The impact of emotional stress on periodontal disease: The summery of evidence

Aditi Ghosh, Balaji R, Anindya Priya Saha, Indrasri Das, Priyanka Yadav and PK Giri

DOI: https://doi.org/10.22271/oral.2022.v8.i2a.1479

Abstract
Stress represents a set of non-specific changes, both emotionally and physically, triggered by some unwanted stimuli. Stress has been accepted as a ‘risk factor’ for periodontal disease recently. The hormonal and behavioral changes induced by the emotional stress explains the relationship between stress and periodontal disease. This review article enlightens the influence of stress on periodontal pathology.

Keywords: Stress, anxiety, periodontal disease

1. Introduction
Stress is almost an integral part of modern urban life style. The term arises from a Latin word ‘stringere’, meaning ‘tight/ strained’. Stress represents a state of reactions, which tends to disturb the normal state of activities of an organism by unwanted stimuli, which could be internal or external, emotional or physical and which a person tries to avoid [1]. Selye (1976) defined stress as a state of response to physical or emotional forces beyond their adaptive capacity that lead to disease of adaption and eventually exhaustion and death [2]. Hence, stress is the problem of mal-adaptive coping strategy in response to a ‘perceived threat’ (Breivik, 1996) [3]. Selye furthermore explained it as the sum of all non-specific changes resulted by a challenge or damage, including the biological events necessary for re-establishment of normal resting state or condition [4]. Hence, Stress can be viewed as a process with both psychologic and physiologic components (Boyapati, 2007) [4]. The effects of stress reaction include emotional upsets, like impaired cognition, depression, anxiety etc. and systemic illness involving CNS, CVS and endocrinal changes. The stimuli, those elicit the stress response, are referred to as stressor. The psycho-social stressors were classified by LeResche and Dworkin (1976) as ‘Major life events’ and ‘Minor daily hassels’ [5]. Again, Holmes and Rahe (1967) developed a scale to measure stress in terms of life changes (Table 1) [6].

Periodontal disease is a chronic inflammatory disease of mixed microbial origin involving tooth-supporting tissues and structures, which results progressive periodontal loss and eventually tooth loss. Modern research already established that it isn’t the bacteria, but mediators of inflammation, which brings about the tissue destruction largely. Hence even though plaque represent the prime etiologic factor for development of inflammatory process, host inflammatory response plays pivotal role in the progression of periodontal disease. Again, some biological or behavioral factors, including ‘stress’, influence the inflammation and subsequent tissue destruction [7]. These are referred to as ‘periodontal risk factors’, the existence of which favors the severity of disease.

As stress affects host immunity, and host’s immuno-inflammatory response is most critical determinant of periodontal disease, stress is thought to influence the course and severity of periodontal disease also [8]. Historically, De Marco (1976) coined the term ‘periodontal stress syndrome’ for the soldiers involved in Vietnam War, who were suffering from severe gingivo-periodontal infection and also were under emotional stress related to warfare [9].
Table 1: Life events and their score for stress

<table>
<thead>
<tr>
<th>Life events</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demise of spouse</td>
<td>100</td>
</tr>
<tr>
<td>Marital separation</td>
<td>65</td>
</tr>
<tr>
<td>Death of close friend/family member</td>
<td>60</td>
</tr>
<tr>
<td>Personal illness</td>
<td>53</td>
</tr>
<tr>
<td>Marriage</td>
<td>50</td>
</tr>
<tr>
<td>Frustration from job/Loss of employment</td>
<td>47</td>
</tr>
<tr>
<td>Retirement</td>
<td>43</td>
</tr>
</tbody>
</table>

2. The link between stress and periodontal disease

Psychologic conditions, such as stress, were recommended as ‘a risk indicator for periodontal disease’ by Genco in 1996 [10]. As mentioned earlier, stress alters host response by affecting neuro-endocrinal control. In addition, it influences daily habits that furthermore predispose periodontal disease. The most documented relationship is that between stress and Acute Necrotic Ulcerative Gingivitis (ANUG) among students before examination or soldiers in war. Despite their well-known connection it has been elusive to confirm the relation between stress and different forms of periodontal disease, as the etio-pathogenesis of latter is a multi-factorial action and role of individual factor (e.g., stress) is still difficult to define [11]. Plus, it is notable to remember that although stress predispose a subject to a more advanced destruction from periodontal inflammation, it alone cannot evoke periodontal disease in absence of pathogen, microbial tooth deposit, i.e. plaque, remains the essential factor, and stress only aggravates the periodontal involvement already existing [12]. Individuals with a more positive life style (depending on relationship and employment status) and less negative life events are seen to report a less destructive disease process [13]; and the effect not merely depends on the presence of stressful events, rather it depends on how one deals with those conditions.

