ORIGINAL RESEARCH

Evaluation of serum and salivary alkaline phosphatase levels in chronic periodontitis patients

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ABSTRACT

Background: The customary way of diagnosing periodontitis involves evaluating the destruction of periodontal tissue using clinical measurements and radiographic tools. However, saliva has the potential to be a useful diagnostic fluid for oral diseases. The objective of this research was to compare the levels of alkaline phosphatase (ALP) in both saliva and serum, both before and after scaling and root planing, in patients who have chronic generalized periodontitis. **Materials and Methods**: This study involved a total of 100 participants, of which 50 had chronic generalized periodontitis and 50 were periodontally healthy volunteers. The age range of the participants was between 30 to 50 years. The researchers measured various clinical parameters, including the simplified oral hygiene index (OHI-S), gingival index, probing depth, and clinical attachment loss (CAL). Afterward, samples of saliva and blood were collected from each participant and analyzed for their ALP levels using spectrometry. Following Phase I periodontal therapy, the clinical parameters, saliva, and serum ALP levels were measured again after 30 days. The data were then statistically analyzed using the paired t-test and one-way ANOVA. **Results**: The study found that subjects with chronic generalized periodontitis had significantly higher levels of ALP in both saliva and serum compared to periodontally healthy individuals. These higher levels of ALP were also associated with increased clinical parameters such as OHI-S, gingival index, probing depth, and CAL. However, after Phase I periodontal therapy, there was a significant decrease in both saliva and serum ALP levels, along with an improvement in clinical parameters. **Conclusion**: Despite the limitations of this study, it can be concluded that ALP levels in saliva have the potential to be used for the diagnosis of the active phase of periodontal disease, as well as for evaluating treatment outcomes following Phase I periodontal therapy.

Keywords: Alkaline phosphatase, biomarkers, chronic periodontitis, saliva, serum

INTRODUCTION

Periodontal disease is an inflammatory process that affects the protective and supportive tissues around the tooth. Bacterial plaque accumulation on the tooth surface leads to marginal tissue inflammation, known as gingivitis. Gingivitis is fairly common and is present in up to 90% of the US population.[1] If left untreated, gingivitis may progress to periodontitis, which is characterized by loss of periodontal attachment support (clinical attachment loss, [CAL]) and bone resorption, eventually resulting in tooth mobility and loss. Chronic periodontitis is a common disease characterized by a painless, slow progression. It may occur in most age groups, but is most prevalent among adults and seniors worldwide, with approximately 35% of adults (30–90 years) in the US being affected by at least one site with CAL ≥ 3 mm and probing depth (PD) ≥4 mm.[2]

Chronic periodontitis is more prevalent than the general population recognizes. Around 80% of adults in the US have at least one site with attachment loss. More severe chronic periodontitis affects roughly 35% of the US population. Interestingly, only a small percentage of this population seek periodontal care. Generally, chronic periodontitis is not the chief complaint of a patient when he/she seeks dental treatment. The reason is that chronic periodontitis usually progresses painlessly and slowly. A study reported that the most common chief complaint reported by chronic periodontitis subjects is: “I was

told I have gum disease". The second most common chief complaint reported is: "I would like to save my teeth". Neither of these chief complaints are true chronic periodontitis symptoms, such as bleeding gums. Only 6.2% of the subjects reported having painful gingiva.[3] Thus, most diagnosis of this condition occurs when the disease reaches a severe stage where clinically detectable mobility and radiographic bone loss is evident.

The purpose of this study was to compare the serum and salivary ALP levels in chronic periodontitis patients before and after Phase I periodontal therapy which served to hold to the hypothesis that saliva can be used as an alternative to serum for evaluating ALP as a biomarker in periodontal disease progression.

MATERIAL AND METHODS

This clinical study involved a total of 100 participants between the ages of 30 and 50. The control group consisted of 50 periodontally healthy individuals, while the study group consisted of 50 patients with chronic generalized periodontitis. The participants were selected from the outpatient division of periodontics, and all were informed about the nature of the study and signed an informed consent form.

To be included in the control group, participants had to have at least 20 natural teeth with probing pocket depths of 2-3 mm, no attachment loss, and less than 20% sites with bleeding on probing. For the study group, participants had to have at least five qualifying sites in two quadrants, with a minimum of two affected teeth in each quadrant. Each site had to have a probing depth of at least 5 mm, clinical attachment loss (CAL) of at least 3 mm, and bleeding on probing. Patients with systemic diseases, smokers, pregnant women, and those who were not maintaining their oral hygiene were excluded from the study.

