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Original Article

Knowledge and awareness of dental considerations in diabetic patients: A questionnaire survey

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Abstract

Diabetes Mellitus (DM) has become a worldwide concern, with several systemic and oral complications. Dental students must be aware of the condition. Hence, the study aimed to assess and compare the levels of knowledge and awareness regarding oral considerations in diabetic patients among interns and postgraduate (PG) dental students. The survey was conducted among interns (119) and PGs (92) from dental colleges in Mangalore, using a web-based questionnaire form consisting of 14 questions. A chi-square test analyzed the categorical variables, and an independent sample t-test was used to compare the two groups' mean knowledge and awareness scores. PGs exhibited significantly higher knowledge (p-value 0.000) about the average plasma glucose test (65.2%) than interns (39.5%). Whereas interns (45.4%) showed superior knowledge about the glycemic goal when compared to PGs (40.2%) ($p \leq 0.05$). However, the two groups had no statistically significant difference in the mean knowledge and awareness scores (p-values 0.156 and 0.618, respectively). Although the study groups exhibited similar levels of knowledge and awareness, the dental students' accurate response rate about the risk factors of diabetes, prophylactic antibiotic coverage, hypoglycemic state, and its symptoms were limited. Establishing effective educational resources for dental students is necessary to address this issue.

Keywords: diabetes mellitus, xerostomia, glycemic goal, uncontrolled diabetes, hypoglycemia.

Introduction

Diabetes mellitus (DM) is a chronic condition marked by elevated blood glucose levels due to a shortage of insulin secretion, function, or both [1]. According to the International Diabetes Federation (IDF), diabetes is expected to have a prevalence of more than 10.9% in 2045 [2]. Type 1 diabetes, type 2 diabetes (T2DM), and gestational diabetes mellitus are the three primary subtypes, each with its subgroups. Physical inactivity and poor diet make obesity and T2DM more likely to coexist [3]. Four hundred fifty-one million people worldwide had T2DM in 2017, making it the most common type of diabetes and a significant public health issue [4].

Diabetes has drawn the attention of specialists and general practitioners in both medicine and dentistry due to its increased incidence. Diabetic patients might develop a variety of macrovascular and microvascular systemic illnesses. There has been abundant research on how DM affects the oral cavity. In the scientific literature, DM has been linked to complications such as periodontal disease, salivary gland dysfunction, halitosis, a burning mouth sensation, and taste dysfunction. Additionally, individuals with DM are more vulnerable to bacterial and fungal infections, soft tissue lesions of the mouth, impaired oral wound healing, dental caries, and tooth loss [5]. Notably, the level of glycemic control a patient exhibits is a key factor in determining the

severity and propensity of oral health issues [6]. The current treatment of diabetes includes a significant emphasis on preventing and managing these problems. Because of this, in 2009, the International Diabetes Federation (IDF) released the "guideline on dental health for individuals with diabetes", which encourages the integration of oral care into diabetes management [7].

Given the wide range of possible oral manifestations of DM and the possibility of an intraoperative diabetic emergency, dentists must understand how the condition affects dental treatment, particularly when performing invasive procedures. Hence, this survey was conducted to assess and compare the knowledge and awareness level of interns and postgraduate students regarding dental considerations in diabetic patients.

Material and methods

Recruitment of study subjects

The survey was conducted using a self-constructed web-based questionnaire among interns and PGs from dental institutions in Mangalore, Karnataka, India. A total of 211 responses were obtained from interns and postgraduates from July to September 2022. The nature and objective of the study were disclosed to each participant, and their prior consent was obtained.

Questionnaire design

The questionnaire consisted of 14 multiple-choice questions designed to appraise the knowledge and awareness levels of interns and PG dental students about diabetes. The first seven questions were incorporated to assess the knowledge level, and the following seven questions were assigned to evaluate the awareness level. Each question had four options: the correct answer was scored as one, and the incorrect answer was scored as zero.

Statistical analysis

The collected data were analyzed using IBM SPSS (Statistical Package for Social Sciences, IBM Co., Armonk, NY, USA) version 26 statistical software. The responses for each question were expressed in percentage and frequency. Pearson's Chi-square test was used to compare the proportions, and the independent samples t-test was applied to compare the mean knowledge and awareness scores between the two groups. A p-value of ≤0.05 was considered to be statistically significant.

