

## Diabetes Educators' Knowledge, Opinions and Behaviors Regarding Periodontal Disease and Diabetes

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### Introduction

The potential link between oral and systemic health has received much attention in medical and dental circles. Studies have shown potential links between oral health and nutritional deficiencies and periodontal disease in relation to cardiovascular disease, diabetes mellitus, obesity and pre-term low-birth weight babies.<sup>1-5</sup> While more studies need to be conducted before positive associations can be confirmed or rejected, it is generally accepted that the mouth can reflect the effects of systemic diseases.

Theories about focal infection and how it contributes to systemic disease have been discussed since the early 1900s.<sup>6</sup> A 1908 article by Merritt titled *Mouth Infection: the Cause of Systemic Disease* stated that "there is a general disposition on the part of the medical and dental professions to underestimate the relations which exist between an unclean mouth and many local and systemic disorders of grave nature."<sup>7</sup> Originally termed "oral sepsis," it was later termed "focal infection" and defined as a "circumscribed area of tissue infected with pathogenic organisms."<sup>6</sup> The term implied that a focus or lesion of infection existed, was bacterial in nature and was capable of dissemination, resulting in systemic infection.<sup>8</sup> While the role of focal infection was debated throughout the 1900s, the late 1980s saw a resurgence of publications in the dental literature inferring an association between periodontopathogenic bacteria and certain systemic conditions.<sup>9</sup> Methods of systemic involvement regarding focal infection include periodontal bacteria (primarily

Gram-negative) entering the bloodstream through ulcerated epithelium, which can provoke systemic inflammatory and immune responses,<sup>9</sup> or through inflammatory mediators present in the diseased pocket which transfer directly into the systemic circulation.<sup>10</sup> In essence, if the bacteria that have entered the bloodstream find favorable conditions,

### Abstract

**Purpose:** The purpose of this study was to determine certified diabetes educators' (CDE) knowledge, behaviors and opinions about periodontal disease and diabetes.

**Methods:** A 33 item questionnaire was distributed to CDEs who provide counseling and education services to patients with diabetes. Questions were open and closed-ended and Likert-scale. A total of 298 CDEs participated in the survey. Descriptive statistics were utilized.

**Results:** Most (62%) agreed that CDEs need to collaborate with dental professionals in disease management and 84% indicated interest in an oral health component being added to their continuing education. Only 20% felt confident in providing an oral health screening to their patients, while 51% discussed oral health with their patients and 64% said they have referred a patient to a dentist within the past year. Most (79%) have not received formal oral health education.

**Conclusion:** The findings indicate that CDEs are aware of and agree that there is a link between oral health and systemic health and that collaboration with the dental profession would be a positive outcome for their patients, as would oral health topics being added to their continuing education courses. By introducing inter-professional collaboration between dental professionals and CDEs, and adding an oral health component to CE courses, CDEs' ability to educate their patients regarding the oral/systemic link could improve.

**Keywords:** Periodontal disease, periodontitis, diabetes mellitus, certified diabetes educator, inter-professional practice

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it is possible for them to colonize in distant sites and form ectopic foci of infection. Inflammatory mediators secreted or shed in the gingival tissues may also transport via circulatory mechanisms and activate remote tissues.<sup>11-13</sup>

The Surgeon General's Report on Oral Health in America states the need to have an oral health infrastructure, wherein all health care providers have the knowledge to discuss oral health with their patients.<sup>14</sup> One of the major links between oral and systemic health is the relationship between periodontal disease and diabetes mellitus. Diabetes has become a world-wide epidemic,<sup>15</sup> while periodontal disease is one of the most common infections in humans.<sup>3,4</sup> Approximately 8.3% of the American population has diabetes, roughly 25.8 million children and adults. Future projections predict 1 in 3 Americans born in the year 2000 will develop some form of diabetes.<sup>15</sup> The American Academy of Periodontology estimates that 75% of Americans have some form of periodontal disease.<sup>16</sup> With these statistics, it is no surprise that Healthy People 2010 relates the importance of individual health in making a healthy society and states as 2 of its objectives: "through prevention programs, to reduce the disease and economic burden of diabetes and improve the quality of life for all persons who have or are at risk for diabetes" and "to prevent and control oral and craniofacial diseases, conditions and injuries and improve access to related services."<sup>17</sup> This is a challenge to health care professionals to work together to give comprehensive care to the patient in relation to oral and systemic disease and especially in the area of periodontal disease and diabetes mellitus.

