Adequacy of Oral Health Information for Patients with Diabetes

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Abstract

Objective: *We investigated the perception of dental hygienists regarding their adequacy of providing diabetics with diabetes-related oral health preventive education.* ***Methods:*** *A one-page questionnaire printed on both sides was mailed to 2,237 licensed registered dental hygienists with a South Carolina (SC) mailing address. In addition to the dental hygienists' background and practice characteristics, their perception of adequacy for educating patients with diabetes on various diabetes-related oral health topics and reasons for inadequate coverage of materials were queried in the survey.* ***Results:*** *After two follow-up mailings, 995 completed and usable surveys were returned. An average of 93.6 percent of respondents indicated that they adequately covered topics of oral hygiene and general oral health issues. However, about 60 percent of respondents reported not covering all essential materials related to oral health when educating diabetic patients. The three most common reasons were: a) insufficient time (60.1 percent); b) patient disinterest (41.2 percent); and c) insufficient information on oral care and diabetes (39.7 percent). Respondents reporting insufficient information were less likely to adequately address the effect of periodontal disease on diabetes (*$P < 0.001$*), effect of uncontrolled diabetes on periodontal disease (*$P < 0.001$*), and dry mouth management (*$P = 0.03$*).* ***Conclusion:*** *This study indicates that SC dental hygienists do not routinely provide patient education on diabetes-related oral health and healthy lifestyle topics. Lack of time, patient disinterest, and insufficient information were the three main reasons for respondents not covering these essentials. A practical method for improving dental hygienists' comprehensive service to patients with diabetes is to offer them more continuing education on diabetes and oral health to supplement their knowledge, skills, and confidence to educate this growing population.*

Key Words: patient education, dental hygienists, oral health, diabetes mellitus, questionnaire

Introduction

Diabetes mellitus is a chronic metabolic disease with serious oral health implications. People with diabetes, especially those with uncontrolled or poorly controlled diabetes, have an increased susceptibility to chronic infections and inflammation of oral tissues, including periodontal disease (chronic gingivitis and periodontitis), dental caries, and oral candidiasis (1,2), which contributes to substantial oral functional disability and impaired quality of life (3). The likelihood of having periodontal disease among diabetics is about three times greater than among nondiabetics (4). For people with uncontrolled or poorly controlled diabetes, periodontal diseases progress more rapidly and more severely than in their controlled or nondiabetic counterparts (4). Studies (5,6) suggest a bidirectional relationship between periodontal disease and diabetes, with periodontal disease worsening glycemic control, and uncontrolled or poorly controlled diabetes increasing the likelihood of destructive periodontitis.

In addition, dry mouth is a common diabetic phenomenon (1). The decrease of salivary flow may predispose these individuals to dental caries and oral candidiasis (7). Frequent daily intake of refined carbohydrates (e.g., snacking) may also contribute to a higher incidence of caries among diabetics (8). Effective control of oral disease can be attained systemically through better glycemic control, and locally through improved oral hygiene (9,10). Therefore, diabetics must be educated about the importance of controlling blood sugar, removing oral plaque daily through meticulous oral hygiene, managing dry mouth, ceasing tobacco use, managing diet, and obtaining regular professional dental cleaning and care (10,11). Studies also show that improved oral health may facilitate better glycemic control in people with poorly controlled diabetes (12-14).

A significant source of oral health information is dental hygienists who are well prepared to provide patient education concerning oral health preventive practices (15). Studies indicate that dental hygienists focus primarily on a variety of "traditional oral hygiene instructional" activities (e.g., providing information on caries

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and periodontal disease, discussing plaque control, and demonstrating brushing and flossing techniques) (16-18). Education about smoking cessation or dietary counseling was either limited or not part of the dental hygienists' routine practice (16,19-23).

The most common strategies of dental hygienists in delivering oral hygiene patient education are through one-way didactic provision of information and, to a lesser extent, through hygienist–patient discussion, but with minimal patient-skill demonstration and feedback (17,24). Measuring patients' recall or comprehension of information, requesting patients to demonstrate proper oral hygiene technique after instructions, and providing (visual) feedback on patients' oral hygiene performance using disclosing solutions were infrequently incorporated in oral hygiene patient education (17,25).

Among studies on oral health patient education by dental health professionals, few investigated oral disease prevention of a specific medical diagnostic group. Given the importance of good oral hygiene among people with diabetes, adequate oral hygiene instruction (OHI) and healthy lifestyle information related to oral health in this population is essential. The purpose of this study is to: a) determine dental hygienists' perceptions of their adequacy in providing diabetes-related oral health educational information to people with diabetes; and b) identify facilitators and barriers that relate to adequate coverage of diabetes-related oral health educational information. Results obtained from this study will provide information for oral health-care professionals to improve oral health education for people with diabetes, and ideally will lead to improved oral health and diabetes control among this population.

