

# Topics on combined problem of diabetes and periodontitis from epidemiological point of view

## Abstract

Medical practice is like a woven fabric, consisting of warp & weft threads. Physician manages diabetic patients for long years as longitudinal axis, and treats diabetic various complications as transverse axis from epidemiological aspect. Recently, periodontitis has been estimated to be 6<sup>th</sup> common complication for diabetes. The existence of periodontitis revealed elevated odds ratio (OR) as 1.96 for overall micro vascular complications, with retinopathy 3.77 and nephropathy 1.55. When HbA1c value decreases 1%, the risk of periodontitis seems to decrease by 35% from epidemiological report. Periodontitis becomes a risk factor for Atherosclerotic cardiovascular disease (ASCVD) as hazard ratio (HR) 1.67.

**Keywords:** diabetes, periodontitis, epidemiology, atherosclerotic cardiovascular disease (ASCVD), Healthy Japan 21

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## Introduction

Medical practice is like a woven fabric. It consists of warp & weft threads, which are called as longitudinal & transverse axes.<sup>1</sup> Physicians, have seen many patients for long and broadly. The author has been in charge of diabetic patients for long, which is warp. In contrast, lots of patients with diabetes have various complications with certain ratio, which is weft. In the light of epidemiology and public health, such considerations are crucial.<sup>2</sup> Especially at present, the pandemic issue of Covid-19 has been influential worldwide. Consequently, these perspectives related to usual daily life will be important.<sup>3</sup>

Primary care includes medical care and health care, which means important perspectives for common health problems.<sup>4</sup> The author was the chairman of 8th annual congress of Japan Primary Care Association (JPCA) in 2017 with 4500 attendees.<sup>5</sup> Lots of patients with common diseases are adequately managed in ordinary clinical practice. As a matter of fact, diabetes and periodontitis have been common in internal medicine and dental departments. The combination of these pathophysiologies would become in focus, and then recent topics and discussions will be described in this article.

For decade, diabetes and periodontitis have been highly increasing and prevalent in the world.<sup>6</sup> The combined pathophysiology has been in focus for long. Periodontitis has been estimated to be one of main diabetic complications.<sup>7</sup> As a matter of fact, various health and medical problems are observed in patients with diabetes and periodontitis.<sup>8</sup> Consequently, appropriate medical management for them has been necessary for diabetic department and dentistry. When the exacerbation of both diseases exists, the mechanism of mutual vicious cycle will be found.<sup>9</sup> The adequate management of diabetes and periodontitis will be introduced for some aspects.

There were several guidelines about diabetes and periodontitis until now. Among them, the Consensus report and guidelines on diabetes and periodontitis were presented.<sup>10</sup> It was formerly accepted in the Perio-Diabetes workshop, which was organized by European Federation of Periodontology (EFP) and International Diabetes Federation (IDF).<sup>11</sup> The contents included were from the proposal

of lots of physicians and dentists. Several important viewpoints are observed, including i) giving patients the links of both region, ii) making the most of screening questionnaire and iii) continuing the program of monitoring for periodontitis.

For long, diabetes has been known as the well-predicted risk factor of periodontitis.<sup>12</sup> To put it the other way around, periodontitis can give much influence to generally insulin resistance, glucose metabolism and lipid metabolism.<sup>13</sup> Diabetes has been evaluated to be chronic metabolic disease, and then its influence includes elevated insulin resistance and reduced insulin secretion. Periodontitis can give some affects to both of dysfunction of glucose and insulin. Mutual influencing directional association between diabetes and periodontitis has been known for years.<sup>14</sup> Several researchers have revealed two-way relationship of them. In the light of epidemiological aspect, elevated incidence and prevalence of periodontitis has been found in adult diabetic patients.<sup>15</sup> The reduced level of HbA1c seemed to be significantly effective for therapy for diabetes.<sup>16</sup> As the value of HbA1c may be decreased 1% each, diabetic complications including periodontitis will cause risk reduction by 35%.<sup>17</sup>

Periodontitis has been estimated to be 6<sup>th</sup> common complication for diabetes. There are consistent evidences between diabetes and periodontitis associated with the dual directionality.<sup>18</sup> Impaired glucose variability can give various impaired function including cytokine mechanism, immune activity, and some damages of connective tissue.<sup>19</sup> The investigation of the association among retinopathy, nephropathy and periodontitis was conducted for patients for diabetes.<sup>20</sup> It was meta-analysis of 3987 subjects in 8 reports. The existence of periodontitis revealed elevated odds ratio (OR) as 1.96 for overall micro vascular complications. Obtained results were retinopathy as OR 3.77 and nephropathy as OR 1.55. Thus, it is clarified that periodontitis can be present associated with diabetic retinopathy and nephropathy and further evaluation will be required for larger sample size of clinical trials. Consequently, appropriate therapy of periodontitis can bring in the reduction of HbA1c. DM patients can have beneficial efficacy by receiving adequate periodontitis treatment. When a diabetic patient is admitted to the hospital, further evaluation of dental checkup would be included that is not done in routine.<sup>21</sup> Thus, medical staff has to keep in mind for the dental check in primary care setting.

