



## Comparative Evaluation of C-reactive Proteins in Pregnant Women with and without Periodontal Pathologies: A Prospective Cohort Analysis

<sup>1</sup>Padmakanth Mannava, <sup>2</sup>Sunil Gokhale, <sup>3</sup>Sudarshan Pujari, <sup>4</sup>Krishna P Biswas, <sup>5</sup>Satish Kaliappan  
<sup>6</sup>Shashank Vijapure

### ABSTRACT

**Introduction:** Inflammation of tooth supporting structures is referred to as periodontitis. C-reactive proteins (CRP) levels are usually increased in case of chronic inflammatory process like periodontitis. Association of CRP with pregnancy has been observed in the past, which includes most commonly preterm delivery, preeclampsia, etc. Therefore, it can be hypothesized that CRP may act as a link between periodontitis and adverse pregnancy outcomes. Hence, we aim to evaluate the plasma CRP levels in pregnant women with and without periodontal pathologies.

**Materials and methods:** The study included 210 pregnant women who reported to the hospital with periodontal problems and for routine checkups. All the patients were divided into three groups based on the presence and absence of periodontal pathologies. Russell's Periodontal Index Score was used for the evaluation of periodontal status of the subjects.

**Results:** While comparing the mean CRP levels in all the three study groups, statistically significant results were obtained.

Statistically significant results were obtained while comparing the mean CRP levels in group C patients before treatment and after treatment therapy. The CRP levels were estimated by taking blood samples. Paired t-test and one-way analysis of variance was used to assess the correlation between the two parameters.

**Conclusion:** Casual association might exist between the CRP levels and periodontal diseases in pregnant women and the CRP levels may also get elevated in pregnant women.

**Keywords:** C-reactive proteins, Periodontitis, Pregnant.

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### INTRODUCTION

Periodontitis refers to the inflammation of the tooth supporting structures accompanied by edema, gingival bleeding initiating clinically in the gingival tissue and further progressing to involve the alveolar bone tissue causing its resorption, cemental and periodontal ligament destruction. Loss of teeth in the involved region occurs mostly in cases where the disease is left untreated.<sup>1</sup> Depending upon the immune response of the host, the severity of this disease shows a considerable variation.<sup>2</sup> Evidence-supported hypothesis postulates that persistent bacterial attacks along with varied host's inflammatory response may extend the disease beyond the level of periodontal tissues.<sup>2,3</sup> Proteins, such as C-reactive proteins (CRP), levels are usually increased because of chronic inflammatory process associated with periodontitis. Since these proteins are independent markers for cardiac

<sup>1</sup>Department of Periodontics, Triveni Institute of Dental Sciences Bilaspur, Chhattisgarh, India

<sup>2</sup>Department of Periodontology, Vaidik Dental College and Research Centre, Daman, India

<sup>3</sup>Department of Conservative Dentistry and Endodontics, PDU Dental College, Solapur, Maharashtra, India

<sup>4</sup>Department of Conservative Dentistry and Endodontics, Tamil Nadu Government Dental College and Hospital, Chennai, Tamil Nadu, India

<sup>5</sup>Department of Periodontics, Sarjug Dental College, Darbhanga Bihar, India

<sup>6</sup>Department of Periodontics, MS Ramaiah Dental College Bengaluru, Karnataka, India

**Corresponding Author:** Padmakanth Mannava, Reader Department of Periodontics, Triveni Institute of Dental Sciences Bilaspur, Chhattisgarh, India, Phone: +918109838589, e-mail: padmakanthm2012@gmail.com

pathologies, this very well explains the relation between periodontal diseases and cardiovascular diseases. These facts favor the hypothesis that periodontal diseases exaggerate the risk of development of cardiovascular pathologies. Literature quotes CRP values of more than 3 mg/L as high risk for further development of cardiac diseases.<sup>4</sup> In response to various inflammatory stimuli, liver produces CRP as an acute phase reactant product. Association of CRP with pregnancy has been observed in the past, which includes most commonly preterm delivery, preeclampsia, etc. Therefore, it can be predicted that CRP may act as an intermediate between periodontitis and adverse pregnancy effects.<sup>5</sup> Hence we conducted this study to evaluate the plasma CRP levels in pregnant women with and without periodontal pathologies.

