Research

Knowledge, Attitudes and Practices of Dental Hygienists Regarding Diabetes Risk Assessments and Screenings

Christina DeBiase RDH, MSDH; Lori Giblin-Scanlon RDH, DHSc;
Linda D. Boyd RDH, RDN, LD, EdD; Jared Vineyard, PhD

Abstract

Purpose: Untreated and poorly controlled diabetes causes increased levels of blood glucose associated with poor periodontal disease outcomes. Dental hygienists can play a significant role in screening patients for diabetes mellitus, leading to referral and early diagnosis. The purpose of this study was to determine the knowledge, attitudes, practices, and barriers faced by clinical dental hygienists regarding diabetes risk assessment and screenings.

Methods: A mixed method design was used with a convenience sample of dental hygienists in clinical practice (n=316). A 32 item, electronic survey was validated at item-level, and participants were recruited through multiple dental hygiene Facebook groups. Descriptive statistics were used to analyze the data. The survey also included two open-ended attitude questions that were interpreted using thematic analysis to pinpoint common patterns within the data.

Results: Dental hygienists had high knowledge scores regarding diabetes and oral health, although many were unaware of their states' specific statutes and regulations for screening practices. Nearly all (95.9%), were likely to educate and refer patients (82%), although fewer than half (40.9%), were likely to perform chairside screening for diabetes. Emergent themes for barriers to screening were time, money, patient acceptance/willingness, lack of education, not having the proper tools, and states' rules and regulations.

Conclusion: Despite high knowledge scores regarding diabetes and oral health, there is a gap in regards to dental hygienists' willingness to perform diabetes screenings in a clinical setting. Dental hygienists should be capable of integrating chairside diabetes screening practices into the process of care with proper training.

Keywords: diabetes mellitus, diabetes risk assessment, diabetes screening, dental hygienists, HbA1c testing

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Introduction

Diabetes is the seventh leading cause of death in the United States and the estimated financial burden related to the disease in 2017 was 327 billion dollars.[1] There are 1.5 million Americans diagnosed with diabetes annually. Of the 30.3 million adults currently living with diabetes, 7.2 million are undiagnosed, and 84.1 million Americans over the age of 18 had pre-diabetes in 2015.[1] Untreated or poorly controlled diabetes can result in elevated glucose levels, leading to complications including cardiovascular disease, vision loss, and renal disease.[2] Evidence from meta-analyses indicate that poor glycemic control is also associated with poorer periodontal health and outcomes.[3,4] According to the Centers for Disease Control and Prevention (CDC), 47.2% of American adults, or 64.7 million people, have mild, moderate, or severe periodontitis.[5] Periodontal disease is more common in men than women, in those living below the federal poverty level, in individuals with less than a high school education, and in individuals who use tobacco.[5]

Left untreated, periodontal disease can lead to tooth loss, periodontal infection, and poor blood glucose control.[5] Evidence from a meta-analysis indicates periodontitis significantly impacts glycemic control in patients with and without type 2 diabetes mellitus (T2DM).[3] There is a suggested bidirectional relationship between T2DM and periodontal disease, as

evidenced by improved glycemic control following periodontal treatment of chronic periodontitis in patients with T2DM.[4,6]

The evaluation of patients' risk for pre-diabetes and T2DM during dental hygiene patient assessment is recommended in the Standards for Clinical Dental Hygiene Practice.[7] Chairside screening using the American Diabetes Association Diabetes Risk Test has been positively correlated with HbA1c levels in periodontal maintenance patients.[8,9] Additionally, the consensus guidelines from the European Federation of Periodontology (EFP) and the International Diabetes Federation (IDF) report "the oral healthcare team have a role to play in identifying both prediabetes and undiagnosed diabetes mellitus, and physicians need to be aware of periodontal diseases and their implications for glycemic control in people with diabetes."[4] Since dental hygienists encounter periodontal patients who may be at risk for diabetes, they are encouraged to screen these patients for pre-diabetes, and T2DM.[7] Previous research demonstrates that dental hygienists are confident and knowledgeable in utilizing chairside caries risk assessments during patient care, therefore it should not be unfamiliar for dental hygienists to also perform diabetes risk assessments.[10,11]

