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Original ARTICLE

Assessment of matrix metalloproteinase- 3 levels in gingival crevicular fluid in periodontal disease, healthy and after scaling and root planing

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ABSTRACT
Background: Periodontal diseases are common chronic pathologies worldwide that affect periodontal tissues, which include the gingiva, periodontal ligament, radicular cementum, and alveolar bone. Matrix metalloproteinases (MMPs) are a large family of proteases involved in many cell-matrix and cell-cell signalling processes. Also matrix metalloproteinase-3 (MMP-3) or stromelysin-1 contributes to several pathologies. Hence; the present study was conducted with the aim of assessing MMP - 3 levels in gingival crevicular fluid in periodontal disease, healthy and after scaling and root planning. **Materials & methods:** A total of 60 subjects were enrolled in the present study. All the subjects were broadly divided into three study groups with 20 subjects in each group as follows: Group A: Clinically healthy controls with absence of any periodontal pathology, Group B: Subjects with clinical signs of inflammation, probing pocket depth (PPD) ≥5 mm and clinical attachment loss (CAL) ≥2 mm, with radiographic evidence of bone loss, and Group C: Subjects fulfilling the criteria of group B who were treated by scaling and root planing (SRP) only. All the patients were recalled in the morning and gingival crevicular fluid (GCF) samples were obtained using sterile micropipettes. All the samples were sent to laboratory where auto-analyzer and ELISA technique were used for assessing MMP-3 levels. **Results:** Mean MMP-3 levels among the patients of group A, group B and group C was found to be 0.39 ng/mL, 6.95 ng/mL and 2.96 ng/mL respectively. In the present study, significant results were obtained while comparing the mean MMP-3 levels among the patients of all the three study groups. Mean MMP-3 levels was highest among the patients of group C, followed by Group B and lowest for Group A. **Conclusion:** With increasing severity of periodontal destruction, there is concomitant increase in the concentrations of MMP-3 in GCF.
Key words: Matrix metalloproteinase, Periodontal

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INTRODUCTION

Periodontal diseases are common chronic pathologies worldwide that affect periodontal tissues, which include the gingiva, periodontal ligament, radicular cementum, and alveolar bone. Bacterial–host interactions at the biofilm–periodontium interface will initially trigger gingival inflammation, resulting in gingivitis. Over time, it can progress to the immune-mediated loss of the periodontal supporting tissues, including alveolar bone, determining the destructive character of the disease.[1- 3]

Matrix metalloproteinases (MMPs) are a large family of proteases involved in many cell-matrix and cell-cell signalling processes through activation, inactivation or release of extracellular matrix (ECM) and non-ECM molecules, such as growth factors and receptors. Uncontrolled MMP activities underlie the pathophysiology of many disorders. Also matrix metalloproteinase-3 (MMP-3) or stromelysin-1 contributes to several pathologies, such as cancer, asthma and rheumatoid arthritis, and has also been associated with neurodegenerative diseases. MMPs were traditionally regarded to degrade extracellular matrix components and grouped according to their substrate specificity in collagenases, gelatinases, stromelysins, matrilysins, and membrane type (MT) MMPs. [4- 6] Hence; the present study was conducted with the aim of assessing MMP - 3

levels in gingival crevicular fluid in periodontal disease, healthy and after scaling and root planning.

MATERIALS & METHODS

The present study was conducted with the aim of assessing MMP - 3 levels in gingival crevicular fluid in periodontal disease, healthy and after scaling and root planning. A total of 60 subjects were enrolled in the present study. Inclusion criteria for the present study included:

- Patients between the age group of 25 to 50 years
- Patients with negative history of any other systemic illness,
- Patients with any known drug allergy
- Patients with negative history of diabetes or hypertension

All the subjects were broadly divided into three study groups with 20 subjects in each group as follows:

- Group A: Clinically healthy controls with absence of any periodontal pathology,
- Group B: Subjects with clinical signs of inflammation, probing pocket depth (PPD) ≥5 mm and clinical attachment loss (CAL) ≥2 mm, with radiographic evidence of bone loss.
- Group C: Subjects fulfilling the criteria of group B who were treated by scaling and root planing (SRP) only.

All the patients were recalled in the morning and gingival crevicular fluid (GCF) samples were obtained using sterile micropipettes. All the samples were sent to laboratory where auto-analyzer and ELISA technique were used for assessing MMP-3 levels. All the results were recorded in Microsoft excel sheet and were analyzed by SPSS software. Mann-Whitney U test was used for evaluation of level of significance.

RESULTS

In the present study, mean age of the patients of group A, group B and group C was found to be 46.8 years, 47.2 years and 45.1 years respectively. Mean MMP-3 levels among the patients of group A, group B and group C was found to be 0.39 ng/mL, 6.95 ng/mL and 2.96 ng/mL respectively. In the present study, significant results were obtained while comparing the mean MMP-3 levels among the patients of all the three study groups. Mean MMP-3 levels was highest among the patients of group C, followed by Group B and lowest for Group A.