One of the complications of uncontrolled diabetes mellitus is dental disease includes xerostomia, increased risk of caries, oral candidiasis, periodontal abscesses and periodontal disease.<sup>18,19</sup> Xerostomia results from the disruption in salivary flow due to effects of systemic disease (in this case, diabetes).<sup>20</sup> The reduction in salivary flow in turn may lead to an increase in caries,<sup>21</sup> though there does not appear to be a direct correlation between diabetes mellitus and increased dental caries.<sup>22</sup> In a controlled, cross-sectional oral health study in Switzerland, Sandberg et al found that 53.5% of their study participants with diabetes complained of dry mouth compared to 28.4% of participants without diabetes.<sup>23</sup> The study also showed that patients with diabetes and good glycemic control reported less xerostomia than those patients with poor glycemic control (HbA1c levels above 7.5%).<sup>23</sup> Oral candidiasis can be a result of xerostomia and systemic infections such as diabetes.<sup>20</sup> Candidiasis is an opportunistic infection. When the body's im-

mune system is lowered, as in diabetes, candidiasis is more prevalent.<sup>24</sup>

Both diabetes mellitus and periodontal disease are chronic inflammatory diseases; the relationship that exists between the two is bi-directional.<sup>3,20,21,25,26</sup> In fact, Loe has identified periodontal disease as the sixth complication of diabetes along with the classic complications.<sup>27</sup> In patients with diabetes and poor glycemic control the periodontium is more susceptible to infection, which increases the risk of periodontal disease, as Campus et al found in their case-control study.<sup>28</sup> Periodontal disease in turn can exacerbate the glycemic control in patients with diabetes due to the inflammation of the periodontal tissues. This is believed to be a result of the inflammatory response to periodontal disease. Proinflammatory cytokines produced by periodontal disease aggravate the ability of the body to use insulin and can therefore disrupt the regulation of glycemic levels.<sup>29</sup> According to Taylor and colleagues, subjects with diabetes and periodontal disease have a 6-fold higher risk for worsening of glycemic control over time compared to patients with diabetes who do not have periodontal disease.<sup>30</sup> Collin and colleagues studied the periodontal status of elderly patients with Type II diabetes compared to patients without diabetes. They found that patients with Type II diabetes and severe periodontal disease had HbA1c levels that significantly deteriorated as compared to patients with Type II diabetes without severe periodontal disease. They concluded that there seems to be a correlation between severe periodontal disease and the impairment of metabolic control for patients with Type II diabetes.<sup>31</sup>

Few reports appear in the literature that have assessed health care professionals' knowledge and practice behaviors regarding oral health. Of those that have been conducted, they have focused on obstetricians, nurse practitioners and certified nurse midwives and physicians.<sup>32-34</sup> Findings from these studies show that, though knowledge of periodontal disease has been low, there is keen interest in collaboration with oral health care professionals and a desire for more information about oral health to share with their patients.

Diabetes educators focus on 7 areas when counseling their patients: healthy eating, being active, monitoring, taking medication, problem solving, healthy coping and reducing risks.<sup>35</sup> However, among diabetes educators, there is little research to show their knowledge about periodontal disease and diabetes and how this affects their behaviors in counseling and referring their patients. Yuen et al conducted a study to determine South Carolina

certified diabetes educators' (CDEs') perceptions regarding their preparation to provide oral health information to their patients, what barriers they felt prevented them from including oral health education in their curricula and how adequately the curriculum covered the topic of oral health.<sup>36</sup> The study found that the majority of the diabetes educators had been practicing for a median of 8 years, worked about 25 hours a week and saw a median of 15 patients weekly.<sup>36</sup> Those surveyed were asked to rate the content of their diabetes education curricula regarding its coverage of general and oral health topics. Responses ranged from a low of 0.8% (in response to whether they ask their patients to demonstrate correct brushing and flossing techniques) to a high of 59.2% (in response to whether or not they recommend frequent dental cleanings).<sup>36</sup> The majority responded positively to the addition of an oral health component to their curricula, while 76.9% reported that they did not have an oral health component already in place. Diabetes educators who had an oral health component in their curricula were more likely to recommend frequent cleanings and oral hygiene home care, emphasize the effect of uncontrolled diabetes and periodontal disease and the effect of periodontal disease on diabetes and monitor their patients' oral health (gum health and dry mouth).<sup>36</sup> Yuen concluded his study by encouraging the integration of oral health content in the diabetes education curriculum.