Methods

The study was a cross-sectional survey that was mailed to 2,237 licensed registered dental hygienists with a South Carolina (SC) mailing address. The survey was approved by the Institutional Review Board of the Medical University of South Carolina. Address labels of the dental hygienists were purchased from the SC Board of Dentistry. To maintain anonymity, respondents returned the completed one-page questionnaire (printed on both sides) and an acknowledgment slip separately, in two different pre-addressed, return postage-paid envelopes. Upon receipt of the return acknowledgment slip, a US$5 store gift card was sent to the respondent's address. Two complete follow-up mailings about 3 months apart were sent to nonrespondents. Data were collected between August 2006 and May 2007. Of the 2,237 listed dental hygienists, 41 had moved out of the state, 69 had no forwarding address, and 8 were temporarily away from the current address. Of the 2,119 delivered letters, 1,042 were returned after the third mailing to nonrespondents, resulting in a response rate of 49.2 percent. Of the respondents, 46 stated that they had retired or no longer practiced as a dental hygienist, and one respondent returned an incomplete survey; thus, these 47 respondents were excluded. Therefore, the analytic sample consisted of 995 respondents with usable data.

Survey Instrument. A 13-question survey instrument was developed based on questions drawn from a review of related literature (17,25-27) and input from practicing dental hygienists. The questionnaire was reviewed for content validity by a panel of four practicing dental hygienists.

Information related to respondents' years of practice, working hours per week, and type of dentistry they practiced with was collected. The questionnaire also included information on the number of diabetic patients treated in a typical week, average length of a treatment session, frequency of patient recall, and whether the respondents spend more time educating diabetic patients about oral health compared with other patients. The core of the survey was a question regarding respondents' perception of the adequacy of educating diabetic patients regarding oral health (including 19 topics of OHI and healthy lifestyle related to oral health). Respondents rated the 19 topics on a 3-point scale ("Adequate," "Not adequate," or "Not covered"), and they were asked to select topics on which they spent the most time educating diabetic patients, reasons for not adequately covering all educational information related to oral health, and frequencies of recommending different oral health products to patients with diabetes.

Statistical Analysis. In addition to descriptive statistics and univariate comparisons of proportions between categorical variables using χ^2 testing, we implemented univariable (unadjusted) and multivariable (adjusted) logistic regression models to determine respondents' practice characteristics that are associated with their perception of the adequacy in covering all diabetes-related oral health information. Explanatory variables utilized in the univariable logistic regression were: frequencies of diabetic patient recall interval (less than 6 months versus 6 months or more), years of working experience of the respondents, duration of treatment sessions (in minutes), numbers of patients with diabetes treated per week, hours respondents worked per week (less than 25 hours versus 25 hours or more), and whether the respondents spend more time educating patients with diabetes compared with other patients (yes versus no). Explanatory variables with a *P*-value <0.25 in univariable models were included in the multivariable model (28). Statistical significance for all χ^2 tests and multivariable model parameters was set at a two-sided alpha level of 0.05.

Results

Dental hygienists who responded to the survey primarily worked in a general dentistry setting (90.7 percent), with only 4.6 percent ($n = 46$) of the respondents working in a periodontal office. Respondents had been practicing for an average (and standard deviation) of 14.8 ± 10.6 years (range: 1-54 years);

Table 1
Percent of Responses Regarding Adequacy of Covering Different Diabetes-Related Oral Health Topics (*n* = 995)

	Adequate (%)	Not adequate (%)	Not covered (%)
Daily brushing and flossing	99.5	0.4	0.1
Importance of good oral hygiene (plaque control)	99.0	1.0	0.0
Causes and results of plaque, calculus, gingivitis, and periodontal disease	96.1	3.6	0.3
Used bleeding to monitor the health of gums	94.0	5.5	0.5
Shown proper flossing technique	91.8	7.5	0.7
Shown proper toothbrushing technique	91.0	8.2	0.8
Care of removable prosthetic appliances (if your patients wear it)	88.8	7.3	3.8
Frequent prophylactic dental visits	88.3	9.7	1.9
Effect of periodontal disease on diabetes	78.0	19.3	2.7
Effect of uncontrolled diabetes on periodontal disease	73.7	22.6	3.7
Managing dry mouth	73.1	21.5	5.4
Tobacco/smoking cessation (if your patients use tobacco products)	69.4	23.6	6.9
Benefits of fluoride	60.0	27.4	12.6
Control of blood sugar level	47.9	30.2	21.9
Nutrition and dietary counseling	39.7	41.7	18.6
Avoiding alcohol	28.2	43.0	28.7
Have patients demonstrate recommended flossing technique in their mouth	27.3	51.4	21.3
Have patients demonstrate recommended brushing technique in their mouth	26.6	51.2	22.2
Physical activity/exercise	17.3	45.5	37.2

