The Diabetes-Periodontal Association: Awareness and Oral Care Practices of Patients Attending a Nigerian Teaching Hospital - A Cross-sectional Study

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Abstract

Background: There is a bidirectional relationship between diabetes mellitus and periodontitis; hence, diabetic patients must be aware of this association. This study, therefore, aims to evaluate the awareness of diabetic patients of the association between diabetes mellitus and periodontitis, and how this influences their dental care utilisation.

Materials and Methods: This was a descriptive, cross-sectional study conducted among diabetic patients of the endocrinology clinic of UPTH. Semi-structured, self-administered questionnaires were used for data collection. The questionnaire had three sections. Section A included information on socio-demographic, section B included information on the awareness of the association between periodontitis and diabetes mellitus. Section C included information on oral hygiene practices and dental care utilisation. Statistical analysis was done using the Statistical Product and Service Solution (SPSS) version 25.0.

Results: There were 198 participants; 88 males and 110 females. One hundred and forty-nine (75.3%) participants were unaware of the link between periodontitis and diabetes mellitus. Concerning dental clinic visitation, 106 (53.5%) had previously visited the dental clinic while 92 (46.5%) never attended the dental clinic. Among those that have attended the dental clinic; 5 (4.7%), 41 (38.7), 7 (6.6%) and 50 (47.2%) participants visited for routine check-ups, extractions, scaling & polishing and toothaches, respectively. Among those who knew of the association between periodontitis and diabetes mellitus, 14 (26.4%) never visited the dental clinic, while 39 (73.6%) visited the dental clinic. This finding is statistically significant ($p = 0.003$)

Conclusion: Most of the participants were unaware of the association between periodontitis and diabetes mellitus. Among participants who were aware of the association, more participants visited the dental clinic for curative/symptomatic care rather than for preventive care.

Keywords: Awareness, Diabetes, Oral care practices, Periodontitis.

Introduction

Diabetes is a group of metabolic diseases characterised by hyperglycaemia, which results from either the pancreas not producing enough of the hormone insulin, the body's cells becoming unresponsive to insulin's effects, or both. This can lead to long-term dysfunction or failure of different organs, especially the eyes, kidneys, nerves, heart and blood vessels.[1]

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Diabetes also affect the oral cavity, as the degenerative vascular changes associated with diabetes also impede nutrient and leukocyte migration to gingival tissues, thus reducing oxygen diffusion and increasing the severity of oral diseases such as periodontal diseases, oral fungal and bacterial infections, dental caries and tooth loss and salivary dysfunction.[2] Other oral mucosa lesions include stomatitis, benign migratory glossitis, lichen planus, lichenoid reactions, fissured tongue, traumatic ulcer, and angular cheilitis.[3]

Additionally, diabetes mellitus leads to polymorphonuclear leukocyte (PMN) deficiencies that result in impaired chemotaxis, defective phagocytosis, or impaired adherence, hence increasing susceptibility to infections in diabetic patients.[4] Furthermore, chronic hyperglycaemia adversely affects the synthesis, maturation, and maintenance of collagen and

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extracellular matrix, in the hyperglycaemic state, many proteins and matrix molecules undergo a nonenzymatic glycosylation, resulting in advanced glycated end-products (AGEs).[5] As a result, collagen in the tissues of patients with poorly controlled diabetes is older, more susceptible to pathogenic breakdown and less resistant to destruction by periodontal infections; hence, uncontrolled diabetes is associated with more severe periodontal disease.[6-8] According to the American Academy of Periodontology, 50% of diabetics up to the age of 35 suffer from periodontal disease, and this rises to 80% at the age of 45–54 years, compared to 60% in the healthy population.[9]

There is a two-way connection established between periodontitis and diabetes mellitus.[10] Diabetes mellitus worsens periodontitis, with higher levels of inflammatory mediators in both saliva and gingival crevicular fluid when compared to non-diabetics.[11] Likewise, periodontitis worsens glycaemic state, through increased insulin resistance, if present in a diabetic patient.[12] In the 2017 classification of periodontal diseases and conditions, diabetes mellitus was identified as one of the modifying factors for periodontitis.[13] Likewise, periodontitis is considered the sixth complication of diabetes mellitus.[14]

Periodontal treatments in diabetes have resulted in reduced glycated haemoglobin (HbA1c) levels and improvement in glycaemic control.[10] Periodontal treatment aids in eliminating or reducing dental plaque and plaque-retentive factors such as calculus, which are required for periodontal diseases to develop even in patients with diabetes mellitus.[15] Personal oral self-care practices and professional plaque control measures are critical factors in the prevention and treatment of periodontal diseases.[16,17] A previous study reported that diabetic patients who practised effective tooth brushing with lower levels of plaque deposit had better HbA1c levels. [18] Also, professional help through regular dental visits is essential in the prevention, early detection, and treatment of oral conditions (such as periodontitis) associated with diabetes mellitus.[19] Similarly, adequate glycaemic control is also indispensable to prevent oral complications associated with diabetes mellitus.

