J Clin Periodontol 2005; 32: 1134–1140 doi: 10.1111/j.1600-051X.2005.00838.x

Journal of Clinical Periodontology

Psychosocial factors as risk indicators of periodontitis

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Dolic M, Bailer J, Staehle HJ, Eickholz P. Psychosocial factors as risk indicators of periodontitis. J Clin Periodontol 2005; 32: 1134–1140. doi: 10.1111/j.1600-051X.2005.00838.x. © Blackwell Munksgaard, 2005.

Abstract

Objective: Cross-sectional investigation of associations between psychosocial and periodontal parameters.

Methods: One hundred and ten patients 18–76 years of age were examined clinically and 57 radiographically at the Department of Conservative Dentistry of the University Hospital of Heidelberg: probing depths (PDs) and attachment level (PAL-V) were obtained at six sites per tooth. Inter-proximal bone loss was assessed in 57 patients on panoramic radiographs. Further chemical and general environmental sensitivity, somatization, and smoking status were assessed by several questionnaires.

Results: Significant correlations between severe bone loss and age ($r = 0.38$, $p = 0.004$) were observed. PAL-V and PD also correlated with age ($r = 0.45$, $p < 0.001$; $r = 0.37$, $p < 0.001$) and pack years ($r = 0.21$, $p = 0.031$; $r = 0.3$, $p = 0.002$). After adjustment for age, smoking, and sex a negative correlation between chemical odour sensitivity and bone loss, PD = 4 mm as well as PAL-V = 4 mm was observed. Further, a negative correlation was observed between gastrointestinal sensitivity and PAL-V = 4 mm. Psychological stress correlated positively with bone loss.

Conclusion: The results give evidence for associations of psychosocial factors and periodontal disease. Some environmental traits seem to be related to more favourable periodontal status.

Key words: multiple chemical sensitivity; periodontal disease; psychosocial parameters; risk indicators; smoking

Accepted for publication 18 July 2005

For more than 50 years psychologists and dentists presumed a relation between psychosocial stress and periodontitis. It has been demonstrated that emotional factors and stress play a role in the etiology of necrotizing ulcerative gingivitis (Moulton et al. 1952). Several epidemiological surveys revealed an increase in necrotizing periodontal diseases during periods in which patients were exposed to stress (Pindborg 1951a, b, Giddon et al. 1963, Goldhaber & Giddon 1964). Other authors showed that individuals under high working load, bad marital status (Marcenes & Sheiham 1992), occupational dissatisfaction (Linden et al. 1996), and high psychological strain caused by critical life events (Green et al. 1986, Croucher et al. 1997) exhibited more often periodontal destruction. Critical life events such as the loss of a spouse may cause a transitory immune suppression (Stein et al. 1985). However, the impact of stress seems to be more complex. An association between psychosocial stress assessed as financial pressure and increased attachment loss as well as bone loss has been shown. However, this association was dependent on the patients' favoured coping strategy. In people with highly problem-orientated coping the study failed to show an association between stress and periodontal status (Genco et al. 1999). All those studies give evidence for the fact that psychological factors influence the periodontal status most likely by modulating the function of the immune system. The aetiology of periodontal diseases is determined by bacterial infection and host response. Inflammatory and immune response of the host may act protective or destructive. However, stress may also influence a person's behaviour (e.g. nutrition, oral hygiene) and, thus, may indirectly influence periodontal status.

Beyond psychosocial stress other psychological traits or parameters may have direct or indirect effects on the aetiology of periodontitis. Depression might deteriorate a patients energy and self-discipline and, thus, result in deterioration of oral hygiene and periodontal status. Therefore, the purpose of this study was the investigation of associations between psychological and periodontal parameters.

Material and Methods

Patients

One hundred and eighteen consecutive patients who introduced themselves at or were referred to the Department of Conservative Dentistry of the Clinic for Oral, Dental and Maxillofacial Diseases at the University Hospital Heidelberg in 2001 and 2002 because of periodontal or restorative reasons and were willing to participate in a survey on physical or psychological complaints regarding dental materials were examined consecutively in this inter-disciplinary prospective cross-sectional study. The patients had to meet the following inclusion criteria: between 18 and 80 years of age, good knowledge of German language, present or former amalgam restorations, and written informed consent. Patients who did not fulfill these criteria or suffered from severe acute pain syndrome were not included into the study. Prior to examination and questionnaire all qualifying patients were informed about the purpose, rationale, risks and benefits of the study and written consent was obtained.

