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Evaluation of Periodontal Status and Serum C-Reactive Protein Levels in Adult Cigarette Smokers

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Abstract

Background: This study aimed to evaluate the periodontal status of adult smokers and assess their serum C-reactive protein (CRP) levels, hypothesizing an association between periodontal inflammation, smoking, and elevated serum CRP, a marker for cardiovascular diseases. The primary objective is to contribute to the assessment and prevention of potential cardiovascular diseases in adult smokers.

Methods: This cross-sectional study was conducted at HIT Hospital and Dental Hospital HITEC-IMS Taxila Cantt over five months from October 20, 2021, to March 31, 2022, the study included 60 healthy male adult smokers and 20 healthy male non-smokers as a control. Basic periodontal examination involved the use of a periodontal probe, assessing parameters such as gingival index, bleeding on probing, oral pigmentation, presence of periodontal pockets, and gingival recession. Blood samples were collected to evaluate serum CRP levels.

Results: Smokers exhibited higher rates of gingival recession (38.3%), gingival pigmentation (43.3%), and periodontal pocket formation (33.3%) compared to the nonsmokers control group, with significant p-values of 0.040 in gingival recession and 0.035 in the presence of periodontal pockets. Serum CRP levels were significantly elevated in adult smokers, with a significant p-value of 0.024.

Conclusion: The study concluded that adult smokers show signs of periodontitis, and their serum CRP levels are elevated. Assessing periodontal status and serum CRP in adult smokers may aid in risk assessment and reducing the likelihood of developing future cardiovascular diseases.

Keywords: Adult smokers, periodontal status, serum CRP levels.

Introduction

Periodontitis is a chronic inflammatory disease that harms soft and hard tissues supporting the teeth. Its etiology is based on the level of oral pathogens and status of host immune reaction. When not treated properly, it weakens the periodontium leading to tooth loss (1). Tobacco smoking, diabetes, pathogenic bacteria and tooth deposits are the major risk factors contributing to periodontal diseases (2). It has been shown that, the most important risk factor that affects the occurrence and severity of periodontal diseases is smoking. In adult smokers, increased prevalence and severity of periodontitis, increased marginal bone loss, deep periodontal pockets, severe loss of tooth attachment, and involvement of furcation has been observe (3). Smoking affects bone regeneration and reduces the efficiency of the immune system. Smoking has many systemic effects which increases the vulnerability for poorer healing, reduced circulation, and impairment of host response (4). Duration of smoking also alters the levels of inflammatory and immune markers, including C reactive protein (CRP), among others (5). C-reactive protein (CRP) is released into the blood as a result of inflammation which is a part of the immune reaction. For low-grade inflammation, serum CRP is the major standard measure of inflammation, and it aids in predicting future problems evenin healthy individuals (6).

C-reactive Protein (CRP) is an acute-phase protein that indicates infection and chronic inflammation. Investigations has been done to determine the clinical relationship between CRP and periodontitis. Increased plasma CRP levels in periodontitis patients as compared to periodontally healthy controls has been shown by systematic reviews and meta-analysis of cross-sectional studies. The CRP is not only associated with acute responses, it is also associated with cardiovascular risk, including coronary heart disease, stroke and myocardial infarction. Periodontitis may be linked with cardiovascular risk through regulating CRP level (7).

Periodontitis, which is the common chronic inflammatory condition worldwide, has been epidemiologically shown to play a contributing role in the onset of cardiovascular disease in the general population. Elevated CRP levels that indicates chronic low-grade inflammation, has been known to foresee future onset of cardiovascular disease among individuals who are apparently healthy, which may be due to some extent to periodontitis (8). In several investigations, adirect link between cigarette smoking, increased levels of CRP, and other markers of inflammation, and has been reported. Araised baseline inflammatory status, as measured by CRP level, has been known to increase the risk of numerous chronic conditions, including cardiovascular diseases (9). Alsothere is plentiful evidence in indexed literature to ratify that tobacco smoking is a risk factor of systemic diseases such as cardiovascular and oral diseases that also includes chronic periodontitis (10).

So the main aim of our study is to assess the periodontal status and serum CRP levels in adult smokers to help in assessment and prevention of future cardiovascular diseases.

