

## Original Research

### Evaluation of Alkaline Phosphatase in Gingival Crevicular Fluid among Chronic Periodontitis Patients with Smoking Habit

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#### ABSTRACT:

**Background:** To evaluate levels of alkaline phosphatase in gingival crevicular fluid in chronic periodontitis subjects with smoking.

**Materials & Methods:** A group of 50 subjects participated in the study, with ages ranging from 30 to 70 years. All participants were smokers and had generalized chronic periodontitis. The collected data was subjected to statistical analysis, employing Student's paired t-test, and the results were evaluated using SPSS software. **Results:** Fifty patients were included in the study. Among smokers with chronic periodontitis, the average Gingival Index (GI) score was determined to be 1.482. This finding exhibited statistical significance with a p-value of less than 0.001. **Conclusion:** Serum ALP levels were high in smokers with chronic periodontitis.

**Keywords:** Smoking, Chronic periodontitis, alkaline phosphatase.

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#### INTRODUCTION

Periodontal disease is an inflammatory disease of the supporting tissues around the tooth. The most common form of this disease is chronic periodontitis, which is considered an infectious disease leading to inflammation in the supporting tissue of the tooth, progressive attachment loss, and bone loss. <sup>1</sup> Although subgingival plaque biofilm is the main cause of the disease, the interference between microbial plaque and the response of host tissues affected by environmental factors such as age, systemic conditions, and genetics, plays an important role in pathogenesis. <sup>2</sup> Periodontal disease is diagnosed based on clinical parameters such as bleeding on probing, clinical attachment loss, probe depth, and bone loss seen on radiography. <sup>1</sup> Another advanced diagnostic method for periodontal disease is the evaluation of the host response, which is performed by studying specific or nonspecific mediators by biochemical or immunological methods. Recently, saliva has been considered an important biological substance in new diagnostic tests. <sup>3</sup> Periodontal disease is considered to progress in periods of disease activity, followed by periods of quiescence. For effective treatment, it is important to know whether the disease is in an active phase or not. Even in apparent health, there are inflammatory changes in gingiva at the molecular level due to the exposure to the oral environment. <sup>4,5</sup> The present trend in clinical medicine leans towards the use of non invasive procedures that determine the changes in salivary constituents to diagnose several diseases. The potential diagnostic importance of gingival crevicular fluid (GCF) was recognized more than 60 years ago. <sup>6</sup>

ALP is a calcium- and phosphate-binding protein and a phosphor-hydrolytic enzyme. <sup>7</sup> It is a membrane-bound glycoprotein produced by many cells such as polymorphonuclear leukocytes (PMNLs), osteoblasts, macrophages, and fibroblasts within the area of the periodontium and gingival crevice. <sup>8</sup> ALP is considered to be an important indicator of bone formation and is a phenotypic marker for osteoblast cells. ALP is detected in the parotid, submandibular, and minor salivary glands, as well as in desquamated epithelial cells, leukocytes, and bacteria from dental plaque. The presence of ALP in the saliva and GCF is usually indicative of inflammation and/or destruction of the periodontal tissues. The level of ALP is positively correlated with the severity of the periodontal disease. <sup>7</sup> Hence, this study was conducted to evaluate levels of alkaline phosphatase in gingival crevicular fluid in chronic periodontitis subjects with smoking.

**Materials & Methods:**

A group of 50 subjects participated in the study, with ages ranging from 30 to 70 years. All participants were smokers and had generalized chronic periodontitis. During the clinical assessment, at least 18 teeth per subject were examined. Parameters including Probing Pocket Depth (PPD), Gingival Index (GI), Plaque Index (PI), and Clinical Attachment Loss (CAL) were measured at four different sites on each tooth using William's periodontal probe. The collected data was subjected to statistical analysis, employing Student's paired t-test, and the results were evaluated using SPSS software.

**Results:**

Fifty patients were included in the study. Among smokers with chronic periodontitis, the average Gingival Index (GI) score was determined to be 1.482. This finding exhibited statistical significance with a p-value of less than 0.001. Additionally, the mean Clinical Attachment Loss (CAL) score among patients was 3.08mm, and this result also displayed statistical significance (p < 0.001). In smokers with chronic periodontitis, the mean serum Alkaline Phosphatase (ALP) level was measured at 96.821 micro/mL. The associated p-value for this observation was 0.001, indicating a statistically significant result.

Table 1: comparing indices in smokers with chronic periodontitis

	Plaque index	Gingival index	Clinical attachment level
Mean	1.58	1.482	3.08
p- value	0.001*	0.001*	0.001*

\*: significant

Table 2: alkaline phosphatase (ALP) in smokers with chronic periodontitis

	Serum ALP
Mean	96.821
p-value	0.001*

\*: significant

**Discussion:**

Periodontal disease is an inflammatory disease of the supporting tissues of the tooth caused by specific microorganisms that leads to progressive destruction of the periodontal ligament, alveolar bone, with the pocket formation or gingival loss, or both. <sup>1,9</sup> Diagnosis is usually based on clinical parameters such as bleeding on probing, clinical attachment loss and probing depth, and bone loss seen on radiography. <sup>10</sup> Due to limitations of diagnostic methods and the nature of sedation and activity of periodontitis, identification of inflammatory and destructive markers of gingival crevicular fluid and saliva has been considered in recent years and various studies have used these biomarkers to predict the progression of chronic periodontitis. <sup>10</sup> Hence, this study was conducted to evaluate levels of alkaline phosphatase in gingival crevicular fluid in chronic periodontitis subjects with smoking.