Clinical examination

At six sites per tooth (mesiobuccal, midbuccal, distobuccal, distooral, midoral, mesiooral) probing pocket depths (PDs) and vertical clinical attachment levels (PAL-V) were measured using a manual rigid periodontal probe (PCPUNC15, Hu Friedy, Chicago, IL, USA) to the nearest millimetre. As reference for PAL-V measurements the cemento-enamel junction (CEJ) was used. If the CEJ was destroyed by restorative treatment, the margin of the restoration was taken as reference. If a tooth was replaced by a dental implant the tooth was assessed as missing. However, PD and PAL-V were assessed at six sites per implant using a colour-coded periodontal plastic probe (Hawe Perio Probe, Kerr Hawe, Bioggio, Switzerland) to avoid damage to the implant surface by periodontal probing. At all multirooted teeth at each furcation site the degree of furcation involvement was assessed using a colour-coded curved probe (PQ2N, Hu Friedy) (Hamp et al. 1975). Further, tooth mobility was assessed in 4° (Carranza 1990). According to the clinical findings, patients were categorized for the following periodontal diagnoses: periodontally healthy, plaque-induced gingivitis, generalized chronic periodontitis, localized chronic periodontitis, aggressive periodontitis (Armitage 1999).

Radiographic analysis

In a majority of patients panoramic radiographs had been obtained because of reasons not related to this study within 2 years before they were examined clinically. For all these patients the panoramic radiographs were assessed for periodontal inter-proximal bone loss and evaluated according the total dental index (Mattila 1989). Further, the radiographs were used to confirm periodontal diagnosis. For evaluation of all panoramic radiographs a radiographic screen was used (67-0420, Dentsply Rinn, Elgin, IL, USA).

Relative bone loss in percent was assessed at two sites per tooth (mesial and distal) using a Schei ruler (Schei et al. 1959). This ruler consisted of six straight lines that divert in the same angle. For each site the basic line of the Schei ruler was placed to the CEJ of the respective tooth parallelly to the occlusal plane. Then the ruler was moved until the sixth line was placed tangentially to the apex. Finally the alveolar crest was located. Location between the two coronal lines meant bone loss up to 20% of root length, location between the second and third line, between 20% and 40% bone loss, and so forth. Inter-proximal bone loss of up to 20% was classified as low and bone loss of more than 20% was classified severe. If the CEJ was destroyed or overlapped by inter-proximal restorations the restoration margin was used as reference. If the alveolar crest could not be determined because of overlapping of adjacent teeth the inter-proximal site was classified as ''cannot be assessed'' (x). After measuring 10 sets of radiographs under supervision of an experienced radiographic examiner (P. E.), all radiographic assessments were made by one examiner (M. D.).

Questionnaires

After the dental examination the patients filled out three psychological questionnaires (Environmental Sensitivity Questionnaire (ESQ), chemical and general environmental sensitivity (CGES), Symptom Check List (SCL-90R) somatization scale, an additional health questionnaire, and a questionnaire regarding medical consultations as well as medicine intake on their own.

ESQ

The ESQ is a 10-item self-report questionnaire asking for perceived health damage caused by dental materials (amalgam, gold, composite, palladium) and various environmental agents (electro-smog, passive cigarette smoking, radioactivity from nuclear reactors, and chemicals or other potentially harmful substances in the air, in the water, and in the food). Subjects are asked to appraise each substance for their damaging effect on the health of the respondent. The ratings were added to a total score. The scale was found to be of good reliability and validity (Bailer et al. 2000, 2001, 2004a, b).

Somatization scale (SCL-90-R)

The somatization subscale of the *SCL-90R* was used to assess somatic symptoms. This well-validated self-report scale measures the presence and severity of 12 common somatic symptoms during the previous 7 days (Franke 1995).

