



Awareness about the periodontal disease and diabetes mellitus interrelationship among diabetic patients

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Original Article

Abstract

BACKGROUND AND AIM: The awareness about bidirectional relationship between periodontitis and diabetes mellitus (DM) is not well known among the Malaysian population. This study aimed to evaluate the level of awareness of periodontal disease (PD)-DM interrelationship and self-reported periodontal health among patients with DM.

METHODS: Patients who attended the diabetic clinic were systematically and randomly invited to participate in this cross-sectional study. Consented participants completed a validated self-administered questionnaire and provided information on socio-demographic background, oral hygiene practice, periodontal health status, and awareness about whether there is relationship between PD and DM. The level of hemoglobin A1c (HbA1c) was obtained from the medical record. Descriptive and logistic regression analyses were carried out using SPSS software with $P < 0.05$ considered as significant.

RESULTS: A total of 123 patients with DM with a mean age of 62.20 ± 9.55 years participated in the study. The mean duration of living with DM was 10.62 ± 6.52 years and that for HbA1c level was 9.08 ± 2.24 mmol/l. About 53% of the participants had signs of PD, but only 22% perceived that they had PD. Only 15% were aware of the PD-DM interrelationship. The odds of knowing the definition and cause of PD and believing that oral health could be better without DM were greater in participants who had the awareness compared to those without awareness ($P < 0.01$).

CONCLUSION: This study showed that patients with DM had a low level of awareness about PD-DM interrelationship which could be due to a lack of understanding about PD. It is recommended that patients with DM should be referred to a dental clinic for oral health counselling.

KEYWORDS: Diabetes Mellitus; Diabetes Complications; Oral Health; Periodontitis; Periodontal Disease

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Diabetes mellitus (DM) is a metabolic disease characterised by hyperglycemia due to impairment in insulin secretion, function, or both.¹ It is a major public health concern, as it affects about 8.8% of the global population, including 17.5% of Malaysians in 2015, and the trend is set to increase over the foreseeable future.²⁻⁴ The World Health Organization (WHO) reported that globally, more than 422 million adults in the

middle- and upper-income countries were affected by DM in 2014, and it is expected to rise to about 700 million people within age of 18-99 years in 2045.^{4,5}

DM is linked to other complications such as hyperlipidemia, microangiopathy, nephropathy, neuropathy, macrovascular disease, and delayed wound healing through its effect on the immune system.⁶⁻⁸ In oral cavity, periodontal disease (PD) is one of the main complications of DM and it was

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reported to affect 15.75% of patients with DM.⁹ It was demonstrated that patients with DM were more than two times more likely to have PD compared to non-diabetic individuals.¹⁰⁻¹³ This is evidenced when poorly-controlled patients with DM showed greater gingival bleeding, risk of alveolar bone loss, and periodontitis compared to those without the disease.¹⁴ In addition, moderate/severe periodontitis is more prevalent in DM as well as in prediabetes patients when compared to non-diabetics subjects.¹⁵ It was also documented that both diseases shared many common risk factors such as higher age, genetic predisposition, obesity, smoking, and excessive alcohol consumption.^{16,17}

In PD, the bacteria and their endotoxins in the gingival sulcus trigger the local immune cell responses and release of proinflammatory cytokines,¹⁸ which then enter the local tissue and blood/plasma and continue to damage the periodontal tissues and upregulate systemic inflammation. In patients with DM, these chronic inflammatory cycles continuously assault organs and body system, leading to substantial functional disability.¹⁹ Thus, DM will increase the prevalence and severity of periodontitis, which then will compromise the diabetic control. However, the contribution of periodontitis in the cyclical process can be decreased by improving periodontal health; a study showed that diabetic condition has improved following periodontal therapy.²⁰ Therefore, the association of PD and DM was considered as a “two-way relationship”, as has been reported elsewhere.¹⁵

One of the factors that contributes towards a successful periodontal therapy is the understanding of PD and DM interrelationship, through increased motivation to take better care of oral hygiene and prevent further complications of both conditions. However, previous studies showed that most patients with DM were not aware that they had a greater risk of developing PD.^{21,22} This study was aimed to

assess and explore factors associated with the awareness of DM-PD interrelationship in patients with DM.

