Section: Dentistry

Original Research Article

SALIVARY ALKALINE PHOSPHATASE LEVELS IN PATIENTS WITH CHRONIC PERIODONTITIS: A CROSS-SECTIONAL STUDY

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Abstract

Background: Chronic periodontitis is a prevalent inflammatory condition affecting the supporting structures of teeth. Salivary biomarkers, such as alkaline phosphatase (ALP), have been explored for their diagnostic potential in periodontal diseases. This study aimed to evaluate the levels of salivary ALP in patients with chronic periodontitis compared to healthy controls and to explore the correlation between ALP levels and clinical parameters of periodontitis. **Material and Methods:** A cross-sectional study was conducted with 100 participants, comprising 70 patients with chronic periodontitis (Group A) and 30 healthy controls (Group B). Salivary ALP levels were measured, and clinical parameters, including probing depth and clinical attachment loss, were recorded. Statistical analyses, including independent t-tests and logistic regression, were performed to assess differences and associations. **Results:** The mean salivary ALP level in Group A was significantly higher (60.2 ± 15.3 U/L) than in Group B (25.7 ± 8.4 U/L, $p < 0.001$). A positive correlation was found between ALP levels and probing depth ($r = 0.62$, $p < 0.01$) and clinical attachment loss ($r = 0.58$, $p < 0.01$). Logistic regression analysis revealed that elevated ALP levels were strongly associated with chronic periodontitis (OR = 3.85, 95% CI: 2.10–7.05, $p < 0.001$). **Conclusion:** Salivary ALP levels are significantly elevated in patients with chronic periodontitis and correlate with clinical indicators of the disease. These findings suggest that salivary ALP could be a useful biomarker for the diagnosis and monitoring of chronic periodontitis.

INTRODUCTION

Chronic periodontitis is a common and complex inflammatory disease that affects the supporting structures of teeth, including the gingiva, periodontal ligament, cementum, and alveolar bone.[1,2] It is characterized by progressive destruction of these tissues, leading to tooth loss if left untreated.[3] The etiology of chronic periodontitis involves a multifactorial interplay between microbial biofilms, host immune response, and genetic and environmental factors.[4,5]

The early detection and diagnosis of chronic periodontitis are crucial for effective management and prevention of its progression.[6] Traditional diagnostic methods, such as clinical examination and radiographic assessment, primarily focus on identifying established disease rather than early changes.[7] Consequently, there is a growing interest in identifying non-invasive biomarkers that can facilitate early diagnosis and monitoring of periodontal disease activity.[8]

Salivary biomarkers have emerged as promising candidates for non-invasive diagnostic tools in periodontitis9. Among these, salivary alkaline phosphatase (ALP) has garnered attention due to its role in bone metabolism and tissue turnover. ALP is an enzyme present in various tissues, including the periodontal ligament, and is released in response to inflammation and tissue destruction. Elevated levels of salivary ALP have been reported in individuals with periodontal diseases, suggesting its potential as a biomarker for periodontal health status.

This study aims to investigate the levels of salivary ALP in patients with chronic periodontitis compared to healthy controls and to examine the correlation between salivary ALP levels and clinical parameters of periodontitis. By exploring these relationships, the study seeks to evaluate the utility of salivary ALP as a diagnostic and monitoring tool for chronic periodontitis.

MATERIALS AND METHODS

Study Design and Period

This cross-sectional study was conducted from February 2023 to January 2024 at Sri Sai Dental College, Vikarabad, Telangana. The study aimed to evaluate salivary alkaline phosphatase (ALP) levels in patients with chronic periodontitis and compare them with healthy controls.

Study Population

The study included 100 participants, divided into two groups: Group A (patients diagnosed with chronic periodontitis, n = 70) and Group B (healthy controls, n = 30). Participants were recruited from the outpatient department of the college. The inclusion criteria for Group A were patients aged 18-65 years with clinically diagnosed chronic periodontitis, as evidenced by clinical attachment loss and probing depth. The exclusion criteria included a history of systemic diseases affecting periodontal status, pregnancy, smoking, recent periodontal treatment, and antibiotic use within the last three months. Group B consisted of age- and sex-matched healthy individuals with no clinical signs of periodontal disease.

