

■ **Review Article**

Interlink between stress and periodontal disease

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Abstract

Stress is a term that is commonly used today but has become increasingly difficult to define. It shares, to some extent, common meanings in both biological and psychological sciences. Stress typically describes a negative concept that can have an impact on one's mental and physical well-being, but it is unclear what exactly defines stress and whether or not stress is a cause, an effect, or the process connecting the two. An interrelationship between stress and periodontal disease has been suspected for centuries, but evidence to explain the connection has only elucidated in the past few decades. The purpose of this review article is to provide the progression of evidence present in the field of stress and periodontal disease for dental professionals so that they can better understand the link between stress and periodontal diseases.

Keywords: stress, immune system, periodontal disease, behavioural changes

Introduction

Periodontitis is a multifactorial disease and research promoting the identification of risk factors are gaining importance for treatment and prevention. It is suggested that stress, depression and ineffective coping may contribute to development of periodontitis.¹ Chronic stress may tend to have a net negative effect on the immunological response of body leading to an imbalance between host and parasites and further resulting in periodontal breakdown.²

Several clinical studies have investigated the possible relationship between psychological stress and periodontitis and have suggested that stress may play a role in development of periodontal disease.³⁻⁶

Stress originates from a latin word "Stringere" which means 'tight', 'strained'⁷. Hans selye coined the term "stress" and in 1950, Selye published a book known as "Relief from stres" which had over 1000 pages

and more than 5000 references.⁷ According to Selye, Stress is defined as the sum of all non-specific changes caused by function or damage , including the biologic phenomenon necessary for re-establishment of normal resting state.⁷

Today stress is defined as physiological and metabolic perturbations caused by various aggressive agents and psycho-physiological response of an organism facing the perception of a challenge or a threat.⁸

The purpose of this review article is to provide the literature evidences present in the field of stress and periodontal disease for dental professionals so that they can better understand the link between stress and periodontal diseases.

Role of stress on immune system

Various types of stress such as physical or emotional stress have shown its effects on experimental animals such as mice.⁹⁻¹² As a result, there is a diminished levels of tumour necrosis factor and response of leucocytes are modified. Several human studies have shown how major events influence the immune response to a great extent.^{13,14}

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The various psychosomatic conditions and its impact on the immune system in body has been explained by Biondi (2001).¹⁵ A complex interconnection prevails among immunology, psychology, neurology and endocrinology and explains the importance to meet stress demands from a psychological point of view.

The role of stress on immune system can be explained by two main axes. Brain is stimulated by psychosocial stress and at this level, it is enhanced by maladaptive coping whereas adaptive coping inhibits this stimulation.^{16,17}

The autonomic nervous system releases prostaglandins and proteases and the hypothalamo-pituitary-adrenal axis releases glucocorticoids (cortisol) which depresses the immune system by diminishing the IgA and IgG secretions.

Role of stress on behavior changes

A study conducted by Ringsdorf and cheraskin has shown that mental stress could influence the dental hygiene habits and life-style of the person. This influence has deleterious effects on general health through an increase in alcohol consumption and usage of tobacco and even a decrease in quality of dental hygiene.⁸

This influence was also confirmed by study done by Suchday et al¹⁸ recently.

Due to poor oral hygiene and lower immune response, stress may enhance the effects of periodontal disease in these individuals.

Stress and microbiology of periodontal disease

Microorganisms have the ability to recognize the hormones that are found within the host and use them effectively to adapt to their environment. This supports the idea that bacterial infections may develop in response to stress. In an invitro study done by Roberts et al (2002) to determine whether noradrenaline and adrenaline which are released during human stress responses, signals to alter the growth of 43 microorganisms found within subgingival microbial complexes.¹⁹

The researchers found that 20 species within the subgingival biofilm significantly grew from inoculation

with noradrenaline and 27 species significantly grew when adrenaline was introduced. There was also a marked difference in the growth response within bacterial species and within and between microbial complexes. They concluded that this variation may influence the in vivo composition of the subgingival biofilm in response to stress-induced changes in local catecholamine levels and thus play a vital role in the etiology and pathogenesis of periodontal diseases.

