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Tooth-related risk factors for periodontal disease in community-dwelling elderly people

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Abstract

Objective: While most previous epidemiological studies have focused on subject-level risk factors for periodontal destruction, tooth-related factors have not been fully explored. The purpose of this study was to evaluate both tooth-related and subject-related factors affecting periodontal disease progression using a two-level multilevel model.

Material and Methods: A longitudinal survey over a period of 10 years was carried out on 286 community-dwelling elderly subjects aged 70 years at baseline. Clinical attachment level (CAL) was measured at six sites per tooth on all teeth present and periodontal disease progression was defined as CAL $\geqslant$ 3 mm.

Results: Periodontal disease progression was found in 79% of the subjects and most frequently in maxillary molars. Multilevel logistic regressions revealed that subjects wearing removable dentures were significantly at risk for periodontal disease progression. Abutment teeth for removable/fixed dentures were also significantly more likely to suffer periodontal breakdown. Furthermore, the following tooth-related variables were found to be possible risk factors for periodontal disease progression: maxillary and multirooted teeth.

Conclusion: Multirooted teeth and abutments for a fixed denture were possible risk factors for periodontal disease progression.

Key words: elderly people; epidemiology; multilevel modelling; periodontal disease progression; tooth-related factors

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Introduction

Until recently, there have been very few longitudinal studies presenting the incidence rates of periodontal disease in the elderly. The Piedmont 65+ Dental Study, the South Australian Dental Longitudinal Study and the Iowa 65+ Oral Health Study involved elderly populations over the age of 60 with study periods of 5 years or longer. In these three studies, comparable figures for periodontal disease incidence of 54%, 59% and 63% were found, respectively (Beck et al. 1997, Thomson et al. 2004, Qian et al. 2007). However, these studies have followed relatively small numbers of subjects. An epidemiological survey with a longer study period and a larger sample size is warranted.

The progression of periodontitis has been shown to be influenced by several factors including cigarette smoking (Grossi et al. 1994, Haffajee & Socransky 2001), diabetes mellitus (Sandberg et al. 2000, Soskolne & Klinger 2001) and irregular attendance at a dentist (Elter et al. 1999). These studies focused on subject-level factors, but other local factors, namely, tooth-related factors, have not been fully explored concurrently with subject-level factors in epidemiological studies. Epidemiologists have tended not to report results at the tooth level because of concerns about the non-independence of tooth-specific observations within an individual. An analytical strategy commonly used is to average tooth-level measurements into subject-level mean values. Although this strategy helps meet the statistical requirements, aggregation of information from a lower level to higher levels results in loss of information and overlooks the tooth-specific nature of periodontal disease (Gilthorpe et al. 2000a, b, 2001).

Conflict of interest and source of funding statement

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A multilevel statistical model allows and adjusts for the correlation of tooth characteristics in the same subject and has been adopted in several clinical studies (D'Aiuto et al. 2005, Matuliene et al. 2008, Pretzl et al. 2008, Wan et al. 2009). A recent clinical study using multilevel analysis demonstrated that smoking habits, location of pockets in molars and presence of supragingival plaque at the tooth site were significant factors contributing to an inferior outcome of non-surgical periodontal treatment (Tomasi et al. 2007). Furthermore, the aggregated variable of plaque score on the subject level was not a significant factor, but the presence of plaque at the tooth site was identified as significant. Hence, multilevel modelling is valuable for exploring risk factors operating at different levels, because the susceptibility to periodontal disease is expected to vary markedly both between subjects in a study sample and between individual teeth within a subject.

However, as far as we know, there have been no epidemiological surveys applying multilevel modelling and exploring intra-oral factors for periodontal disease progression among elderly people. Thus, the purpose of this longitudinal study was to evaluate tooth-related factors as well as subject-related factors using a multilevel model in a Japanese elderly population over 10 years.