73 percent reported working at least 25 hours per week and treating an average of 5.2 ± 4.6 patients with diabetes a week (range: 0-40), with more than two-thirds treating 1-5 patients a week. Only 2.1 percent of the respondents reported that they do not provide service to any patients with diabetes in a week. The average treatment session duration for patients with diabetes was 54.6 ± 11.6 minutes (range: 20-180 minutes), with 90.1 percent of the respondents reporting that a typical treatment session runs between 45 and 60 minutes. Respondents recommending recall at intervals of 3, 4, and 6 months were 23.0, 37.2, and 33.3 percent, respectively, with only 1.3 percent recommending patient recalls of <3 months and 0.2 percent recommending patient recalls of >6 months. Only 40.8 percent of the respondents reported that they spent more time educating patients with diabetes on oral health compared with other patients. The proportion of respondents who reported recommending the recalls be more frequent than 6 months (i.e., 3 or 4 months) was significantly greater among those who reported spending more time educating their patients with diabetes than those who did not spend extra time ($P < 0.001$).

The survey questionnaire responses involving adequacy in covering different diabetes-related oral health topics is displayed in Table 1. Among the 19 topics, adequacy scores ranged from a low of 17.3 percent on education about physical exercise to a high of 99.5 percent on the importance of daily brushing and flossing. Topics of oral hygiene and general oral health issues were considered to be adequately covered by an average of 93.6 percent respondents (ranging from 88.3 percent for educating patients on frequent prophylactic dental visits to 99.5 percent for daily brushing and flossing). Of note, having patients demonstrate recommended proper oral hygiene technique was rated by only 27.0 percent of respondents as being adequately covered. Topics that are specifically related to diabetes and oral health (such as effect of periodontal disease on diabetes, effect of uncontrolled diabetes on periodontal disease, and managing dry mouth) were rated as adequately addressed by about 75 percent of respondents. Topics with a less immediate-direct relationship with oral health, such as blood sugar control (47.9 percent), nutrition and dietary counseling (39.7 percent), and physical activity/exercise (17.3 percent), were the least adequately addressed. The three areas where respondents reported spending the most time were plaque control (52.6 percent), relationship between periodontal disease and diabetes (32.1 percent), and proper brushing and flossing techniques (10.1 percent).

Only 41.0 percent of respondents reported that they covered all essential materials related to oral health when educating patients with diabetes. Of the 59.0 percent who felt they did not cover all essential materials, the three top reasons were: a) insufficient time during the scheduled visit (60.1 percent); b) patient

Table 2
Logistic Regression Displaying Unadjusted and Adjusted Odds Ratios for Adequacy in Covering All Essential Materials Related to Oral Health when Educating Patients with Diabetes (n = 971)

Variable	Referent group	Comparison group	Unadjusted model		Adjusted model	
			Odds ratio (95% CI)	*P*-value	Odds ratio (95% CI)	*P*-value
Frequency of recommended patient recall (months)	≥6	≤5	1.27 (1.15, 1.39)	<0.001	1.23 (1.11, 1.36)	<0.001
Working experience (years)	0	1 year increment	1.02 (1.00, 1.03)	0.02	1.01 (1.00, 1.02)	0.02
Duration of treatment session (minutes)	0	1 minute increment	1.02 (1.00, 1.03)	0.01	1.01 (1.00, 1.03)	0.04
Number of patients treated per week	0	1	1.02 (0.99, 1.05)	0.12	1.02 (0.99, 1.05)	0.12
More time spent educating patients with diabetes	No	Yes	1.38 (1.06, 1.79)	0.02	1.19 (0.91,1.56)	0.20

Table 3
Frequency of Respondents Following Recommendations of Oral Hygiene Products for Patients with Diabetes (n = 994)

Oral hygiene products	Often (%)	Sometimes (%)	Rarely (%)	Never (%)
Power toothbrushes	72.0	24.4	2.4	1.0
Adapted interdental aids	64.2	29.9	3.4	2.1
Over-the-counter products to alleviate dry mouth	43.5	41.8	9.9	4.5
Chewing xylitol/ sugar-free gum	30.3	39.7	14.4	15.5
Oral irrigators	21.8	41.0	27.4	9.4

disinterest (41.2 percent); and c) insufficient information on oral care and diabetes (39.7 percent). Only 2.0 percent of respondents indicated that the main reason for not covering all essential oral health materials was that patient education is not reimbursable. Respondents who felt they had insufficient information on oral health and diabetes were less likely to adequately address the effect of periodontal disease on diabetes ($P < 0.001$), effect of uncontrolled diabetes on periodontal disease ($P < 0.001$), and management of dry mouth for diabetics ($P = 0.03$).