Shortly after this research was published, it was also discovered that chronic psychological stress has a marked impact on the localized immune response to *Porphyromonas gingivalis*.²⁰

These findings are of great importance to the field of stress research because *P. gingivalis* is the most often cited periodontal pathogen implicated in the link between cardiovascular disease and periodontal disease.^{21, 22}

Role of stress on gingivitis

Stress has shown to reduce the saliva flow and it increases the formation of plaque. A study has shown that emotional stress modifies pH and its IgA secretion.⁸

A series of studies done by Deinzer et al, examine the role of academic stress during their examination period on periodontal health. Academic stress as shown to be a risk factor for gingival inflammation with increasing crevicular interleukin-1b levels and a decrease in the quality of the oral hygiene.²³⁻²⁶

In a pilot study done by Axtelius et al in 1998 showed the presence of cortisol in gingival crevicular fluid.²⁷

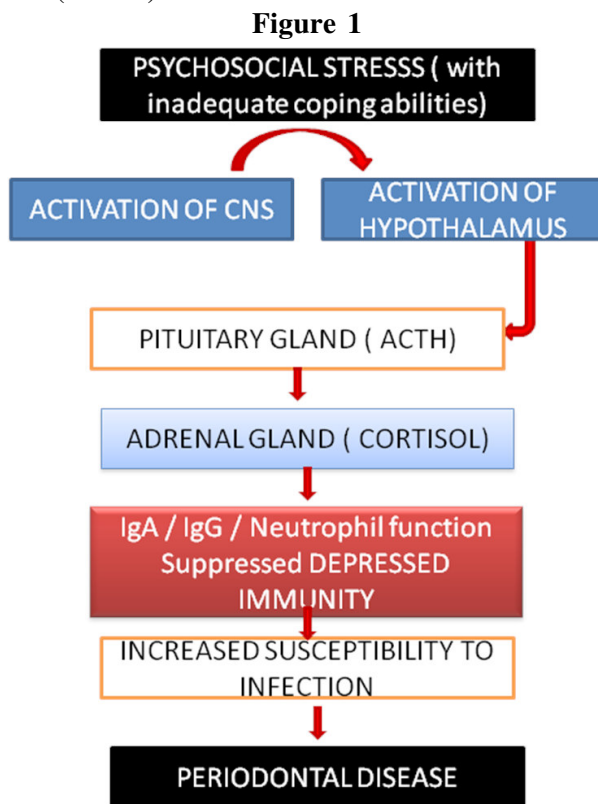
A study conducted by Johanssen et al also confirmed that persons with depressive signs show a elevation in cortisol levels in gingival crevicular fluid.²⁸

Stress and its role in periodontal disease

The mechanisms to explain how stress may affect periodontal disease is not yet clearly understood; however there are 2 pathways which have been proposed how stress plays a role in periodontal disease. These include the biologic model and the behavioral model.²⁹

The biologic model proposes that periodontal disease may be biologically moderated through the hypothalamic-pituitary-adrenal (HPA) axis to promote the release of corticotropin-releasing hormone from the hypothalamus and glucocorticosteroid from the adrenal cortex. Figure 1 illustrates the following cascade of events:

1. Under a potential stressful situation, hypothalamus is activated.
2. The hypothalamus induces secretion of corticotropin-releasing hormone (CRH) which flows to the pituitary gland to stimulate the secretion of adrenocorticotropic hormone (ACTH).



Source: Genco RJ, Ho AW, Kopman J, et al. Models to evaluate the role of stress in periodontal disease. *Ann Periodontol* 1998;3:288-302.

