Some characteristics of 50/55-year-old individuals with various experience of destructive periodontal disease: a cross-sectional study

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Objective: To analyze the association between subject characteristics and degree of destructive periodontal disease in a randomly selected sample of 50/55-year-old individuals. *Methods:* A randomized and geographically stratified (urban/rural districts) subject sample composed of dentate 50-year-old ($n = 190$) and 55-year-old individuals ($n = 359$) from the county of Värmland, Sweden were examined. Data were collected through full mouth clinical and radiographic examinations and by the use of questionnaires. Based on the cumulative distribution of the individuals with respect to mean probing attachment loss (PAL), subgroups of subjects with the lowest (L20%) and highest (H20%) experience of PAL were identified. Similar classifications were made for never-smokers and current smokers. Correlation analyses and forward stepwise logistic regression models were performed. *Results:* The subgroup with the most extensive PAL loss (H20%) included a significantly higher proportion of (i) males (60 vs 33%), (ii) subjects with low educational level (65 vs 41%), (iii) smokers (49 vs 15%), and had (iv) less favorable lifestyle characteristics than the subgroup with minimal experience of PAL loss (L20%). The same pattern of differences was observed when the analysis was restricted to never-smokers, with the addition of a significantly lower proportion of subjects living in urban areas (40 vs 69%) in the H20% compared to the L20% subgroup. The stepwise logistic regression analysis revealed that number of teeth and smoking habits were significant factors in the identification of individuals in the L20% subgroup. For the H20% subgroup, number of teeth, gender, number of cigarettes/day and lifestyle index were significant explanatory variables. *Conclusion:* Number of remaining teeth and smoking habits were identified as the main discriminating factors for classification of subjects with regard to degree of destructive periodontal disease. □ *Oral epidemiology; periodontal disease; risk association*

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Data from epidemiological studies suggest that the prevalence of overt signs of gingival inflammation in the adult population is high, but that only a comparatively small proportion of individuals show advanced forms of destructive periodontal disease (1). Although it is generally accepted that dental biofilm is the major etiologic factor of periodontitis, the fact that the severity of periodontal tissue destruction exhibits significant inter- and intra-individual variability indicates that other factors may possess modifying effects on the expression of the disease.

Cross-sectional epidemiological studies may identify risk variables associated with advanced periodontal disease. Data from such studies were interpreted to indicate that such risk associations exist for, for example, age (2–4), gender (1, 5, 6), smoking habits (7–9), and oral hygiene standards (10–12). Geographical living area (urban/rural) may influence the risk for periodontal disease because of, for example, variation in genetic susceptibility (13), living condition and health behavior (5, 14, 15). Factors such as educational level, socio-economic status, stress, dental attendance, dietary habits, and physical exercise may indirectly influence the risk for periodontal disease (16–21). Furthermore, general disorders such as diabetes mellitus (22–24) and cardiovascular disease (24–27) have been suggested as risk variables.

In order to gain further knowledge regarding potential risk variables associated with periodontal disease, it was considered important to evaluate the characteristics of not only subjects with advanced periodontal disease but also those of subjects of the same age who exhibited no or only minimal signs of destructive periodontitis. The aim of this study was therefore to analyze the association between subject characteristics and degree of loss of periodontal tissue support in a randomly selected sample of 50/55-year-old individuals.

Materials and methods

The data in the present study were derived from two randomized and geographically stratified (urban/rural districts) samples of 50-year-old and 55-year-old individuals (Table 1) living in the county of Värmland, Sweden. Both samples were examined in 1993. The dentate 55-year-old subjects ($n = 429$) originated from a longitudinal cohort study initiated in 1988, i.e. when the subjects were

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Table 1. The random samples and examined subjects 1993

1988		1993	
n	No. of dentate examined subjects (%)	*n*	No. of dentate examined subjects (%)
Sample I (55 years)			
510	429 (84.0)		359 (83.7)
Sample II (50 years)			
		230	190 (82.6)
		Total	549 (83.3)

50 years of age (7, 28). The 50-year-olds ($n = 230$) were recruited in 1993 based on a procedure similar to that used in 1988. One-hundred-and-ninety-six (85%) individuals took part in the examination, out of which 6 appeared to be edentulous. Hence data from a total of 549 dentate subjects out of the 659 originally selected (83%) were obtained (Table 1). The predominant reasons presented for not taking part in the examination among the 55-year-olds were (i) that they had moved from the county and (ii) that they were reluctant to participate. Reluctance to participate or severe systemic disease was the predominant reason among the 50-year-olds.

