Rapid Quantitative Chairside Test for Active MMP-8 in Gingival Crevicular Fluid

First Clinical Data

N. PRESCHER,[a] K. MAIER,[b] S. K. MUNJAL,[b] T. SORSA,[c] C.-D. BAUERMEISTER,[d] F. STRUCK,[b] AND L. NETUSCHIL[b]

[a]*Dental Clinic, Friedrich Schiller University, Jena, Germany*

[b]*Dentognostics GmbH, Jena, Germany*

[c]*Department of Oral and Maxillofacial Diseases, Institute of Dentistry, University of Helsinki, Helsinki, Finland*

[d]*Laboratories for Oral Microbiology, Düsseldorf, Germany*

ABSTRACT: In a first pilot field study 64 gingival crevicular fluid (GCF) samples were collected from patients of dental practitioners. The dentists (one orthodontist one periodontist, and one general practitioner) were asked to monitor the respective clinical status of the sites of sampling and to collect, if possible, sulcus fluid samples from healthy as well as affected sites from the same patient. The concentration of activated matrix metalloproteinase-8 (aMMP-8) in the GCF was recorded using a set of monoclonal antibodies and a novel Dento*Analyzer*. From all three dental offices the distribution of the aMMP-8 values in GCF showed a congruent pattern, where healthy and periodontitis-affected inflamed sites were clearly disparate.

KEYWORDS: chairside; Dento*Analyzer*; immunoassay; MMP8; periodontitis; point-of-care

In the last decade it became a textbook knowledge that matrix metalloproteinases (MMPs) are responsible for tissue degradation and bone resorption.[1,2] Of these, MMP-8 in GCF[3] is the most prominent collagenase (collagenase 2) associated with periodontitis.[4–6]

It was the aim of this pilot study (1) to collect GCF samples in different dental offices, from healthy, doubtful (e.g., gingivitis), and inflamed (e.g., periodontitis-affected) sites; (2) to assess the concentration of activated

Address for correspondence: Dr. Lutz Netuschil, Dentognostics GmbH, Winzerlaer Str. 2, D-07743 Jena, Germany. Voice: +49-3641-508 503; fax: +49-3641-508 509.
l.netuschil@dentognostics.de

Ann. N.Y. Acad. Sci. 1098: 493–495 (2007).
doi: 10.1196/annals.1384.019

TABLE 1. Values (ng) of activated matrix metalloproteinase-8 (aMMP-8) per milliliter eluate of GCF

Status	Healthy	Doubtful	Periodontitis
n	21	18	25
Median	1.0	6.3	14.3
25% 75% quartile	0.2–2.9	3.5–14.2	10.9–33.7
10–90%	0.0–6.7	2.2–18.2	8.4–51.7
Range	0.0–7.4	0.0–27.1	5.7–64.6

matrix metalloproteinase-8 (aMMP-8) in the GCF with the aid of monoclonal antibodies and a novel Dento*Analyzer*[7,8]; (3) to compare the concentrations of aMMP-8 with the clinical status; and (4) to compare our data with reports in the literature.

GCF was collected with a standard technique using MMP-8 collection strips.[9,10] Concomitantly, the pocket depth was assessed and clinical status was recorded by the attending dentist. The aMMP-8 was immediately eluted from the strips and, after appropriate dilution, quantitatively assessed with the Dento*Analyzer*.[7,8] By this assay the concentration of aMMP-8 was calculated as nanogram of aMMP-8 per milliliter of eluate.

A total of 64 samples were collected, 23 by orthodontists, 18 by periodontists, and 23 in the practice of a general dentist. According to the dentists' judgment, 21 sites were estimated as healthy, 18 as doubtful (e.g., gingivitis; adjacent to brackets, etc.), and 25 as periodontically affected. In all three offices a congruent pattern of aMMP-8 values was recorded: Low values were concerned with healthy periodontium, high values reflected periodontitis-affected sites, and the doubtful cases lay in between. The summarized outcome is presented in TABLE 1.

Healthy sites (median 1.0, range 0.0–7.4 ng aMMP-8/mL eluate) were clearly different from inflammatory sites (median 14.3, range 5.7–64.6). Low values of aMMP-8 in periodontitis cases represented in *all* cases treated, nonactive disease. Whenever healthy and periodontitis sites could be compared in the same patient ($n = 30$, i.e., 15 pairs), without exception the affected sites showed higher aMMP-8 values than the healthy control sites. The aMMP-8 values assessed with the Dento*Analyzer* were found to be similar to results described previously.[9,11,12]

CONCLUSIONS

We conclude that the assessment of aMMP-8 in GCF is a noninvasive method to assess and monitor the pathophysiological status of the periodontium. The determination of aMMP-8 with the Dento*Analyzer* enables the dentist to distinguish between the healthy and the periodontitis-affected sites within 20 min.