CGES

The newly developed Questionnaire of CGES (Kiesswetter 1997) contains 67 statements describing strong physical responses to a wide range of environmental stimuli (e.g. common environmental chemicals, allergens, physical and psychological stressors). Probands rate on a six-point Likert scale to which extent the reactions are applicable to them (ranging from ''not applicable'' [0] to ''highly applicable'' [5]). The CGES consists of eight factor analytically derived subscales measuring the following constructs: (1) *chemical odour sensitivity*, defined as intolerant reactions to common environmental chemicals (sprays, paints, cigarette smoke, cleansing agents, perfumes, exhaust fumes, gasoline); (2) *general environmental sensitivity I*, defined as troublesome reactions to physical stressors (bright light, heat, noise); (3) *general environmental sensitivity II*, defined as reactions to psychological stressors, disturbance of appetite and sleep related to environmental modifiers (tension); (4) *physical sensitivity*, defined as general physical exhaustion and pain sensitivity; (5) *general respiratory sensitivity*, defined as general respiratory sensitivity related to tension and physical activity; (6) *allergic sensitivity*, defined as reactions to known allergens (e.g. hay fever) ; (7) *skin sensitivity*, defined as intolerance mostly to food; (8) *gastrointestinal sensitivity*, defined as intolerance mostly to food.

The CGES is mainly used to assess self-reported multiple chemical sensitivity (MCS) and self-reported allergy (Kiesswetter et al. 1999, Bailer et al. 2004a). MCS is an acquired clinical syndrome with recurring symptoms in different organ systems (Cullen 1987). MCS has been operationalized as intolerance reaction to chemical stressors (Kiesswetter et al. 1999). This intolerance reaction is defined as the effect of an odour perception, that results in extraordinarily strong neurological reactions as vertigo and nausea. Some authors assume that MCS patients suffer mainly from a ''functional somatic syndrome'' attributed by the individual to an environmental cause (Barsky & Borus 1999, Bailer et al. 2004b, in press).

General environmental sensitivity II and the SCL-90-R somatization scale may be looked upon as indicators for strong stress reactions. All questionnaires were evaluated and the respective psychopathological scores were calculated at the Department of Clinical Psychology, Central Institute of Mental Health, Mannheim.

Medical and socioeconomic questionnaires

The additional health questionnaire and the questionnaire regarding medical consultations as well as medicine intake assess behaviour regarding oral hygiene, nutrition, nicotine consumption, dental and muscular malfunctions, dental consultation, and former dental treatment. Social history is assessed as well as medical consultation during the last 2 years and medicine intake during the last 4 weeks. Social status was assessed as level of education: score = 1 (junior high school), score = 2 (college: ''A-levels''), score = 3 (university degree). Nicotine consumption was assessed as pack years (packs of cigarettes per day multiplied with the number of years of smoking).

Statistical analysis

After checking the data for completeness and controlling for possible errors, statistical analysis was performed using SPSS™, Version 10 (SPSS Inc., Chicago, IL, USA).

Using this database the following patient's means of all data and patient level parameters could be calculated:

- Mean PD per patient (Meyle 1996, Moss et al. 1996);
- mean PAL-V per patient;
- PD distribution in percent per patient (1–3, 4, 5, >5 mm) (Meyle 1996);
- PAL-V distribution in percent per patient (1–3, 4, 5, >5 mm);
- >50% teeth with PD>3 mm (Beck et al. 1996).

All obtained radiographic data were also entered into an electronic database (Microsoft Excel – 97 SR-2, Redmond, WA, USA). Using this database the following patient's means of all data and patient level parameters could be calculated:

- mean relative bone loss (%) per patient;
- amount (%) of sites with severe inter-proximal bone loss per patient.

A Spearman's rank correlation matrix and a Pearson's correlation matrix were generated to identify putative associations between the single variables. Stepwise multiple regression analyses were applied to reveal associations between the dependent (periodontal/dental parameters) and independent variables (psychosocial parameters). The stepwise multiple regression analyses were adjusted for the established confounding factors: age, sex, and smoking (pack years) (Genco et al. 1999). None of the examined patients reported diabetes mellitus. Thus, the regression model was not adjusted for the established periodontitis risk factor diabetes. A variable was kept in the model if the probability of F values was <0.1.

