



EFFECT OF PERIODONTAL THERAPY AND VITAMIN C ON SERUM C-REACTIVE PROTEIN LEVELS AND ASSOCIATED ORAL ANATOMICAL AND PHYSIOLOGICAL RESPONSES

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ABSTRACT

Background: Periodontitis is a chronic inflammatory condition of the supporting tissues of the teeth which can lead to inflammation in other parts of the body. One of the inflammatory markers that could be elevated in PD patients is the serum levels of C-reactive protein (CRP). The effects of phase I periodontal therapy will decrease local periodontal inflammation, and vitamin C may benefit further, owing to its antioxidant and immune supporting properties.

Objective: To determine the effect of Phase I periodontal therapy with adjunctive vitamin C on serum C-reactive protein levels in patients with generalized chronic moderate periodontitis.

Methods: The present study was a quasi-experimental pre-test/post-test comparative study carried out in Department of Periodontology at Sardar Begum Dental College, Gandhara University, Peshawar, from January 2025 to June 2025. Forty patients having generalized chronic moderate periodontitis were included and were divided into two groups of 20 patients each. Group A was given the periodontal therapy (Phase I) with vitamin C and Group B received the periodontal therapy (Phase I) with placebo. Serum C-reactive protein (CRP) was taken before and after 1 month. A SPSS version 26 data analysis software was used for the analysis of data. The mean values and standard deviations were obtained for the CRP levels and also for the comparison between groups independent sample t-test was used. A p value of < 0.05 was deemed as statistically significant.

Results: The study included 17 males and 23 females. Before treatment, the mean serum CRP level was 39.8720 ± 25.95338 mg/L in the vitamin C group and 35.2720 ± 36.12485 mg/L in the placebo group. After one month, CRP decreased to 8.7895 ± 9.85048 mg/L in the vitamin C group and 26.4155 ± 29.67659 mg/L in the placebo group. The post-treatment difference between the groups was statistically significant, indicating a greater reduction in CRP among patients receiving adjunctive vitamin C.

Conclusion: Phase I periodontal therapy with adjunctive vitamin C was more effective in reducing serum CRP levels than Phase I periodontal therapy with placebo. Vitamin C may be considered a useful adjunct in patients with generalized chronic moderate periodontitis for reducing systemic inflammatory burden.

Keywords: Periodontitis, Phase I therapy, Vitamin C, C-reactive protein, periodontal therapy, inflammation.

INTRODUCTION

Periodontitis is a chronic inflammatory condition of the tooth supporting tissues namely gum, periodontal ligament, tooth cementum and alveolar bone. It is primarily caused by the action of the microbial dental plaque and the immune response of the host. Untreated, periodontitis can cause periodontal pockets, clinical attachment loss, loss of alveolar bone, tooth mobility and eventually tooth loss. In addition to the oral effects it has locally, periodontitis is now known to be a form of disease which could lead to systemic inflammation [1-3].

Periodontitis is a multifactorial, complex disease. While dental plaque biofilm is the principal etiological factor, the extent and progression of periodontal destruction is largely dependent upon the host inflammatory response. Cytokines and other mediators (IL-1 beta, IL-6, tumour necrosis factor alpha, prostaglandins) are released by inflammatory cells. These mediators are associated with local damage to the periodontal tissues and can also rise into the systemic circulation and thus elevate systemic inflammatory markers [4-6].

C-reactive protein is an acute-phase protein, primarily synthesized by the liver, in response to inflammation, infections, and tissue injury. It is a non-specific, but sensitive, indicator of systemic inflammation. If the patient is suffering from periodontitis, the chronic periododitis may raise the serum content of CRP. Clinically important elevated CRP, because it too has been linked to cardiovascular disease. Thus, periodontal treatment can be effective and the reduction of CRP may benefit beyond the mouth [7-9].

Phase I periodontal therapy is a basic non-surgical treatment that is required to treat periodontitis. It involves oral hygiene instructions, scaling and root planning which helps to eliminate any local irritants, such as plaque and calculus. As a result of Phase I, periodontal health is enhanced and local inflammatory markers can be controlled, which may decrease systemic inflammatory markers. However, response to treatment can differ in patients and there may be added supportive treatments that can enhance the healing [10-12].

Vitamin C is a water-soluble vitamin that has antioxidant and immune supportive properties. It is essential for the production of collagen, for wound healing, for the activity of the immune cells and for the protection against oxidative stress. Vitamin C is known to impact periodontal tissue damage by reducing inflammation and oxidative stress, which could contribute to healing and less periodontal activity. Therefore, it is suggested that its use as an adjunct to Phase I periodontal treatment may have an additional benefit in the reduction of serum CRP level [13].

