

Correlation of Individual Bone Metabolic Status with Severity of Periodontitis: A Cross-Sectional Study¹Dr Virender S, ²Dr T Prasanth, ³Dr Saravanan SP, ⁴Dr Ruchi Harish, ⁵Dr Manish Rathi, ⁶Dr Nitin Verma¹⁻⁶Department of Periodontology, Army Dental Centre(R&R), Dhaula Kuan, New Delhi.**Corresponding Author:** Dr T Prasanth, Prof & HOD, Department of Periodontology, Army Dental Centre (R&R), Dhaula Kuan, New Delhi.**Type of Publication:** Original Research Article**Conflicts of Interest:** Nil

Abstract**Introduction:** Periodontitis is characterized by a complex host parasite interaction resulting in patients exhibiting higher levels of biomarkers which causes systemic inflammatory bone destruction. Routine methods of diagnosing periodontitis include assessment of clinical and radiographic parameters. The Serum levels of biomarkers may indicate the inflammatory status of periodontitis and help in evaluation of the disease activity before and after scaling and root planning.**Aim:** To compare the quantitative levels of serum Parathyroid hormone, Vitamin D3, Alkaline phosphatase, Calcium and Phosphorous before and after scaling and root planning and establishing the correlation with clinical parameters in patients of periodontitis.**Materials/Methods:** 30 subjects were enrolled with written and informed consent after evaluating their periodontal status. The clinical parameters recorded at baseline were Simplified Oral hygiene index, gingival index, probing pocket depth, clinical attachment loss. Serum levels of Vitamin D3, Calcium, Phosphorous, Parathyroid hormone and Alkaline phosphatase were also recorded at baseline. The clinical parameters alongwith the serum biomarkers were reevaluated after 90 days following scaling and root planing. The results were statistically analyzed using paired t-test.**Results:** After analysing the data using appropriate statistical analysis, it was observed that there was a gradual increase in the serum levels of these biomarkers with progression of periodontitis and levels were reduced considerably after scaling and root `planning except for Vitamin D3 which showed an increase in serum level.**Conclusion:** Based on these results, it is concluded that the serum levels of these biomarkers can be considered for evaluating the disease progression and can be correlated with the clinical parameters of periodontitis.**Keywords:** Periodontitis, Probing depths, Calcium, Phosphorous, Parathyroid, Vitamin D3, Alkaline phosphatase.**Introduction**Periodontitis is characterised by a complex host microbial interaction resulting in patient's exhibiting varying levels of biomarkers which causes systemic inflammatory bone destruction.¹The bone concept factor given by Irvin Glickman in 1951, explained that the clinical periodontal problems are the gross expression of microscopic tissue changes and these tissue changes are the possible composite effects of local and systemic factors.²

Routine methods to diagnose periodontitis include assessment of clinical and radiographic parameters.

The serum levels of biomarkers may indicate inflammatory status of periodontitis and help in evaluation of disease activity before and after professional mechanical plaque removal (PMPR).³

So this study aimed at assessing the quantitative changes in biomarkers of bone metabolism in periodontitis patients after PMPR. To achieve this aim, the objectives decided were assessment of quantitative changes of serum biomarkers and assessment of quantitative changes of clinical parameters in periodontitis patients before and after PMPR.

Materials and Methods

It was a prospective clinical study with a sample size of 30 patients visiting the Dept of Periodontology in a tertiary care Govt. teaching institution in Northern India. The duration of the study was from Sep 2023 to Feb 2024. The patients aged between 30 to 50 years with diagnosed cases of Stage III/IV Grade B periodontitis and Patient with ASA-I physical status classification with no history of periodontal therapy in last 2 years were included in the study. The written informed consent was taken from the patients. The patients using any form of tobacco or who were taking over the counter multivitamins/calcium/vitamin D3/performance enhancer and Pregnant/Expecting/Lactating women and those patients who were non-compliant were excluded from this study. The quantitative levels of clinical parameters: Oral Hygiene Index-Simplified (OHI-S), Gingival Index (GI), Probing pocket depths (PPD) and clinical attachment loss (CAL) and serum levels of biomarkers: Calcium (Ca), Phosphorous (P), Vitamin D3 (Vit D3), Parathyroid hormone (PTH) and Alkaline phosphatase (ALP) were recorded for each patient at the base line and 90 days post intervention.

