Oral Health Knowledge, Attitudes and Behaviors of Parents of Children with Diabetes Compared to Those of Parents of Children without Diabetes

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Abstract

Purpose: To compare the oral health knowledge, attitudes, and behaviors of parents of children, aged 6 to 13, who have type 1 (insulin-dependent) diabetes to those of parents of similarly aged children without diabetes.

Methods: The study population consisted of 46 parents of children with diabetes and 46 parents of children without diabetes from outpatient clinics, providing medical care to children with and without diabetes, respectively. After gaining permission of clinic directors, the investigator approached parents, who were waiting in the clinics' reception areas, to complete the 33-item survey. The survey included questions on socio-demographic characteristics, their child's oral hygiene practices, dental visits, dietary habits, their own oral health knowledge and attitudes, and their child's diabetic condition, when relevant. A Chi-square test was used to determine significant differences between responses of the two groups of parents.

Results: All parents approached completed the survey. Children with diabetes had significantly less frequent sugary drink consumption and less untreated dental caries than children without diabetes. The majority of parents of children with diabetes selected "don't know" for statements related to diabetes and oral health, whereas most parents of children without diabetes agreed with the statements, resulting in significant differences between groups. Most parents of children with diabetes considered these same statements important to them, while the importance to parents of children without diabetes was variable.

Conclusion: To maintain their children's oral health, parents of children with diabetes must receive more education regarding the prevention and control of the oral complications of diabetes.

Keywords: diabetes mellitus type 1, diabetes complications, periodontal diseases, oral health, oral hygiene

This study supports the NDHRA priority area, **Clinical Dental Hygiene Care:** Investigate how dental hygienists identify patients who are at-risk for oral/systemic disease.

Introduction

Diabetes mellitus is one of the most common chronic diseases in children and adolescents.[1] Type 1 diabetes represents only 5 to 10% of all diagnosed diabetes cases; however, it is the leading form of diabetes in children of all ages and accounts for almost all diabetes in children younger than 10 years old.[2] From a population of 3,458,974 youth less than 20 years of age, 6,668 were diagnosed with type 1 diabetes in 2009, for a prevalence of 1.93 per 1,000.[3] Applying this prevalence to U.S. census data, it was estimated that 166,984 youth less than 20 years of age have type 1 diabetes.[3] These statistics emphasize the importance of studying type 1 diabetes in childhood.

Diabetes is associated with many pathological complications including periodontal disease.[1,4] Numerous studies have shown that children with diabetes are at increased risk for developing periodontal disease at an early age.[4-11] Furthermore, periodontal disease is more prevalent among children with diabetes compared to children without diabetes, as evidenced by higher plaque index scores, significantly more gingival inflammation and greater clinical attachment loss.[4,6-11]

Due to the increased risk of periodontal disease, prevention of plaque-induced gingival inflammation through proper oral hygiene self-care and regular professional care are crucial in children with diabetes.[4,5,9] Because parents are children's primary caregivers during childhood, their knowledge, attitudes and behaviors toward oral health can significantly influence their child's oral health and behavior.[12-15] These studies have shown a positive relationship between children's oral health status, as deter-

mined by either self-report or clinical examination, and their parents' oral health knowledge, attitudes and behaviors.[12-15]

Although much is known about the association between childhood diabetes and periodontal disease, no studies of the oral health knowledge, attitudes and behaviors of parents of children with diabetes related to their child's oral health have been identified. Therefore, this study specifically asks the following research questions:

- What are the knowledge, attitudes and behaviors of parents of children with diabetes towards oral health?
- Do the knowledge, attitudes, and behaviors of parents of children with diabetes differ from those of parents with children without diabetes?

The purpose of this study was to compare the oral health knowledge, attitudes and behaviors of parents of children, aged 6 to 13 years, who have type 1 (insulin-dependent) diabetes with those same factors of parents of similarly aged children without diabetes.