Oral examination

All individuals were subjected to a full mouth clinical and radiographical examination performed by 4 well-trained and calibrated dentists. For details regarding the various variables included in the examination, the reader is referred to recent publications by Axelsson et al. (7) and Paulander et al. (28). From data collected, the following variables—representing the mesial aspect of all teeth except 3rd molars—were analysed in the present study:

Number of teeth: Root remnant was considered as a missing tooth.

Probing attachment level (PAL): Assessed in millimeters from the cement-enamel junction (CEJ) by the use of a WHO probe. The highest scored value for the mesio-buccal and mesio-lingual sites was selected.

Percentage periodontally healthy sites (percentage Perio-healthy): The percentage of periodontally healthy sites was assessed according to the criteria of the Community Periodontal Index of Treatment Needs (29), i.e. CPITN = 0.

Percentage sites with probing pocket depth ≥ 4 mm (%PPD ≥ 4): The percentage of sites scored 3 or 4 according to CPITN.

Percentage sites with probing pocket depth ≥ 6 mm (%PPD ≥ 6): The percentage of sites scored 4 according to CPITN.

Plaque score: The percentage of tooth surfaces showing presence of plaque (30).

Percentage decayed tooth surfaces (%DS): The percentage of tooth surfaces displaying caries lesions, i.e. clinically and/or radiographically identified primary, secondary (recurrent) caries lesions (31).

Questionnaire

From the information obtained through a questionnaire, completed by the subjects at time of the clinical examination, the following variables were selected:

Living area: Urban or rural living.

Educational level: Low (≤ 7 school years) or high (>7 school years).

Smoking habits: Never, former, or current smokers were identified. For former and current smokers, information was obtained regarding the number of years they had smoked as well as the number of cigarettes per day.

Lifestyle: Four lifestyle variables were constructed for (i) dental attendance habits, (ii) occupation, (iii) dietary habits, (iv) weight and height, (v) physical exercise, and (vi) dental fear or anxiety (scored as either no/low or high). *Variable 1:* No regular dental care (>5 years since the last visit) and/or having an occupation that called for irregular working hours; 1 point for each characteristic, i.e. a total score of 0–2 points. *Variable 2:* Less than 3 regular meals per day = 1 point. *Variable 3:* Body mass index (BMI) greater than 29 and/or a low physical exercise level; 1 point for each characteristic, i.e. maximum score 2 points. The BMI index was calculated according to the subject's weight (kg) / height^2 (m). *Variable 4:* High degree of fear/anxiety for dental treatment = 1 point. A *Lifestyle index* was constructed based on the sum of the points obtained from the 4 variables, i.e. a possible index value of 0–6, where 0 indicates the most positive lifestyle.

General health impairment (GHI): Determined from the answers in the questionnaire regarding heart disease, including high blood pressure, and diabetes as well as the regular use of drugs related to such diseases. The presence of one or more of the above conditions classified the subject as having impaired general health.

Data analysis

Based on the cumulative distribution of the individuals with respect to their mean PAL value (Fig. 1), subgroups of subjects with minimal and advanced loss of periodontal tissue support, respectively, were identified. Hence, the subjects representing the lowest 20% of the PAL distribution were considered as the minimal diseased group (L20%; mean PAL 0.1–1.1 mm), whereas subjects belonging to the highest 20% of the PAL distribution (mean PAL