Material and Methods

Study population

The subject included in this longitudinal study, with three examinations at 5-year intervals from baseline to 10 years later, was generated from an epidemiological survey performed in 1998 on elderly people living in Niigata City, Japan (Hirotomi et al. 2002). In 1998, the subjects were recruited among residents of the city born in 1927. A written invitation in which the aim of the study was briefly described was sent to all subjects of the population sample ($n = 4542$). To non-respondents, the invitation was sent again and 81.4% ($n = 3695$) replied positively. Among them, 600 subjects were randomly selected with approximately the same number of each gender. A total of 599 subjects aged 70 years participated in the baseline study. Oral examinations and the completion of a questionnaire were carried out in several community centres. All subjects were in good general health and did not require special care for their daily activities. The study was reviewed and approved by the Ethics Committee of the Faculty of Dentistry, Niigata University. All subjects gave written informed consent regarding their participation in the examinations.

The baseline examination revealed that 45 individuals were edentulous, which resulted in a total sample of 554 dentate subjects to be involved in the planned longitudinal study (Fig. 1). At the 5-year follow-up, 378 of the subjects (68.2%) were available for re-examination. For the evaluation of periodontal disease progression, the subject sample available for analysis was further reduced because 11 of the re-examined 378 subjects had become edentulous. At the 10-year follow-up, 291 of the subjects (52.5%) were available and three subjects had become edentulous. Two further subjects had to be excluded from analysis due to incomplete data. Hence, the final subject sample comprised 286 individuals examined on all three occasions. This corresponded to 51.6% of the 554 originally examined dentate subjects at baseline.

Overall, there were 5574 teeth present at baseline, comprising a mean of 19.5 ± 7.2 teeth per subject. During the first 5-year and the entire 10-year study periods, a total of 374 and 791 teeth were lost and the total numbers of teeth examined at follow-ups were 5200 and 4783, respectively. Among them, longitudinal periodontal data were obtained from 5112 (98.3%) and 4739 (99.1%) teeth over 5 and 10 years, respectively. The remaining 88 and 44 teeth, respectively, were excluded from analysis owing to not being available for periodontal measurement at baseline (37 and 28 teeth) and longitudinal data discrepancies (51 and 16 teeth).

Examination

Periodontal measurements including clinical attachment level (CAL) and probing pocket depth (PPD) were made by four trained dentists. Mouth mirrors incorporating light and pressure-sensitive plastic periodontal probes, set to yield a constant probing force of 20 *g* and graduated at 1 mm intervals (Vivacare TPS Probe, Vivadent, Schaan, Lichtenstein), were used. All functioning teeth, with the exception of third molars, were assessed and root remnants were considered as missing teeth. CAL and PPD were measured at six sites per tooth and rounded to the nearest whole millimetre. Attachment loss was calculated by subtracting baseline CAL from follow-up CAL on a site-by-site basis. In order to distinguish between genuine change and measurement error, periodontal disease progression was defined as a CAL $\geqslant$ 3 mm at each assessed site in common with other epidemiological studies (Haffajee et al. 1991, Baelum et al. 1993, Brown et al. 1994, Hirotomi et al. 2002). Before and during the survey, calibrations were conducted at an institution for the elderly and the Faculty Hospital of Dentistry, Niigata University. Inter-examiner agreements ranged from 86.6% to 95.9% and from

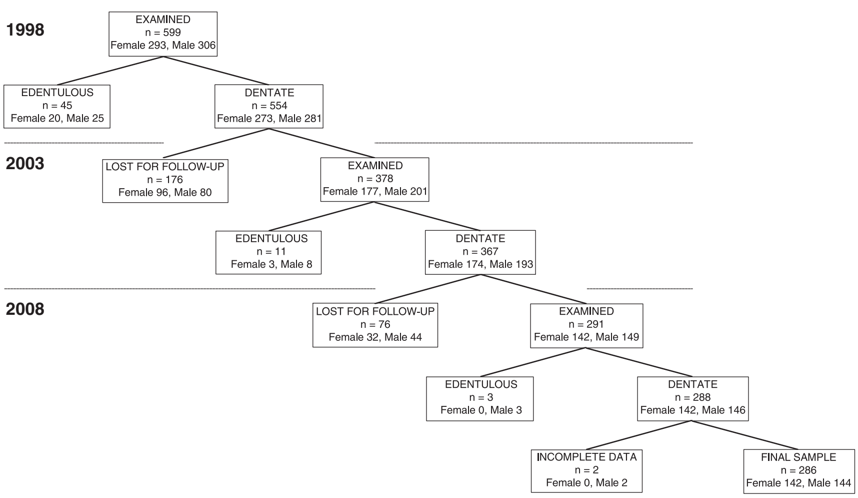

Fig. 1. Longitudinal description of the subjects. The final subject sample comprised 286 subjects.

