Assessment of the effect of periodontal treatment in patients with coronary artery disease: A pilot survey

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ABSTRACT

Background: Periodontitis is a chronic inflammatory condition believed to cause a low but long lasting systemic inflammatory reaction which in turn contributes to the development of atherosclerosis. Recent data suggests that around 40% cases of coronary artery disease remain unaccounted despite the identification of the classical risk factors. **Objectives:** To evaluate the efficacy of non surgical periodontal therapy on the levels of serum inflammatory markers in subjects with chronic periodontitis and known coronary artery disease. **Materials and Methods:** Twenty subjects with known coronary artery disease (CAD) were recruited from the Department of Cardiology, CSM Medical University, Lucknow, India, for this study. Periodontal disease was measured through the clinical parameters bleeding on probing (BOP) and probing depth (PD). All subjects received non surgical periodontal therapy that included oral hygiene instructions and meticulous scaling and root planing. Systemic levels of inflammatory markers such as high-sensitivity C reactive proteins (hsCRP), tumor necrosis factor-α (TNF-α), and white blood cell (WBC) counts were measured prior to and 1 month after periodontal therapy. **Results:** Subjects experienced significant reductions in bleeding on probing (BOP) and probing depth (PD), indicating improvement in overall periodontal health. In all subjects, high-sensitivity C reactive proteins (hsCRP), and WBC counts were reduced significantly,; however, tumor necrosis factor-α (TNF-α) levels showed no statistically significant reduction. **Conclusion:** In this study, periodontal treatment resulted in a significant decrease in bleeding on probing (BOP) and probing depth (PD), and this treatment lowered the serum inflammatory markers (hsCRP and WBC counts) in patients with coronary artery disease. This may result in a decreased risk for coronary artery disease in the periodontally treated patients.

Key words: Coronary artery disease, high-sensitivity C-reactive protein, periodontitis, tumor necrosis factor-α

INTRODUCTION

Non communicable diseases are taking an epidemic form and will be a major cause of death in developing countries by the year 2020.[1] Over 29.8 million people have coronary artery disease in India.[1] Studies conducted in India show that every second person above 35yrs of age has periodontal pockets and 30% of total teeth extracted after 35yrs of age are due to periodontal disease.[2] As a result of high prevalence of both coronary artery disease (CAD) and periodontal disease it has led to a hypothesis that these might be connected.[3]

Framingham heart study has identified a list of classical

risk factors (hypertension, male gender, age, smoking, diabetes mellitus, and obesity). However, they were not sufficient to account for the etiology of this multifactorial pathological process. Although major improvements have been made in primary and secondary prevention of major risk factors of CAD, it continues to be highly prevalent. Around 40% cases of atherosclerosis cannot be attributed to the classical risk factors.

Due to these facts, there is an increased interest for considering chronic infections as a risk factor for atherosclerosis.[4] As inflammatory mechanisms play a central role in mediating all phases of atherosclerosis and destructive periodontal disease, when left untreated they become a chronic inflammatory condition leading to an increase in local and systemic inflammatory mediators. Thus, perio systemic connection is a major current interest in periodontology.

Periodontal associated inflammatory process contributes to an increase in inflammatory mediators including tumor necrosis factor-α (TNF-α), C reactive proteins (CRP) and interleukin- 6 (IL- 6).[5]

Epidemiological studies have associated plasma levels of IL-6 and TNF - α with cardio vascular risk factors and have associated IL- 6levels with a risk of CAD.

Thus, the purpose of this interventional survey was to see the effect of periodontal treatment on levels of serum inflammatory markers CRP, TNF-α and white blood cell (WBC) counts.

MATERIALS AND METHODS

Twenty subjects were recruited from the Department of Cardiology, CSM Medical University, Lucknow, India, for the survey. Subjects with a chronic generalized periodontitis having coronary artery disease confirmed by clinical findings and ECG as interpreted by a cardiologist were included in the study.

Exclusion criteria included current smoking, smoking within last 6 months, diabetes and acute/chronic systemic diseases (e.g. influenza, rheumatoid arthritis, COPD, or kidney disease), antibiotics or anti inflammatory drug administration within the last 2 months, and pregnancy/lactation.

Clinical periodontal parameters

Probing depth was recorded at six sites per tooth (mesio

buccal, mid buccal, disto buccal, mesio lingual, mid lingual, and disto lingual).[6] Probing depth was recorded to the nearest millimeter using UNC 15 probe.

The presence or absence of bleeding was recorded using Sulcular Bleeding Index (SBI, Muhlemann and Son 1971).[7]

All subjects received oral prophylaxis and sublingual scaling and root planing. Oral hygiene instructions were given and the subjects were recalled 1 month after the last treatment visit.

Serum inflammatory markers
Serum high-sensitivity C reactive protein (hsCRP) was measured by using particle- enhanced turbidimetric assay (hsCRP, latex, COBAS, Integra 400 plus, ROCHE, Basel, Switzerland). Precipitate was determined turbidimetrically at 552 nm. The lower limit of assay was 0.1mg/ml.