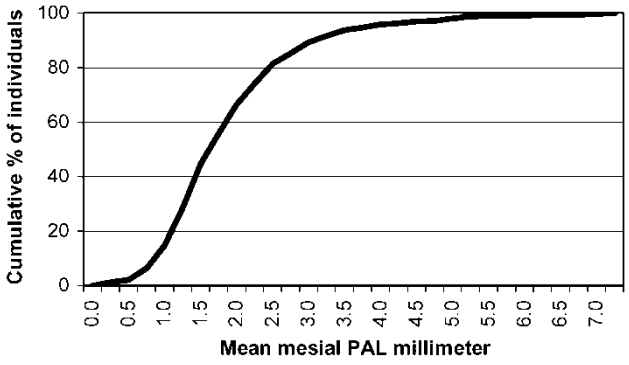

Fig. 1. Cumulative percent of individuals in relation to mean mesial periodontal attachment level (millimeters).

2.4–7.1 mm) were included in the most diseased group (H20%). A similar classification was made for individuals who were never-smokers and current smokers, respectively. For descriptive analyses, mean values and standard errors were calculated based on the subject as the unit. Statistical analyses regarding differences between the L20% and the H20% subgroups were performed on the entire sample with the use of parametric (ANOVA; post hoc tests with Bonferroni or Tamahane's 2 test) and non-parametric tests (Mann-Whitney U-test and Kolmogorov-Smirnov test) depending on type and distribution of the variable studied. Binary forward stepwise logistic regression models based on the L20% and H20% subgroups versus the remainder of the subject sample, respectively, were applied to (i) all individuals as well as (ii) never-smokers. The variables included in the various models (number of teeth, %DS, % of various CPITN scores, gender, living area, educational level, smoking habits, GHI, and lifestyle index) were selected following an analysis of factors that exhibited significant correlation to mean PAL (Pearson or Spearman correlation coefficient analysis according to data type and distribution) and a plausible relationship to periodontal disease. The coefficient of the model and the fit of data to the model were tested in the SPSS program (SPSS Inc.) version 11.5 according to Hosmer and Lemeshow (32). A P value <0.01 was defined as being statistically significant in the correlation analyses, while a $P < 0.05$ was used for all other analyses.

Results

The subject sample is given in Table 2 with respect to gender, living area, educational level, and smoking habits. Two-hundred-and-ninety-four (54%) of the total sample of 549 subjects were females; 55% lived in urban areas and approximately 53% had a low educational level. The proportion of current smokers was 28%.

Comparison between the L20% and H20% subgroups (Table 3) revealed that there was a significantly (i) lower percentage of females (33 vs 60%), (ii) higher percentage of subjects with low educational level (65 vs 41%), (iii) higher mean lifestyle index (1.8 vs 1.1), and (iv) higher percentage of current smokers (49 vs 15%) in the H20% subgroup. Corresponding differences between the L20% and H20% subgroups were observed for never-smokers (349 subjects;

Table 2. Frequency distribution of 50/55-year-olds with regard to gender, living area, education, and smoking habits

		Gender		Living area		Educational level		Smokers*		
Age		Female (%)	Male (%)	Rural (%)	Urban (%)	High (%)	Low (%)	Current (%)	Former (%)	Never (%)
50	190 (34.6)	109 (57.4)	81 (42.6)	92 (48.4)	98 (51.6)	97 (51.1)	93 (48.9)	31 (34.7)	10 (5.8)	113 (59.5)
55	359 (65.4)	185 (51.5)	174 (48.5)	154 (42.9)	205 (57.1)	162 (45.1)	197 (54.9)	89 (24.9)	32 (9.0)	236 (66.1)
Total	549 (100)	294 (53.6)	255 (46.4)	246 (44.8)	303 (55.2)	259 (47.2)	290 (52.8)	155 (28.3)	43 (7.9)	349 (63.8)

* Missing information from two individuals.