More recent findings from a workshop co-sponsored by the American Academy of Periodontology (AAP) and the EFP published in 2018 presented an overview of a new classification system for properly diagnosing periodontal diseases and conditions.[12] This system employs a multidimensional staging and grading system that utilizes risk factors, including the individual's HbA1c level as a means of tracking the potential for progression of periodontal disease.[12] Uncontrolled diabetes can negatively modify the course of periodontitis, making the HbA1c level a crucial factor in comprehensive case management.[12]

Due to the recognition of an association between T2DM and periodontal disease, in 2017, the American Dental Association (ADA) developed code D0411 for hemoglobin A1c (HbA1c) in-office point of service testing.[13] This code enables dental professionals to provide chairside testing for dysglycemia via the finger-stick method in accordance with providers' state rules and regulations.[13] Additionally, in 2018, the ADA developed code D0412 for in-office blood glucose testing, using a glucose meter.[13] Similar to caries risk testing, diabetes risk testing is relevant to dentists in regards to overall treatment planning.[13] Moreover, the ADA encourages oral health care providers to determine patients' risk for disease by utilizing resources such as the Center for Disease Control Pre-diabetes Screening Test and the American Diabetes Association Type 2 Diabetes Risk Test, which identify patients at risk and candidates for in-office glucose and HbA1c testing.[13–15]

Despite evidence suggesting a bidirectional relationship between elevated glucose levels and periodontitis, and the development of code D0411 and D0412, dentists and dental hygienists may not screen patients for pre-diabetes or T2DM. By assessing a patient's risk for diabetes in the dental setting, oral health care providers are creating opportunities for referral and formal evaluation. This practice can ultimately support early diagnosis and potentially lessen the economic burden of T2DM in the United States.[16] The purpose of this study was to assess the knowledge, attitudes, and practices of dental hygienists in clinical practice regarding diabetes risk assessment and screening. Perceived barriers and obstacles faced, along with the perceived roles of dental hygienists may help identify a need for further education and practice changes.

Methods

A descriptive, cross-sectional survey research design was used with a convenience sample of dental hygienists in clinical practice. MCPHS University Institutional Review Board (IRB) gave this study an exempt status and assigned it protocol number IRB100118G. Inclusion criteria consisted of registered dental hygienists who provided direct patient care and were licensed in the United States and Canada. Exclusion criteria consisted of dental hygiene students and dental hygienists who are not currently licensed or are not providing clinical patient care.

Survey instrument

The survey instrument assessed knowledge, attitudes, and practices (KAP) using the 2018 American Diabetes Association Standards of medical care in diabetes, and the guidelines from the EFP and the IDF joint workshop on periodontitis and systemic diseases.[12] The final instrument consisted of 32 items divided into five sections: demographics (6 items); knowledge of T2DM and periodontal disease (5 items); knowledge of diabetes screening (5 items); attitudes towards diabetes screening in practice (8 items); and frequency of practicing diabetes screening (7 items). A 5-point Likert scale ranging from strongly agree to strongly disagree was used for the responses. Two additional open-ended questions were included to explore dental hygienists' perceived role regarding diabetes assessments and screenings, along with barriers faced.

Procedure

The survey was validated by 5 experts in the field of dental hygiene and diabetes. Item-level content validity index (CVI) was used to calculate the relevance of each item. Items that yielded ≥0.78 were considered to have good content validity

and were included in the survey.[17] The survey was piloted among 5 dental hygienists of various ages and education levels, who were practicing clinically, to ensure clarity of the survey questions. Following the pilot test, an invitation to participate in the survey was posted to Facebook groups that were dental hygiene related for recruitment of participants with an explanation of the purpose and link to the web-based survey. The invitation was reposted two weeks later as a reminder. Participants had the option of including email addresses of other dental hygienists who may have been interested in completing the survey. These individuals were emailed a link to participate in the survey.

