



Research Article

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Two Way Relationship between Diabetes and Periodontitis: A Cross-Sectional Survey of Knowledge, Awareness, and Attitude

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ABSTRACT

Periodontitis is the inflammation of the periodontium which is the sixth complication of diabetes mellitus. Periodontitis influences the development and progression of diabetes and its complications. Improved knowledge and attitude about periodontitis in diabetic patients reduce the risk of periodontal disease and its effects on the diabetic status. The current study aimed to assess the knowledge, awareness, and attitude of diabetic patients towards periodontal disease. A total of 400 diabetic patients from Karad, Maharashtra, > 35 years of age with a known history of diabetes, consenting to participate in the survey were included in the study. A one-to-one interview was conducted with all the subjects to complete the pretested close-ended questionnaire containing twenty questions. The data collected were analyzed using statistical software SPSS version 21. The total of 400 subjects who participated in the study, included 194 males (54.8%) and 206 females (45.2%). The majority of subjects had a lack of knowledge, limited awareness, and poor attitude about the association between diabetes and periodontitis toward oral health. The overall knowledge, awareness, and attitude of diabetic patients towards periodontal disease were insufficient. There is a need to educate patients regarding periodontal complications in poorly controlled diabetics if oral healthcare is ignored. They should be educated and motivated about the importance of oral hygiene maintenance and rehabilitation.

Key words: Association, Diabetes mellitus, Oral health awareness, Periodontitis, Questionnaire, Survey

INTRODUCTION

Diabetes mellitus (DM) is a heterogeneous group of metabolic disorders manifested by reduced insulin production by the pancreas or inadequate utilization of insulin by the cells, which results in elevation of the blood glucose level. DM affects practically all the organs in the body, possibly leading to disability and sometimes, life-threatening complications. The prevalence of diabetes is rising globally with a prevalence rate in the Indian population of 2.4% in the rural area and 11.6% in the urban area [1].

DM is an established risk factor for periodontal disease, and periodontal disease is one of the leading causes of tooth loss among adults [2, 3]. Dental patients with uncontrolled DM have a deteriorated periodontal status with poor periodontal prognosis compared to patients with controlled blood glucose levels [2-5]. The association between DM and periodontal disease is well-researched, and the dental practice offers a good setting for the timely management of the periodontal status of patients with uncontrolled DM.

Periodontal disease is an inflammatory, predominantly gram-negative anaerobic bacterial infection. It is initiated by plaque biofilm resulting in gingivitis, which may progress to periodontitis and eventually tooth loss if left untreated [6]. Periodontitis might induce and prolong a systemic inflammation that may aggravate systemic diseases such as cardiovascular disease, pulmonary disease, rheumatoid arthritis, and diabetes mellitus [7]. Several

studies, reviews, and meta-analyses suggest a bidirectional relation between periodontal disease and diabetes mellitus [8-14]. This interrelationship of periodontal disease and glycaemic controls has been vastly investigated and it has been proven that periodontal disease aggravates the diabetic status of the individual and is considered the sixth complication of Diabetes mellitus [15, 16]. The increased severity of the periodontal disease can adversely affect the diabetes status, its complication, and its response to the treatment [17, 18].

The level of knowledge and awareness present in diabetic patients with periodontitis is essential to assess and analyze their approach toward periodontal health status. The analysis of the patient's attitude towards the same will benefit the operator in assessing the interest he/she will have in accepting the information as well as the treatment. The current study aimed to collect baseline data on awareness, attitude, and practices of diabetic patients in Karad city of Maharashtra state, concerning their periodontal status given improving dental health education of the targeted population.

MATERIALS AND METHODS

Study design

The current study's hospital-based, cross-sectional survey was carried out among the diabetic patients visiting the dental hospital at Krishna Institute of Medical Sciences, deemed to be a university, (KIMSUDU), Karad. The Ethical clearance for the study was obtained from the Institutional Ethical Committee (EIC) of KIMSUDU, Karad, (Ref. No. KIMSUDU/EC/06/2021, dated: 25/08/2021) before commencing the study. Informed verbal consent was obtained from each participant. The survey was conducted from November 2021 to January 2022.

Sample size

A sample size of 400 was calculated based on a diabetic prevalence rate of 2.4% from a national survey with the allowable error of 5% using the statistical formula, $n = Z^2pq/L^2$ [19].