65.8% to 94.4% for PPD and CAL, respectively. κ values ranged from 0.79 to 0.93 and from 0.56 to 0.92 for PPD and CAL, respectively.

Each remaining tooth was assessed in terms of whether it was restored with an artificial single crown and/or used as an abutment for a removable partial denture (RPD) or a fixed partial denture (FPD). Seven subjects wore telescopic crown-retained RPDs, including 20 teeth fitted with a telescope crown, which were treated as in a conventional clasp-retained RPD.

Information on smoking status at baseline and follow-ups was gathered by questionnaire. Subjects were asked about their use of cigarettes and categorized as current, former or non-smokers. Only subjects who had continued with the habit during the study period were categorized as current smokers. The questionnaire was also used to obtain baseline information about oral hygiene habits, namely, use of devices for inter-dental cleaning (yes/no) and the status of visits to a dentist (regularly/episodically).

Statistics

A tooth with periodontal disease progression in at least one site was the main outcome variable. A multilevel logistic regression model considering subject and tooth levels was applied to explain the variation in the binomial dependent variable. In this analysis, the basic level ''tooth'' was nested into the upper level ''subject''. The following independent subject-related variables were considered in the model: gender, smoking status (current/former/non-smokers), number of teeth present at baseline (1–9/10–19/20–28) and wearing an RPD (yes/no); tooth-related variables were as follows: jaw (maxilla/mandible), tooth type (single rooted/multi-rooted), teeth restored with a single crown (yes/no), abutment teeth for an RPD (yes/no) and abutment teeth for an FPD (yes/no). The chosen level of statistical significance was 5%. Data analysis was performed using STATA software (Stata 10 for Windows, Stata Corporation, College Station, TX, USA). For multilevel mixed-effects logistic regressions, the ''xtmelogit'' procedure in STATA, which uses maximum-likelihood estimation, was used. Mixed-effects logistic regression is logistic regression containing both fixed effects and random effects. Random effects are useful for modelling intra-subject correlation; that is, teeth in the same subject are correlated because they share common subject-level random effects. The logistic regression reports odds ratios (ORs) and an OR >1 indicates that periodontal disease progression is more likely to occur in the group.

Results

In comparison with the subjects remaining at 10 years, non-respondents did not differ with respect to gender or periodontal disease parameters at baseline (Table 1). However, non-respondents included significantly more current smokers ($p<0.05$) and had significantly fewer teeth present ($p<0.01$).

Among the 5574 teeth at baseline, 3.4% and 13.8% had deep PPD and severe CAL, respectively (Table 2). In both parameters, worst condition was found in maxillary molars.

Periodontal disease progression was found in 76.2% and 79.0% of the subjects and means of 3.5 ± 4.3 and 3.0 ± 3.3 teeth during the first 5-year and the entire 10-year periods, respectively. Table 3 shows the mean number of teeth with periodontal disease progression by subject characteristics. During both the study periods, males had significantly more teeth with periodontal disease progression than females ($p<0.01$). Subjects with one to nine teeth at baseline had a significantly lower number of teeth with disease progression ($p<0.001$, ANOVA). Non-smokers

Table 1. Baseline characteristics of dentate subjects who were examined on all three occasions compared with those who were lost to follow-up [number of subjects (%) or mean (standard deviation)]

Subject characteristics at baseline	Lost to follow-up ($n=263$)	Examined ($n=291$)
Female	132 (50.2)	149 (51.2)
Current smoker †,*	59 (22.7)	45 (15.5)
Mean number of teeth present**	17.4 (8.2)	19.3 (7.3)
Mean number of teeth with PPD ⩾ 4 mm	4.7 (5.1)	4.9 (4.8)
Mean number of teeth with PPD ⩾ 6 mm	0.8 (1.8)	0.7 (1.4)
Mean number of teeth with CAL ⩾ 4 mm	9.4 (6.6)	10.1 (6.4)
Mean number of teeth with CAL ⩾ 6 mm	2.5 (3.4)	2.7 (3.4)

†Baseline data missing for three subjects who had been lost to follow-up.
*$p<0.05$, χ^2-test.
**$p<0.01$, Student's t-test.
CAL, clinical attachment level; PPD, probing pocket depth.