It is therefore imperative for diabetic patients to be aware of the association between periodontitis and diabetes. However, there is a paucity in the literature of the awareness of the association between periodontitis and diabetic mellitus among diabetic patients in the South-South region of Nigeria, especially in Port Harcourt, Rivers State. Hence, this study aims to assess the awareness of diabetic patients of the association between periodontitis and diabetes mellitus, and how this influences their dental care utilisation.

Materials and Methods

Study design and study setting

This was a descriptive, cross-sectional study conducted among diabetic patients of the endocrinology clinic of the University of Port Harcourt Teaching Hospital (UPTH), Port Harcourt, Rivers State. The hospital is located about 15km away from Port Harcourt city, along the East-West Road in Obio/Akpor Local Government Area of Rivers State.

Ethical approval (Protocol number: UPTH/ADM/90/5.II/VOL.XI/1907) was obtained from the Health Research and Ethics Committee of the Institution, followed by participants' consent before commencing the study.

Data sources:

A total of 200 questionnaires were distributed, but only 198 were retrieved and properly filled, giving a percentage response of 99%. Data was collected over 2 months (January 2023 to February 2023), using semi-structured, self-administered questionnaires. The questionnaire had three sections. Section A included information on socio-demography (age, gender, marital status, ethnicity). Section B included information on the awareness of the association between periodontitis and diabetes mellitus. Section C included information on oral hygiene practices and dental care utilisation.

Study participants:

Participants were recruited using a convenience sampling method. The participants were those who had diabetes and attended the endocrinology clinic, UPTH. Inclusion criteria included diabetic patients who were present at the time of data collection and gave consent to participate in the study. Exclusion criteria were patients who were not diabetic and diabetic patients who did not give consent to participate in the study.

Study Independent variables:

The study had 3 independent variables: 1. Knowledge of the association between periodontal disease (gum disease) and diabetes mellitus 2. Oral hygiene practices 3. Dental service utilisation of participants.

Concerning awareness of the link between periodontitis and diabetes mellitus, participants were asked: "*Do you know that your gum disease (periodontal disease) can affect your systemic condition?"* This had 2 responses 1. Yes 2. No

Concerning oral hygiene practices, participants were asked about how often they brush. This had 2 responses: 1. Once 2. Twice. Participants were asked what cleaning aids they used, this had 3 options: 1. Chewing stick, 2. Toothbrush, 3. Both.

Concerning dental service utilisation, participants were

asked if they had visited the dental clinic by asking, "*Have you visited the dental clinic before*?*"* This had 2 responses: 1. Yes, 2. No

Participants were also asked, "*If yes, when was the last time you visited a dentist?"* This had 4 responses: 1. < 6 months, 2. 6 -12 months, 3. More than a year ago 4. Never visited the dentist. Participants were further asked to specify what treatments they received by asking, "*If yes, what treatment did you receive?"* This has 7 responses: 1) Routine dental check- up 2) Extractions, 3) Partial dentures, 4) Fillings, 5) Tooth pain, 6) Scaling and polishing, 7) Others (please specify)

Study dependent variable:
The dependent variable was the comparison of the participants' knowledge of the association between periodontitis and diabetes mellitus to dental service utilisation of the participants.
Study size determination:

With reference to a previous study, the prevalence of diabetic patients accessing dental care = 10.8%,[20] the formula: $N = \frac{Z^2*pq}{d2}$, was utilised, the minimum sample size calculated was 148. However, in this study, 200 questionnaires were distributed, while 198 questionnaires were retrieved and accurately filled.

Statistical analysis:
Statistical analysis was done using the Statistical Product and Service Solution (SPSS) version 25.0 (IBM SPSS Inc. Chicago, Illinois). Continuous variables were expressed as means and standard deviation. Categorical variables were presented as frequencies and percentages. Differences between age groups were compared using the chi-square test for categorical variables, and independent t test for continuous variables for 2 groups. Differences between groups were compared using the Chi-square tests for categorical variables. P values < 0.05 were considered statistically significant.

Results

Sociodemographic of participants

Table 1 shows that there were 198 participants; 88 males and 110 females, with M: F of 1:1.25. The age range was 17 - 91 years, with a mean age of 50.9 ± 15.6 years. 48 (24.2%), 64 (32.3%) participants had primary education and tertiary education, respectively. More than half of the participants were married; 107 (54.0%), while 39 (19.7%) were single, 24 (12.1%) participants had diabetes for less than 6 months, 26 (13.1%) participants had diabetes for 1-5 years, while 15 (7.6%) participants gave no response.

