J Clin Periodontol 2004; 31: 633–638 doi: 10.1111/j.1600-051X.2004.00538.x
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Journal of Clinical Periodontology

Association of periodontal disease to anxiety and depression symptoms, and psychosocial stress factors

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Solis ACO, Lotufo RFM, Pannuti CM, Brunheiro EC, Marques AH, Lotufo-Neto F: Association of periodontal disease to anxiety and depression symptoms, and psychosocial stress factors. J Clin Periodontol 2004; 31: 633–638. doi: 10.1111/j.1600-051X.2004.00538.x. © Blackwell Munksgaard, 2004.

Abstract

Objective: A cross-sectional study was conducted to investigate if anxiety, depression and hopelessness symptoms are associated with periodontal disease.

Method: A total of 160 subjects took part in this study. Probing depth and clinical attachment level were recorded at six sites per tooth and the gingival and plaque indices were also recorded. The instruments used to assess the psychological variables (anxiety, depression, stress, psychiatric symptoms and hopelessness) were: the State–Trait Anxiety Inventory, the Beck Depression Inventory, the Life Events Scale modified by Savoia, the Self-Report Screening Questionnaire-20 and the Beck Hopelessness Scale.

Results: There was no difference in scale score means between patients with and without established periodontitis. Results of the Ordinal Logistic Regression Analysis model that included age, plaque index, smoking and psychological factors showed that patients with psychiatric symptoms (odds ratio (OR) 1.24, 95% confidence interval (CI) 0.33–4.78), depression symptoms (OR 0.57, 95% CI 0.15–2.21) and with hopelessness (OR 0.70, 95% CI 0.13–3.84) were not at a greater risk of developing established periodontitis.

Conclusion: In this sample, no evidence was found for an association between depression, hopelessness, psychiatric symptoms and established periodontitis. The association of periodontal disease to depression, anxiety and stress should be investigated in psychiatric populations, especially in those with depression and anxiety disorders.

Key words: anxiety; chronic periodontitis; depression; psychosocial factors; stress

Accepted for publication 26 October 2003

Epidemiological studies have shown that periodontitis does not affect all subjects in the population in a similar way. Some individuals present risk conditions that make them more susceptible to develop periodontal disease (Page 1998). Consistent data in the literature show that smoking, non-controlled diabetes and infection with specific periodontal pathogens increase the risk for periodontitis (Genco 1996). Other factors, such as stress, depression and anxiety are not yet confirmed as risk conditions, but have also been identified in observational studies (Monteiro da Silva et al. 1996, Moss et al. 1996). The biological plausibility for such an association is supported by studies that have demonstrated that psychological states, such as depression and exposition to stress agents, could modify the immune response, making the individual more susceptible to develop an unhealthy condition and may also have an impact on periodontal health (Irwin et al. 1990, Biondi & Zannino 1997). The relationship between psychological factors and periodontitis requires carefully designed studies because it is known that psychological states can interfere with the course of chronic diseases. The understanding of this relationship may allow for improvements in the prevention and treatment of periodontal disease.

The aim of this study was to evaluate the association between periodontal

clinical parameters and anxiety, depression and psychiatric symptoms.

Material and Methods

Study population

A cross-sectional study was conducted at the Health and Sciences Center at the University of Vale do Paraíba, Brazil. The study population was comprised of a consecutive sample of 160 volunteers of both genders, recruited by a screening service, with ages ranging from 19 to 67 years. Cases (patients with ''established periodontitis'', according to Machtei et al. 1992) were defined as subjects with two or more interproximal sites from different teeth with a clinical attachment level (CAL) of 6 mm or greater and at least one additional site with a pocket depth (PD) of 5 mm or greater. Patients who did not meet these criteria were considered controls (periodontal ''healthy''). The exclusion criteria were: periodontal therapy in the previous 3 months, patients who reported any type of systemic alteration that might have hindered periodontal clinical examination, non-controlled diabetes, HIV infection, patients with cardiovascular disease and those who made use of immunosuppressant drugs or calcium-channel blocking agents.

Ethical issues

This project and the informed consent documents were submitted to and approved by the Ethics Committee of the Faculty of Medicine at the University of São Paulo; by the Ethics and Research Committee of the Faculty of Dentistry at the University of São Paulo as well as by the Ethics Committee in Research at the University of Vale do Paraiba.

