

CLINICAL RESEARCH

Effect of Nonsurgical Periodontal Therapy on Serum Levels of Predialysis Chronic Kidney Disease Patients

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ABSTRACT

Researchers have shown inflammation to be a common feature in patients suffering from periodontal disease and various other systemic conditions. A field of periodontal research known as "Periodontal Medicine" has emerged, investigating the link between periodontal diseases and other systemic diseases and the role periodontal diseases play in systemic disease progression and vice versa. Chronic Kidney Disease is a public health problem whose prevalence has been increasing worldwide. The aim of the study was to investigate how predialysis CKD patients with periodontitis respond to non-surgical periodontal treatment. A total of 100 patients were enrolled for this study with the following selection criteria:

- Age range 35-55 years
- No antibiotic treatment within last month
- No other systemic disease except CKD
- No periodontal treatment within last 6 months

Chronic kidney disease was diagnosed on the values of GFR and stage 2 CKD patients (GFR 60 -89) were included in the study.

Patients with periodontitis were included with the Probing depth \geq 5mm in atleast 30% of sites. The study concluded that successful periodontal treatment may represent an important means of ameliorating the inflammatory burden seen in CKD. keywords- Chroniv Kidney Disease(CKD), Probing Depth (PD), Plaque Index (PI), Bleeding Index (BI).

Keywords: Kidney disease, Periodontal therapy, Periodontitis.

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INTRODUCTION

Inflammation is the biological response of tissue to harmful stimuli, such as pathogens or irritants. Researchers have shown inflammation to be a common feature in patients suffering from periodontal disease and various other systemic conditions.^{1,2} Periodontal diseases are chronic, predominantly gram-negative infections of the oral cavity that are initiated in the gingiva and, if untreated, lead to alveolar bone destruction and eventual tooth loss.

During the last two decades, a field of periodontal research known as "Periodontal Medicine" has emerged, investigating the link between periodontal diseases and other systemic diseases and the role periodontal diseases play in systemic disease progression and vice versa.³ Recent evidence suggests that there may be an association between periodontal infections and several systemic conditions including chronic kidney disease (CKD), diabetes, cardiovascular disease, and adverse pregnancy outcomes.^{4,5} Periodontal disease is an infection caused by gram-negative bacteria leading to a chronic inflammatory state, which more recently has been associated with CKD.⁶ However, in many cases, the etiology of kidney disease remains unknown and cannot be explained by the usual primary causes, such as diabetes mellitus, hypertension, pyelonephritis, glomerulonephritis, nephrosclerosis, polycystic kidney disease, and collagen vascular disease.⁷

Periodontitis is an inflammatory disease that is characterized by increased oxidative stress.^{8,9} It is known that CKD is also an inflammatory syndrome associated with adverse outcomes.¹⁰ Oxidative stress has been implicated in the development of these degenerative diseases. Inflammation causes reactive oxygen species (ROS) overproduction, which, in turn, recruits other inflammatory cells leading to additional ROS production, thus amplifying the damage causing increased oxidative stress.¹¹ This leads to increased lipid peroxidation causing increase in the levels of malondialdehyde (MDA). Therefore, periodontitis causes increased oxidative stress resulting in increased levels of MDA.¹²

The CKD is a generalized term for a variety of chronic conditions that result in compromised kidney functions. The CKD is a public health problem whose prevalence has been increasing worldwide. A clinical consequence of renal failure is the retention of excretory products and interference with endocrine and metabolic functions. This failure in kidney homeostasis is called uremia and it is

associated with immune dysfunction, including defects in lymphocyte and monocyte function.¹³ Based on the above, this research project was based on the assessment of effect of periodontal therapy on systemic status and its renal outcome. The aim of the study was to investigate how predialysis CKD patients with periodontitis respond to nonsurgical periodontal treatment.

OBJECTIVE

Quantitative assessment of serum albumin at baseline and 6, 12, and 18 months.

- Assessment of periodontal parameters at baseline and 6, 12, and 18 months.
 - Probing depth (PD)
 - Bleeding index (BI)
 - Plaque index (PI)
- Correlating periodontal and biochemical parameters at various intervals.