Table 2 depicts unadjusted and adjusted odds ratios for adequacy in covering all essential materials related to oral health. Significant unadjusted explanatory variables included frequency of recommended patient recalls, years of working experience of the respondents, duration of treatment sessions, and time spent educating patients with diabetes. Results were nearly identical in the adjusted models, with the exception of time spent educating patients with diabetes, which was not statistically significant. Recommending patient recalls of <6 months was associated with a 23 percent increase in the odds of adequacy in covering all essential material related to oral health. Both an additional year of working experience as a dental hygienist and an additional minute in the treatment session each resulted in a 1 percent increase in the odds of adequacy in covering all essential materials related to oral health. Number of diabetic patients treated per week was not significant in either unadjusted or adjusted models.

Recommended Oral Health Products. As shown in Table 3, hygienists most frequently recommended the powered toothbrush to patients with diabetes and least frequently recommended the oral irrigator. All products described in Table 3 were recommended more often by respondents who perceived they covered all essential components of oral health (*P*-values ranged from 0.04 to <0.001) and (except for powered toothbrushes) were recommended less often by respondents who felt they had insufficient information on oral health and diabetes (Ps < 0.001). In addition, a significantly higher proportion of dental hygienists employed in a periodontist's office recommended adapted interdental aids compared with those working in general dentistry ($P < 0.001$).

Discussion

Consistent with the literature (16-18,21), topics related to traditional OHI were perceived as adequately covered for patients with diabetes by dental hygienist respondents practicing in SC. Oral health topics specifically related to diabetes and oral health were considered fairly adequately covered, as reported by about three-quarters of the respondents, whereas healthy lifestyles related to oral disease preventive measures appear not to be a routine

part of dental hygienists' practice. This pattern mirrors other findings that dental hygienists occasionally educate their patients about problems related to smoking but rarely address dietary profile, alcohol intake, and physical activity issues (21).

Adequacy of patient demonstration of oral hygiene performance and subsequent feedback is low. Time constraints are critical factors, as dental health professionals generally devote 5-10 minutes on OHI during a prophylaxis appointment (17,25). Such a demonstration by the patient with (visual) feedback on proper oral hygiene technique and cleaning effectiveness may require an additional 10 minutes (29). Some adults with diabetes may have never learned how to properly brush or floss their teeth. Without supervised, hands-on practice and feedback in the dental clinic, this group of diabetic individuals is less likely to practice these techniques at home.

Overall, periodontal disease is more prevalent than caries among adults with diabetes, possibly explaining why fewer respondents indicated that they address the benefits of fluoride adequately compared with plaque control (30). The higher proportion of respondents addressing tobacco cessation compared with other healthy lifestyle preventive measures may be attributed to the documented smoking histories in the dental chart and teeth stains which prompt hygienists to address smoking cessation. In contrast, alcohol consumption, dietary habits, and exercise may not be routinely included in dental chart histories. To explore those areas requires a question-and-answer type of interaction which may not be feasible during dental cleaning. Also, limited visit durations preclude conducting in-depth quality education, such as going through pamphlets with various healthy lifestyle topics related to oral health and diabetes. Furthermore, several respondents commented that they need to receive more training on diabetes and oral health before they would feel confident in providing patient education on healthy lifestyle changes. These comments are consistent with the lack of training among dental health professionals in educating patients on healthy lifestyles related to oral disease preventive measures (22,31).

Less than half of the respondents (40.8 percent) reported that they spent more time on educating patients with diabetes on oral health compared with other patients. Once again, there is not much flexibility for the dental hygienists to devote extra time in educating patients with diabetes, as the amount of time for a scheduled appointment is usually fixed for each patient. Unless oral health education is scheduled as a separate appointment and is financially reimbursed by the insurance company, time constraints within the scheduled appointment time may dictate the amount, type, and quality of oral health education.