TNF- α serum levels were determined by sensitive enzyme-linked immunosorbent assay (ELISA) using commercially available kit (R and D systems Inc, Minneapolis, MN, USA). The lower limit of detection was 0.06 pg/ml. The plates were read using an automated microplate reader (Bio Rad, Hercules, California, USA).

WBC count ($\times/10^9$) was obtained.

All the parameters (PD, BOP, hsCRP, TNF-α, WBC counts) were obtained at the baseline and 1 month post treatment.

Statistical analysis

The data collected were analyzed using non parametric Wilcoxon signed rank test. *P* values ≤ 0.05 were considered statistically significant.

RESULTS

There was a statistically significant reduction in BOP and PD post treatment. BOP was reduced by 28% and PD was reduced by 41% at the end of 1 month [Table 1].

hsCRP and WBC levels were significantly reduced post treatment. However, the levels of TNF α were not significantly reduced. The hsCRP, TNF- α levels and WBC counts reduced by 18, 2, and 14%, respectively [Table 2].

DISCUSSION

The present study was conducted with the purpose of detecting the role of non surgical periodontal therapy in

Table 1: Data on periodontal disease markers before and after treatment

Parameters	Baseline	Post treatment	Change
Bleeding on probing (%)			
(mean ± SD)	66.6 (± 1.4)	48.1 (± 5.7)	18.5
Probing depth(mm)			
(mean ± SD)	4.40 (± 0.80)	2.60 (± 0.78)	1.8

Table 2: Data on serum inflammatory markers before and after treatment

Inflammatory markers	Baseline	Post treatment	Change
hsCRP (mg/L)			
(mean ± SD)	2.54 (± 0.31)	2.08 (± 0.31)	0.46
TNF α (pg/ml)			
(mean ± SD)	1.79 (± 0.13)	1.59 (± 0.13)	0.20
WBCs (109/L)			
(mean ± SD)	8.04 (± 1.08)	6.90 (± 0.87)	1.14

subjects with coronary artery disease. The study clearly showed that there was a significant reduction in the levels of serum inflammatory markers (hsCRP and WBC counts) after periodontal therapy. The study is in agreement with the results of previous studies[6-10] that stated a reduction in systemic inflammatory markers of inflammation associated with periodontitis post treatment.

In this study, non surgical therapy alone produced significant improvements in various periodontal parameters. BOP is an informative parameter to estimate the severity of gingival inflammation as well as the response to treatment, and it is a clinical indicator of disease progression and stability[11]. BOP ≤ 20% of sites is associated with a lower risk for periodontal attachment loss. In the present study, BOP was significantly reduced 1 month after treatment, and the number of subjects with BOP >20% of sites at baseline was reduced by almost half after therapy. Similarly, all subjects experienced significant reductions in PD after the treatment.

In this study, 1month after mechanical therapy, the circulating levels of hsCRP and WBC counts significantly reduced in all subjects. CRP is a prognostic marker for future cardiovascular events.[12] The release of bacteria and proinflammatory mediators such as bacterial endotoxins and cytokines in the bloodstream that causes the release of acute phase reactants (such as C reactive protein) leading to increased inflammatory activity in atherosclerotic lesions may represent the link between periodontal infection and CAD.

In addition, subjects with periodontitis present with higher counts of WBCs. WBC count, a crude marker of systemic inflammation associated with the prediction of future cardiovascular events[13] also significantly decreased

for subjects with CAD. Individuals in our study showed a significant reduction of WBC after 1 month.

TNF-α has a role in apoptosis, bone resorption, matrix metalloproteinase (MMP) and IL- 6 production. It has also been associated with increased risk of recurrent coronary events[14.] However, the role of TNF - α remains disputed as several studies have not been able to recognize its association to cardiovascular events.[15] Also, in our study there was no significant reduction in the levels of TNF- α. Large sample size is required to justify the association of TNF-α.

The observation that cardiovascular risk factors might be influenced by periodontitis may have important clinical consequences. First, as inflammation plays an important role in the pathophysiology of various conditions (metabolic syndrome, BP, vascular health).[16] The association of mild chronic inflammation with future serious events in observational studies[17] may be influenced by an underlying severe periodontal infection. Second, periodontitis may increase the risk of future cardiovascular events because of the pro atherogenic changes (increased cholesterol) and increased systolic blood pressure induced in affected individuals. Cigarette smoking represents the major influential factor with regard to the association between periodontal infections and systemic inflammation, and this preliminary investigation raises the hypothesis of a possible interaction of smoking, periodontal infection and systolic blood pressure on systemic health.Third, if periodontitis were the major inflammatory stimulus in at least some patients with periodontitis, severe periodontal infections may represent a major etiologic factor for atherosclerosis, metabolic syndrome, and their sequelae.

Still, the causal relationship between periodontitis and CAD cannot be established as the sample size was small and the role of other risk factors was not explored. On the basis of the data obtained, a large scale interventional study could be conducted in future.

CONCLUSION

- Poor oral health is detrimental to systemic health.
- Inflammatory markers are significantly associated with periodontitis.
- Periodontitis is a modifiable risk factor, which can be prevented and treated.

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