**MATERIALS AND METHODS**

The study was carried out from May 2014 to June 2015. A total of 210 pregnant women reported to the hospital for routine checkup and with periodontal problems and were included in the study. Ethical permission was taken from the Institutional Ethical Committee before the commencement of the study. All the patients were divided into three groups, as shown in Table 1. The periodontal therapy in group C patients was carried in second trimester. Complete medical and dental history of the subjects was taken to rule out any other systemic illness. Inclusion criteria for the present study included subjects with 20 to 35 years of age, no present or past history of any systemic illness, or any known drug allergy. Only women with 3rd to 7th month of gestation and with a minimum of 21 permanent teeth were included for final analysis. Russell’s Periodontal Index Score<sup>5</sup> was used as standard criteria for the evaluation of periodontal status which divided the patients into three categories as follows:

1. Gingivitis with a score of 0.3 to 0.9.
2. Beginning of periodontal disease with a score of 0.7 to 1.9.
3. Established periodontal disease with a score of 1.7 to 5.0.

Patients with any history of past pregnancy, antibiotic therapy in past 6 months, and any alcohol or smoking

**Table 1:** Distribution of pregnant women in different groups

| Groups | Number of patients | Parameter   |
|--------|--------------------|---|
| A      | 70                 | Pregnant women with healthy periodontal status  |
| B      | 70                 | Pregnant women with clinically diagnosed cases of periodontitis                               |
| C      | 70                 | Pregnant women with clinically diagnosed cases of periodontitis and under periodontal therapy |

habit were excluded from the study. UNC-15 probe was used to record the periodontal status at baseline. Blood examination was done for analysis of CRP levels with the help of ultrasensitive turbidimetric immunoassay. In group C patients, the periodontal therapy included scaling, root planing, plaque control, and daily rinsing of oral cavity with 0.2% chlorhexidine mouthwash. Oral hygiene maintenance instructions was given in group A patients, while in patients of group B, supragingival plaque removal was done. The CRP values were compared in group C before and after the treatment therapy. All the results were analyzed by the Statistical Package for the Social Sciences (SPSS) software. Paired t-test and one-way analysis of variance (ANOVA) were used to assess the level of significance.

**RESULTS**

We attempted to evaluate the CRP levels in pregnant women suffering from periodontal pathologies using ultrasensitive measurement of CRP levels, with the detection limit of 0.015 mg/dL. Statistically significant results were obtained while comparing the mean CRP levels in all the three groups as shown in Table 2. Table 3 shows the mean CRP levels in groups A to C (before and after periodontal therapy) with normal and preterm delivery. While comparing the mean CRP levels in group C patients (Graph 3) before treatment and after treatment therapy, significant (p-value < 0.05) results were obtained as shown in Table 4.

**Table 2:** Descriptive comparison of mean CRP levels in different groups

| Groups | n   | Mean   | SD      | F-value (one-way ANOVA) | p-value  |
|--------|-----|--------|---------|-------------------------|----------|
| A      | 70  | 0.8745 | 0.15478 | 54.41                   | 0.0012 S |
| B      | 70  | 1.2225 | 0.25315 | –                       | –        |
| C      | 70  | 1.2451 | 0.26713 | –                       | –        |
| Total  | 210 | 1.0859 | 0.33185 |                         |          |

S: Significant

**Table 3:** Mean CRP levels in groups A to C (before and after periodontal therapy) with normal and preterm delivery

| CRP                       | n       | Mean ± SD        | t-value | p-value |
|---------------------------|---------|------------------|---------|---------|
| Group A                   | Term    | 60 0.745 ± 0.213 | -5.42   | 0.002   |
|                           | Preterm | 10 0.980 ± 0.710 |         |         |
| Group B                   | Term    | 32 1.102 ± 0.285 | -4.51   | 0.001   |
|                           | Preterm | 38 1.250 ± 0.213 |         |         |
| Group C: Before treatment | Term    | 58 1.230 ± 0.270 | -510    | 0.452   |
|                           | Preterm | 12 1.260 ± 0.310 |         |         |
| Group C: After treatment  | Term    | 58 0.812 ± 0.175 | -4.10   | 0.005   |
|                           | Preterm | 12 0.984 ± 0.174 |         |         |