Methods

This cross-sectional study systematically and randomly selected patients who attended the Diabetic Clinic at Hospital Universiti Sains Malaysia, Kelantan, Malaysia, for regular follow-up. Data collection was carried out after the ethical approval has been obtained from the Human Research Ethics Committee of Universiti Sains Malaysia (USM/JEPeM/18010033). Patients over the age of 30 years who had at least 6 teeth were invited to participate in the study.²³ Sample size calculation was carried out by using sample size calculator based on the prevalence of patients with DM who were aware of the risk of developing PD (26.5%) at 5% margin of error and 95% confidence level.²² It showed that 200 patients should be recruited for the study. However, with some limitations in conducting this study, the complete response received were only from 123 participants.

Patients were briefed about the study and written informed consent was sought before the data collection process. The demographic information (age, gender, ethnicity, education level) and knowledge on DM-PD interrelationship were collected using self-administered questionnaires. The questionnaire is an instrument that assesses health behaviours, knowledge on PD, and self-perceived general oral health and periodontal status; its content has been validated by periodontist and pre-tested on a sample of patients with DM with periodontitis.²⁴ Information on oral health behaviours included the frequency of brushing ($\leq 1/\text{day}$, once/day , $> 2/\text{day}$), use of interdental cleaning kits (yes/no), frequency of dental visit (rarely, < 2 times yearly, and ≥ 2 times yearly), and smoking status (current, former, and never smoker).

The knowledge on PD asked whether a participant knew it (yes/no) based on the

simple definition of PD (gum bleeding with or without tooth mobility) and selected the right answer for the cause of the disease between plaque (correct) and sweet food (incorrect). The symptoms of PD, bleeding gums and loose teeth, were recorded as yes/no. The responses for self-perceived PD status (yes: 1, no/unsure: 0), general oral health status (very good/good: 1, moderate/poor/very poor: 0), and the opinion about whether oral health would be better without DM (yes: 1, no/unsure: 0) were re-categorised as binary variables. A participant was considered to be aware of the PD-DM interrelationship if only she/he responded "yes" to the question "Does DM affect oral health?" and selected "gum disease" as the effect of DM, and was considered to be unaware, otherwise. The year of diagnosis with DM and hemoglobin A1c (HbA1c) level were obtained from patients' record.

Descriptive analyses were carried out to describe all variables by the awareness status. Logistic regression analysis was used to examine the association between the risk factors and awareness of PD-DM relationship. Data were analysed using SPSS software (version 24, IBM Corporation, Armonk, NY, USA) and the level of significance was set at 5%.

Results

A total of 123 patients with a mean age of 62.00 ± 9.55 years participated in the study (Table 1). The proportion of men and women in the sample was similar, but the majority were the Malays (87.0%) and those with secondary education or lower (56.1%). They were diagnosed with DM for a mean of 10.60 ± 6.52 years and the majority were uncontrolled (90.2%) with mean HbA1c level of 9.10 ± 2.24 mmol/l. The large percentage of the participants practiced tooth brushing at least twice a day (84.0%), used interdental hygiene kit (58.0%), rarely visited a dentist (87.0%), and did not smoke (73.2%).

There were 15.4% [95% confidence interval

(CI): 8.97-21.92] of the participants who were aware of the PD-DM interrelationship. Only 9.76% of the participants with the awareness knew both the definition and cause of PD. The analysis showed that the odds of awareness regarding the PD-DM interrelationship was greater in participants who knew about the definition of PD [odds ratio (OR) = 4.9] and the cause of it (OR = 8.1) compared to those who did not (Table 1) ($P < 0.010$). Furthermore, the odds of awareness were also greater in those with bleeding gum (OR = 3.3, $P < 0.050$). The awareness was also greater in participants who believed that their oral health status could be better if they did not have DM (OR = 7.9, $P < 0.010$). Further analysis did not find any adjusted OR of these associations to be significant.