REFERENCES

1. REYNOLDS, J.J., R.M. HEMBRY & M.C. MEIKLE. 1994. Connective tissue degradation in health and periodontal disease and the roles of matrix metalloproteinases and their natural inhibitors. Adv. Dent. Res. **8:** 312–319.
2. KINANE, D.F. 2000. Regulators of tissue destruction and homeostasis as diagnostic aids in periodontology. Periodontology **24:** 215–225.
3. SUOMALAINEN, K., T. SORSA, L. SAXEN, *et al*. 1991. Collagenase activity in gingival crevicular fluid of patients with juvenile periodontitis. Oral Microbiol. Immunol. **6:** 24–29.
4. BIRKEDAL-HANSEN, H. 1993. Role of matrix metalloproteinases in human periodontal diseases. J. Periodontol. **64:** 474–484.
5. MCCULLOCH C.A. 1994. Host enzymes in gingival crevicular fluid as diagnostic indicators of periodontitis. J. Clin. Periodontol. **21:** 497–506.
6. SORSA, T., L. TJÄDERHANE & T. SALO. 2004. Matrix metalloproteinases (MMPs) in oral diseases. Oral Dis. **10:** 311–318.
7. MUNJAL, S.K., P. MIETHE, L. NETUSCHIL, *et al*. 2007. Immunoassay-based diagnostic point-of-care technology for oral specimen. Ann. N. Y. Acad. Sci. This volume.
8. MUNJAL, S.K., N. PRESCHER, F. STRUCK, *et al*. 2007. Evaluation of immunoassay-based MMP-8 assessment in gingival crevicular fluid on a point-of-care platform. Ann. N. Y. Acad. Sci. This volume.
9. MÄNTYLÄ, P., M. STENMAN, D.F. KINANE, *et al*. 2003. Gingival crevicular fluid collagenase-8 (MMP-8) test stick for chair-side monitoring of periodontitis. J. Periodontol. Res. **38:** 436–439.
10. MÄNTYLÄ, P., M. STENMAN, D. KINANE, *et al*. 2006. Monitoring periodontal disease status in smokers and non-smokers using a gingival crevicular fluid matrix metalloproteinase-8 (MMP-8) specific chair-side test. J. Periodontal Res. **41:** 503–512.
11. CHEN, H.Y., S.W. COX, B.M. ELEY, *et al*. 2000. Matrix metalloproteinase-8 levels and elastase activities in gingival crevicular fluid from chronic adult periodontitis patients. J. Clin. Periodontol. **27:** 366–369.
12. KINANE, D.F., I.B. DARBY, S. SAID, *et al*. 2003. Changes in gingival crevicular fluid matrix metalloproteinase-8 levels during periodontal treatment and maintenance. J. Periodont. Res. **38:** 400–404.

Rapid quantitative chairside test for active MMP-8 in gingival crevicular fluid. Ann N Y Acad Sci. 2007;1098:493â€“5. 12. Sorsa T, Suomalainen K, Uitto VJ. The role of gingival crevicular fluid and salivary interstitial collagenases in human periodontal diseases. Arch Oral Biol. 1990;35(Suppl):193Sâ€“6S. 13. Uitto VJ, Suomalainen K, Sorsa T. Salivary collagenase. Origin, characteristics and relationship to periodontal health. J Periodontal Res. 1990;25:135â€“42. CO True (measured) total quantity of substance (possible carryover) on the cleaned surface in contact with the product, calculated from results of swab tests. Ai Area for the tested piece of equipment # i. mi Quantity in Âµg/dm2, for each swab per area of swabbed surface (normally 1 dm2). 4.2.5.1. LSe and Holm-Pedersen~ sampled crevicular fluid flow as an indicator of gingival in-. designed to correct all modified defects in the periodontium, position and amountof gingivae sur-rounding the teeth. â€™ â€™~ Maynardand others 94,97 sugÂ These indices are rapid and can be performed in the den-tal office for both the primary and permanent d9e8ntitions. The PBI appears to have been tested clinically with muchsuccess. 22 A sample form of this index is shown in Figure 4. Similarly, Garnick 98 has suggested a graphic display showing the subjectâ€™s plaque and gingival index over a period of time.Â Arapid chairside test for the severity of periodontal disease using gingival fluid. J Periodontol 49:391, 1978. 87.Smith, Q. T. Gingival crevicular fluid as a diagnostic aid.