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# THE INCREASE OF PERIODONTAL TISSUE IN TYPE 2 DIABETES MELLITUS PATIENTS BASED ON INDEX CPITN

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**Abstract**

The prevalence of periodontal disease in Indonesia for all age groups has reached 96.58%. Periodontal disease has been identified as a consequence of diabetes mellitus (DM). The purpose of this study is to determine the differences of periodontal tissues in type 2 diabetes and non-diabetic patients based on CPITN index (Community periodontal index of Treatment index). This study employed case control design. The population of the study consisted of 3.544 visits in the Internal Disease Polyclinic of RSUD Cimahi Cibabat in January 2015. The samples for case group were 50 people (diabetes mellitus type 2) and control group were 50 people (non-DM). The sampling technique used accidental sampling. The study was conducted in 2015 by conducting measurement of periodontal pocket depth using CPITN index. The analysis of data was carried out with independent T test. The results show that the average pocket depth based on CPITN index in the case group of type 2 DM (4.26) is greater than control group of patients without DM (3.14). There is different condition on the periodontal tissue in the group of type 2 diabetes (value-p = 0.002 <0.05). The awareness in increasing the oral health protection is done by providing consultation related to blood glucose.

## Introduction

Based on the data from the International Diabetes Federation (2003), it is estimated that in 2003, there are approximately 194 million people who have diabetes mellitus worldwide. This has reached 5.1% of the world population. This number is expected to increase to 333 million, or 6.3% of the world's population by 2025. Global status report on NCDs World Health Organization (WHO) in 2010 reported that 60% of the death cause of all ages in the world is because of Non-Transmitted Disease. Diabetes mellitus (DM) is ranked the sixth leading cause of death. About 1.3 million people died from diabetes and 4 percent die before the age of 70 years. In 2030 the estimated diabetes mellitus ranks 7th of leading cause of death in the world. In Indonesia, it is expected in 2030, there will be 21.3 million people with diabetes mellitus (diabetes).

The prevalence of diabetes in Indonesia in 2013 is 2.1%. This figure is higher than 2007 (1.1%). A total of 31 provinces (93.9%) show that the increase of diabetes mellitus prevalence is significant. The highest prevalence of diabetes at age ≥ 15 years according to the doctor's diagnosis/symptoms Riskesdas in 2013 is in Central Sulawesi (3.7%), followed by North Sulawesi (3.6%) and South Sulawesi (3.4%). The lowest prevalence is in Lampung (0.8%), then followed by Bengkulu and West Kalimantan (1.0%). The province with the largest prevalence increase is in South Sulawesi (0.8%) in 2007 to 3.4% in 2013. The highest decrease of prevalence is in West Papua, namely 1.4% in 2007 to 1.2% in 2013 (Badan Penelitian dan Pengembangan Kesehatan, 2013).

The report from Household Health Survey of Ministry of Health in 2001 stated that among the complained and non-complained

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illness, the prevalence of oral and dental diseases were the highest, covering 60% of the population. The results of the survey from dental health data in 2001 of periodontal status in the age group of 25-34 years showed the prevalence of people with calculus 47.40% and periodontitis 8.40%. The periodontitis prevalence was very low at 9% (Kementrian Kesehatan RI, 2002).

There are still many people who do not know that diabetes mellitus is closely associated with periodontal disease, which is a chronic inflammatory disease in the tissue supporting the teeth. Periodontitis has been identified as the sixth complication of diabetes. Some studies suggest that diabetes becomes the risk factor of prevalence, severity of gingivitis (gingival inflammation) and periodontitis (inflammation of the periodontal tissues).

In general, almost 85% prevalence of diabetes mellitus is type 2diabetes mellitus. In type 2 diabetes, the patients are suffered no damage to the insulin-producing cells. However, those cells cannot function properly. Type 2 diabetes mellitus is a very significant concern to public health. Periodontal disease has been known traditionally as a consequence of diabetes. Epidemiological studies have shown that diabetes increases the risk of alveolar bone loss and attachment loss in periodontal tissues three times greater as compared to non-diabetic patients (Mealey.B., 2008).