Dats analysis

Data were explored using descriptive statistics. Frequencies were calculated for all categorical data and means plus standard deviations were calculated for continuous variables. Knowledge questions were coded as correct or incorrect. Neither agree nor disagree responses were interpreted as guesses and coded as incorrect. Correct responses were summed for each participant to create a total number of correct variables. The question, "My states rules and regulations do not allow me to perform HbA1c screenings on my patients" was recoded from a 5-point Likert (strongly agree to strongly disagree) to a dichotomous variable with aware=1 and unaware=0. Responses with either agree or disagree were interpreted as being aware of the state regulations; while neither agree nor disagree was interpreted as being unaware of the regulations. Attitude question responses used a five-point Likert scale (-2=strongly disagree, -1=disagree, 0=neither agree nor disagree, 1=agree, 2=strongly agree).

Bi-variate analysis using Spearman's Rank Order Correlations was used to determine the relationship between all study variables. The Mann-Whitney U test was used to determine rank order differences in the number of correct knowledge responses and the Likert scale questions between being aware or unaware of state regulations. The Kruskal-Wallis H test was used to determine rank order differences in the number of correct knowledge responses and the Likert scale questions between different education level categories. All hypothesis testing used an alpha=.05 as the cut off for statistical significance. All analysis was conducted using the Statistical Package for the Social Sciences, SPSS 23 (IBM; Armonk, NY).

The responses from the two open-ended questions were organized and prepared for data analysis. The data was read and re-read to gather the meaning and then coded into common words and phrases. The words and phrases were generated into themes to describe the overall findings.

Results

A total of 332 participants attempted the survey, and 316 completed the survey (n=316), for a completion rate of 95%. The final sample consisted predominantly of females (98%) and males (2%). The median age of the respondents was 38 years, and ranged from 22 years to 72 years. Participant demographics are shown in Table I. Of the study sample (n=316), there were 269 responses to the open-ended questions regarding barriers to performing screenings. Common themes included time, money, patient acceptance/willingness, lack of education, not having the proper tools, and states rules and regulations.

Table I. Respondent demographics

	n	%
What is your gender? (n=316)		
Female	310	98.1%
Male	6	1.9%
Other	0	0.0%
What is the highest level of education you have completed? (n=313)		
Associates Degree	154	49.2%
Bachelor's Degree	133	42.5%
Master's Degree	25	8.0%
Doctoral Degree	1	0.3%
	Mean	**SD***
What is your age?	40.7	12.6
How many years has it been since you graduated from an entry level dental hygiene program?	14.6	12.3
How many years of dental hygiene clinical practice do you have?	14.4	11.9
How many hours do you provide direct patient care per week?	29.5	10.0

* **SD=standard deviation of the mean.**

Knowledge

Nearly three-fourths of the respondents (71%) were unaware of their state's regulations regarding HbA1c screenings. Most participants (70%), correctly answered the knowledge question regarding oral health and diabetes. The question "People with periodontitis have an increased risk of developing pre-diabetes and type 2 diabetes mellitus" had the highest percentage of incorrect responses (30%) from the oral health knowledge questions. For the remaining questions about diabetes, the highest number of incorrect responses

were in regards to gender differences (41%) and high blood pressure (43%. Knowledge responses are shown in Table II.

The median number of correct responses for the ten knowledge questions was eight. In regards to questions about oral health and diabetes only, 79% of participants answered four or more, out of five questions correctly, while 73% answered four or more, out of five, questions about diabetes correctly. The median number of correct responses for participants awareness of their state regulations and those who were unaware, were nine and eight, respectively. A Mann-Whitney's U test was conducted to evaluate the difference in the total number of correct responses. Participants who were aware of their state regulations had a higher median number of correct responses (Mdn=9) than participants who were unaware (Mdn=8); ($Z = -2.83$, $p=0.005$, $r = 0.16$).

