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Stress and periodontal disease

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© 2007 The Authors. Journal compilation © 2007 Blackwell Munksgaard **Abstract:** Stress is an association of physiological and psychological reactions of a person confronted to a change of situation he cannot face. The relationship between stress and any disease is explained by hormonal modifications and behavioural changes induced by the stress. The evidence of such an association between stress and periodontal disease will be evaluated. The purpose of the present review article is to differentiate between old feelings and knowledge, and present findings which show that a lot of prospective studies are still needed for a more defined role of stress and periodontal disease.

Key words: burnout; coping; immune system; periodontal disease; stress

Introduction

Periodontitis is a multifactorial disease (1, 2). Dental plaque which harbours specific periodontal pathogens is its primary actiological factor. In addition several risks and susceptibilities have been associated with periodontitis, like systemic diseases, some genetic polymorphisms, socio-economic or educational status, tobacco smoking and psychological stress (3, 4). Chronic stress is commonly thought to have a net negative effect on the efficacy of the immune response, leading to an imbalance between host and parasites, and consequently resulting in periodontal break-down (5). For necrotizing periodontitis, stress has been shown to represent a secondary actiological factor (6, 7).

Several clinical studies have investigated the possible relationship between psychological stress and periodontitis and have suggested that stress may play a role in the development of periodontal disease (8–12). Furthermore, in a longitudinal study, Linden *et al.* (13) suggested a relationship between occupational stress and the progression of periodontitis. In an exploratory case–control analysis of psychosocial factors and adult periodontitis, individuals with prevalent disease were found to report higher levels of social strain than individuals without prevalent disease (14). In that study, a strong relationship was also found between prevalent disease and elevated antibody levels to *Bacteroides forsythus* among individuals with greater evidence of depression.

The purpose of this article is to find in the literature evidences of this relationship between stress and periodontal disease.

Definitions

Stress should be considered as a dynamic and interactional process of intricate systems with formulations and operationalization of the components at various levels (15).

Figure 1 shows the place of the different definitions in the dynamic response of stress. Definitions are important to understand stress because they are often misused. Stress originates from a latin word: 'stringere' which means 'tight', 'strained'. It was reintroduced by Claude Bernard (1813-1878) who described the outside milieu and the inside milieu and the inter-relations existing between these two milieus. Later, Cannon (16) and Selye (17) gave more precisions to the definition of stress. Cannon described stress as the result of the homeostasis and showed the influence of the sympathetic system. Selye explained the important hyperactivity of the adrenal-cortex that stress had and proposed the following definition: a response state of the organism to forces acting simultaneously on the body which, if excessive (straining the capacity of adaptive processes beyond their limits) led to diseases of adaptation and eventually to diseases of exhaustion and death.

Today stress is defined as physiological and metabological perturbations caused by various aggressive agents and the psycho-physiological response of an organism facing the perception of a challenge or a threat (18).



Fig. 1. Dynamic response to stress.

The stressors are all situations that can constitute aggressions or feel like that. Various origins can take place: physical or psychological, from the every day life (daily hassles) to certain incidents. There is a scale made by Holmes and Rahe (1967) (19) in which all possible stressors received a value. For example:

Death of spouse	100
Divorce	73
Death of close relative	63
Sickness	53
Marriage	50
Loss of work	47
Conjugal reconciliation	45
Retiring	45
Birth	39
To move in a new house	20
Holidays	13
Christmas	12

The stress reactions are all the biological, physiological or behavioural expressions that appear under certain conditions.

The coping is the effort to try to reduce, control or tolerate the state of stress. It needs adjustment, adaptation and confrontation strategies.

There are different coping strategies, described here:

- 1 Resigned coping: avoidance, escape, social withdrawal, resignation, self-pity, rumination.
- **2** Active coping: response control, situation control, positive self-instruction, minimization.
- **3** Distractive coping: distraction, search for self-affirmation, substitute gratification, need for social support.
- 4 Defensive coping: denial of guilt, self-blame, self-aggrandizement.
- 5 Coping with aggression and drug use: aggression, drug use.

These coping strategies may be used in generalized stressful situations. Individuals use coping measures as a response to stressors to reduce its intensity or to overcome stress altogether.