Periodontal disease is a disease that affects many people in various countries which is a complication of diabetes mellitus. Therefore, to determine the prevalence and severity of the disease, it can be followed by more intensive efforts from WHO in combating the disease is to develop CPITN index (Community periodontal index of Treatment index) to describe the level of periodontal tissue condition also illustrates the type and maintenance needs (Megananda, 2009).

The study from Hindriyana (2011) on a sample of 45 people with type 2 diabetes mellitus patients and 45 people without diabetes mellitus, there are differences between the mean index of CPITN in patients with type 2 diabetes mellitus and patients without diabetes mellitus. In patients with type 2 diabetes (2.11), it is higher as compared to patients without diabetes mellitus (1.77) and this difference is statistically significant ($p < 0.05$). Periodontitis is a factor for the development of type 2 diabetes, and vice versa, patients with type 2 diabetes mellitus are more prone to suffer periodontitis and more severe than non-diabetic patients (Struch, F., 2008)

The preliminary study on 10 patients with type 2 diabetes mellitus was carried out by the writer on March 31, 2015 in the polyclinic of internal disease of RSUD Cibabat Cimahi. The test done on periodontal tissues based on the index CPITN shows that there is 1 person who has score 2 (no tartar on sub gingival), 5 people who have score 3 (shallow pocket), 4 people with score 4 (deep pocket). The results of interviews conducted on 10 people with diabetes mellitus in the maintenance of oral health show that the patients do not know how to maintain their oral health well and correctly such as right brushing techniques and timing. They rarely and never even check or control to the dental clinic for treatment such as fillings, scaling and consequently many patients complain that their teeth loosing and having cavities.

Based on this, the writer would like to further examine the condition of the periodontal tissue in patients with type 2 diabetes mellitus as compared to non-diabetic patients in the clinic CPITN based on index of disease in hospitals Cibabat 2015.

**Method**

This study is an analytic survey with a design that used a case control study. The reason why the writer used a case control design for this study was to identify a group of subjects with effects (diabetes mellitus patients) as a case group and a group of subjects without effect as the control (non-diabetes mellitus) as a control group and then retrospectively investigated the presence or absence of risk factors.

The population in this study was all patients who visited the clinic of the disease in hospitals Cibabat in January 2015 amounted to 3544 visits. Calculation of the samples using the formula of Lemeshow (1997) with a large sample of cases acquired as many as 50 people and used comparisons between cases and controls 1: 1. The total samples obtained were

100 votes (consisting of 50 people as case group and 50 people as control group). The sampling technique used was accidental sampling. The writer selected group of cases who were registered and identified in RSUD Cibabat which were incidentally encountered during a visit to the internal poly, including in selecting the control group.

Data collection was conducted through the examination of the patient with type 2 diabetes mellitus and patients without diabetes mellitus based on CPITN index using WHO Periodontal Examining Probes for measuring the teeth of the upper jaw and teeth of the lower jaw is divided into 6 sextants, with teeth index 71, 61, 11, 21, 26, 27, 37, 36, 31, 41, 46, 47, to obtain data on the condition of the periodontal tissues. Secondary data from the polyclinic of internal disease in RSUD Cibabat was in the form of data from the medical records of patients with type 2 diabetes mellitus and without diabetes mellitus. The collected data was then analyzed using univariate and bivariate analysis with mean difference test namely independent t test and significance level of 95% or the value of α = 0.05 (5%).

**Results and Discussion**

This research was conducted in the clinic of internal disease in RSUD Cibabat, with 100 respondents consisting of 50 research subjects who were diagnosed with type 2 diabetes mellitus and met the inclusion criteria were selected as the case group and 50 subjects were not diagnosed with diabetes mellitus as a control group with research as follows.

Table 1. Frequency Distribution of Periodontal Tissue Conditions of Patients with Type 2 Diabetes Mellitus Based on Index Score CPITN

| CPITN Index | Observed Groups Patients with type 2 DM | |
|---|---|---|
| | Total | Percentage |
| Score 0 | 11 | 22% |
| Score 1 | 0 | 0% |
| Score 2 | 13 | 26% |
| Score 3 | 15 | 30% |
| Score 4 | 11 | 22% |
| Total | 50 | 100% |

The primary data source in 2015

Referring to Table 1, the results of the study in patients with type 2 diabetes mellitus after measurement index score is almost evenly distributed among scores of 0, 2, 3, and 4. It shows that score 3 indicates CPITN index in patients with type 2 diabetes with the highest proportion of 30%. For frequencies of periodontal conditions based on the periodontal pocket in groups of patients with type 2 diabetes are listed in Table 2.

