

Diabetes Mellitus (DM) and Periodontal Disease (PD) with Mutual Vicious Cycle

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In the world, Japan would be one of the countries supplying healthcare with adequate balance. The author has continued presenting research in World Organization of Family Doctors (WONCA) and Japan Primary Care Medical Association (JPCA). For JPCA annual meeting in 2017, I worked as the chairman and gave lectures about diabetes (DM) and Low Carbohydrate diet (LCD).

On the other hand, Japan's Ministry of Health, Labor and Welfare has advocated 'Healthy Japan 21' for years [1]. Among them, there are nine important tasks of lifestyle diseases, including dental health and diabetes at 6th and 7th tasks. Especially, the increasing periodontal disease (PD) would be one of the focus for the future management [1]. In this article, the relationship among these would be described.

DM and PD have been generally encountered as chronic common diseases[2]. Both diseases have showed moderately higher occurrence in the general population in recent years. Then, the relationship between DM and PD has been investigated. According to previous reports, both type 1 and 2 of diabetes mellitus are risk factor for PD[3]

Periodontal disease (PD) have the characteristic aspect for the destruction of teeth-supporting tissues by the infection and accumulation of oral bacteria on teeth[4]. Generally, PD has two major subtypes, which are periodontitis and gingivitis. Gingivitis is characterized by its reversible inflammation in periodontal tissues. In contrast, periodontitis presents destruction of tooth supporting structures, leading to the possibility of loss of the teeth.

According to some evidence, gingivitis always seemed to show the presence of periodontitis. In

contrast, some cases of gingivitis never transform to periodontitis[5]. Then, it is supposed that bacterial plaque accumulation is necessary for onset of both subtypes, while the development to periodontitis needs some individual susceptibility [6].

As regard to previous reports, diabetes has been a risk factor for PD. Historically, Mealey et al. showed that diabetic patients revealed 3 fold higher risk in comparison with standard value by calculating some factors statistically[3]. In diabetic situation, all kinds of chronic infection including periodontitis can affect glycemic variability[7]. By the effects of cell-mediated immunity and humoral immune response such as Interleukin-10 (IL-10), IL-2, transforming growth factor (TGF) and interferon (IFN)-gamma, secretion of insulin and glycemic control have been influenced[8]. Especially, periodontal disease affects the glycemic control. According to 2-year longitudinal trial, there was six-fold increased risk for worsening glycemic variability in diabetic subjects. It showed more severe periodontitis in DM with periodontitis than DM without periodontitis[8].

As to PD and periodontitis, there has applicable standard guideline. American Association of Periodontology (AAP) has presented the classification concerning periodontal disease for 6 classification as follows: gingival disease, chronic periodontitis, aggressive periodontitis, periodontitis as manifestation of systemic disease, necrotizing periodontal disease, and periodontal abscess [9,10]

According to several experiments and clinical studies, periodontitis in diabetes may be mediated by IL-1b, TNF-a, IL-6, OPG and RANKL [11]. As Regard to the diabetic patho- and physiological mechanism, the immunoglobulin superfamily molecule receptor for advanced glycation end product (RAGE) transduces the effects of multiple ligands, such

as advanced glycation end products (AGEs), advanced oxidation protein products, and so on [12]. The AGE-RAGE axis seems to be an important pathway of tissue destruction and impaired repair in diabetes associated periodontitis [13].

PD is characteristic as its inflammatory destruction of periodontal tissues and extensive alveolar bone destruction. Consequently, there are complex interactions between periodontal pathogens and host defense mechanism. Furthermore, CRP is a potential pro-inflammatory biomarker in patients with chronic periodontitis and diabetes mellitus.

Relationship among gingivitis, lifestyle and CRP was studied. As a result, the value of high sensitivity CRP was positively associated with gingivitis, smoking every day and overweight/obesity in adolescents [14]. Furthermore, chronic periodontitis would be influenced by the values of CRP, IL-6 and IL-10 [15]. The value of HOMA-R significantly predicts gingival/periodontal inflammation [16].

There was community-based study about the relationship between periodontitis and glucose tolerance. Data from 961 adults showed that deep pockets condition (> 2.0 mm) were significantly associated with impaired glucose tolerance and with diabetes than that of shallow pockets (< 1.3 mm) [17].

There were the evidence of six studies from United States, Japan, Taiwan with 77 thousand subjects. The results were that patients with periodontitis showed a ratio of developing prediabetes and diabetes, where adjusted HR range was 1.19-1.33 [18]. Although adjusted HRs were small, it showed clinically meaningful data from potentially crucial public health implications [18].

The International Diabetes Federation (IDF) and the European Federation of Periodontology (EFP) presented the consensus guidelines. They are for physicians, oral healthcare professionals, patients to be brought early diagnosis, prevention and management concerning the pathophysiology of diabetes and periodontitis [19]. Periodontal therapy seemed to reveal efficacy for diabetic patients. The improved level of reported HbA1C reductions from these meta-analyses ranges from 0.27% to 0.48% at 3–4 months following periodontal therapy, and this effect is maintained at 6 months [20].