Although periodontal therapy alone can reduce inflammation, the added role of vitamin C in lowering CRP levels among periodontitis patients requires further evaluation. This study was conducted to assess the effect of Phase I periodontal therapy with adjunctive vitamin C on serum C-reactive protein levels in patients with generalized chronic moderate periodontitis. The findings may help determine whether vitamin C can be used as a simple and supportive adjunct to conventional periodontal treatment.

METHODOLOGY

This study was conducted as a quasi-experimental pre-test/post-test comparative study to assess the effect of adjunctive vitamin C with Phase I periodontal therapy on serum C-reactive protein levels among patients with generalized chronic moderate periodontitis. The study was carried out in the Department of Periodontology, Sardar Begum Dental College, Gandhara University, Peshawar, from

January 2025 to June 2025. A total of 40 patients were included in the study and divided into two equal groups, with 20 patients in each group. Group A received Phase I periodontal therapy along with vitamin C, while Group B received Phase I periodontal therapy along with placebo. The original thesis also describes two equal groups and measurement of CRP before treatment and after one month. The patients were selected from the outpatient department of Periodontology with the eligibility criteria. The patients were both male and female. The age range of the participants was 30 to 45 years. Only persons with generalized moderate chronic periodontitis were admitted. To minimize the potential influence of obesity on CRP levels, patients were restricted to having a normal BWI (18.5-24.9 kg/m²). The following patients were excluded from the study: patients with systemic diseases, smokers, obese patients, patients already had received Phase I periodontal therapy, patients already took vitamin C, and patients who had history of vitamin C deficiency. These criteria were applied to reduce the potential confounding factors which could have an independent effect on serum CRP levels.

Baseline data was collected on a structured proforma after informed consent is obtained. Detailed demographic information was collected such as: age, gender, occupation and BMI. The clinical periodontal diagnosis was based on the established criteria for the diagnosis of generalized chronic moderate periodontitis, which involved slow destruction of the tooth-supporting structures, with a clinical attachment loss of 3-4 mm, the presence of calculus, as well as more than 30% involvement of teeth. To assess serum C-reactive protein levels, blood samples were taken before beginning treatment as baseline in all participants.

All participants received Phase I periodontal therapy, which consisted of scaling and root planning for removal of local irritants such as plaque and calculus. After completion of Phase I therapy, patients in Group A were given vitamin C once daily for 30 days, while patients in Group B were given placebo once daily for the same duration. Patients were advised to follow oral hygiene instructions and to take the provided medication regularly. The thesis states that the patients were recalled after one month, and CRP testing was repeated after the intervention period.

Venous blood samples were taken pre- and post-treatment for laboratory assessment 1 month later. Blood samples were all submitted to the same diagnostic lab for consistency of testing. The serum was separated by centrifugation and then the estimation of CRP was carried out following the standard laboratory procedure. Patient serum and control serum were diluted prior to testing and CRP standards were tested as received. Samples, standards and controls were placed in coated wells, incubated, washed and then exposed to enzyme conjugate reagent and developed with TMB reagent. Stop solution was added to the reaction and absorbance was measured at 450 nm. Absorbance values for the various standards, controls and patient samples were measured and then mean values were computed for all of them. The value of the CRP concentration was read from the standard curve.

Serum C-reactive protein (CRP) concentration before and after treatment was the primary outcome variable. The primary comparison was for the difference between the mean level of CRP in the vitamin C group and placebo group after one month. Demographic variables (gender and occupation) were secondary variables. Baseline CRP concentrations were compared between the two groups to determine group comparability and post-treatment CRP levels were compared to determine the effects of the addition of vitamin C to Phase I periodontal therapy.

The data were coded and analyzed through SPSS 26. Demographic variables were computed descriptive statistics. Frequencies and percentages were reported for categorical variables such as gender and occupation. Serum concentrations of CRP were calculated before and after treatment and the mean and standard deviation of these values calculated. The mean values of CRP were compared between the two groups using independent sample t-test. A p value of ≤ 0.05 was deemed as statistically significant. This study compared the effect of adjunctive vitamin C on reducing serum CRP levels with that of the Placebo in phase I periodontal therapy.

RESULTS

A total of **40 patients** with generalized chronic moderate periodontitis were included in this quasi-experimental pre-test/post-test comparative study. The participants were divided into two equal groups. Group A included 20 patients who received Phase I periodontal therapy with vitamin C, while Group B included 20 patients who received Phase I periodontal therapy with placebo. Serum C-reactive protein was measured before treatment and again after one month of intervention.

Among the 40 participants, 17 (42.5%) were male and 23 (57.5%) were female. In the Phase I therapy with vitamin C group, there were 11 males (55.0%) and 9 females (45.0%). In the Phase I therapy with placebo group, there were 6 males (30.0%) and 14 females (70.0%). The age of participants ranged from, according to the inclusion criteria.