Methods and Materials

This analytic cross-sectional study was approved by the Institutional Review Board of the University of California, San Francisco (UCSF).

The target study population consisted of 46 parents of children with type 1 diabetes, 6 to 13 years of age, who were outpatients of the Madison Pediatric Diabetes Clinic in UCSF Benioff Children's Hospital, San Francisco, California, and 46 parents of children without diabetes, in the same age range, from the Pediatric Primary Care Clinic at the same hospital.

Parents who were not English speakers were excluded from the study. The sample size of 46 per group was determined from a power analysis formula, taking into consideration of the level of statistical significance (alpha=0.05), amount of power (0.80) and the effect size (0.95). The effect size was the expected difference in the means between the control and experimental groups, based on past research.

The 33-item questionnaire, developed by the investigators, included questions in the following domains: demographic characteristics (6 multiple-choice questions), oral health behaviors (13 multiple-choice questions), parental attitudes toward oral health (7 Likert-scale statements), and parental knowledge of oral health and the relationship between diabetes and oral health (7 Likert-scale statements). The 4-point Likert scale consisted of strongly agree, agree, disagree and don't know or very important, important, neutral, and not important.

A pilot study was conducted with a convenience sample of 5 parents of children between the ages of 6 to 13 to test the survey questions for clarity. Based on the feedback, questions were modified accordingly.

Potential participants were recruited by the investigator in the reception area of the clinics, while they were waiting to be seen by their child's physician. The investigator obtained verbal consent prior to administering the survey and was available to answer any questions. Reviewing appointment schedules, prior to visiting the clinics, to determine the ages of scheduled patients, allowed the investigator to maximize her efforts in recruiting eligible subjects.

The investigator entered the participants' responses to the survey into Qualtrics™ Survey Software, a web-based survey tool supported by UCSF. Results were expressed as frequencies of responses for each item on the survey. A Chi-square test was conducted to compare the responses of the two groups of parents. A p-value of 0.05 or less was used to determine statistical significant differences between the 2 groups.

Results

Ninety-two parents participated in this study; 46 parents of children with diabetes and 46 parents of children without diabetes. The children with diabetes were significantly (p=0.02) older than the children without diabetes (Table I). Males and females were equally represented in the diabetic population, while there were more males in the non-diabetic group, creating a significantly (p=0.03) different gender distribution between the groups. The children with diabetes were predominantly non-Hispanic white, whereas the non-diabetic group's ethnic background distribution was significantly (p=0.00) different, being evenly distributed among Asians, Hispanics/Latinos and Non-Hispanic whites. All 46 children with diabetes had type 1 diabetes, and the mean duration of having diabetes was 3.1 years (Table I).

A statistically significant (p=0.02) difference was found between the household income level of the 2 groups (Table II). Forty-three percent of the participating parents of children with diabetes had incomes over $125,000, and 22% of parents of children without diabetes reported being below poverty income levels. The educational level of the parents was not statistically different between the 2 groups,

Table I: Demographic Characteristics of the Children with and without Diabetes Mellitus

Variable	Children with Diabetes Mellitus n (%)	Children without Diabetes Mellitus n (%)	p-value
Age	10.1±2.35	8.4±2.17	0.02*
Gender			
Male	23 (50)	33 (72)	0.03*
Female	23 (50)	13 (28)	
Ethnicity			
African American	2 (4)	4(9)	0.00*
Asian	3 (7)	14 (30)	
Hispanic/ Latino	6 (13)	11 (24)	
Native American	0 (0)	7 (15)	
Non-Hispanic White	31 (67)	10 (22)	
Other	4 (9)	7 (15)	
Duration of Diabetes Mellitus, years	3.1	–	–

Age is shown as mean ± standard deviation
*Significant differences between groups (p <0.05)