Table 2. Tooth-level analysis for periodontal health status at baseline by tooth type [number of teeth (%)]

Tooth type	Number of teeth	4–5 mm	⩾6 mm	Not examined
Deepest PPD/tooth at baseline				
Maxillary incisor	815	161 (19.8)	21 (2.6)	7 (0.9)
Maxillary canine	444	96 (21.6)	18 (4.1)	0 (0.0)
Maxillary pre-molar	790	183 (23.2)	42 (5.3)	5 (0.6)
Maxillary molar	652	236 (36.2)	51 (7.8)	3 (0.5)
Mandibular incisor	925	114 (12.3)	14 (1.5)	7 (0.8)
Mandibular canine	530	71 (13.4)	7 (1.3)	3 (0.6)
Mandibular pre-molar	853	155 (18.2)	14 (1.6)	9 (1.1)
Mandibular molar	565	194 (34.3)	24 (4.2)	10 (1.8)
Total	5574	1210 (21.7)	191 (3.4)	44 (0.8)
Deepest CAL/tooth at baseline				
Maxillary incisor	815	254 (31.2)	82 (10.1)	7 (0.9)
Maxillary canine	444	161 (36.3)	68 (15.3)	0 (0.0)
Maxillary pre-molar	790	286 (36.2)	105 (13.3)	5 (0.6)
Maxillary molar	652	312 (47.9)	165 (25.3)	4 (0.6)
Mandibular incisor	925	346 (37.4)	112 (12.1)	7 (0.8)
Mandibular canine	530	177 (33.4)	67 (12.6)	3 (0.6)
Mandibular pre-molar	853	304 (35.6)	83 (9.7)	11 (1.3)
Mandibular molar	565	293 (51.9)	89 (15.8)	10 (1.8)
Total	5574	2133 (38.3)	771 (13.8)	47 (0.8)

PPD, probing pocket depth; CAL, clinical attachment level.

Table 3. Mean number of teeth per subject with periodontal disease progression over 5 and 10 years [mean (standard deviation)]

Subject characteristics at baseline	*n*	Teeth with disease progression	
		over 5 years	over 10 years
Gender			
Female	142	2.87 (3.72)**	2.39 (3.04)**
Male	144	4.21 (4.70)	3.65 (3.52)
Number of teeth present at baseline			
1–9	39	1.10 (1.50)§	1.10 (1.35)§
10–19	81	3.22 (2.88)	2.91 (2.59)
20–28	166	4.28 (5.02)	3.53 (3.81)
Smoking status			
Current*	32	3.72 (4.77)	3.50 (3.27)
Former	99	4.39 (4.90)	3.50 (3.61)
Non-smokers	155	2.97 (3.65)ø	2.62 (3.13)
Removable partial denture			
No denture	139	4.01 (4.77)	3.56 (3.85)**
Wearing partial denture	147	3.11 (3.73)	2.52 (2.70)
Devices for inter-dental cleaning†			
Not use	163	3.34 (4.20)	3.04 (3.44)
Use	113	3.81 (4.39)	3.01 (3.18)
Visits to dentist			
Episodically	219	3.59 (4.48)	3.02 (3.45)
Regularly	67	3.40 (3.61)	3.04 (3.00)

*Current smokers were defined as subjects who continued the habit during the study period. The distribution of subjects by smoking status at the 5-year follow-up is shown. At the 10-year follow-up, the number of current smokers decreased from 32 to 24 subjects.
†Data missing for 10 subjects.
**$p<0.01$, Student's t-test.
§$p<0.001$, *versus* subjects with 20–28 teeth, $p<0.05$, *versus* subjects with 10–19 teeth, Scheffe's post hoc test.
ø$p<0.05$, *versus* former smokers, Scheffe's post hoc test.

