

Evaluation of Dental Student's Knowledge among Diabetes: A Cross Sectional Study

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Abstract

Patients with uncontrolled diabetes are at greater risk for several oral health complications, particularly periodontal disease. Moreover, there is evidence to support a bidirectional relationship between diabetes and periodontal disease. As the prevalence of diabetes continues to rise, it is expected that dental practitioners will be seeing and treating greater numbers of diabetic patients. The aim of this study was to evaluate the knowledge, attitudes and practice of dental students towards diabetic patients. A cross-sectional study was conducted by means of a questionnaire among dental students in a private dental university in Morocco. Qualitative variables were described in terms of numbers and percentages and were compared using a Chi-square test. A p-value of less than 0.005 was considered significant. A total of 268 students participated in the assessment, corresponding to a response rate of 83.7%. The results showed that 80.6% of the students believed that knowing the type of diabetes was important. 14.2% knew the risks that the diabetic patient incurred in dental treatments. For analytical results, 3 groups corresponding to the final 3 years of their 6-year dental curriculum were compared. When asking about the knowledge of the risks incurred by the diabetic patient, there was a statistically significant difference ($p < 0.001$) between the 3 groups. On the other hand, a statistically significant difference ($p < 0.001$) was observed between students in 4th, 5th and 6th year concerning the prescription of antibiotics for endodontic procedures if $HbA1c < 7$. There was a statistically significant difference ($p < 0.001$) between the 3 groups concerning the knowledge of antibiotics and analgesics prescribed in odontology for diabetic patients. To overcome the lack of knowledge relevant to dental students, it is essential that clinical internship of students must consider the management of patients with diabetes. Finally, continuing educational programs should be followed by dentists to improve their knowledge of the management of diabetic patients.

Keywords

Diabetes, Dental Student, Public Health, Attitude

1. Introduction

According to the estimations of WHO (world health organization) and IDF (international diabetes foundation), the incidence and prevalence of diabetes continue rising. Indeed, 425 million people in the world are diabetic, this could rise to 629 million in 2045, which is one person in ten. In addition, one in two people was estimated to be undiagnosed and unaware of his condition.

In Morocco, more than 2 million people aged 18 and over are diabetic, 50% of them are unaware of their disease [1].

The oral cavity presents a site of many complications of diabetes. Such oral complications include periodontal disease, fungal infections, xerostomia, oral ulcers, and many others [2].

Based on the Centers for Disease Control estimates, young adults with diabetes have about twice the risk of periodontal disease than young adults with no diabetes, and almost one-third of people with diabetes have severe periodontal disease [3]. Moreover, there is evidence to support a bidirectional relationship between diabetes and periodontal disease. That is to say that poor glycemic control contributes to poor periodontal health, and periodontal infection contributes to poor glycemic control in patients with diabetes [4]. A study based on an analysis of Third National Health and Nutrition Examination Survey data shows that the prevalence of diabetes in patients with periodontitis is double more than that seen in non-periodontitis patients [3].

Dentists are well positioned to detect undiagnosed patients with diabetes early by recognizing oral manifestations of diabetes and referring suspected undiagnosed patients to a physician for further diagnostic workup.

One study in the northeastern states found that the majority of general dentists surveyed lacked knowledge about diabetes, and believed that activities related to management of patients with diabetes in the dental setting are peripheral to their role and that their patients and colleagues did not expect them to perform those activities [3].

In Morocco, no study was conducted to assess the management of patients with diabetes by dentists.

The objective of this review was to assess dental students' knowledge, attitudes and practices related to patients with diabetes in a private faculty of dentistry in Morocco.

2. Objectives and Type of the Study

The objective of this study was to assess dental students' knowledge, attitudes and practices related to patients with diabetes and to explore the association be-

tween student's knowledge and academic level.

In order to meet the above objectives, we conducted a cross-sectional descriptive study.