MATERIALS AND METHODS

The study was conducted at Aastha Kidney and General Hospital, Sriganganagar, Rajasthan, India. A total of 225 CKD patients with periodontitis were screened, out of which 100 patients were enrolled for this study with the following selection criteria:

- Age range: 35 to 55 years
- No antibiotic treatment within last month
- No other systemic disease except CKD
- No periodontal treatment within last 6 months

The CKD was diagnosed on the values of glomerular filtration rate (GFR), and stage 2 CKD patients (GFR 60–89) were included in the study.

Patients with periodontitis were included with PD ≥5 mm in at least 30% of sites. The other parameters assessed during the course of study were

- BI (Mombelli and coworkers index 1987) (Table 1)
- PI (Mombelli index 1987) (Table 2)

Serum albumin was assessed at different intervals. A complete oral prophylaxis of these patients was done. The patients were then put on maintenance phase, i.e., periodic recall visits. Oral hygiene instructions included toothbrushing technique (vertical) with use of a fluoridated toothpaste. The interval of these visits was set at 3 months. At each visit, a supragingival scaling and

chemical irrigation using chlorhexidine were done. All the parameters, i.e., PI, GI, and PD, and biochemical parameters, were checked at 6, 12, and 18 month intervals.

SAMPLING

Blood samples were collected from a peripheral vein. The samples were put into pyrogen-free tubes containing clot activator (without anticoagulant). After coagulation, samples were centrifuged (at 1500 × g for 15 minutes) and serum was harvested. Serum albumin was measured using albumin test kit (Bromocresol green, End point Assay, ArKay Health care Pvt Ltd.) according to manufacturer’s instructions.

Clinical Evaluation Parameters

BI: The Mombelli and coworkers index (1987) was scored at different intervals.

PI: The Mombelli index 1987 was used to quantify the amount of plaque retained.

The plaque score and bleeding score were measured at different intervals of 6, 12, and 18 months.

Pocket depth: the depth was measured by using a William’s graduated periodontal probe. The distance between the marginal border of the gingiva and the tip of the pocket probe was scored as the probing pocket depth.

RESULTS

All the obtained values were subjected to statistical analysis using Statistical Package for the Social Sciences version 2.0 (IBM SPSS Statistics Inc., Chicago, Illinois, USA). Graph 1 shows changes in value of albumin over time, indicating the values were statistically significant at 6, 12, and 18 months. Graph 2 shows that changes in PD were statistically significant at 6, 12, and 18 months. Graphs 3 and 4 show the changes in BI and PI over time. The values are statistically significant at 6, 12, and 18 months. However, when an intercomparison was done between different time intervals, the change was statistically significant at baseline, 6 and 18 months and from baseline and 12 months. The change was nonsignificant at 6 and 12 months and 12 and 18 months (Graph 5 and 6). Graphs 7 to 10 show the correlation of PD and BI, PD and PI, BI and PI respectively. The values were statistically significant at all time intervals.

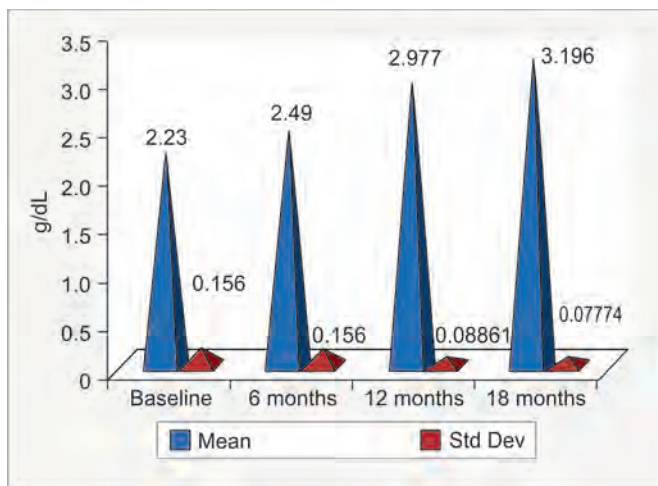
Table 1: Bleeding index—the Mombelli & co-workers index¹⁴ (1987) was scored at different intervals

| Score | Criteria |
|-------|--|
| 1 | No bleeding when a periodontal probe is passed along the gingival margin |
| 2 | Isolated bleeding spots visible |
| 3 | Blood forms a confluent red line on margin |
| 4 | Heavy or profuse bleeding |