Table 4. Tooth-level analysis for periodontal disease progression by tooth type over 5 and 10 years [number of teeth with periodontal disease progression (%)]

Tooth type	Over 5 years		Over 10 years	
	number of teeth followed	periodontal disease progression (%)	number of teeth followed	periodontal disease progression (%)
Maxillary incisor	740	143 (19.3)	669	102 (15.2)
Maxillary canine	422	90 (21.3)	384	61 (15.9)
Maxillary pre-molar	712	172 (24.2)	662	138 (20.8)
Maxillary molar	580	163 (28.1)	529	146 (27.6)
Mandibular incisor	873	129 (14.8)	842	114 (13.5)
Mandibular canine	515	98 (19.0)	494	97 (19.6)
Mandibular pre-molar	776	102 (13.1)	719	114 (15.9)
Mandibular molar	494	117 (23.7)	440	93 (21.1)
Total	5112	1014 (19.8)	4739	865 (18.3)

experienced significantly less periodontal destruction over 5 years ($p<0.05$, ANOVA). Significantly lower disease progression was found in those who wore an RPD over 10 years ($p<0.01$). The use of devices for inter-dental cleaning or the status of visits to a dentist had no influence on the mean number of teeth with periodontal disease progression.

Among the teeth considered, 1014 (19.8%) and 865 (18.3%) exhibited disease progression over 5 and 10 years, respectively (Table 4). The highest rate of disease progression was found in maxillary molars during both periods. As shown in Table 5, a higher rate of disease progression was found in maxillary teeth, multirooted teeth, teeth restored with a single crown and abutments for an RPD and an FPD over 5 and 10 years, respectively. Teeth with deep PPD or severe CAL at baseline tended to exhibit periodontal disease progression.

The results of multilevel logistic regression analysis are shown in Table 6. Over 5 years, wearing an RPD as a subject-level variable was significantly related to periodontal disease progression. In addition, the following tooth-related variables were significantly related to periodontal disease progression: maxillary teeth, multirooted teeth and abutments for an FPD. Over 10 years, multirooted teeth, abutment teeth for an RPD and an FPD had, respectively, a 2.2, 1.5 and 1.4 times higher risk for periodontal disease progression after controlling for other subject-level covariates.

Discussion

A longitudinal study over a period of 10 years was carried out on 286 elderly subjects aged 70 years at the beginning of the study. Using multilevel modelling, this study investigated and reported risk factors operating at the tooth level as well as at the subject level. Subjects wearing an RPD, maxillary teeth, multirooted teeth and abutments for an RPD and an FPD were found to be at a higher risk for periodontal disease progression.

One of the most interesting findings in this study was that abutments for FPDs were significantly associated with periodontal disease progression. In contrast, several studies have reported that abutment teeth for FPDs do not experience periodontal breakdown (Isidor & Budtz-Jørgensen 1990, Valderhaug et al. 1993). Firstly, these contradictory findings may be explained by differences in the study populations. While the studies mentioned above included well-maintained patients, only 23% of elderly subjects in this study attended a dental clinic on a regular basis. Secondly, it is possible that differences in the statistical procedures used influenced the results. Although most previous studies used a simple bivariate analysis, this study utilized a multilevel model taking a hierarchical data structure into consideration and exploring risk factors at the tooth level as well as at the subject level. Thus, the findings in this study are well supported.

Multirooted teeth were found to be susceptible to periodontal disease because of their morphological features (Al-Shammari et al. 2001) and anatomy, which cause relative inaccessibility for self-performed plaque control (Lang et al. 1973). Molars, particularly maxillary molars, were shown to be the teeth most frequently lost owing to perio-

Table 5. Tooth-level analysis for periodontal disease progression by tooth characteristic over 5 and 10 years [number of teeth with periodontal disease progression (%)]