In the present study, fifty patients were included in the study. Among smokers with chronic periodontitis, the average Gingival Index (GI) score was determined to be 1.482. This finding exhibited statistical significance with a p-value of less than 0.001. A study by Rasaei N et al, evaluated twenty-three patients with severe chronic periodontitis and 23 healthy individuals. Mean (standard deviation) of ALP enzyme was 19.43 (12.5) in GCF of patients with chronic periodontitis and 12 (1.48) in the healthy group, and it was 80.17 (23.9) in the saliva of patients with periodontitis and 24.78 (4.37) units per litre in the healthy group. There was a significant difference in the mean of this enzyme in GCF and saliva of patients with chronic periodontitis and healthy individuals (P < 0.001). The results showed that mean of ALP enzyme is significantly higher in GCV and saliva of patients with chronic periodontitis than in healthy individuals. Therefore, it seems that this parameter can be used as a useful biochemical parameter for the diagnosis of periodontal disease. <sup>11</sup>

In the present study, additionally, the mean Clinical Attachment Loss (CAL) score among patients was 3.08mm, and this result also displayed statistical significance ( $p < 0.001$ ). In smokers with chronic periodontitis, the mean serum Alkaline Phosphatase (ALP) level was measured at 96.821 micro/mL. The associated p-value for this observation was 0.001, indicating a statistically significant result. Another study by Sanikop S et al, GCF samples were collected from 45 sites which were divided into three equal groups of healthy samples and gingivitis and chronic periodontitis samples. Difference in the mean ALP levels between healthy and gingivitis groups was found to be nonsignificant ( $P > 0.05$ ) and that between the chronic periodontitis group and healthy as well as gingivitis groups was found to be highly significant ( $P < 0.001$ ). Significant correlations existed between ALP levels and gingival index, probing depths, as well as clinical attachment levels. The finding of the present study confirms the relationship between ALP level and periodontal disease, thus indicating that GCF ALP levels can be used as potential biochemical markers for the detection and progression of periodontal disease.<sup>12</sup> GCF is an inflammatory exudate that seeps into gingival crevices or periodontal pockets around teeth with inflamed gingiva.<sup>13</sup> It represents serum components overlaid with products from local physiologic phenomena, such as connective tissue destruction and bone loss, and has diagnostic value. It is a convenient, noninvasive, and efficient means to sample biomarkers of inflammation and bone resorption in the oral cavity. Although individual GCF samples have the possibility of describing the inflammatory events occurring at the site, pooled samples from a small number of sites may characterize the overall vulnerability to periodontitis and allow periodic assessment during periodontal treatment or maintenance.<sup>14</sup> GCF is an exudate from the microcirculation around the inflamed periodontium and gingiva. It picks up enzymes and other molecules that participate in the disease process, immune mechanism, bacterial products, as well as products of cell and tissue destruction.<sup>15</sup> The main cells that contribute to the constituents of GCF are polymorphonuclear lymphocytes, macrophages, and plasma cells.<sup>16</sup> Unlike serum and saliva that are the commonly used sources for assessment of biomarkers, GCF is site specific, conveniently sampled, and contains components derived from both the host and the bacteria. Conversely only extremely small volume of fluid is available from a single site, and so GCF needs highly sensitive techniques for quantitative analysis.<sup>17,18</sup> Alkaline phosphatase (ALP) is one of the enzymes in GCF and saliva that can be tested for periodontitis.<sup>19</sup> ALP is an intracellular enzyme produced by many cells such as polymorphonuclear leukocytes (PMNs), macrophages, fibroblasts, osteoblasts, and white blood cells in the periodontium and gingival sulcus. When periodontal tissue is destroyed, secretion of this enzyme actively increases into GCF and saliva.<sup>2</sup> In addition, Dabra and Singh<sup>20</sup> examined the levels of ALP and salivary acid phosphatase in three groups, namely, periodontitis, gingivitis, and healthy groups and the results showed a significant increase in these two enzymes in patients with periodontitis compared with the control group. There was also a significant decrease in salivary levels of these two enzymes after routine periodontal treatments. The researchers concluded that salivary ALP and ACP levels could be used to assess periodontal tissue damage. Nomura et al.<sup>10</sup> used biomarkers to predict the progression of periodontitis; the results showed that the salivary level of ALP and *P. gingivalis* could be used to increase the accuracy of periodontitis prediction along with other biochemical markers.<sup>3</sup>

### **Conclusion:**

Serum ALP levels were high in smokers with chronic periodontitis.

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