Sample size calculation formula

$$N=p(1-p)\ x(Z_{\alpha}/E)^2$$
$$=0.729(1-0.729)\times(1.96/0.06)^2$$
$$=210.72\approx211$$

The study required a total sample size 211 at a 95% confidence level.

Results

Subjects

Of 211 participants, 119 (56.3%) responses were submitted by interns and 92 (43.6%) by PGs.

Diabetes-related knowledge assessment

The questionnaire used to evaluate the knowledge of dentistry students included a total of seven items. As depicted in Table 1, only less than half of the interns and PGs knew the diabetes risk factors. PGs had significantly higher knowledge than interns about the average plasma glucose test (p-value 0.000). About 65.2% of PGs stated precisely that the glycated hemoglobin (HbA1c) test indicates the average plasma glucose level over the previous 8–12 weeks, whereas only 39.5% of interns were able to acknowledge it. Surprisingly, interns (45.4%) demonstrated better knowledge of glycemic goal levels than postgraduates (40.2%), with a p-value of 0.005. There was a knowledge deficit with regard to the diagnostic criteria of diabetes, with only 43.7% of interns and 45.7% of PGs responding correctly to it. Nevertheless, a majority of the participants (over 50%) possessed a sufficient understanding of the oral signs linked to unmanaged diabetes and the appropriate timing for scheduling appointments for individuals with diabetes.

Diabetes-related awareness assessment

The percentage of correct responses to questions related to awareness was generally more or less similar between the two groups, as shown in Table 2. Less than 50% of dental students correctly identified Penicillin as the commonly prescribed prophylactic antibiotic. Delayed wound healing is a postsurgical complication of uncontrolled diabetes and was recognized by more

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Table 1: Number and percentage of interns and postgraduates with correct responses to knowledge-related questions.

Questions about knowledge of diabetes	Correct response	Interns (n=119)	PGs (n=92)	P-value*
		Number and percentage of correct response		
Which type of diabetes is more prevalent in the Indian population? (Q1)	Type-2 diabetes	81 (68.1)	63 (68.5)	0.093
Which is the risk factor for diabetes? (Q2)	Obesity with a history of both hypertension and polycystic ovarian disease	38 (31.9)	23 (25)	0.716
Which test reflects the average plasma glucose level over the previous 8-12 weeks? (Q3)	HbA1c	47 (39.5)	60 (65.2)	**0.000**[a]
What is the glycemic goal for the majority of non-pregnant women? (Q4)	>7% HbA1c	54 (45.4)	37 (40.2)	**0.005**[a]
Which of the following are the diagnostic criteria for diabetes? (Q5)	≥126 mg/dl of fasting plasma glucose & ≥200 mg/dl of 2 h postprandial glucose (Two abnormal results)	52 (43.7)	42 (45.7)	0.487
What are the common oral manifestations in uncontrolled diabetic patients? (Q6)	Xerostomia and burning sensation in the mouth	66 (55.5)	58 (63.0)	0.385
What is the advisable treatment schedule for diabetic patients? (Q7)	Morning	94 (79.0)	77 (83.7)	0.360

Note: * – Pearson Chi-square test; [a] – Statistically significant (significance inferred at p≤0.05).

Table 2: Number and percentage of interns and postgraduates with correct responses to awareness-related questions.

Questions about awareness of diabetes	Correct response	Interns (n=119)	PGs (n=92)	P-value*
		Number and percentage of correct response		
Which of the following is the most commonly used prophylactic antibiotic for uncontrolled diabetic patients? (Q8)	Penicillin	41 (34.5)	38 (41.3)	0.325[b]
What are the common postsurgical complications encountered in poorly controlled diabetic patients? (Q9)	Delayed wound healing and increased risk of infection	90 (75.6)	69 (75.0)	0.336[b]
Which of the following medical emergencies is encountered in severe hyperglycemia? (Q10)	Shortness of breath, ketoacidosis and coma	60 (50.4)	46 (50.0)	0.942[b]
Which of the following is a commonly seen complication in insulin-dependent diabetic patients during dental treatment? (Q11)	Hypoglycemia	65 (54.6)	51 (55.4)	0.272[b]

Table 2: Continued.