Tooth characteristics	Over 5 years		Over 10 years	
	number of teeth followed	periodontal disease progression (%)	number of teeth followed	periodontal disease progression (%)
Jaw				
Mandible	2658	446 (16.8)	2495	418 (16.8)
Maxilla	2454	568 (23.1)	2244	447 (19.9)
Tooth type				
Single rooted	3679	645 (17.5)	3433	553 (16.1)
Multirooted	1433	369 (25.8)	1306	312 (23.9)
Single crown				
No	3941	749 (19.0)	3728	660 (17.7)
Yes	1171	265 (22.6)	1011	205 (20.3)
Abutment for a removable denture				
No abutment	4722	914 (19.4)	4421	773 (17.5)
Abutment	390	100 (25.6)	318	92 (28.9)
Abutment for a fixed denture				
No abutment	4560	887 (19.5)	4291	754 (17.6)
Abutment	552	127 (23.0)	448	111 (24.8)
Deepest PPD/tooth at baseline				
<4 mm	3939	659 (16.7)	3744	612 (16.3)
4–5 mm	1046	300 (28.7)	906	221 (24.4)
$\geqslant 6$ mm	127	55 (43.3)	89	32 (36.0)
Highest CAL/tooth at baseline				
<4 mm	2535	403 (15.9)	2437	384 (15.8)
4–5 mm	1972	409 (20.7)	1812	341 (18.8)
$\geqslant 6$ mm	605	202 (33.4)	490	140 (28.6)
Total	5112	1014 (19.8)	4739	865 (18.3)

PPD, probing pocket depth; CAL, clinical attachment level.

Table 6. Results of multilevel logistic regression models exploring the risk factors for periodontal disease progression over time

Independent variables	Odds ratio (95% CI)	
	over 5 years†	over 10 years‡
Subject-level covariates		
Gender (male)	1.49 (0.79–2.79)	1.85 (1.03–3.33)*
Smoking status		
Non-smoker (ref.)		
Former smoker	1.54 (0.81–2.94)	0.95 (0.52–1.73)
Current smoker	1.26 (0.55–2.90)	1.11 (0.48–2.55)
Number of teeth present at baseline		
20–28 teeth (ref.)		
10–19 teeth	1.61 (0.91–2.84)	2.86 (1.67–4.88)***
1–9 teeth	1.15 (0.50–2.62)	2.70 (1.24–5.90)*
Denture use		
Wearing a partial denture	1.76 (1.03–3.00)*	1.09 (0.67–1.80)
Tooth-level covariates		
Jaw (maxilla)	1.51 (1.27–1.80)***	1.16 (0.97–1.40)
Multirooted	2.00 (1.66–2.41)***	2.19 (1.80–2.66)***
Single crown	1.19 (0.95–1.48)	0.90 (0.71–1.14)
Abutment for:		
A fixed denture	1.42 (1.07–1.89)*	1.42 (1.05–1.93)*
A removable denture	1.09 (0.78–1.53)	1.49 (1.05–2.14)*

Dependent variable was teeth with periodontal disease progression during the study period.
†$n = 5112$ teeth in 286 subjects.
‡$n = 4739$ teeth in 286 subjects.
*$p<0.05$; ***$p<0.001$.
CI, confidence interval.

dontal disease (Hirschfeld & Wasserman 1978, McFall 1982, Matthews et al. 2001). These findings support our results that maxillary and multirooted teeth were significantly at risk for periodontal breakdown. In addition, clinical studies have shown that furcation-involved molars respond less favourably to periodontal therapy than molars without furcation involvement and are more prone to further attachment loss (Nordland et al. 1987, Loos et al. 1989, Claffey & Egelberg 1994). Thus, it is reasonable to assume that furcation-involved molars in this study population would experience more periodontal disease progression than molars without furcation involvement. However, one of the limitations of this study was that the examination protocol did not include the assessment of furcation involvement.

Several studies have indicated that smokers have increased risks of experiencing periodontal attachment loss (Grossi et al. 1994, Haffajee & Socransky 2001). In contrast, this study did not reveal a significant relationship between smoking status and periodontal disease progression. This may be partly due to the small number of current smokers in the study population. In addition, further analysis of the questionnaire data showed that only five current smokers smoked $\geqslant 20$ cigarettes per day (data not shown). It has also been suggested that most of the periodontal damage inflicted by smoking manifests earlier in life (Hashim et al. 2001), and that both the teeth and the individuals who survive to old age may not be as susceptible to the detrimental effects of smoking (Thomson et al. 2004).