Table 1. Gender distribution of study participants

Gender	Phase I Therapy + Vitamin C n (%)	Phase I Therapy + Placebo n (%)	Total n (%)
Male	11 (55.0%)	6 (30.0%)	17 (42.5%)
Female	9 (45.0%)	14 (70.0%)	23 (57.5%)
Total	20 (100%)	20 (100%)	40 (100%)

Among participants in the Phase I treatment group (Vitamin C) 7 (35.0%) were professionals, 6 (30.0%) were employed, 2 (10.0%) were self-employed, and 5 (25.0%) were unemployed. Of the placebo group, 2 (10.0%) were professionals, 11 (55.0%) were employed, no one had their own business and 7 (35.0%) were unemployed. The variable of occupation was treated as a background variable and was not used to draw conclusions about treatment.

Table 2. Occupational distribution of study participants

Occupation	Phase I Therapy + Vitamin C n (%)	Phase I Therapy + Placebo n (%)
Professional	7 (35.0%)	2 (10.0%)
Employed	6 (30.0%)	11 (55.0%)
Business	2 (10.0%)	0 (0.0%)
Unemployed	5 (25.0%)	7 (35.0%)
Total	20 (100%)	20 (100%)

Before treatment, the mean serum CRP level was 39.8720 ± 25.95338 mg/L in the Phase I therapy with vitamin C group and 35.2720 ± 36.12485 mg/L in the Phase I therapy with placebo group. There was no statistically significant difference between the two groups at baseline, suggesting that the groups were similar prior to intervention. The mean level of serum CRP after 1 month of treatment was 8.7895 ± 9.85048 mg/L in the group that received vitamin C therapy, and 26.4155 ± 29.67659 mg/L in the control group receiving placebo therapy. This indicates that the vitamin C treated patients with Phase I periodontal therapy had a higher reduction in the CRP level.

Table 3. Mean serum CRP levels before and after treatment

CRP level	Phase I Therapy + Vitamin C Mean $\pm$ SD	Phase I Therapy + Placebo Mean $\pm$ SD
Before treatment	39.8720 ± 25.95338	35.2720 ± 36.12485
After treatment	8.7895 ± 9.85048	26.4155 ± 29.67659

The pre-test results of the independent samples test indicated that there was no significant difference between the two groups. The CRP before treatment was statistically not different from baseline ($p = 0.776$, Levene's test and $p = 0.646$, t-test). Levene's test was significant ($p = 0.008$), and the

independent t-test indicated that there was a statistically significant difference between the two groups ($p = 0.016$, assuming equal variances; $p = 0.019$, assuming unequal variances).

Table 4. Independent samples test for serum CRP comparison

CRP comparison	Mean difference	t-value	p-value
Before treatment	4.6000	0.462	0.646
After treatment	-17.6260	-2.521	0.016

The vitamin C group's mean CRP decreases were greater than the placebo group's. The raw data indicated that the Phase I therapy with vitamin C group had a decrease of 31.0825 mg/L in CRP compared to the decrease of 8.8565 mg/L in the Phase I therapy with placebo group.

Table 5. Mean reduction in serum CRP after treatment

Group	Mean CRP before treatment	Mean CRP after treatment	Mean reduction
Phase I Therapy + Vitamin C	39.8720	8.7895	31.0825
Phase I Therapy + Placebo	35.2720	26.4155	8.8565

Overall, there was a decrease in serum CRP in both groups following periodontal therapy, but a greater decrease in the group receiving adjunctive vitamin C. The post-treatment comparison confirmed there was a statistically significant difference between the two groups, indicating that periodontal therapy involving vitamin C was more effective than periodontal therapy involving placebo in decreasing levels of the serum CRP.

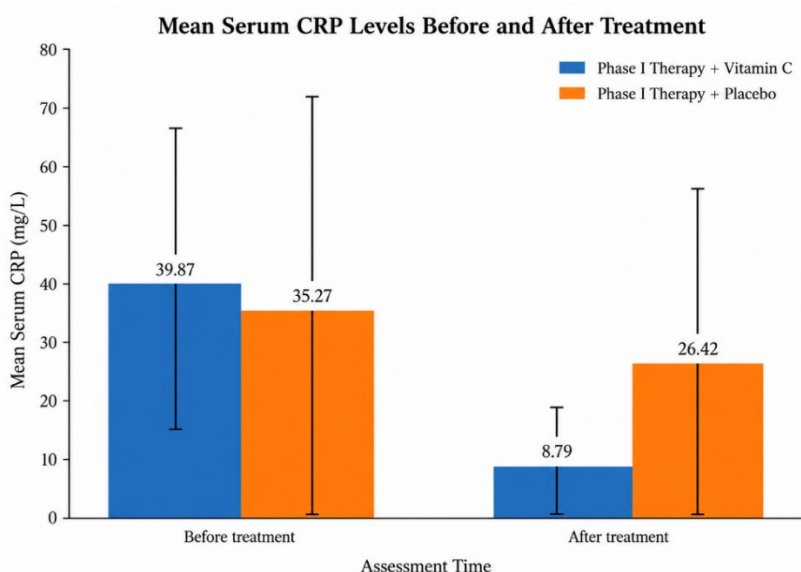


Figure 1. Mean serum C-reactive protein (CRP) levels before and after treatment in the two study groups.