Table 3. All individuals ($n = 549$). Description of the subjects in the total sample, the healthiest (L20%) and the most diseased (H20%) group of individuals in relation to mean mesial periodontal attachment level

	Total sample (%)	L20% $n = 110$ (%)		H20% $n = 110$ (%)		Sign.
Gender—female	54	60		33		$P < 0.01$†
Living area—urban	55	69		54		N.S.
Educational level—low	53	41		65		$P < 0.01$*
Smokers						
Never	64	82		39		$P < 0.01$†
Current	28	15		49		$P < 0.01$†
General health impairment—yes	12	8		17		$P < 0.05$†
		Mean	S.E.	Mean	S.E.	
Lifestyle index		1.1	0.09	1.8	0.11	$P < 0.05$‡

* Mann-Whitney U-test. †Kolmogorov-Smirnov test. ‡Bonferroni test.

Table 4. Never smokers ($n = 349$). Description of the subjects in the total sample, the healthiest (L20%), and the most diseased (H20%) group of individuals in relation to mean mesial periodontal attachment level

	L20% $n = 71$ (%)		H20% $n = 70$ (%)		Sign.
Gender—female	60		28		$P < 0.01$†
Living area—urban	69		40		$P < 0.05$†
Educational level—low	39		63		$P < 0.05$*
General health impairment—yes	8		14		N.S.
	Mean	S.E.	Mean	S.E.	
Lifestyle index	1.0	0.10	1.6	0.16	$P < 0.05$‡

* Mann-Whitney U test. †Kolmogorov-Smirnov test. ‡Bonferroni test.

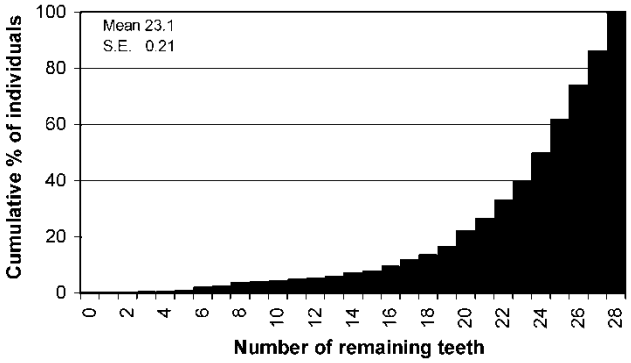

Fig. 2. Cumulative percent of individuals in relation to number of remaining teeth.

Table 5. Smokers ($n = 155$). Description of the subjects in the total sample, the healthiest (L20%) and the most diseased (H20%) group of individuals in relation to mean mesial periodontal attachment level

	L20% $n = 17$ (%)		H20% $n = 54$ (%)		Sign.
Gender—female	65		35		N.S
Living area—urban	71		63		N.S
Educational level—low	53		63		N.S
General health index—yes	6		19		N.S
	Mean	S.E.	Mean	S.E.	
Cigarettes/day	12.5	1.33	15.7	0.90	N.S.
Lifestyle index	1.4	0.26	1.8	0.13	N.S.

Table 4). In addition, a significantly lower proportion of the subjects in the H20% group of never-smokers lived in urban areas (40 vs 69%). In the group of current smokers ($\geq$10 cig/day for $\geq$25 years), no significant differences were found between the L20% and H20% subgroups (Table 5).

The cumulative percentage distribution of the 50/55-year-old subjects in relation to the number of remaining teeth is presented in Fig. 2. About 78% of the subjects had more than 20 remaining teeth. The mean number of remaining teeth was 23.1 (standard error of the mean 0.21) for the entire sample, 19.3 (0.63) in the H20% and 25.1 (0.38) in the L20% subgroup.

The mean values for variables describing the oral conditions are presented in Tables 6 and 7. The statistical analysis based on the entire sample (549 subjects, Table 6) revealed significant differences between the L20% and H20% subgroups in number of teeth (25.1 vs 19.3), %DS (0.39 vs 1.94), %Perio-healthy (69% vs 42%), and %PPD $\geq$4 (2% vs 23%), but not in Plaque scores.