According to the table 2, the group of patients with type 2 diabetes has the average depth of periodontal pockets of 4.26 mm. It shows that that the depth level obtained is at least 2 mm and a maximum of 8 mm. Onwards, we can see the score index of CPITN and periodontal pocket depth in the group that do not suffer from diabetes type 2 as shown in the following table.

Table 2. Frequency Distribution of Periodontal Tissue Conditions Based on Periodontal Pocket Depth in Patients with Type 2 Diabetes Mellitus

| Variables | Group | Mean Median | S.D | Min-Max | 95% CI |
|---|---|---|---|---|---|
| Pocket Depth Periodontal | DM TIPE 2 | 4,26 4,5 | 1,915 | 2-8 | 3,72-4,80 |

The primary data source in 2015

Table 3. Frequency Distribution of Periodontal tissue Conditions of Non Patients with Diabetes Mellitus Based on CPITN Index Score

| CPITN Index | Observed Group Patients without DM | |
|---|---|---|
| | Total | Percentage |
| Score 0 | 8 | 16% |
| Score 1 | 0 | 0% |
| Score 2 | 23 | 46% |
| Score 3 | 14 | 28% |
| Score 4 | 5 | 10% |
| Total | 50 | 100% |

The primary data source in 2015

Referring to Table 3, it shows that in patients with non-DM group CTPM index scores varied. The highest proportion turned out to CPITN index score of 2 is 23 respondents (46%) while the lowest is in the score of 4 which has 5 respondents (10%). Periodontal pocket

depth in patients with non-DM group is listed in the following table 3.

Investigating table 4, the average frequency of the periodontal tissue condition of the in patients with Non DM is 3.14 mm with the maximum of 6mm. To know the average depth of periodontal pockets based on index in patients with type 2 diabetes mellitus and non-DM shown, the following table is presented:

Table 4. Frequency Distribution of Periodontal Tissue Conditions Based on Periodontal Pocket Depth in patients without Diabetes Mellitus

| Variables | Groups | Mean Median | S.D | Min-Max | 95% CI |
|---|---|---|---|---|---|
| Pocket Depth Periodontal | Non DM | 3,14 3,00 | 1,616 | 0-6 | 2,68-3,60 |

The primary data source in 2015

Table 5 shows that the average depth of periodontal pockets in type 2 DM group is higher (4,26mm) as compared to non-DM group (3,14mm). The result of statistical tests at alpha 5% shows that Ho is refused. This means that there are significant differences in periodontal pocket depth among type 2 diabetes patients with non-DM.

Periodontitis is an inflammation of the gum tissues supporting the teeth bones that forms a pocket where the tooth is located and periodontal ligament. Diabetes Meilitus (DM) is a metabolic disease disorders in which the body's hormone insulin does not work as it should. DM is a systemic disease which is one of the risk factors for periodontitis. The highest score of frequency of periodontal tissue by CPITN index scores in patients with type 2 diabetes mellitus is 3 (pocket with a depth of 4 or 5 mm gingival edge is located on the probe black). The result of Hindriyana's study (2011) shows that in CPITN distribution of 45 samples with type 2 diabetes, there are 4 people who have score 4. The average index CPITN in patients with type 2 diabetes mellitus is 2.11. A study conducted by Renata, Pajauta, Gediminas, et al in Lithuania states that, out of 126 samples, 27 are diagnosed with periodontitis (Index CPITN score of 4), 38 (Index CPITN score of 3) and 31 (Index CPITN score of 2), gingivitis is found in 27 subjects (CPITN Index score of 1). Only 2.4% of studied patients with diabetes have healthy periodontal tissues.

Until now, there are many people who do not know that diabetes mellitus is closely associated with periodontal disease. Diabetes mellitus is generally associated with "offspring" factor (Ridwan, 2015). This is not solely heredity, but periodontitis has been identified as the sixth complication of diabetes mellitus (Indrasari, 2013). There are some things that happen in DM patients which worsen periodontal tissue health including: glucose content in the liquid gums and blood in patients with DM can change the environment of microbes into qualitative bacteria that affect the severity of periodontal disease.

