

Association of Serum Cholesterol, Triglyceride, High and Low Density Lipoprotein (HDL and LDL) Levels in Chronic Periodontitis Subjects with Risk for Cardiovascular Disease (CVD): A Cross Sectional Study

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ABSTRACT

Purpose: To assess serum cholesterol, triglycerides, High and Low Density Lipoprotein (HDL and LDL) levels (serum lipid profile) in subjects with chronic periodontitis and the possible association for risk of Cardiovascular Disease (CVD).

Materials and Methods: Total of 80 participants (42 males and 38 females) who were in the age range of 30-65 years were divided into test group (group I- 40 subjects with chronic periodontitis) and control group (group II- 40 subjects with healthy periodontium), based on their periodontal disease statuses. Three ml of venous blood samples were taken for measurement of parameters of

lipid metabolism [serum cholesterol (chol); triglycerides (Tg); HDL and LDL.

Results: Significant increase in serum cholesterol and LDL ($P < 0.05$) were observed in test group (group I), whereas serum triglycerides and HDL ($P > 0.66$) showed no significant increase in test group (group I) as compared to their values in the control group (group II). A P-value of < 0.05 was considered for statistical significance.

Conclusions: Subjects with chronic periodontitis showed increased serum cholesterol and LDL levels. This may suggest that these subjects are potentially at a risk of getting CVD.

Keywords: Chronic periodontitis, Serum cholesterol, Serum triglyceride, Cardiovascular disease, Hyperlipidaemia

INTRODUCTION

Periodontitis is chronic inflammation of the supporting tissues of the teeth. Severe form of the disease is present in 10% to 15% cases and even in 30% of the population [1]. Periodontitis may be associated with the development of atherosclerosis, a pathologic change of Coronary Heart Disease (CHD). Cross-sectional and prospective epidemiologic studies have also suggested that periodontitis may be associated with CHD [2,3]. Periodontitis-related atherogenic alterations are also associated with lipoprotein metabolism [4]. Hyperlipidaemia is a state with an abnormal lipid profile, which is characterized by elevated blood concentrations of triglycerides, elevated levels of total cholesterol and LDL and decreased levels of HDL cholesterol [5]. It has been suggested that hyperlipidaemia could be associated with periodontitis [6]. There are common risk factors for periodontal disease and CVD. Serum lipids may be the most important among these factors. Reduced HDL cholesterol levels are well recognized risk factors for CVD and ischaemic stroke [7]. According to Katz J et al., hypercholesterolaemia and CVDs are related to periodontal disease [8].

An intra-oral source of infection like periodontitis can create an inflammatory immune response, thereby placing an apparently healthy individual at an increased risk for CVD. Periodontal disease can be treated and thereby, the risk of developing CVD can be reduced [9].

Hence, an attempt to investigate the hypothesis, as to whether an association existed between serum lipid profile and CVD in patients with chronic periodontitis was made. The study was carried out on 30-65 year old subjects who attended Yerala Medical Trust's Dental College in Mumbai, India.

MATERIALS AND METHODS

Study Design and Study Population

A cross-sectional study was conducted in November 2012 on subjects aged 30-65 years (who were not matched for age/sex), who attended Yerala Medical Trust's Dental College in Mumbai, India. Subjects who had a history of CVD and who were under treatment were included in this study. Smokers, persons with diabetes mellitus and acute inflammatory conditions, endocrine disorders, myocardial infarction, stroke and cancer, pregnant women, those using oral contraceptives and persons on medication for hypercholesterolaemia were excluded from the study.

Ethical Considerations

The study protocol was reviewed by the Institutional Review Board of Yerala Medical Trust's Dental College and it was granted ethical clearance. Written informed consents were obtained from the participants who fulfilled the eligibility criteria and were willing to participate in the study.

Training and Calibration

Prior to the commencement of the study, the examiner was standardized and calibrated with a consultant in the Department of Periodontics and Implantology, to ensure uniform interpretations, understanding and application of the codes and criteria for the diseases, which had to be observed and recorded and to ensure consistent examination (kappa value=0.90).