3. Materials and Methods

3.1. Location of the Study

International Faculty of Dentistry of Rabat, at the International University of Rabat (UIR)

3.2. Study Population

3.2.1. Inclusion Criteria

Dental faculty in Morocco have followed the French educational structure, embracing a five-year programme of undergraduated dental education, as well as one-year internship before obtaining a dental practicing license. Starting with a three-year preclinic period, the students obtain theoretical information about oral hygiene and healthcare, with minimal applied or practical training on artificial teeth and dummy heads. Following this stage, students starts two clinical years in which they attend lectures and perform clinical treatment on real patients. Finally, graduates must attend an additional one-year internship program in order to obtain a bachelor of medicine and surgery degree upon successful examination and graduation.

The lecture of diabetic patients' management is provided to students in their 3rd year of curriculum.

All undergraduated dental students in the 4th, 5th and 6th year in the international faculty of dentistry of Rabat were enrolled in the study.

3.2.2. Exclusion Criteria

Were excluded from our sample dental students who did not have yet the theoretical lecture on the management of diabetic patients in odontology, which are students in the 1th, 2nd and 3rd year.

3.3. Collection of Data and Variables Studied

The questionnaire (appendix) was developed by the authors and had four primary sections. The first section gathered information on respondents' demographic characteristics including age, sex and educational level. The second section assessed participants' knowledge of diabetic. This section included items about risks of diabetes, diagnostic of diabetes, management of hypoglycemia, interaction drugs. The third section assessed participants' attitudes and practice toward diabetic patients to evaluate if the students apply the recommendations of diabetic patients' management. The participants were asked to state for each statement, if they agree or disagree.

The questionnaire was sent to the students at the beginning of the 2020/2021 academic year to their email addresses, and the responses were received anonymously. No information on the identity of the respondents was collected.

The participants were distinguished according to their year of study, to assess the association between student's knowledge among diabetes and educational level.

3.4. Statistical Analysis

Statistical analysis was performed using SPSS 20.0.0 (Statistic Package for Social Science) software. Quantitative variables with symmetric distribution were expressed in mean and standard deviation. The qualitative variables were expressed in number and percentage. The analyses and associations between different variables were studied using the following statistical tests:

- The Chi-square test for the comparison of qualitative variables.
- Fisher's exact test for comparing qualitative variables when the Chi-square test cannot be applied (when one of the theoretical numbers is less than 5).

The significance threshold was set at 5%.

Data analysis was performed by the International University of Rabat, College of Health Sciences, International Faculty of Dental Medicine, BioMed Unit.

4. Results

From 368 surveys distributed, a total of 268 students accepted to participate to our survey. The response rate was 72.8%.

The students participating in our study were between 20 and 26 years old, with an average age of 22.2 ± 1.2 (**Table 1**).

Among 80.6% of students believed that knowing the type of diabetes is important, 88.8% of students consulted with patient's physician to assess diabetes control.

14.2% of students knew the risks that the diabetic patient incurred in dental treatments.

Students responded to if diabetes was considered balanced when:

- Fasting blood sugar < 1.26 g/l per (89.2%);
- Postprandial blood glucose < 3 g/l per (43.7%);
- And HbA1c $< 7\%$ (88.4%) (**Table 2**).

Table 1. Characteristics of the study population.

Variables	N = 268
Age (year)*	22.2 \pm 1.2
Gender**	
Feminine	148 (55.2)
Masculine	120 (44.8)
Level of study**	
4th year	86 (32.1)
5th year	94 (35.1)
6th year	88 (32.8)

* Expressed in mean \pm standard deviation, ** Expressed in number and (percentage).

Table 2. Description of the population studied according to the management of the diabetic patient.