A successful coping is when the subject has the feeling to face the stress, he keeps the control of the given situation. An unsuccessful coping is when the subject is submerged by stressor agents and is in the reaction of stress.

The reaction of stress is an imbalance between the demands perceived by the subject and the capability to face them. On the somatical level, hormonal and metabolical modifications (acceleration of the cardiac rhythm, hypertension, hypersudation, ...) appear. On the psychological level, the patient has an exacerbation of vigilance and is in an emotional state (strain, feeling of discomfort) with agitation or psychomotricity inhibition.

The state of stress consists of an alarm phase, a stage of resistance and a stage of exhaustion. During the 'alarm stage', some physical adaptations occur like: blood hypertension, hypersudation and hyper-function of the sympathetic and corticotrope systems. The brain and the muscles are stimulated but sexual and thyroid growth hormones are inhibited. There is a behavioural adaptation with disorderly behaviours, thoughtless engagements, lapse of memory, anxiety state and panic. During the 'resistance stage', there is an increasing activity of the noradrenergic and corticotropic systems. The subject is in a state of stress, in heterostasis. At this stage, the development of psychosomatical and psychic sickness appears like: cardio-vascular disease, digestive, dermatological and immune disorders. During the 'exhaustion stage', the resources are exhausted and the patient is giving up, in certain cases there is a vital risk. That stage is more often called the 'burn-out', it is a depressed state. Some patients having an acute stress are directly at this stage so called 'post-traumatic stress syndrome'.

Stress and the immune system

Experimental studies made on mice show the effect of an emotional or a physical stress (20, 21). As consequence, the levels of the tumour necrosis factor are diminished and the leucocytes response modified. Many human studies have demonstrated the way major events can influence the immune response (7, 22, 23).

In a review, Biondi (2001) (24) shows the impact of various psychosomatic conditions on the immune system. A complicated network exists between immunology, psychology, neurology and endocrinology and seemed to show the importance of psychological vulnerability to face stress (25) (*Fig. 2*).

There are two main axes of how stress influences the immune system. Psychosocial stress stimulates the brain, at this level maladaptative coping enhances the stimulation and an adaptative coping inhibits this stimulation (11, 26). The autonomic nervous system leads to prostaglandins and prote-ases secretions. The hypothalamo-pituitary-adrenal axis (HPA) leads to a production of glucocorticoids (cortisol). The function of cortisol is to depress the immune system by diminishing the IgA and IgG secretions.

Stress and behaviour changes

Already in 1969 Ringsdorf and Cheraskin (27) discovered that mental stress could influence life-style and dental hygiene habits. This influence was not only the decrease of the fre-



Fig. 2. Impact of psychosocial stress [Genco et al (26)].

quency as well as the quality of the dental hygiene but also the increase of tobacco use and alcohol consumption, changes in food habits leading to a diminution of the general health. This was also recently confirmed by Suchday *et al.* (28).

As the bacterial invasion is facilitated (poor oral hygiene) and the immune response becomes weaker it is logical to assume that periodontal disease will be enhanced by stress (*Fig. 3*).

Stress and periodontal disease

As stress influences the immune system and also changes the behaviour, it is extremely important to analyse if its influence is the same on the different forms of the periodontal disease.



Fig. 3. Psychosocial stress influences on periodontal disease [Loos *et al.* (29)]

Gingivitis

Stress diminishes saliva flow and increases dental plaque formation (30). Some patriots during the spanish war spit on their executioners to prove and show that they were not afraid to die.

Emotional stress modifies the saliva pH and its chemical composition like the IgA secretion (27, 31).

A series of studies made by Deinzer *et al.* (32–35) examine the impact of academic stress by students at university during their examination period on periodontal health. Academic stress was shown to be a risk factor for gingival inflammation with increasing crevicular interleukin-1 β levels and a diminution of the quality of the oral hygiene. In a pilot study in 1998, Axtelius (36) showed the presence of cortisol in gingival crevicular fluid. A recent study confirm the fact that the concentration of cortisol in the gingival crevicular fluid is higher by person showing depression signs (37).

Necrotic periodontitis

Psychosocial factors are predisposing factors for the development of necrotic periodontitis.

