

Diabetes-Related Knowledge and Sources of Information among Periodontal Patients: Is There a Role for Dental Hygienists?

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Introduction

A considerable body of research has found a relationship between periodontal disease and diabetes. For example, in 2007, a panel of experts representing academic, research and clinical medicine and dentistry performed a systematic review of the literature concerning diabetes and periodontal disease.¹ They concluded that diabetes can affect the periodontium and that periodontitis is an important complication of diabetes.¹ In their meta-analysis in 2006, Khader et al concluded that while persons with and without diabetes had the same extent of periodontal disease, persons with diabetes had significantly higher severity of disease.² Other meta-analyses have suggested that periodontal treatment may lead to some improvement in glycemic control in persons with diabetes.³⁻⁵ In addition, Strauss et al analyzed diabetes and periodontal disease data collected in the 2003 to 2004 National Health and Nutrition Examination Survey (NHANES).⁶ They found that among individuals with moderate or severe periodontal disease who reported never having been diagnosed with diabetes, 93% met American Diabetes Association criteria for diabetes risk and would have been recommended for diabetes screening according to the American Diabetes Association's guidelines.⁶ In view of the many individuals with undiagnosed diabetes,⁷ the increased risk for diabetes among persons with periodontal disease⁶ and the fact that some persons with periodontal disease might not be screened for

Abstract

Purpose: Although there is a bidirectional relationship between periodontal disease and diabetes, little is known about the diabetes-related knowledge of periodontal patients. This study examines what patients with periodontal disease know about diabetes and its association with periodontitis. It also examines their sources of diabetes-related information.

Methods: Patients (n=111) with or at risk for diabetes who were receiving care at a university-based periodontics and implant clinic completed a written survey assessing their socio-demographic characteristics, health-related activities, diabetes knowledge and sources of diabetes-related information. Survey results were summarized using descriptive statistics. Fisher's exact tests were used to compare patients who had and had not been diagnosed with diabetes according to responses on diabetes-related knowledge items and sources of diabetes information.

Results: Although respondents endorsed various diabetes-related information sources, including family and friends and health care providers, respondents demonstrated very limited knowledge about the diabetes and periodontal disease association. There were no statistically significant differences between patients who had, and had not been diagnosed with diabetes regarding their diabetes-related knowledge. As compared with patients not diagnosed with diabetes, patients with diabetes were significantly more likely to have learned about diabetes from a health care provider ($p=0.05$) and significantly less likely to have learned about it from friends or family ($p=0.05$).

Conclusion: Periodontal patients need education about the periodontitis-diabetes relationship. Dental hygienists' regular and ongoing involvement with these patients and their primary role in the patients' periodontal care places them in an optimal position to provide this education.

Keywords: Periodontal disease, Diabetes mellitus, Educational assessment; Dental hygienists

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diabetes because they do not have regular contact with a primary care provider,⁸ the dental visit may be an especially important setting for opportunistic diabetes screening. For patients already diagnosed with diabetes, monitoring the extent to which their diabetes is under control can help dental professionals make decisions about optimal treatment for oral health care.⁹

A variety of approaches can be used to screen for diabetes at dental visits. One approach involves the use of oral and demographic data to identify patients who are at risk.¹⁰⁻¹² Another involves using a hand-held glucose meter to perform chairside glucose testing using finger stick or gingival crevicular blood, the latter obtained from patients with periodontitis.¹³⁻¹⁷ Yet another approach involves the chairside collection of a sample of periodontal patients' finger stick or gingival crevicular blood placed on filter paper.¹⁸ The blood sample is then allowed to dry and sent to a laboratory for testing of hemoglobin A1c (HbA1c).¹⁸ The HbA1c test has recently been promoted by the American Diabetes Association as a test for diabetes diagnostic purposes.¹⁹