	N = 268
Knowing the type of diabetes is important for management*	
Yes	216 (80.6)
Consulting attending doctor *	
Yes	238 (88.8)
Information collected during the interrogatory*	
Family history of diabetes	176 (65.7)
Type of diabetes	209 (78)
Duration of illness	143 (53.4)
Blood glucose level and HbA1c	250 (93.3)
Frequency of medical checks	214 (79.9)
Complications of Diabetes	199 (74.3)
Antidiabetic drugs	249 (92.9)
Knowledge of the risks incurred by the diabetic patient*	
Yes	38 (14.2)
Balanced Diabetes*	
Fasting blood sugar < 1.26 g/l per	239 (89.2%)
Postprandial blood glucose < 3 g/l per	117 (43.7%)
HbA1c < 7%	237 (88.4%)
Tooth infection worsens diabetes*	
Yes	130 (48.7)
Stress can lead to hyperglycemia*	
Yes	183 (68.3)
Modification of insulin dosage if endodontic procedure*	
Yes	93 (35)
In an insulin-dependent person, actions must be*	
Planned in the morning	235 (87.7)
Of short time	249 (92.9)
Performed on an empty stomach	60 (22.4)
Outside peaks of insulin activity	173 (64.6)
Sedative premedication prescription*	
Yes	92 (34.3)
If HbA1c ≤ 7, endodontic procedures can be performed without antibiotic coverage*	
Yes	172 (64.2)
Endodontic treatment if 7 < HbA1c < 8 *	
Antibiotic prophylaxis	88 (33.2)
Continuing antibiotic prophylaxis of antibiotic therapy	52 (19.6)
Antibiotic is not necessary	152 (47.2)
Use of anesthesia with vasoconstrictor is possible if HbA1c>8*	
Yes	56 (20.9)

* Expressed in number and (percentage).

For oral care, the type of diabetes seems important to know for 96.6% of 6th year students, 83% of 5th year students and 61.6% of 4th year students. This difference was statistically significant ($p < 0.001$) (Table 3).

There was a statistically significant difference ($p < 0.001$) between the 4th, 5th and 6th year students concerning the elements of the interrogatory: family history of diabetes, type of diabetes, duration of the disease, and complications of diabetes. It seems that there was no statistically significant difference between students in 4th, 5th and 6th year concerning the elements of the interrogatory: blood glucose level ($p = 0.38$), frequency of medical checks ($p = 0.55$) and anti-diabetic drugs ($p = 0.50$) (Table 4).

About 68.3% of students agreed that stress can lead to hyperglycemia, and 35% considered that a modification of the insulin dosage can be considered.

76.9% students who participated in our survey recognized that anesthesia with vasoconstrictor should not be used for unbalanced diabetic patients.

Concerning the knowledge of the risks incurred in the diabetic patient, there was a statistically significant difference ($p < 0.001$) between the students in 4th, 5th, and 6th year.

There was no statistically significant difference concerning the management of patients in private practice if HbA1c > 8 ($p = 0.31$).

On the other hand, a statistically significant difference ($p < 0.001$) was observed between students in 4th, 5th and 6th year concerning the prescription of antibiotics for endodontic procedures if HbA1c < 7 .

Table 3. Comparison between the 3 groups according to the importance of the type of diabetes for the management of the diabetic patient.

	4th	5th	6th	p
Type of diabetes for the management of the diabetic patient*	53 (61.6)	78 (83)	85 (96.6)	<0.001

* Expressed in number and (percentage).

Table 4. Comparison between the 3 groups according to the elements collected during the interrogatory.

	4th	5th	6th	p
Family history of diabetes*	37 (43)	72 (76.6)	67 (76.1)	<0.001
Type of diabetes*	51 (59.3)	76 (80.9)	82 (93.2)	<0.001
Duration of illness*	27 (31.4)	57 (60.6)	59 (67)	<0.001
Blood glucose and HbA1c levels*	81 (94.2)	85 (90.4)	84 (95.5)	0.38
Frequency of medical checks*	72 (83.7)	73 (77.7)	69 (78.4)	0.55
Diabetes Complications*	44 (51.2)	70 (74.5)	85 (96.6)	<0.001
Antidiabetic drugs*	81 (94.2)	85 (90.4)	83 (94.3)	0.50

* Expressed in number and (percentage).

There was a statistically significant difference ($p < 0.001$) between students in 4th, 5th and 6th year concerning the knowledge of antibiotics and analgesics prescribed in odontology for a diabetic patient.

A statistically significant difference ($p < 0.001$) between students in 4th, 5th and 6th year has been reported concerning the management of hypoglycemia (Table 5).

