

## Association between Oral Health Status and Oral Health–Related Quality of Life in Diabetes Patients

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### Abstract

Patients with diabetes have many risk factors for periodontal disease which can affect their oral health–related quality of life. The aim of this study was to evaluate the oral health status and the oral health–related quality of life of patients with diabetes mellitus. This cross-sectional study was conducted by administering the OHIP-20 questionnaire at Endocrine Subspecialist Clinic in Cipto Mangunkusumo Hospital, Jakarta, to evaluate oral health–related quality of life. Oral health status was based on the DMF-T, BOP, Periodontal Pocket, and OHIS indexes. Of the 70 patients surveyed, 97.1% had a good quality of life, and 95.7% had experienced DMFT, while the prevalence of positive BOP was 74.3%, and periodontal pockets was 15.7%. Dental caries were significantly correlated with smoking status ( $p=0.006$ ), and gender and diabetes duration were significantly correlated with the presence of periodontal pockets  $> 4\text{mm}$  ( $p < 0.05$ ). Oral health–related quality of life was not affected by the presence of diabetes mellitus or oral health status among the respondents.

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### Introduction

Diabetes mellitus is a common abnormality of the endocrine system.<sup>1</sup> The International Diabetes Federation estimates that 8.3% of the adult population in the world, or 382 million people, had diabetes in 2013 and predicts that figure will increase to approximately 592 million people in 2035.<sup>2</sup> About 80% of people with diabetics worldwide live in low- or middle-income countries.<sup>2</sup> In addition to diabetes mellitus type 1 and type 2, the types of diabetes include gestational diabetes, which is an abnormal condition reducing glucose tolerance during pregnancy.<sup>1,3</sup> In 2013, as many as 8.5 million people in Indonesia lived with diabetes, and it is predicted that the total population with diabetes will increase to 14.1 million by 2035. In 2013, the prevalence of diabetes mellitus in Indonesia was as high as 2.1% based on doctor diagnoses and experienced symptoms, with a

higher prevalence in urban areas than rural areas.<sup>4</sup> In addition, the 2013 prevalence of diabetes mellitus had increased by 1 percentage point from 2007. Jakarta had the highest prevalence among all the provinces in Indonesia, at 3%, based on doctor diagnoses and experienced symptoms.<sup>4</sup>

Diabetes symptoms can be observed in the oral cavity, including gingivitis, periodontitis, recurrent fungal infection, and wound healing disorder. Other diabetes-related oral symptoms include burning mouth sensation, candidiasis, caries, gingivitis, lichen planus, salivary gland dysfunction, xerostomia, and tasting dysfunction.<sup>5</sup> The adverse effects experienced by patients with diabetes from periodontitis to tooth loss can cause degradation of quality of life and interfere with patients' ability to eat a healthy diet and perform appropriate glycemic control. Patients with diabetes, though, generally have low awareness of periodontal disease as a consequence or complication of uncontrolled diabetes.<sup>6,7</sup> They also lack knowledge about its manifestations in the oral cavity and other complications of diabetes mellitus.<sup>8</sup>

The association of quality of life with oral and dental health is a multidimensional construction that encompasses individuals'

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subjective evaluations of oral cavity health, functional welfare, emotional welfare, expectations and satisfaction with treatment, and sense of self.<sup>9</sup> Tooth loss, severe caries, and gaps in the oral cavity can make individuals feel shy, worried, or withdrawn. Tooth loss, dry mouth, soft tissue lesions, and uncomfortable dentures that affect eating, talking, and food selection can cause poor health and negatively affect quality of life.<sup>10</sup> Quality of life related to oral and dental health can be measured with Oral Health Impact Profile (OHIP), which has seven conceptual domains: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap. The seven conceptual domains are assessed in questionnaires designed to measure quality of life associated with oral and dental health.<sup>10</sup> Generally, studies on patients with diabetes mellitus in Indonesia cover only oral manifestations, and only limited research has been conducted on quality of life related to the general health of patients with diabetes mellitus.