All individuals who participated in the study provided informed consent. Clinical indices, including the simplified oral hygiene index (OHI-S) and gingival index, as well as clinical parameters, such as probing depth and clinical attachment loss (CAL), were measured at baseline for the study group. Saliva and blood samples were collected from both the study and control groups and analyzed for ALP levels. For patients with chronic periodontitis, complete ultrasonic scaling was performed on day 1, followed by complete root planing in two subsequent visits within 15 days from baseline. On the 30th day, after the completion of Phase I periodontal therapy, patients were reviewed, and saliva and blood samples were collected and analyzed again for ALP activity.

RESULTS

This clinical study aimed to evaluate the levels of serum and salivary ALP in patients with generalized chronic periodontitis before and after nonsurgical periodontal therapy and compare the outcomes with healthy participants. At baseline, all clinical parameters were measured, and saliva and blood samples were collected on the same day, and then 30 days after Phase I periodontal therapy. The collected samples were analyzed for ALP levels using spectrometry.

The obtained results were tabulated and analyzed using statistical software SPSS. The paired-t test was used to assess the baseline and postoperative values of clinical parameters, and one-way ANOVA was used to compare the enzyme levels in saliva and serum between the study group at baseline and postoperatively along with control group.

In the study group, there was improvement in OHI-S and gingival index scores along with a reduction in probing depth and a gain in CAL postoperatively. These changes were found to be statistically significant.

Table 1: Meanserum ALP levels at baseline and 1 month following Phase I periodontal therapy in patients with chronic periodontitis.

Serum ALP Levels	Baseline	1 month postoperatively
Study group	211.283	263.97

Table 2: mean salivary ALP levels at baseline and 1 month following Phase I periodontal therapy in patients with chronic periodontitis.

Salivary ALP levels	Baseline	1 month postoperatively
Study group	18.294	35.78

DISCUSSION

The term biomarker refers to biologic substances that can be measured and evaluated to serve as indicators of biological health, pathogenic processes, environmental exposure, and pharmacologic responses to a therapeutic intervention.[4]

Among several biomarkers of periodontal disease activity, ALP, being a phenotype marker of bone turnover rate has been found to be elevated in a variety of bone disorders with the highest elevations occur in Paget's disease (osteitis deformans). Other bone disorders including osteomalacia, rickets, hyperparathyroidism, and osteogenic sarcoma have also shown elevated levels of ALP. In addition, increased levels were also seen in the case of healing bone fractures and during periods of physiologic bone growth.[5,6]

Hence, this study was conducted to evaluate serum and salivary alkaline phosphatase levels in chronic periodontitis patients.

On comparing the mean values of salivary and serum ALP levels of control group with baseline values of the study group, the difference in salivary and serum ALP levels between control group and study group was found to be statistically significant. On comparing the mean baseline salivary and serum ALP values with postoperative values in study group, the difference in salivary and serum ALP levels from

baselineto postoperative was found to be statistically significant.

The study conducted by Miglani et al.[7], in 1974 revealed the relationship between periodontal disease and ALP levels in saliva was the first study in the Indian population, correlating the periodontal disease status with salivary ALP levels. Later, various studies that include Todorovic et al.[8], in 2006, Desai et al.[9], in 2008, Dabra and Singh[10] in 2012, Trivedi and Trivedi[11] in 2012, Ramesh et al.[12], in 2013, and Luke et al.[13], in 2015 have correlated the relationship between the enzyme ALP levels in saliva with that of clinical parameters in healthy controls, gingivitis patients, and patients with chronic periodontitis and the significant outcomes of the ALP levels after Phase I periodontal therapy.

The results of present study showed that ALP levels were increased in both saliva and serum in patients with chronic generalized periodontitis which was in accordance with the study conducted by Malhotra et al.[14], in 2010. The study also showed that the following Phase I periodontal treatment, there was a significant decrease in the salivary and serum ALP levels in patients with chronic generalized periodontitis in accordance with the results obtained from the study conducted by Dabra and Singh[15] in 2012 along with an added improvement in the clinical parameters following Phase I periodontal therapy.

CONCLUSION

Based on the constraints of the current research, it can be inferred that the measurement of ALP levels in saliva may serve as a means of diagnosing the active stage of periodontal disease, as well as a predictor of treatment success following Phase I periodontal therapy. However, to reinforce the findings of this study, further research with a larger sample size and varying durations of ALP evaluation in saliva is necessary.

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