A routine dental examination is mandatory once a year at the company. A total of 141 employees were enrolled in the study, consisting of 118 men aged 20–59 years and 23 women aged 20–29 years undergoing an initial examination followed by a re-examination 5 years later between 1991 and 1999.

All clinical examinations were carried out by 3 specially trained dentists using a dental explorer and a mouth mirror. The third molars were not included in any of the calculations. The present study was approved by the Ethics Committee of Tokyo Dental College (Approval No.66).

2. Diagnostic criteria for coronal caries, gingival recession, and root caries

Dental examinations for coronal caries were conducted primarily based on the WHO

method¹². Gingival recession was considered present if any root surface was clearly visible. The prevalence of root caries was assessed by focusing on decayed-root and filled-root lesions. Decayed lesions (soft lesions) were defined as those that were located at the cemento-enamel junction or only on the root surface. Lesions comprised well-defined, softened, and discolored areas into which it was easy to insert an explorer but which provided some resistance on the explorer being withdrawn. Recurrent softened lesions were recorded as decayed lesions. Restoration strictly confined to the root surface was recorded as a filled lesion. If there was any doubt as to the precise area which had been treated for caries, it was recorded as a filled-root surface if more than half the filling material was located on the root surface.

3. Data analysis

Univariate logistic regression analyses were used to determine which risk factors were significantly associated with new coronal or root caries. The statistical analyses were carried out using SAS Version 9.2 for Windows (SAS Institute, Cary, NC, USA).

Results

A summary of the results of the baseline examination is presented in Table 1. At baseline, women aged 20–29 years had an average of 27.3 remaining teeth, while men showed 27.8 between 20 and 29 years, 27.5 between 30 and 39 years, 27.1 between 40 and 49 years, and 27.0 between 50 and 59 years. The average prevalence of coronal and root caries at baseline was 15.7 in women aged 20–29 years, while that in men was 19.2 between 20 and 29 years, 22.2 between 30 and 39 years, 25.7 between 40 and 49 years, and 18.2 between 50 and 59 years for decayed and filled coronal surfaces, which corresponded to 0, 0.05, 0.08, 0.8, and 1.7, respectively, for decayed and filled root surfaces. These participants showed far fewer existing untreated coronal and root decayed surfaces than coro-

Table 1 Coronal and root caries at baseline

Age group (years)	Sex	N	Remaining teeth Mean (SD)	Coronal caries			Gingival recession ^d	Root caries			
				DS ^a Mean (SD)	FS ^b Mean (SD)	DFS ^c Mean (SD)		Participants ^e %	DS Mean (SD)	FS Mean (SD)	DFS Mean (SD)
20–29	Women	23	27.3 (1.5)	0.2 (0.6)	15.5 (13.5)	15.7 (13.5)	0.4 (1.3)	0	0	0	0
20–29	Men	22	27.8 (0.6)	1.1 (2.2)	18.1 (11.5)	19.2 (11.3)	0.5 (1.0)	4.5	0	0.05 (0.2)	0.05 (0.2)
30–39	Men	26	27.5 (0.8)	0.3 (0.7)	21.9 (14.6)	22.2 (14.5)	0.4 (1.3)	7.7	0.04 (0.2)	0.04 (0.2)	0.08 (0.3)
40–49	Men	50	27.1 (1.2)	0.7 (2.9)	25.1 (17.0)	25.7 (17.5)	4.8 (5.4)	24.0	0	0.8 (1.9)	0.8 (1.9)
50–59	Men	20	27.0 (1.9)	0.3 (0.6)	18.0 (12.4)	18.2 (12.3)	10.3 (8.7)	45.0	0	1.7 (2.6)	1.7 (2.6)

^aDecayed surfaces, ^bFilled surfaces, ^cDecayed and filled surfaces, ^dSurfaces of gingival recession, ^ePercentage of participants with decayed and filled root surfaces

Table 2 Incidence and mean DFS increment for coronal and root caries over 5-year follow-up