Results

Patients

Eight patients were excluded from a total of 118 recruited and examined patients because of incomplete clinical data. The remaining sample consisted of 110 patients ranging from 18 to 76 years of age. Because panoramic radiographs were available only for 57 patients, the patient characteristics and the probing parameters are given in Table 1 for both the total sample and the two subgroups.

In the total sample 59 patients were never smokers. All other patients reported nicotine consumption for some time in their life. Fifteen patients were light smokers (0.1–5.2 pack years), 13 were

Table 1. Patient characteristics and probing parameters

	Mean ± SD			Group differences p of t-/χ^2 value
	total sample ($n = 110$):	sub-group with X-rays ($n = 57$): mean ± SD	sub-group without X-rays ($n = 53$): mean ± SD	
Age	44.6 ± 14.3	48.5 ± 13.7	40.3 ± 13.8	0.002
Females (%)	62.7	52.6	73.6	0.023
Never smokers (%)	54.1	54.4	53.8	0.995
PD (mean ± SD)	2.88 ± 0.87	3.10 ± 0.90	2.64 ± 0.78	*
PD amount of 1–3 mm (%)	77.8 ± 22.3	71.9 ± 22.7	84.1 ± 20.2	*
PD amount of 4 mm (%)	10.5 ± 8.8	13.0 ± 9.2	7.8 ± 7.4	*
PD amount of 5 mm (%)	5.8 ± 7.0	7.2 ± 6.9	4.4 ± 6.9	*
PD amount of >5 mm (%)	6.0 ± 10.5	7.9 ± 11.9	3.8 ± 8.5	*
PAL-V (mean ± SD)	3.32 ± 1.26	3.62 ± 1.34	2.99 ± 1.08	*
PAL-V amount of 1–3 mm (%)	68.9 ± 28.8	61.7 ± 29.2	76.6 ± 26.5	*
PAL-V amount of 4 mm (%)	12.7 ± 9.6	14.3 ± 9.6	11.0 ± 9.3	*
PAL-V amount of 5 mm (%)	7.6 ± 7.9	9.5 ± 8.2	5.5 ± 7.1	*
PAL-V amount of >5 mm (%)	10.9 ± 17.5	14.6 ± 18.8	6.9 ± 15.1	*

*MANOVA with the 10 probing parameters as depending variables and age as covariate revealed no significant group effect [$F(10, 98) = 1.23$, $p = 0.282$], therefore post-hoc tests were not done.

PD, probing depth; PAL-V, probing vertical clinical attachment level.

moderate (5.3–15 pack years), and 22 were heavy (15.1–50 pack years). The mean of nicotine consumption was 7.25 ± 11.62 pack years with a minimum at 0.06 and a maximum at 50 pack years. In 2837 teeth and three dental implants a total 17,040 PD and PAL-V measurements were assessed. The mean standard deviation amount of severe bone loss was $0.4 \pm 0.3\%$/patient in the 57 patients who radiographs were avail-
able for.

The two subgroups differed significantly with regard to age and sex (Table 1), but there were no overall group differences in the depending variables as indicated by the results of the multivariate analyses of covariance (MANCOVAS). Neither the MANCOVA with the 10 probing parameters as depending variables and age as covariate ($F = 1.23$, $p = 0.282$) nor the MANCOVA with the 10 psychological measures (listed in Table 3) as depending variables revealed a significant group effect ($F = 1.08$, $p = 0.388$).

Spearman's rank correlation coefficients revealed statistically significant correlations between age and periodontal disease (Table 2). Further, Spearman's rank correlation coefficients revealed statistically significant correlations between smoking assessed as pack years and periodontal disease (Table 2). Severe bone loss showed a weak correlation with pack years (Table 2). No single correlation could be found between sex and periodontal parameters in this sample.

Psychological parameters

The means of the SCL somatization and chemical odour sensitivity scale of the total sample were within values observed for community samples (Franke 1995, Bailer et al. 2004a, b). Using a Pearson's correlation analysis, highly significant positive correlations between environmental traits and somatiziation were found, indicating that those variables were powerful stress indicators. Further, several negative correlations between the psychological and the periodontal/dental parameters were found (Table 3). To adjust for smoking, sex, and age, which are known and partially confirmed in this study, confounding variables regarding parameters of periodontal disease stepwise multiple regression models were calculated to identify possible associations between several psychological variables and dental/periodontal parameters. All the 10 psychological variables shown in column 1 of Table 3 were used as potential predictors in the three stepwise multiple regression analyses presented in Tables 4–6.