The graph shows the mean serum CRP levels measured before and one month after treatment among patients receiving Phase I periodontal therapy with vitamin C and those receiving Phase I periodontal therapy with placebo. A greater reduction in CRP levels was observed in the vitamin C group compared with the placebo group.

DISCUSSION

The present study assessed the effect of adjunctive vitamin C with Phase I periodontal therapy on serum C-reactive protein levels among patients with generalized chronic moderate periodontitis. The

study included 40 patients, divided equally into two groups. One group received Phase I periodontal therapy with vitamin C, while the other received Phase I periodontal therapy with placebo. Serum CRP was measured before treatment and again after one month. The findings showed that CRP levels were reduced in both groups after periodontal therapy; however, the reduction was more marked in the group receiving vitamin C. This indicates that vitamin C may provide an additional anti-inflammatory benefit when used along with conventional non-surgical periodontal treatment [14, 15]. At baseline, the mean CRP level was 39.8720 ± 25.95338 mg/L in the vitamin C group and 35.2720 ± 36.12485 mg/L in the placebo group. Baseline difference between groups was not statistically significant reflecting similarity of groups prior to intervention. After one month, the mean CRP level decreased to 8.7895 ± 9.85048 mg/L in the vitamin C group and 26.4155 ± 29.67659 mg/L in the placebo group. The higher decrease in the vitamin C group indicates that systemic inflammation could be reduced in patients with periodontitis by using adjunctive vitamin C. The thesis also mentioned that both treatment groups had their CRP levels measured prior to the treatment and after 1 month [16].

Periodontitis is a chronic inflammatory condition, which is triggered by microbial plaque and host immune response. Periodontal tissue changes may lead to an elevation of systemic inflammatory markers such as CRP. High CRP levels are significant, because they indicate widespread inflammation, and they have been correlated with higher cardiovascular risk. In the current study, levels of CRP were decreased after periodontal treatment (Phase I), confirming that scaling and root planning is a therapeutic factor in controlling periodontal inflammation. The reduction of bacterial load as a result of removal of plaque and calculus will lead to a local reduction in tissue inflammation and may, therefore, result in a local reduction in systemic inflammatory markers [17].

The increased improvement in the vitamin C group may be attributed to the antioxidant and immune supporting effects of vitamin C as it helps in collagen production, regulates the normal function of immune cells and decreases oxidative stress. Oxidative stress and inflammatory mediators play a role in tissue destruction in periodontal disease. Thus, vitamin C might enhance healing response and decrease inflammatory activity during the Phase I therapy. This could account for the greater reduction in CRP observed in the vitamin C group as compared to the placebo group [18, 19].

The results of this study have clinical application as Phase I periodontal therapy is the foundation and first line of therapy for periodontal disease and Vitamin C is a simple and inexpensive adjunct that could be useful in systemic inflammatory outcomes. A decrease in CRP following periodontal therapy indicates that not only is it crucial for oral health but that it could also be beneficial on systemic inflammation. But CRP is a non-specific inflammatory marker and may be affected by other factors like infection, over/under weight, smoking, systemic disease and nutrition. To minimize the effects of these confounding factors, smokers, obese patients, patients with systemic disease and vitamin C deficiency were excluded [20].

One limitation of the study was the small sample size of 40 patients, with only 20 participants in each group. Long-term changes in CRP were also not possible as the follow-up period was limited to one month. The latter was also a limitation as a systemic inflammatory marker, only CRP was used. Other markers like interleukin-6, tumor necrosis factor alpha, and oxidative stress markers may have given a more comprehensive insight into the inflammatory response. In conclusion, further research with greater numbers of patients, longer observation periods and more periodontal and biochemical indices is recommended to further validate the positive effect of vitamin C as an adjunct to periodontal therapy.

CONCLUSION

This study concluded that Phase I periodontal therapy with adjunctive vitamin C produced a greater reduction in serum C-reactive protein levels compared with Phase I periodontal therapy with placebo among patients with generalized chronic moderate periodontitis. Although CRP levels decreased in both groups after treatment, the reduction was more pronounced in the vitamin C group. These findings suggest that vitamin C may be a useful adjunct to non-surgical periodontal therapy for

reducing systemic inflammation. Larger studies with longer follow-up are recommended to further confirm its clinical benefit.

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