Table II. Knowledge response frequencies

		n	%
People with periodontitis have an increased risk of developing pre-diabetes and type II diabetes mellitus.	Incorrect	94	29.7%
	Correct	222	70.3%
People with diabetes have an increased risk of developing gum disease.	Incorrect	4	1.3%
	Correct	312	98.7%
People with diabetes and periodontitis may have an increased risk for kidney and cardiovascular diseases.	Incorrect	11	3.5%
	Correct	305	96.5%
People with periodontitis have increased levels of HbA1c, when compared to people with better periodontal health.	Incorrect	77	24.4%
	Correct	239	75.6%
Treatment of chronic periodontitis may modestly improve glycemic control in patients with type 2 diabetes mellitus.	Incorrect	51	16.2%
	Correct	264	83.8%
Men have a higher risk of undiagnosed diabetes than women.	Incorrect	130	41.1%
	Correct	186	58.9%
Family history of diabetes can increase the risk for diabetes.	Incorrect	9	2.8%
	Correct	307	97.2%
Physical activity can decrease the risk for diabetes.	Incorrect	21	6.7%
	Correct	294	93.3%
High Body Mass Index (BMI) can increase the risk for diabetes.	Incorrect	13	4.1%
	Correct	303	95.9%
High blood pressure can contribute to an increased risk for diabetes.	Incorrect	135	43.0%
	Correct	179	57.0%

Attitude

When asked about whether it was their professional responsibility to screen patients for diabetes, a little more than one-half (56%) agreed, while a little less than one-half (47%) agreed that performing a diabetes screening was an integral part of dental hygiene treatment planning. Nearly one-third (32%), indicated that they were not comfortable performing diabetes screening. Most participants (91%), felt the need for continuing education for diabetes screening and assessment, while a little more than one-half (53%) reported not having enough knowledge to perform the screening. Participant attitudes are shown in Table III.

Practice

Various questions related to diabetes screening and assessment practice were asked. Overall, the practice question most often endorsed by dental hygienists was referring patients for a medical follow-up to ensure proper diabetes management (96%), while the least endorsed was using a glucose meter chairside to obtain HbA1c levels (24%). Practice question responses are shown in Table IV.

Knowledge, Attitude, Practice Question Relationships

Each attitude and practice question response variable was correlated with the total number of correct responses to explore the relationship between all study responses. Spearman correlations were calculated for all continuous demographic variables and Likert scale questions. There were no significant correlations between demographics and attitude, practice, or knowledge ($p>.05$). A Kruskal-Wallis test was performed to identify differences in median values for attitude and practice items as well as correct knowledge question between different education levels. All results were non-significant ($p>.05$).

Table III. Attitude responses

		n	%
It is not my professional responsibility to screen my patients for diabetes.	Strongly Agree	10	3.2%
	Agree	49	15.5%
	Neither Agree nor Disagree	79	25.0%
	Disagree	121	38.3%
	Strongly Disagree	57	18.0%
Performing diabetes screening is an integral part of dental hygiene treatment planning.	Strongly Agree	47	14.9%
	Agree	102	32.3%
	Neither Agree nor Disagree	122	38.6%
	Disagree	41	13.0%
	Strongly Disagree	4	1.3%
I do not feel comfortable performing HbA1c screenings on my patients.	Strongly Agree	25	8.0%
	Agree	83	26.4%
	Neither Agree nor Disagree	104	33.1%
	Disagree	66	21.0%
	Strongly Disagree	36	11.5%
I feel the need for continuing education courses on diabetes risk assessment and screening.	Strongly Agree	128	40.5%
	Agree	159	50.3%
	Neither Agree nor Disagree	18	5.7%
	Disagree	9	2.8%
	Strongly Disagree	1	.3%
I do not have enough knowledge on diabetes screening tools.	Strongly Agree	27	8.6%
	Agree	138	43.8%
	Neither Agree nor Disagree	46	14.6%
	Disagree	77	24.4%
	Strongly Disagree	27	8.6%
I do not have enough time to perform diabetes risk assessments or screenings when applicable.	Strongly Agree	58	18.4%
	Agree	124	39.2%
	Neither Agree nor Disagree	59	18.7%
	Disagree	59	18.7%
	Strongly Disagree	16	5.1%
My office is not equipped to perform HbA1c screenings.	Strongly Agree	149	47.2%
	Agree	133	42.1%
	Neither Agree nor Disagree	13	4.1%
	Disagree	17	5.4%
	Strongly Disagree	4	1.3%
My states rules and regulations do not allow me to perform HbA1c screenings on my patients	Unaware	223	70.8%
	Aware	92	29.2%