Various studies have been found from dental point of view concerning periodontitis. The relationship between periodontitis and poor oral hygiene was evaluated in order to analyze the risk factors for cerebrovascular accident (CVA) and cardiovascular disease (CVD) in diabetic patients.<sup>22</sup> The protocol included 17 thousand diabetic cases. Among them 1341 cases developed CVA and CVD for 11.6 years. As a result, periodontitis became a risk factor for hazard ratio (HR):1.17 ( $p=0.03$ ). Increased carious teeth ( $\geq 5$ ) also showed higher risk of CVA/CVD (Atherosclerotic cardiovascular disease, ASCVD) (HR 1.67,  $p=0.002$ ), and frequent tooth brushing as  $\geq 2$  times/day showed lower risk (HR 0.79,  $p<0.001$ ) in comparison with those  $< 1$  mal/day.

Regarding the periodontal situations in diabetes, 104 cases were assessed.<sup>23</sup> Periodontal health was evaluated using the Periodontal Inflamed Surface Area (PISA) Index. The results revealed that each increase of PISA as  $10\text{mm}^2$  will bring the odds ratio (OR) of 2% increase of HbA1c value. In a recent paper, 54 records were reviewed and examined if non-surgical periodontal therapy (NSPT) could decrease HbA1c or not.<sup>24</sup> The results showed that the changes in HbA1c was not significant, associated with recommended future evaluation about NSPT efficacy.

Due to recent investigation for diabetes, the relationship between periodontitis and glucose variability were studied.<sup>25</sup> Subjects were 182 diabetes cases having chronic periodontitis. For the biomarkers, HbA1c and fasting glucose values, probing depth (PD), bleeding on probing (BoP), presence of suppuration (SUP), clinical attachment level (CAL), number of remaining teeth were analyzed. As a result, periodontitis severity was significantly worse in poor controlled group, compared with better controlled group. Periodontal pathogens cause oxidative stress and cytokine production, leading to impaired function of insulin.<sup>26</sup> The therapy of periodontitis associated with improved glucose variability is effective. In a compared study concerning these aspects, cases with diabetes and periodontitis were followed up using HbA1c level, full-mouth scaling and scaling root planning (SRP). The result showed that significant improvement of periodontal condition and HbA1c were observed for three months.<sup>26</sup>

Scientific evidence has been observed supporting the relationship between periodontitis and coronary heart disease (CHD).<sup>27</sup> For 808 non-diabetic CHD subjects; oral hygiene was studied using World Health Organization (WHO) Oral Health Assessment form and Simplified Oral Hygiene Index (OHI-S). Compared to controls, the cases showed significantly higher attachment loss  $\geq 4\text{mm}$ , poorer oral hygiene mean scores. The cases revealed higher odds ratio (OR) as tobacco 2.26, alcohol 1.83, poor oral hygiene 5.20, pocket ( $\geq 6\text{mm}$ ) 6.70, attachment loss ( $\geq 9\text{mm}$ ) 11.31. These results supported significant relationship between PD and CHD.

As diabetes and periodontitis can show detrimental effect each other, a study were conducted whether smoking would exacerbate both situation.<sup>28</sup> Totally 128 cases were divided into 4 groups with 32 cases each. They were i) smoke(+)/DM(+), ii) smoke(-)/DM(+), iii) smoke(+)/DM(-), iv) smoke(-)/DM(-). To evaluate periodontal status, 4-stage classification method (Fernandez et al.) was applied. The results showed that remarkable severe stage of periodontitis was found in group i) smoke (+)/DM (+). The results suggested synergetic exacerbation of damage to periodontal tissues. However, the sample size was limited, and then larger investigation would be expected.<sup>28</sup>

Author and collaborators have for long continued diabetic practice and research including low carbohydrate diet (LCD).<sup>29</sup> Among them; we experienced a 57-year-old man with diabetes, periodontitis and

obesity.<sup>8</sup> He was received several treatments with LCD, removal of calculus on gingival and temporary splinting under supportive periodontal therapy (SPT). He was advised to continue super-LCD with carbohydrate 12%, and showed satisfactory progress for the reduction of HbA1c (7.8%-5.4%) and weight reduction (100kg-90kg), respectively.

Regarding patient-oriented medicine, a proposal can be recommended to take advantage of official comments about the clinical problem of satisfactory progress. In Japan, we have 'Healthy Japan 21' from the Ministry of Health, Labor and Welfare.<sup>30</sup> It includes a variety of recommendations for important tasks for life style-related diseases, including diabetes and dental health. As a useful way, tooth brushing, self-care, plaque control, regular dental and medical checkup, cessation of smoking, moderation in drink, and suppression of intake for sugar.

The importance of self-care has been emphasized. For the diabetic and sociodemographic clinical determinates, the association with patient self-care and oral hygiene for periodontitis was investigated.<sup>31</sup> The protocol was a multi-center, prospective cohort study with 379 diabetic cases using HbA1c, periodontal index (CPI) probe and others. As a result, odds of periodontitis increased with elevated HbA1c, and decreased by adequate diet content (-64%), physical exercise (-85%), and oral hygiene continuation (-92%), respectively. Consequently, this report will become a useful reference for explaining and educating diabetic patient's adequate beneficial daily health care methods. In summary, a variety of topics about diabetes and periodontitis was introduced in this article. Patients, medical staffs and dental staffs will hopefully understand clinical significance of these problems. It is expected that this article would become a reference for medical and dental research and practice in the future.

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## Conflicts of interest

The authors declare no conflict of interest.

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