Table 1: Sociodemographic of participants

Variables		Frequency	Percentage
Age group	< 20	3	1.5
	20-29	15	7.6
	30-39	36	18.2
	40-49	34	17.2
	50-59	48	24.2
	60-69	35	17.7
	70-79	21	10.6
	80-89	5	2.5
	90-99	1	0.5
Gender	Male	88	44.4
	Female	110	55.6
Education	None	23	11.6
	Primary	48	24.2
	Secondary	46	23.2
	Tertiary	64	32.3
	Postgraduate	17	8.6
Marital status	Single	39	19.7
	Married	107	54.0
	Separated/ Divorced	23	11.6
	Widow (er)	29	14.6
Ethnic group	Hausa	7	3.5
	Igbo	70	35.4
	Yoruba	11	5.6
	Others	110	55.6
When were you diagnosed with diabetes?	< 6months	24	12.1
	6-11 months	38	19.2
	1_5 years	26	13.1

Awareness of the link between periodontitis and diabetes mellitus among participants

Table 2 shows that 149 (75.3%) participants were unaware of the link between periodontitis and diabetes mellitus, while 49 (34.7%) were aware of this connection. Regarding the source of information, 5 (10.2%), 23 (46.9), 9 (18.4%) participants got the information from books, doctors, media and seminars, respectively.

Oral hygiene practices and dental care utilisation of the participants

Table 3 shows that 147 (74.2) participants brush once daily, while 51 (25.8%) participants brush twice daily. Concerning the type of brushing aids used, 123 (62.1%) participants used toothbrushes, 7 (3.5%) used chewing sticks, while 68 (34.3%) used both chewing sticks and toothbrushes. Regarding the method of brushing. 20 (10.1%) participants used the horizontal method of

Table 2: Awareness of the link between periodontitis and diabetes mellitus among participants

Variables		Frequency	Percentage
Awareness of the link between periodontitis and diabetes mellitus	No	149	75.3
	Yes	49	34.7
If yes, what is the source of information?	Books	5	10.2
	Doctors	23	46.9
	Friends	1	2.0
	Media	9	18.4
	School	1	2.0
	Seminar	9	18.4
	No response	1	2.0

Table 3: Oral hygiene practices and dental care utilisation of participants

Variables		Frequency	Percentage
Frequency of brushing	Once	147	74.2
	Twice	51	25.8
Type of brushing aids	Chewing stick	7	3.5
	Toothbrush	123	62.1
	Both	68	34.3
Method of brushing	Horizontal	20	10.1
	Vertical	14	7.1
	Both	164	82.8
Have you ever visited a dental clinic	No	92	46.5
	Yes	106	53.5
If yes, time of visitation	<6 months	10	9.4
	6-12 months	30	28.3
	>1 year	66	62.3
Dental treatment received	Routine check-up	5	4.7
	Dentures	3	2.8
	Extractions	41	38.7
	Scaling &polishing	7	6.6
	Toothache	50	47.2

brushing, 14 (7.1%) used vertical method of brushing, while 164 (82.8%) used both methods of brushing. Concerning dental clinic visitation, 106 (53.5%) had previously visited the dental clinic while 92 (46.5%) never attended the dental clinic.

Among those that have attended the dental clinic, 5 (4.7%), 41 (38.7), 7 (6.6%) and 50 (47.2%) participants visited for routine check-ups, extractions, scaling & polishing and toothaches, respectively.

Association between awareness of the link between periodontitis and diabetes mellitus, and dental service utilisation

Table 4 shows that among participants who were unaware of the link between periodontitis and diabetes mellitus, 78 (53.0%) never attended the dental clinic, while 67 (46.2%) had attended the dental clinic. Among those who were aware of the association between periodontitis and diabetes mellitus, 14 (26.4%) never visited the dental clinic, while 39 (73.6%) visited the dental clinic. This finding is statistically significant (X^2 (2) = 11.755, p = 0.003)

Discussion

In this study, diabetes was more common in the 50 -59 age group and more among females. This finding is consonant with the report that diabetes is prevalent among the 40 – 59 age group and females among the Nigerian population.[21] This finding, however, contrasts with global reports from the International Diabetes

Table 4: Association between awareness of the link between periodontitis and diabetes mellitus, and dental service utilisation

Variables		Dental Visitation		Chi-square value	P value
		No n (%)	Yes n (%)		
Awareness of the link between periodontitis and diabetes mellitus	No	78 (53.8)	67 (46.2)	$X^2(2) = 11.755$	**0.003***
	Yes	14 (26.4)	39 (73.6)		

*significant

Federation (IDF), which indicate that men tend to develop diabetes at a younger age.[22] This disparity suggests that demographic patterns and risk factors for diabetes can vary significantly between local and global contexts.

