

## Association between Chronic Periodontitis and Serum Lipid Levels

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**Abstract-** Regarding the high prevalence of hyperlipidaemia, which is one of the major risk factors of cardiovascular disease, and uncertain reports about the relation between periodontal disease and serum lipid profile, this study was conducted to assess this relation. The historical cohort study was conducted on 52 cases including 26 persons with chronic periodontitis as case group, and 26 healthy subjects as control group. Both groups had the same age and weight ranges, sex, and diet, without any periodontal treatment history in the past six months, underlying systemic disease such as diabetes, anti-hyperlipidemic drugs or active tobacco smoking history. Low Density Lipoprotein (LDL), High Density Lipoprotein (HDL), Triglyceride (TG) and Total Cholesterol (CHOL) were measured by direct enzymatic assay. TG level was  $128.4 \pm 71.1$  mg/dl in control group and  $165.2 \pm 83.7$  in case group indicating a significantly higher level in case group ( $P < 0.05$ ). In control group, 30.8 percent and in case group, 61.5 percent had abnormal serum cholesterol levels, which presents a significantly higher level in case group ( $P < 0.03$ ). Other serum level indices did not show any significant difference. Although it seems that patients with chronic periodontal disease are more susceptible to hyperlipidemia, it is doubtful that the former causes an increase in serum lipid levels, so we suggest studying the effects of treating chronic periodontitis on serum lipid level.

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**Keywords:** Chronic periodontitis, serum lipid level, hyperlipidaemia, cholesterol, triglyceride, HDL, LDL

### Introduction

A high serum lipid level is one of the modern society concerns. Hyperlipidaemia is considered as one of the major cardiovascular disease risk factors (1). Studies indicate considerable prevalence of dislipoproteinemia in Iran; 23.6 percent adults over 20 demonstrate the upper normal level of total serum cholesterol (2). Hyperlipidaemia causes atherosclerosis, ischemic heart disease and stroke, meanwhile high serum levels of TG can cause pancreatitis (1). The most important conflict in hyperlipidaemia is investigating the cause of this disorder; however, the most common recognized causes are genetic disorders, high lipid diet and hydrogenated lipid consumption, low intake of antioxidant agents and inadequate physical exercise (incorrect life style) accordingly (1). Recently, a causal relation has been demonstrated between high serum lipid levels and periodontal disease. Recent studies illustrate the existence of a relation between periodontal disorders and hyperlipidaemia, which power the probable effect of periodontal disease as an underlying factor for

hyperlipidaemia. This theory is presented in Losche et al study, which demonstrated higher level of Total serum Cholesterol and LDL among the patients suffering periodontitis than control group significantly (3), which was approved by some other studies (4-7); otherwise, another were experienced insignificant relation (8-10).

According to this controversial data and rising trend of serum lipid levels and consequently unknown complication, this study was conducted to determine the relation between chronic periodontitis and serum lipid levels, among out-patients who were visited at School of Dentistry, Periodontics and Oral Medicine of Shahed University, in 2005, Tehran, Iran.

### Patients and Methods

This historical cohort study was conducted on 52 cases; the sample size was determined according to dependent variables of the study (lipid profile indices), of which all were quantitative variables with normal distribution. We also considered the similar previous studies (3,6).

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Twenty-six patients in the case group were selected among patients of periodontics section of School of Dentistry, Shahed University. Definite diagnosis of chronic periodontitis was performed by two expert periodontists based on the existence of calculus and plaques, at least one pocket within 4mm depth in every quadrant, and bone destruction, appropriate to calculus and plaque in radiography, accordingly<sup>11</sup>. Exclusion criteria included any history of periodontal treatment during the past 6 months, systemic disease such as diabetes and cardiac heart disease, hypertension, antihyperlipidemic consumption or tobacco smoking.

Daily activity rate, a family history of high serum lipid levels, tobacco smoking and diet were the same in both groups. All patients studied were referred to Danesh photobiology laboratory and taken 5 cc fasting blood samples to determine serum lipid levels including HDL, LDL, TG and total cholesterol (12). The pathological cut-off points were considered LDL-cholesterol >180, HDL-cholesterol <30, Triglyceride >200 and total cholesterol >250.

