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C-TELOPEPTIDE PYRIDINOLINE LEVEL IN GINGIVAL CREVICULAR FLUID AS INDICATOR OF ALVEOLAR BONE RESORPTION

(KADAR C-TELOPEPTIDA PIRIDINOLIN PADA CAIRAN KREVIKULAR GINGIVA SEBAGAI INDIKATOR ADANYA RESORBSI TULANG ALVEOLAR)

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Abstract

Periodontal disease is an inflammation and degeneration of chronical dental support tissue, accumulative, and progressive that caused tooth loss. Periodontal disease is caused by bacteria that has an ability to activate host response to produce pro-inflammatory mediator. Pro-inflammatory mediator causes collagen fibers degradation or destruction in periodontal tissue. Collagen cross-link of periodontal tissue would be broken down and released into serum, and then excreted through urine. Collagen cross-link is called pyridinium cross-link, such as pyridinoline, deoxypyridinoline, N-telopeptide, and C-telopeptide (ICTP). This study was to investigate the level in gingival crevicular fluid as an indicator of alveolar bone resorption. This study used 24 subjects with periodontal disease and 6 healthy subjects. Dividing of periodontal disease was based on periodontal index and every subject had minimum 20 teeth in mouth. Gingival crevicular fluid was taken at mesial site of maxillary posterior tooth by paperpoint and was measured by ELISA technique. The result showed that the lowest level of ICTP was in control group, and the highest level was in grade 3 periodontitis group. The level of ICTP increased followed by periodontal disease progression. The result of Kruskal-Wallis-H and Mann-Whitney-U test showed that was significant difference in ICTP between subject with and without periodontitis ($p<0.05$). It can be concluded that ICTP level in gingival crevicular fluid can be used as indicator of alveolar bone resorption in periodontal disease subjects.

Key words: alveolar bone resorption, C-telopeptide pyridinoline

INTRODUCTION

Periodontal disease is a soft and hard tooth support tissue inflammation and degeneration. Periodontal disease is one of the oral diseases that has the highest prevalence and intensity. Based on Survey Kesehatan Rumah Tangga (SKRT, 2004), 46% population affected periodontal disease and the prevalence increased followed by the age.[1] Periodontal disease is a chronic, cummulative, and progresssive disease. Periodontal disease is a serious infectious disease, because it causes tooth loss.[2] Severity variation of periodontal disease influenced individual tooth.[3] Periodontal disease is divided into reversible and irreversible disease. Reversible disease is gingivitis and irreversible periodontal disease is periodontitis.[4]

The progression of periodontal disease is caused by local, systemic, or environmental factor. These factors will influence host and bacterial interaction. Bacteria of oral cavity can cause inflammation by host cell activation to produce pro-inflammatory mediator.[5] Pro-inflammatory mediator causes collagen fiber degradation of periodontal disease. It causes collagen cross link and will be degradation, then will be released in blood and excreted in urine.

Releasing of collagen cross link is pyridinium cross link. It consists of pyrydinoline, deoxypyridinoline, N-telopeptide, and C-telopeptide (ICTP).[6]

Palys, et al. showed that there was changing of ICTP level in gingivitis and periodontitis subjects. Dentists need information and examination for determining diagnosis of periodontal disease. For a long time, dentists used clinical examination such as probing depth, bleeding on probing, loss attachment, plaque index, and radiographic examination. The advantages of this method are easy, cheap and non invasive. Loss attachment and alveolar bone loss can be measured by probe periodontal and radiographic in late period of tissue destruction or destructtion is more than 3 mm.[6] This study aimed to know ICTP level in gingival crevicular fluid as indicator of alveolar bone resorption.