Interestingly, about two-thirds of respondents reported that the recommended recalls for patients with diabetes was <6 months, indicating that dental health professionals are actively modifying dental care services to maintain and improve the oral health of this population. More frequent patient recalls are also related to respondents spending more time in educating patients with diabetes and covering all essential materials related to oral health. This modification of dental care services is consistent with findings from a qualitative study exploring the attitudes and practices of dental health professionals about diabetes and periodontal disease (32).

About 40 percent of the respondents who did not cover all essential materials related to oral health indicated that insufficient information on oral care and diabetes is the main reason preventing them from adequately providing oral health patient education. However, there is a great deal of information (e.g., pamphlets/brochures) available on oral health and diabetes from a variety of sources, including the American Dental Hygienists' Association, the American Dental Association, the National Institute of Dental and Cranio-Facial Research, the American Diabetes Association, as well as the industry sector (such as Colgate and Crest/Oral-B, both of which have websites with specific diabetic-patient educational information in English or Spanish that can be downloaded). Lack of time at work or lack of encouragement may be the limiting factors for these respondents to search, obtain, and compile the information.

Contrary to previous studies (17,26), patients' disinterest in oral health is not the top reason why respondents do not adequately provide oral health patient education. The linkage of diabetes and oral health may increase patients' awareness of this important issue, raising their interest in oral health more than would be the case for patients without diabetes. Reimbursement was reported not to be an issue in relation to adequacy of oral health education for people with diabetes, possibly because there is usually no separate fee for oral health education (17,33).

In addition to the three main reasons (time constraint, patient disinterest, and insufficient information), inadequacy in covering all essential materials related to oral health is independently associated with frequency of recommended patient recalls, duration of treatment sessions, and years of working experience as a dental hygienist. A 1-minute increase in duration for a treatment session results in a 1 percent increase in the odds of adequately covering all essential materials related to oral health when educating patients with diabetes, whereas modifying dental health service by recalling patients more often than 6 months (e.g., 3 or 4 months) results in a 23 percent increase in the odds on the adequacy of oral health education coverage. A treatment session would have to be prolonged by 23 minutes to achieve similar results. It is therefore not efficient to prolong the treatment

session to provide oral health education for patients with diabetes. As expected, an increase in the amount of working experience as a dental hygienist increases the likelihood of respondents adequately educating patients; however, given that 1 year more of working experience accounts for only a 1 percent increase in the odds of adequacy in covering all essential oral health information, this seems clinically nonsignificant.

Recommended Oral Health Products. In addition to powered toothbrushes, adapted interdental aids were also a popular recommended item – especially among respondents who worked in a periodontal office. Compliance with interdental cleaning (such as flossing) increases when patients find that the procedure is easy to accomplish and the flossing device is user-friendly (34). The frequency of recommending products that alleviate dry mouth was similar to the prevalence of dry mouth complaints among patients with diabetes (about one-third of people with diabetes) (35-37).

Limitations. The lower-than-expected return rate, even after three mailings, may be attributed to the fact that not all dental hygienists have an opportunity to treat patients with diabetes on a regular basis (e.g., weekly). It is possible that dental hygienists who found the content of the survey not applicable to their routine practice may not have completed and returned the survey.

A more accurate picture would have been obtained on how adequate dental hygienists provided diabetes-related oral health preventive education had we collected the data on the amount of educational information provided and time spent on each patient, as well as the oral health status of each patient.

Recommendations. To improve the adequacy of comprehensive diabetes-related oral health preventive education for patients, dental hygienists must have sufficient information and time to educate patients. This study indicates a practical method for improving dental hygienists' comprehensive service to patients with diabetes – offer continuing education on various healthy lifestyle and diabetes-related oral health topics (including glycemic control) for dental hygienists in order to better equip them with sufficient knowledge, skills, and confidence to educate their patients with diabetes. Success in adequately educating patients with diabetes about oral health will also depend on the interest and willingness of dentists (employers) to allow time for dental hygienists to search, obtain, and compile diabetes-related oral health information, as well as time to educate the patients. A survey to measure dentists' interest, concerns, and willingness to allow dental hygienists to spend more time (direct and indirect) on educating patients with diabetes would provide some direction on the feasibility of implementing a traditional model or an alternate oral health educational service delivery model.

Video (DVD) and simple low literacy pamphlets/brochures, as well as active patient involvement in practicing proper oral hygiene techniques with subsequent immediate feedback, may stimulate diabetic patients' interest in oral health. An excellent example for healthy lifestyle resource is the Smoking Cessation Initiative (http://www.askadviserefer.org/) through the American Dental Hygienists' Association which provides detailed guidelines for dental hygienists for delivering tobacco cessation services. Availability of similar educational resources in other diabetes-related oral health topics could be helpful to dental hygienists and their patients.

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