Methodology

The study was conducted in Hit Hospital and Dental Hospital HITEC-IMS Taxila Cantt for the duration of 5 months from 20th October 2021 to 31st March 2022. It included 60 healthy male adult smokers as a subject group and 20 healthy male non-smokers as a control group. The consent was taken from every participant before periodontal examination and taking blood sample.

The inclusion criteria included healthy male adult cigarette smokers including age from 18 to 40 years who smoke minimum of 10 cigarettes per day for at least one year. Exclusion criteria included females and individuals having chronic systemic diseases such as hypertension, cardiovascular disease, diabetes, other hematological conditions, any other inflammatory diseases, long term medications, past periodontal treatment within 6 months before examination.

Periodontal examination:

The participants were subjected to basic periodontal examination using basic periodontal probe. The parameters such as gingival index (by Silness and Loe), bleeding on probing (BOP), gingival recession, gingival pigmentation, presence of periodontal pockets were assessed.

Gingival index by Silness and Loe was used. Its scores are

0 Normal gingiva
1 Mild inflammation
2 Moderate inflammation
3 Severe inflammation

The presence of periodontal pockets was determined as a part of basic periodontal examination. Its scoring is

0 No pockets<3.5mm, no calculus/overhangs, no BOP
1 No pockets< 3.5mm, no calculus/overhangs, BOP present
2 No pockets< 3.5mm, but supra or subgingival calculus/overhangs is present.
3 Probing depth 3.5-5.5 mm indicating pocket of 4-5mm.
4 Probing depth >5.5 mm indicating pocket of 6mm or more.

* Furcation involvement

The parameters bleeding on probing and gingival recession and gingival pigmentation were assessed separately.

These parameters were examined on every participant and a questionnaire was filled accordingly with the consent of every participant.

We divided smokers by their number of cigarettes smoking per day.

10 or fewer are considered mild smokers.
11-20 as moderate smokers.
21- 30 or 30 above as heavy smokers.

Blood sample for serum CRP:

Blood sample from every participant was taken after their consent. The sample was taken from antecubital vein by initially cleaning the area with alcohol swab. 2cc blood was taken and transferred into serum vial. The sample was sent to Hit Hospital Pathology Lab for quantitative measurement of serum CRP levels. CRP was determined by standard automated machine and according to manufacturer's instructions.

Results

Results were computed using Spss23. Percentage values of different periodontal parameters were calculated among smokers (subject group) and nonsmokers (control group). P values were calculated using chi square test. For statistical analysis, P value <0.05 were considered statistically significant. Serum CRP levels< 3 mg/L were considered normal.

57% of smokers were mild smokers. 35% were moderate smokers and 8% were heavy smokers.

As shown in table 1, smokers showed more gingival inflammation, gingival recession, and oral pigmentation than control group. However, nonsmokers exhibited more gingival bleeding as compared to smokers. Non-smokers exhibited a higher percentage for bleeding on probing 30% as compared to smokers 23.3%.

41.7% of smokers showed symptoms of mild inflammation, 20% showed symptoms of moderate inflammation while 3.3% showed severe inflammation, while percentages shown by control group are less as compared to subject group. Gingival recession, with p value of 0.040, is significantly higher in smokers than control group.38.3% smokers exhibited gingival recession. Also, gingival pigmentation was more prominent in the subject group with percentage of 43.3%. Presence of periodontal pockets is more prominent in smokers with percentage of 33.3% this gives statistically significant p value of 0.035 in smokers. So, the signs of periodontitis are more prominent in smokers than nonsmokers.

Table 1: Percentage values of periodontal parameters among adult smokers and nonsmokers.

Periodontal parameters		Smokers	Nonsmoker (control group)
		Percentage	Percentage
1	**Gingival status**		
	Normal gingiva	35%	55%
	Mild inflammation	41.7%	30%
	Moderate inflammation	20%	15%
	Severe inflammation	3.3%	0%
2	**Bleeding on probing**		
	No	76.7%	70%
	Yes	23.3%	30%
3	**Gingival recession**		
	No	61.7%	95%
	Yes	38.3%	05%
4	**Gingival pigmentation**		
	No	56.7%	75%
	Yes	43.3%	25%
5	**Presence of periodontal pockets**		
	Absent	66.7%	90%
	Present	33.3%	10%

Serum CRP values in adult smokers showed significant p values of 0.024. Nonsmokers showed normal values for serum CRP.