MATERIALS AND METHODS

This research was admitted and approved by agreement from Ethical Commission of Dentistry Faculty, Gadjah Mada University. Thirty patients conescutively recruited for the study at the Periodontic Department of Prof. Soedomo Dental Hospital Gadjah Mada University. There were 24 patients with periodontal disease and 6 healthy patients. Inclusion subject criteria were man or woman 30-50 years old, had minimally 20 teeth in oral cavity, did not have systemic disease, non smoker, did not use oral rinse, antibiotic, or drug that had calcium metabolic effect for 6 months, did not get periodontal treatment for 6 month, were not pregnant, menstruation, or menopause. Subjects were divided into 5 groups based on Russel's modification periodontal index: patients with gingivitis, periodontitis grade 1, 2, 3 and healthy subject as control.[7,8]

All patients also were examined loss attachment degree, probing depth, and bleeding on probing. gingival crevicular fluid (GCF) examination was taken on clinical and radiographical examination, particularly posterior teeth of maxilla.[9] Tooth element was cleaned by cotton roll to remove supragingival plaque and saliva. Paper point was inserted into periodontal pocket for 30 minutes. After that, paper point was put into 1.5 mL Eppendorf tube and closed by paraffin tape. Then, Eppendorf tube was inserted into ice box and kept in deep freezer -30^0 C until ICTP test. ICTP test used ELISA technique. Data were analyzed by Kruskal-Walis-H test and followed by Mann-Whitney-U test with 5% significant degree.

RESULTS

The highest ICTP level was in periodontitis *grade* 3 and the lowest was in healthy subject. Based on Kruskal Wallis test, there was significant difference in ICTP level of subject with and without periodontal disease ($p < 0.05$) (Table 1).

Table 1. Mean and standard deviation of ICTP level in subject with and without periodontal disease (nmol/ L)

Group	ICTP level	Subjects
Control	0,22 ± 0,02	6
Gingivitis	0,56 ± 0,07	6
Periodontitis grade 1	2,57 ± 0,36	6
Periodontitis grade 2	4,44 ± 0,73	6
Periodontitis grade 3	6,44 ± 1,07	6

The result of Mann Whitney test showed there was significant difference of ICTP level between subject with and without periodontal disease ($p < 0.05$) (Table 2).

Table 2. Mann Whitney Test of ICTP level between subject with and without periodontal disease

Correlation between groups	Sig.
Control – gingivitis	0.000*
Control – periodontitis *grade* 1	0.000*
Control – Periodontitis *grade* 2	0.000*
Control – Periodontitis *grade* 3	0,000*
Gingivitis – periodontitis *grade* 1	0.000*
Gingivitis – Periodontitis *grade* 2	0.000*
Gingivitis – Periodontitis *grade* 3	0.000*
Periodontitis *grade* 1 – Periodontitis *grade* 2	0.000*
Periodontitis *grade* 1 – Periodontitis *grade* 3	0.000*
Periodontitis *grade* 2 – Periodontitis *grade* 3	0.000*

DISCUSSION

Based on research result, there was an increasing of ICTP level following severity of periodontal disease. The highest of ICTP level was in periodontitis *grade* 3 subjects. It means that alveolar bone resorption was more than the other groups. The result also showed that there was significant difference of ICTP level in subjects with and without periodontal disease ($p<0.05$). ICTP level on gingivitis subject was lower than periodontitis subject.

In gingivitis subject, there occurred gingival connective tissue destruction without alveolar bone destruction. In periodontitis subject, all of periodontal tissues were destruction, especially alveolar bone.[5]

Besides, there was difference between collagen type of connective tissue in gingiva and alveolar bone, collagen fiber in gingiva tissue is type I, III and V collagen, and composition type I collagen in gingiva is less than type III. Alveolar bone consisted of 90 % type I collagen. [10] In gingival inflammation, collagen fiber of gingiva will be degradated and loss, especially type III. The result of immunofluoressence test showed that type III collagen of gingivitis subject was lost and there was less type I collagen.[11] ICTP cross link supported link of type I collagen fiber. Besides, pyridinium cross link in gingiva is lower than in bone,[12] then it caused significant difference of ICTP level between gingivitis and peridontitis subjects.