In particular, quality of life related to the oral and dental health of patients with diabetes mellitus has not been investigated yet. It is important to study this matter, though, because the knowledge obtained can be useful for society, especially patients with diabetes mellitus.

### Materials and methods

The study was approved by the Ethics Committee of the Faculty of Dentistry, Universitas Indonesia, and the Faculty of Medicine, University of Indonesia, before data collection. Sampling was carried out at Cipto Mangunkusumo Hospital based on data collected on patients with diabetes mellitus type 2 at the hospital's Internal Medicine Polyclinic Endocrine Subspecialty. Respondents who met the inclusion criteria were selected based on a review of medical records and patients' willingness to participate. The participants willing to become respondents were given an explanation of the study and provided informed consent.

The participants were then given instructions in how to fill out the OHIP-20 questionnaire and asked to respond truthfully. Once the participants completed the questionnaires, their oral health status was determined by reviewing caries, periodontal, and

oral hygiene status. Oral health status was checked with the DMFT, BOP, Periodontal Pocket, and OHIS indexes. The OHIP-20 had 20 questions using a 5-point Likert-type scale (1 = always to 5 = never). Total questionnaire scores ranged from 20 to 100, and higher scores indicated better perceived quality of life related to oral health. Questionnaire data and oral health status were subjected to univariate and bivariate analysis. The correlations between oral health status and quality of life related to oral health in patients with diabetes were tested using Spearman's correlations.

### Results

The 70 respondents consisted of mostly 43% female patients, with 45.7% younger than 55 years old (Table 1). Table 2 presents the dental health, periodontal, and oral hygiene status of the respondents. Missing teeth were the most commonly presented component of DMFT among the respondents (87.1%), followed by teeth with dental caries (decay) 72.9%, and, finally, teeth with fillings (filled) 35.7%. Regarding the respondents' periodontal status, 74.3% had bleeding on probing (BOP positive) that indicated gingivitis, with an average of 3.67 bleeding points (bleeding point range: 0–22). Eleven respondents (15.7%) had periodontal pockets, with an average depth of 0.36 mm and a range of pocket depth of 0–6 mm. Using the OHIS index to assess dental and oral hygiene, 75.7% of the respondents had moderate OHIS, an average of 2.04, which falls into the category of moderate oral hygiene.

The OHIS values for all the respondents ranged from 0 to 3.83. In general, the respondents did not experience or rarely experienced any problems with oral and dental health that could affect quality of life. The total scores for the OHIP-20 questionnaire were categorized into low and high total scores, and 97.1% (Table 3) of the respondents were categorized as having a good quality of life based on their answers to the OHIP-20 questionnaire.

The state of BOP is divided into two categories: no bleeding (BOP negative) and bleeding on probing (BOP positive). Periodontal pockets are also divided into two categories: no pocket and pocket > 4 mm. No statistical difference between oral health status and OHIP-20 total scores was found ( $p > 0.05$ ).

Characteristics	N (%)
Gender	
Male	27 (38.6)
Female	43 (61.4)
Age	
< 55	32 (45.7)
56–65	28 (40.0)
> 65	10 (14.3)
Highest Education	
Elementary school	11 (15.7)
Middle school	9 (12.9)
High school	22 (31.4)
College	28 (40.0)
Smoking status	
Yes	23 (32.9)
No	47 (67.1)
Frequency of Daily Tooth Brushing	
Twice or more	61 (87.1)
Once or rarely	9 (12.9)
Dentures Use	
Yes	8 (11.4)
No	62 (88.6)
Diabetes Mellitus Duration	
≤ 10 years	41 (58.6)
> 10 years	29 (41.4)
OHIP-20 Total Score	
Low (20-59)	2 (2.9)
High (60-100)	68 (97.1)