Some dental providers have, in fact, expressed their willingness to conduct chairside screenings for medical conditions, including diabetes.²⁰ However, dental chairside screenings also require dental patients' willingness to participate.²¹ Such willingness will likely require that patients have knowledge about diabetes and its association with periodontal disease. There has been some research in the U.S. and elsewhere examining diabetes patients' knowledge about periodontal disease as a complication of diabetes. This knowledge has been shown to be limited.²²⁻²⁸ For example, in a U.S. study, 30% of 253 individuals with diabetes did not know that people with diabetes are more likely to have gum disease and that diabetes could make the condition of one's teeth and gums worse.²² Another U.S. study involving 390 patients with diabetes found that only 18.2% recognized that their oral health might be affected by diabetes.²⁸ In addition, a study of 405 patients with diabetes in Jordan determined that 47.7% were aware that diabetes patients were prone to gum disease and oral health complications and 38% knew that periodontal treatment may help in controlling diabetes.²⁷ A study of 240 diabetic patients in Pakistan found that 35.4% knew that an individual with diabetes was more prone to oral diseases and 38% knew that smoking is more injurious to the gums of a person with diabetes than to a person without diabetes.²³ The studies that examined diabetes patients' sources of information regarding the link between diabetes and oral health identified these sources as including dentists, dental hygienists, physicians, nurses, the internet and televi-

sion.^{25,27} To our knowledge, no study has examined periodontal patients' knowledge about diabetes and its association with periodontitis and diabetes or the sources of their diabetes-related information.

To the extent that there may be gaps in knowledge about the periodontitis-diabetes relationship among periodontal patients, even patients who have regular contact with medical primary care providers may not have their knowledge gaps filled by these providers. Many medical providers have limited familiarity with the link between diabetes and periodontal disease.²⁹ However, dental hygienists are in a unique position to educate their patients and to reinforce diabetes-related knowledge. This is especially the case due to their regular involvement with periodontal patients who are seen several times each year for periodontal maintenance and their knowledge about the oral-systemic link. This knowledge is reflected in survey responses of 392 dental hygienists in 2008 that indicate that about 90% knew that periodontal disease is considered a complication of diabetes and that periodontal disease may worsen glycemic control, with 90.1% of the surveyed dental hygienists reporting feeling competent in educating patients about oral health and diabetes.³⁰ In addition, a 2007 survey of 134 U.S. dental hygiene program directors found that most dental hygiene students were assessed (and therefore needed to show competence) in their knowledge of the periodontal-diabetes association.³¹ For example, 90% of dental hygiene students were assessed on their ability to discover patients' potential for periodontal-diabetes complications and 92% for discussing the risk of these complications with patients. Research has also found that many dental hygienists currently provide information and educational materials to diabetes patients about periodontal disease and oral health.³⁰

This study examined current knowledge about diabetes and sources of diabetes-related information among periodontal patients with diabetes and periodontal patients at risk for diabetes in order to better understand their diabetes-related information needs.

Methods and Materials

Participant recruitment and data collection took place at the New York University (NYU) College of Dentistry Periodontics and Implant Clinic from March through May 2011. Prospective participants were involved in a study whose primary focus was to examine the acceptability and feasibility of using a novel intra-oral chairside diabetes screening approach.¹⁸ To be included, periodontal patients needed to be at least 18 years of age and either have diabetes or be at risk for diabetes according to criteria established

by the American Diabetes Association.³² Consistent with NHANES exclusion criteria, patients were ineligible to participate in the research if they required antibiotic pre-medication before dental treatment or if they had a history of severe cardiovascular, hepatic, immunological, renal, hematological or other organ impairment.³³ Individuals were assured that the decision regarding participation would not affect services they received at the NYU College of Dentistry. The institutional review board at the NYU School of Medicine approved all survey instruments and procedures.

After participants gave their informed consent for study participation, a research assistant monitored completion of a 5 minute eligibility assessment that determined self-reported diabetes status and elements of diabetes risk according to the American Diabetes Association (e.g., older age, high body mass index, amount of exercise during a given day, diabetes in a first degree relative, minority ethnicity/race).³² Participants completed a 10 minute written survey while waiting for their dental visit at the NYU College of Dentistry Periodontics and Implant Clinic. The survey gathered socio-demographic information not collected on the eligibility assessment (e.g., sex, education), participants' health related activities (regularity of visits with a dental provider, past testing for blood glucose) and assessed participants' knowledge about diabetes and their sources of diabetes-related information.