Table II: Demographic Characteristics of Parents

Variable	Children with Diabetes Mellitus n (%)	Children without Diabetes Mellitus n (%)	p-value
Highest Education of the Mother			
Less than high school	1 (2)	4 (9)	0.22
High school	4 (9)	9 (20)	
Some college	13 (28)	8 (17)	
College graduate	15 (33)	16 (35)	
Graduate education	13 (28)	9 (20)	
Highest Education of the Father			
Less than high school	1 (2)	3 (7)	0.47
High school	9 (18)	14 (30)	
Some college	8 (18)	9 (20)	
College graduate	15 (33)	10 (22)	
Graduate education	13 (29)	10 (22)	
Annual Household Income			
Less than $23,550	4 (9)	10 (22)	0.02*
$23,551 to $39,999	5 (11)	6 (13)	
$40,000 to $49,999	0 (0)	5 (11)	
$50,000 to $74,999	5 (11)	2 (4)	
$75,000 to $99,999	2 (4)	1 (2)	
$100,000 to $124,999	2 (4)	7 (15)	
Over $125,000	20 (43)	8 (17)	
Decline to answer	8 (17)	7 (15)	

*Significant differences between groups (p<0.05)

although it appeared that more parents of children with diabetes had graduate education (Table II).

A statistically significant difference was found between the 2 groups in terms of the child brushing independently; a greater number of parents of children with diabetes reported that their child brushed independently than parents of children without diabetes (Table III). The majority of parents from both groups reported a twice daily frequency of brushing and similar frequencies of flossing. Eighty-three percent of the parents of the children with diabetes and 67% of the parents of the children without diabetes reported that their child had acquired the skill of flossing.

Seventy-four percent of the parents of children with diabetes reported that the frequency of their child's dental visits was "every 6 months," while this value was 59% for parents of children without diabetes (Table IV). Likewise, no parents of children with diabetes reported any dental visits at more than 2 year intervals and "only when experiencing pain," while 11% of parents with children without diabetes selected these responses. Cleaning/check-up was the main reason for the last visit for both groups, although extractions were reported to be a more common reason for children without diabetes (13% versus 4%) (Table IV). Having untreated cavities was reported by significantly (p=0.01) more parents in the non-diabetic group than in the diabetic group (Table IV).

Approximately one-third of both groups of parents reported that their child consumed sugary food

once a week (Table V). Significantly (p=0.01) more frequent sugary drink consumption was reported for the non-diabetic group than the diabetic group (Table V).

The majority of parents of children with diabetes selected "don't know" for the statements regarding the relationship between diabetes and oral health (Table VI). To these same statements, most of the parents of children without diabetes selected "agree," resulting in statistically significant differences between the 2 groups for 3 of the 4 statements. The vast majority of both groups strongly agreed or agreed with the statements related to sugary snacks and drinks and their effects on oral health.

Most parents of the children with diabetes considered these same statements very important or important to them (Table VII). The importance to parents of children without diabetes was variable; statements directly related to diabetes were less important to them. One statement, "Bacteria in the mouth can worsen systemic disease, such as diabetes," was significantly (p=0.05) more important to parents of children with diabetes (Table VII).

Discussion

Periodontal disease has been reported to be more frequent in children with diabetes than in children without diabetes, but it is not known whether these risks are recognized by parents.[4,6-11] Thus, the purpose of this study was to compare the oral health knowledge, attitudes and behaviors of parents of children with type 1 diabetes with those of parents of children without diabetes. The results indicate that the diabetic group had significantly less frequent sugary drink consumption and less untreated dental caries. The majority of parents of children with diabetes selected "don't know" for statements related to diabetes and periodontal disease, whereas most parents of children without diabetes agreed with the statements, resulting in significant differences between the 2 groups. On the other hand, most parents of the children with diabetes considered these same statements important to them while the importance to parents of children without diabetes was variable.