Inclusion and exclusion criteria

The patients pre-diagnosed with type II diabetes above 35 years of age were included in the study and pregnant, lactating females, individuals with systemic illness, and subjects unwilling to participate were excluded from the study.

Data collection

The data collection was by a pretested questionnaire printed in English, Hindi, and the local language (Marathi), focusing on the awareness of various diabetic complications and periodontal disease. The questionnaire was preferred as a mode of data collection as it can be used to obtain standardized information. A structured questionnaire containing twenty questions divided into three parts based on a thorough review of the literature on diabetes and periodontal disease was designed based on the understanding of the disease. The validation of the questionnaire was regulated utilizing face validation, content validation, reliability, and consistency tests by piloting it on 30 subjects [20].

Statistical analysis

The data entries were done in Microsoft Office Excel 2010 and analyses of results were done using Statistical product and service solution (SPSS) version 21 software. Descriptive statistics such as frequency and percentage were calculated. The p-value was fixed at 0.05. The Chi-square test was used to analyze responses concerning three domains i.e. knowledge, awareness, and attitude of the study population.

RESULTS AND DISCUSSION

A total of 400 subjects, within the age range of 36-75 years participated in the study. The majority of the participants were in the age group of 41-50 years. On gender Correlation with overall knowledge, it revealed that females had a significant lack of knowledge on the association between periodontal disease and DM. The education level of the participants varied from above secondary school level (20.5%), below secondary (17.75%) to illiterate (61.75%). The correlation of education with overall knowledge revealed that the illiterate group had a significant lack of knowledge on the association between periodontal disease and DM.

Gender distribution of study population

The study population was heterogeneous, with 194 males (48.5%) and 206 females (51.5%).

Table 1. Age distribution of study population

	Mean	S.D	Minimum	Maximum
Age (in years)	47.69	8.43	0.42	26.0

Table 2. Gender distribution of study population

Gender	n (%)
Male	194 (48.5%)
Female	206 (51.5%)
Total	400 (100%)

Educational qualification of the study population

Out of the total study population, 82 (20.5%) were graduates, 71 (17.75%) had secondary school education and 247 (61.75%) were illiterate. **Tables 1-3** shows Demographic details of study participants.

Table 3. Educational qualification of the study population

Education level	n (%)
Illiterate	247 (61.75%)
<12 th standard	71 (17.75%)
>12 standard	82 (20.5%)
Total	84 (100%)

Response to knowledge questions

A majority of the subjects 64.5% ($p < 0.001$) knew that dental treatment can cure gum diseases. 52.5% of the subjects were unaware of any relationship between diabetes and gum health and 50.8% of the subjects did not know about the increased risk of developing gum-related problems due to diabetes. A significant proportion of the subjects were affirmative about the need to visit a dentist for check-ups and treatment of gum disease. About 58.8% of respondents did not know about the relation between diabetes and early tooth loss, however, 50.2% were aware of delayed wound healing due to diabetes. A vast majority of the subjects 90.8% ($p < 0.001$) did not know about periodontal disease as one of the complications of Diabetes Mellitus (**Table 4**).

Table 4. Level of knowledge of subjects enrolled in the study

KNOWLEDGE (n=400)	YES n (%)	NO n (%)	Chi square test	p-value
Do you know that dental treatment can cure gum diseases?	258 (64.5%)	142 (35.5%)	Chi = 33.64	p < 0.001**
Do you think there is any relation between diabetes and gum health?	190 (47.5%)	210 (52.5%)	Chi = 1.00	p = 0.317
Does being diabetic increase your risk of developing gum-related problems?	197 (49.2%)	203 (50.8%)	Chi = 0.09	p = 0.764
Do you think Treatment of gum disease involves regular visits to the dentist for checkups and treatment?	178 (44.5%)	222 (55.5%)	Chi = 4.84	p = 0.028*
Did you know diabetes might result in early loss of tooth?	165 (41.2%)	235 (58.8%)	Chi = 12.25	p < 0.001**
Do you think your healing of wounds is altered compared to non-diabetic?	201 (50.2%)	199 (49.8%)	Chi = 0.01	p = 0.920
Did you know that Periodontal disease (periodontitis) is one of the Diabetes Mellitus complications?	37 (9.2%)	363 (90.8%)	Chi = 265.6	p < 0.001**

Response to awareness questions

A significant proportion of the subjects 55% were unaware of bleeding gums. A great proportion of the subjects 73.8% were informed about their periodontal disease status by their doctor. A vast majority of the subjects 67.2% were referred to the dentist by their physician for dental consultation and 73% were informed about extra care of oral health to be taken, being diabetic. A majority of the subjects 63% experienced dryness of mouth and 56.5% experienced bad breath. A significant proportion of the subjects were unaware of the fact that good oral hygiene

maintenance could help in the prevention of worsening diabetes. The awareness was significantly less about cleaning aids other than toothpaste and toothbrush (Table 5).