Using the amount of PD = 4 mm in percent as dependent variable model 1 explained 28% of the variability. This model included, after controlling for age, sex, pack years only chemical odour sensitivity. Age, sex, and pack years explained 21%, whereas chemical odour sensitivity explained further 7% of the variability of the respective dependent variable (Table 4). Chemical odour sensitivity was negatively associated with periodontal disease indicating some protective effect.

Model 2 used the amount of sites with PAL-V = 4 mm in percent as dependent variable. This model revealed, after controlling for age, sex, and pack years, chemical odour sensitivity and gastrointestinal sensitivity as significant predictors for the respective dependent variable. Model 3 explained 33% of the variance of the amount of sites with PAL-V = 4 mm in percent. Age, sex, and pack years explained 21%, chemical odour sensitivity 9%, and gastrointestinal sensitivity 4% (Table 5). Chemical odour sensitivity and gastrointestinal sensitivity were negatively associated with periodontal destruction indicating some protective effect.

Model 3 included age, sex, and pack years, chemical odour sensitivity, and general environmental sensitivity II (psychological stressors) as independent and amount of severe bone loss (>20%) in percent as dependent variables. This model explained 26% of the variability of severe bone loss. Age, sex, and pack years explained 13%, whereas chemical odour sensitivity explained 5%, and general environmental sensitivity II 7% (Table 6). Chemical odour sensitivity was negatively associated with periodontal destruction, indicating some

Table 2. Unadjusted correlations (*r*; *p*) between age, smoking status, sex and periodontal parameters (amount of PD and PAL-V = 4 mm in percent per patient; amount of severe bone loss in percent per patient)

	r (p)		
	PD	PAL-V	bone loss
Age	0.37 (0.001)	0.45 (0.001)	0.38 (0.004)
Sex	– 0.10 (0.324)	– 0.07 (0.500)	– 0.08 (0.580)
Pack years	0.30 (0.002)	0.21 (0.031)	0.25 (0.063)

PD, probing depth; PAL-V, probing vertical clinical attachment level.

Table 3. Unadjusted correlations (*r*; *p*) between psychological and periodontal parameters (amount of PD and PAL-V = 4 mm in percent per patient; amount of severe bone loss in percent per patient), and overall means (SD) of the psychological scales

	r (p)				Mean (SD)
	SCL Soma	PD	PAL-V	bone loss	
Chemical odour sensitivity	**0.38 (0.001)**	– **0.30 (0.001)**	– **0.32 (0.001)**	– **0.26 (0.049)**	1.09 (1.04)
General environmental sensitivity I	**0.50 (0.001)**	– 0.14 (0.134)	– **0.20 (0.035)**	– 0.16 (0.226)	1.80 (1.13)
General environmental sensitivity II	**0.56 (0.001)**	– 0.14 (0.141)	– 0.14 (0.153)	0.16 (0.249)	1.58 (1.28)
Physical sensitivity	**0.48 (0.001)**	– 0.17 (0.087)	– **0.22 (0.021)**	0.12 (0.392)	1.31 (1.11)
General respiratory sensitivity	**0.52 (0.001)**	– 0.11 (0.253)	– 0.14 (0.155)	0.02 (0.906)	0.54 (0.77)
Allergic sensitivity	**0.37 (0.001)**	– **0.19 (0.043)**	– **0.25 (0.008)**	– 0.15 (0.264)	0.78 (0.87)
Skin sensitivity	**0.39 (0.001)**	– **0.21 (0.026)**	– **0.26 (0.006)**	– 0.11 (0.441)	1.20 (1.09)
Gastrointestinal sensitivity	**0.45 (0.001)**	– **0.18 (0.058)**	– **0.31 (0.001)**	– 0.04 (0.775)	0.90 (1.08)
Environmental Sensitivity (ESQ)	**0.39 (0.001)**	– 0.08 (0.438)	– 0.12 (0.221)	0.05 (0.724)	8.85 (6.83)
Somatization (SCL-90-R Soma)	1.00	– 0.11 (0.283)	– 0.14 (0.144)	0.04 (0.759)	0.54 (0.51)

PD, probing depth; PAL-V, probing vertical clinical attachment level; SCL, symptom check list.