The H20% subgroup of never-smokers (Table 7) exhibited, in comparison to the total H20% group (Table 6), significantly lower mean PAL (0.6 mm; $P < 0.05$) and had on average 1.5 more remaining teeth ($P < 0.05$), whereas subjects belonging to the corresponding subgroup of smokers (Table 8) showed significantly higher mean PAL (0.7 mm; $P < 0.05$) and 1.6 fewer remaining teeth ($P < 0.05$). The comparison between the L20% and H20% subgroups of never-smokers and smokers, respectively, revealed similar patterns of differences in oral conditions as observed in the entire sample. No difference in oral conditions was found between the L20% subgroups of never-smokers and smokers. In the H20% subgroups, however, the smokers had fewer remaining teeth (17.7 vs

Table 6. All individuals ($n = 549$). Mean values and standard errors (S.E.) for the low (L20%) and high (H20%) mean mesial periodontal attachment level groups

	L20% $n = 110$		H20% $n = 110$		
	Mean	S.E.	Mean	S.E.	Sign.
Periodontal attachment level (mm)	0.84	0.02	3.47	0.10	
No. of teeth	25.1	0.39	19.3	0.63	$p < 0.05$†
%Decayed surfaces	0.39	0.11	1.94	0.53	$p < 0.05$†
%Perio-healthy	68.9	2.38	42.4	2.69	$p < 0.05$*
%Probing pocket depth $\geq$4 mm	2.2	0.54	23.2	2.18	$p < 0.05$†
%Probing pocket depth $\geq$6 mm	0.1	0.05	8.0	1.35	$p < 0.05$†
Plaque score (%)	22.6	1.96	30.1	2.52	N.S.

ANOVA: *Bonferroni. †Tamahane's 2 test.

Table 7. Never-smokers ($n = 349$). Mean values and standard errors (S.E.) for the low (L20%) and high (H20%) mean mesial periodontal attachment level groups

	L20% $n = 71$		H20% $n = 70$		
	Mean	S.E.	Mean	S.E.	Sign.
Periodontal attachment level (mm)	0.76	0.03	2.91	0.12	
No. of teeth	25.2	0.49	20.8	0.70	$P < 0.05$†
%Decayed surfaces	0.38	0.14	1.42	0.59	N.S.
%Perio-healthy	64.3	3.29	47.2	3.65	$P < 0.05$*
%Probing pocket depth ≥4 mm	2.6	0.79	14.9	2.68	$P < 0.05$†
%Probing pocket depth ≥6 mm	0.1	0.05	6.5	1.93	$P < 0.05$†
Plaque score (%)	25.3	2.49	33.1	2.58	N.S.

ANOVA: *Bonferroni test. †Tamahane's 2 test.

Table 8. Current smokers ($n = 155$). Mean values and standard errors (S.E.) for the low (L20%) and high (H20%) mean mesial periodontal attachment level groups

	L20% $n = 31$		H20% $n = 31$		Sign.
	Mean	S.E.	Mean	S.E.	
Periodontal attachment level (mm)	1.07	0.04	4.16	0.17	
No. of teeth	24.4	0.70	17.7	1.14	$P < 0.05$†
%Decayed surfaces	0.49	0.24	2.63	1.28	N.S.
%Perio-healthy	76.1	2.77	35.2	4.80	$P < 0.05$*
%Probing pocket depth ≥4 mm	1.7	0.58	32.4	3.41	$P < 0.05$†
%Probing pocket depth ≥6 mm	0.1	0.12	10.1	1.80	$P < 0.05$†
Plaque score (%)	18.8	3.39	30.6	5.07	N.S.

ANOVA: *Bonferroni test. †Tamahane's 2 test.

20.8), higher %DS (2.6 vs 1.4), and higher %PPD ≥4 mm (32% vs 15%) than the never-smokers.

Logistic regression analysis

Total sample. The regression model formulated for identification of subjects belonging to the L20% subgroup (Table 9A) revealed that number of remaining teeth and smoking habits were the only independent variables that entered into the model. The odds ratio (OR) for the number of remaining teeth was 1.16, and the variable smoking habits, coded relative to current smokers, showed that never-smokers were more likely to be found in the L20% subgroup than in the remaining 80% of the subject sample (OR 2.41).