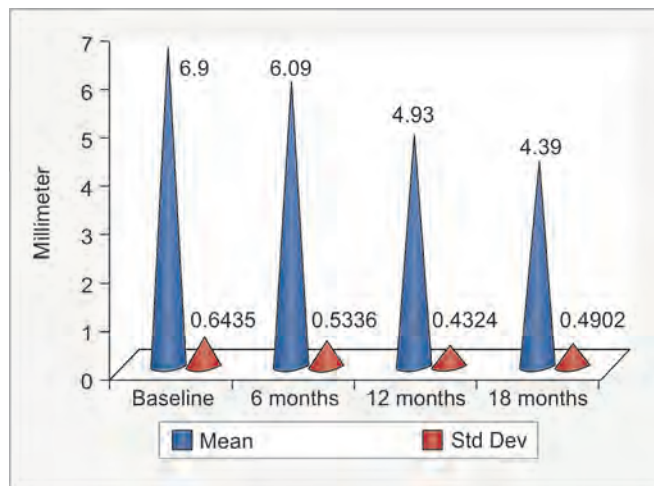
Table 2: Plaque index—the Mombelli index¹⁴ (1987) was used to quantify the amount of plaque retained

| Score | Criteria |
|-------|--|
| 1 | No plaque |
| 2 | Plaque detected by running a probe across the margin |
| 3 | Plaque can be seen by naked eye |
| 4 | Abundance of plaque |

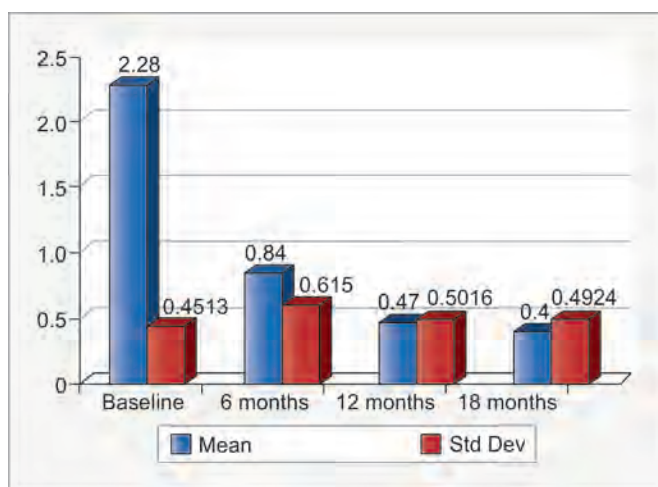




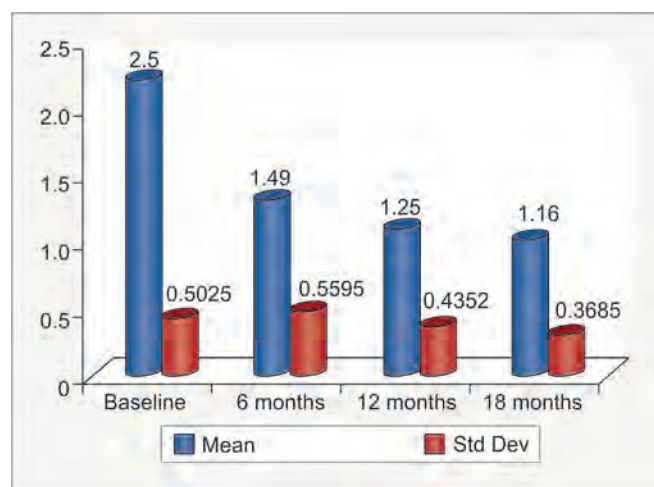
Graph 1: Comparison of albumin at various time period



