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RESEARCH ARTICLE

TO EVALUATE THE RELATION BETWEEN LIPID PROFILE AND STRESS IN CHRONIC PERIODONTITIS AND HEALTHY INDIVIDUALS

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ABSTRACT

Hyperlipidemia is a condition where there is an elevation of serum levels of total cholesterol(TC) and triglycerides(TGL) due to the lipid metabolism alteration, with an increase in the liver lipogenesis and lipolysis in the adipocytes. It is well known that a causal relationship exists between serum lipid levels and systemic health particularly cardiovascular diseases, diabetes and tissue repair capacity. It is hypothesized thatperiodontitis causes bacteremia or endotoxemia producing a cytokine cascade that leads to increase levels of pro-inflammatory cytokines which results in fat metabolism and hyperlipidemia. On the other hand psychological stress can down regulate the cellular immune response. Stress disrupts the homeostasis, which inturn alters the immune function. The association of stress with periodontal disease is said to be a risk factor. This study is conducted to evaluate the association between the stress levels and the lipid profile in patients with periodontitis.

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INTRODUCTION

Periodontitis regarded as the second most common disease world-wide, after dental decay is characterized by a destructive inflammatory process affecting tooth supporting tissues eventually leading to exfoliation of tooth (Madhur *et al*., 2014). With the progression of periodontitis, bacteria and other products enter the periodontal tissue and blood circulation, causing systemic or local inflammatory reactions in the host. Also, periodontal disease cause the releases cytokines such as tumor necrosis factor-α (TNF-α) and interleukin-1β (IL-1β), which can increase the risk of coronary heart disease (Kinane, 1998). Other common risk factors such as smoking, diabetes, hyperlipidemia, aging and male gender place an individual at risk for both periodontitis as well as cardiovascular disease (CVD). Hyperlipidemia is a condition where there is an elevation of the serum levels of total cholesterol (TC) and triglycerides (TGL) due to the lipid metabolism alteration, with an increase in the liver lipogenesis and lipolysis in the adipocytes (Wilkins, 2005). TGL are the glycerols which are esterified at each of its three hydroxyl groups by a fatty acid and are most abundant lipids comprising 85-90% of body lipids.

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Cholesterol is the most abundant steroid in animal tissues, especially food rich in animal fats; circulates in the plasma complexed to proteins of various densities and plays an important role in the pathogenesis of atheroma formation in the arteries; a precursor of steroid hormones. Low-density lipoprotein (LDL) is the compound containing both lipid and protein, which transport cholesterol to tissues other than the liver. High-density lipoprotein (HDL) is the compound containing both lipid and protein, which transport cholesterol to the liver for excretion in the bile (Fentoglu *et al*., 2009). Chronic local and acute systemic infections have been demonstrated to induce profound changes in the plasma concentrations of cytokines leading to a catabolic state characterized by altered lipid metabolism. The main features of this altered metabolism are hypertriglyceridemia and lipid oxidation (Cutler *et al*., 1999). The proinflammatory cytokines such as IL-1β and TNF-α are significantly elevated in diseased periodontal ligament sites demonstrating inflammation ad period of active tissue destruction. The psycho-physiological response of the organism to perceived challenge or threat is referred to as "stress". Stress is compatible with good health, being necessary to cope with the challenges of everyday life. Problems start when the stress response is inappropriate to the intensity of the challenge and it has been reported that periodontal disease is more widespread and severe in those with higher levels of stress. Psychological disturbances can lead patients to neglect oral hygiene with resultant unfavorable

effects on the periodontal tissues. The association of stress with periodontal disease is difficult to prove as there are many factors influencing the incidence and severityof periodontal disease, some of which are assumed and have not been identified. Nevertheless, more recent studies indicate that psychosocial stress represents a risk indicator for periodontal disease and should be addressed before and during the treatment (Sachin Goyal *et al*., 2013). Holmes developed a scale to measure stress in terms of life changes. In this scale, the life events are ranked in order, from the most stressful (death of a spouse) to the least stressful (minor violations of the law) (Holmes, 1967).