2.1 Altered immunity

In a schematic model, Genco et al. (1998) explained how stress triggers a cascade of events in both autonomic Nervous system (ANS), and central nervous system (CNS) and hypothalamic-pituitary-adrenal (HPA) axis, resulting in impaired immune response, and aggravated periodontal tissue destruction; which all together worsen the periodontal disease status [14](figure 1).

When ANS is activated, it results the secretion of catecholamines (epinephrine and nor-epinephrine) from adrenal medula, which promotes the production of post-anoïds and proteases in tissue, and thus favoring the periodontal tissue destruction.

Again, activation of HPA axis and CNS results secretion of cortico-trophin releasing hormone (CRH) from hypothalamus, that stimulate release of adreno-cortico-trophic hormone (ACTH) from anterior pituitary, which up-regulate the production of glucocorticoid hormones, chiefly cortisol, from adrenal cortex into circulation. Immune-inflammatory response is suppressed by the higher level of cortisol, as it interferes with both cellular immunity (by inhibiting PMNL activity and IgA/G production respectively). Furthermore, cortisol is seen to reduce collagen synthesis in-vitro, and sulfated GAG synthesis in-vivo. In addition, cortisol increases the glucose level in tissue, rendering it susceptible for microbial infection (figure 1).

Hence, stress influences the neuro-endocrinal control for immune response, which suppresses anti-microbial resistance of host and also affects the structural integrity of tissue, and all these aggravate the severity of periodontal disease, if already existing.

Fig 1: Stress induced altered immune-inflammatory response and periodontal disease.

2.2 Altered behavior

Emotional stress negatively impact daily habits, like oral hygiene practice, diet and others, which all together affect periodontal health (figure 2).
2.2.1 Oral hygiene negligence
Mental status of a subject is an obvious factor for orientation of maintenance of oral hygiene. Patients with psychological disturbance exhibit increased plaque score due to their negligence toward hygiene maintenance [15].

2.2.2 Change in dietary intake
Emotional disturbances direct to behavioral changes like over-eating, or skipping the meals, or non-balanced diet; especially high lipid containing diet, which can induce increased cortisol production, and hence immuno-suppression. Affinity to diet with soft consistency and greater amount of refined carbohydrate increases plaque deposition from less vigorous mastication [16].

2.2.3 Smoking and other oral habits
Smoking and all harmful oral habits get increased by emotional disturbance and all those worsen periodontal health significantly [17]. Circulating nicotine results in (1) vasoconstriction, which causes lack of nutrients for periodontal tissue; and (2) immune-suppression.

2.2.4 Bruxism and para-functional habits
Stress and anxiety trigger bruxism which is detrimental to periodontal health by resulting repetitive occlusal trauma, though it is difficult to establish the claim by evidences [18].

2.3 Change in salivary flow
Stress and anxiety reduces salivary flow by sympathetic pathway resulting in a thick saliva, which favors plaque deposition. Besides, it induces change in its pH and composition, like IgA secretion, which favors microbial growth. Hence, anxiety and stress contribute to periodontal disease by enhancing microbial plaque formation via altering salivary secretion with ANS control (Gupta et al., 1966) [19].

2.4 Change in gingival circulation
As sympathetic stimuli constricts the periodontal vessels, and stress activates sympathetic control; Manhold et al. (1971) suggested that in continued and long-term stress, blood supply to tissue is diminished; which affects periodontal homeostasis [20].

2.5 Stress and periodontal microbiota
In an in-vitro study, Roberts et al. (2002) demonstrated that adrenalin and nor-adrenalin, which are released as a response to stress, signal to alter the growth of 43 microbial species seen within sub-gingival plaque [21]. Shortly after this, it was also found that chronic emotional stress has an impact on host response against Porphyromonas gingivalis [22]. Again, in a case-control study among person with active periodontal disease, Moss et al. (1996) showed that IgG for Tannerella forsythia count was higher among individuals more suffering from family, financial and job related stress [23]. These indicate that stress induces a shift in sub-gingival plaque biofilm, and microbial infections develop as a response to stress.

