Research Article

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Stress as A Risk Indicator for Chronic Periodontitis by Estimating Salivary Cortisol Level: A Clinicobiochemical Study

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ABSTRACT

Aim: The aim of the study was to scrutinize the relationship between psychological stress and periodontal disease with the use of questionnaire data and salivary cortisol level.

Method: The study was carried out on twenty patients. All the patients included in the study were suffering from psychological stress, and they also showed clinical features of periodontal disease. The clinical examinations were performed on the day after the psychologic evaluations which included anxiety and depression measurements. Saliva was collected and the cortisol level (stress marker) was measured using the ELISA test.

Results: A positive correlation was shown between the stress periodontitis and the cortisol level.

Conclusion: Stress and Cortisol level were correlated with measures of periodontal disease..

Keywords: Stress, chronic periodontitis, Salivary Cortisol.

INTRODUCTION

Periodontitis is a chronic inflammatory disease of the supporting tissues of the teeth caused by specific organisms or groups of specific organisms, resulting in progressive destruction of the periodontal ligament and alveolar bone with increase in the probing depth, recession, or both. The etiology and pathogenesis of periodontal disease are multifactorial. Multitudinous risk factors are involved like uncontrolled diabetes, smoking, specific infections, age, psychosocial stress and depression etc. Stress is a state of physiological or psychological strain provoked by adverse stimuli, physical, mental, or emotional, internal or external, which disturbs the functioning of an organism.[4] Socioeconomic status, type of occupation, work load, emotional disturbances, etc. have increased stress levels in the modern lifestyle.[5] Negative life events expressed as psychological stress is very common in day-to-day life, accentuating the relationship between the person and environment.[6]

Stress is said to influence the host defenses, exerting an immunosuppressive effect, increasing one's vulnerability to disease.[7-9] Cytokines(IL-1, IL-6, TNF-α) are potent activators of the hypothalamic-pituitary-adrenal (HPA) axis, thereby increasing the glucocorticoid secretion and suppress the further inflammatory response.[10,11] The role of stress on immune system can be described by two main axes. Brain is stimulated by psychosocial stress and it is enhanced by maladaptive coping whereas inhibited by adaptive coping.[12,13]

The autonomic nervous system releases prostaglandins and proteases causing the activation of HPA axis which releases glucocorticoids

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(cortisol) and thereby depressing the immune system by decreasing the IgA and IgG secretions. Chronic activation of the hypothalamic-pituitary-adrenal axis influences the initiation and progression of periodontitis through impairment of circulating cortisol and other glucocorticoids (GCs) that affect immune function.[13] Studies have shown a positive correlation between stress and periodontal disease.[14-17] The intention of this study was to investigate the role of stress in the periodontal disease by measuring the periodontal clinical parameters and the serum cortisol levels.

MATERIALS AND METHOD

Study population

The present study was conducted in College of Dental Sciences and Research centre, Ahmedabad. Twenty patients, both male and female, were included in the study.

Inclusion criteria

1. Age group 30-55years
2. Patients who were diagnosed with chronic generalized periodontitis (Probing depth (PD) ≥ 4 mm at more than 30% of the sites assessed in the mouth demonstrating the attachment loss)

Exclusion criteria

1. Subjects who were taking antibiotics in last three months
2. Patients who had undergone periodontal therapy for past six months
3. Patients with systemic diseases and smokers
4. Patients who were pregnant and lactating mothers.

The nature of the study was explained to all the participants and consent was obtained prior to the commencement of the study.

Clinical Investigations and Parameters

The clinical parameters measured were

- Plaque index (PI).[18]
- Gingival index (GI).[19]
- Probing depth (PD; using Williams graduated probe)
- Periodontal disease index (PDI).[20]
- Probing pocket depth (PPD) were measured at mesio-buccal; mesio-lingual; mid-buccal; disto-buccal; disto-lingual, and mid-lingual sides of each tooth, excluding third molars.
- Probing depth of tooth = Sum of all scores per tooth/ 6
- Mean probing depth per person = Sum of each tooth score/ Total number of teeth examined
- All the clinical parameters were collected prior to the commencement of the study.

Psychological Analysis[21]

The level of stress was accessed on the basis of the standard questionnaire (Psychological Well-being Scale by Dr. Devendra Sisodia & Ms. Pooja Choudhary) on the demographic variables and socioeconomic level, habits, health history, and health problems, family, job satisfaction, under the guidance of psychologist to detect whether the patient was in stress. The questionnaire comprised of 50 questions to measure the several aspects of well being like satisfaction, efficiency, sociability, Mental health and Interpersonal relations. From the list, participants rated each question from 1 (strongly disagree) to 5 (strongly agree). The reliability of the scale was directed by the test-retest method and internal consistency method. The test-retest reliability was 0.87 and the consistency value was 0.90. Higher the score more is the well being.

Cortisol Sample

Whole saliva was collected by using sterilized cotton rolls. Individuals were asked to keep a cotton roll in the mouth sublingually for three minutes. It was transferred into containers and stored at -20°C in the freezer. The salivary cortisol levels were measured using enzyme-linked fluorescent assays (ELISA) within 24 hours of collection of the sample.

STATISTICAL ANALYSIS

All the data were entered into the Word excel sheet. Pearson's product–moment co-relation test was used. (SPSS-Statistical Package for the Social Sciences Version 17). $p< 0.05$ was considered statistical significant.