In periodontal lesions, excessive production of reactive oxygen species (ROS) appears as a result of inflammatory responses. This may induce the oxidation of various molecules in the blood. lipid peroxidation and protein carbonyl levels in serum or plasma are significantly higher in chronic periodontitis patients than in periodontally healthy individuals. Furthermore the antibodies against oxidized low-density lipoprotein (oxLDL) in blood were significantly higher in periodontitis patients than in the healthy individuals. This indicated that systemic increases in oxidative stress induced by periodontitis might promote the oxidation of LDL, that is the major carrier of plasma cholesterol. So periodontal destruction may have detrimental effects on cardiovascular disorders by increasing circulating oxLDL, as oxLDL has propathogenic and proinflammatory properties (Naofumi Tamaki *et al*., 2011). So, this study was conducted to access the relationship between the lipid profile and the stress levels in chronic periodontitis and healthy individuals.

MATERIALS AND METHODS

A total of 60 subjects attending the out-patient clinic of department of periodontology and implantology at Drs.Sudha&NageswaraRao Siddhartha Institute of Dental Sciences (SNRSIDS) were recruited for this study. These subjects were divided into two groups: test and control.

INCLUSION CRITERIA

Test group: consisted 30 individuals who were diagnosed as periodontitis with a mean age group of 30-80 years. Full mouth plaque and calculus scores >20%, probing pocket depth and attachment loss $\geq$5 mm, at least in 3 different sites in each quadrant.

Control group: consisted 30 individuals who were diagnosed as healthy with a mean age group of 30-80 years. Full mouth plaque and calculus scores <20%, probing pocket depth and attachment loss $\leq$4 mm.

Written informed concent were taken from all the 60 subjects, who participated in the study.

EXCLUSION CRITERIA

Subjects suffering from any underlying systemic conditions like cardiovascular disease, diabetes, hepatic impairment and respiratory diseases were excluded from the study. pregnant and lactating mothers, smoker, alcoholics and individuals receiving any harmones or vitamin therapy were also excluded from the study.

PROCEDURE

5 ml of venous blood samples (fasting blood sample) were collected in plain from all the 60 subjects. Blood samples were centrifuged at 3,000 g for 10 mins using spectrophotometer. This fasting blood sample was tested for total cholesterol (TC), triglyceride (TG), high density lipo-protein (HDL) and LDL was calculated from TC, TG and HDL. The stress levels of the subjects were evaluated using the perceived stress scale (PSS). The perceived stress scale was given by Sheldon Cohen is most widely used psychological instrument for measuring the perception of stress. It is a measure of the degree to which situations in one's life are appraise as stressfull. The scale includes a number of direct queries about current levels of experienced stress (Cohen, 1988; Cohen *et al*., 1983).

STATISTICAL ANALYSIS

All the variables in both the groups were subjected to Kolmogorov Smirnov test. Intergroup comparison was done using paired t-test.

RESULTS

Table 1 shows the demographic data of the study subjects. The mean age group in the test and control group were 57.267±11.614 and 59.033±11.804respectively. A total 17 males and 13 females were enrolled in the test group and 22 males and 8 females in the control group. The data was not statistically significant. Table 2 shows the mean values of clinical parameters. The test group showed higher plaque 2.200±0.414, gingival 2.273±0.418 and probing pocket depth scores 2.754±0.535 when compared to the control group 0.927±0.571, 0.463±0.460, 0.597±0.271 respectively and were statistically significant (*p<0.005). Table 3 depicts the intergroup comparison of the lipid parameters. Totoal cholesterol 166.600±19.183, triglycerides 171.700±12.228, and LDL 147.133±22.462 values were high in the test group when compared to the control group 114.933±10.728, 103.700±11.923, 84.233±15.377 and the results were statistically significant (*p<0.005). The control group showed higher HDL values 44.367±2.710 when compared to test group 35.100±3.100.The control group showed statistically significant results when compared to the test group (*p<0.005). Table 4 shows the co-relation between the various clinical parameters with the lipid parameters. Total cholesterol values in the test group showed higher values with plaque index 2.23, gingival index 2.46 and probing pocket depth 2.66 when compared to the control group 0.63, 0.52, 0.62 respectively and the results were statistically significant (*p<0.005). Similar values were shown for the triglycerides in the test group when compared to the control group and were statistically significant. However HDL values showed higher in the control group 1.06 with probing pocket depth (<5mm) when compared to the test group 0.82 and were statistically significant (*p<0.005). An inverse relationship was shown between the probing depth and the HDL values ie, lower the probing depth higher were the HDL values. Higher HDL values represented the good oral health status of the individual. On the other hand LDL values were higher in the test group 2.77 with probing depth (>5mm) when compared to the control group 0.46 and were statistically significant (*p<0.005). A direct relationship was shown between the probing depth and the LDL values ie, higher the probing depth higher were the LDL values.