Table 4. Hierarchical regression analysis for psychosocial variables predicting periodontal disease (% of probing depth = 4 mm) (model 1)

Step	Predictor	β*	t	p	ΔR^2
1	Age	0.25	2.86	0.005	0.19
	Sex	0.03	0.32	NS	
	Pack years	0.30	3.44	0.001	
2	Chemical odour sensitivity	− 0.28	− 3.26	0.001	0.07
	$N = 110$		$R^2 = 0.28$ ($F = 10.17$) Adjusted $R^2 = 0.25$		

*β coefficients, standardized regression coefficients.

Table 5. Hierarchical regression analysis for psychosocial variables predicting periodontal disease (% of vertical attachment loss = 4 mm) (model 2)

Step	Predictor	β*	t	p	ΔR^2
1	Age	0.38	4.45	0.000	0.21
	Sex	0.12	1.43	NS	
	Pack years	0.18	2.06	0.041	
2	Chemical odour sensitivity	− 0.22	− 2.47	0.015	0.09
3	Gastrointestinal sensitivity	− 0.21	− 2.34	0.021	0.04
	$N = 110$		$R^2 = 0.33$ ($F = 10.37$) Adjusted $R^2 = 0.30$		

*β coefficients, standardized regression coefficients.

Table 6. Hierarchical regression analysis for psychosocial variables predicting periodontal disease (% severe bone loss [> 20%]) (model 3)

Step	Predictor	β*	t	p	ΔR^2
1	Age	0.24	1.84	0.072	
	Sex	− 0.06	− 0.42	NS	0.13
	Pack years	0.09	0.07	NS	
2	Chemical odour sensitivity	− 0.39	− 2.79	0.007	0.05
3	General environmental sensitivity II	0.32	2.22	0.031	0.07
	$N = 57$		$R^2 = 0.26$ ($F = 3.582$) Adjusted $R^2 = 0.19$		

*β coefficients, standardized regression coefficients.

protective effect, whereas general environmental sensitivity II was correlated positively with periodontal destruction.

Discussion

There is some evidence that psychosocial stress generated, e.g. by financial strain or an examination is associated with periodontal disease. This association seems to depend on the coping strategy of the patient. Patients with more emotional coping exhibit a significant association with periodontal disease while individuals with more rational coping fail to show such an association (Genco et al. 1999). This association is confirmed by our data revealing a positive correlation between general environmental sensitivity II and the amount of severe bone loss in percent. Environmental sensitivity II represents reactions to psychological stressors, disturbance of appetite and sleep related to environmental modifiers, and thus may be interpreted as psychological stress. There is growing evidence for putative mechanisms behind this modulation of host response by psychosocial stress. Under continuous psychological strain, reduction of saliva IgA levels was reported (Deinzer & Schüller 1998). Deinzer et al. (2001) observed significantly increased interleukin-1β (IL-1β) levels in crevicular fluid of individuals under academic stress as compared with controls without academic stress. High levels of IL-1β are associated with loss of periodontal attachment and bone (Nguyen et al. 1991). Prostaglandin E_2 (PGE_2) is another important cytokine regulating the shift from protective to destructive inflammatory response. PGE_2 is significantly associated with periodontal bone loss. Animal studies have shown increasing levels of PGE_2 under stress (Auguste et al. 1990, Castagliuolo et al. 1996).