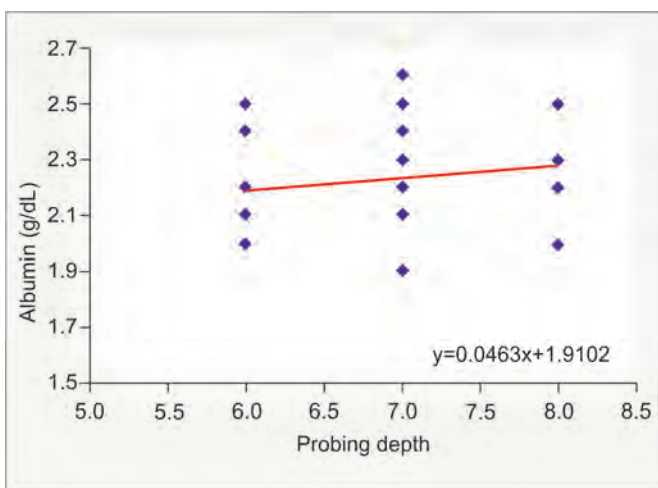
Graph 2: Comparison of PD at various time period



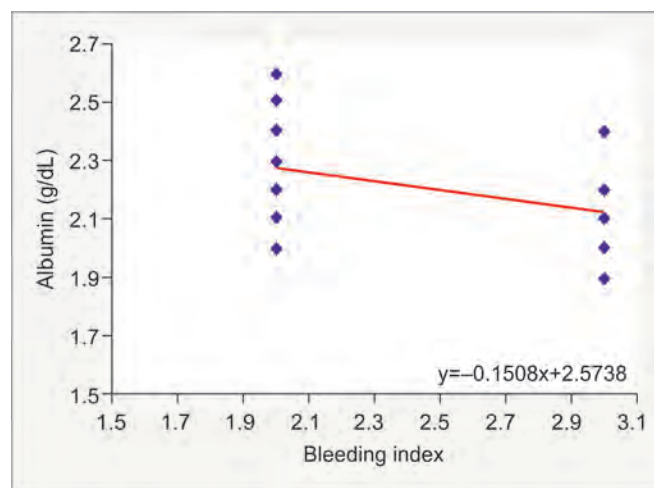
Graph 3: Comparison of BI at various time period



Graph 4: Comparison of PI at various time period



Graph 5: Correlation between probing depth and albumin

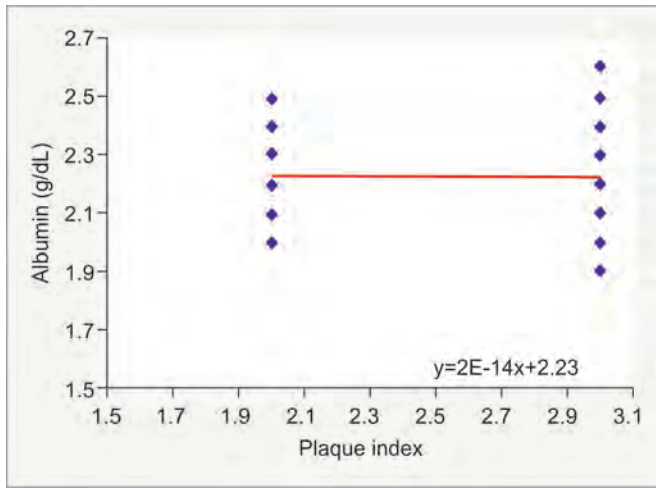


Graph 6: Correlation between bleeding index and albumin

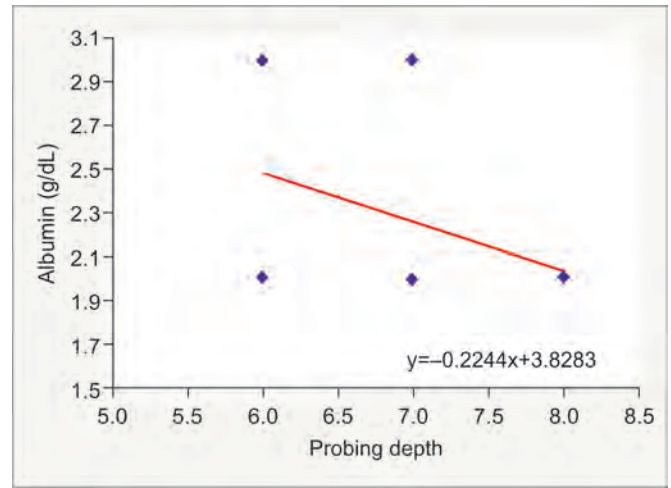
DISCUSSION

Periodontal disease is a complex, multifactorial, chronic inflammatory disease that involves degradation of periodontal structures including alveolar bone. Inflammation promotes endothelial dysfunction. Inflammation and