The purpose of this study was to determine CDEs' knowledge, opinions and practice behaviors regarding the evidence between periodontal disease and diabetes mellitus.

## Methods and Materials

The University of North Carolina Biomedical Institutional Review Board approved the study design and instrument. The survey instrument "Diabetes Educators' Opinions and Behaviors Regarding Periodontal Disease and Diabetes Mellitus" was developed specifically for this study and was designed by a multidisciplinary research team and pilot tested by 5 CDEs. The survey was 33 questions in length and was designed to assess the knowledge, behaviors and opinions of CDEs regarding the relationship between periodontal disease and diabetes. In addition, it assessed the demographics and practice settings of CDEs, their knowledge and opinions about periodontal disease and systemic health, their role and comfort level in providing counseling to their patients about periodontal disease and diabetes and oral health education received throughout their training. Some questions were open and closed ended and some used Likert-scale responses. Revisions were incorporated prior

to printing the final version of the survey instrument. The survey was conducted in paper format (Teleform), which allowed answers to be bubbled in for the desired response. These responses could then be scanned directly into an ACCESS database. No other measures of the instrument's validity or reliability were conducted.

The survey sample was recruited from participants attending the 36th Annual American Association of Diabetes Educators' meeting in Atlanta, Georgia in August 2009. Approval for the data collection was obtained from the American Association of Diabetes Educators. Participants in this meeting represented a sample of CDEs from across the nation. Recruitment took place at a booth in the Exhibition Hall of the meeting. The survey was available to all participants at the meeting who were CDEs and who currently provided counseling to patients. An explanation of the purpose and design of the survey was provided to each potential participant. Participants were free to refuse to participate in the study. As an incentive for completion, \$5 in cash was given to each participant upon completion of the survey. No identifying data was associated with the survey – participants remained anonymous. A total of 298 CDEs participated in the study, approximately 10% of the attendees as reported by the AADE.

Descriptive statistics were generated for all study variables and domains.

## Results

**Demographics:** Demographics of the survey participants are illustrated in Table I (n=298). Fifty-eight percent were nurses, 35% were registered dietitians, 2% were pharmacists and 5% were other professionals. The majority of participants (99%) were female and 58% held a nursing degree. Seventy-six percent had been to the dentist in the past 6 months and 84% were told they did not have periodontal disease, with 57% rating themselves as having "good" oral health. Forty-two percent reported working in a hospital practice, while 15% reported working in a specialty office. The mean number of years reported for providing counseling and educational services to patients with diabetes was 15 years. Sixty percent reported spending more than 20 hours a week providing care to patients with diabetes.

**Knowledge:** CDEs' knowledge about periodontal disease and systemic health was high. When asked about risk factors for periodontal disease, the majority recognized the important factors. However, many did not know whether tooth decay was a factor in periodontal disease (Figure 1). Most (84%)

Table I: Demographics of Participants

Variables (n=298)	Nurse		Registered Dietitian		Pharmacist		Other	
	N	%	N	%	N	%	N	%
Age								
25–35	6	2.0	8	2.7	1	0.3	0	0
36–45	25	8.5	32	10.8	3	1.0	6	2.0
46–55	73	24.7	32	10.8	1	0.3	6	2.0
56–65	64	21.7	30	10.2	1	0.3	2	0.7
>65	4	1.4	0	0	1	0.3	0	0
Last dental visit with perio assessment								
≤6 months	111	42.5	72	27.6	6	2.3	8	3.1
>6 months and <1 year	32	12.3	8	3.1	0	0	2	0.8
>1 year and <2 years	7	2.7	7	2.7	0	0	0	0
>2 years	4	1.5	3	1.1	0	0	0	0
Never	0	0	0	0	1	0.4	0	0
Personal oral health								
Excellent	47	18	35	13.4	2	.8	6	2.3
Good	95	36.4	46	17.6	5	1.9	3	1.1
Fair	11	4.2	7	2.7	0	0	1	0.4
Poor	1	0.4	2	0.8	0	0	0	0
Gender								
Male	3	1.1	0	0	0	0	0	0
Female	151	57.9	90	34.5	7	2.7	10	3.8
Diagnosed with periodontal disease								
Yes	22	8.4	11	4.2	2	0.8	1	0.4
No	130	49.8	74	28.4	5	1.9	9	3.4
Maybe	2	0.8	5	1.9	0	0	0	0