Of the 92 children in the study, 46 were from the Madison Pediatric Diabetes Clinic and 46 were from the Pediatric Primary Care Clinic at the same hospital. The Madison Pediatric Diabetes Clinic is a specialty clinic where patients come from a broad geographic area whereas the majority of patients seen at the Pediatric Primary Care Clinic are local patients from the city of San Francisco. The race/ethnicity difference between the 2 groups reflects this difference in the patient population of the clinics as the population in San Francisco is more diverse than other cities in northern California.[16]

Table III: Parents' Reports on Oral Hygiene Behaviors of the Children with and without Diabetes Mellitus

Variable	Children with Diabetes Mellitus n (%)	Children without Diabetes Mellitus n (%)	p-value
Independent brushing			
Yes	45 (98)	38 (83)	0.01*
No	1 (2)	8 (17)	
Frequency of brushing			
More than 3 times	1 (2)	0 (0)	0.56
3 times	2(4)	3 (7)	
Twice	36 (78)	39 (85)	
Once	7 (15)	3 (7)	
Less than once a day	0(0)	1 (2)	
Ability to floss			
Yes	38 (83)	31 (67)	0.09
No	8 (17)	15 (33)	
Frequency of flossing			
More than once a day	2 (4)	2 (4)	0.61
Once a day	6 (13)	9 (20)	
2 to 3 times a week	16 (35)	8 (17)	
Once a week	10 (22)	11 (24)	
Less than once a week	8 (17)	9 (20)	
Never	3 (7)	4 (9)	
Don't know	1 (2)	3 (7)	

*Significant differences between groups (p<0.05)

One component of the survey examined parental reports of their child's oral health behaviors. One of the findings was that more children with diabetes than children without diabetes brushed their teeth independently. This difference is probably related to the age of the children. The mean age of the diabetic group was approximately 2 years older than the non-diabetic group; additionally, the age of the highest percentage of children with diabetes was 13 years old, as compared to 6 years old for the children without diabetes. Most parents who reported helping their child with tooth brushing were parents of the 6-year-old subgroup. The 2 groups did not report any differences in frequency of tooth

Table IV: Parents' Reports on Dental History of the Children with and without Diabetes Mellitus

Variable	Children with Diabetes Mellitus n (%)	Children without Diabetes Mellitus n (%)	p-value
Frequency of dental visit			
Every 6 months	34 (74)	27 (59)	0.3
Yearly	9 (20)	11 (24)	
Between 1 to 2 years	3 (7)	2 (4)	
More than 2 years	0 (0)	4 (9)	
Only when Experiencing Pain	0 (0)	1 (2)	
Never	0 (0)	0 (0)	
Don't Know	0 (0)	1 (2)	
Reason for the Last Visit			
Checkup/Cleaning	39 (85)	38 (83)	0.17
Fillings	4 (9)	0 (0)	
Extraction	2 (4)	6 (13)	
Gum Problem	1 (2)	2 (4)	
Presence of Untreated Cavities			
Yes	2 (4)	6 (13)	0.01*
No	43 (94)	34 (74)	
Don't Know	1 (2)	6 (13)	

*Significant differences between groups ($p<0.05$)

Table V: Parents' Reports on Frequency of Sugary Food and Drink Consumed by Children with and without Diabetes Mellitus

Variable	Children with Diabetes Mellitus n (%)	Children without Diabetes Mellitus n (%)	p-value
Sugary food consumption			
Never	1 (2)	0 (0)	0.47
Less than once a week	4 (9)	5 (11)	
Once a week	17 (37)	17 (37)	
Once a day	15 (33)	19 (41)	
Twice a day	7 (15)	2 (4)	
More than twice a day	2 (4)	3 (7)	
Sugary drink consumption			
Never	11 (24)	4 (9)	0.01*
Less than once a week	13 (28)	8 (17)	
Once a week	11 (24)	13 (28)	
Once a day	7 (15)	14 (30)	
Twice a day	0 (0)	6 (13)	
More than twice a day	4 (9)	1 (2)	