Table 1. Shows the demographic data of the study subjects

1.DEMOGRAPHIC DATA OF STUDY SUBJECTS					
STUDY SUBJECTS	AGE MEAN ±SD	P-VALUE	GENDER MALE	FEMALE	P-VALUE
CONTROL GROUP	59.033±11.804	0.5613	22	8	0.1760
TEST GROUP	57.267±11.614		17	13	

Table 2. Periodontal parameters in study subjects

CLINICAL PARAMETERS	TEST MEAN ±SD	CONTRL MEAN ±SD	p-VALUE
PLAQUE INDEX	2.200±0.414	0.927±0.571	<0.001*
GINGIVAL INDEX	2.273±0.418	0.463±0.460	<0.001*
PROBING POCKET DEPTH	2.754±0.535	0.597±0.271	<0.001*

(*p<o.oo5)

Table 3. Lipid parameters in study subjects

LIPID PARAMETERS	TEST MEAN ±SD	CONTRL MEAN ±SD	p-VALUE
TOTAL CHOLESTEROL	166.600±19.183	114.933±10.728	<0.001*
TRIGLYCERIDES	171.700±12.228	103.700±11.923	<0.001*
HDL	35.100±3.100	44.367±2.710	<0.001*
LDL	147.133±22.462	84.233±15.377	<0.001*

(*p<0.005)

Table 4. Co-rrelation between clinical parameters with lipid parameters in study subjects

	TEST MEAN ±SD	CONTRL MEAN ±SD	p-VALUE
Stress	29.433±5.263	18.767±3.683	0.001*

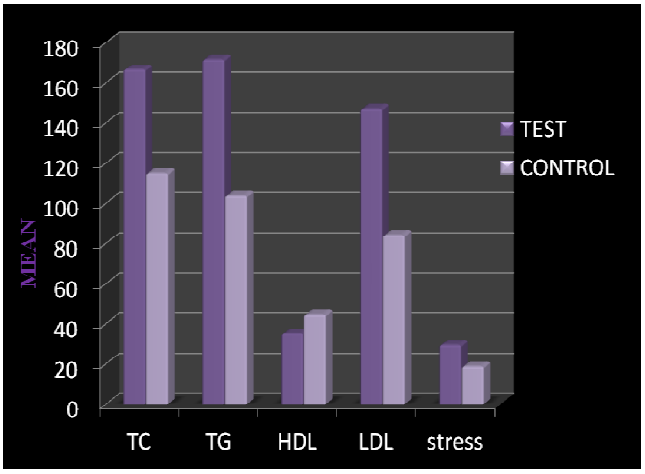
Parameters In Study Subjects
(*p<0.005)

Table 5. Evaluation of stress in study subjects

Clinical parameters	TOTAL CHOLESTEROL			TRIGLYCERIDES			HDL			LDL		
	Test	Control	p	Test	Control	p	Test	Contol	p	Test	Control	p
Plaque index	2.23	0.63	<0.001*	1.86	0.42	<0.001*	0.66	0.45	0.10	0.66	0.42	0.21
Gingival index	2.46	0.52	<0.001*	2.26	0.50	<0.001*	0.82	0.64	<0.022	0.83	0.58	0.16
Probing pocket depth	2.66	0.62	<0.001*	2.72	0.77	<0.001*	0.52	1.06	<0.001*	2.77	0.46	<0.001*

(*p<0.005)
(TG), HDL, LDL AND STRESS SCORES BETWEEN TEST AND CONTROL GROUPS

Higher LDL values represented the poor oral health status of the individual.Thus, higher LDL values could act as risk factors for the development of periodontal diseases, as more amount of periodontal destruction is anticipated in deep pockets.



