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Anxiety, gingival inflammation and periodontal disease in non-smokers and smokers – an epidemiological study

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Abstract

Objectives: The aim of the present study was to investigate the influence of anxiety, measured by one single question, on gingival inflammation and periodontal disease in non-smokers and smokers.

Material and Methods: The participants were 144 subjects with untreated periodontal disease 30–40 years of age, and 26 healthy controls, 30–40 years of age. All subjects were clinically examined and answered an uncomplicated question regarding anxiety in every day life, as well as smoking habits. The periodontitis subjects were divided into; an aggressive periodontitis (AP)-group and a chronic periodontitis (CP)-group. Fisher's exact probability *t*-test, analysis of variance (ANOVA), Mann–Whitney *U*-test and analysis of covariance (ANCOVA) were used as statistical methods.

Results: Anxious subjects had a significantly higher gingival index than non-anxious subjects, when controlling for smoking ($p<0.01$). The healthy anxious non-smokers had an average score of GI 1.6 (± 0.4 SD) compared with 1.2 (± 0.4 SD), $p<0.05$ for the non-anxious non-smokers. Anxious smokers with periodontits (AP-/CP-group) had significantly more sites with pockets $\geqslant 5$ mm, compared with non-anxious smokers, ($p<0.05$).

Conclusions: The results of the present study, suggest that self-reported anxiety was associated with an adverse affect on the gingiva. Anxiety seemed to be associated with increased severity of periodontal disease in smokers.

Key words: anxiety; dental plaque; gingival inflammation; periodontal disease; smoking; stress

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Dental plaque and neglect of oral hygiene are generally believed to be the most important risk factors for periodontal disease (Silness & Löe 1964, Christersson et al. 1991, Shibly et al. 1995). Stress is another important factor in the aetiology and maintenance of many inflammatory diseases including periodontal disease (Moulton et al. 1952, Gupta 1966, Clarke & Hirsch 1995, Genco 1996, Linden et al. 1996, Moss et al. 1996, Genco et al. 1999, LeResche & Dworkin 2002). Psychosocial stress probably interacts with lifestyle factors, such as smoking, in the initiation of periodontal disease (Croucher et al. 1997, Söder et al. 1999, Hugoson et al. 2002). Associations have been found between work stress and periodontal status (Marcenes & Sheiham 1992). Stressful life events have been related to degree of periodontal disease (Green et al. 1986). Subjects with psychiatric illness had more periodontal disease than subjects with non-psychiatric disorders (Belting & Gupta, 1961).

More gingivitis has been reported in general dental patients with higher scores on self reported measures of anxiety (the Hospital Anxiety and Depression Scale) (Kurer et al. 1995). Patients with aggressive periodontitis (AP) had significantly more depression and loneliness, when compared with patients with chronic periodontitis (CP) and control subjects (Monteiro da Silva et al. 1996). Financial strain, depression and smoking, as well as gender, diabetes mellitus and subgingival microorganisms have been associated with increased severity of loss of dental attachment (Genco et al. 1999).

These findings suggest that it may be important for successful treatment of a periodontitis patient to evaluate anxiety levels. High anxiety may contribute to initiation and relapse of the illness, maintain adverse life style factors such as smoking, and increase the risk that the patient will neglect his oral hygiene. How then could the level of anxiety be assessed in the clinical setting? Self-administered questionnaires have been developed to assess psychological stress, life events and their impact on depression, anxiety, and coping style (Svanborg et al. 1994, Kurer et al. 1995, Monteiro da Silva et al. 1996, 1998, Moss et al. 1996, Genco et al. 1999). Specialized questionnaires need scoring, however, which may be too time consuming in a busy clinical practice. The aim of the present study was to investigate the influence of anxiety, measured by one single question, on gingival inflammation and periodontal disease in non-smokers and smokers.

Material and Methods

Subjects

The participants were 144 subjects with untreated periodontal disease, 30–40 years of age, 65 women and 79 men, mean age 36.2 (± 2.8 SD) years. The subjects were a random population sample drawn from the registry file of all inhabitants of the Stockholm area, as previously described by Söder et al. (1994). The initial sample consisted of 3273 people and of these 1681 participated, 840 men and 841 women. A dental investigation of these 1681 subjects showed that 289 had an untreated periodontitis, with at least one site with probing depth $\geqslant$5 mm. These subjects were offered a complete clinical examination and treatment. 144 subjects agreed to participate, and these subjects are included in the present study. The healthy control group was randomly selected and comprised of 26 subjects, 16 women and 10 men, mean age 35.4 (± 3.5 SD) years, without signs of periodontal disease (Söder et al. 1994).

The subjects were in good general health as assessed by a health questionnaire. Subjects with a self reported psychiatric disorder, or psychotic medications were not included.