Discussion

Dental hygienists are primary preventative specialists and are in a unique position to implement diabetes risk assessments and screenings in clinical settings. This study provides information on the current knowledge, attitude, and practices regarding diabetes risk assessments and screenings. Data from this study found dental hygienists have high knowledge scores regarding the suggested relationship between diabetes mellitus and periodontal disease. The significant relationship between high knowledge scores and being unaware of statutory rules and regulations for diabetes screenings suggests dental hygienists are knowledgeable but unaware of their state's rules and regulations regarding HbA1c screenings. Additionally, while nearly all dental hygienists felt the need for continuing education courses on HbA1c screenings, over one-half (67.5%) of respondents felt they were not comfortable performing them. This is notably a smaller percentage as compared to a similar study conducted in 2008, where 91.7% of hygienists reported being unlikely to perform HbA1c screenings.[18]

In addition to HbA1c and glucose screenings, diabetes risk assessment tests such as the American Diabetes Association diabetes risk test and the CDC Pre-diabetes test are suitable assessments for evaluating a patient's risk for disease.[14,15] The American Dental Hygienists' Association (ADHA) Standards for Clinical Dental Hygiene Practice guidelines recommends the evaluation of a patients' overall risk for disease when treatment planning.[7] However, only 56.3% of respondents in this study felt it was their professional responsibility to screen patients for diabetes mellitus, and only 47.2% identified diabetes screenings as an integral part of dental hygiene treatment planning. While many respondents felt it was not their role to screen for diabetes, past studies have shown that evaluating a patients risk for diabetes and concurrently assessing their HbA1c level, led to the identification of pre-diabetes-diabetes in asymptomatic patients.[8,9,19–22]

Moreover, when asked how likely the respondent was to use a chairside questionnaire, only 40.9% were in agreement. When asked

Table IV. Practices

		n	%
How likely are you to ask a patient with pre-diabetes or diabetes for their most recent HbA1c level?	Very likely	149	47.2%
	Likely	67	21.2%
	Neither likely nor unlikely	41	13.0%
	Unlikely	47	14.9%
	Very unlikely	12	3.8%
How likely are you to use a chair-side diabetes risk assessment questionnaire?	Very likely	40	12.7%
	Likely	89	28.2%
	Neither likely nor unlikely	71	22.5%
	Unlikely	85	26.9%
	Very unlikely	31	9.8%
How likely are you to use a glucose meter chair-side to obtain HbA1c levels?	Very likely	29	9.2%
	Likely	48	15.2%
	Neither likely nor unlikely	61	19.3%
	Unlikely	95	30.1%
	Very unlikely	83	26.3%
How likely are you to educate patients with diabetes about the association between oral health and diabetes management?	Very likely	223	70.6%
	Likely	80	25.3%
	Neither likely nor unlikely	8	2.5%
	Unlikely	5	1.6%
	Very unlikely	0	0.0%
How likely are you to refer a patient for medical follow-up to ensure proper diabetes management?	Very likely	149	47.2%
	Likely	110	34.8%
	Neither likely nor unlikely	40	12.7%
	Unlikely	13	4.1%
	Very unlikely	4	1.3%
How likely are you to collaborate with health professionals about a patient's diabetes management?	Very likely	82	25.9%
	Likely	99	31.3%
	Neither likely nor unlikely	76	24.1%
	Unlikely	47	14.9%
	Very unlikely	12	3.8%

about time constraints, 57.6% of respondents felt there was not enough time to perform diabetes risk assessments or screenings, an improvement over responses from a previous study finding indicating that 70.6% of the dental hygienists survey felt that they had insufficient time to perform screenings.[18]