3. ACTH enters the peripheral blood flow, and induces the adrenal cortex to secrete cortisol and other steroids. Increased level of these steroids results in immunosuppression and reduced resistance to infection. This is done by suppressing IgA, which protect by preventing initial colonization of periodontal

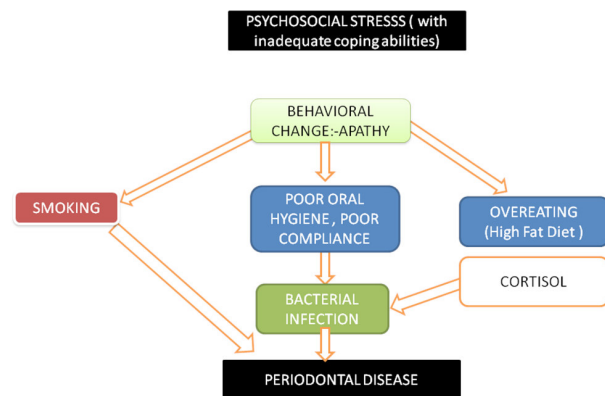
organisms, and IgG which exert protection by covering the periodontal bacteria with a type of coating that allows the phagocytes to bind and ingest the invading bacteria in addition to suppressing neutrophil functions.

All of these immune processes are important in protection against infection by the colonization of periodontal pathogens.

4. This increases susceptibility to periodontal infection resulting in destructive periodontitis.

The behavioral model (Figure 2) suggests that psychosocial stress may influence behavioral changes which affect health behaviors (i.e., smoking, poor oral hygiene, poor compliance). Additionally, stress leads to overeating, especially high fat diets which increases cortisol production.

Figure 2
 Behavioral model to explain the role that stress has in influencing the onset and progression of periodontal disease.



Source:- Genco RJ, Ho AW, Kopman J, et al. Models to evaluate the role of stress in periodontal disease. *Ann Periodontol* 1998;3:288-302

The first studies showing this influence were done by Pindborg (1951) (higher number of necrotic periodontitis during military service) and in 1963–1964 by Giddon (more necrotic periodontitis in college during examination period).^{30,31} Other studies have shown the influence of psychosocial factors.³² The main risk factors for necrotic periodontitis are: past episode of necrotic periodontitis, bad oral hygiene, unusual emotional stress, bad sleep, tobacco, alcohol and

recent illness. Many of the factors mentioned above are often related to stress.

Role of stress on aggressive periodontitis

According to Page et al (1983), aggressive periodontitis is described as a particular disease. He established the interconnection existing between aggressive periodontitis, psycho-social factors and loss of appetite.³³

One study by Monteiro da Silva et al (1996) showed that people with aggressive periodontitis were more depressed and socially isolated people than people with chronic periodontitis or the control group.³⁴

These studies show the interconnection that exists between aggressive periodontitis and psychosocial stress.

Role of stress on chronic periodontitis

Linden et al predicted the future attachment loss depending on the following criteria: age, socio-economical level, less satisfactory professional life, passive and dependant character.³⁵

A study conducted by Axtelius (1998) showed that patients with psychosocial strain and passive dependent traits did not respond to treatment when compared to patients with less stressful psychosocial situation and a rigid personality.³⁶

The exact relationship between stress and chronic periodontal disease is unknown and therefore, more studies are needed to investigate the relationship between stress and chronic periodontitis

Role of stress on periodontal treatment

A study done by Kamma and Baehni showed that supportive periodontal care was more effective in less stressful patients with aggressive periodontitis.³⁷ Wimmer et al explained the influence of coping with stress on periodontal therapy and concluded that patients who had maladaptative coping strategies have more advanced disease and those patients showed a poor response to non-surgical periodontal treatment.³⁸

Gamboa et al showed the influence of emotional intelligence which was used as a measure of the coping mechanism in patients with chronic

periodontitis on the initial responses to periodontal treatment. The results of this study showed a decrease in plaque formation and reduction in bleeding on probing in patients with active coping strategy.³⁹

Conclusion

It is widely acknowledged that assessment of risk for periodontal disease is the cornerstone of contemporary periodontics. Based on the literature review, it can be seen that a positive relationship was observed between stress and periodontal disease. Evaluating patients' for stress is an important component in assessing risk for periodontal disease, and may be important in pointing patients in the direction of greater systemic health. It is likely that systemic diseases that are associated with periodontal disease such as diabetes, cardiovascular disease, preterm delivery, and osteoporosis may share stress as a common risk factor.

Stress management may be included in the part of treatment considerations for the patients. Future research should focus on developing targeted interventions that periodontists could use to improve their patients treatment outcomes and thus, their quality of life during treatment.

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