Table 1: MMP-3 levels among patients of the three study groups

MMP- 3 levels	Group A	Group B	Group C
Mean (ng/mL)	0.39	6.95	2.96
SD	0.19	3.15	1.88

DISCUSSION

Several signaling molecules such as cytokines, chemokines, and growth factors can be processed by active MMPs, thus regulating their biological functions and/or bio availability. Cytokines are key modulators of cellular responses during periodontal inflammation and, upon coupling with their cognate receptors in their cellular targets, they induce intracellular signaling and modify gene expression. Likewise, chemokines are small signaling molecules responsible for the regulated trafficking of specific cell types into the inflamed tissues.[7- 9] Hence; the present study was conducted with the aim of assessing MMP - 3 levels in gingival crevicular fluid in periodontal disease, healthy and after scaling and root planning.

Graph 1: MMP-3 levels among patients of the three study groups

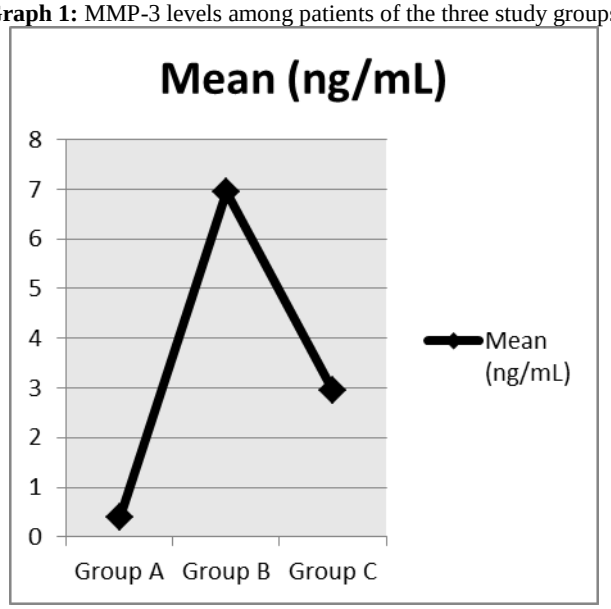

Table 2: Comparison of MMP-3 levels

Group comparison	U value	p- value
Group A Vs Group B	-15.36	0.001*
Group A Vs Group C	-10.84	0.020*
Group B Vs Group C	-11.61	0.000*

*: Significant

In the present study, mean age of the patients of group A, group B and group C was found to be 46.8 years, 47.2 years and 45.1 years respectively. Mean MMP-3 levels among the patients of group A, group B and group C was found to be 0.39 ng/mL, 6.95 ng/mL and 2.96 ng/mL respectively. Adriana M Romero et al determine the levels of MMP-3 and MMP-8 in GCF, before and after nonsurgical periodontal treatment (NSPT), to evaluate disease activity and therapy response. Eleven patients with PC and eleven healthy controls were selected. Clinical measurements to evaluate gingival index (GI), plaque index (PI), probing depth (PD) and clinical attachment loss (CAL) were made in all the teeth of each individual and in six sites per tooth. GCF samples were taken from one tooth per quadrant, with a pocket depth > or =4 mm and a clinical attachment loss > or =5 mm, and the levels of MMP-3 and MMP-8 measured using an ELISA test. Statistically significant differences in clinical parameters were observed ($p < 0.05$) between patients with CP and control groups before the periodontal treatment, with significant decrease in all indexes after the NSPT. The initial concentrations of MMP-3 and MMP-8 were significantly higher than those obtained after the NSPT and in the control group, without observing a correlation between the clinical parameters and the levels of MMPs. Increased levels of MMP-3 and MMP-8 in the GCF of patients with PC declined significantly after NSPT, and the difference between the levels in healthy individuals and patients, suggested the important participation of these MMPs in tissue destruction in PC disease.[10]
In the present study, significant results were obtained while comparing the mean MMP-3 levels among the patients of all the three study groups. Mean MMP-3 levels was highest among the