Procedure

Patients seeking dental treatment at the HSC-UNIVAP were invited to answer questions on their general health and oral hygiene habits. On agreement, they were asked to fill out an informed consent document in order to be included in the study. Demographic data were also collected. The periodontal clinical examination was carried out using a Williams probe (Hu-Friedy, Chicago, IL, USA). The CAL and the probing depth (PD) were measured at six sites per tooth, excluding third molars. The presence of plaque was recorded using the plaque index (PI) (Silness & Löe 1964) and the gingival condition using the gingival index (GI) (Löe & Silness 1963). The frequency of missing teeth was also reported. All clinical data was collected by a single investigator, who had been calibrated prior to the commencement of the study. The intra-examiner agreement was evaluated by means of repeated measurements with a 7-day interval from the first examination. The intra-class correlation coefficient was 0.901 ($p<0.001$) for PD and 0.889 ($p<0.001$) for CAL.

After the clinical examination, the patients were invited to answer the following psychometric instruments: the Self-Report Screening Questionnaire-20 (SRQ-20) (Harding et al. 1980, Mari & Williams 1986), the Beck Depression Inventory (BDI) (Beck et al. 1961, Gorenstein & Andrade 1996), the State–Trait Anxiety Inventory (STAI) (Spielberger et al. 1970, Gorenstein et al. 1995, Gorenstein & Andrade 1996), the Life Events Scale modified by Savoia (Savoia 1995) and the Beck Hopelessness Scale (BHS) (Beck et al. 1974).

Psychometric instruments

Psychometric instruments are scales that permit the recording of the reports of patients in a standardized and reproducible way. They can be divided into two groups: those filled out by the observer (rating scales) and those filled out by the subject himself (self-report scales). While the former present problems regarding the observer's experience, the latter are harder to understand, and demand greater individual cooperation (Gorenstein et al. 2000). The majority of these scales was idealized in developed western countries and, therefore, should undergo a trans-cultural adaptation in order to be used (Gorenstein et al. 2000).

Self-Report Psychiatric Screening Questionnaire-20

This screening scale was designed to detect mental disorders in primary health care attendance and may be administered and scored by paraprofessionals. The first 20 statements were designed to detect non-psychotic disorders whereas the remaining statements were to detect psychotic disorders (Harding et al. 1980). The 20-statement version was used in the present study, for it has been validated in Brazil (Mari & Williams 1986). SRQ-positive patients have a higher probability of suffering from mental disorders.

Beck Depression Inventory

BDI is a self-report scale consisting of 21 statements including symptoms and attitudes. Each of the 21 statements is scored from 0 to 3. These statements are related to sadness, pessimism, sensation of failure, lack of satisfaction, suicidal ideation, irritability and social retraction, among others (Beck et al. 1961).

The BDI is scored by adding the greatest value of each statement. In the present study, a cut-off score of 10 or greater identified the patient with depression symptoms. This scale was also validated in Brazil (Gorenstein & Andrade 1996).

State–Trait Anxiety Inventory

The STAI is composed of two scales with 20 statements each and designed to measure the state and trait of anxiety (Spielberger et al. 1970). The state of anxiety is defined as a transitory emotional state or condition of the human mind characterized by consciously perceived unpleasant tension and feelings of apprehension. The anxiety trace refers to the trend to react to situations perceived as threatening with the intensification of the state of anxiety.

The STAI is scored by adding the keyed responses – the scores ranging from 1 to 4. Possible total scores range from a minimum of 20 to a maximum of 80 in both scales. This scale was also validated in Brazil (Gorenstein et al. 1995, Gorenstein & Andrade 1996).

Life Events Scale modified by Savoia

The LES was originally developed by Holmes & Rahe (1967) to assess psychological stress, and it contains 43 life-events that had occurred in the last 12 months. It was modified by Savoia (1995) to be used on a Brazilian population, and it contains 26 life-events. These life-events are related to work, lack of social support, family, environmental changes, personal difficulties and financial strain. The LES is scored by adding the number of keyed events (Savoia 1995).

Beck Hopelessness Scale

The BHS consists of true–false statements that assess the extent of negative

expectancies about the immediate and long-term future (Beck et al. 1974). Each of the 20 statements is scored either 1 or 0. Of the 20 true–false statements, nine are keyed false, and 11 are keyed true to indicate endorsement of pessimism about the future. The scores are summed to yield a total score that can range from 0 to 20 with higher scores indicating greater hopelessness. The cut-off score of 9 was used to identify the hopelessness subjects. This scale is in process of validation in Brazil.