The pictures below at figure 1 (a-d) are of a representative case of Stage IV Grade B periodontitis, where clinical, radiographic and serological parameters were recorded at base line before the intervention.



Figure 1(a): Base line clinical picture



Figure 1(b): Recording clinical parameters



Figure 1 (c): Recording clinical parameters



Figure 1(d): Orthopantomogram at baseline

The Oral Hygiene Index-Simplified (OHI-S) given by Greene JC and Vermillion JR in 1964 was calculated by adding the debris and calculus components recorded from buccal surfaces of teeth number 16, 11, 26 & 31 and lingual surfaces of 36 & 46. The Gingival Index (GI) given by Loe H and Silness J in 1963 was calculated from all four teeth surfaces (Facial, Lingual, Mesial and Distal) of teeth number 16, 11, 24, 36, 31 & 44. The probing pocket depths (PPD) were measured using UNC-15 probe at Mesiobuccal, Midbuccal, Distobuccal, Mesiolingual, Midlingual & Distolingual sulcus of each tooth. The clinical attachment loss (CAL) were recorded for each patient by calculating the distance from cemento-enamel-junction (CEJ) to base of the pocket.

The figure 2 (a-c) below represents the collection of blood in an EDTA vacutainer and utilizing the Auto-analyser for obtaining the serum levels of biomarkers for each patient at base line and 90 days post intervention.



Figure 2(a): Venipuncture for blood sample

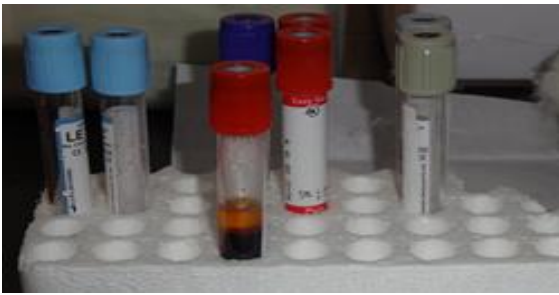


Figure 2(b): Blood sample in EDTA vacutainer



Figure 2(c): Autoanalyzer

The clinical and serological parameters were recorded again for each patient at 90 days post intervention.

Statistical analysis

The tables 1 and 2 below showed the data collected for clinical parameters and serological parameters at base line and 90 days post intervention that were analysed using paired t test. A p value of < 0.05 was considered statistically significant.

Table 1: Data collected for clinical parameters at baseline and 90 days post PMPR.

Clinical parameters	Baseline (Mean ± SD)	90 days post PMPR (Mean ± SD)	'p' value
OHI-S	2.49 ± 0.77	1.93 ± 0.73	< 0.001
GI	1.86 ± 0.62	1.35 ± 0.53	< 0.001
PPD	4.28 ± 0.49	3.65 ± 0.49	< 0.001
CAL	3.91 ± 0.53	3.86 ± 0.52	< 0.001

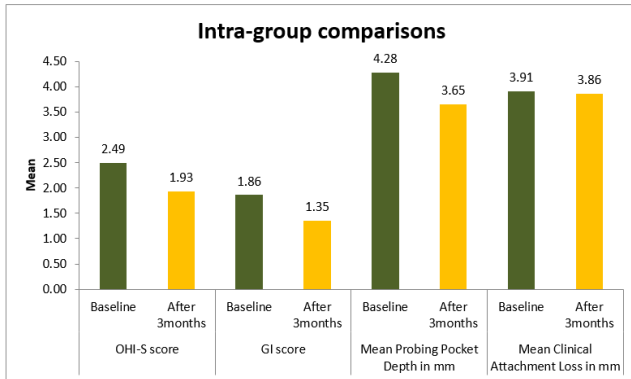
Table 2: Data collected for serological parameters at baseline and 90 days post PMPR.

