

## Periodontal Status Differences between Chronic Periodontitis Patient with and Without Type 2 Diabetes Mellitus

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### Abstract

National Basic Health Research of Indonesia in 2013 stated there were 6.9% proportion of Indonesian population or about 12 million people suffered from diabetic mellitus. Periodontitis is the most related oral disease with diabetic mellitus, but there are still lack of studies about this relationship especially in Indonesia.

The purpose of this study is to understand the comparison of periodontal status among type 2 diabetes mellitus (T2DM) patients and non-diabetics with chronic periodontitis. The periodontal status of interest includes periodontal pockets, gingival recession, and attachment loss.

A cross-sectional study method is used using 97 subjects with type 2 diabetes mellitus and 97 subjects without type 2 diabetes mellitus, sourced from medical record status in Periodontics Clinic, Dental Hospital, Faculty of Dentistry, Universitas Indonesia during 2007-2016. It was statistically analyzed by Mann-Whitney test.

The results showed that there were statistically significant differences in the mean values of pocket depth, gingival recession, and attachment lost on subjects with type 2 diabetes mellitus compared with subjects without type 2 diabetes mellitus ( $p$  value<0,05).

In conclusion, there are periodontal status differences between chronic periodontitis patient with and without T2DM, with findings on deeper pocket depth, bigger gingival recession, and greater attachment lost on subjects with type 2 diabetes mellitus compared with subjects without type 2 diabetes mellitus.

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### Introduction

Chronic periodontitis is an inflammation caused by infection on supporting structures of a tooth that happens slowly, and predisposition factor such as diabetes mellitus can affect the progression of the disease.<sup>1,2</sup> Diabetes mellitus is a complex metabolism failure that is characterized by appearance of chronic hyperglycemia.<sup>3,4</sup> Several studies stated that diabetes mellitus can affect periodontal condition, and causing severe gingival inflammation, deep pocket depth, and bone loss.<sup>2</sup> Those conditions can be worsened if

the patient with diabetes mellitus does not control their blood sugar level.<sup>2,5</sup>

Among the two types of diabetes mellitus, the one that shows higher frequency in Indonesia is type 2 diabetes mellitus (T2DM), with 57% population exposed in 2012.<sup>3</sup> Type 2 diabetes mellitus, also known as Non-Insulin Dependent Diabetes Mellitus, which usually affects the individual in adult age, and it is caused by imbalance between insulin secretion and glucose from the heart.<sup>3,6</sup> One of serious complications of type 2 diabetes mellitus in dentistry is *oral diabetic*, which are dry mouth, gingivitis, alveolar bone resorption, periodontitis, calculus and many more.<sup>1</sup>

There are several symptoms had been seen in oral cavities that indicated diabetes mellitus, such as gingivitis, periodontitis, fungal infection and wound healing disorder.<sup>7</sup> Type 2 diabetes mellitus known to exacerbates chronic periodontitis condition, and vice versa. Patients

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with type 1 or 2 diabetes mellitus, exhibit manifestation as a complex periodontal disease.<sup>5</sup> Studies have shown that the prevalence of periodontal disease with type 2 diabetes mellitus is higher, with number of 60%, compared with periodontal disease occurring not as a complication of T2DM.<sup>5</sup> Poor glycemic control in diabetes mellitus patients showed more complication and presented severe chronic periodontal disease.<sup>8,9</sup>

Patients with chronic periodontitis and type 2 diabetes mellitus tend to experience more progressive inflammation, compared with patients without T2DM.<sup>4,10,11</sup> Type 2 diabetes mellitus play a role in increasing progressive destruction on periodontal ligament and alveolar bone, causing an increase of chronic loss of attachment and deeper periodontal pocket.<sup>12,13</sup> The most common condition that had been found was high rates of bad periodontal health status, especially in periodontal pocket depth and clinical attachment loss.<sup>12,14,15</sup> Type 2 diabetes mellitus patients also have been proven to have an increase risk of greater alveolar bones destruction on periodontal tissue three times bigger than the healthy ones.<sup>12</sup>

Despite the large number of patients with T2DM, there is still lack of research in Indonesian people that can be used as an evidence based, especially on their relationship with chronic periodontitis. Knowledge about the influence of T2DM to the severity of chronic periodontitis, can make people more aware to maintain their oral health. Clinicians can be more aware about the periodontal condition of T2DM patients. The purpose of this research is to understand the comparison of the periodontal status among T2DM patients and nondiabetics with chronic periodontitis, and can become one of evidence based on epidemiological study in this field.