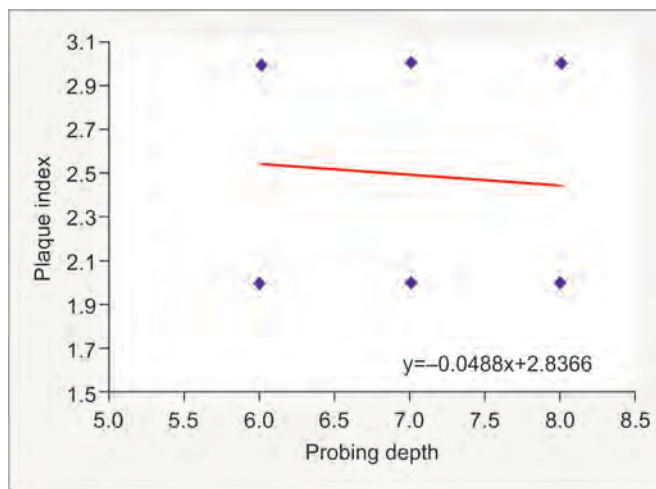
endothelial dysfunction in kidneys can cause damage to glomerulus. This subsequently leads to the impairment of kidney function noted by decrease in renal GFR. The present study involved the assessment of serum albumin and clinical assessment of periodontal parameters like PD,



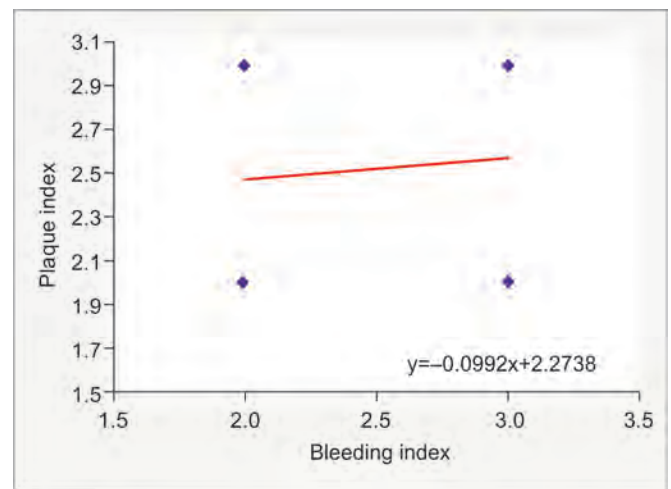
Graph 7: Correlation between plaque index and albumin



Graph 8: Correlation between probing depth and albumin



Graph 9: Correlation between probing depth and plaque index



Graph 10: Correlation between bleeding index and plaque index

BI, and PI in predialysis CKD patients with periodontitis at baseline, 6, 12, and 18 month intervals. In a study conducted by Marnizio J Tonetti et al,¹⁵ they speculated the nontraditional risk factors as periodontitis with their influence on endothelium structure and function through infection-driven inflammatory markers in the kidney. The present study included stage 2 CKD patients (predialysis) and the effect of nonsurgical periodontal therapy was evaluated at different intervals. Until recently, the emphasis has been on the patients needing dialysis or transplantation. It is now realized that less severe CKD is quite common, and monitoring in primary care will enable the minority of patients who go on to develop a more severe form to be detected at earlier stage. This is important because the earlier the intervention, the earlier the impact. F Brito et al¹⁶ studied the extent and severity of chronic periodontitis in CKD patients and found that predialysis patients are associated with higher prevalence of severe periodontitis compared with healthy individuals. Bastos JA et al¹⁷ studied the severity of periodontal disease and