3. Review of literature
3.1 Stress and necrotizing ulcerative gingivitis/periodontitis (ANUG/NUP)
NUG/NUP is the most frequently studied periodontal disease in relation to predisposing psycho-social factors, as those are thought to possess definite immunological bearing; and stress is known to alter immune reaction. Pindborg (1951) reported higher incidence of necrotizing ulcerative gingiva-periodontal lesion during military service [24], and soon after Giddon (1964) showed the same among college students during examination [25]. Later other studies as that of Cohen-Cole (1983) [26] and Monterio et al. (1995) [27] also indicated role of emotional stress on ANUG. Shannon et al. (1969) [28] and Maupin et al. (1975) [29] found higher concentration of 17-hydroxy corticosteroid in urine of ANUG patients indicating the possible role of stress in its pathogenesis.

3.2 Stress and chronic periodontitis
The definitive correlation between emotional stress and chronic periodontitis is hard to establish, and still demanding more research work. Genco and co-researches (1999) evaluated the relation between financial strain and periodontal attachment loss [30]. They observed that persons with a ‘problem focused (practical)’ and better coping for managing strains from daily life performed better than patients those expressed a more ‘emotionally focused (avoidance)’ and poor coping to strain, and concluded that positive coping behavior can improve the periodontal health. After that, Croucher et al. observed a positive correlation between periodontal disease and major life events [13].

3.3 Stress and aggressive periodontitis
Page et al. (1983) first suggested a link between aggressive periodontitis and psycho-social factors including loss of
appetites [31]. Monatario et al. (1996) reported depression and loneliness as significant factor for aggressive periodontal disease [32]. In a case-control study by Kamma and co-workers (2003), evaluation of clinic-microbiological periodontal status among patients with early onset periodontitis, who had received supportive periodontal care every 3-6 months for 5 years following active periodontal therapy showed that stress was one of the co-factors for progression of disease at few sites in few patients [33].

3.4 Stress and periodontal therapy
Prognosis of periodontal therapy largely depends on one’s emotional stress level and ability to cope up with that stress. Axtellius (1998) observed that patients with psycho-social strain and passive dependent trait did not respond well to periodontal therapy [34]. Elter (2002) analyzing dental records of 1299 subjects, who previously underwent periodontal therapy, noticed that 85 subjects, who had suffered from depression also, had less favorable post-treatment outcomes compared to those without depression [35]. Kamma et al. (2003) reported that, in aggressive periodontitis, supportive periodontal therapy was more effective in subjects with lesser stress [33]. Wimmer et al. (2005) showed that patients with mal-adaptive coping strategy have a more advanced disease and poor response to non-surgical periodontal therapy, and concluded that this mal-adaptive behavior, especially with co-existing risk factors (like smoking) is a concern for prognosis and treatment for periodontal disease [36]. Gamboa et al. (2005) explained the influence of ‘emotional intelligence’ (used as a measure for coping) on early response to periodontal therapy in chronic periodontitis, and showed significant improvement of periodontal status in patients with active coping [37]. Positive cognitive behavioral therapy has been attempted to patients suffering from stress and anxiety and also having periodontal disease, as an adjunct to routine periodontal care, with promising results recently.

4. Conclusion
Stress represents a set of changes in response to perceived threat. Based on the literature review, now it can be concluded that emotional stress has a bearing on periodontal disease process. One with more stressful life events and maladaptive coping strategy suffers more destructive periodontal lesion. Stress itself cannot evoke the early inflammatory response, but it worsen severity of the disease, if already existing. Different stressful life events and individual active ‘coping’ skill to handle those stress are determinant for impact of stress on periodontal health; and with cognitive behavioral management, outcomes of periodontal therapy have been improved.

Hence, before making the treatment plan, it is necessary to evaluate a person’s emotional stress level for assessing the risk for periodontal destruction as well as success for the planned therapy. Finally, thinking beyond the oral cavity, a dentist must introspect the psycho-social issues, considering behavioral management with routine periodontal therapy.

5. References