patients of group C, followed by Group B and lowest for Group A. Wings T Y Loo et al investigated the association amongst the single nucleotide polymorphisms of genes encoding for matrix metalloproteinase (MMP) 1, 3, 9 and cyclooxygenase-2 (COX-2) of subjects. Protein production of MMPs, COX-2 and Vascular Endothelial Growth Factor (VEGF) were also investigated. 280 chronic periodontitis patients and 250 periodontitis-free subjects were selected. The mean probing depth (PD) was 5.4mm and the clinical attachment loss (CAL) was 6.4mm in patients group with at least 2 years history. 2G/2G genotype of MMP-1, the periodontitis patients presented frequency of 28% and the control only showed 3%. 5A/5A genotype of MMP-3, the periodontitis patients presented higher frequency of 55% than the control 40%. C/C of genotype MMP-9, the periodontitis patients presented higher frequency of 51% than the control 17%. C/C of genotype COX-2, the periodontitis patients demonstrated 28% frequency and the control was 3%. ELISA analysis determined a significant difference ($p<0.001$) in protein production between patient and control samples for the bio-markers. 12 cases with suspicious genotype of MMPs and in COX-2 showed the serum level was the highest value between other C/C genotype. Combine genotype and serum expression of inflammatory mediators that may be a good bio-marker for diagnosis and prognosis of the periodontitis.[11] Letra A et al investigated the association of MMP and TIMP polymorphisms with chronic periodontitis in two populations. Thirty-four polymorphisms spanning 12 MMP and 2 TIMP genes were genotyped in 401 individuals from Brazil (99 cases with chronic periodontitis and 302 controls), and 274 individuals from the US (70 cases and 204 controls). Individuals were considered cases if presenting at least three teeth exhibiting sites of clinical attachment loss ≥5mm in two different quadrants. Controls were characterized by absence of clinical attachment loss and no sites with probing depth >3mm. MMP3 and TIMP1 mRNA expression was evaluated in healthy and diseased periodontal tissues. TIMP1 showed association with chronic periodontitis in the Brazilian population, whereas MMP3 showed association in the US population and in the Brazilian population. MMP3 and TIMP1 mRNA expression was significantly higher in diseased tissues when compared to control tissues. Their results supported a role for variations in MMP3 in chronic periodontitis and report a novel association with TIMP1.[12]

CONCLUSION

From the above results, the authors concluded that with increasing severity of periodontal destruction, there is concomitant increase in the concentrations of MMP-3 in GCF.

REFERENCES

1. Houri-Haddad Y., Wilensky A., Shapira L. T-cell phenotype as a risk factor for periodontal disease. Periodontol. 2000. 2007;45:67–75.
2. Haerian A, Adonogianaki E, Mooney J, Docherty JP, Kinane DF. Gingival crevicularstromelysin, collagenase and tissue inhibition of metalloproteinase levels in healthy and diseased sites. J Clin Periodontol. 1995;22:505–9.
3. Ogata Y, Enghild JJ, Nagase H. Matrix metalloproteinase 3 (Stromelysin) activates the precursor for the human matrix metalloproteinase 9. J Biol Chem. 1992;267:3581–4.
4. Naesse EP, Schreurs O, Helgeland K, Schenck K, Steinsvoll S. Matrix metalloproteinases and their inhibitors in gingival mast cells in persons with and without humanimmunodeficiency virus infection. J Periodontal Res. 2003;38:575–82.
5. Haerian A, Adonogianaki E, Moneey J, Manos A, Kinane DF. Effects of treatment on gingival crevicular collagenase, stromelysin and tissue inhibitor of metalloproteinase and their ability to predict response to treatment. J Clin Periodontol. 1996;23:83–91.
6. Nitta H., Katagiri S., Nagasawa T., Izumi Y., Ishikawa I., Izumiyama H., Uchimura I., Kanazawa M., Chiba H., Matsuo A., et al. The number of microvascular complications is associated with an increased risk for severity of periodontitis in type 2 diabetic patients: Results of a multicenter hospital-based cross-sectional study. J. Diabetes Investig. 2017 doi: 10.1111/jdi.12633.
7. Pussinen P.J., Paju S., Mantyla P., Sorsa T. Serum microbial- and host-derived markers of periodontal diseases: A review. Curr. Med. Chem. 2007;14:2402–2412.
8. Heath JK, Gowen M, Meikle MC, Reynolds JJ. Human gingival tissues in culture synthesize three metalloproteinases and a metalloproteinase inhibitor. J Periodontal Res. 1982;17:183–90.
9. Figueredo CM, Areas A, Mirinda LA, Fischer RG, Gustafsson A. The short term effectiveness of non-surgical treatment in reducing protease activity in gingival crevicular fluid from chronic periodontitis patients. J Clin Periodontol. 2004;31:615–9.
10. Adriana M Romero 1, Patrizzia Mastromatteo-Alberga, Laura Escalona, María Correnti. MMP-3 and MMP-8 Levels in Patients With Chronic Periodontitis Before and After Nonsurgical Periodontal Therapy. Invest Clin. 2013 Jun;54(2):138-48.
11. Wings T Y Loo 1, Min Wang, L J Jin, Mary N B Cheung, G R Li Association of Matrix Metalloproteinase (MMP-1, MMP-3 and MMP-9) and cyclooxygenase-2 Gene Polymorphisms and Their Proteins With Chronic Periodontitis. Comparative Study Arch Oral Biol. 2011 Oct;56(10):1081-90. doi: 10.1016/j.archoralbio.2011.03.011. Epub 2011 Apr 11.
12. Letra A, Silva RM, Rylands RJ, et al. MMP3 and TIMP1 variants contribute to chronic periodontitis and may be implicated in disease progression. J Clin Periodontol. 2012;39(8):707-716. doi:10.1111/j.1600-051X.2012.01902.x