## Materials and methods

The research type is cross sectional study with secondary data analytic approach. Data that was used is forms of periodontal medical records of patients with chronic periodontitis with and without T2DM who were treated at Integration and Periodontic Clinic of Dental Hospital, Faculty of Dentistry, Universitas Indonesia in 2007-2016 period. The group of T2DM subjects were chosen by using sampling technique in the form of purposive sampling, considering the number of

patients with T2DM which is not much and the result of statistical analysis must be good and accurate. Similarly, subject without T2DM was chosen using purposive sampling technique. Ethics committee has approved this study at Faculty of Dentistry, Universitas Indonesia (No. 123/Ethical Approval/FKG/IX/2017).

The sample's inclusion criteria were the medical record status of patients with chronic periodontitis who had T2DM and did not suffer from other systemic diseases, aged 35-65 years, Periodontic Clinic of Dental Hospital Faculty of Dentistry Universitas Indonesia patient in 2007-2016 period, and data on the periodontal status was clear and completed on medical record.

The exclusion criteria are the medical record status of chronic periodontitis patient that suffers from aggressive periodontitis which caused by defect in PMN's immune response and can be confusing because they have similar clinical signs; smokers, pregnant women, orthodontic users, and unclear examination, identity, and diagnosis data. Data that was taken from the medical record are demographic data of identity, age and gender, presence of systemic disease T2DM, Papillary Bleeding Index (PBI), Oral Hygiene Index Simplified (OHIS) value and periodontal status of gingival recession level, depth pockets, and loss of clinical attachment. Data was recorded in Microsoft Excel and analyzed using SPSS statistical data processing software.

## Results

### Univariate Analysis

Among all the 2437 medical record status cards that have been found, there were 140 subjects with chronic periodontitis systemic disease T2DM and 2297 patients with chronic periodontitis without systemic T2DM disease. The purposive sampling technique was performed on the subjects of chronic periodontitis with and without T2DM, so that 97 subjects with chronic periodontitis with T2DM were chosen based on inclusion criteria and 97 subjects with chronic periodontitis without T2DM as data comparison.

Variable	Subject (N)	Percentage (%)
<b>Type 2 DM</b>		
With type 2 DM	97	50.00
Without type 2 DM	97	50.00
<b>Gender</b>		
Male	89	45.90
Female	105	54.10
<b>Age</b>		
Early adult (35 years)	8	4.10
Late adult (36-45 years)	-	-
Early elderly (46-55 years)	43	22.20
Late elderly (56-65 years)	143	73.70
<b>OHIS value</b>		
Good	10	5.20
Medium	62	32.00
Bad	122	62.90
<b>PBI</b>		
Very good	101	52.10
Good	72	37.10
Bad	21	10.80

**Table 1.** Distribution of Demographic Variables and Clinical Status of Research Subject.

Table 1 shows that the highest percentage of gender is female (54.10%), the largest age category is the late elderly (73.70%), the largest OHIS value category is poor (62.90%), and the largest PBI value is good (52.10%).

Variable	Type 2 DM subject (N) Yes (N=97)	Type 2 DM subject (N) No (N=97)
<b>Gender</b>		
Male	54 (55.70%)	45 (36.10%)
Female	53 (44.30%)	62 (63.90%)
<b>Age</b>		
Early adult (35 years)	3 (3.10%)	5 (5.20%)
Late adult (36-45 years)	-	-
Early elderly (46-55 years)	13 (13.40%)	30 (30.90%)
Late elderly (56-65 years)	81 (83.50%)	62 (63.90%)
<b>OHIS value</b>		
Good	4 (4.10%)	6 (6.20%)
Medium	23 (23.70%)	39 (40.20%)
Bad	70 (72.20%)	52 (53.60%)
<b>PBI</b>		
Very good	40 (41.20%)	61 (62.90%)
Good	41 (42.30)	31 (32.00%)
Bad	16 (16.5%)	5 (5.20%)

**Table 2.** Distribution of Demographic Variables and Clinical Status of Chronic Priodontitis Patients with and without Type 2 Diabetes Mellitus.

Table 2 shows that in the group of chronic periodontitis patients with T2DM the majority of the subjects were male (55.70%), whereas in the group of patients with chronic periodontitis without T2DM, the number of female subjects

was greater (63.9 %). Based on the age group, the late elderly age category was the dominant category, where the percentage shows 83.5% in T2DM and 63.9% on a subject without T2DM. Both groups, patients with chronic periodontitis with and without T2DM, the majority of subjects had poor oral hygiene status (72.2% and 53.6%), seen from the OHIS value category. Based on the Papillary Bleeding Index (PBI), chronic periodontitis patients with type 2 diabetes mellitus dominantly had a moderate PBI score (42.3%). Another case with patients with chronic periodontitis without T2DM, where the majority of subjects are subject to the category of PBI with very good value (62.9%).