The model constructed for the most diseased subjects (H20% subgroup; Table 9B) identified (i) number of remaining teeth, (ii) number of cigarettes smoked per day, (iii) gender, and (iv) lifestyle index as significant explanatory variables. Thus, with increasing number of remaining teeth a subject was less likely to belong to the H20% subgroup (OR 0.88 per remaining tooth). Smoking habits,

Table 9. Entire sample ($n = 549$). Binary logistic forward stepwise model for the low (L20%) and high (H20%) mean mesial periodontal attachment level groups

Step	Variables in the equation	Coefficient	S.E.	Odds ratio	95% CI
A. Low (L20%) mean mesial periodontal attachment level group					
1	No. of teeth	0.145	0.035	1.16	1.08 ; 1.24
2	Smoker				
	Never smoked	0.879	0.290	2.41	1.36 ; 4.25
	Former smoker	−0.630	0.658	0.53	0.15 ; 1.94
	Constant	−5.463	0.894		
B. High (H20%) mean mesial periodontal attachment level group					
1	No. of teeth	−0.130	0.023	0.88	0.84 ; 0.92
2	Cigarettes/day	0.062	0.015	1.06	1.03 ; 1.10
3	Gender (female)	−0.893	0.251	0.41	0.25 ; 0.67
4	Lifestyle index	0.336	0.116	1.40	1.12 ; 1.75
	Constant	1.088	0.566		

Table 10. Never-smokers ($n = 349$). Binary logistic forward stepwise model for the low (L20%) and high (H20%) mean mesial periodontal attachment level groups

Step	Variables in the equation	Coefficient	S.E.	Odds ratio	95% CI
A. Low (L20%) mean mesial periodontal attachment level group					
1	No. of teeth	0.145	0.041	1.16	1.07; 1.26
	Constant	−4.850	1.150		
B. High (H20%) mean mesial periodontal attachment level group					
1	No. of teeth	−0.176	0.033	0.84	0.79 ; 0.90
2	Gender (female)	−1.080	0.294	0.34	0.13 ; 0.57
	Constant	2.507	0.708		

expressed as number of cigarettes smoked per day, revealed an OR of 1.06. Furthermore, for each point of increase in the lifestyle index there was a significantly increased likelihood for a subject to be included in the H20% subgroup (OR 1.40), while the probability for women to belong to this subgroup was significantly lower than that for men (OR 0.41).

Never-smokers. The models formulated based only on subjects who were never-smokers (Table 10) did not generate any additional information to that obtained in the analysis of the total sample. The only variable that entered into the model for identification of subjects belonging to the L20% subgroup was the number of remaining teeth (OR 1.16). A reduced likelihood being a member of the H20% subgroup was observed for females (OR 0.34) and individuals with a large number of remaining teeth (OR 0.84 per tooth).

Discussion

The result of the present study demonstrated that (i) number of remaining teeth, (ii) number of cigarettes smoked per day, (iii) gender, and (iv) lifestyle index were important variables in the identification of individuals with advanced periodontal disease. To identify subjects with minimal loss of periodontal support, only (i) number of remaining teeth and (ii) smoking habits had a significant explanatory value.

For analysis of the data in the current study, the individuals examined were grouped according to their mean overall probing attachment loss and subgroups of 110 individuals with the smallest (L20%) and the largest amount (H20%) of loss of periodontal tissue support, were identified. Hence, the L20% subgroup included subjects with a mean PAL varying between 0.1 and 1.1 mm (overall mean 0.8 mm), while the corresponding figures for the H20% subgroup were 2.4 and 7.1 mm (overall mean 3.5 mm). It may be argued that the criteria used failed to properly separate the two groups and that pertinent differences between subjects with minimal and pronounced loss of periodontal attachment may therefore have been overlooked. Parallel analyses based on subgroups including only the lowest and highest 10% or 5% of the subjects with respect to PAL, however, were also performed, but the results of these analyses failed to yield additional information, apart from increasing ORs for PAL in smokers compared to never-smokers. Furthermore, it should be realized that in the search for factors identifying subjects belonging to the L20% or H20% subgroups by the use of binary regression models, all subjects in the sample were included in the analysis.