could distinguish periodontitis from gingivitis, and realized periodontitis is the worse condition. When asked about the first clinical sign of periodontal disease, 38% answered bleeding gums, followed by 29% who thought it was bad breath. An overwhelming number recognized that people with diabetes are at an increased risk of periodontal disease (99%), that poor glycemic control promotes growth of oral bacteria (99%) and that periodontal disease may worsen glycemic control (97%).

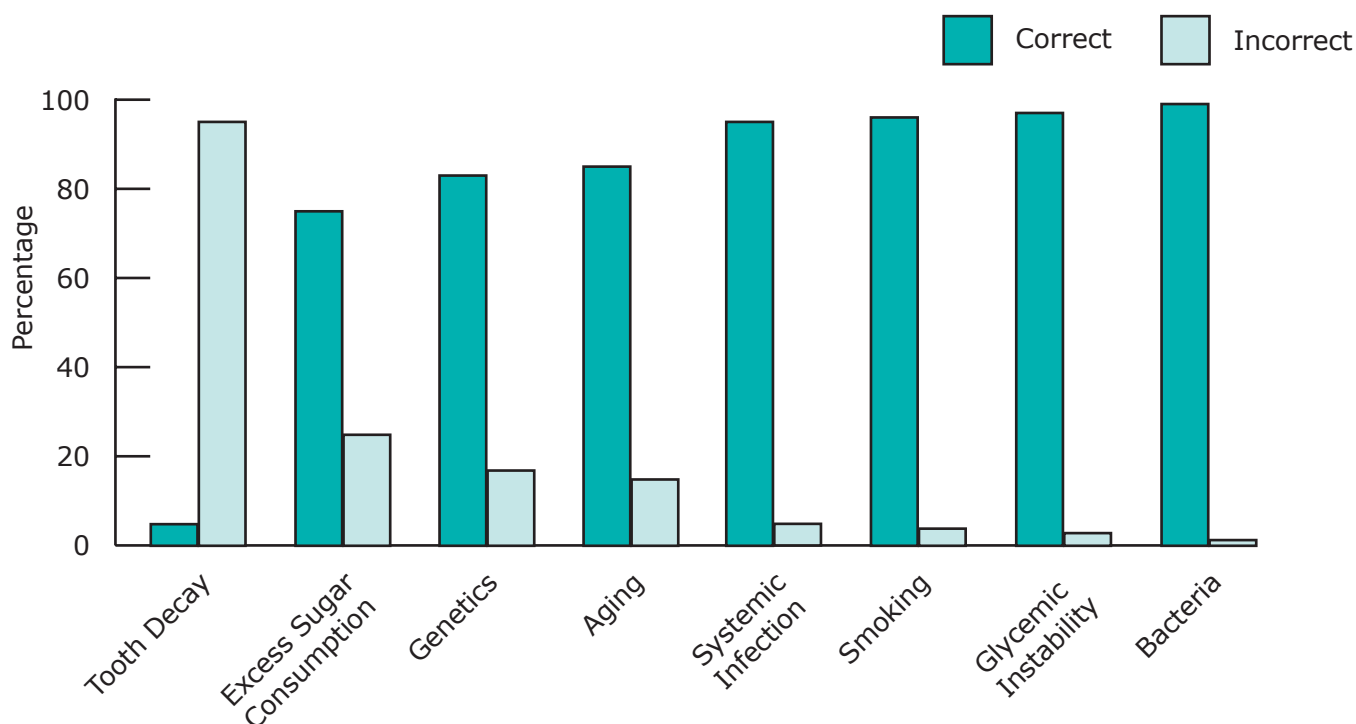
**Attitudes and Opinions:** Attitudes of CDEs regarding the link between periodontal disease and diabetes were reflected in their referral patterns. When asked the average number of patients with whom they discuss oral health, the mean percentage for all those surveyed was 55.7%. Sixty-four percent of CDEs said they have referred a patient with diabetes to a dental office or clinic within the past year. For those who don't refer, the main ob-

stacles reported were their patients' lack of financial resources for dental care (57%) and their own uncertainty about when to refer (56%).