Statistical analysis

Data were stored in a database (Excel for Windows™) and analysed using software SPSS for Windows version 10.0. The mean values for the PD, the CAL, the PI, the GI and the frequency of missing teeth (MT) were calculated for each subject and compared for each group. The mean values of all psychometric instruments were compared between cases and controls. The cut-off scores of BHS, SRQ and BHS were compared between cases and controls. Differences at the 5% level were considered significant. Ordinal logistic regression model was used to measure the association between the outcome variable (''established periodontitis'') and explanatory variables that included age, PI, smoking, being SRQ-positive, being Beck-positive and being considered hopeless (BHS). The odds ratios (ORs) and corresponding 95% confidence intervals (CIs) were calculated.

Results

The final sample was comprised of 153 subjects who completed the periodontal clinical examination and answered the scale evaluations. Forty-seven subjects fell into the category of established periodontitis and were considered cases. The other 106 were considered healthy (control). The BHS was applied in a smaller group of 93 subjects. Demographic data referring to the 153 patients included in the study are shown in Table 1. The mean age was significantly different between the groups. The mean clinical parameters (PD, CAL, PI and GI) were also significantly different between the groups (Table 2). Table 3 displays the mean periodontal clinical parameters of smoking and non-smoking patients. The mean PI, MT and CAL were significantly different between patients with and without established periodontitis.

The cut-off (SRQ-20, BDI and BHS) and the mean (LES, STAI, BDI and BHS) psychometric instrument scores were compared between cases and controls. There were no significant differences between the groups (Tables 4 and 5). The periodontal clinical parameters (PD, CAL, PI and GI) were compared between Beck-positive and negative patients and showed not to be different, as was found when these parameters were compared between SRQ-positive and negative patients (Table 6).

There was no association between smoking, SRQ-positive patients, Beck-positive patients, hopeless patients and patients with established periodontitis (Table 7). From this analysis it can be seen that age and plaque were significantly associated with established periodontitis.

Table 1. Demographic and socioeconomic variables of the groups

Variables	Controls, $N = 106$	Cases, $N = 47$	p
Gender (%)*			
female	71 (66.98)	28 (59.57)	0.48
male	35 (33.02)	19 (40.43)	
Race (%)*			
Caucasian	87 (82.08)	43 (91.48)	0.31
African	8 (7.54)	2 (4.26)	
Mulatto	11 (10.38)	2 (4.26)	
Marital status (%)*			
unmarried/alone	35 (33.02)	10 (21.27)	0.28
divorced/detached	9 (8.49)	5 (10.64)	
married	59 (55.66)	32 (68.09)	
widow	3 (2.83)	–	
Education level (%)*			
incomplete elementary school	40 (37.74)	21 (44.68)	0.86
junior high school	25 (23.58)	10 (21.28)	
high school	37 (34.91)	14 (29.79)	
college	4 (3.77)	2 (4.25)	
Age†			
$\mu \pm$ SD	34.92 ± 10.21	42.91 ± 10.45	0.000
Household income† (Reais)			
$\mu \pm$ SD	731.13 ± 680.40	587.55 ± 426.41	0.25
Smoking (%)*			
yes	21 (19.81)	15 (31.91)	0.10
no	85 (80.19)	32 (68.09)	

*χ^2 test.
†Mann–Whitney test.
SD, standard deviation.

Table 2. Periodontal clinical characteristics of the controls (''healthy'') and cases (''established periodontitis'')

Variable	Controls	Cases	p
PD*	$N = 106$	$N = 47$	
$\mu \pm$ SD	2.22 ± 0.29	3.11 ± 0.94	0.04†
CAL*	$N = 106$	$N = 47$	
$\mu \pm$ SD	2.33 ± 0.37	3.84 ± 1.57	<0.001†
MT‡	$N = 106$	$N = 47$	
$\mu \pm$ SD	4.96 ± 5.27	6.68 ± 6.21	0.08
PI*	$N = 105$	$N = 44$	
$\mu \pm$ SD	0.87 ± 0.57	1.32 ± 0.79	0.002†
GI*	$N = 105$	$N = 44$	
$\mu \pm$ SD	1.33 ± 0.58	1.80 ± 0.64	0.000†

*Mann–Whitney test.
†Statistically significant.
‡*t*-test.
CAL, clinical attachment level; PI, plaque index; GI, gingival index; SD, standard deviation; PD, probing depth; MT, missing teeth.