Serum levels	Baseline	90 days post PMPR	'p' value
PTH	50.02 ± 9.87	46.76 ± 9.75	< 0.001
Vit D3	81.10 ± 25.40	85.34 ± 24.31	< 0.001
ALP	91.27 ± 13.40	86.40 ± 13.23	< 0.001
Ca	8.84 ± 0.42	8.51 ± 0.39	< 0.001
P	3.66 ± 0.37	3.38 ± 0.34	< 0.001

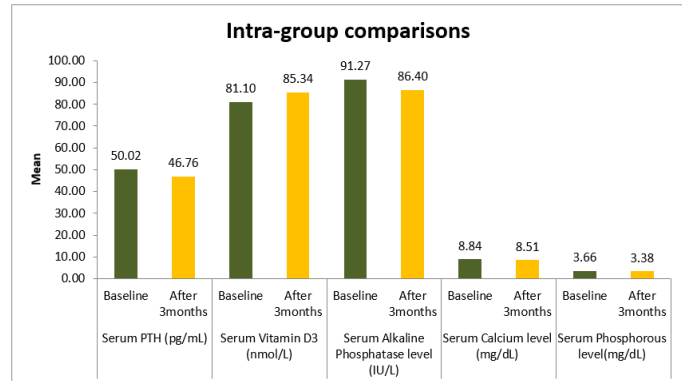
Results

The clinical parameters alongwith serological biomarkers showed the significant improvement.

The results of this study showed a significant reduction in clinical parameters and there was significant reduction in serum levels of biomarkers PTH, ALP, Ca & P alongwith increased serum levels of Vit D3. The same is represented by the graphs 1 & 2 below.



Graph 1



Graph 2

Principle findings

The principle findings of this study indicates:

- Serum biomarkers are effective in determining the status of periodontal disease
- Serum of ALP, PTH, Ca and P levels were significantly reduced following PMPR
- Serum Vitamin D3 level was significantly increased following PMPR
- Clinical parameters OHI-S, GI, PPD and CAL were significantly improved following PMPR

Discussion

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

The main function of parathyroid gland is to maintain serum calcium and phosphorous levels within a narrow range.⁵ The primary function of PTH is on bone, kidney and intestine. On bone PTH causes release of CA and P by resorption. On kidney, PTH increases Ca reabsorption and reduces its excretion. On intestine, PTH alongwith Vit D Causes Ca and P absorption. The increased levels of ALP at base line may indicate the bone destruction in alveolar process suggestive of advanced periodontitis.⁶

Vitamin D plays an important role in several physiological processes such as bone and Calcium metabolism. The main function of Vit D is to maintain serum concentration of CA & P with normal range.⁷ So the homeostasis of Ca & P is maintained by PTH and Vit D.

The reduced levels of serum Ca and increased levels of Vit D3 after the intervention in this study were in accordance with study conducted by Rodriguez-Archilla & co-workers in 2023.⁸ The decreased levels of PTH in this study was not in accordance with study done by Antonoglou & his co-workers in 2015, where they mentioned that there is no consistent difference in serum level in relation to periodontal condition.⁹ The reduced serum levels of P & ALP in this study were in

accordance with study conducted by Patel & co-workers in 2016, where they concluded the gradual increase in these serum levels with periodontitis.¹⁰

Conclusion

These biomarkers are having the role in bone metabolism and they can be quantitatively assessed for evaluating the underlying periodontal disease. The levels of these biomarkers can be used for diagnosis of active phase of periodontal disease and also a prognostic indicator for evaluating the outcomes of the intervention. Considering all the data and results of analysis, it may be concluded that there is a significant improvement in clinical and serological parameters after Professional Mechanical Plaque Removal in patients with periodontitis and the intervention has a beneficial effect on Calcium and Phosphorous metabolism.

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