Table 2: Significant p-values

Parameters	Chi-value	P-value
Presence of gingival recession	29.730	0.040
Presence of periodontal pocket	30.275	0.035
CRP	31.636	0.024

Discussion

Periodontitis is an inflammatory disease which causes the destruction of both soft and hard tissue in the periodontium (11). Cigarette smoking has been linked to the accelerated periodontal destruction and increased risk of periodontitis in young adults (12). Our study showed that smokers exhibited more gingival recession (38.3%), gingival pigmentation (43.3%) and periodontal pocket formation(33.3%) as compared to control group showing significant p value of 0.040 in gingival recession and 0.035 in periodontal pocket presence. Mild gingival inflammation (41.7%) was prominent in smokers but not statistically significant from nonsmokers. This finding is in accordance with the results of previous studies conducted on smokers and nonsmokers, where gingival inflammation in smokers was higher than nonsmokers (13). Bleeding on probing was less prominent in smokers than nonsmokers. This also been affirmed by previous studies. These lowest values in all clinical periodontal parameters except BOP was observed in control group (14,15). This low value of bleeding on probing in smokers, despite of presence of inflammation, is explained in prior studies which states that with an underlying inflammatory cell infiltrate, gingival inflammation can be present even with a clinically decreased gingival bleeding. This hidden inflammatory status may explain the high level of periodontal destruction perceived in smokers. Vasoconstriction caused by smoking, along with fibrosis, could be responsible for the masking of clinical signs of inflammation (e.g. bleeding on probing), despite underlying inflammatory infiltrate in smokers. This also put an importance of diagnosing gingival inflammation in smokers, despite of the conception that smokers present reduced gingival bleeding (16). So the signs of periodontitis are more prominent in smokers than nonsmokers showing the impact of smoking for development of periodontitis.

It has been observed in previous studies as well that individuals with periodontitis displayed a significantly higher level of CRP in comparison with individuals without periodontitis (17). In our study, serum CRP levels are significantly higher in smokers. It gives a significant p value of 0.024. These results are in accordance with prior studies (18). Control group gave no elevated CRP values. The normal range of CRP levels in healthy individuals is observed to be 2-3mg/L. CRP levels >3mg/L are indicative of high risk for developing cardiovascular diseases (18). Increase in CRP levels can contribute to the risk of coronary heart disease, myocardial infarction, and stroke. The link between periodontitis and the CRP levels may help in understanding the pathophysiological mechanisms that link periodontitis to cardiovascular diseases. Also avoiding increased CRP levels may help in preventing cardiovascular diseases (7).

These results from our study is in agreement with previous publications which supported the association between periodontitis and raised serum CRP levels. Epidemiological studies have demonstrated that elevated CRP is associated with an increased risk for future cardiovascular events (19).

So smoking, which is a risk factor for periodontitis, has also been associated with high levels of serum CRP. In our study smokers show signs of periodontitis and raised serum CRP. This supports the theory that periodontitis has a significant impact on the levels of inflammatory biomarkers, suggesting that periodontal infection can lead to a systemic effect, favoring the development of cardiovascular diseases (17).

So, our study concludes that evaluation of the periodontal status and serum CRP levels in smokers in adult age can help in assessment and prevention of future cardiovascular diseases. However, further studies, with special attention to perplexing factors, are needed to further assess the association between periodontitis and serum levels of CRP and their link to the development of cardiovascular diseases. Further studies are needed to clarify the extent to which periodontitis-associated CRP can contribute to an increased risk for future cardiovascular events or a worse prognosis in individuals with existing cardiovascular diseases. Also, by reducing cigarette smoking and by preventing and treating periodontal diseases at adult age can help in reducing the risk of developing cardiovascular diseases.

Conclusion

Our study concluded that adult smokers exhibits the signs of periodontitis and their serum CRP is also elevated. So by assessing periodontal status and serum CRP in adult smokers might help in assessment and reducing risk for developing future cardiovascular diseases.

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