As the pathological condition of diabetes and PD becomes worse, mutual vicious cycle comes

more. They cause elevated blood glucose and increased inflammation. In connection with lifestyle habits, daily meal, exercise, resting, drinking and smoking can affect PD [1]. Prevention of periodontal disease is important, including the improvement of efficiency for medical examination, the spread of periodic dental checkup, information of smoking influence against gingivitis / periodontitis, the revision of the manual for periodontal disease screening, problem of dental caries in aged people, efforts to the life stage, daily self-care, and so on. For the strategy of self-care, proper tooth brushing, plaque control and suppression of sugar intake are important, because approximately 1 billion bacteria are present in 1 milligram of plaque.

In summary, non-communicable disease (NCD) has spread in current medical care worldwide. Among these circumstances, DM and PD have been in higher prevalence as common diseases. It is expected that the latest and useful information will be disseminated and the current problems concerning DM and PD would be improved in various areas.

REFERENCES

- [1] Ministry of Health, Labour and Welfare (2018) Healthy Japan 21 (second) "Interim Report. (August 2, 2018). <https://www.mhlw.go.jp/english/>
- [2] Taylor GW (2001) Bidirectional interrelationships between diabetes and periodontal diseases: an epidemiologic perspective. *Ann Periodontol* 6(1):99-112.
- [3] Mealey BL (2000) Diabetes and periodontal disease: two sides of a coin. *Compend Contin Educ Dent* 21(11):943-6, 948,950.
- [4] Listgarten MA, Schifter CC, Laster L. 3-year longitudinal study of the periodontal status of an adult population with gingivitis. *J Clin Periodontol* 1985;12(3):225-238.
- [5] Loe H, Anerud A, Boysen H, Morrison E. Natural history of periodontal disease in man. Rapid, moderate and no loss of attachment in Sri Lankan laborers 14 to 46 years of age. *J Clin Periodontol* 1986; 13 (5):431-445.
- [6] Page RC. Milestones in periodontal research and the remaining critical issues. *J Periodontal Res* 1999;34(7):331-339.
- [7] Kornman KS (2008) Mapping the pathogenesis of periodontitis: a new look. *J Periodontol* 79: (suppl 8):1560-8.
- [8] Allen EM, Matthews JB, O'Connor R, O'Halloran D, Chapple IL (2009) Periodontitis and type 2 diabetes: is oxidative stress the mechanistic link? *Scott Med J* 54(2):41-7.

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- [9] Armitage GC (1999) Development of a classification system for periodontal diseases and conditions. *Ann Periodontol* 1999;4(1):1-6.
- [10] Van der Velden U (2005) Purpose and problems of periodontal disease classification. *Periodontol* 2000. 2005; 39:13-21.
- [11] Polak, D., & Shapira, L. (2017). An update on the evidence for pathogenic mechanisms that may link periodontitis and diabetes. *Journal of Clinical Periodontology*, 45(2), 150–166. doi:10.1111/jcpe.12803.
- [12] Senatus LM, Schmidt AM (2017) The AGE-RAGE Axis: Implications for Age-Associated Arterial Diseases. *Frontiers in Genetics*, 8. doi:10.3389/fgene.2017.00187.
- [13] Taylor, J. J., Preshaw, P. M., & Lalla, E. (2013). A review of the evidence for pathogenic mechanisms that may link periodontitis and diabetes. *Journal of Clinical Periodontology*, 40, S113–S134. doi:10.1111/jcpe.12059.
- [14] Pitchika V, Thiering E, Metz I, Rothmaier K, Willenberg A, Hickel R, et al. (2017) Gingivitis and lifestyle influences on high-sensitivity C-reactive protein and interleukin 6 in adolescents. *Journal of Clinical Periodontology*, 44(4), 372–381. doi:10.1111/jcpe.12690.
- [15] Aziz AS, Kalekar MG, Suryakar AN, Kale R, Benjamin T, Dikshit M (2018) Pre- and Post-Treatment Effectiveness of SRP on Levels of IL-6, IL-10, and CRP in Chronic Periodontitis Patients with and without Diabetes. *Am J Biochem* 8(1): 1-6. doi:10.5923/j.ajb.20180801.01.
- [16] Andriankaja OM, Muñoz-Torres FJ, Vivaldi-Oliver J, Leroux BG, Campos M, et al. (2018) Insulin resistance predicts the risk of gingival/periodontal inflammation. *J Periodontol*. 89(5): 549–557. doi: 10.1002/JPER.17-0384.
- [17] Saito T, Shimazaki Y, Kiyohara Y, Kato I, Kubo M, Iida M *et al.* (2004) The severity of periodontal disease is associated with the development of glucose intolerance in non-diabetics: the Hisayama study. *J Dent Res* 83(6):485-90. doi:10.1177/154405910408300610.
- [18] Graziani P, Gennal S, Solini A, Petrini M (2017) A systematic review and meta-analysis of epidemiologic observational evidence on the effect of periodontal disease on diabetes: An update of the review of the EFP-AAP workshop. *Journal of Clinical Periodontology*, <https://doi.org/10.1111/jcpe.12837>.
- [19] Sanz M, Ceriello A, Buyschaert M, et al. Scientific evidence on the links between periodontal diseases and diabetes: Consensus report and guidelines of the joint workshop on periodontal diseases and diabetes by the International Diabetes Federation and the European Federation of Periodontology. *J Clin Periodontol*. 2018;45: 138–149. <https://doi.org/10.1111/jcpe.12808>.
- [20] Madianos PN, Koromantzou PA (2017) An update of the evidence on the potential impact of periodontal therapy on diabetes outcomes. *Journal of Clinical Periodontology*, <https://doi.org/10.1111/jcpe.12836>.

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