

Relationships of Stress and Coping Styles to Periodontal Disease: A Case-Control Study

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KEY WORDS

Coping Skills;
Attachment Loss;
Psychological adaptation;
Emotional stress

ABSTRACT

Statement of Problem: The effects of individual variations in coping strategies have been debated in studies of the association between stress and chronic periodontitis, with conflicting results.

Purpose: To investigate the associations between stress, coping styles and periodontal disease in a sample of Iranian population.

Materials and Method: Forty patients with chronic periodontitis and forty control subjects with a healthy periodontium were enrolled in this study and matched for age and gender. Participants were patients undergoing periodontal treatment at the Department of Periodontics, Guilan University of Medical Sciences. A single examiner performed periodontal examination. Psychological assessments, including the Life Events Questionnaire and the Ways of Coping Questionnaire were done by a second examiner; both examiners were blind to the study. Bi-variate and multivariate logistic regression analyses were used to compare results for patients and control subjects.

Results: Statistically significant differences in the problem-focused coping ($p < 0.01$), intensity of stress ($p < 0.006$), as well as escape-avoidance ($p < 0.01$), and accepting responsibility ($p < 0.001$) subscales were observed between the patient and control groups. Multivariate logistic regression identified a negative association between periodontitis and tooth-brushing frequency (OR= 3.3, 95% CI: 1.22- 8.69), as well as the accepting responsibility coping style (OR= 1.5, 95% CI: 1.14- 1.98), and a positive association with stress intensity (OR= 1.081, 95% CI: 1.023-1.143).

Conclusion: The results suggest that psychological stress associated with various life events is a significant risk indicator for periodontal disease. Although statistically small, there was a clinically important link between coping strategies and periodontal disease.

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Introduction

Economic development and modernisation have introduced a variety of new stressors with disadvantageous consequences on the welfare and happiness of individuals in developed and developing countries. Clinical observations and epidemiologic studies have found that host defence and vulnerability to oral inflammatory infectious diseases are influenced by psychological fac-

tors and tension of behavioural and emotional challenges induced by life events, known as psychosocial stress [1-5]. There were more than 50,000 papers published over the past few decades discussing this issue in different aspects; from the impacts of stress on physical and mental health to its mechanism and consequences at cellular and genomic level. The potential relationship between stress and oral inflammatory infectious dis-

eases is not a new concept; psychological stress was known as a predisposing factor in the aetiology of necrotising ulcerative gingivitis for more than four decades [6]. One of the likely mechanisms of such relationship is activation of the hypothalamic-pituitary-adrenal axis following stressful life events, which leads to elevation of cortisol concentrations in gingival crevicular fluid (GCF), serum, and other body fluids. Leukocytic, chemotactic, and bactericidal abilities of polymorphonuclear leukocytes (PMNs), IgG production, and salivary IgA secretion are considerably declined by continued elevation in cortisol concentrations, placing the host in an immunosuppressive status, hence more vulnerable to periodontal infection and breakdown [7].

Severe general periodontitis is a chronic inflammatory disease induced by bacteria with a multifactorial aetiology. It affects roughly 7–15% of adults worldwide and about 12.6% of the US population [8]. However, the results of the 2009–2010 National Health and Nutrition Examination Survey (NHANES) suggest that the prevalence of periodontal disease among the adult US population were underestimated by up to 50% [9]. These findings emphasise the importance of diagnosis, treatment, and prevention of periodontal disease as a major public health problem.

There are considerable differences in the susceptibility of individuals to periodontal disease. The role of environmental risk factors such as smoking and diabetes in the progression, severity, and outcome of periodontitis is important. Hence, it seems reasonable to investigate the effects of stress and coping among people from different cultural and social communities. Over the past several years, some observational studies have showed that periodontal disease and its progression may be associated with psychosocial stress, financial stress, distress, and depression, and the individual's way of coping with stress [10–13]. In contrast, other studies found no association between stress and periodontal disease [14–16]. Therefore, more research is needed to get a clearer understanding of this relationship.