*Significant differences between groups ($p<0.05$)

brushing or flossing. This similarity may relate to the data in which parents of children with diabetes did not know that children without diabetes are more likely to experience gum disease than children without diabetes. Children with diabetes have been reported to exhibit significantly greater gingival inflammation and clinical attachment loss, compared with non-diabetic children, when the sub-gingival bacterial challenge did not differ.[4,6,7,11] This may be due to the fact that individuals with type 1 diabetes exhibit more exacerbated inflammatory response to a bacterial challenge than individuals without diabetes.[17,18] Thus, more frequent tooth brushing and flossing, to reduce the accumulation of the bacterial biofilm, is recommended for children with diabetes.[4]

Higher numbers of untreated cavities were reported by the parents of the children without diabetes. This finding may be related to the demographic characteristics, such as race and ethnicity, and parents' education and household income level. The non-diabetic group had higher proportions of racial/ethnic minorities and a higher percentage of parents with only a high school education. Furthermore, more parents of children without diabetes reported household income below the poverty level. According to a 2000 Surgeon General's report, disparities in oral health in children are impacted by family income, race/ethnicity and caregiver's education level.[19] Untreated dental caries is more prevalent in poor and low-income children and racial/ethnic minority groups, with low-income children being twice as likely to have untreated dental caries than higher income children.[17] Children whose parents were not college educated were reported to be less than half as likely to receive dental care compared to children of college-educated parents.[19,20] In the current study, 6 month dental visits were less frequent in children without diabetes, whose parents tended to be less college educated.

Another explanation for the higher number of untreated cavities in the children without diabetes is the greater frequency of sugary drink consumption in this group. The relationship between sugar and dental caries is well known.[21] The data showing that sugary drink consumption was more frequent in children without diabetes than in chil-

dren with diabetes are consistent with a previous study by Siudikiene et al.[22] They found that children with diabetes consumed more main meals and less snacks per day whereas children without diabetes consumed more frequent sugary snacks.[22] This may be because children with diabetes usually have a recommended number of meals per day, based on the dosage of insulin being administered.[22] Additionally, even distribution of complex carbohydrates throughout the day and avoiding refined sugar are frequent dietary recommendations for children with diabetes.[23] These dietary practices more likely explain why parents of children with diabetes reported their children consuming less frequent sugary drinks but no greater knowledge of the effect of sugar on oral health than the parents of the children without diabetes. The data showed no difference between the 2 groups in agreement with the statement that sugary snacks and drinks can hurt children's teeth.

The findings from the survey questions regarding parents' oral health knowledge suggest that parents of children with diabetes lacked knowledge of the association between diabetes and periodontal disease. These findings are in accordance with those of previous studies on oral health perceptions of individuals with diabetes.[24,25] Moore et al reported that patients with diabetes lacked important knowledge regarding the effects of diabetes on their oral health.[24] In another study it was found that individuals with diabetes seek dental care less frequently than those without diabetes, with the main reason for not seeing a dentist being lack of a perceived need.[25] Moreover, the time commitment for glucose monitoring, drug administration and frequent visits to the physician causes oral health care to be less of a priority for this population.[25] Even though these studies were mainly focused on adult populations with diabetes, it would be reasonable to assume that the same is true for parents of children with diabetes. These parents may have focused on the medical aspects of the disease, studying the medical literature, often supplied by the physicians. They may have been overwhelmed by the vast amount of information, especially that related to medical management of the condition, which may be requiring multiple life style modifications.

In the current study, oral health may also not have been a priority for these parents of children with diabetes who may not even be considering the possibility of oral complication of the disease. Perhaps these parents did receive the information about diabetes and oral health, but have not been able to internalize it due to all the other lifestyle changes necessitated by the diagnosis. This may explain our result that the majority of parents of children with diabetes selected "don't know" for statements related to diabetes and oral health. The findings that parents of children with diabetes appeared to know