The periodontal examination protocol adopted in this study had an advantage over most other epidemiological studies, because periodontal measurements were made at six sites per tooth on all teeth present with the exception of third molars. Periodontal disease progression was found in 76.2% and 79.0% of subjects, and 19.8% and 18.3% of teeth over the first 5 years and the entire 10 years, respectively. It seems odd that these figures were almost identical in the two study periods. There may be an underestimation of the disease progression, mainly due to tooth loss. In fact, 373 teeth were not included in the analysis at 10 years, corresponding to 7.3% of the total number of teeth assessed at the 5-year follow-up. In addition, a Japanese nationwide survey targeting general dental practitioners revealed that the most frequent reason for tooth extraction in elderly patients aged 70 and older was periodontal disease (Aida et al. 2009). These findings suggest that periodontal disease in elderly people has a huge impact on tooth loss, resulting in underestimation of periodontal disease progression assessed in epidemiological studies. This is unavoidable for a long-term longitudinal study, especially one targeting community-dwelling elderly populations. However, the potential bias of a systematic drop-out of sicker cohort members was eliminated by limiting the analysis to subjects who had examinations on all of the three occasions over 10 years.

One of the limitations of this study is that it could not consider teeth with disease progression at multiple sites or the severity of disease progression. However, for example, further tooth-level analysis of our data over 10 years revealed that among the 865 teeth with disease progression, 62.0% experienced periodontal breakdown at only one site and 24.2% at two sites. In addition, maximum attachment loss/tooth of 3 and 4 mm, respectively, was found in 64.7% and 21.7% of such teeth. More than half of the teeth (51.2%) experienced disease progression at only one site in combination with a severity of 3 mm. Thus, the definition of the disease progression would have a slight impact on the results of this study.

Although teeth with deep PPD or severe CAL at baseline tended to experience periodontal disease progression, these two variables were not included in the final models. It seems valuable to examine whether the baseline disease severity is associated with subsequent disease progression. However, these values should not be regressed on each other because the baseline PPD and CAL are related. Furthermore, it has been pointed out that the use of regression to test the association between change in an outcome and its baseline value has a serious statistical artefact: mathematical coupling (Tu et al. 2004).

This study showed that subjects who wore an RPD were at a significantly higher risk for periodontal disease progression, and that abutment teeth for an RPD were also prone to periodontal breakdown. Case–control studies found that the periodontal health of abutment teeth in RPD wearers was worse than that of non-abutment teeth (Drake & Beck 1993, Wright & Hellyer 1995, Zlatarić et al. 2002). Among the 1434 Japanese dental patients aged 70 years or older, it was revealed that patients wearing an RPD had significantly more teeth extracted owing to periodontal disease (Aida et al. 2009). Furthermore, our study revealed that abutments for an FPD were also significantly more likely to exhibit disease progression. However, these negative effects of an RPD/FPD could be reduced through adequate oral hygiene, careful prosthetic treatment planning and regular dental appointments (Isidor & Budtz-Jørgensen 1990, Valderhaug et al. 1993, Jorge et al. 2007). Hence, elderly subjects wearing an RPD and/or with abutments for an FPD are advised to enrol in a strict maintenance regimen to prevent periodontal disease progression.

Conclusions

Multirooted teeth and abutments for a fixed denture were possible risk factors for periodontal disease progression. These findings underline the significance of a strict maintenance regimen for dentate elderly people with prosthetically treated teeth.

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Clinical Relevance

Scientific rationale for the study: During periodontal treatment and maintenance, more attention should be paid to subject-related risk factors such as smoking and diabetes. However, tooth-related factors have not been fully explored in previous epidemiological studies.

Principal findings: Multilevel logistic regressions showed that maxillary teeth, multirooted teeth, abutments for prostheses and subjects wearing partial dentures were significantly related to periodontal disease progression over 10 years in this community-dwelling elderly people.

Practical implications: It is important to recognize that tooth-related factors contribute to periodontal destruction. It is suggested that maintenance procedures should focus on abutment teeth and subjects wearing partial dentures.