**Table 1.** Characteristics of Patients with Diabetes Mellitus Respondents.

Oral Health Status	N (%)	Mean (SD)	Range
Dental Health Status			
DMFT	67 (95.7)	9.16 (6.13)	0-28
Decay	51 (72.9)	1.91 (1.71)	0-7
Missing teeth	61 (87.1)	6.41 (6.33)	0-28
Filled teeth	25 (35.7)	0.81 (1.497)	0-6
Periodontal Status	52 (74.3)	3.67 (4.32)	0-22
BOP	11 (15.7)	0.36 (1.10)	0-6
Periodontal pocket	10 (14.3)	2.04 (0.87)	0-3.83
Oral Hygiene (OHIS)	53 (75.7)		
Good	7 (10.0)		
Moderate			
Poor			

**Table 2.** Oral and Dental Health Status.

Tables 4, 5, and 6 show the relationship between the general characteristics of patients with active caries, BOP, and periodontal pockets. There was a correlation between smoking status and active caries circumstances ( $p < 0.05$ ): 83% of the participants who smoked had active caries compared to 52.2% among the patients who did not smoke. No significant relationship was found between the participants' general characteristics and bleeding on probing state ( $p > 0.05$ ).

There was a correlation between gender and periodontal pocket depth ( $p < 0.021$ ): 28.6% of male participants and 7% of female participants had periodontal pockets.

Dental and Periodontal Health Status	OHIP-20 Total Score Mean (SD)	p-value
Dental Health Status*		0.512
Free caries	79.89 (12.60)	
Active caries	81.88 (10.67)	
Bleeding on Probing*		0.174
BOP positive	84.44 (10.95)	
BOP negative	80.27 (11.15)	
Periodontal Pocket*		0.270
No pocket	81.98 (11.23)	
Pocket > 4mm	77.91 (10.66)	
Oral Hygiene (OHIS)**		0.465
Good	85.00 (8.81)	
Moderate	81.11 (9.97)	
Poor	77.86 (20.50)	

**Table 3.** Comparison of Oral and Dental Health Status with OHIP-20 Total Score. \*Independent Ttests, \*\* tested with Kruskal–Wallis test

Variable	Free Caries N (%)	Active Caries N (%)	p-value*
Gender			0.442
Male	9 (32.1)	19 (67.9)	
Female	10 (23.8)	32 (76.2)	
Age			0.409
< 55	10 (31.3)	22 (68.8)	
55–65	8 (28.6)	20 (71.4)	
> 65	1 (10.0)	9 (90.0)	
Education Level			0.442
High school or less	10 (23.8)	31 (76.2)	
College	9 (32.1)	19 (67.9)	
Smoking Status			<b>0.006</b>
No	11 (47.8)	12 (52.2)	
Yes	8 (17.0)	39 (83.0)	
Frequency of Daily Tooth Brushing			0.247
Twice or more	18 (29.5)	43 (70.5)	
Once or rarely	1 (11.1)	8 (88.9)	
Diabetes Mellitus Duration			0.035
≤ 10 years	15 (36.6)	26 (63.4)	
> 10 years	4 (13.8)	25 (86.2)	

**Table 4.** Relationship between Patients' General Characteristics and Caries Status. \*Chi-square test

Variable	BOP Negative N (%)	BOP Positive N (%)	p-value*
Gender			0.584
Male	6 (21.4)	22 (78.6)	
Female	12 (28.6)	30 (71.4)	
Age			0.294
< 55	6 (18.8)	26 (81.3)	
55–65	10 (35.7)	18 (64.3)	
> 65	2 (20.0)	8 (80.0)	
Education Level			0.118
High school or less	8 (19.0)	34 (81.0)	
College	10 (35.7)	18 (64.3)	0.594
Smoking Status			1.00
No	5 (21.7)	18 (78.3)	
Yes	13 (27.7)	34 (72.3)	
Frequency of Daily Tooth Brushing			0.763
Twice or more	16 (26.2)	45 (73.8)	
Once or rarely	2 (22.2)	7 (77.8)	
Diabetes Mellitus Duration			0.763
≤ 10 years	10 (24.4)	31 (75.6)	
> 10 years	8 (27.6)	21 (72.4)	