There are differences in the processes of stress and coping among different cultures, socioeconomic, and ethnic groups. Cultural morals and values affect the appraisal of stress by individuals in different ways. Therefore, the aim of this case-control study was to investigate the relationship between stress and coping

styles and periodontal disease in a sample of Iranian subjects.

Materials and Method

Study Population

Based on a pilot study, 80 patients between 18–65 years of age were included in this case-control trial. The participants were recruited from adults attending restorative, endodontics, and periodontal departments of the Faculty of Dentistry, Guilan University of Medical Sciences (GUMS), Rasht, Iran. This study was approved by The Research and Ethics Committee of the Faculty of Dentistry. To take part in the study, informed consents were signed by all participants.

The case group, comprised patients with generalised advanced periodontitis, according to Armitage et al [17]. It consisted of 40 patients (23 women, 17 men) with at least 20 teeth, with more than 30% of the evaluated sites having clinical attachment level (CAL) \geq 5 mm, bleeding on probing (BOP) in at least 50% of the sites, probing pocket depth (PPD) \geq 6 mm in at least 5 teeth, and radiographic evidence of bone loss, all whom required periodontal treatment. The control subjects (21 women, 19 men) had at least 20 teeth, with CAL \leq 3 mm and having no more than 7 sites with 4 mm CAL and/or PPD. Exclusion criteria included periodontal treatment within the past 3 months; current smokers; patients who reported any systemic conditions that could have hindered periodontal examination, such as the need for antibiotic prophylaxis; patients having diabetes, HIV infection, or cardio-vascular disease; those taking antibiotics, anti-inflammatory, anti-depressive, or immunosuppressive drugs or calcium channel blockers; pregnant women; and patients wearing orthodontic appliances. To reach the final sample size, 280 patients were scrutinized for their eligibility, from March to August 2011. Baseline characteristics and socioeconomic data were collected before periodontal evaluation.

Clinical Examination

The periodontal clinical examination was carried out by an examiner using a manual probe (Williams- periodontal probe; Hu-Friedy, Chicago, IL, USA). The examiner was blinded to the study and trained for correct assessment. The CAL (distance from the cement-enamel junction to the base of the pocket) and PPD (distance from the free gingival margin to the base of the pocket) were

assessed at 6 sites for each tooth. BOP was recorded using the bleeding point index [18] at 6 points for each 12 anterior teeth and a bleeding percentage was calculated for each patient.

Psychometric Instruments

To assess the number and intensity of stressful events, a combination of two scales was used: the Social Readjustment Rating Scale [19] and the Scale of Life Events [20]. The combined list comprised 84 questions, which were answered Yes or No, and the impact of each event was also measured using a five-point Likert scale. A combined questionnaire was adapted for the Iranian population and its reliability and validity was verified in a study [21].

To collect psycho-diagnostic data on coping strategies, we used the Iranian version of the Ways of Coping questionnaire (WCQ) by Folkman and Lazarus [22]. They have suggested two major coping strategies, problem-focused coping, including four subtests: seeking social support, accepting responsibility, planful-problem solving, and positive reappraisal; and emotion-focused coping, also including four subtests: confronting, distancing, escape-avoidance, and self-controlling [23]. Individuals responded to each item on a four-point Likert scale showing the frequency of each strategy which were used. All psychological assessments were performed by an examiner who was blinded to the study protocol and was trained and supervised by an expert psychiatrist.

Statistical Analysis

Descriptive data are expressed as means and standard deviations (SDs). Comparisons between groups were conducted using an Independent t-test for variables with a normal distribution and a Mann-Whitney test for those with a non-normal distribution. Chi-square and Fisher's exact test were used to present and compare frequency distributions for gender, marital status, income, and educational level of the two groups. Variables associated with clinical outcomes in a bivariate analysis ($p < 0.1$) were fitted in a multivariate regression model to determine the odds ratio (OR) and 95% confidence intervals (CI) for associated risk indicators of periodontitis.

Results

The baseline characteristics of the participants are shown in Table 1.