Total cholesterol and LDL levels were analyzed by t-test, while TG and HDL levels were analyzed by mann-wittney test. Relative Risk (RR) and Attributed Risk (AR) of chronic periodontic disease with any incidence of high serum lipid levels were determined.

## Results

The study was conducted on 52 persons, including 26 cases of chronic periodontitis and 26 control cases. Personal characteristics of the evaluated cases are presented in table 1, according to periodontal status, indicating no significant differences between the two groups including age, sex, size and diet.

The prevalence of abnormal serum lipid levels and periodontal disease status is presented in table 2, demonstrating higher levels of TG (abnormal) in case group (12 patients, 46/1%) than in control group (7 patients, 26.9 %;  $P<0.15$ ). The prevalence of abnormal levels of serum cholesterol was 30.8% in control group and 61.2% in case group ( $P<0.02$ ). Subjects with chronic periodontitis had twice abnormal cholesterol levels than healthy group (Relative Risk=2) with 95 % confidence interval (CI 95%). This relative risk is estimated 1 to 46 times, while Attributed Risk of periodontal disease for higher serum TG is 30.4 %. Hence, the percentage of abnormal serum level of LDL and HDL were similar in both groups. Serum lipid levels are presented in table 3, demonstrating higher serum TG levels in periodontitis group than in control group ( $P<0.05$ ). The other indices did not show any significant difference between the two groups.

**Table 1.** Personal characteristics, according to periodontal disease state:

|                      | Age     | Sex     |        | BMI     | Diet Regiment |        |      |
|----------------------|---------|---------|--------|---------|---------------|--------|------|
|                      |         | Male    | Female |         | Low           | Medium | Good |
| Case group (N=26)    | 45±12/2 | 9       | 17     | 23/7±3  | -             | 26     | -    |
| Control group(N=26)  | 48±11/6 | 9       | 17     | 24/4±3  | -             | 26     | -    |
| Statistical analysis | $P<0/4$ | $P<0/9$ |        | $P<0/4$ | $P<0/4$       |        |      |

**Table 2.** Prevalence of abnormal serums lipid levels in chronic periodontitis and control groups

|                      | Cholesterol | Triglyceride | LDL      | HDL     |
|----------------------|-------------|--------------|----------|---------|
| Case group (N=26)    | 16(61/2)    | 12(46/1)     | 12(46/1) | 5(19/2) |
| Control group(N=26)  | 8(30/8)     | 7(26/9)      | 0(-)     | 4(15/4) |
| Statistical analyses | $P<0/02$    | $P<0/15$     | $P<0/9$  | $P<0/9$ |

**Table 3.** Serum lipid levels in chronic periodontitis and control groups

|                      | Cholesterol | Triglyceride | LDL        | HDL       |
|----------------------|-------------|--------------|------------|-----------|
| Case group (N=26)    | 207/3±42/1  | 165/2±83/7   | 122/7±35/1 | 48/8±12/6 |
| Control group(N=26)  | 192/3±34/6  | 128/4±71/1   | 116/4±29   | 48/8±12/6 |
| Statistical analyses | $P<0/2$     | $P<0/05$     | $P<0/6$    | $P<0/8$   |

## Discussion

The present study demonstrated higher abnormal cholesterol and TG levels in periodontal group than in healthy subjects, although LDL and HDL indices were almost the same. Some studies address a relation between chronic periodontitis and serum lipid levels (3-7). Each of these studies has their own specifications such as definition of periodontal disease, assay for serum lipid levels, study design, and number of cases. Others have shown lack of this relation<sup>8-10</sup>. Such controversy was a reason for this study.

Ebersol et al, in 1997 demonstrated significant increases in serum lipid profile (TG, Chol, LDL, HDL) during periodontal disease (13). Although it was the first study in this area, it was carried out on non-human mammals that do not fully mimic the human body.

Cutler et al in 1999 also confirmed the relation of periodontitis with age and hyperlipidemia (4). This study was performed without any case-control assessment. Therefore, interfering factors could affect the outcome, particularly high serum lipid level due to inappropriate diet.