**Table 5.** Relationship between Participants' General Characteristics and Bleeding on Probing State. \*Chi square test

Variable	No Pocket N (%)	Pocket > 4mm N (%)	p-value
Gender			0.021
Male	20 (71.4)	8 (28.6)	
Female	39 (92.9)	3 (7.1)	
Age			0.400
< 55	28 (87.5)	4 (12.5)	
55–65	24 (85.7)	4 (14.3)	
> 65	7 (70.0)	3 (30.0)	
Education Level			0.789
High school or less	35 (83.3)	7 (16.7)	
College	24 (85.7)	4 (14.3)	
Smoking Status			0.318
No	21 (91.3)	2 (8.7)	
Yes	38 (80.9)	9 (19.1)	
Frequency of Daily Tooth Brushing			0.143
Twice or more	53 (86.9)	8 (13.1)	
Once or rarely	6 (66.7)	3 (33.3)	
Diabetes Mellitus Duration			0.006
Twice or more	39 (95.1)	2 (4.9)	
Once or rarely	20 (69.0)	9 (31.0)	

**Table 6.** Relationship between Participants' General Characteristics and Periodontal Pockets. \*Chi square test

## Discussion

This study was conducted to evaluate the oral and dental health status and the quality of life related to oral and dental health in patients with diabetes at Endocrine Subspecialty Clinic Cipto, Mangunkusumo Hospital. The participants' oral and dental health was evaluated using the DMFT, BOP, Periodontal Pocket, and OHIS indexes. The OHIP-20 questionnaire was employed to evaluate the quality of life related to oral and dental health. Regarding oral and dental health status, 95.7% of the respondents had dental cavities, missing teeth, and filled teeth. Missing teeth were the most common component of DMFT among the respondents (87.1%). Clinical dental examinations also found that missing teeth were the most common component of DMFT.<sup>10</sup> Among the respondents, 74.3% were BOP positive, and based on the OHIS assessment, 75.7% had moderate OHIS. In 2013, the National Basic Health Research found a DMFT Index of 4.6 in Indonesia (D-T: 1.6, M-T: 2.9, F-T: 0.08). Compared to the national DMFT values, the respondents of this study had high DMFT, at 9.16, and missing teeth had the highest value, at 6.41, much higher than the national value.

In the results evaluating the quality of life related to oral and dental health based on responses to the OHIP-20 questionnaire, 97.1% of the respondents reported having a good quality of life. High total scores on the OHIP-20 questionnaire indicated an improving quality of life related to oral and dental health. These results suggested that diabetes had no effects on quality of life related to oral and dental health. Other studies on quality of life related to oral health in patients with diabetes also showed that patients with diabetes mellitus enjoyed a good quality of life and that diabetes had no effect on quality of life related to oral and dental health.<sup>6,9,11</sup> In the present study, the participants had generally low oral and dental health, according to the DMFT index, BOP index, and OHIS value. The participants' low levels of oral and dental health arose because oral and dental health and conditions were not the main focus, concern, or priority for this group of patients, as seen in the many patients with missing teeth and poor oral hygiene. A study from Iran reported similar findings.<sup>12</sup>

The oral and dental health status of patients with diabetes mellitus indicated low oral hygiene, particularly high rates of decay and missing teeth and positive BOP scores. The respondents' OHIP-20 scores, though, generally fell into the good category. The relationship between oral and dental health status as evaluated with the DMFT, BOP, Periodontal Pocket, and OHIS indexes showed no significant correlation with OHIP-20 total scores. The relationship of quality of life and the clinical evaluation of oral and dental health can be affected by various factors, including cultural characteristics, living standards, and attitudes toward quality of life.<sup>13</sup> This study found no significant relationship of OHIP-20 total scores with gender, age, education level, smoking status, frequency of tooth brushing, and duration of diabetes. In contrast, another study observed significant relationships between quality of life with age, education level, frequency of tooth brushing, and duration of diabetes.<sup>9</sup> As well, it has been reported that age, gender, ethnicity, socioeconomic factors, and education level have no specific effects on the quality of life of patients with diabetes.<sup>14</sup>