Number of remaining teeth and smoking habits were important variables for the identification of subjects in the L20% and H20% groups. In all analyses, the factor 'number of remaining teeth' was the most powerful (Tables 9 and 10). Thus it was demonstrated that with decreasing number of remaining teeth the likelihood increased of a subject belonging to the H20% subgroup. The opposite was valid for the L20% subgroup. The finding that increasing degree of periodontal tissue loss is associated with decreasing number of remaining teeth corroborates observations made in several epidemiological studies (e.g. 33–37) and suggests that the loss of teeth may not seriously bias the interpretation of epidemiological data regarding periodontal disease, i.e. experienced loss of PAL or periodontal bone support. In other words, the number of remaining teeth may in fact be used as an indicator of the individuals' periodontal status. Reduction in the number of remaining teeth per se, however, may not be regarded as a risk for advanced periodontal disease, but rather as the consequence of the progression of severe periodontitis.

The odds ratio (OR) that a never-smoker belonged to the L20% subgroup was 2.4. The probability that a subject who smoked one pack/day was a member of the H20% subgroup was about 130% higher than for non-smokers. Fifteen percent of the subjects in the L20% subgroup were current smokers with a mean daily consumption of 13 cigarettes, while the corresponding figures in the H20% subgroup were 49% of subjects and 16 cigarettes (Tables 3 and 5). These observations corroborate findings from cross-sectional and longitudinal epidemiological studies (e.g. 6, 7, 28, 38–42) and indicate that cigarette smoking has a significant negative impact on periodontal health. In this context, however, it must be realized that (i) smokers occurred in the L20% subgroup and (ii) 50% of the individuals in the H20% subgroup were never-smokers. Furthermore, the analysis performed on the subsample of

never-smokers failed to identify risk factors other than those observed in the entire sample. This suggests that smoking may not impact on periodontal disease development to a degree that other potential risk factors may be obscured, as proposed by Hujoel (43) and Spiekerman et al. (44). Grossi et al. (45) suggested that a dose-response relationship exists between exposure to smoking and periodontal morbidity. Based on analysis of epidemiological data on 20 to 69-year-old individuals Bergström et al. (46) stated that distinct effects of smoking may not be found until middle age. In other words, 'a rather long incubation time until symptoms of disease become clinically or radiographically apparent to such an extent that the effects of smoking can be discerned' (46). In the present study, a 50/55-year age cohort was selected and all current smokers reported that they had smoked for at least 25 years with a daily consumption of $\geq$10 cigarettes. This makes the sample of smokers homogeneous with respect to the accumulated effect of extensive smoking on the periodontal tissues. Also, the fact that the number of remaining teeth was comparatively large among the smokers (average 19 teeth) gives further credence to the current finding that smoking is not a dominating risk factor for advanced periodontal disease. In this context it should be recalled that the correlation coefficients in the binary logistic models were small and that the outcome was not superior when only never-smokers were included in the analysis.

Besides the two explanatory variables 'number of remaining teeth' and 'smoking habits', which were common for both subgroups, only gender and lifestyle index entered into the logistic model for identification of subjects belonging to the H20% subgroup. Hence, the probability of women belonging to this subgroup was significantly lower than that for men (OR 0.41), and poorer lifestyle significantly increased the likelihood of a subject being found in the H20% subgroup (OR 1.40). The finding that gender was a significant factor is in agreement with data from a large number of studies (for review, see 1, 5, 6).

The lifestyle index contained variables such as stress, fear/anxiety, and physical activity. The variables included were selected based on a model on interaction with periodontitis described by Clarke and Hirsch (47). It has previously been reported that behavioral factors, e.g. dental behavior, dietary habits, physical activity, and body mass index (obesity) have an independent influence on periodontal disease (5, 48–50). The findings in the present study support the hypothesis that a relation exists between behavioral factors and periodontal disease. The risk association between educational level and periodontal disease found in a bivariate analysis of a sample from the same population (21), however, was not confirmed in the multivariate analysis of the current study. In interpreting such differences, one has to realize that the interaction between lifestyle variables is complex and poorly understood (47). Consequently, results from bivariate analyses must be interpreted with great care.

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