Table 5. Level of awareness of subjects enrolled in the study

AWARENESS (n=400)	YES n (%)	NO n (%)	Chi squaretest	p-value
Do your gums bleed during brushing?	180 (45 %)	220 (55%)	Chi = 4.213	p = 0.04*
Have you been told by your dentist that you have a gum-related disease?	105 (26.2%)	295 (73.8%)	Chi = 90.25	p <0.001**
Did your physician ask you to consult a dentist?	131 (32.8%)	269 (67.2%)	Chi = 47.61	p <0.001**
Have you ever been told that you should be extra careful of oral health as you have diabetes?	108 (27 %)	292 (73%)	Chi = 84.64	p < 0.001**
Do you experience the dryness of your mouth?	148 (37%)	252 (63 %)	Chi = 27.04	p <0.001**
Do you experience bad breath?	174 (43.5 %)	226 (56.5%)	Chi = 6.76	p = 0.009*
Are you aware that good oral hygiene maintenance helps in preventing or worsening diabetes?	106 (26.5 %)	294 (73.5 %)	Chi = 88.36	p <0.001**
Have you heard about interdental Cleaning aids other than toothpaste and toothbrush?	133 (33.2%)	267 (66.8 %)	Chi = 44.89	p <0.001**

Response to attitude questions

A significant proportion of the study subjects 86.2% thought that problems with gums might be associated with their general health. A majority of the subject 77.5% felt the need to inform the dentist about their diabetic status. A greater proportion of the subjects 92% had never used interdental cleaning aids. 74% of the study subjects were interested in obtaining more information about gum-related diseases and 53.8% of subjects were willing to undergo treatment for the gum disease (Table 6).

Table 6. Level of the attitude of subjects enrolled in the study

ATTITUDE (n=400)	YES n (%)	NO n (%)	Chi squaretest	p-value
Do you think the problem in gums might be associated with your general health?	55 (13.8 %)	345 (86.2%)	Chi = 210.2	p <0.001**
Do you feel the need to inform your dentist that you have diabetes?	90 (22.5 %)	310 (77.5 %)	Chi = 121.0	p <0.001**
Do you use any interdental cleaning aids?	32 (8%)	368 (92 %)	Chi = 282.2	p <0.001**
Are you willing to get more information about gum-related diseases?	104 (26 %)	296 (74%)	Chi = 92.16	p <0.001**
Are you willing to get the treatment done for the gum disease?	215 (53.8%)	185 (46.2%)	Chi = 2.25	p = 0.134

Periodontal disease is a multifactorial, inflammatory disease caused by the interplay between virulent microorganisms and the host immune response [6]. Several systemic disorders manifest and have a direct effect on the oral tissues. Diabetes Mellitus (DM) has questioned various researchers over decades about its bidirectional relationship with periodontitis. Periodontal disease is considered the sixth complication of Diabetes mellitus [15]. Several studies carried out strongly indicate a bidirectional relationship between poor glycemic control and periodontal disease parameters [20-27]. Earlier studies have highlighted that there is a need to raise awareness among diabetic patients about the relationship between periodontitis and diabetes. Hence the current questionnaire-based study was undertaken which aimed at determining the knowledge, awareness, and attitude of diabetic patients toward periodontal disease. The literature suggests that there is an increased prevalence of diabetes in the age group between 35 to 70 years [28]. The current study demonstrated that the awareness among diabetes patients towards periodontal disease was independent of age. The gender distribution of the study consisted of a greater proportion of males as compared to the females. The level of knowledge and awareness among female subjects was more as compared to the males. This is in agreement with the findings by Shanmukappa et al. [20].

Two-thirds of the study population comprised uneducated participants, who had less knowledge and awareness as compared to educated study subjects. This is in contrast to the findings by Hegde *et al.*, where the majority of subjects showed inadequate awareness despite being educated [15]. The knowledge about the relation between diabetes and gum health was low amongst our participants, similar to results obtained by Shanmukappa *et al.* and Sandberg *et al.* [20, 29]. The low level of knowledge in our study, could be as the majority of the participants in our study belonged to the uneducated group (61.67%). A majority of the study population was not affirmative about the need to visit the dentist for check-ups and treatment of gum disease.