Variable	Mean ± Standard Deviation (mm)		Min – Max (mm)	
	Subject with Type 2 DM	Subject without Type 2 DM	Subject with Type 2 DM	Subject without Type 2 DM
Pocket Depth	5.79 ± 2.23	3.35 ± 0.80	1.50-13.00	1.50-5.83
Gingival Recession	3.37 ± 1.90	2.03 ± 0.88	0.83-9.75	0.50-4.25
Loss of Clinical Attachment	7.55 ± 3.27	3.56 ± 1.08	1.90-19.50	1.50-7.18

**Table 3.** Mean, Minimum, and Maximum of Pocket Depth, Gingival Recession and Loss of Clinical Attachment among Chronic Periodontitis Patients with and without Type 2 Diabetes Mellitus.

Table 3 shows that the periodontal status in the T2DM subjects group has greater value, compared to subjects without T2DM. The periodontal status that had the greatest value among the three periodontal statuses compared in this study was clinical attachment loss, whereas the gingival recession had the smallest value.

### Bivariate Analysis

	Variable	P Value
Pocket Depth	Chronic Periodontitis with Type 2 DM	0.003
	Chronic Periodontitis without Type 2 DM	0.072
	Chronic Periodontitis with Type 2 DM	0.000
Gingival Recession	Chronic Periodontitis without Type 2 DM	0.200
	Chronic Periodontitis with Type 2 DM	0.000
Loss of Clinical Attachment	Chronic Periodontitis without Type 2 DM	0.200
	Chronic Periodontitis with Type 2 DM	0.000

**Table 4.** Test of Normality in Chronic Periodontitis Subject with and without Type 2 diabetes mellitus.

Table 4 shows that data variables are not normally distributed, so Mann Whitney test was used to analyze the difference in mean periodontal status between subjects with type 2 diabetes mellitus and without T2DM.

	Mean ± Standard Deviation (mm)		P Value
	Subject with Type 2 DM	Subject without Type 2 DM	
Pocket Depth	5.79 ± 2.23	3.35 ± 0.80	0.000
Gingival Recession	3.37 ± 1.90	2.03 ± 0.88	0.000
Loss of Clinical Attachment	7.55 ± 3.27	3.56 ± 1.08	0.000

**Table 5.** Mean Test of Mean Difference of Pocket Depth, Gingival Recession, and Loss of Clinical Attachment between Subjects with and without Type 2 diabetes mellitus

Table 5 shows the Mann-Whitney test value of mean pocket depth difference, gingival recession, and clinical attachment loss between T2DM and non T2DM subjects, which obtained p value of 0.000 on mean of pocket depth, gingival recession, and loss of clinical attachment difference. P value below 0.05 indicates a significant difference.

## Discussion

The study was conducted on 194 subjects that divided into two groups, 97 chronic periodontitis subjects with T2DM and 97 chronic periodontitis subjects without T2DM. This study focused on the comparison analysis on pocket depth, gingival recession, and clinical attachment loss between two groups of subjects, the group of T2DM and non- T2DM. Pocket depth, gingival recession, and clinical attachment loss were chosen as the signs of periodontitis that can assess the degree of periodontal destruction. The data that has been taken and processed shows that each group has a different proportion of subjects based on gender, age, OHIS score, and PBI score in the population.

Majority of research subjects in the T2DM group were male, whereas in the group without T2DM was dominated by female subjects. The subject of the T2DM group had a total of 54 male and 43 female subjects, whereas in the group without T2DM there were 35 males and 62 females subjects. Both groups had the highest number in late elderly category with more than

50% of all samples, it is 83.50% in the T2DM group and 63.90% in the group without T2DM, in terms of age category. This result similar with a study by Musurlieva et. al., that diabetes commonly found among 50 years old rather than group of aged 40-49.<sup>16</sup>