Opinions of CDEs regarding their own knowledge about the link between periodontal disease and diabetes are included in Table II. Most (44.7%) agreed with the statement "I am knowledgeable regarding the studies linking periodontal disease and diabetes," but felt they needed more information about periodontal disease and its impact on diabetes (88.5%). The majority agreed that CDEs need to collaborate with dental professionals to reduce their patients' risk of developing periodontal disease (96.3%). A large percentage showed enthusiasm for an oral health component being added to their diabetes continuing education (83.8%).

**Education and Training:** Of those surveyed, 79% said they have not received any oral health

Figure 1: Certified Diabetes Educator's Knowledge about Factors Influencing Periodontal Disease



education (didactic or curricular) in their professional training. For the 21% that had oral health education in their professional training, 38% rated that education as fair, while 31% reported theirs as good. Ninety percent reported they had not had any oral health education since receiving their CDE certification. Of the 10% who did report having had oral health education since their certification, 31% indicated this information only covered general information on healthy teeth and gums.

## Discussion

Due to the relationship between periodontal disease and diabetes and the increasing numbers of patients diagnosed with diabetes, it is important to know about the oral health information patients with diabetes are receiving from their counselors. This study sought to determine if CDEs are knowledgeable about the link between periodontal disease and diabetes, and if they provide any oral health counseling to their patients. Results showed that CDEs have a high knowledge of periodontal disease and its impact on systemic health. However, results also showed that CDEs desire more information about periodontal disease and diabetes and they are not sure how to counsel their patients.

**Knowledge about Periodontal Disease and Diabetes:** CDEs appear to be very knowledgeable about periodontal disease and diabetes. Regarding questions asking about factors influencing

periodontal disease, the majority of respondents answered correctly. The majority agreed that if a patient has periodontal disease, they are more likely to have poor glycemic control than a patient without periodontal disease (95%). They also agreed that patients with poor glycemic control are more likely to have periodontal disease. However, CDEs are not confident in screening for periodontal disease themselves. Ninety-six percent agreed that there should be collaboration between dental professionals and CDEs to increase their patients' health. This interest in working with dental professionals shows potential for the oral health infrastructure discussed in the Surgeon General's Report.<sup>14</sup> If both CDEs and dental professionals can collaborate inter-professionally, patients might have the potential to receive better dental and overall care for their condition. The prediction for the future is that the numbers of patients with diabetes will vastly increase,<sup>15</sup> so an increase in inter-professional collaboration and communication will be needed for the care of these patients. Opportunities for providing CE courses for CDEs regarding oral health and systemic complications could further the knowledge and promote working relationships between these groups.

**Counseling and Referrals Regarding Periodontal Disease and Diabetes:** About half of CDEs reported counseling their patients about oral health. Specific questions about the content of this counseling were not asked, however, 31%

Table II: Certified Diabetes Educators' Opinions about Periodontal Disease and Systemic Health

n=298	Strongly Agree		Agree		Unsure/ Don't know		Disagree		Strongly disagree	
The research is inconclusive regarding the relationship between periodontal disease and systemic health	7%	(20)	11.4%	(34)	19.5%	(58)	37%	(110)	25.1%	(76)
I am knowledgeable regarding the studies linking periodontal disease and diabetes	15.8%	(47)	28.9%	(86)	23.8%	(71)	28.9%	(86)	2.7%	(8)
I need additional information about periodontal disease and its impact on diabetes	41.9%	(125)	46.6%	(139)	7.0%	(21)	3.4%	(10)	1.0%	(3)
I am confident that I can provide an oral health screening to my patients with diabetes	19.8%	(59)	19.1%	(57)	30.5%	(91)	24.5%	(73)	6.0%	18
CDE's should be taught to screen for periodontal disease in their patients	49.7%	(148)	30.9%	(92)	14.1%	(42)	3.7%	(11)	1.7%	(5)
CDE's need to collaborate with dental professionals to reduce their patients' risk of developing periodontal disease	62.1%	(185)	34.2%	(102)	1.7%	(5)	1.0%	(3)	1.0%	(3)
I am interested in including an oral health component in my diabetes continuing education	37.2%	(111)	46.6%	(139)	12.1%	(36)	2.3%	(7)	1.7%	(5)

reported receiving only general information about oral health. Therefore, patients may only be receiving general information about healthy teeth and gums and not specific information about their condition and periodontal risks. This is corroborated by Koeber et al, who identified that nurses and nutritionists considered oral health to be important but spent less time focusing on periodontal and systemic issues than on the patient's systemic condition.<sup>37</sup> While the CDEs in this study who reported having received oral health education do not appear more likely to counsel their patients than those who have not received any oral health education, Yuen et al report that having an oral health component in the curricula does influence CDEs' recommendations for frequent scalings, and their emphasis to patients about the effect of uncontrolled diabetes on the periodontium.<sup>36</sup>