Table 1 Baseline and socioeconomic characteristics of the subjects in the patient and control groups

Characteristics	Patients (n= 40) (%)	Controls (n= 40) (%)	p
Age* (mean ± SD)	37.1±8.5	35.1±7.2	0.27
Gender [†]			
Female	23 (57.5)	21 (52.5)	0.653
Male	17 (42.5)	19 (47.5)	
Educational level [♦]			
High school diploma<	18 (45)	24 (60)	0.338
>High school diploma	22 (55)	16 (40)	
Marital status [†]			
Married	31 (77.5)	29 (72.5)	0.606
Single	9 (22.5)	11 (27.5)	
Tooth brushing frequency* (mean ± SD)	1.5 ± 0.5	1.75 ± 0.58	0.04 [#]
Income ^{†§}			
<200	11 (27.5)	2 (5)	0.029 [#]
200–300	4 (10)	10 (25)	
300–400	8 (20)	10 (25)	
>400	17 (42.5)	18 (45)	

* Independent t test
[†] Chi-square
[♦] Fisher's exact test
[#] Significant
[§] Expressed as US\$, monthly

There were statistically significant differences in tooth-brushing frequency and income, between the case and control subjects. Healthy control subjects brushed their teeth more frequently than case subjects. All periodontal parameters were statistically different between the patients and healthy controls (Table 2).

Table 2 Periodontal clinical parameters in the test and control groups (mean ± SD)

Clinical parameters	Patients (n = 40)	Controls (n = 40)	p
Probing pocket depth (mm)*	3.01± 0.40	2.16 ± 0.43	0.0001
Clinical attachment level (mm)*	3.94± 0.53	2.72 ± 0.6	0.0001
Bleeding on probing (%) [†]	43 ± 19.5	15 ± 17	0.0001

* Independent t-test
[†] Mann-Whitney test

Control subjects significantly liked to use problem-based coping strategies compared to patients with periodontal disease ($p = 0.018$). Although cases used emotion-based coping strategies more than controls, this difference was not statistically significant. A subsequent assessment at the subtest level revealed that the patients differed significantly from the controls in using more escape-avoidance ($p = 0.01$) and less accepting responsibility ($p = 0.001$) coping styles (Table 3).

Although there were similarities between the case

Table 3 Scores for the coping strategies and subtests in the patient and control groups

Coping strategy/ subtest	Patients (n = 40) (mean ± SD)	Controls (n = 40) (mean ± SD)	p
Emotion-based*	36.3 ± 7.2	35.1 ± 5	0.271
Confronting†	8.6 ± 2.44	9.07 ± 2.53	0.473
Distancing†	8.47 ± 2.97	7.75 ± 1.98	1.439
Escape-avoidance†	9.87 ± 3.17	7.92 ± 3.66	0.013#
Self-controlling†	9.72 ± 3.04	10.37 ± 2.32	0.528
Problem-based*	33.5 ± 6.1	37.1 ± 7.1	0.018#
Accepting respon- sibility*	6.5 ± 2.23	8.02 ± 1.81	0.001#
Planful problem solving*	9.35 ± 3.01	10.47 ± 3.21	0.11
Seeking social support†	8.77 ± 3.06	9.57 ± 3.15	0.118
Positive reap- praisal*	8.9 ± 2.85	9.05 ± 3.58	0.837

* Independent t-test
† Mann-Whitney test
Significant

and control subjects regarding the total number of life events; the intensity of the stress experienced was significantly higher in the periodontal patients (Table 1). Pearson correlation showed weakly positive relationships between attachment loss (AL) and emotion-based coping strategies and the number and intensity of stressful events ($r = 0.13$, 0.08 , and 0.16 , respectively), and a weakly negative correlation between AL and problem-based strategies ($r = -0.11$), none of which reached a significance level of $p < 0.05$ (data not shown). On the other hand, there was a significant negative correlation between the emotion-based and problem-based coping styles ($r = -0.27$, $p = 0.01$, Figure 1a), and a positive relationship between the number of stressful life events and their intensity among all participants ($r = 0.77$, $p = 0.0001$,