Discussion

This study found that the percentage of patients with DM with the awareness of the PD-DM interrelationship was very low (15.0%) compared to another local study (26.5%)²² but consistent with other reports (13.0%-24.2%).²⁵⁻²⁷ Another concern is that there is only 10% of the participants with the awareness who actually know the definition and cause of PD. A previous study has found that 69% of patients with DM were not aware of risk of getting PD in DM.²⁷ Further assessment of our data showed that among those without the awareness, 85% had uncontrolled DM and 79% had at least one of the PD symptoms. The uncontrolled DM condition can lead to the spiralling of both PD and DM complications and further damage to the periodontal tissues.

The results showed that the participants with the awareness about PD-DM interrelationship were five and eight times more likely to know the definition (OR = 4.0) and cause (OR = 8.1) of the disease, suggesting that having an understanding of the PD and its cause contributes towards the awareness. However, it is not clear who is responsible for raising the awareness of the relationship in the participants.

Table 1. Summary statistics and distribution of subjects by awareness status of the periodontal disease (PD)-diabetes mellitus (DM) interrelationship and results of the logistic regression analysis (n = 123)

Variables	Aware (n = 19)	Not aware (n = 104)	Crude OR (95% CI)	P	
Age (year)	62.23 ± 9.55	59.84 ± 8.97	62.66 ± 9.62	1.00 (0.93-1.02)	0.200
Gender					
Men	66 (53.7)	13 (19.7)	53 (80.3)	2.10 (0.74-5.90)	0.200
Women	57 (46.3)	6 (10.5)	51 (89.5)		
Ethnicity					
Malay	107 (87.0)	17 (15.9)	90 (84.1)	0.80 (0.16-3.63)	0.700
Chinese	16 (13.0)	2 (12.5)	14 (87.5)		
Education level					
Primary	12 (9.8)	2 (16.7)	10 (83.3)	1.00 (0.56-1.83)	> 0.900
Secondary	57 (46.3)	8 (14.0)	49 (86.0)		
Tertiary	39 (31.7)	7 (17.9)	32 (82.1)		
Other	15 (12.1)	2 (13.3)	13 (86.7)		
Duration of DM (year)	10.62 ± 6.52	10.63 ± 6.52	10.62 ± 6.64	1.00 (0.93-1.08)	> 0.900
Diabetes status					
Controlled	12 (9.8)	2 (16.7)	10 (83.3)	1.10 (0.22-5.50)	0.900
Uncontrolled	111 (90.2)	17 (15.3)	94 (84.7)		
HbA1c (mmol/l)	9.08 ± 2.24	9.78 ± 2.21	8.95 ± 2.23	1.20 (0.95-1.44)	0.100
Brushing frequency					
≤ 1 a day	20 (16.3)	10 (50.0)	10 (50.0)	0.80 (0.38-1.66)	0.500
Twice a day	66 (53.7)	25 (37.9)	41 (62.1)		
> 2 times a day	37 (30.1)	15 (40.5)	22 (59.5)		
Interdental hygiene					
Yes	71 (57.7)	14 (19.7)	57 (80.3)	2.30 (0.78-6.88)	0.100
No	52 (42.3)	5 (9.6)	47 (90.4)		
Dental visit					
≥ 2 times per year	6 (4.9)	2 (33.3)	4 (66.7)	1.80 (0.90-3.60)	0.100
< 2 times per year	10 (8.1)	3 (30.0)	7 (70.0)		
Rarely	107 (87.0)	14 (13.1)	93 (86.9)		
Smoking status					
Smoker	5 (4.1)	1 (20.0)	4 (80.0)	1.20 (0.47-3.17)	0.700
Former smoker	28 (22.8)	3 (10.7)	25 (89.3)		
Never smoker	90 (73.2)	15 (16.7)	75 (83.3)		
Definition					
Yes	52 (42.3)	14 (26.9)	38 (73.1)	4.90 (1.63-14.56)	0.005
No	71 (57.7)	5 (7.0)	66 (93.0)		
Cause of PD					
Yes	35 (28.4)	13 (37.1)	22 (62.9)	8.10 (2.75-23.68)	< 0.001
No	88 (71.5)	6 (6.8)	82 (93.2)		
Bleeding gum					
Yes	36 (29.3)	10 (8.1)	26 (21.1)	3.30 (1.22-9.10)	0.020
No	87 (70.7)	9 (7.3)	78 (63.4)		
Loose teeth					
Yes	51 (41.5)	10 (8.1)	41 (33.3)	1.70 (0.64-4.56)	0.300
No	72 (58.5)	9 (7.3)	63 (51.2)		
Self-perceived PD					
Yes	18 (22.1)	5 (27.8)	13 (72.2)	2.50 (0.77-8.10)	0.100
No	105 (85.4)	14 (13.3)	91 (86.7)		
Self-perceived general oral health status					
Good	37 (30.1)	5 (4.1)	32 (26.0)	0.80 (0.27-2.42)	0.700
Poor	86 (69.9)	14 (11.4)	72 (58.5)		
Better oral health without DM					
Yes	71 (57.7)	17 (23.9)	54 (76.1)	7.90 (1.73-35.80)	0.008
No/not sure	52 (42.3)	2 (3.8)	50 (96.2)		