Table VI: Parents' Levels of Agreement with Oral Health Statements

Statement	Parents of Children with Diabetes Mellitus n (%)	Parents of Children without Diabetes Mellitus n (%)	p-value
Gum disease can cause poor glycemic control in diabetics.			
Strongly agree	7 (15)	14 (30)	0.00*
Agree	8 (17)	17 (37)	
Disagree	0 (0)	2 (4)	
Don't know	31 (68)	13 (28)	
Bacteria in the mouth can worsen systemic disease such as diabetes.			
Strongly agree	4 (9)	10 (22)	0.03*
Agree	13(28)	21 (46)	
Disagree	12 (2)	1 (2)	
Don't know	28 (61)	14 (30)	
Sugary snacks and drinks can hurt children's teeth.			
Strongly agree	34 (74)	29 (63)	0.23
Agree	9 (20)	16 (35)	
Disagree	2 (4)	0 (0)	
Don't know	1 (2)	1 (2)	
Bleeding gums may indicate gum disease.			
Strongly agree	20 (43)	20 (43)	0.8
Agree	20 (43)	19 (41)	
Disagree	0 (0)	1 (2)	
Don't know	6 (14)	6 (13)	
Gum problems can occur in children.			
Strongly agree	20 (43)	19 (41)	0.61
Agree	23 (50)	20 (43)	
Disagree	0 (0)	0 (0)	
Don't know	6 (7)	7 (15)	
Diabetes can cause gum disease.			
Strongly agree	6 (13)	10 (22)	0.03*
Agree	7 (15)	15 (33)	
Disagree	1 (2)	3 (7)	
Don't know	32 (70)	18 (39)	
Diabetic children are more likely to experience gum disease than non-diabetic children.			
Strongly agree	6 (13)	12 (26)	0.26
Agree	10 (22)	13 (28)	
Disagree	1 (2)	1 (2)	
Don't know	29 (63)	20 (43)	

*Significant differences between groups ($p<0.05$)

less than parents of children without diabetes may also relate to our observation that more parents of children with diabetes had graduate education. Perhaps more educated parents were more comfortable admitting their lack of knowledge on certain issues or they may have had higher expectations as to the meaning of "agree" in reference to these questions.

Another possible reason why less parents of children with diabetes agreed than parents of children without diabetes with the statements relating diabetes and periodontal disease may be cognitive dissonance.[26] Perhaps parents of children with diabetes, despite their advantageous educational background, do not want to believe that their children are susceptible to detrimental health conditions that are not typically associated with the disease process. Similarly, parents of children without diabetes, despite similar levels of knowledge about the relation of periodontal disease and diabetes, may find it easier to agree with the statements because it is not their child who has diabetes and thus the issue is less important to them. Interestingly, parents of children with diabetes indicated that they feel that the information regarding the association between periodontal disease and diabetes is important to them, even though they did not know that the statements were true. This could indicate that the parents of children with diabetes consider their child's oral health to be important, but they lack sufficient knowledge to recognize that their child's oral health may be more compromised than children without diabetes and require better oral hygiene practices. This lack of knowledge would also explain some of the similarity of oral health behaviors between the two groups.

The current study findings in general suggest that there is a need for oral health education for parents of children with diabetes in order to provide them with the appropriate knowledge to properly care for their child's oral health. Periodontal disease is largely preventable and the amount of periodontal destruction can be reduced when recognized during early stages.[27,28] Therefore, it is critical for children with diabetes to build good oral hygiene habits at an early age so that severe periodontal disease, which can lead to tooth loss later in their lives, can be prevented. Type 1 diabetes can be diagnosed at any age, as early as infancy,[29] and the duration of diabetes has been shown to be associated with the amount of periodontal destruction.[8] These factors make it even more important that parents are educated early in the course of their child's diagnosis of diabetes.