S: Significant

**Table 4:** Mean CRP levels in group C before and after periodontal therapy

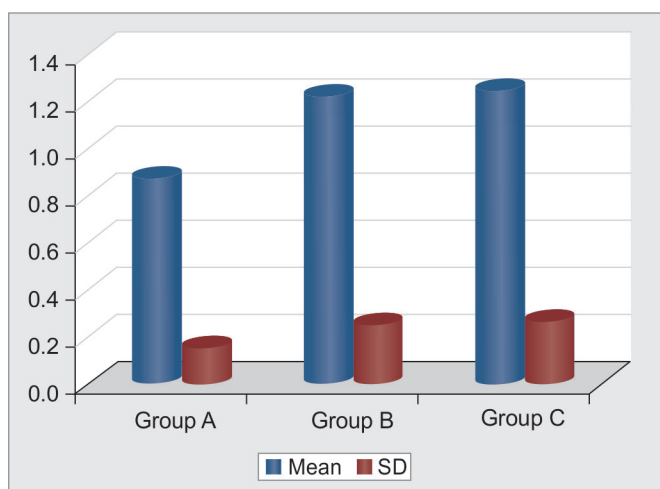
| CRP levels       | Mean ± SD    | t-value | p-value |
|------------------|--------------|---------|---------|
| Before treatment | 1.24 ± 0.26  | 11.51   | 0.001 S |
| After treatment  | 0.821 ± 0.20 |         |         |

S: Significant

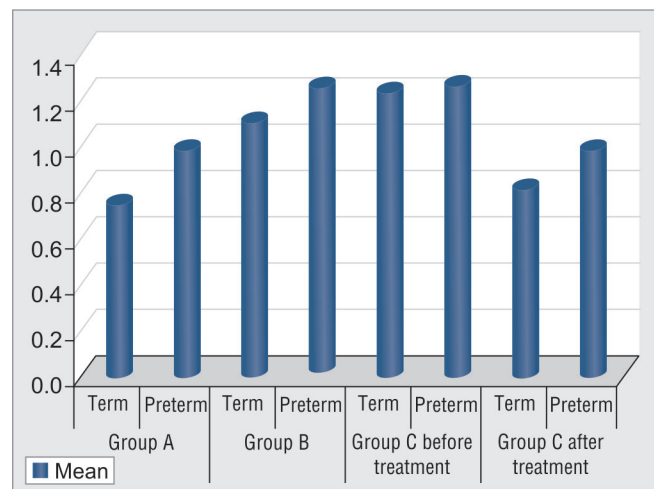
### DISCUSSION

C-reactive proteins are the acute phase products produced by liver as a reaction to inflammatory mediators. They are, therefore, markers of inflammation and are linked with periodontal pathologies in which rise in inflammatory cytokines is seen. Also, nonsurgical treatment of periodontitis is known to lower the serum CRP values.<sup>6,7</sup> Most of the studies in the past showing evidence supporting the relation between periodontal therapies and CRP are mostly focused in males and nonpregnant females. Literature quotes paucity in the studies analyzing relation of periodontitis and CRP levels in pregnant women. Association of CRP has been observed with adverse pregnancy outcomes, including preterm delivery. Furthermore, association between periodontitis and elevated risk of preterm birth has been observed.<sup>7,8</sup> Therefore, we evaluated the plasma CRP levels in pregnant women with and without periodontitis. We observed rise in CRP values in pregnant women with periodontitis as compared to healthy pregnant women without periodontitis as shown in Table 2 and Graph 1. Also, we found that there was higher preterm delivery rate in pregnant women with periodontal disease as compared to healthy controls as shown in Table 3 and Graph 2. The results of our study were consistent with the results of Noack et al<sup>9</sup> and Salzberg et al<sup>10</sup> who also observed rise in CRP values in periodontitis patients. As stated by Beck et al,<sup>11</sup> induction of local inflammatory response along with increase in systemic inflammation and immune response might be the possible reason for rise in CRP levels in periodontitis patients. For the production