Data are presented as mean ± standard deviation (SD) or number and percentage

OR: Odds ratio; CI: Confidence interval; HbA1c: Hemoglobin A1c; DM: Diabetes mellitus; PD: Periodontal disease

Shanmukappa et al. demonstrated that the absence of knowledge on association between PD and DM was significantly related to lower duration of DM in their study population in India.²⁷ Lack of awareness on PD-DM interrelationship signifies the need of dental health education among patients with DM.

Dental professionals are less likely to counsel patients about the PD-DM relationship without knowing the DM status of the patients. And similarly, the non-dental health professionals who are responsible for diabetic care may not be aware of the PD-DM interrelationship,²⁵ as they have greater concern for other medical complications related to DM. In addition, they may not be aware of the PD-DM interrelationship or routinely refer patients with DM for a dental consultation. This is despite the call to consider PD as one of the DM complications since for almost 30 years.²⁸

The patients with DM themselves may not view PD as a priority because of other more serious complications such as heart disease, circulatory problems, eye disease, and kidney problems.²⁹ A recent clinical trial showed that educational intervention based on the Health Belief Model (HBM) increased the awareness towards oral health care to prevent oral complications among patients with DM.³⁰ Hence, the low awareness about the PD-DM interrelationship, possibly related to a lack of accessible information among the patients with DM,²⁷ can be improved through intersectoral action between the DM and oral health care providers. This can be achieved by educating the DM carers about the PD-DM interrelationship, signs of PD, and referring the cases to oral health professionals.

This study does not specifically identify the specific knowledge about the PD that influences the understanding of the PD-DM interrelationship. However, most participants correctly identified the plaque as a risk factor of PD, suggesting that they understood its role in the disease development, possibly from previous counselling with oral health professionals. The lack of awareness about

periodontal risk factors and poor oral health behaviour increases the risk of PD, particularly in patients with DM.³¹ Equally, an increase in awareness will, hopefully, improve the behaviour and lower the risk of PD.

The effort to improve the periodontal health status should aim to use the DM-PD interrelationship, for example, to strengthen the self-efficacy in patients with DM by capitalizing on the understanding of the potential benefits of periodontal therapy on glycemic control.^{32,33} However, the participants of this study with the awareness are three times more likely to have bleeding gums (OR = 3.3), that could be due to poor compliance with oral hygiene instruction and/or inefficient oral hygiene care technique among the ageing patients, indicating that educating the patients with DM about PD is inadequate. It should be followed by assessment and regular monitoring of skill and efficiency of plaque control.

This study has several limitations; thus, the result should be interpreted with caution. Poor cooperation of the patients and low participation rate led to much smaller sample size than estimated from the calculation; the effect is reflected in the wide CI. The use of self-reported instrument does not confirm a diagnosis of PD, but it is a practical alternative which has been recommended to be used for its good reliability.^{23,34-36} Nevertheless, this study provides baseline information on the awareness of PD-DM counter complications among local patients with DM. This could serve a basis for further research in this scope to inculcate awareness among patients and health professional in managing the bidirectional relationship of these two chronic diseases affecting the population at risk.

Conclusion

The level of awareness on the DM-PD interrelationship is low among selected patients with DM in Malaysia which can be increased by improving the knowledge about PD. Placing PD as one of the complications of DM as equal as with heart disease, circulatory

problems, eye disease, and kidney problems may see greater attention and effort to improve the disease and general oral health.

Conflict of Interests

Authors have no conflict of interest.

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