

## ORIGINAL RESEARCH

### Evaluation of matrix metalloproteinase-3 levels in gingival crevicular fluid in periodontal disease, health and after scaling and root planing

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#### ABSTRACT:

**Background:** Periodontitis is one of the most common ailments affecting the teeth, leading to the destruction of the supporting and surrounding tooth structure. Degradation of the collagenous matrix involves the activity of a group of enzymes known as matrix metalloproteinases. Hence; the present study was conducted for evaluating matrix metalloproteinase-3 levels in gingival crevicular fluid in periodontal disease, health and after scaling and root planning.

**Materials & methods:** A total of 50 patients who were diagnosed both clinical and radiographically as affected by periodontitis were enrolled. Another set of 25 subjects who came for routine dental check-up were included as healthy controls. 50 periodontitis subjects with further divided into two study groups as follows: Group A: Chronic periodontitis patients who didn't underwent any treatment, Group B: Chronic periodontitis patients who were treated by scaling and root planing (SRP) only. All the patients were recalled in the morning and GCF collection was done. Gingival crevicular fluid enzyme-linked immunoabsorbent assay analysis for MMP-3. **Results:** Mean MMP-3 levels among the subjects of control group, Group A and Group B was found to be 0.39 ng/ml, 6.12 ng/ml and 3.69 ng/ml respectively. Significant results were obtained while comparing the mean MMP-3 levels among the subjects of the three study groups. **Conclusion:** Progression of periodontal diseases is accompanied by concomitant increase in MMP-3 concentrations

**Key words:** Chronic periodontitis, Root planing.

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#### INTRODUCTION

Periodontitis is one of the most common ailments affecting the teeth, leading to the destruction of the supporting and surrounding tooth structure. The term "periodontitis" is build up of two words, i.e., "periodont-" meaning "structure surrounding the teeth" and "itis" means "inflammation." Periodontitis is originally a disease originating from the gingival tissue which if left untreated results in penetration of

inflammation to the deeper tissues, altering the bone homeostasis causing tooth loss. Periodontal disease has a multifactorial origin. The main culprit identified in periodontitis is the bacterial biofilm growing on the tooth surfaces.<sup>1-3</sup>

Degradation of the collagenous matrix involves the activity of a group of enzymes known as matrix metalloproteinases. These matrix metalloproteinases are important sub family of zinc-and calcium-

dependent endopeptidases secreted or released by a variety of host cells such as polymorphonuclear leucocytes, macrophages, fibroblasts, bone, epithelial and endothelial cells that function at neutral pH and utilize the various constituents of the extracellular matrix as their substrates, and are responsible for their remodelling and degradation. These molecules degrade interstitial and basement membrane collagens, gelatins, fibronectin, elastin, laminin, vitronectin and the proteoglycan core protein etc.<sup>4-6</sup> Hence; the present study was conducted for evaluating matrix metalloproteinase-3 levels in gingival crevicular fluid in periodontal disease, health and after scaling and root planing.

## MATERIALS & METHODS

The present study was conducted for evaluating matrix metalloproteinase-3 levels in gingival crevicular fluid in periodontal disease, health and after scaling and root planing. A total of 50 patients who were diagnosed both clinical and radiographically as affected by periodontitis were enrolled. Patients not received any periodontal treatment in previous 6 months and were excluded. Another set of 25 subjects who came for routine dental check-up were included as healthy controls. 50 periodontitis subjects with further divided into two study groups as follows:

Group A: Chronic periodontitis patients who didn't underwent any treatment,

Group B: Chronic periodontitis patients who were treated by scaling and root planing (SRP) only.

All the patients were recalled in the morning and GCF collection was done. Supragingival plaque was removed to avoid contamination and blocking of the microcapillary pipette. Gingival crevicular fluid enzyme-linked immunoabsorbent assay analysis for MMP-3. All the results were recorded in Microsoft excel sheet and were analysed by SPSS software. Mann Whitney U test and student t test were used for evaluation of level of significance.

## RESULTS

In the present study, a total of 50 patients who were diagnosed both clinical and radiographically as affected by periodontitis were enrolled. Another set of 25 subjects who came for routine dental check-up were included as healthy controls. 50 periodontitis subjects with further divided into two study groups as follows: Group A: Chronic periodontitis patients who didn't underwent any treatment, Group B: Chronic periodontitis patients who were treated by scaling and root planing (SRP) only. Mean MMP-3 levels among the subjects of control group, Group A and Group B was found to be 0.39 ng/ml, 6.12 ng/ml and 3.69 ng/ml respectively. Significant results were obtained while comparing the mean MMP-3 levels among the subjects of the three study groups.

Table 1: Mean MMP-3 levels

Group	Mean MMP-3 levels (ng/ml)	SD
Control group	0.39	0.11
Group A	6.12	1.85
Group B	3.69	1.27

Table 2: Comparison of Mean MMP-3 levels

Group Vs Group	p- value
Control group Vs Group A	0.00*
Group A Vs Group B	0.01*
Control group Vs Group B	0.00*

\*: Significant

## DISCUSSION

Periodontal disease refers to the inflammatory processes that occur in the tissues surrounding the teeth in response to bacterial accumulations, or dental plaque, on the teeth. The bacterial accumulations cause an inflammatory response from the body. The chronic and progressive bacterial infection of the gums leads to alveolar bone destruction and loss of tissue attachment to the teeth. Periodontal disease has many states or stages, ranging from easily treatable gingivitis to irreversible severe periodontitis. Periodontal disease is increased by several risk factors: cigarette smoking; systemic diseases; medications such as steroids, anti-epilepsy drugs and cancer therapy drugs; ill-fitting bridges; crooked teeth and loose fillings; pregnancy; and oral contraceptive use.<sup>7,8</sup>