The Diabetes Knowledge Assessment and Sources of Diabetes-Related Information

The 10-item Diabetes Knowledge Assessment was developed by members of the project team using fact sheets from the National Institute of Dental and Craniofacial Research, the Centers for Disease Control and Prevention, the American Diabetes Association, the American Academy of Periodontology and the National Diabetes Information Clearinghouse,^{7,34-37} a report from the American Diabetes Association³⁸ and a review of the literature on diabetes and periodontal disease. Before pilot testing the assessment with 51 periodontal patients who participated in an earlier research study at the NYU College of Dentistry Periodontics and Implant Clinic,¹³ it was reviewed for appropriate wording and face validity by NYU colleagues with expertise in diabetes and periodontology. Detailed review of the assessment items with 5 of the study participants suggested addition of a "don't know" option for 8 of the 10 questions.

The Diabetes Knowledge Assessment contained 2 components: a General Diabetes Component (6 items) and a Periodontal-Diabetes Association Com-

ponent (4 items). The General Diabetes Component included items concerning the effect of diabetes on blood sugar, diabetes diet, types of diabetes, awareness of diabetes status, causes of diabetes and high blood glucose levels. The Periodontal-Diabetes Association Component contained questions concerning the periodontitis-diabetes connection and its relationship to smoking and to blood glucose levels. The first 2 items in the General Diabetes Component were multiple-choice type questions with 2 answer options. Each of the remaining items (4 questions) in the General Diabetes Component and all items in the Periodontal-Diabetes Association Component (4 questions) were true/false type questions along with a "don't know" option.

Participants also responded to questions regarding sources of diabetes information (a health care provider, friends or family, school, newspapers, magazines or books, television, or the internet).

Statistical Analysis

Descriptive statistics were used to report results on the Diabetes Knowledge Assessment, participants' socio-demographic characteristics and health-related factors, and sources of diabetes-related information. Fisher's exact tests were used to compare patients who reported that they had and had not been diagnosed with diabetes according to responses on diabetes-related knowledge and sources of diabetes-related information. All analyses were conducted using Predictive Analytics Software version 18.0.

Results

Characteristics of the Participants

Of the participants who completed the Diabetes Knowledge Assessment (n=111), 56.8% were female. Participants ranged in age from 23 to 87 years, with an average age of 56.6 years (SD=13.7). With regard to their ethnicity, 22.7% were Latino. A total of 37.3% were Black, African American or Caribbean, 40.0% were Caucasian and 7.3% were Asian, Native American, American Indian or Pacific Islander. All but 4 of the remaining 17 participants identified their race as Hispanic. Most (74.3%) had at least some college education. More than half of the respondents (58.6%) had a body mass index (BMI) >25 kg/m² and 48.6% indicated little daily exercise. A total of 80.2% saw a health care provider in the past year, with 84.3% of these participants indicating that they had a test for blood glucose in the past. In all, 79% of all 111 participants indicated that they had had a past test for blood glucose and 19.8% indicated that they had been told by a

Table I: Responses on the General Diabetes Component of the Diabetes Knowledge Assessment (%) (n=111)

Item	Told Have Diabetes (n=22)		Not Told Have Diabetes (n=89)			All Participants (n=111)			
	Choice A	Choice B	Choice A	Choice B	Choice A	Choice B	Choice A	Choice B	
The diabetes diet is: (a) A healthy diet for most people (b) Too high in protein for most people	86.4*	13.6	88.8*	11.2	88.3*	11.7	88.3*	11.7	
Diabetes causes your: (a) Blood sugar to be too high (b) Body to stop making blood sugar	100.0*	0.0	84.3*	15.7	87.4*	12.6	87.4*	12.6	
Item	Told Have Diabetes (n=22)			Not Told Have Diabetes (n=89)			All Participants (n=111)		
	True	False	Don't Know	True	False	Don't Know	True	False	Don't Know
There is just one type of diabetes	4.5	81.8*	13.6	3.4	83.1*	13.5	3.6	82.9*	13.5
Just about everyone who has diabetes knows that they have it	13.6	81.8*	4.5	2.2	83.1*	14.6	4.5	82.9*	12.6
A fasting blood sugar level of 250 is too high	72.7*	0.0	27.3	56.2*	2.2	41.6	59.5*	1.8	38.7
Eating too many sweet foods is one cause of diabetes	59.1	27.3*	13.6	56.2	24.7*	19.1	56.8	25.2*	18.0

*Correct Response

health care provider that they had diabetes. Almost half (45.9%) reported a first degree relative (i.e., a parent or sibling) who had diabetes. Most (78.7%) indicated that they had dental checkups at least annually with a dentist or dental hygienist.