Table 1. Number of subjects, non-anxious, anxious, females, males, non-smoking and smoking subjects in the AP-group, CP-group and healthy controls

	AP-group ($n = 22$)	CP-group ($n = 119$)	Healthy ($n = 26$)
Non-anxious/non-smoking females ($n = 18$)	0	14	4
Non-anxious/non-smoking males ($n = 30$)	5	22	3
Anxious/non-Smoking Females ($n = 16$)	0	8	8
Anxious/non-smoking males ($n = 18$)	0	13	5
Non-anxious/smoking females ($n = 23$)	3	19	1
Non-anxious/smoking males ($n = 20$)	2	17	1
Anxious/smoking females ($n = 24$)	7	14	3
Anxious/smoking males ($n = 18$)	5	12	1

n, number of subjects; AP, aggressive periodontitis; CP, chronic periodontitis.

Ethics

The subjects gave their informed consent to participate in the study. The study was approved by the Ethics Committee at Huddinge Hospital, Huddinge, Sweden.

Questionnaire

Before the clinical examination all subjects filled in a 78-item questionnaire. The questionnaire concerned the last visit to the dentist, self-reported evaluation of periodontal health, smoking habits, marital status and use of dental home care devices. The questionnaire contained one single question concerning anxiety, namely ''do you feel anxious in your every day life'' with the response alternatives, (1) no, never, (2) yes, sometimes and (3) yes, often. Only six subjects reported that they often had anxiety. The two anxiety response categories were therefore collapsed into one ''anxious'' category, while all those who reported no anxiety were clarified as ''non-anxious''. Subjects were classified as smokers or non-smokers. Smoking was quantified by number of cigarettes smoked per day.

Clinical examination

The subjects were clinically examined. The following indices were measured on each tooth: plaque index (Silness & Löe 1964), gingival index (GI), (Löe & Silness 1963), number of pockets $\geqslant$5 mm and number of teeth excluding third molars. Probing depth was determined with a standard probe (Hu-Friedy, PCPUNC 15 Chicago, IL, USA), and recorded to the nearest higher millimetre at six sites of each tooth (mesio-buccal, mesio-lingual, mid-buccal, disto-buccal, disto-lingual and mid-lingual). The quantification of periodontal disease severity was based on pocket depth. The periodontitis subjects were divided into two groups; an AP group with $\geqslant$20 sites with pockets $\geqslant$5 mm and a (CP) group with $<$20 sites with pockets $\geqslant$5 mm. The healthy control group had no pockets $\geqslant$5 mm.

Statistical analysis

Analysis of variance (ANOVA) and differences between data sets with a probability of less than 0.05 were regarded as significant, and means ± SD were given. The Fisher's exact probability *t*-test was employed to determine the significance of differences between the

Table 2. Plaque index (PLI), gingival index (GI) and sites with probing depth $\geqslant$5 mm (PD) (mean ± SD), in non-anxious, anxious, non-smoking and smoking subjects with periodontitis (chronic-(CP)/aggressive periodontitis (AP)

	Non-anxious non-smokers ($n = 41$) mean ± SD	Anxious non-smokers ($n = 21$) mean ± SD	*p*-Value	Non-anxious smokers ($n = 42$) mean ± SD	Anxious smokers ($n = 38$) mean ± SD	*p*-Value
PLI	0.9 (0.5)	1.1 (0.7)	NS	0.9 (0.4)	0.9 (0.4)	NS
GI	1.9 (0.5)	2.1 (0.3)	NS	1.9 (0.5)	2.1 (0.5)	NS
Sites PD$\geqslant$5 mm	9.9 (6.4)	7.9 (4.8)	NS	10.7 (7.4)	16.6 (17.4)	$<$0.05

NS, not significant; SD, standard deviation; *n*, number of subjects.

Table 3. An analysis of covariance (ANCOVA), gingival inflammation (GI) of diagnostic group (aggressive (AP)-chronic periodontitis (CP)-healthy controls) (mean ± SD), respectivily, non-anxious and anxious subjects, when controlling for smoking

	AP ($n = 22$) mean ± SD	CP ($n = 122$) mean ± SD	Healthy controls ($n = 26$) mean ± SD	DF	F	p-Value	Non-anxious ($n = 92$) mean ± SD	Anxious ($n = 76$) mean ± SD	DF	F	p-Value
Gingival inflammation	2.36 (0.43)	1.97 (0.45)	1.44 (0.48)	2.163	27.22	<0.00	1.87 (0.54)	2.03 (0.48)	1.163	6.69	<0.01

n, number of subjects; SD, standard deviation.

non-anxious and anxious subjects. The data analysis was performed using the statistical packages of SPSS 9.0. (SPSS Inc., Chicago, IL, USA) and Stat View 5.0.1 (SAS Institute Inc. SAS Campus Drive Cary, NC 27513, USA). The Mann-Whitney U-test was used to determine the significance of difference between the sites with ⩾5 mm in smokers and non-smokers. Analysis of covariance (ANCOVA), controlling for smoking was performed to compare gingival inflammation between groups, as well as evaluating the potential correlation of anxiety and gingival inflammation.

