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Original Research

Dental loss among ambulatory patients with diabetes

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ABSTRACT

Aims: There is a high prevalence of dental loss among patients with diabetes. Understanding the factors that impact dental loss in this population will aid with developing new strategies for its prevention.**Methods:** Using a cross-sectional study design, patients with diabetes presenting for routine clinic visit were evaluated with an investigator-administered questionnaire. Data were collected on demographics, dental history, duration, control and complications of diabetes.**Results:** Among 202 subjects, 100 were female, mean age: 58.9 ± 13.2 years, duration of diabetes: 15.8 ± 11.0 years, and hemoglobin A1c: 7.7 ± 1.6%. Thirty-one patients (15.3%) had lost all their teeth and only 13 patients (6.4%) had all 32 of their natural teeth. Using multiple linear regression, older age ($\beta = -0.146$; 95% CI: -0.062 to -0.230), not flossing ($\beta = -3.462$; 95% CI: -1.107 to -5.817), and presence of diabetic retinopathy ($\beta = -4.271$; 95% CI: -1.307 to -7.236) were significant predictors of dental loss.**Conclusions:** Dental loss is common in patients with diabetes and is associated with older age, diabetic retinopathy and not flossing. In order to reduce dental loss among patients with diabetes, regular flossing should be emphasized as an important component of dental care.© 2016 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

In the United States, the prevalence of diabetes in 2012 was more than 29 million [1,2]. Compared to their age-matched non-diabetic counterparts, patients with diabetes tend to lose their teeth earlier in life [3]. It is estimated that individuals with diabetes are 1.46 times more likely to have at least one tooth removed, when compared to those without diabetes [3]. In addition, patients with diabetes have poorer dental health practices and are less likely to have gone for a dental examination, when compared to non-diabetic patients [4,5].

The mechanism for the increase in dental loss among patients with diabetes likely relates to the increased incidence and severity of periodontal disease and dental caries among this population. Inflammation resulting from bacterial growth in periodontal plaque

causes alveolar bone loss that ultimately results in the loss of teeth [6,7]. Regular dental care and good oral hygiene practices have been demonstrated to reduce the incidence of dental loss; however, there is inadequate emphasis on prevention and treatment for dental problems among medical providers caring for patients with diabetes.

The purpose of this study was to assess the prevalence of dental loss among our diabetes clinic patient population and to determine what clinical variables are associated with dental loss in this population.

Materials and methods

Subjects

The details of our study methods have been published previously [8]. In summary, this was a cross-sectional study of all patients with diabetes presenting for their routine care at a university outpatient clinic. We included all adult patients (age ≥ 18 years) who were willing to participate in the study. Informed consent and HIPAA authorization were obtained from all included participants.

Some of the findings included in this article were presented in poster format at the American Diabetes Association 75th Scientific Sessions, Boston, MA, 5–9 June 2015.

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Study procedures

Using a 48-item investigator-administered questionnaire [8], all subjects were interviewed to obtain information about their age, gender, body mass index (BMI), diabetes history (onset, use of insulin), diabetes control and complications (A1c, retinopathy, neuropathy, nephropathy, heart attack, stroke), dental care history (last visit to dentist, frequency of brushing, flossing and use of mouthwash), dental problems (loose teeth, bleeding while brushing, teeth sensitivity and number of teeth) and presence of osteoporosis (treatment for or history of osteoporotic fracture). We manually counted their teeth, and all questionnaire responses regarding the above clinical variables were verified from the patient's clinic chart. Questionnaire responses that were considered to suggest the presence of periodontal disease (i.e., gingivitis or periodontitis) included any positive answer to a history of deep cleaning, loose teeth, tooth sensitivity or gum bleeding when brushing. Patients were assigned unique study identification numbers and de-identified data were stored in a password-protected database.

Statistical analysis

Survey responses were summarized using means with standard deviations for continuous variables and using frequencies/percentages for categorical variables. The appropriate univariate analyses were done to ascertain the relationship between each surveyed variable and the number of remaining teeth (i.e., dental loss). For continuous survey variables, the appropriate univariate analyses included Pearson correlations; for categorical survey variables, the analyses included independent-samples t-tests and one-way ANOVAs. Suitable non-parametric tests were performed when indicated. Survey variables with significant association (p -values < 0.05) with number of remaining teeth were used to construct the multiple linear regression model for the prediction of degree of dental loss. The alpha value for statistical significance was set at $p < 0.05$, and all statistical analyses were performed using SPSS version 22.0 (IBM).