Diabetes Knowledge Assessment

General Diabetes Component: As seen in Table I, more than 80% of the participants responded correctly to questions regarding the diabetes diet, effect of diabetes on blood sugar, the number of types of diabetes and the many people unaware that they have diabetes.^{7,35,38} However, only 59.5% (n=66) could correctly identify a high blood glucose level.⁷ Moreover, only 25.2% (n=28) knew that eating too many sweet foods did not cause diabetes.³⁵ There were no statistically significant differences between patients who had, and had not been diagnosed with diabetes according to their responses on any of the items on the General Diabetes Component (p>0.05).

Periodontal-Diabetes Association Component: As can be seen in Table II, only 39.6% (n=44) knew that "people with diabetes have gum problems more often if their blood sugar stays very high," and only 23.4% (n=26) knew that "if you have gum disease, it is likely to be harder to control your blood sugar."³⁶

In addition, only 17.1% (n=19) knew that people with diabetes who smoke are more likely to "get a bad case of gum disease" than those with diabetes who don't smoke,³⁴ and only 11.7% (n=13) knew that people with diabetes are more likely to have periodontal disease than those without diabetes.³⁷ The proportion of people who selected "don't know" regarding the association between periodontal disease and diabetes ranged from 45.0% to 61.3% (n=50 to n=68) on each of the items. There were no statistically significant differences between patients who had and had not been diagnosed with diabetes according to their responses on any of the items on the Periodontal-Diabetes Association Component (p>0.05).

Sources of Diabetes-Related Information

A total of 109 of the 111 participants who completed the Diabetes Knowledge Assessment selected 1 or more of the provided options in describing how they had learned about diabetes. As can be seen in Table III, more than half of the participants had learned about diabetes from friends or family. Some got their information from a health care provider (38.5%), print materials (36.7%) or television (30.3%). A smaller proportion of participants learned about diabetes from the internet (20.2%) or from school (13.8%). Patients who had been di-

Table II: Responses on the Periodontal-Diabetes Association Component of the Diabetes Knowledge Assessment (%) (n=111)

Item	Told Have Diabetes (n=22)			Not Told Have Diabetes (n=89)			All Participants (n=111)		
	True	False	Don't Know	True	False	Don't Know	True	False	Don't Know
People with diabetes have gum problems more often if their blood sugar stays very high	50.0*	4.5	45.5	37.1*	6.7	56.2	39.6*	6.3	54.1
If you have gum disease, it is likely to be harder to control your blood sugar	18.2*	18.2	63.6	24.7*	14.6	60.7	23.4*	15.3	61.3
For people with diabetes, those who smoke cigarettes get a bad case of gum disease about as often as those who don't smoke	50.0	9.1*	40.9	29.2	19.1*	51.7	33.3	17.1*	49.5
People with diabetes are just as likely to get gum disease as people who don't have diabetes	59.1	9.1*	31.8	39.3	12.4*	48.3	43.2	11.7*	45.0

*Correct Response

agnosed with diabetes were significantly more likely than patients who had not been diagnosed with the condition to have learned about diabetes from a health care provider (59.1% vs. 33.3%, respectively, $p=0.05$) and were significantly less likely to have learned about diabetes from friends or family (36.4% vs. 60.9%, respectively, $p=0.05$).