Age group (years)	Sex	New coronal DFS		New root DFS		
		Participants (%) ^a	Mean DFS ^b	Participants (%) ^c	Participants at risk (%) ^d	Mean DFS ^e
20–29	Women	87.0	5.2	13.0	25.0	0.1
20–29	Men	77.3	5.8	13.6	15.8	0.4
30–39	Men	61.5	3.7	7.7	10.5	0.1
40–49	Men	64.0	2.6	38.0	43.2	0.9
50–59	Men	60.0	3.8	35.0	35.0	1.3

^aPercentage of participants with new coronal decayed and filled surfaces after 5 years, ^bMean number of new coronal decayed and filled surfaces after 5 years, ^cPercentage of participants with new root decayed and filled surfaces after 5 years, ^dPercentage of participants with gingival recession with new root decayed and filled surfaces after 5 years, ^eMean number of new root decayed and filled surfaces after 5 years

nal and root filled surfaces, yielding a mean of 0.4 for women aged 20–29 years, while men showed 0.5 for 20–29 years, 0.4 for 30–39 years, 4.8 for 40–49 years, and 10.3 for 50–59 years for root surfaces with gingival recession, which are surfaces considered to be at risk of root caries. Men aged 40–49 years and 50–59 years had markedly higher risk than the other age groups.

The data in Table 2 summarize the incidence and mean of decayed and filled surface increment for coronal and root caries over the 5-year follow-up. The rate of incidence of coronal caries during this 5-year period was 87.0% in women aged 20–29 years, 77.3% in men aged 20–29 years, 61.5% in men aged 30–39 years, 64.0% in men aged 40–49 years, and 60.0% in men aged 50–59 years. The rates for participants at risk (with gingival recession)

for the incidence of root caries were 25.0% for women aged 20–29 years, 15.8% for men aged 20–29 years, 10.5% for men aged 30–39 years, 43.2% for men aged 40–49 years, and 35.0% for men aged 50–59 years over the 5-year period of the study. The incidence and increment of coronal caries were higher for both sexes among those aged 20–29 years, while these values were markedly higher for root caries among men aged 40–49 and 50–59 years.

Table 3 shows the distribution of new coronal and root caries lesions per participant over the 5-year period. The occurrence of new coronal caries was 68.8%, with 28.4% of the participants having 5 or more teeth with new coronal decayed and filled lesions. However, the occurrence of new root caries was 24.1%, with 4.3% of the participants having

Table 3 Distribution of new coronal and root caries lesions over 5 years

No. of new DFS ^a	Coronal caries % (N)	Root caries % (N)
0	31.2 (44)	75.9 (107)
1	13.5 (19)	11.3 (16)
2	11.3 (16)	5.7 (8)
3	7.1 (10)	2.1 (3)
4	8.5 (12)	0.7 (1)
5 or more	28.4 (40)	4.3 (6)
One or more	68.8 (97)	24.1 (34)

N = 141, ^aDFS: Decayed and filled surfaces

Table 4 Univariate logistic regression analysis for new coronal caries over 5 years

Explanatory variables	Odds ratios	95% CI ^a	p-values
Age group ^b	0.702	0.494–0.986	0.0440
Coronal DFS ^c	2.893	1.279–6.595	0.0107
Sound teeth ^d	3.381	1.627–7.215	0.0013
Missing teeth ^e	0.952	0.451–2.052	0.8977

Objective variable was presence or absence of new coronal caries over 5 years

^aConfidence interval, ^bAge groups (20–29, 30–39, 40–49, and 50–59 years) at baseline,

^cNumber of coronal decayed and filled surfaces (<10, ≥10) at baseline, ^dNumber of sound teeth (≥20, <20) at baseline, ^eNumber of missing teeth (0, >0) at baseline

Table 5 Univariate logistic regression analysis for new root caries over 5 years

Explanatory variables	Odds ratios	95% CI ^a	p-values
Age group ^b	1.787	1.220– 2.700	0.0039
Gingival recession ^c	3.288	1.445– 8.064	0.0062
Root DFS ^d	11.00	4.223–30.900	p<0.0001
Coronal DFS ^e	5.38	1.027–99.132	0.1099

Objective variable was presence or absence of new root caries over 5 years

^aConfidence interval, ^bAge groups (20–29, 30–39, 40–49, and 50–59 years) at baseline,

^cAmount of gingival recession (0, >0) at baseline, ^dNumber of root decayed and filled surfaces (0, >0) at baseline, ^eNumber of coronal decayed and filled surfaces (<5, ≥5) at baseline

5 or more teeth with new root decayed and filled lesions.