METHODOLOGY

A total of eighty (42 males and 38 females) subjects who were aged between 30-65 years, who attended the out-patients department of Yerala Medical Trust's Dental College were randomly selected. The subjects were divided into test group (group I-40 subjects

with chronic periodontitis) and control group (group II-40 subjects healthy periodontium), based on their periodontal disease statuses. The two groups were matched with regards to their ages; thus, the average age of Group I was 45.93±3.52 years and that of Group II was 43.7±3.59 years. Data were collected by using an interviewer-administered questionnaire, which consisted of two parts. The first part was used to collect information on socio-demographic data and the second part contained oral examination.

Oral examination was carried out immediately following the interview. The following clinical parameters were estimated: Oral Hygiene Index-Simplified (OHI-S) [Greene and Vermilion 1964] [10], Gingival Index (GI) [Loe and Sillness 1963] [10], clinical attachment level, percentages of probing sites and probing pocket department using William's graduated periodontal probe, along with checking for a radiographic evidence of bone loss on the Orthopantomographic Radiographs (OPGs). A duplicate examination was conducted on 5% (n=4) of the study population during the course of the study (kappa statistic = 90%). The intra-oral examination was done using a mouth mirror, a dental explorer and William's graduated periodontal probe. Both investigator and patients were not aware about the study criteria. The body mass index (BMI) was calculated using the formula BMI=weight /Height² and it was measured in kilograms (kg)/meter² (m²). The subjects were grouped accordingly as not acceptable (NA; BMI<20), acceptable (A; BMI 20-25) and overweight (O; BMI 25-30). Obesity was assessed using the BMI. Obesity was associated with an increase in serum cholesterol and LDL. The BMI was assessed, so as to eliminate the role of obesity as a contributing factor for CVD in subjects with chronic periodontitis. Three mL of venous blood samples were obtained from the central veins through the skin in the cubital fossa from the selected subjects. The blood samples were then centrifuged at 3,000 r.p.m (revolutions per minute) for 5 minutes. Serum was separated. Serum cholesterol (chol), triglycerides (Tg) as well as HDL and LDL were measured using a semi-automatic biochemical analyzer (Biosystems BTS-310 Photometer, Sigma, USA).

STATISTICAL ANALYSIS

The recorded data were compiled and entered into a spreadsheet computer program (Microsoft Excel 2007) and they were then exported to data editor of SPSS, version 15.0 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics included mean and standard deviations. Intergroup comparisons were made by One-way ANOVA (Analysis of variance), followed by Mann-Whitney test for pairwise comparisons. For all the tests, confidence interval and p-value were set at 95% and ≤0.05 respectively.

RESULTS

The assessment of the OHI-S and GI scores showed significant differences in the test group (group I) as compared to those of the control group (group II). The BMI scores showed no significant differences in both the groups. Percentages of sites with probing pocket department (71±23 %) and clinical attachment level (4.5±1.9) in group (I) have been shown in [Table/Fig-1].

The lipid profile was assessed by using One-way ANOVA and Mann-Whitney test. It showed a significant increase in serum cholesterol (chol) and LDL in test group I, but no significant increase in serum triglycerides and HDL in test group (group I) as compared to their values in the control group (group II) [Table/Fig-2].

DISCUSSION

A relationship between periodontitis, a common chronic oral disease in adults, and CVDs has been identified in several studies [11]. It was hypothesized that possibly, daily episodes of bacteraemia originating from periodontal lesions were the cause for the

Groups	BMI			OHI Score	GI Score	PD (%)	CAL mm
	A	NA	O				
Group I	25	10	5	4.0 ± 1.1	1.9 ± 0.5	71%±23%	4.5±1.9
Group II	25	5	10	0.8 ± 0.3	0.1 ± 0.1	---	---
p-value	---	---	---	< 0.001	< 0.001	---	---
Significance	---	---	---	HS	HS	---	---

[Table/Fig-1]: Characteristics of study groups (Clinical parameters)