Most of the study subjects were aware of the delayed wound healing in the case of diabetes, which is in agreement with the finding reported by Shanmukappa, where the majority of the subjects (62.2%) were aware [15]. In the current study, the subjects were unaware of early tooth loss associated with the progression of the periodontitis, which is not following the findings reported by Murugesan *et al.* [30]. In this study, subjects did not know about periodontal disease as one of the complications of diabetes mellitus, which complies with the study conducted by Kamath *et al.* [31]. Among the overall study population, a greater proportion of the subjects were unaware they had a problem with bleeding gums, which is similar to findings by Renatus *et al.* [32]. In the current study, a majority of the study subjects were informed by their doctors about their periodontal disease status. This is in contrast to the results reported by Shanmukappa *et al.*, where participants stated that they had never been told by their doctors that they have gum problem/disease [20]. In the current study, very few subjects were advised to take extra care of their oral health owing to their condition of diabetes, which is in agreement with the findings by Jansson *et al.* [33].

About less than half of the subjects were referred to the dentist by their physician; this is in agreement with the findings by Al Habashneh *et al.* and Bowyer *et al.* [34]. The lack of referral by the physician could be due to the lack of awareness or regarding the interrelationship between diabetes and periodontitis. The proportion of subjects experiencing bad breath and dryness of mouth was more, which is similar to the findings reported by Eldarrat *et al.* [35]. A majority of the diabetic participants failed to recognize that periodontal disease might affect their glycemic level, which is following findings by Shanmukappa *et al.* [20].

The majority of subjects were not aware that problems in gums might be associated with their general health, these findings were following those by Moore *et al.* and Almas *et al.*, where the subjects failed to recognize the association between systemic health and gum diseases [36, 37]. The lack of awareness about the association of gum health to general health could be due to the lack of education or negligence towards themselves. In the current study, the majority of the subjects feel the need to inform their dentist about having diabetes; this is in agreement with the finding reported by Jansson *et al.* [33].

A greater proportion of the subjects were unaware of interdental cleaning aids and did not use interdental cleaning aids, these results are in contrast to the study by Jansson *et al.* and Sandberg *et al.* where half of the subjects reported that they used proximal cleaning aids regularly [29, 33]. The unawareness about the interdental cleaning aids could be due to inadequate knowledge and no easy availability of the same in the rural population.

There was a positive response from the subjects regarding getting more information about gum-related diseases. However, an average proportion of the study subjects were willing to get the treatment done for the gum disease, which shows unacceptability and negligence towards maintaining oral health.

The overall results suggest that the knowledge, awareness, and attitude of diabetic patients toward periodontal disease are not sufficient. Similar findings are reported in the study by Hegde *et al.* where a majority of the population had poor knowledge regarding the effects of diabetes on the oral cavity [15]. In a study conducted by Tang *et al.*, it was reported that literacy and patient awareness scores were negatively correlated to diabetic control; however, Bakhshandeh *et al.* demonstrated that diabetics with lower education levels were more likely to be diagnosed with periodontal disease [38, 39]. The current study indicates there is an insufficient level of knowledge and awareness among the subjects. The knowledge of the interrelationship between diabetes and periodontal disease will motivate the patient to maintain a healthy periodontium thereby reducing the severity of diabetes in the affected individuals.

Limitations and future perspective

The limitation of the current study was that out of the 400 study participants, the majority of the subjects belonged to an uneducated rural background, which could have led to bias in lack of awareness and knowledge among the participants. The future perspective could include stratification of the education level. Another limitation of the current study was that the study population included the patients visiting the dental hospital which has led to a lack of the generalizability of the findings. Hence, a multicentric study design can include multiple hospitals in the area.

CONCLUSION

There is insufficient knowledge, awareness, and attitude regarding the mutual relationship between diabetes and periodontitis among the rural population in Karad city of Maharashtra, India. Diabetic patients must be educated regarding the possible complications that might incur if oral healthcare and related diseases are ignored. They should be educated and motivated about the importance of oral hygiene maintenance and rehabilitation. The general physician treating diabetics should also educate them about the interrelationship between periodontal disease and diabetes. This will enable the further referral of the patient to the oral health care facility timely, which will benefit the overall well-being of the patient.

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