Table 3. Periodontal variables in non-smoking and smoking patients

Variable	Non-smoking	Smoking	*p*
PD*	$N = 117$	$N = 36$	
$\mu \pm$ SD	2.49 ± 0.74	2.50 ± 0.53	0.93
CAL*	$N = 117$	$N = 36$	
$\mu \pm$ SD	2.62 ± 1.12	3.08 ± 1.46	0.05†
MT‡	$N = 117$	$N = 36$	
$\mu \pm$ SD	4.68 ± 4.66	8.11 ± 7.43	0.02†
PI*	$N = 115$	$N = 35$	
$\mu \pm$ SD	0.92 ± 0.62	1.24 ± 0.76	0.02†
GI*	$N = 115$	$N = 35$	
$\mu \pm$ SD	1.49 ± 0.60	1.35 ± 0.69	0.24

*Mann–Whitney test.
†Statistically significant.
‡*t*-test.
CAL, clinical attachment level; PI, plaque index; GI, gingival index; SD, standard deviation; PD, probing depth; MT, missing teeth.

Table 4. Number of patients with and without depression symptoms

Variable	Controls, *N* (%)	Cases, *N* (%)	*p*
SRQ*			
negative	72 (67.9)	35 (74.5)	0.42
positive	34 (32.1)	12 (25.5)	
BDI*			
negative	63 (59.4)	28 (59.6)	0.99
positive	43 (40.6)	19 (40.4)	
BHS*			
negative	55 (83.3)	23 (85.2)	0.83
positive	11 (16.7)	4 (14.8)	

*χ^2 test.
SRQ-negative/positive and BHS-negative/positive patients of the groups. SRQ, Self-Report Screening Questionnaire; BDI, Beck Depression Inventory; BHS, Beck Hopelessness Scale.

Table 5. Mean scores of psychometric instruments of the groups

Variable	Controls	Cases	*p*
LES*			
$\mu \pm$ SD	3.92 ± 3.12	3.13 ± 2.49	0.23
median	3.00	3.00	
STAI-s*			
$\mu \pm$ SD	38.70 ± 9.28	35.91 ± 9.47	0.09
median	39.50	36.00	
STAI-t*			
$\mu \pm$ SD	39.95 ± 9.03	39.77 ± 11.49	0.57
median	40.00	37.00	
BDI*			
$\mu \pm$ SD	9.81 ± 8.40	9.83 ± 9.01	0.78
median	8.00	7.00	
BHS†			
$\mu \pm$ SD	5.23 ± 3.15	4.85 ± 3.64	0.09
median	4.00	4.00	

*Mann–Whitney test.
†*t*-test.
LES, Life Events Scale modified by Savoia; STAI, State–Trait Anxiety Inventory; BDI, Beck Depression Inventory; BHS, Beck Hopelessness Scale; SD, standard deviation.

Discussion

In this cross-sectional study, the relationship between psychological and periodontal variables were investigated in a consecutive sample of 153 subjects aged 19–67 years. This study design is often used to investigate the association between risk factors and disease prevalence in situations where less is known about the form or type of association (Kingman & Albadar 2002). Studies with similar design were conducted by other authors, using however, different target populations, threshold scores and indices to positively identify the disease (Davis & Jenkins 1962, Green et al. 1986, Marcenes & Sheiham 1992). Studies conducted by other authors (Monteiro da Silva et al. 1996, Moss et al. 1996, Vettore 2000) also applied different self-report scales as instruments to measure psychological variables (Minnesota Multiphasic Personality Inventory, Modifiers and Perceived Stress Scale, Brief Symptom Inventory) as well as different psychological variables (stress, anxiety, depression). These differences may limit the comparisons between the investigations.

A simple random sampling was used to select participants among the subjects (19–67 years old) who were attending the HSC-UNIVAP in 2000. Demographic data and habits were compared and a similar distribution regarding the variables: gender, race, education, income and smoking frequency was observed, indicating a homogeneous distribution among the groups. However, age proved to be significantly higher among the diseased (Tables 1 and 7), probably due to the cumulative nature of loss of periodontal support reflecting the length of exposure to the etiologic factors (Gjermo et al. 2002).

Some studies have also tried to correlate psychiatric patients to periodontal disease (Baker et al. 1961, Belting & Gupta 1961, Davis & Jenkins 1962). In this study, the presence of psychiatric symptoms was assessed by a screening scale (SRQ-20) designed to detect mental disorders in primary health care services. No significant differences were observed between the groups. Ordinal logistic regression did not indicate that SRQ-positive patients have a greater risk of presenting established periodontitis. Baker et al. (1961) found similar results, showing that there was no significant correlation between periodontal disease and psychiatric disease.