Questions about awareness of diabetes	Correct response	Interns (n=119)	PGs (n=92)	P-value*
		Number and percentage of correct response		
Which of the following blood sugar levels indicates a hypoglycemic state? (Q12)	<70 mg/dL	34 (28.6)	35 (38.0)	0.283 [b]
Which of the following is a symptom of severe hypoglycemia? (Q13)	Seizures	31 (26.1)	15 (16.3)	0.223 [b]
How is hypoglycemia in a conscious diabetic patient managed in the dental office? (Q14)	15 g of oral glucose	78 (65.5)	63 (68.5)	0.955 [b]

Note: * – Pearson Chi-square test; [b] – Statistically significant (significance inferred at p≤0.05).

than half of the interns and postgraduates (75%, on average). A similar trend was seen in the responses to the common complication present in insulin-dependent diabetes patients (approximately 55%). Unfortunately, dental students, whether they were interns or PGs, did not pay enough attention to the hypoglycemic state and its symptoms. Only 28.6% of interns, 26% of PGs, and 38% of interns and 16% of PGs were aware of the hypoglycemic state and symptoms of severe hypoglycemia, respectively. However, more than 50% of participants from both groups stated accurately that hypoglycemic-conscious individuals should be managed with 15 g of oral glucose.

Comparison of knowledge and awareness levels

According to the data presented in Table 3, there was no significant difference (p>0.05) in the average scores of knowledge and awareness between the two groups, with t-values of -1.425 and -0.499, respectively. This emphasizes that both interns and postgraduates exhibited a similar level of understanding and awareness concerning diabetes.

Discussion

The management of diabetes is a crucial factor to consider when planning dental treatments due to the intricate nature of the disease. Individuals with diabetes frequently experience various oral complications, including gum disease, tooth loss, dry mouth, tooth decay, burning mouth syndrome, difficulties with taste and salivary gland function, delayed wound healing, lichen planus, geographic tongue, and fungal infections such as candidiasis [8].

As a vital part of a multidisciplinary approach, dentists are anticipated to manage diabetes and its oral implications effectively, given its prevalence in dental practice. Their care should be guided by strategies to identify oral diseases that can impact glycemic control, consequently influencing oral health [9]. Additionally, dentists should possess knowledge about the pathophysiology of diabetes, recognize its oral manifestations, signs, and symptoms, and be prepared to respond to emergencies [10, 11].

Evaluating the behavior of dental students in relation to diabetes is vital in order to gauge their understanding, which can help establish goals for their training in both public and private healthcare settings,

Table 3: Independent samples t-test for comparison of the mean score for knowledge and awareness of interns and postgraduates.

Variables	Interns (n=119)		Postgraduates (n=92)		SE	T-value	P-value**
	Mean score	SD	Mean score	SD			
Knowledge	3.63	1.29	3.91	1.59	0.198	-1.425	0.156 [b]
Awareness	3.34	1.38	3.45	1.56	0.203	-0.499	0.618 [b]

Note: SD – Standard deviation; SE – standard error difference; ** – Significance inferred at p≤0.05 based on independent samples t-test; [b] – Statistically not significant.

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educational institutions, and teaching facilities. This assessment is crucial for defining educational guidelines and improving the quality of care provided to patients with diabetes. Therefore, it holds significant importance to assess and compare dental students' knowledge and awareness regarding diabetes.

Individuals of South Asian descent, especially Asian Indians, are part of an ethnic group with a notable inclination towards developing type 2 diabetes. This susceptibility can be attributed to their distinctive phenotype, characterized by increased levels of abdominal fat and heightened insulin resistance, even at lower body mass index (BMI) values [12]. Most participants (approximately 70%) in the present study acknowledged accurately that type 2 diabetes was more prevalent in India. According to the American Diabetes Association, obese individuals with both hypertension and polycystic ovarian disease are under threat of developing diabetes [13]. In the present study, only 32% of interns and 25% of postgraduates responded suitably.

Healthcare professionals utilize the HbA1c test to evaluate the control and management of diabetes mellitus. This test, reported as a percentage, offers insights into the average blood glucose levels experienced by an individual over the preceding three months [14]. PGs had better knowledge (65.2%) about this when compared to interns (39.5%). This was in accordance with the results of a survey conducted by Amrithaa *et al*., in which only 3.9% of students answered accurately that the HbA1c test represents the average blood glucose level [15]. The glycemic goal recommendation for most non-pregnant adults is <7%, based on the criteria of the American Diabetes Association [3]. It is an important parameter for practicing dentists to be aware of. However, only 40% of the group participants could appreciate it. This was in contrast to a survey conducted in 2020, in which 60.2% of participants strongly agreed that less than 5.7% of HbA1c level was a good glycemic control [16].