The first reports were written about mouth pain among the soldiers of Alexander the Great. The first scientific observations dated from the late 1940s: young men often searched for help on Mondays after the weekend activities not unlike the circumstances of the tranches: lack of sleep, food and oral hygiene, and the stress inflicted by too much alcohol and too many cigarettes. A few young girls were also searching for help with their gums, but the reason was different: their menstruation was overdue. In the less secularized society of that time, the consequences could be social disaster for the girl (38).

The first studies showing this influence were made by Pindborg (1951) (higher number of necrotic periodontitis during military service) (39) and in 1963–1964 by Giddon (more necrotic periodontitis in college during examination period) (40, 41). Other studies like that of Cohen-Cole in 1983 (6), have shown the influence of psychosocial factors. The main risk factors for necrotic periodontitis and previous episode are: past episode of necrotic periodontitis, bad oral hygiene, bad sleep, unusual emotional stress, tobacco, alcohol, bad alimentation and recent illness. Many of those factors are often related to stress.

Aggressive periodontitis

Page *et al.* (1983) (42) describes the aggressive periodontitis as a particular disease and established the link existing between aggressive periodontitis and psycho-social factors and loss of appetite. In a case–control study in 1996, Monteira da Silva (43) showed that people with aggressive periodontitis were more depressed and more socially isolated people than people with chronic periodontitis or a control group. Kamma and Bae-hni (44) made a study to evaluate the clinical and microbiological status of patients with early onset periodontitis who had received supportive periodontal care every 3–6 months for a period of 5 years following active periodontal treatment. The results showed that supportive periodontal care was effective, but some sites in some patients were still progressive. These variables were related to the progression of the disease: *Porphyromonas gingivalis, Treponema denticola*, total bacterial load, number of acute episodes, number of teeth lost, smoking and stress.

Those studies show the relationship existing between aggressive periodontitis and psychosocial stress.

Chronic periodontitis

Linden *et al.* (13) predicted the future attachment loss depending on the following criteria: age, socio-economical level, a less satisfactory professional life and a passive and dependant character. Axtelius (1998) (45) has suggested that patients with psychosocial strain and passive dependent traits did not respond as well as patients with less stressful psychosocial situation and with a rigid personality to periodontal treatment. Psychosocial stress associated with financial problems and distress are risk indicators to develop a periodontal disease (odds ratio: 2) (11).

The real relationship between stress and chronic periodontal disease is difficult to establish and more research needs to be done.

Periodontal treatment

Kamma and Baehni (44) found that supportive periodontal care was more effective in patients with aggressive periodontitis harbouring less stress.

Wimmer *et al.* (46) explain the influence of coping with stress on periodontal therapy and conclude that patients with maladaptative coping strategies have more advanced disease and poor response to a non-surgical periodontal treatment. Thus maladaptative behaviours, especially in association with other risk factors (like smoking) are of great importance in the medical history, treatment and maintenance of patients with periodontal disease (12). Gamboa *et al.* (47), show the influence of Emotional Intelligence (a measure of the coping mechanisms) on the initial responses to periodontal treatment in patients with chronic periodontitis. Reductions of dental plaque and gingival bleeding were positively correlated in patients having an 'active coping'.

Practical conclusions

Because of the better understanding of the stress dynamic and the progress made in the field of the psycho-neuro-immunologyendocrinology and also because of the impact stress has on the behaviour, it is clear that stress influences periodontal disease.

At which level and how exactly its influence is not fully understood, further studies are needed. However, changes in the every day practice can already be implemented.

It is very important to understand the patients' situation to help them to maintain a healthy periodontium. People who are socially isolated, having financial problems, feeling depressed or people having a passive coping strategy may be at risk (11, 13, 36, 45). The stress situation of the patients treated has to be registered. There are questionnaires measuring the level of the stress and the coping strategy. Patients are on a recall system in periodontal practice. The role of the dental specialists is to discuss lifestyle in a broader concept than just oral hygiene, they should be more psychologically oriented. To help patients to quit smoking is a part of the periodontal treatment. It would be of interest to study if reduced stress could prevent periodontal disease and improve the outcome of periodontal treatment. Should this be proven, then it should be mandatory for us to help patients to have less stress and, when needed, to refer them to a psychologist or other specialists in the field of stress medicine.

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