The results of a univariate logistic regression analyses to predict which factors were associated with new coronal and root caries over the 5-year period are shown in Tables 4 and 5. The predictive factors for the inci-

dence of coronal caries were age group at baseline (OR = 0.702, $p = 0.0440$), number of coronal decayed and filled surfaces at baseline (OR = 2.893, $p = 0.0107$), and number of sound teeth at baseline (OR = 3.381, $p = 0.0013$). Further, predictive factors for incidence of root caries were age group at

baseline (OR=1.787, $p=0.0039$), presence or absence of gingival recession at baseline (OR=3.288, $p=0.0062$), and presence or absence of root decayed and filled surfaces at baseline (OR=11.00, $p<0.0001$).

Discussion

Not only in Japan, but worldwide, few cohort studies have been conducted on adults aged less than 60 years due to difficulties in maintaining follow-up in this particular population in comparison to in the elderly. In the present study, annual dental examinations were performed on approximately 400 patients at a single business facility of a company. If any participant subsequently retired from the company or was transferred, making the scheduled follow-up examination impossible, their data were excluded from the analysis. Men greatly outnumbered women at the company, especially in the older age groups. Only participants undergoing a second dental examination 5 years after the first between 1991 and 1999 were included in the study, and all women were excluded except those in the youngest age group.

The mean number of remaining teeth, excluding the third molars, in a Japanese national survey²⁾ was 27.3 in women aged 20–29 years, 27.4 in men aged 20–29 years, 26.3 in men aged 30–39 years, 25.1 in men aged 40–49 years, and 22.2 in men aged 50–59 years. Oral health status in the present study was better than that reported in these earlier national data. In another earlier study, our group reported that the prevalence of root caries in 770 company employees was 0.9% in women aged 20–29 years, 1.8% in men aged 20–29 years, 15.8% in men aged 30–39 years, 19.2% in men aged 40–49 years, and 34.3 % in men aged 50–59 years⁴⁾. The prevalence of root caries in the present study was similar to that in these earlier data.

Few researchers have reported the incidence of coronal and root caries in adults aged less than 60 years old throughout the world. Ripa *et al.*⁶⁾ compared the incidence

of coronal and root caries in patients aged 18 to 65 years over a 3-year period between an NaF mouth-rinse group and a placebo (non-mouth-rinse) group. The results revealed that the mean number of coronal decayed, missing, or filled tooth surfaces (DMFS) was 2.43, and that the mean number of root DFS was 0.43 in the placebo group. A systematic review⁷⁾ by Ritter *et al.* reported that the incidence of root caries could be predicted by risk models, and that the most frequently described predictors of the incidence of root caries in published studies on risk models were the prevalence of root caries, the number of teeth, and the plaque index. Another report¹⁾, on the other hand, noted that the factors related to root caries differed more for middle-aged adults (aged 45–64 years) than for older adults (>65 years).

The incidence of coronal caries decreased with aging in this study, whereas the incidence of root caries significantly increased. The rate of incidence of coronal caries in both sexes aged 20–29 years, especially, and the rate of incidence of root caries in men aged 40–49 years or 50–59 years was markedly higher than that in the other age groups (Table 2). Also, in the high risk group that had 5 or more surfaces with new coronal and root caries over the 5-year period, coronal caries was observed in 28.4% and root caries in 4.3% (Table 3). In the present cross-sectional study the predictive factors for root caries in the elderly were gingival recession, bleeding on probing, and self-reported dry mouth. The results of the univariate logistic regression analyses revealed age, caries experience, and number of sound teeth as predictive factors for coronal caries, while those for root caries (Tables 4 and 5) were age, the amount of gingival recession, and root caries experience.

Conclusion

It was concluded from these results that the target of dental caries prevention in adults should be root surfaces in those aged 40 years or over, and that caries prevention should

be considered in coronal surfaces, especially in those in their twenties. Moreover, the predictive factors for coronal caries were coronal caries experience and number of sound teeth, while those for root caries were the presence or absence of gingival recession and root caries experience in adults.

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