Interestingly, the present study observed other psychological parameters to correlate negatively with parameters describing periodontal disease and periodontal destruction. In the different multiple regression models that had been corrected for age, sex, and smoking, chemical odour sensitivity was negatively correlated to all three parameters describing periodontal disease: amount of PD = 4 mm in percent, amount of sites with PAL-V = 4 mm in percent, and amount of severe bone loss (> 20%) in percent. Further, gastrointestinal sensitivity was negatively correlated to amount of sites with PAL-V = 4 mm in percent. This means these two parameters are associated with periodontal health. What distinguishes chemical odour sensitivity and gastrointestinal sensitivity from general environmental sensitivity II (psychological stressors)? The first two psychological parameters describe sensitivity to chemical, i.e. material stimuli, e.g. nutrition constituents, unpleasant taste as well as chemical or mechanical irritations in the dentition, whereas general environmental sensitivity II describes psychological irritants like those used to represent (financial strain; Genco et al. 1999) or simulate (academic stress; Deinzer et al. 1999) psychosocial stress. Whereas psychological stress may lead to deterioration of oral hygiene (Deinzer et al. 1998, 2001), sensitivity to chemical odours could lead to higher oral consciousness resulting in better individual dental care (oral hygiene) and more frequent professional dental care. In this study, parameters of oral hygiene (e.g. plaque indices) were not assessed. Thus, the hypothesis of more efficient dental care (oral hygiene) in patients with sensitivity to chemical odours and gastrointestinal sensitivity cannot be proven. On the one hand, the parameter amount of PD = 4 mm in percent may reflect actual and recent oral hygiene to some extent. On the other hand, however, amount of sites with PAL-V = 4 mm in percent and amount of severe bone loss reflect periodontal destruction over longer periods. Thus, it may be doubted that plaque parameters obtained at the clinical examination could reflect a patient's attitude to oral hygiene over a period sufficient to create periodontal destruction. This study is a cross-sectional study. Hence, causality cannot be proven anyway. Cross-sectional studies are designed to create and to some extent support hypotheses that if they are supported may be proven in longitudinal studies that could document individual hygiene over longer periods.

Earlier studies had reported negative correlations of allergies and periodontal disease (Genco et al. 1999). The results of our univariate analyses are consistent with these findings. We observed significant negative correlations between allergic sensitivity as well as skin sensitivity and probing parameters (PD, PAL-V). However, these correlations failed to be retained in the multivariate models of association between psychological parameters and parameters describing periodontal disease. Allergic sensitivity is a parameter representing self-reported allergic disease and not allergic disease as validated by an allergologic test. Patients who are intolerant to chemical stressors (sensitivity to chemical odours) or food (gastrointestinal sensitivity) may interpret this as allergy. Hence, allergic sensitivity must not mean in any case that the respective patient is suffering from true allergy. These patients are likely to score for sensitivity to chemical odours and gastrointestinal sensitivity as well as allergic sensitivity (Bailer et al. 2004a). Presumably the association of sensitivity with chemical odours and gastrointestinal sensitivity with periodontal disease is stronger than that of allergic sensitivity. Thus, in the multivariate model sensitivity to chemical odours and gastrointestinal sensitivity are retained, whereas allergic sensitivity drops out.

A recent study that investigated the association of periodontal disease with anxiety, depression, and psychosocial stress failed to reveal any association. The population was dichotomized either for established periodontitis or not and both groups were compared according to different psychological parameters (Solis et al. 2004). Further, the population was not chosen according to psychological problems, but consecutively as they appeared at a Department of Periodontology. Thus, a certain threshold of periodontal disease was used to search for differences in psychological parameters. As the authors guess, the overall discrepancies of psychological parameters within the sample were to small to distinguish for periodontal disease. The present sample consisted of consecutive patients who introduced themselves at or were referred to the Department of Conservative Dentistry of the Clinic for Oral, Dental and Maxillofacial Diseases at the University Hospital Heidelberg because of periodontal or restorative reasons and were willing to participate in a survey on physical or psychological complaints regarding dental materials. Depending on the definition of thresholds, dichotomization or categorization may distort or even obscure existing associations because of reduction of information. The associations were calculated using continuous variables and not using a dichotomization. These may be reasons why the present study found associations of periodontal disease and psychological factors whereas other authors recently did not. On the other hand, the observed collective is not representative of the general population because of this kind of sampling. This study indicates that certain psychosocial parameters are associated with periodontal health in the observed collective. Future trials may search for these associations in representative samples to assess their epidemiological relevance.

Within the limitations of this cross-sectional study we may draw the conclusion that besides psychosocial stress further psychological traits such as chemical odour sensitivity, gastrointestinal sensitivity, and general environmental sensitivity II are associated to periodontal disease. Future representative cross-sectional studies should try to confirm these associations in representative samples, and future longitudinal studies are required to evaluate whether there is a cause–effect relation.

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