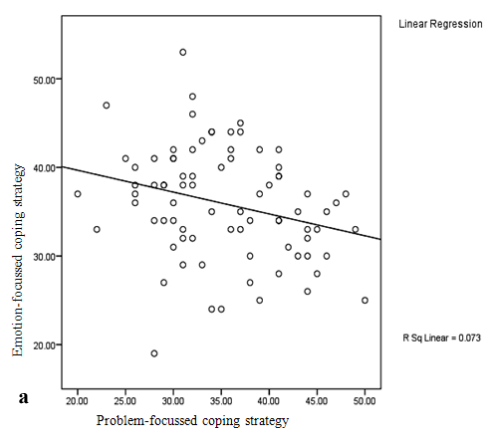


Figure 1b). Table 4 shows the results of multivariate logistic regression analysis. After controlling for tooth-brushing frequency and income, tooth-brushing frequency remained in the model; accepting responsibility positively (OR: 1.5), and the severity of life events negatively (OR: 1.081), influenced the outcome variable (periodontitis), as defined by CAL, PPD, and BOP.

Table 4 Multivariate logistic regression analysis expressing the Odds ratio, 95% confidence intervals (95% CI), and P values

Variable	β	Odds ratio	95% CL	p
Tooth-brushing frequency	-1.82	3.3	1.22-8.69	0.018
Accepting responsibility	-0.409	1.5	1.14-1.98	0.004
Stress intensity	0.078	1.081	1.023-1.143	0.006

Discussion

This study investigated the association between perceived stress and coping styles and periodontal disease in a sample of Iranian patients seeking dental treatment.

We demonstrated that the risk of having periodontal disease is influenced positively by stress intensity and moderated by the accepting responsibility coping style (OR= 1.5). There was also a negative relationship between periodontitis and tooth-brushing frequency (OR= 3.3).

From the periodontal view, we classified the subjects according to Armitage, 1999 [17], who defined periodontal disease based on the presence of attachment loss and further categorised the severity of periodontitis as mild, moderate and severe according to the amount of attachment loss. Wimmer et al. used the same criteria and

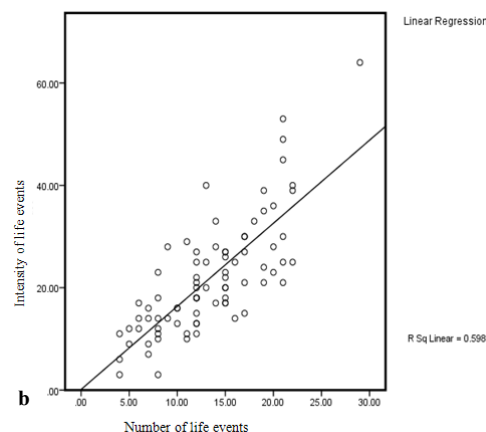


Figure 1a Correlation between mean scores for emotion-based and problem-based coping styles **b** Correlation between mean scores for the number and intensity of stressful life events

further categorised the patients into two groups (mild and moderate/ severe periodontitis) in their analysis [10]. It is essential to ensure a clear difference in exposure (measured by the amount of attachment loss) between case and control or healthy and periodontal disease groups, such as the statistically significant differences in mean PPD, CAL, and BOP that we found between our case and control groups. Nunn et al. indicated that alveolar bone loss and clinical AL are the best and most sensible measures of periodontal destruction [23]. However, the existing data are conflicting on this point, since several criteria have been applied to characterise periodontitis, including PPD, CAL, BOP, alveolar bone loss, and the number of missing teeth. Wimmer et al. used the categorised form of AL, while Crouched et al. included subjects with one site having $AL \geq 5$ mm in the case group, Teng et al. proposed their own criteria defining health or periodontitis [1, 10, 13].