Results

Participants

A total 202 consecutive patients with diabetes were interviewed with an investigator-administered questionnaire during their routine clinic visit. Mean age and duration of diabetes were 58.85 ± 13.2 and 15.75 ± 11.0 years, respectively. Our population included 100 female (49.5%), 105 Caucasian (52.0%), 39 Hispanic (19.3%), and 35 African American (17.3%) subjects. Average BMI was $33.3 \pm 8.2 \text{ kg/m}^3$ and 67% were current or former smokers (Table 1).

Only 13 subjects (6.4%) had all their natural teeth, and 189 subjects (93.5%) were missing one or more of their natural teeth (31 subjects had no teeth, 32 had 1–16 teeth and 126 had 17–31 teeth; Fig. 1). Of those with teeth ($n = 171$), 87.7% had questionnaire responses suggestive of periodontal disease (Table 2).

Univariate analyses

Univariate analyses between each of the survey variables and number of teeth revealed that the following variables were significantly associated with the number of remaining teeth: age (in years), duration of diabetes (in years), smoking status (current/former vs. never), flossing, presence of retinopathy, presence of nephropathy, presence of neuropathy, presence of periodontal disease, and number of months since last visit to a dentist (Table 3).

Table 1

Characteristics of survey respondents, $n = 202$

	Mean (\pm SD), or number (%)
Demographics	
Age, in years	58.85 (\pm 13.2)
Gender (female)	100 (49.5%)
Body mass index (BMI)	33.29 (\pm 8.2)
Race (Caucasian)	105 (52.0%)
Diabetes (DM) status	
DM duration, in years	15.75 (\pm 11.0)
Hemoglobin A1c, in %	7.67 (\pm 1.6)
DM type (type 2)	176 (87.1%)
Dental status	
Number of teeth	19.63 (\pm 11.1)
Last dentist visit, in months	39.01 (\pm 79.1)
Have dental insurance	117 (57.9%)
Vascular complications	
Retinopathy	44 (21.8%)
Nephropathy	58 (28.9%)
Neuropathy	97 (48.0%)
Heart disease	39 (19.3%)
Stroke	29 (9.9%)
Other variables	
Current or former smoker	136 (67.4%)
Bone disease	36 (17.8%)

Regression model

Significant variables from the univariate analyses were included in the multiple linear regression model for the prediction of number of teeth remaining in a patient with diabetes (Table 4). This model was significant at $p < 0.001$ with an adjusted R^2 of 0.181. When adjusted for the other variables in this model (duration of

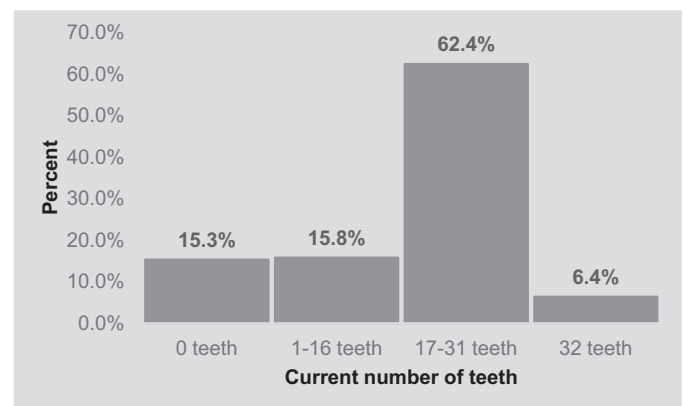


Figure 1. Current number of teeth in survey respondents, $n = 202$.

Table 2

Dental hygiene practices and dental health status of survey respondents with teeth, $n = 171$

	Number (%)
Dental hygiene practices	
Brush teeth daily	168 (83.2%)
Floss daily	100 (58.5%)
Use mouthwash daily	114 (67.1%)
Dental health status	
Have had a deep-cleaning	125 (73.1%)
Have loose teeth	14 (8.2%)
Experience tooth sensitivity	52 (30.4%)
Gums bleed	56 (32.9%)
Responses suggestive of periodontal disease (i.e. one or more of above)	150 (87.7%)

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