Patients with diabetes have greater risk of periodontitis and bone loss than those without diabetes. In this study, 61 respondents (87.1%) had missing teeth, but only 8 (11.4%) used dentures. These loose and missing teeth could be caused by the faster bone loss in patients with diabetes and by periodontitis, a chronic inflammation affecting the structure of the supporting tissues of the teeth that can increase the risk of periodontal disease in the presence of diabetes.<sup>5,11</sup> Common variables, such as gender, age, education level, smoking status, and frequency of tooth brushing, did not show any association with oral and dental health status. In this study, however, a relationship between smoking statuses and the presence of active caries could be seen. As many as 83% of the patients who smoked had active caries. Tobacco use in patients with diabetes causes poor oral hygiene, higher DMFT, and increased risk of periodontitis.<sup>13</sup> As well, this study found a significant relationship ( $p = 0.021$ ) between periodontal pockets and gender. Socioeconomic factors, such as age and gender, can influence clinical characteristics, including periodontal disease state, because these factors may

determine lifestyle, oral hygiene condition, health care access, and education level.<sup>14</sup>

Additionally, in this study, it appears that periodontal pockets  $> 4\text{mm}$  occurred more frequently in patients who had diabetes mellitus for more than 10 years (31.0%), while periodontal pockets occurred in only 4.9% of patients with diabetes mellitus for less than 10 years. Diabetes mellitus duration has a significant relationship with the presence of periodontal pockets. Diabetes mellitus duration can aggravate periodontal disease;<sup>15</sup> therefore, the longer the duration of diabetes mellitus, the worse the pathogenesis of periodontitis become.<sup>16</sup> Damage to periodontal tissues occurs when hyperglycemia induces abnormalities in blood flow, increasing blood viscosity, reducing erythrocytes, and raising platelet aggregation, which result in hypoxia in the tissue.<sup>15,17</sup> In this study, patients with diabetes mellitus had low oral and dental health status but good scores on the OHIP-20 questionnaire evaluating quality of life related to oral and dental health. Oral cavity disorders can diminish quality of life.<sup>12</sup> Other studies have provided evidence that disturbances in oral and dental health can affect individual physical functional, social status, and welfare, making it difficult to separate the impacts of general health and of oral and dental health on quality of life.<sup>19,20</sup> These studies can support the results of the present researching showing that oral and dental health status had no impact on quality of life.<sup>19,20</sup>

In this study, there was no significant difference between the quality of life related to oral and dental health status. This result suggested that patients with diabetes did not pay attention to the impacts of associated oral health conditions. Other studies have supported that periodontitis and diabetes did not affect the daily aspects of life and the quality of life.<sup>11,18</sup> Patients with diabetes paid more attention to maintaining general health to cope with the effects of diabetes. Similarly, among the patients with diabetes mellitus, oral and dental health did not affect the quality of life related to oral and dental health. The oral health status of patients with diabetes mellitus in this study seemed to be low, pointing to a need for education to raise awareness of the importance of maintaining oral and dental health in patients with diabetes. This requires the participation of the medical doctors and dentists who treat patients with diabetes.

Patient education plays an important role in improving knowledge, especially regarding the complications of oral health and their effects on quality of life.

## Conclusions

This study supported the conclusion that diabetes mellitus did not affect the perceived quality of life related to oral and dental health in patients with diabetes. Additionally, oral and dental health status did not affect these patients' quality of life related to oral and dental health. It is suggested that more samples should be recruited for further research on quality of life related to oral and dental health in patients with diabetes with more samples. Improving oral health education is needed to maintaining oral health in patients with diabetes mellitus.

## Declaration of Interest

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