Results

Of the 144 subjects with untreated periodontitis, 122 subjects had chronic periodontitis (CP-group) and 22 subjects had aggressive periodontitis (AP-group). Non-anxious, anxious, females, males, non-smoking and smoking subjects with AP-group, CP-group and healthy controls are shown in Table 1. In the AP-group, 12 of the 22 subjects were anxious smokers (Table 1). The AP-group had significantly more anxious smokers compared with non-anxious smokers ($p < 0.05$, Fisher's exact probability *t*-test). Number of teeth did not differ between any of the groups.

In the AP-group there were 17 smokers who smoked a mean 17.2 (± 5.5 SD) cigarettes/day for a mean smoking duration of 17.8 (± 6.1 SD) years. The 64 smoking subjects in the CP-group had smoked for 17.4 (± 7.3 SD) years at a rate of 17.6 (± 8.6 SD) cigarettes/day. In the healthy control group there were six smokers who smoked for 23.3 (± 6.6 SD) years at a rate of 11.6 (± 5.1 SD) cigarettes/day. The anxious subjects had smoked for 19.3 (± 6.7 SD) years at a rate of 16.7 (± 6.7 SD) cigarettes/day. The non-anxious subjects had smoked for 16.5 (± 7.2 SD) years at a rate of 17.5 (± 9.1 SD) cigarettes/day. Smokers had a mean rank of 95.51 sites with probing depth ⩾5 mm and non-smokers 72.07. The difference was statistically significant ($p < 0.002$).

Anxious smokers with periodontits had significantly more sites with pockets ⩾5 mm, compared with non-anxious smokers, ($p < 0.05$) (Table 2). Furthermore, anxious subjects in the AP-group had an average of 37.2 (± 17.5 SD) sites with probing depth ⩾5 mm compared with 24.8 (± 5.3 SD) ($p < 0.05$) for non-anxious subjects.

Anxious subjects had a significantly higher GI than non-anxious subjects, after controlling for smoking ($p < 0.01$) (Table 3). The anxious non-smokers in the CP-group had an average of GI, 2.1 (± 0.3 SD) compared with the non-anxious subjects 1.8 (± 0.4 SD). The difference was statistically significant, $p < 0.05$. The mean GI of healthy anxious non-smokers 1.6 (± 0.4 SD), was significantly higher than that of the healthy non-anxious non-smokers 1.2 (± 0.4 SD), $p < 0.05$.

Discussion

In this study of markers of periodontal disease, higher levels of self reported every day anxiety were associated with more deep pockets in smokers, and with more gingival inflammation in non-smoking subjects without deep pockets. This is in line with a series of previous reports, suggesting that almost any kind of anxiety or stress will affect the condition of the gingiva (Marcenes & Sheiham 1992, Monteiro da Silva et al. 1998, Genco et al. 1999, Hugoson et al. 2002, Vettore et al. 2003).

Smoking is a well-known risk factor for periodontal disease and smoking, stress, anxiety and depression are closely connected (Glassman 1993, Hall et al. 1993, Kendler et al. 1993, Tamburrino et al. 1994, Wang et al. 1994, Moss et al. 1996, Genco et al. 1999). In our study, periodontal disease and gingival inflammation were more severe in anxious smokers compared with non-anxious smokers, regardless of the amount of dental plaque. Thus, anxiety might influence the severity of periodontal disease in smokers.

Our finding that anxious subjects had significantly higher GI than non-anxious subjects, after controlling for smoking, resemble the finding of Kurer et al. (1995), who reported higher levels of gingival inflammation in general dental patients with more anxiety. However, in our periodontally healthy non-smokers, a higher degree of gingival inflammation was found in the anxious than in the non-anxious subjects. Whether the association between anxiety and gingival inflammation is because of impairment of the immune system, or a tendency to neglect oral hygiene among those who are anxious cannot be decided on the basis of the present investigation, but should be further studied. However, it is interesting in this context that the

amount of plaque, (which may reflect hygiene) did not differ between anxious and non-anxious subjects. This suggests that immune impairment may be the more important factor. The present study thus shows an association between smoking, anxiety and periodontal disease. It is possible that anxiety and stress have an adverse effect on the immune response and, therefore reduce resistance to periodontal disease.

It should be noted that in our study, we measured anxiety in every day life with one single question, and no differentiation between various kinds of anxiety was made. One simple question concerning anxiety, in the clinical setting, can thus be successfully used to identify patients with an increased risk of periodontal disease, indicating different needs for periodontal maintenance care.

In conclusion, results of the present study, suggest that self-reported anxiety was associated with an adverse affect on the gingiva. Anxiety seemed to be associated with increased severity of periodontal disease in smokers.

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