Type 2 diabetes mellitus majority subjects had poor OHIS category score, based on OHIS value category. Similarly, subjects without T2DM were dominated by subjects with poor OHIS grade. The last variable in the univariate analysis is based on PBI values, whereas T2DM group has the highest number on the subject with good category of PBI score. Meanwhile, subject without T2DM has the majority of subjects with a excellent category of PBI value. The same result proved in a study by Rohit Sharma et al<sup>17</sup>, showed that diabetics have higher risk, reaching 90%, of having poor OHI-S score, compared with nondiabetics, which had revealed the diabetic patients exhibited significantly higher levels of gingivitis, periodontitis and bone loss than the nondiabetic patients.<sup>17</sup>

Calculation of mean periodontal status in both groups showed that the mean in type 2 diabetes mellitus group was higher than the group of patient without T2DM. This proves the validity of the research hypothesis as well as some literature that says that the prevalence and severity of clinical attachment loss in T2DM patients is higher than those without T2DM.<sup>4,5,12,18</sup> In their study Cerdá, et.al., also reported that there was an increased risk of destructive periodontitis with odds ratio of 2.81 when attachment loss and 3.34 when bone loss to measure the periodontal structure, whereas diabetes increases the risk of developing periodontal destruction.<sup>9</sup>

The statistical test of the research showed significant difference in T2DM group and those without T2DM. Mealey, et. al., also found in their study that high value of pocket depth is one of the characteristics of chronic periodontitis sufferers aggravated by T2DM.<sup>12</sup> The appearance also looks more severe and continues.<sup>8,9</sup>

In addition to pocket depth, statistical tests were also performed on the mean of gingival recession. The result is there was a significant difference between T2DM and non T2DM subjects. Periodontal tissue damage, particularly in this case characterized by gingival recession, may be caused by qualitative changes in periodontal pathogen bacterial that cause

periodontal tissue damage to occur more rapidly.<sup>19,20</sup> A study by Haseeb, et al also proved that worsening glycemic control had a significant detrimental influence on gingival recession, with p score < 0,01 statistically.<sup>21</sup>

A statistical test on the loss of clinical attachment mean showed a significant difference in clinical attachment loss between T2DM and non T2DM subjects. Preshaw et. al., reported that poor glycemic control might increase the severity and prevalence of loss of clinical attachment and alveolar bone, that can be progressive in patients with T2DM.<sup>18,19,22</sup> Radeef et al., in their study also stated that poor glycemic control and depression level another of the factors that contribute to the severity of periodontitis.<sup>23</sup> Adiatman et al., suspected that 87.1% respondents of their study that had loose and missing teeth were caused by faster bone loss in patients with diabetes and periodontitis.<sup>7</sup>

Periodontal status changes, which are increased gingival recession, periodontal pocket, and loss of clinical attachment starting from hyperglycemia that causes microvascular complications, characterized by the increasing of Advanced glycation end product (AGEs) in plasma and tissue. Protein glycation reaction leading to AGEs had been known to be the major causes of different complications in diabetic, such as nephropathy, retinopathy and neuropathy. Periodontal infection affects the secretion and synthesis of cytokines, where this condition can increase the response of cytokines mediated by AGEs. The formation of AGEs in proteins also leads to establishment of a basal membrane collagen cross link, resulting in a decrease in the interactions of collagen and other matrix components, followed by the incidence of injury to basal membrane structure and function.<sup>24</sup>

The condition of hyperglycemia in patients with T2DM that produce AGE will bind to the AGE receptor (RAGE), leading to further complication such as the development of vascular lesion, increased vascular permeability, increased expression of adhesion molecules, and increased migration and activation of monocytes. As a result of this stress condition, causing blood vessel disorders in periodontal tissue. Blood vessel disturbances will lead to disruption of the distribution of nutrients and oxygen to the periodontal tissues, so that the negative anaerobic bacteria—commensal bacteria in the periodontal pocket—will become more

pathogenic. Blood vessel disorders can also affect the disposal of metabolic waste in the periodontal tissues, resulting in toxicity of periodontal tissue and gingival, as well as an increased complication of diabetes mellitus. This condition is characterized by an increase in gingival recession, periodontal pocket, and loss of clinical attachment in this study.<sup>25</sup>

## Conclusions

There was deeper pocket depth on chronic periodontitis subjects with T2DM, compared with those without T2DM. There was bigger gingival recession on chronic periodontitis subjects with T2DM, compared with those without T2DM. There was also greater loss of clinical attachment on chronic periodontitis subjects with T2DM, compared with those without T2DM. In conclusion, there are periodontal status differences between chronic periodontitis patient with and without T2DM, with findings on deeper pocket depth, bigger gingival recession, and greater attachment lost on subjects with T2DM compared with subjects without T2DM.

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## Declaration of Interest

The authors report no conflict of interest.

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