RESULTS

Pearson's product–moment correlations were used to investigate the relationship between stress and periodontal disease. (Pearson correlation coefficient r= 0.985) (Table-2)

Table 1: Showing Mean and Standard deviation for probing depth and cortisol level

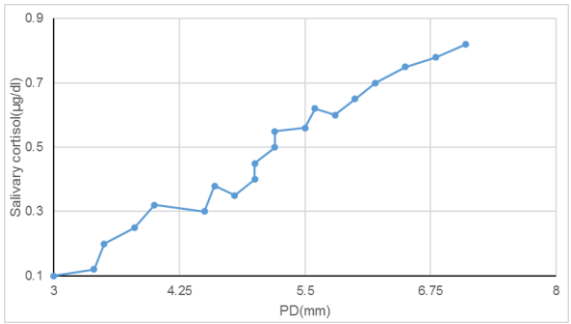
	N	Mean	Standard deviation
Probing Depth (PD)	20	5.09	1.158
Salivary cortisol level	20	0.475	0.2215

Table 2: Pearsons Correlation of Cortisol level with Probing depth (clinical parameter for periodontitis).

	Cortisol Level		
Probing Depth	Pearson's correlation	.985(**)	
	Significant(2-tailed) P value	0.001	
	N	20	
**Correlation is significant at the 0.01 level (2-tailed)			

Results showed a positive correlation between the cortisol level (stress biomarker) and the PD (clinical parameter for chronic periodontitis).

High significance was observed ($p < 0.001$) when cortisol level and clinical parameters were compared. (Table-2)



Graph 1: Relation between Salivary cortisol level and Probing Depth.

As salivary cortisol level (stress marker) is increased, probing depth (PD) clinical parameter for periodontitis is also increased. (Chart-1)

DISCUSSION

The results of the present clinicobiochemical study involving twenty subjects showed an association between elevated levels of cortisol in subjects, with periodontitis. The age group of 30 years and above was selected, because patients above 30 years would come across many negative life events such as financial problems, work load, death of close person, divorce, illness, which causes stress and ultimately leads to various systemic diseases, including periodontal disease. Here, it was noted that the stress factor has a great influence on periodontal disease, wherein the more stress factor more is the periodontal disease.

This could be due to down regulation of the immune system, mediated through the hypothalamic–pituitary-adrenal and sympathetic-adrenal medullary axis[22].The principal effectors of the stress response are confined in the paraventricular nucleus (PVN) of the hypothalamus, the anterior lobe of the pituitary gland, and the adrenal gland. This collection of structures is referred as the hypothalamic-pituitary-adrenal

(HPA) axis. Hypophysiotropic neurons in the medial parvocellular subdivision of the PVN synthesize and secrete corticotropin-releasing factor (CRF)/ corticoliberin, the principle regulator of the HPA axis.[23] Thus, the activation of HPA axis by means of stress might result in the release of an increased concentration of the corticotropin-releasing factor (CRF) from the hypothalamus into the hypophyseal portal vessels, which in turn, may act on the anterior pituitary, resulting in the release of the adrenocorticotropic hormone (ACTH)/corticotropin into the systemic circulation. The corticotropin may then act on the adrenal cortex increasing the level of cortisol into the circulation, leading to unwanted effects throughout the body, such as suppression of the inflammatory response, altering cytokine profiles, elevation of blood glucose levels, and alteration of certain growth factor levels[24,25]. Glucocorticoids can instigate the reduction of pro-inflammatory cytokines secretion such as interleukin-1 (IL-1), IL-2, IL-3, IL-6, tumor necrosis factor alpha (TNF-α), interferon gamma (IFN-γ)[26].

Hence, diminished immune response may lead to destructive periodontal diseases. Stress hormones altering the cytokines production, causes an imbalance between T helper cell phenotypes with a transition to TH 2 cell dominance(antibody mediated immunity), which is related with the progression of periodontitis.[14] These results are in accordance with the studies done by :

Ishisaka et al. (2008)[27] They examined 467 subjects for serum cortisol levels, psychological stress and clinical parameters for periodontitis. A significant correlation was found between serum cortisol and severity of periodontitis.

Deinzer et al. (2001)[28] conducted a study to assess the effect of academic stress on oral hygiene.The medical students participating in exam were studied against the control students. It was concluded that psychosocial stress may incite neglect from oral hygiene and plaque accumulation.

Genco et al. (1995)[29] analyzed data from 1400 people of 25 – 75 years age to perceive if stress, distress and poor coping behaviors are risk factors of periodontitis. He deduced that people with financial stress had more severe periodontal disease. A significant association was established between work tension, economic problems, insecure job and chronic periodontitis in the studies conducted by Moss (1999)[30].

Croucher et al. (1997)[31] did a case-control study design to assess the role of life-events with the measures of periodontitis in adults. They concluded that psychosocial factors and oral health behaviors were important determinants of periodontitis.

Thus according to our results, psychological stress and high salivary cortisol levels are associated with chronic periodontitis in the age group of 30-55 years, establishing a risk profile. Therefore, patients who are under stress should be given more periodontal care to avoid the commencement of periodontal disease.

CONCLUSION

The results of the present study concluded psychosocial stress to be contributing factor in the pathogenesis of periodontal disease and increased serum cortisol level.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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