Graph 1. Comparison of mean total cholesterol (tc), triglycerides (tg), hdl, ldl and stress scores between test and control groups

Table 5 depicts the mean stress levels in the study subjects. The test group showed higher stress values 29.433±5.263 when compared to the control group 18.767±3.683 and the results were statistically significant (*p<0.005).

DISCUSSION

Periodontitis is an infectious disease caused by gram negative anaerobic bacteria. It has been shown that acute infections can interrupt lipid metabolism, and there is a significant rise in plasma TG during gram-negative bacterial infections (Wanner *et al*., 1997). These changes are contributed by the release of cytokines such as TNF-α, IL- 1β and IL-6 which are produced in large amounts in infectious periodontal tissues. These cytokines increase the mobilization of lipids from the liver and adipose tissue, and increase the binding of LDL to endothelium and smooth muscles. It has been reported that oxidative modification of LDL leads to an increase in cholesterol accumulation because modified LDL is very susceptible to macrophage uptake. Hyperlipidemia causes an increase in white blood cell (WBC) activity, which helps the progression of periodontal disease in adults (Gustafsson, 1996). In this study the test group (periodontitis individuals) showed higher levels of total cholesterol, triglycerides and LDL when compared to the control group (healthy individuals).

However the HDL values in the test group (35.1) showed lower values when compared with the control group and these results were however statistically significant. The stress levels were also higher in the stress group (29.4) than the control group (18.76) and the results showed statistically significant between the groups. Ebersole *et al*. reported that periodontal disease causes a significant rise in serum TG, CHL, HDL and LDL levels in non-human primates (Ebersole *et al*., 1999). Cutler *et al*. observed that chronic periodontitis has a significant relationship with the increase of serum TG and total cholesterol. Losche *et al* reported that pathological levels of TG and total cholesterol were higher in periodontal patients compared to healthy subjects, and periodontal patients had a significantly higher abnormal LDL levels (Losche *et al*., 2000) which was similar to the findings of this study. Katz *et al*. (2001) confirmed a positive relationship between deep periodontal pockets and high total cholesterol and LDL levels, using the index Community Periodontal Index of Treatment Needs (CPITN). Saxlin *et al*. (2008) carried out a cross-sectional study on 1297 subjects and concluded that serum lipid levels were not associated with an increased likelihood of periodontal infection among normal weight subjects, yet were associated with the presence of deepened periodontal pockets (4 mm or more) among obese subjects. In this study a strong association between stress and periodontal destruction was seen.

A significant association was established between work tension, economic problems, coping-up-capacity of the individual and chronic periodontitis. Stress might result in the release in the release of an increased concentration of the corticotropin releasing hormone from the hypothalamus, whin in turn, may act on the anterior pituitary, resulting in the release of adrenocorticotrophic hormone. The corticotrophin may then act on the adrenal cortex enhancing the production and release of cortisol into the circulation, leading to unwanted effects throughout the body, such as suppression of the inflammatory response, alternating the cytokine profiles and elevation of blood glucose levels (Miller, 2002). As a result more number of inflammatory cytokines such as IL-1, 6, 8 and TNF- α are released into the circulation which aggregates the progression and destruction of the periodontal ligament. Breivik *et al*. (2001) has shown that stressful stimuli and extreme genetic differences in the hypothalamus-pituitary-adrenal axis structure in rats and their susceptibility to periodontal disease. These differences between individuals with high- and low-responding hypothalamus-pituitary-adrenal axis could be modulated by environmental factors. Vettore *et al*. (2001) stated a significant positive correlations between anxiety and frequencies of clinical parameters for periodontal disease. Increase stress level causes alterations in the crevicular interleukin-1, depressed polymorphonuclear leukocyte chemotaxis and phagocytosis, reduced proliferation of lymphocytes upon stimulation by a mitogen. These changes directly or indirectly play a vital role in the pathogenesis of periodontal diseases.

Conclusion

Patients with chronic periodontitis showed higher levels of total cholesterol, triglycerides and LDL when compared to the healthy individuals. The stress levels were also elevated in the periodontitis groups than that of the healthy individuals. So, within the limitations of this study, it can be concluded that both stress and the lipid profile of the individual can act as a risk indicator for the development and progression of the periodontal disease.

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