Periodontal tissue is closely related to food impaction or retention i.e. food leftovers in the oral cavity which are usually tucked between the teeth, or to pile on the basin in the neck of the teeth near the gingiva. Food impaction occurs due to food habits performed by people with type 2 diabetes mellitus. Puspita (2011) states that eating pattern habit influences people with diabetes. Rikawarastuti's study (2015) finds that the severity of the diabetic group is 3.5 times higher than the group of people who do not have DM (value OR = 3.5) and shows no significant relationship between the severity of periodontal tissue with DM (p = 0.002).

The average depth of periodontal pockets in respondents with diabetes mellitus type 2 is 4.26 mm, median 4.5 mm (95% CI: 3.72 to 4.80) with a standard deviation of 1.915 mm with a low of periodontal pocket depth of 2 mm and the highest periodontal pocket depth of 8 mm. Periodontal status of diabetic patients in Polyclinic Endocrine Hospital Prof. DR. R. D. Kandou Manado shows that none of the diabetic patients has periodontal status of good or normal, there are 16 patients (43.2%) with medium status and 21 patients (56.8%) with poor periodontal status. Patients with type 2 diabetes mellitus are more severe if they have poor periodontal status as compared with healthy people. Diabetes is associated with excessive inflammation response of gingivi toward plaque.

Patients with diabetes who have good control over their blood sugar levels (good glycemic / metabolic control) can prevent or delay and slow the progression of diabetic-

related complications, particularly retinopathy, nephropathy, and neuropathy. Similarly, it applies to delay or to slow the progression of periodontal disease. However, for people with diabetes who have poor glycemic control (high blood sugar levels), the risk of infection becomes much greater. For example, it is estimated that the uncontrolled diabetes patients are at risk of 2 to 4 times higher to develop periodontal infection than non-diabetic people. Then the diabetic patient should be able to control the rate of blood glucose manner dietary adjustments (Arimandaliza, 2011). A bad dietary pattern will cause trouble in the process of food in the mouth that can leave plaque on teeth or pockets in periodontal tissues.

Periodontal tissue based score index CPITN in patients with diabetes mellitus who has the highest score is a score of 2 (the calculus, but all parts of the black probe are still visible, there are pockets with a depth of more than 3 mm) as many as 23 people (46%). The average index of CPITN in patients with type 2 diabetes mellitus is higher compared to patients without diabetes mellitus (1.77) and this difference is statistically significant ($p < 0.05$). The obtained results show that the average depth of periodontal pockets based on CPITN index in patients with diabetes is higher than patients without diabetes mellitus. It concludes that patients with type 2 diabetes have more severe periodontal tissue damage than patients without diabetes mellitus. In accordance with the score CPITN index, people with diabetes mellitus require greater periodontal treatment than patients without diabetes mellitus.

Periodontitis starts with gingivitis and if the possibility of an inflammatory process, then most patients but not all patients, will gradually enter the deeper inflammatory periodontal tissue. Together with inflammatory process, there will be the potential to stimulate periodontal tissue resorption and formation of periodontal pockets. With the formation of pockets, inflammatory periodontal disease becomes self-perpetuating principal of etiological factors, namely plaques, which at this time, is formed inside anaerobic environment pocket which encourages the growth of pathological periodontal organisms and is more difficult to access for discarded by the patient. If the sequence of these events last for a long time, chronic infection can lead to severe periodontal damage and loss of teeth. Recent research shows that there may be a period of active bone resorption followed by a period of inactivity where no periodontal pockets but do not cause a further attachment loss.

Patients without diabetes mellitus have lower level of periodontal disease conditions as compared to patients with diabetes mellitus. However, it does not rule out the possibility, based on the observation of patients, that diabetes mellitus is also a risk of periodontitis. The local risk factors is imperfect tooth anatomy (crowding and spacing between the teeth), the patient is wearing dentures, poor denture will result in severe damage to the structure of periodontal tissue, the formation of calculus (tartar teeth), patients are not informed about tooth brushing technique and brushing frequency. Some patients are also smokers and smoking is an important factor in the development of periodontitis.