Reduced saliva production is a typical oral characteristic of diabetes. Patients with uncontrolled diabetes may experience a burning sensation in the oral cavity and changes in their sense of taste [17]. Approximately half of the interns and 60% of postgraduates were knowledgeable about this phenomenon. It is recommended for patients with diabetes that morning appointments are scheduled since cortisol levels naturally rise during this time, which can elevate blood glucose levels and decrease the likelihood of hypoglycemic episodes during the visit [18]. In this survey, most of the participants (around 80%) were well-informed regarding the preferable appointment timings for diabetic individuals. The immunocompromised status of diabetic patients is often responsible for their increased susceptibility to oral bacterial infections [19]. Diabetic patients under control, listed for standard invasive oral procedures, do not require prophylactic antibiotics. However, in an uncontrolled diabetic state, it is recommended to prescribe Penicillin as a prophylactic antibiotic [20]. 40% of dental students were informed of this [21].

When it comes to the surgical aspect, surgical procedures in diabetic patients can be challenging due to complications such as inadequate soft tissue regeneration and delayed bone healing. Managing and treating these patients becomes more difficult as a result. According to a report, factors like delayed vascularization, reduced blood flow, weakened immune response, diminished production of growth factors, and psychological stress contribute to the prolonged healing of oral wounds in diabetic individuals [22]. A majority of the participants (around 75%) in this survey were familiar with it. A similar trend was seen in a survey conducted by Amrithaa *et al*. in 2022, where 86.1% of dental students responded that poor control of blood sugar could cause delayed wound healing [15].

While managing patients with diabetes, the most frequent complication encountered is a hypoglycemic episode; however, hyperglycemia is also a potential occurrence [8]. It can lead to severe medical conditions such as diabetic ketoacidosis (in both type 1 and type 2 diabetes) and even hyperosmolar coma, specifically in type 2 diabetes, posing life-threatening risks. Some of the common symptoms of the hyperglycemic crisis include severe breathing and shortness of breath, chest pain, confusion, and coma [23]. Around half of the dental students in the present study acknowledged it.

A hypoglycemic episode is the most prevalent intraoperative complication observed in individuals with DM [22]. When the levels of insulin or oral hypoglycemic drugs surpass the body's physiological requirements, the patient may encounter a significant decrease in blood sugar levels [24]. Unfortunately, only half of the participants in the study were aware of this complication of insulin-dependent diabetic patients. The hypoglycemic episode develops when the blood glucose reaches less than 70 mg/dl [21]. This was accurately appreciated by only 28.6% of interns and 38% of PGs. Signs and symptoms of hypoglycemia include mood changes, hunger, and weakness followed by sweating, incoherence, tachycardia, and coma [21]. However, only 26% of interns and 16% of postgraduates were aware of it.

In a suspected hypoglycemic episode, the dentist should promptly halt dental treatment and administer

15 grams of oral carbohydrates through candy, juice, or glucose tablets [25]. Research has indicated that consuming 15 grams of glucose increases blood glucose levels by approximately 2.1 mmol/L within 20 minutes [26]. Most participants responded precisely that 15g of oral glucose could be administered to manage a hypoglycemic-conscious patient.

When comparing the percentage of responses from each group, it was found that PGs better understood average plasma glucose tests. At the same time, interns demonstrated greater knowledge regarding glycemic targets. However, both groups displayed unsatisfactory knowledge regarding the risk factors of diabetes, hypoglycemic conditions, and their complications. This emphasizes the urgent necessity of enhancing diabetes-related knowledge and awareness among dental students.

There were certain limitations in the present study. This included a restricted geographical area and response quality issue bias, such as respondents providing incomplete, inaccurate, or inconsistent answers. Hence, conducting similar studies on a larger scale, thereby addressing interdisciplinary dental management in diabetes, is necessary.

Conclusion

Due to the risks and complications involved, DM presents an enormous health challenge to practicing dentists. The present study showed a low level of knowledge and awareness in the survey population studied. Most students had theoretical knowledge about certain important aspects of diabetes but were lacking when it came to managing medical emergencies in the dental office. Hence, there is a need to educate the dental fraternity to keep them abreast of the latest trends in patient management trends. This would help them to provide better care for diabetic patients and minimize the incidence of dental emergencies associated with dental treatment.

Conflict of interest

The authors declare no conflict of interest.

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