The findings in this study did not confirm the hypothesis that depression, stress and anxiety are associated to periodontitis. This may be explained, in part, due to the nature of the target population. The mean BDI and STAI scores were compatible with normality if compared with populations with a clinical diagnosis of depressive and anxiety disorders (Goreinstein et al. 1999). Future investigations conducted in individuals with higher degrees of

Table 6. Periodontal variables in patients with and without depression symptoms and SRQ-negative/positive patients

Variable	Beck-negative ($N = 91$)	Beck-positive ($N = 62$)	p	SRQ-negative ($N = 107$)	SRQ-positive ($N = 46$)	p
PD*						
$\mu \pm$ SD	2.53 ± 0.81	2.43 ± 0.49	0.37	2.53 ± 0.78	2.40 ± 0.47	0.31
CAL*						
$\mu \pm$ SD	2.77 ± 1.20	2.81 ± 1.08	0.84	2.81 ± 1.15	2.72 ± 1.16	0.67
MT*						
$\mu \pm$ SD	5.23 ± 5.45	5.87 ± 5.86	0.49	5.55 ± 5.64	5.34 ± 5.31	0.83
PI*						
$\mu \pm$ SD	1.04 ± 0.66	0.93 ± 0.67	0.36	1.05 ± 0.66	0.87 ± 0.68	0.13
GI*						
$\mu \pm$ SD	1.51 ± 0.62	1.41 ± 0.63	0.36	1.51 ± 0.63	1.36 ± 0.60	0.16

*t-test.

CAL, clinical attachment level; PI, plaque index; GI, gingival index; SD, standard deviation; PD, probing depth; MT, missing teeth.

Table 7. Results of Ordinal Logistic Regression Analysis model to measure the outcome variable (''established periodontitis'') and explanatory variables that include age, PI, smoking and psychological factors (SRQ-20, BDI and BHS)

Variable	OR	95% confidence interval	p
age	1.06	1.01–1.11	0.03*
PI	2.45	1.06–5.69	0.04*
smoking	2.41	0.81–7.14	0.11
SRQ-20	1.25	0.33–4.78	0.75
BDI	0.57	0.15–2.21	0.42
BHS	0.70	0.13–3.84	0.68

*Statistically significant.

PI, plaque index; SRQ-20, Self-Report Screening Questionnaire-20; BDI, Beck Depression Inventory; BHS, Beck Hopelessness Scale.

exposition to these psychological factors may, or may not, confirm such a relationship.

Observational studies with different designs can assess risk factors for developing periodontal disease and should be considered according to their capability of producing credible scientific evidence.

Hypothesis generating studies concerning psychological variables include the case reports by Moulton et al. (1952) and De Marco (1976). In these studies, it would be possible to observe a presumed primary relationship between these variables and periodontitis. Cross-sectional and case–control studies (Baker et al. 1961, Moss et al. 1996, Monteiro da Silva et al. 1998, Genco et al. 1999) supply stronger evidence of this correlation. Studies that suggest a strong evidence for risk factors are cohort studies. Regarding this issue, we found two studies that followed patients for a specified period of time (Freeman & Goss 1993, Linden et al. 1996). Both these studies emphasized the relationship between occupational stress and periodontal disease, finding significant associations. However, these data should be carefully evaluated for the populations analysed in both studies were small.

Another point to be considered is the measurement of psychological variables. They are usually measured by self-report scales and do not allow an assessment of the subjective and behavioural aspects of individuals. When this type of instrument is used in research, one should bear in mind that the informers may supply incorrect information (due to reasons ranging from misunderstanding the question to filling in the answers incorrectly) and the situation bias may also take place, that is, the condition of instability of the clinical phenomenon being evaluated.

The analysis of the effects that these psychological variables (with self-report scales) have on periodontitis may be approached inappropriately in epidemiological studies, for it is difficult to correlate facts of the present or recent past to periodontitis, especially due to the mean age of the onset of disease, its clinical course and chronicity (Genco et al. 1999).

Longitudinal and prospective studies such as the ones carried out by Freeman & Goss (1993), Linden et al. (1996) and Deinzer et al. (1998, 1999, 2001) may have assessed the psychological variable of stress more appropriately, for they followed a group of patients who were analysed for a specified period of time. Somehow, these studies also evaluated the degree of exposure to the studied factor.

Future studies are required to investigate the association of periodontal disease and psychological variables, using structured interviews (Spitzer et al. 1992) on groups with operational diagnosis, by means of instruments like the DSM-IV (American Psychiatric Association, 1994). Thus, sources of error can be minimized and the influence of these psychological variables on periodontitis can be evaluated with greater precision.

Acknowledgments

This work was supported by grants from Fundação de Amparo a Pesquisa do Estado de São Paulo (FAPESP 00/09234-4 and 99/08446-9).

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