CDEs do recognize the importance of referring their patient with diabetes to a dental office. Though they understand the importance of referrals, CDEs appear to be uncomfortable deciding when this referral should take place. This could be due to their beliefs concerning their scope of practice, i.e that nurses and registered dietitians do not believe this to be a part of their scope of practice, or it could be an ethical issue – they be-

lieve it is unethical to make a referral when they are being consulted. Fifty-six percent report not referring their patients because they are unsure of when to refer, and 53% say their lack of oral health training prevents them from making this decision.

**Opinions Regarding Oral/Systemic Research:** CDEs in this study indicated that they believe the research to be strong showing the relationship between periodontal disease and systemic health. However, less than half felt they were knowledgeable about these studies (Table II). Eighteen percent received their oral health information in their professional journals. This finding agrees with Koerber et al who found that nurses and nutritionists reported that the best way for them to receive information about periodontal disease and diabetes would be through guidelines and protocols in their workplaces, or through their professional journals.<sup>37</sup> It is possible that the information about the periodontal/diabetes link may be represented more in dental literature and not in their own journals, which could contribute to their uncertainty about these studies. Eighty-nine percent of CDEs in this study indicated that they needed additional information regarding periodontal disease and its impact on diabetes (Table II).

This information seems to point to a potential demand for oral health information that could easily be provided by the dental academic community or corporate entities.

While knowledge of periodontal disease and diabetes is high, CDEs welcome continuing education courses explaining both the research in this area and how to translate their knowledge into clinical practice. Ninety percent of those surveyed said they have not received any formal oral health education since receiving their CDE. Of those, 31% said the information they received focused on general information about healthy teeth and gums and did not deal with oral/systemic conditions. There is potential for development of a course for CDEs that would provide specific and practical information about periodontal disease and diabetes, and incorporate recommendations on how to educate patients with diabetes. Several dental companies have created oral health education packets focusing on diabetes and periodontal disease. Many of these companies have websites with educational information that may be downloaded. CDEs need to be alerted to the resources available to them. Also, web-based courses or traditional continuing education courses designed to increase inter-professional education and collaboration between nursing, dentistry and medicine might enhance the overall health of patients with diabetes.

Due to the increasing numbers of patients with diabetes and the prevalence of periodontal disease, the authors feel that this report is very timely. Both diabetes and periodontal disease have been a primary focus of medical and dental research and will continue to increase in the future. With the increased emphasis for medical and dental professionals to work together in a more collaborative way, the results of this study show that one group in particular, CDEs, are very receptive and eager to participate. It is anticipated and desired for prevention strategies to gain increased support in the future as the national health care debate continues. CDEs primary focus is to counsel and educate patients with diabetes about preventive strategies for a better quality of life and by offering some suggestions for inter-professional collaboration. The authors hope that CDEs and dental professionals alike will partner together to help their patients with diabetes. As dental curricula are modified to include inter-professional

education and collaboration with medical providers and educators, CDEs should be included.

The findings in this study reflect the need for further studies to determine the best methods to use to educate CDEs about periodontal disease and diabetes. Methods of data collection could include a continuing education course or focus group format to discuss the specifics of periodontal disease and diabetes, the research findings and how to translate the information into patient education. Results may make a difference in the confidence of CDEs in providing oral health counseling to their patients. Further studies could be conducted to determine if increased oral health information provided to CDEs has an impact on their patients with diabetes.

## Conclusion

CDEs are very knowledgeable regarding periodontal disease and its impact on diabetes. They realize the importance of referring their patients to the dental office and are interested in collaborating with dental professionals. They agree with the current literature showing a potential link between diabetes and periodontal disease, however, many CDEs indicated they do not feel knowledgeable about these studies. The majority indicated they would appreciate continuing education courses explaining how to educate their patients and when to refer to a dental professional.

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