Synthesis and secretion of cytokines as a result of infection from periodontitis can intensify the synthesis and secretion of cytokines. The association of periodontitis with DM takes place in two directions. Periodontal disease which is a chronic inflammatory form can aggravate diabetes mellitus status towards more severe complications. The results show that diabetes complications in diabetes mellitus type 1 and type 2 are more severe in diabetic patients with severe periodontal disease as compared to diabetic patients who suffer only mild to moderate periodontal disease. Severe chronic periodontitis in DM patients is suspected to be the cause for the increase in concentration of glycated hemoglobin. Infection from periodontitis in addition to increasing the production of cytokines could be expected to also increase insulin resistance, which in turn worsens glycemic control in diabetics who also suffer from periodontitis in his mouth.

Diabetes can increase the risk of damage to the periodontal tissue that continues over time. A longitudinal study shows that in patients with type 2 diabetes, the risk is increased four times in alveolar bone loss in adults compared to adults who do not have diabetes. Such as gingivitis, periodontitis development risk is

greater in patients with diabetes who have poor glycemic control as compared to patients with well-controlled diabetes. Low glycemic control in patients with diabetes also has been associated with an increased risk of progressive loss of periodontal tissue attachment and alveolar bone (Mealey, 2006). Diabetic patients with periodontitis also have elevated levels of C-reactive protein on periodontal health status (Yekti, N., 2014). Even, these patients will experience a decrease in alveolar bone and thinning of the mandible cortical bone (Epsilawati, 2012).

Patients with type 2 diabetes mellitus who go to RSUD Cibabat have more severe periodontal disease than patients without diabetes mellitus. This is caused by high glycemic control in patients with diabetes with periodontal disorders which are always accompanied by a local function and local irritation factor. Principles of treatment of periodontitis in diabetic patients are similar to that of patients without diabetes mellitus due to all high-risk patients who already have periodontal disease. Great efforts should be directed to prevent periodontitis patients at risk of diabetes. Diabetes patients with poor metabolic control should be seen more often, especially if periodontal disease already exists. Patients with uncontrolled diabetes, who have good oral hygiene and periodontal treatment, have the same risk of severe periodontitis as non-diabetics. Diabetes is a long-term impact on micro vascular complications leading to ischemia and malnutrition on the network (Budiman, 2015). Periodontitis can cause excessive inflammation with increased TNF-α, IL-6.IL-1 enters the circulatory system (Engebretson, 2007).

During the treatment, health professionals need to explain to patients about the constraints that exist in the case of controlling blood sugar levels and periodontal disease, since patients must also participate in maintaining their own health. In diabetes mellitus patients and non-diabetic patients, they need to be explained about the susceptibility to tooth decay and mouth because both can be affected by periodontal disease. For uncontrolled periodontal disease in people with diabetes, the condition of the teeth and mouth easily experience great alveolar bone loss in periodontal infections. Adjustments supplements can prevent periodontitis. Supplementation combination of ATRA and Zn gives high collagen synthesis closest to the state of health (Hanafi, P., 2015).

The prevention which needs to be done is by examination and routine care to the dental health team, in order to determine ways to maintain healthy teeth and mouth and dental health team must also provide the motivation to apply the advice and guidance that has been given. This starts with conducting oral health examinations to dental clinic at least six months, regular maintenance for scaling and brushing teeth at home regularly and doing right techniques of brushing. Regular checkup to internal disease clinic is important to control blood sugar levels, because in order to maintain dental and oral surgical procedures or risk, such as extraction of teeth a patient's blood sugar levels should be controlled. Blood glucose levels have a significant relationship with the incidence of dental caries in patients with type 2 diabetes mellitus (Budiman, 2015). Maintaining the health of the whole body is very important so that the disease can be controlled and the control will be effective when the patient is completely aware and know the purpose of such action.

## Conclusion

The condition of the periodontal tissues of patients with type 2diabetes mellitus who have the highest score is 3 (pocket with a depth of 4 or 5 mm, and the edge of the gingival are on the probe black) whereas in patients without diabetes mellitus, the highest score is 2 with depth more than 3 mm. The average depth of periodontal pockets in patients with diabetes mellitus respondents is 3.14 mm, and there are significant differences between the periodontal tissue conditions of type 2 diabetes mellitus.

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