Stromelysin-1 (MMP-3) is with broad substrate specificity that has been linked to tissue destruction associated with chronic inflammatory diseases such as periodontitis. MMPs are counteracted by tissue inhibitor of matrix metalloproteinases (TIMPs), which inhibit MMP activity there by restricting extracellular matrix (ECM) breakdown. The balance between MMPs and TIMPs play an important role in maintaining the integrity of healthy tissues. A disturbed balance of MMPs and TIMPs is found in various pathologic conditions, such as rheumatoid arthritis, cancer, and periodontitis.<sup>8-10</sup> Hence; the present study was conducted for evaluating matrix metalloproteinase-3 levels in gingival crevicular fluid in periodontal disease, health and after scaling and root planing.

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and increased amount of MMP-3 mRNA in periodontal lesions have been demonstrated and it has been suggested that MMP-3 may act as a marker stromal cell in the tissue degradation process.<sup>8-10</sup> MMPs are zinc-dependent endopeptidases derived predominantly from polymorphonuclear leukocytes during acute stages of periodontal disease and are the key enzymes responsible for extracellular collagen matrix degradation. Elevated MMP levels have been observed in inflamed human gingiva and GCF in subjects with adult periodontitis. MMPs have the unique ability to breakdown type I and III collagen, which is critical for periodontal destruction. Subantimicrobial doses of doxycycline inhibit MMPs and reduce periodontal disease activity. Gingival crevicular MMP levels in periodontitis were higher than those in healthy subjects.<sup>11-13</sup>

In the present study, significant results were obtained while comparing the mean MMP-3 levels among the subjects of the three study groups. Reddy NR et al estimated the levels of MMP-3 in GCF in periodontal health, disease and to evaluate the effect of periodontal therapy on MMP-3 concentrations in GCF. Periodontal examination and collection of GCF by extracrevicular method was performed in 30 subjects selected randomly and categorized into three groups. Group I (Healthy, n=10), group II (Chronic periodontitis, n=20) and group III (After treatment group, n=20). MMP-3 was detected in all samples. Highest mean MMP-3 concentrations in GCF were obtained for group II (7.490 ng/ml), while the lowest concentrations were seen in group I (0.344 ng/ml) and group III (2.129 ng/ml). This suggests that MMP-3 levels in GCF increases proportionally with the progression of periodontal disease and decreases after treatment. There is a substantial increase in the concentrations of MMP-3 as periodontal disease progresses.

## CONCLUSION

From the above results, the authors conclude that progression of periodontal diseases is accompanied by concomitant increase in MMP-3 concentrations. However; further studies are recommended.

## REFERENCES

- Petersen PE, Baehni PC. Periodontal health and global public health. *Periodontol.* 2000. 2012 Oct;60(1):7-14.
- Bartold PM, Van Dyke TE. Periodontitis: a host-mediated disruption of microbial homeostasis. *Unlearning learned concepts.* *Periodontol.* 2000. 2013 Jun;62(1):203-17.
- Socransky SS, Haffajee AD, Cugini MA, Smith C, Kent RL. Microbial complexes in subgingival plaque. *J. Clin. Periodontol.* 1998 Feb;25(2):134-44.
- Darveau RP. Periodontitis: a polymicrobial disruption of host homeostasis. *Nat. Rev. Microbiol.* 2010 Jul;8(7):481-90.
- Elter JR, Champagne CME, Offenbacher S, Beck JD. Relationship of periodontal disease and tooth loss to prevalence of coronary heart disease. *J Periodontol.* 2004;75:782-90.
- Hujoel PP, Drangsholt MT, Spiekerman C, Derouen TA. Periodontitis-systemic disease associations in the presence of smoking: causal or coincidental? *J Periodontol.* 2000 2002;30:51-60.
- Ebersole JL, Capelli D, Steffen MJ. Longitudinal dynamics of infection and serum antibody in *A. actinomycetemcomitans* periodontitis. *Oral Dis.* 1995;1:129-38.
- Hayes C, Antezak-Bouckoms A, Burdick E. Quality assessment and meta-analysis of systemic tetracycline use in chronic adult periodontitis. *J Clin Periodontol.* 1992;19:164-8.
- Massova I, Kotra LP, Fridman R, Mobashery S. Matrix metalloproteinases: Structures, evolution, and diversification. *FASEB J.* 1998;12:1075-95.
- Visse R, Nagase H. Matrix metalloproteinases and tissue inhibitors of metalloproteinases: Structure, function and biochemistry. *Circ Res.* 2003;92:827-39.
- Miller C.S., King C.P., Jr., Langub M.C., Kryscio R.J., Thomas M.V. Salivary biomarkers of existing periodontal disease: a cross-sectional study. *J. Am. Dent. Assoc.* 2006;137:322-329.
- Navazesh M. Methods for collecting saliva. *Ann. NY Acad. Sci.* 2003;694:72-77.
- Rai B., Kharb S., Anand S.C. Thiocyanate, a salivary marker of periodontitis among smokers and nonsmokers: a pilot study. *J. Pak. Dent. Assoc.* 2007;16:35-37.
- Reddy NR, Roopa D, Babu DS, Kumar PM, Raju CM, Kumar NS. Estimation of matrix metalloproteinase-3 levels in gingival crevicular fluid in periodontal disease, health and after scaling and root planing. *J Indian Soc Periodontol.* 2012;16(4):549-552.