Table III: Participants' Sources of Diabetes-Related Information (%) (n=109)

Source	Told Have Diabetes (n=22)	Not Told Have Diabetes (n=87)	All Participants (n=109)
Friends or family ^a	36.4	60.9	56.0
Health care provider ^b	59.1	33.3	38.5
Newspapers, magazines, or books	31.8	37.9	36.7
Television	27.3	31.0	30.3
Internet	22.7	19.5	20.2
School	13.6	13.8	13.8

^a $p=.05$

^b $p=.05$

Discussion

Results indicate that this convenience sample of periodontal patients had greater knowledge about general diabetes issues than they did about the association between periodontal disease and diabetes. Given the high correlation between periodontitis and diabetes, it is concerning that correct responses to each of the 4 survey items on this association were endorsed by fewer than half of the participants, with a large percentage indicating that they did not know if these diabetes knowledge statements were true or false. Thus, both periodontal patients and diabetes patients have limitations in knowledge about the periodontal-diabetes link.²²⁻²⁸

Results suggest that participants had considerable exposure to general information about diabe-

tes. Friends and family were a frequent source of this information, especially for participants without diabetes. While health care providers were the most frequent source of this information for those who had been told they had diabetes, 79% indicated having had a test for blood glucose. Therefore, it is not surprising that a large minority of those who had never been told that they had diabetes also reported they had learned about diabetes from health care providers. However, because internists and endocrinologists may not have much specific knowledge about the relationship between diabetes and periodontal disease,²⁹ they may not have made the periodontal-diabetes association known to their patients. Whether learning about diabetes from family or friends, health care providers, printed material, television, the internet or school (similar sources of information for diabetes patients regarding periodontal disease^{25,27}), it is clear that the study sam-

ple's knowledge about the association between periodontal disease and diabetes is limited.

Dental hygienists are in a unique position to educate and periodically review information with periodontal patients about the oral-systemic disease connection, including mechanisms underlying the association between diabetes and periodontal disease, and they could also help patients to evaluate their own diabetes risk. In particular, dental hygienists can provide periodontal patients with disease prevention information, counsel patients with diabetes to maintain good glycemic control and collaborate with and/or refer patients to other health care providers. Many dental hygienists see their periodontal patients on a regular basis, and they are the primary professionals in periodontal practice charged with providing non-surgical periodontal care.³⁹

Regarding dental hygienists' knowledge about diabetes, Boyd et al's 2008 survey findings indicated that participating dental hygienists' diabetes and oral health knowledge was relatively up-to-date,³⁰ and Wilder et al's 2007 survey of U.S. dental hygiene program directors indicated that dental hygienists were knowledgeable about diabetes and that they were assessed for their diabetes-related competencies.³¹ However, many dental hygiene programs do not provide extensive diabetes education. For example, Wilder et al's survey found that 30.8% of 138 dental hygiene program directors reported fewer than 3 didactic hours of teaching about the periodontal-diabetes connection.³¹ In addition, Boyd et al reported that 75% of the 392 participants in their nationwide survey of dental hygienists indicated that they had 4 or fewer hours of diabetes education in their entry level dental hygiene programs.³⁰ Only 50.4% of the surveyed dental hygienists had completed more than 4 hours of continuing professional education related to diabetes since graduation from their professional programs.³⁰ Information about diabetes changes rapidly. Thus, in order for dental hygienists to be able to optimally inform and educate their patients about diabetes and its relationship to periodontal disease, they need more entry-level diabetes content and continuing education. This is of particular importance because patients do not appear to be obtaining this information elsewhere.

A limitation of this research is that the results were obtained using data from a non-random convenience sample of periodontal patients from 1 university-based periodontal clinic. As such, it is unclear to what extent the results are representative of periodontal patients in this or other university-based clinics or in periodontal practice settings in

diverse geographic locations. Additional research could focus on assessing periodontal patients' diabetes-related knowledge in a variety of locations and practices.

Conclusion

In spite of its limitations, this study suggests that knowledge about diabetes and its association with periodontal disease may be limited among periodontal patients. These results support the need for education about the periodontitis-diabetes relationship for these at-risk patients. In view of dental hygienists' regular and ongoing involvement with periodontal patients, their knowledge about the periodontal-diabetes association and their primary role in patients' periodontal care, they are in an optimal position to provide patients with comprehensive and accurate information to best maintain their health.

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