5. Discussion

Diabetes is a systemic disease that affects the whole organism, including the oral cavity. The dentist plays a key role to detect undiagnosed patients with diabetes in any patient showing signs of this disease [5]. The diagnosis, treatment and control of the patient require a perfect knowledge of this pathology [6].

At the first appointment, the dentist must obtain detailed information about the type of diabetes, previous treatments and medications used by the patient so that he can classify him according to the degree of risk he will be exposed to during clinical procedures. Indeed, patients undergoing insulin therapy have an increased susceptibility to hypoglycemia during dental procedures. In addition, oral hypoglycemic agents may have drug interactions with those prescribed by the dentist [7] [8].

Moreover, 80.6% of students who participated in our survey considered that knowing the type of diabetes is essential when taking care of the diabetic patient. On the other hand, practitioners must consult with patient's physician to assess diabetes control in order to know all the information concerning the patient's state of health; 88.8% of our students agreed with this statement.

A study conducted by Anabelle T. *et al.* within a health network in France found that more than half of the doctors surveyed declared that the dentists asked them to know some medical data before carrying out oral care. However, 25.2% of dentists were satisfied with the information provided by the patient, and 10.10% carried out the act under antibiotic prophylaxis systematically [6].

When asking the participants about the risks incurred by patients with diabetes, 14.2% identified them, 6th year students had a significantly level of agreement ($p < 0.001$).

Table 5. Comparison between the 3 groups.

	4th	5th	6th	p
Risks incurred by the diabetic patient in odontology*	2 (2.3)	8 (8.5)	28 (31.8)	<0.001
Endodontic procedures without antibiotic prescription when HbA1c < 7*	43 (50)	62 (66)	67 (78.8)	<0.001
Antibiotics prescribed for a diabetic*	12 (14)	18 (19.1)	41 (46.6)	<0.001
Analgesics prescribed for a diabetic*	8 (9.3)	17 (18.1)	30 (34.1)	<0.001
What to do in case of hypoglycemic discomfort*	4 (4.7)	8 (8.5)	37 (42)	<0.001

* Expressed in number and (percentage).

Indeed, diabetic patients are prone to infections. However, the aim of endodontics treatment is not to add an infectious risk on a fragile ground. This treatment generates low bacteremia, especially compared to avulsions and periodontal care. According to the national medical security agency in 2011, the frequency of induced bacteremia rises to 31.2% in case of endodontic treatment with a peri-apical overrun, compared to a zero percentage 0% in the case of endodontic treatment without peri-apical exceeding [8].

- The balanced diabetic patient (HbA1c < 7%) is considered as a healthy subject, initial endodontic treatments and endodontic retreatment can be carried out by respecting the usual precautions. There are no contraindications to surgical treatment such as endodontic surgery.
- For the unbalanced patient (7% < HbA1c < 8%) in whom endodontic treatment is necessary, two scenarios are possible:
 - o If it is an initial treatment on a vital tooth (deemed to be conserved and functional), the treatment can be considered. The essential prerequisite for any endodontic treatment is to be able to isolate the tooth correctly and effectively by setting up a rubber dam. The impossibility of placing the rubber dam is in itself a contraindication to endodontic treatment, especially in a patient at risk of infection;
 - o If it is an initial treatment or retreatment on an infected tooth and the tooth is of major strategic interest, after having assessed its feasibility, the treatment may be carried out under antibiotic prophylaxis. This is based on the infective endocarditis protocol. We will then do treatments in one session to not multiply antibiotic prophylaxis. If necessary, the tooth will have to be extracted [9].

Regardless of the patient's level of infection risk, antibiotic prophylaxis is not indicated for non-invasive procedures (non-bloody preventive procedures; conservative care; taking dental x-rays, etc.) [9].

We found that when faced with a controlled diabetic patient, participants have given an antibiotic coverage, before anesthesia and before setting up a rubber dam, although in reality the indication for coverage antibiotic is not necessary. According to the study by AL RAHABI M. and ABUANG Z. in Al Madinah in 2017, it was reported that antibiotic prophylaxis is systematically introduced by private dentists regardless of the nature of the act to be performed [10].