It is well documented in the literature that there is a bi-directional relationship between periodontitis and diabetes mellitus; diabetes mellitus increases the risk of periodontitis and the periodontal inflammation also worsens glycemic control,[23] hence it is important for the patients to be aware of this association and take the necessary precautions. However, in this study, most of the participants were unaware that there was an association between periodontitis and diabetes mellitus. This finding aligns with previous studies,[24,25] but in contrast to the study conducted in Saudi Arabia,[26] where a majority of the diabetic patients were aware of the association between diabetes and periodontal problems. The findings in this present study indicate that diabetic patients should be educated more about the oral and periodontal complications of diabetes mellitus. Regarding the source of information among participants who were aware of the association between periodontitis and diabetes, more participants were informed by the doctors; this finding is in contrast to the study by Oyapero et al., where more of the participants were informed by the nurses,[24] while in the study by Al Amassu et al., the media was the main source of information.[26]

Plaque biofilm is one of the main aetiological factors for periodontal disease; other factors include genetics and environmental factors.[27] Hence, elimination of plaque by toothbrushing is an essential fundamental self-care behaviour for maintenance of oral health. The American Dental Association advocates that toothbrushing twice daily for about two minutes using a fluoride toothpaste could achieve a remarkable reduction in the amount of plaque accumulation and improved oral hygiene.[28] Equally, the Nigerian Dental Association advocates brushing twice daily, with a fluoride toothpaste for fresh breath and prevention of dental diseases.[29] In this study, most of the participants brush their teeth once daily, while only a handful of the participants brush twice as recommended. This finding is similar to previous studies, where only a few participants brushed their teeth twice daily.[24,26] It is therefore imperative for diabetic patients to be educated on the importance of adequate frequency of brushing. Considering the type of brushing aids utilised, the majority of the participants used toothbrushes, while some used a combination of toothbrushes and chewing sticks. Chewing stick usage brings about a marked reduction in dental plaque, gingivitis and improved oral hygiene.[30,31] However, the inappropriate usage of chewing sticks could cause increased prevalence of tooth wear and gingival recession.[32,33]

Concerning dental service utilisation, a little over half of the participants had visited the dental centre previously. However, of those who have visited the dental clinic, only a few participants visited the dental clinic within the preceding year, while most of them visited over a year ago. This signifies a poor oral health behaviour amongst the participants, as utilisation of dental services is one of the essential indicators of oral health behaviour, as it measures the number of visits per year or the number of people with at least one visit during the previous year.[34] Furthermore, among participants who visited the dental clinic previously, more participants visited for toothache and extraction, while very few visited for routine checkups and scaling & polishing, this finding is in tandem with a previous study,[24] but in contrast to the study conducted in Davangere city,[35] where more of the participants visited the dental clinic for routine dental checkups and scaling & polishing. The finding in this study confirms the report from previous studies that more people in the developing countries visit the dental clinic for curative/symptomatic treatment rather than for preventive care.[36,37] This is often because of low awareness, poor attitude, cost, and accessibility issues.[38] However, the reasons for not visiting the dental clinic were not interrogated in this study.

Considering the effect of the awareness of the association between periodontitis and diabetes mellitus on dental care utilisation among the participants, more of the participants who were unaware of the association did not attend the dental clinic, while more participants who were aware of the association visited the dental clinic; however, most of them visited for curative/ symptomatic care rather than preventive care. Preventive care is necessary for reducing professional plaque biofilm and calculus, thereby preventing periodontal disease. Therefore, it is recommended that both healthcare professionals and patients be educated on relevant oral self-care instructions necessary to minimise the oral health complications associated with diabetes. In addition, diabetic patients should have dental referral for a comprehensive oral health assessment as part of the overall management of diabetes mellitus.

Limitation of the study

The study was limited to individuals attending a single tertiary hospital in Nigeria, which may have introduced selection bias and limited the generalizability of the findings to other populations. Additionally, the data were self-reported, which has potential for recall and

social desirability bias.

Conclusion

Most of the participants were unaware of the association between periodontitis and diabetes mellitus. Among participants who were aware of the association, more participants visited the dental clinic for curative/symptomatic care rather than for preventive care.

Conflict of Interest / Declaration

We certify that this research is original, not presently under consideration for publication elsewhere, and free of conflict of interest.

Source of fund

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