The ADHA recommends dental hygienists collaborate with health professionals for definitive diagnoses and treatment referrals as a means of evaluating patient outcomes.[7] Most respondents reported that they were likely to educate patients about the association between oral health and diabetes management (95.9%) and refer a patient for medical follow up to ensure proper diabetes management (82%). This finding is consistent with previous findings from 2008 with 90% of dental hygienists reporting being likely to educate, and 80% being likely to refer.[18] Regarding respondents perceived role regarding diabetes risk assessment and screening in the current study, the most common response was educating patients on the oral-systemic link between diabetes and periodontitis and giving referrals.

It is highly likely for dental hygienists to educate their patients and give referrals when appropriate. Unfortunately, if dental hygienists are not screening for T2DM, they are not properly referring high risk individuals for medical follow up. This gap may be the result of a lack of education regarding proper tools to assess a patient's risk for T2DM, which, when integrated into the dental hygiene process of care, may ultimately lead to referral and diagnosis. These findings suggest the need for continuing education courses on the relationship between diabetes and periodontal disease, including valid and reliable forms of diabetes risk assessments/screening tools. This finding is similar to other studies which have recommended continuing education courses on oral conditions and systemic diseases.[18,23] Hands-on training of diabetes assessment/screening tools may be beneficial for dental hygienists, along with information on current ADA codes such as D0411 and D0412, which allow for in-office glucose and HbA1c screening. Future studies should be conducted to evaluate patient willingness for glucose and HbA1c screening by dental hygienists in a clinical dental setting to support the advancement of the dental hygiene scope of practice and to increase the proportion of persons with diabetes whose condition has been diagnosed.

This study had limitations. The social media platform "Facebook" was used to deliver the survey limiting to individuals who use Facebook, and members of various online dental groups. Thus, the non-probability sample cannot be generalized to the total population. Self-reporting bias may have occurred due to participants' propensity for participation correlating with an interest in the topic of study. Additionally, respondents may have given a response that represents the average and not

necessarily their own behavior. While this study was targeted at all clinical practicing dental hygienists, the type of practice settings were not gathered and also limits the generalization of the findings.

Conclusion

Results indicate that dental hygienists had high knowledge scores on the oral-systemic link between diabetes mellitus and periodontal disease. While dental hygienists perceive themselves to be educators of the oral-systemic link and would likely educate and refer, most felt they did not possess the proper education on the current diabetes risk assessment/screening tools. There is a need to improve dental hygienists' willingness to include diabetes screening into the process of care, while also increasing their confidence in doing so. Additionally, ongoing professional development courses on the use of established diabetes risk questionnaires, and time management should be designed to influence practice behaviors.

Christina DeBiase RDH, MSDH is an adjunct professor at New York City College of Technology, Brooklyn, NY; ***Lori Giblin-Scanlon RDH, DHSc,*** is an associate professor and the Associate Dean of the Forsyth School of Dental Hygiene, MCPHS University, Boston, MA; ***Linda D. Boyd RDH, RDN, LD, EdD*** is a professor and the Associate Dean of Graduate Studies, Forsyth School of Dental Hygiene; MCPHS University, Boston, MA; ***Jared Vineyard, PhD*** is a post-doctoral fellow, Idaho State University, Pocatello, ID.

Corresponding author: Lori Giblin-Scanlon RDH, DHSc; Lori.giblin@mcphs.edu

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