On the other hand, Cortisol is an endogenous hormone that increases blood glucose levels. Because Cortisol levels are typically higher in the morning and during times of stress (e.g., a dental procedure), it is advisable that diabetic patients are scheduled for morning appointments. In taking this precaution, the dentist reduces the risk of a hypoglycemic episode. For patients receiving exogenous insulin therapy, appointment scheduling should avoid the time of peak insulin activity when the risk of hypoglycemia is highest. If these patients require surgery or invasive procedures, the dentist should consult their physician regarding possible adjustment of insulin doses. Sedation may be recommended

[11].

Our study found that 40.7% of students agreed that the sessions should be scheduled in the morning, of short duration and outside peak insulin activity for insulin-dependent patients.

About 68.3% of students agreed that stress can lead to hyperglycemia, and 35% considered that a modification of the insulin dosage can be considered.

Moreover, in most dental procedures, anesthesia is an essential step allowing both the comfort of the practitioner and the patient. Studies found that epinephrine (vasoconstrictor) exerts a pharmacological effect opposite to that of insulin, contributing to the increase in blood sugar, especially in diabetes [12] [13].

According to Terra BG *et al.*, administration of vasoconstrictors from the catecholamine group, such as epinephrine (adrenaline), is not recommended in these patients until glycemic control is assured. Therefore, the use of these vasoconstrictors is allowed in patients with controlled diabetes [12]. In this sense, 76.9% students who participated in our survey recognized that anesthesia with vasoconstrictor should not be used for unbalanced diabetic patients. Indeed, the presence of uncontrolled diabetes represents an absolute contraindication to the use of adrenergic receptor vasoconstrictors associated with local anesthetics.

The study conducted by Corbati I. *et al.* in the United Kingdom reported that 20% of dentists used anesthesia without vasoconstrictors for uncontrolled diabetic patients. Another study conducted by A. Vander Auwera *et al.* showed that only 25.3% of participants chose anesthesia without vasoconstrictors among this type of patient [14] [15].

Studies showed that antibiotics, except aminoglycosides which should not be prescribed in case of renal failure, sedatives and the usual analgesics can be used without complication. However, acetylsalicylic acid should be avoided because of its interference with oral hypoglycemics.

Our study found that 26.5% of students recognized the antibiotics that could be prescribed for a diabetic patient. 20.5% recognized the analgesics that could be used by the diabetic patient. Only 15.7% of students chose aspirin as a possibility of prescription for a diabetic patient. We found that 6th year students were more likely to recognize the antibiotics and analgesics that can be prescribed for a diabetic patient. This difference is statistically significant.

In daily practice, the primary objective of the dentist will be to avoid metabolic disorders or imbalances during the treatment period. As a rule, the patient must be informed by the procedure to follow, concerning his diet and/or his treatment in order to reduce as much as possible any risk of hyper- or hypoglycemia.

The most common intraoperative complication of diabetes is a hypoglycemic episode. The risk is highest during peak insulin activity, when the patient does not eat before an appointment or when oral hypoglycemic medication and/ or insulin levels exceed the needs of the body.

Hypoglycemia can be seen when blood sugar levels are below 40 milligrams per deciliter of blood, accompanied by characteristic signs and symptoms such

as paleness, tremors, tachycardia, sweating, dizziness, drowsiness, mental confusion, weakness, headache, and blurred vision [14]. In the presence of any of these manifestations, the dentist must interrupt the procedure and give the patient a food rich in carbohydrates and must then monitor his blood sugar every 15 minutes until the blood sugar is normalized [16].

Our study showed that 44.4% of students recognized that care must be stopped immediately if this discomfort occurs and must give sugar when the patient is conscious. A study conducted by Joshi S. and al. reported that 71.8% of the dentists had chosen the correct management of the emergency [17].

The results of this survey should be taken with caution because it is a declarative study, so a discrepancy is likely to exist between declared practices and actual practices.