Acceptable, NA- Not acceptable, O-Overweight, HS- Highly significant, BMI- Body mass index, OHI- Oral hygiene index, GI- Gingival index, PD- Probing pocket department, CAL- Clinical attachment level

Parameters (mg/dl)	Group II		Group I		Significance	
	Range	Mean±SD	Range	Mean±SD	F-value	P-value
Sr. Chol.	97-192	165.5±30.08	167-281	216.6±38.9	3.55	<0.05*
Sr. Tg	75-141	103.6±23.6	72-201	120.0±41.2	1.20	0.33
Sr. HDL	31-48	40.06±5.6	33-51	42.4±5.7	0.54	0.66
Sr. LDL	51-128	104.0±24.7	107-180	142.0±26.9	3.28	<0.05*

[Table/Fig-2]: Characteristics of study groups (Lipid profile)

*Statistically significant.

Sr. chol- Serum cholesterol, Sr. Tg- Serum triglyceride, Sr. HDL- Serum high density lipoprotein, Sr. LDL- Serum low density lipoprotein

changes which occurred in systemic markers in periodontitis [12]. An association between poor oral status and CHD exists and improvement in periodontal status may influence the systemic and haemostatic situation [13]. In the present study, it was observed that there was an increase in the serum cholesterol and LDL values in subjects with chronic periodontitis. This could reflect an increased risk for CVD in these subjects. This finding could be of benefit in early recognition/prevention of CVD and it could thereby minimize the risk for CVD in these individuals through prevention and/or control of the periodontal disease.

Periodontal disease could result in repeated systemic exposure to bacteria, endotoxin, lipopolysaccharide and other bacterial products. The lipopolysaccharides of dental plaque diffuse into the systemic circulation and they elicit a systemic lipopolysaccharide specific antibody response. This may lead to lipid metabolism disturbance and a hypercoagulable state through elevation of circulating cytokines. Monocyte derived cytokines such as TNF- α , IL-1, 6 and 8 have powerful effects on hepatic protein synthesis (eg. in upregulating fibrinogen synthesis), tissue catabolism and lipid metabolism. Both TNF- α and IL-1 inhibit the production of lipoprotein lipase, thus causing lipid metabolism disturbance [14]. This results in increase in the levels of serum cholesterol and LDL. In the present study, serum cholesterol and LDL levels were found to be increased in subjects with periodontal disease. This suggested that periodontal disease may increase the risk for CVD.

In the present study, no significant increase in serum triglycerides and HDL was observed in chronic periodontitis. Lui J, et al., reported that chronic periodontitis was associated with decreased HDL concentrations, which suggested that there might exist some relationship between periodontal inflammation and CHD [1]. Similar results were reported by Pussinen PJ, Mattila K, [4]. These findings may be attributed to the influences on lipid metabolism, exerted by the release of lipopolysaccharide and proinflammatory cytokines, caused by periodontal inflammation [15]. Gufran K et al., also confirmed that there was no significant relationship between periodontal disease, regardless of its intensity, and blood lipid levels in systematic healthy subjects [16].

HDL cholesterol has anti-inflammatory and anti-atherogenic properties and decreased HDL cholesterol levels have also been considered to be a risk factor for CHD. For patients with periodontitis, decreased HDL cholesterol concentrations suggest that a periodontal inflammation might be associated with CHD [17,18]. Palle AR et al., also reported that there was a significant relationship between obesity and periodontitis in population of patients with CVD [19].

Nevertheless, the exact mechanism of this association was not clarified in this study and it needs to be further explored. Since this study was of a cross sectional nature, which was conducted on a modest sample size of 80 subjects, studies with larger sample sizes and standard protocols need to be carried out in future, to endorse the results observed in our study. While the aetiology of hyperlipidaemia is multifactorial, it has been suggested that some true experimental design research should be done, to exactly confirm the effect of chronic periodontitis.

CONCLUSION

The elevated levels of serum cholesterol and LDL which were observed in chronic periodontitis subjects suggest an increased risk for CVD in chronic periodontitis subjects.

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