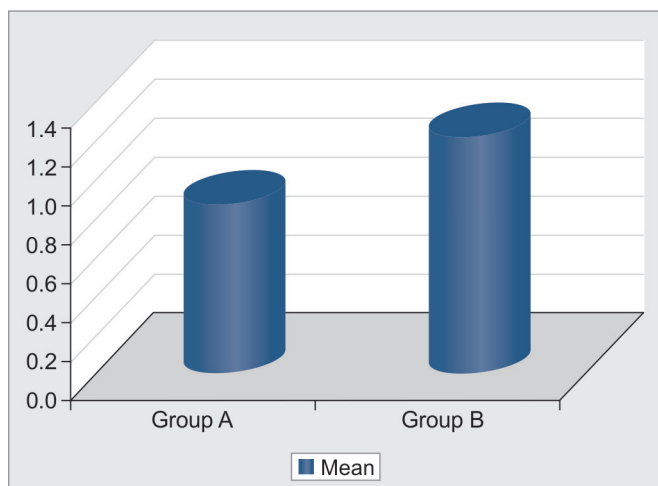
of CRPs by the cells of periodontal tissue, lowered bacteremia and bacterial component's levels might give the stimuli and initiative through activation of inflammatory mediator's cascade.<sup>9</sup> Literature quotes very few studies evaluating the CRP levels in pregnant women with periodontitis. In the present analysis, we observed a positive correlation of CRP values with increasing incidence of preterm delivery. We observed a higher CRP values in preterm delivery cases as compared to normal delivery cases. Also, if the periodontal therapy was started before 7 months of gestation, a significant fall in the mean CRP values was observed as shown in Table 4. Results of our study were in correlation with the results of Sharma et al,<sup>5</sup> who also observed similar changes in CRP values in their study. Jeffcoat et al<sup>12</sup> and Sadatmansouri et al<sup>13</sup> observed a significant fall in serum CRP levels in periodontitis patients undergoing periodontal therapy. Horton et al<sup>15</sup> evaluated the association of maternal periodontal disease in early pregnancy with elevated serum CRP levels and concluded that among African-American women, moderate/severe periodontal disease is associated with elevated CRP levels early in pregnancy. Khairnar et al<sup>15</sup> estimated the changes in CRP level and pregnancy outcome after nonsurgical supportive periodontal therapy in women affected with periodontitis in a rural setup of India. From the results they concluded that nonsurgical-supportive periodontal therapy may lower the risk of preterm delivery in females affected with periodontitis by reducing the CRP level. Pitiphat et al<sup>7</sup> examined the relationship between periodontitis and CRP among women who provided dental radiographs and had blood collected during early pregnancy, excluding smokers and diabetic patients. They found that the mean CRP level was 65% higher in women with periodontitis (2.46 ± 0.52 mg/L) than in healthy controls (1.49 ± 0.22 mg/L). Similar results were obtained in our study as shown in Table 3. From their results, Pitiphat et al<sup>7</sup> suggested that periodontitis



**Graph 1:** Mean CRP levels along with SD in different groups



**Graph 2:** Mean CRP levels in groups A to C (before and after periodontal therapy) with normal and preterm delivery



**Graph 3:** Mean CRP levels in group C before and after periodontal therapy

may increase the CRP levels in pregnancy and CRP could potentially mediate the association of periodontitis with adverse pregnancy outcomes. While comparing the mean CRP levels in group C before and after periodontal therapy, significant alterations were observed as shown in Table 4. Similar results were obtained by Sharma et al who evaluated the effect of periodontal therapy on the incidence of preterm delivery and compared the incidence of preterm delivery in pregnant women with and without periodontal disease. From the results they concluded that the periodontal therapy during pregnancy reduces plasma CRP levels, and further decrease in incidence of preterm delivery is seen after periodontal therapy.<sup>5</sup> Since there are very few studies in the past evaluating the effect of periodontitis on CRP in pregnant women in subcontinent region, further research is required to explore the correlation between the two parameters.

## CONCLUSION

From the above results, it can be concluded that a casual association may exist between the CRP levels and periodontal pathologies in pregnant women. The CRP levels may get elevated in pregnant women. The association between periodontitis and adverse pregnancy outcomes may get amplified due to raised CRP levels. Further research with higher sample size and more parameter is required to decrease the adverse pregnancy outcomes in pregnant women with periodontal pathologies.

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