The link between diabetes and periodontal disease demands greater medical-dental professional collaboration: the inflammatory response to oral

Table VII: Parents' Perceptions of Personal Importance of Oral Health Statements

Statement	Parents of Children with Diabetes Mellitus n (%)	Parents of Children without Diabetes Mellitus n (%)	p-value
Gum disease can cause poor glycemic control in diabetics			
Very important	23 (50)	15 (33)	0.1
Important	15 (33)	17 (37)	
Neutral	7 (15)	7 (15)	
Not important	1 (2)	7 (15)	
Bacteria in the mouth can worsen systemic disease such as diabetes			
Very important	24 (52)	12 (26)	0.05*
Important	15 (33)	26 (57)	
Neutral	6 (13)	5 (11)	
Not important	1 (2)	3 (7)	
Sugary snacks and drinks can hurt children's teeth			
Very important	29 (63)	26 (57)	0.61
Important	13 (28)	15 (33)	
Neutral	3 (7)	4 (11)	
Not important	1 (2)	2 (9)	
Bleeding gums may indicate gum disease			
Very important	24 (52)	22 (48)	0.89
Important	16 (35)	18 (39)	
Neutral	5 (11)	4 (9)	
Not important	1 (2)	2 (4)	
Gum problem can occur in children			
Very important	25 (54)	22 (48)	0.19
Important	18 (39)	18 (39)	
Neutral	3 (7)	4 (9)	
Not important	0 (0)	2 (4)	
Diabetes can cause gum disease			
Very important	25 (54)	16 (35)	0.51
Important	15 (33)	17 (37)	
Neutral	5 (11)	10 (22)	
Not important	1 (2)	3 (7)	
Diabetic children are more likely to experience gum disease than non-diabetic children			
Very important	25 (54)	17 (37)	0.27
Important	15 (33)	18 (39)	
Neutral	5 (11)	7 (15)	
Not important	1(2)	4 (9)	

*Significant differences between groups ($p<0.05$)

pathogens may be exacerbated with patients with diabetes, and proinflammatory cytokines produced by periodontal tissues during chronic infection may lead to poor glycemic control and insulin resistance.[27,30] However, some health care professionals may not be aware of the importance of controlling periodontal disease among patients with diabetes. It is critical that this topic be included in curricula of all professional schools, especially dentistry, medicine, nursing and pharmacy. In-service training programs at wellness centers, medical clinics and health care institutions are another opportunity in which health care providers can be educated. Dental hygienists would be the ideal professional to develop and provide these programs. The goal for both these approaches would be for all health care providers, who come in contact with patients with diabetes, to be knowledgeable about the link between diabetes and periodontal disease.

Dental hygienists need to assume greater roles in providing effective education regarding the oral complications of diabetes to families with children with diabetes. Dental hygienists could be valuable at diabetes centers to provide educational services directly to these families, ideally at the time of the child's diagnosis. Moreover, when caring for patients in dental practices, dental hygienists are in a great position to provide this education. Dental hygiene curricula prepare dental hygienists with the breadth and depth of knowledge of diabetes and oral health. Dental hygienists need to take advantage of all opportunities to promote the prevention and control of the oral complications of diabetes. It is an interesting dichotomy that these children with diabetes appear to have regular dental care and yet the parents have limited knowledge of this association.

The fact that some of the findings of the current study may have been due to the difference of the mean age of the 2 groups, rather than the presence or absence of diabetes, is a limitation of the study. Additionally, the differing socio-economic profile of the 2 groups may have had some impact on the results of the study. Because the data are self-reported, another limitation would be the ability of parents to accurately report the dental history and frequencies of oral hygiene behaviors and sugary food and drink consumption. The survey instrument, while pilot-tested, may have limited validity and reliability as it was self-generated. Lastly, the small sample size of 46 subjects per group may limit the generalizability of the data.

Conclusion

Because children with diabetes are at increased risk for periodontal disease, it is important that extensive preventive measures are instituted at an early age. Parents play a significant role in their child's oral health during childhood.[12,13] Thus, this study investigated the oral health knowledge, attitudes and behaviors of parents with children with diabetes. The results indicated that parents of children with diabetes are not sufficiently aware of their child's increased oral health risks. Thus, dental hygienists should assume more responsibility to educate these parents of children with diabetes regarding the prevention and control of the oral complications of diabetes.

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