Data Collection and Clinical Examination

Upon obtaining informed consent, participants underwent a thorough clinical examination by a calibrated periodontist. Clinical parameters, including probing depth, clinical attachment loss, and plaque index, were recorded using a periodontal probe. Demographic data, including age and gender, were also collected.

Saliva Sample Collection and Analysis

Unstimulated saliva samples were collected from all participants in the morning, between 9:00 AM and 11:00 AM, to minimize diurnal variation. Participants were instructed not to eat, drink, or perform oral hygiene procedures for at least two hours before sample collection. Approximately 5 ml of saliva was collected in sterile containers and immediately stored at -20°C until analysis.

Salivary ALP levels were measured using an enzymatic colorimetric assay. The assay was performed according to the manufacturer's instructions, and the results were expressed in units per liter (U/L).

Statistical Analysis

Data were analyzed using SPSS software (version 25.0). Descriptive statistics were used to summarize the data. The independent t-test was employed to compare mean salivary ALP levels between groups. Pearson's correlation coefficient was used to assess the relationship between salivary ALP levels and clinical parameters in Group A. Logistic regression analysis was conducted to evaluate the association between ALP levels and the presence of chronic periodontitis. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

The study protocol was approved by the Institutional Ethics Committee of Sri Sai Dental College. All participants provided written informed consent before inclusion in the study. The study was conducted in accordance with the Declaration of Helsinki and adhered to ethical principles for medical research involving human subjects.

RESULTS

Demographic Characteristics

The study included 100 participants, with 70 individuals in Group A (patients with chronic periodontitis) and 30 in Group B (healthy controls). The mean age of participants was 45 ± 12 years, with Group A having a slightly higher mean age of 47 ± 11 years compared to 42 ± 13 years in Group B. The gender distribution was balanced, with 52 males and 48 females overall (Table 1).

Salivary Alkaline Phosphatase (ALP) Levels

Salivary ALP levels were significantly higher in Group A compared to Group B. The mean ALP level in Group A was 60.2 ± 15.3 U/L, while in Group B, it was 25.7 ± 8.4 U/L (Table 2).

Correlation with Clinical Parameters

In Group A, salivary ALP levels showed a positive correlation with clinical parameters of periodontitis. Specifically, ALP levels were significantly correlated with probing depth ($r = 0.62$, $p < 0.01$) and clinical attachment loss ($r = 0.58$, $p < 0.01$). However, no significant correlation was observed between ALP levels and age ($r = 0.12$, $p = 0.29$) or gender ($r = -0.05$, $p = 0.67$) (Table 3).

Statistical Analysis

An independent t-test revealed a statistically significant difference in mean ALP levels between the two groups, with a mean difference of 34.5 U/L ($t = 8.34$, $p < 0.001$) (Table 4).

Logistic Regression Analysis

The logistic regression analysis demonstrated that higher ALP levels were significantly associated with the presence of chronic periodontitis. The odds ratio for the association was 3.85, with a 95% confidence interval of 2.10–7.05, indicating a strong relationship ($p < 0.001$) (Table 5).

Table 1: Demographic Characteristics of Study Participants

Characteristic	Group A (Chronic Periodontitis)	Group B (Healthy Controls)	Total
Sample Size (n)	70	30	100
Mean Age (years)	47 ± 11	42 ± 13	45 ± 12
Gender (M/F)	37/33	15/15	52/48

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Table 2: Mean Salivary Alkaline Phosphatase (ALP) Levels

Group	Mean ALP Level (U/L)	Standard Deviation (SD)
Group A (Chronic Periodontitis)	60.2	15.3
Group B (Healthy Controls)	25.7	8.4

Table 3: Correlation of Salivary ALP Levels with Clinical Parameters in Group A

Clinical Parameter	Correlation Coefficient (r)	p-value
Probing Depth	0.62	<0.01
Clinical Attachment Loss	0.58	<0.01
Age	0.12	0.29
Gender	-0.05	0.67