In the present study, the number of subjects was the same in both groups (i.e. 26). Our results are the same as Losche et al in 2000, including TG and Cholesterol levels. However, in the mentioned study, the number of subjects with abnormal serum levels of LDL was significantly higher in periodontal group than control group (3). This is probably because of more participants (39 persons) and a difference in definition of abnormal level, which was considered LDL > 160 mg/dl and HDL < 45 mg/dl, accordingly. Meanwhile, we considered it 180 mg/dl and 30 mg/dl, respectively (12). Therefore, subjects falling into this span decreased. Hinrichs in 2001 found that the prevalence of periodontal disease is more in patients with higher Chol and lower HDL (14). The author, however, did not discuss other lipids. Another study in 2002 suggested a relation between hyperlipidemia and periodontal disease in systemically healthy subjects (6). In this study, like ours, LDL and HDL serum levels were not significantly higher in case group than control group the two groups were only matched by sex and age.

On the other hand, Lopes-Virella study did not confirm a relation between hyperlipidemia and infection (8). However, another study done by Joseph Katz on individuals with healthy medical history, controlling factors related to elevated serum cholesterol levels (such as BMI, age, diastolic blood pressure and tobacco smoking), confirmed a positive relation between

periodontal pocket (as a periodontal index) and elevated total cholesterol and LDL serum levels<sup>7</sup>, which was confirmed in our study as well. Machado et al (2005) in a similar study found that the average cholesterol and TG were not significantly higher in periodontal patients than healthy ones (10). In this study, patients were matched by age and sex.

There are some theories that periodontitis predispose individuals to systemic disease<sup>15</sup>. In 2000, Iacopino & Cutler confirmed that an increase in pre-inflammatory cytokine in response to chronic periodontitis causes a rise in serum lipid levels. Infection with Gram negative periodontal pathogens could prompt release of systemic IL-1 $\beta$  and TNF- $\alpha$ , causing chronic hypertriglyceridaemia. Morita et al, 2004, reported a significant relation between elevated TG (over 149 mg/dl) and periodontal disease. Although HDL serum level in case group (with periodontal disease) was lower than control group, this difference was not significant (16), which is similar to our results.

Losche et al in 2005 assayed plasma lipid concentration before and three months after local therapy in 32 patients suffering from periodontitis. Although periodontal treatment caused dramatical decreases in local inflammation and tissue damage and pre-treatment value of LDL coordinated with clinical inflammatory parameters and periodontal erosion, the difference between plasma lipid levels before and after treatment was not significant (17). Results of another study in 2007 conducted by Fentoglu et al showed that periodontitis could cause some changes in total cholesterol and LDL serum levels and local periodontal treatment could cause noticeable decrease in these markers (18). Velanta Vicente et al in 2006 studied relation between serum lipids level and periodontal condition by CPITN index. The results of this study revealed that serum lipid levels in periodontal patients did not have any difference with healthy subjects. The author concluded the results of their study were influenced from low age status (average 38 years) and ignorance of diet factors, emotional stress and physical behavior (9).

The present study was designed as a cross-sectional historical cohort study, without the errors of case-control study, with the hypothesis that there exists a relation between chronic periodontitis and LDL, HDL serum levels. The mean age in case group was higher, which is acceptable considering chronic course of disease; however, this difference was not significant. High age is a risk factor for hyperlipidemia and could be an effective factor to set a significant relation between chronic

periodontitis and hyperlipidemia. Moreover, if the relation between severity of chronic periodontitis with the rate of elevated serum lipid levels and more subjects were investigated, the accuracy of study would be increased. Joseph Katz has stated that a relation between hypercholesterolemia and periodontal disease exists in developed state of disease (7).

One specification of this study is that each person as a case is completely matched with its control .

It is not possible to confirm the cause-effect relation by this study, because such results need designing experimental methods, with historical cohort studies we can only confirm relation based on Factor and Outcome. While the etiology of hyperlipidemia is multifactorial, it is suggested to do true experimental design research to exactly confirm the effect of chronic periodontitis.

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