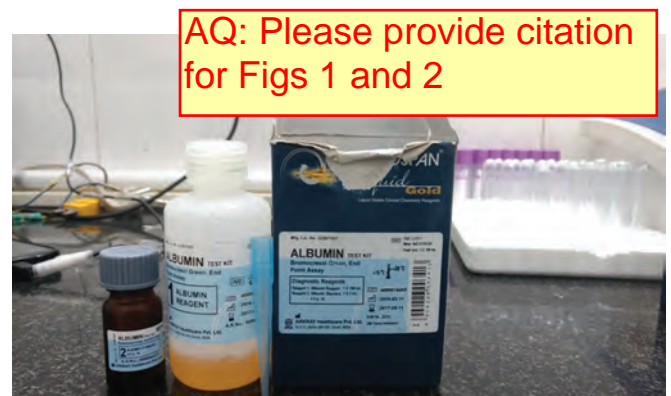


Fig. 1: Albumin test kit (arkay healthcare pvt ltd)

identification of microorganisms in subgingival plaque in patients with and without CKD. The results showed that chronic periodontal disease was more severe in patients with CKD. Similarly, Monica A Fisher et al¹⁸ performed a study to measure kidney function, periodontal status, and other traditional and nontraditional risk factors for CKD. They concluded that identifying individuals with periodontal disease and inclusion of periodontal therapy



Figs 2A to C: Assessment of periodontal parameters: (A) Probing depth; (B) plaque index; and (C) bleeding index

could be an approach to impede the increasing number of individuals with CKD. Jacek Borawski et al¹⁹ concluded that prophylaxis and early periodontal treatment should be intensified in these subjects. The study involved the assessment of albumin. In patients with acute kidney injury, serum creatinine level does not increase until moderate-to-severe reduction in GFR occurs. Thus, it is important to detect early kidney damage and making important therapeutic decisions. Albumin is a protein. It provides the body with the protein needed to both maintain growth and repair tissues. It can also help with fluid removal during the dialysis treatment. There are a variety of reasons for low albumin level. These include inadequate nutrition, protein loss, and inflammation.²⁰ Pradeep AK et al²¹ reported a study on the association between periodontal disease and CKD. The result indicated that values of inflammatory mediators could be used for identifying individuals with PD at higher risk of CKD. AV Kshirsagar et al²² measured serum albumin levels in end-stage renal disease patients. They found that severe periodontal disease was associated with low serum albumin as compared with individuals without severe periodontal disease. Celso Oliveira et al²³ studied

the effect of nonsurgical periodontal treatment on CKD predialysis patients. The result showed that periodontal treatment had a statistically significant positive effect on GFR. The study demonstrates that CKD predialysis patients show a good response to nonsurgical periodontal treatment. In the present study, the values of albumin increased, i.e., macroalbuminuria was noted as the periodontal treatment progressed at different time intervals. Arsalan wahid et al²⁴ studied the bidirectional relationship between CKD and periodontal disease. The study inferred that patients with CKD have high prevalence of periodontal disease while nonsurgical periodontal therapy has been indicated to decrease the systemic inflammatory burden by altering the values of albumin in CKD patients. Similar results have been shown by Monica A Fisher et al.²⁵ Ayyaz A Khan²⁶ conducted a study to determine the effect of nonsurgical periodontal therapy on serum albumin levels in CKD patients. The results showed the levels of albumin increased with effect of periodontal treatment, thus showing improved renal function. Similar results were found by Ramesh Amitha et al,²⁷ who concluded that there is an inverse correlation between the levels of serum albumin and periodontal

parameters. The results of the present study showed that all the systemic inflammatory markers as well as the periodontal parameters improved with nonsurgical periodontal treatment in CKD predialysis patients. This is justified as periodontal treatment leads to improvement in endothelial function via decrease in inflammatory factors.²⁸ Artese HP et al²³ found that CKD predialysis patients show a good response to nonsurgical periodontal treatment with statistically significant improvement in GFR indicating improved renal health. Fillippo Graziani et al²⁹ described the kinetics of serum inflammatory markers after a course of treatment comparing surgical and nonsurgical treatments for chronic periodontitis. The results concluded that patients undergoing periodontal treatment experience perturbations of systemic inflammation of a greater magnitude after nonsurgical than surgical periodontal therapy. Viela M et al³⁰ reported the effect of periodontal treatment in patients with CKD and found that the treatment resulted in significant reductions in C-reactive protein, interleukin-6, and prohepcidin levels before and 3 months after treatment. The study concluded that successful periodontal treatment may represent an important means of ameliorating the inflammatory burden seen in CKD.

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