Increasing of ICTP level was also found in urine and serum of rat, after ovaryectomy treatment, and the level decreased after calcium and parathyroid hormone administration.[13] It showed that the increasing of ICTP level was related with bone destructtion or resorption. ICTP level in periodontal disease subjects was more than control group (Table 1). It showed that from the early of periodontal disease, gingivitis become to chronic periodontitis occurred collagen fiber destruction and continued with alveolar bone destruction. ICTP level of periodontitis was higher than gingivitis, and related with alveolar bone destruction activity. [7]

ICTP level was different significantly between periodontitis *grade* 1, 2 and 3 subjects. There were loss attachment and alveolar bone destruction, but the severity of destruction was different. In periodontitis *grade* 1, alveolar bone destruction was in interdental septum of alveolar bone. In periodontitis *grade* 2, alveolar bone destruction was less a third of bone of tooth support, and in periontitis *grade* 3, alveolar bone destruction was more than third of bone of tooth support.[14] Severity of alveolar bone destruction was related with collagen degradation of alveolar bone that was manifested in ICTP level changing.

It can be concluded that ICTP level in GCF can be used as indicator of alveolar bone resorption in periodontal disease. Besides, it needs further research about the changing of ICTP level longitudinally, so it can be used as biomarker or alveolar bone resorption.

References

1. Riset Kesehatan Dasar. Laporan Nasional 2004. Departemen Kesehatan Badan Penelitian Dan Pengembangan Kesehatan. Jakarta, 2004: Departemen Kesehatan, 2004: 131-2.
2. Situmorang N. Profil penyakit periodontal penduduk di dua kecamatan kota Medan tahun 2004 dibandingkan dengan kesehatan mulut tahun 2010. Dentika Dent J 2003; 9 (2): 71-7.
3. Soames JV, Southman JC. Oral pathology. 4th ed., New York: Oxford University Press, 2005: 116-27.
4. Kinney SJ, Christoph AR, William VG. Oral fluid – based biomarker of alveolar bone loss in peridontitis. Ann N Y Acad Sci 2007; 230-251.
5. Bee Ng YP, Maureen D, Ernest H, Alan DH, Edward FR, Farnk AS. Candidate salivary biomarkers associated with alveolar bone loss: cross sectional and in vitro studies. FEMS Immunol med Microbiol 2007; 49 (2): 252-60.
6. Taba M, Janet K, Amy SK, William VG. Diagnostic biomarker for oral and periodontal disease. Dental Clinical North America 2005; 49 (3): 551-6.
7. Dye BA, Gina TE. A brief history of national surveillance efforts for periodontal disease in the United States. J Periodontol 2007; 78 (Suppl): 1373- 9.
8. Ciancio SG. Taking oral health to heart: an overview. JADA 2002; 133:4S-6S.
9. Reimseier CA, Janet SK, Amy EH, Thomas B, James VS, Charlie AS, Lindsay AR, Huu MT, Anup KS. Identification of pathogen and host response markers correlated with periodontal disease. J Periodontol 2009; 80: 436-46.
10. De Coster PJ, Luc CM, Anne De P. Oral health in prevalent types of Ehlers-Danlos syndromes. J Oral Pathol Med 2005; 34: 298-307.
11. Martinez EF, Arau´ jo VC. In vitro immunoexpression of extracellular matrix proteins in dental pulpal and gingival human fibroblasts. International Endodontic J 2004; 37: 749-55.
12. Gyneyst, E, Paul ACC, Oliver B, Laurent G, Pierre DD, Patrick G. Recemization and isomerization of type 1 collagen c-telopeptide in human bone and soft tissue: assessment of tissue turnover. Biochem J 2000; 345: 481-5.
13. Srivastana AK, Bhattacharyya S, Castillo G, Miyakoshi N, Mohan S, Baylink DJ. Development and evaluation of c-telopeptide enzyme linked immunoassay for measurement of bone resorption in mouse serum. Bone 2000; 27 (4): 529-33.
14. Aguiar A. Periodontal disease recognition: a review course for dental hygienists. 2008. www.classification.htm (26 July 2010).