6. Conclusion

The care of diabetic patients requires the dentist to have a perfect knowledge of the various risks to which they are exposed. This survey has allowed us to have an overview of the dental students' knowledge, in the 4th, 5th and 6th year of the International Faculty of Dentistry of the UIR, among this category of patients. For better care of diabetic patients, we recommend that the validation of clinical internships for students consider the management of patients at risk. Moreover, every service of care should have a protocol for managing hypoglycemia in both conscious and unconscious patients with the emergency number on it, to allow students and practitioners to refer to it. Finally, continuing educational programs should be followed by dentists to improve their knowledge of the management of patients with diabetes.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Appendix

Q1. Level of study:

4 th year 5 th year 6 th year

Q2. Age:

Q3. Gender:

Men Women

Q4. For diabetic patients, knowing the type of diabetes seems essential to you for oral care:

Agree

Disagree

Q5. Faced with a diabetic patient or suspected diabetes:

You consult with patient's physician to assess diabetes control

You are satisfied with the information given by the patient

Q6. Among the information that you think is important to collect during the interrogation

6.1. Family history of diabetes Yes No

6.2. Type of diabetes Yes No

6.3. Recent levels of blood glucose and HbA1C Yes No

6.4. Frequency of medical controls Yes No

6.5. Complications of diabetes Yes No

6.1. Antidiabetic drugs Yes No

Q7. The diabetic patient may present a risk:

7.1. Infectious Yes No

7.2. Hemorrhagic Yes No

7.3. Anesthetic Yes No

7.4. Drugs interaction Yes No

7.5. Hypoglycemic faintness Yes No

Q8. Diabetes is considered balanced when:

8.1. Fasting blood sugar < 1.26 g/L Yes No

8.2. Post prandial blood sugar < 3 g/L Yes No

8.3. HbA1c < 7% Yes No

Q9. Any dental infection increase diabetics' complications:

Agree

Disagree

Q10. Stress can cause hyperglycemia:

Agree

Disagree

Q11. In an endodontic treatment, a modification of the insulin dosage is possible:

Agree

Disagree

Q12. For Diabetic patients Type I, the dental treatment should be:

12.1. Planned in the morning Yes No

12.2. Of short time Yes No

12.3. Performed on an empty stomach Yes No

12.4. Outside peaks of insulin activity Yes No

Q13. Before starting the treatment, you prescribe sedative premedication for the diabetic patient:

Agree

Disagree

Q14. You assess the glucose level before starting your treatment:

Agree

Disagree

Q15. In case of HbA1c > 8, patient management is possible in a private practice:

Agree

Disagree

Q16. In case of HbA1c ≤ 7, endodontic procedures can be performed without antibiotics:

Agree

Disagree

Q17. In case of 7 < HbA1c < 8, for endodontic treatment:

You prescribe antibiotic prophylaxis

You prescribe an antibiotic prophylaxis continued 7 to 10 days after the operation.

The antibiotic is not necessary

Q18. Procedures requiring a prescription for antibiotic prophylaxis:

	Intra-ligament Anesthesia	Conservative treatments	Loco-regionale Anesthesia	Endodontic Treatments
Balanced diabetes	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
Moderate Hyperglycemia	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
High Hyperglycemia	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No

Q19. If HbA1c > 8, the use of anesthesia with vasoconstrictors is possible:

Agree

Disagree

Q20. If prescribed medication, a diabetic can take:

Amoxicillin

Amoxicillin + clavulanic acid

Spiramycin

Metronidazole

Q21. For an analgesic effect, a diabetic can take:

Paracetamol

- Aspirin-containing compounds
- Paracetamol + codeine
- Paracétamol + caffeine

Q22. In front of a patient presenting signs of hypoglycemia:

-
- You stop the care and administer the antidiabetic treatment. Yes No
 - You stop treatment and call the emergency number without moving the patient. Yes No
 - You stop treatment and inject glucagon IM or SC if the patient is unconscious regardless of the type of diabetes. Yes No
 - You stop the treatment and administer an oral source of carbohydrates if the patient is conscious regardless of the type of diabetes. Yes No
-