Table 4: Comparison of Salivary ALP Levels Between Groups

Test	Mean Difference (U/L)	t-value	p-value
Independent t-test	34.5	8.34	<0.001

Table 5: Logistic Regression Analysis for the Association Between ALP Levels and Chronic Periodontitis

Variable	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
ALP Level	3.85	2.10–7.05	<0.001

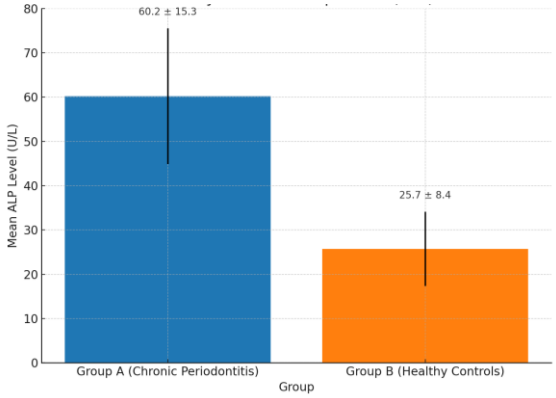

Figure No: 1 Mean Salivary Alkaline Phosphatase (ALP) Levels

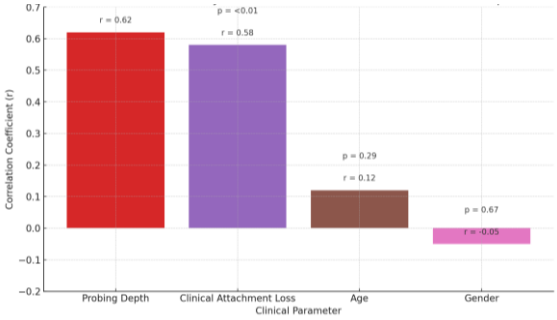

Figure No:2. Correlation of Salivary ALP Levels with Clinical Parameters in Group A

DISCUSSION

This study aimed to assess the levels of salivary alkaline phosphatase (ALP) in patients with chronic periodontitis and compare them with healthy controls. Additionally, it sought to explore the correlation between salivary ALP levels and clinical parameters of periodontitis. The findings revealed significantly higher salivary ALP levels in patients with chronic periodontitis compared to healthy controls, suggesting that ALP may serve as a potential biomarker for periodontal disease.

The observed elevation in salivary ALP levels in the periodontitis group aligns with previous studies, which have reported increased ALP activity in periodontal tissues and saliva of individuals with periodontal diseases. ALP is an enzyme involved in bone metabolism and is released during tissue destruction and bone resorption, processes commonly seen in periodontitis.[10] The significant difference in ALP levels between the two groups underscores the enzyme's potential role in reflecting the underlying pathological processes in periodontal disease.[11]

A positive correlation between salivary ALP levels and clinical parameters such as probing depth and clinical attachment loss was also observed. This suggests that as the severity of periodontitis increases, indicated by deeper probing depths and greater attachment loss, the level of ALP in saliva rises correspondingly.[12] This relationship supports the use of salivary ALP as a non-invasive indicator of disease severity, providing a practical approach for monitoring periodontal health and progression.[13]

The logistic regression analysis demonstrated a strong association between elevated salivary ALP levels and the presence of chronic periodontitis, with an odds ratio of 3.85. This finding indicates that individuals with higher ALP levels are significantly more likely to have chronic periodontitis. This association further reinforces the potential utility of ALP as a diagnostic biomarker for periodontal disease.[14]

However, several limitations must be considered. The cross-sectional nature of the study limits the ability to establish causality. Additionally, factors such as dietary habits, oral hygiene practices, and genetic predispositions, which may influence salivary ALP levels, were not controlled. Future studies could address these limitations by incorporating longitudinal designs and controlling for confounding factors.

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CONCLUSION

This study provides evidence that salivary ALP levels are elevated in patients with chronic periodontitis and correlate with disease severity. These findings suggest that salivary ALP could be a valuable non-invasive biomarker for the diagnosis and monitoring of chronic periodontitis. Further research is warranted to validate these results and explore the clinical applicability of salivary ALP in periodontal diagnostics.

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