In addition, there is currently no generally accepted method for measuring stress; although several studies have explored associations among saliva cortisol levels, stress, and periodontal disease [7, 24], a well-accepted biological test has not yet been established. This study benefited from using a combination of two different adapted scales to integrate the most possible features of stress processes and to decrease the time needed to complete two separate questionnaires, reducing the burden on the participants. Nevertheless, collecting self-reported, personal information is a complex process, as participants may under or over-report their perceived stress for various reasons. It is important to keep in mind the limits of the implements to measure conceptual issues such as stress or coping skills, as well as their accuracy in measuring subjective data. Several factors affect this accuracy, among which the respondent's level of education is of great importance, a variable that had similar distributions between the case and control subjects in our study.

The impacts of stress and psychological disorders on individual health status probably lead to behavioural changes that reduce oral hygiene and increase health threatening behaviours, by modulating the convoluted interactions of nervous, endocrine, and immune systems. In view of that, our study groups had a statistically significant difference in daily tooth-brushing frequency ($p < 0.04$), which may have been associated with their-

psychological status.

It was postulated that besides the stress, inactive or inadequate adaptive capacity and the way of coping with stressful situations trigger up the regulation of neurotransmitters and corticosteroids, followed by decreased immune competence of the host [2, 8]. According to Lazarus et al., individuals respond to stress, consciously or unconsciously, using certain types of coping skills to cut, control or overcome the stressful situation successfully [25].

In our study, although there was no difference in the number of life events between the case and control groups, the periodontal patients experienced significantly higher stress (expressed on the Likert scale as higher stress scores), independent to other variables. This may be partly caused by their different personalities. Individuals with different combinations of personality traits experience and manage stress in different ways. For example, it is reported that neuroticism predisposes people to experience negative emotions and distress regardless of the level of stress, whereas extraversion is a predisposing trait for perceiving more positive effects [26]. This finding is consistent with other investigations presenting a positive correlation between stress and periodontitis [4, 24, 27-28], and in contrast to the studies by Solis et al. and Castro et al. [14-15] who did not find any association between anxiety, depression, and psychiatric or psychosocial factors. Other studies have also investigated the association between life event stressors and periodontal disease. Pistorius et al. reported a negative effect of stressful life events on the course of chronic periodontitis in a case-control study matched for age and gender [29]. Similarly, Green et al. documented an association between life event stressors and periodontitis severity [30]. On the other hand, Vettore et al. and Monterio da Silva et al. are among the investigators who did not find a significant relationship between periodontal and psychometric variables [11, 31]. This lack of consensus may be due, at least in part, to limitations in periodontal disease classifications and the type of diseases being investigated, and also assessing different psychosocial variables and using a wide range of questionnaires. Using a validated questionnaire for the analysed sample is of considerable importance. A recent systematic review of case-control, cross-sectional, and prospective studies which investi-

gated the relationship between stress, depression, and other psychological variables and periodontal disease, indicated that only 5 of 14 studies used adapted questionnaires as a methodological approach [4].

In the present study, periodontal patients used escape-avoidance and accepting responsibility as the most and least frequent coping strategies, whereas the control group used plan-full problem solving and distancing most and least, respectively. Furthermore, the case and control groups differed on the problem-focused coping subscales in such a way that the control subjects relied mainly on active coping in response to stress in contrast to the periodontal patients. This finding is consistent with that of Wimmer et al. with respect to differences in the ways of coping between the case and controls, i.e. the use of escape-avoidance (resigned coping) by periodontal subjects and active coping strategies by control subjects [10].

There are several notable limitations to our study. First, the cross-sectional design of the study does not provide information on the temporal nature of stress exposure and the true effect that stress may have over the course of periodontal disease. This is due to the fact that the stress responses of the patients may be a reflection of recent symptoms, while periodontitis is a chronic phenomenon. Second, the convenience rather than random method of sampling and cross-sectional data collection brings into question whether the sample was truly representative of the population from which it was obtained and to what extent the information can be generalised to the entire population. Nevertheless, the results of our research provide a significant source of data at the exploratory level. Future studies with a particular focus on the effects of stress and coping on the initiation and progression of periodontal breakdown, based on multiple objective variables such as biomarkers of stress and repeated measurements of variables over a longitudinal approach and with larger sample sizes, should be conducted. Moreover, there is a need for studies that address the role that stress and psychological imbalance play in the expression of at-risk behavioural habits.

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