Periodontal Disease among Adult, New-Immigrant, Chinese Americans in Boston with and without Diabetes – A Brief Communication

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Abstract

Objectives: *We compared the periodontal disease levels in a population of low socioeconomic status (SES), urban, adult, Chinese American immigrants with and without type 2 diabetes.* ***Methods:*** *Dental records of 51 diabetic adults were compared with 102 nondiabetic controls from South Cove Community Health Center, Boston, MA, cross-matched by age and gender.* ***Results:*** *Our results showed that the proportion of sites with bone loss greater than 5 mm in the mesial areas of teeth was significantly correlated with higher glycosylated hemoglobin (HbA1c) (*r *= 0.35,* P*-value = 0.01). The number of teeth with mesial bone loss of greater than 5 mm was correlated to increasing HbA1c (*r *= 0.37,* P*-value = 0.01).* ***Conclusions:*** *Our preliminary data showed that mesial bone loss greater than 5 mm was correlated with inadequate control of diabetes. The implications and recommendations for the dental care of immigrant Chinese Americans with diabetes were discussed.*

Key Words: oral disease, diabetes, Chinese American, Boston

Introduction

According to the World Health Organization, 366 million people are projected to have diabetes by the year 2030, and approximately half of the world's new cases of diabetes will be among Asian and Pacific Islanders (1). Asian and Pacific Islander immigrants in the United States have higher rates of diabetes than those in their native Asian countries despite their common genetic background (2). The age, sex, and body mass index-adjusted prevalence of diabetes in Asian-Americans are approximately 60 percent higher than in non-Hispanic Whites (3).

In this study, we reviewed the comprehensive medical records of patients of South Cove Community Health Center ("South Cove") in Boston. These comprehensive medical records contain the medical history, medical laboratory test results, and dental records of all patients. Local community advocates founded South Cove in 1972. In 1976, South Cove became a federally funded community health center.

Based on the data in the 2000 US Census report, there are 44,284 Asian-Americans in Boston (7.9 percent of Boston's population). Chinese constitute the largest Asian-American subgroup in Boston at 19,632 (44.3 percent) (4). Nearly one-half of Chinese households have incomes less than $25,000, and 26 percent of these report less than $10,000 per household (4). More than 72 percent of South Cove patients have incomes less than 200 percent of the federal poverty rate, and over 80 percent are Chinese new immigrants. South Cove defines new immigrants as individuals who have lived in the United States for less than 5 years. From April 2004 to March 2005, 200 percent of the federal poverty income level for a family of two was $24,980 and for a family of four was $37,700 (5).

The objective for this study was to compare the level of periodontal disease among community health center patients with and without diabetes.

Methods

Study Population. This study received approval from the Internal Review Board of Harvard Medical School and the administration of the South Cove Community Health Center.

This is a retrospective, cross-sectional, case-matched, medical record review study modeled after another study published in 2004 in the *American Journal of Public Health* entitled "Oral disease burden in Northern Manhattan patients with diabetes mellitus." In that study, Lalla et al. studied existing full mouth dental X-ray films (FMX) in adults with diabetes (6). We chose this

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method in our study because of the availability of both dental and medical records at South Cove.

From 2002-04, there were over 750 adult patients with a diabetes mellitus diagnosis at South Cove. Of these patients, 68 had full mouth dental radiographs taken from 2002-04 at the health center. The inclusion criteria for this study included: a) availability of the medical record at the times of chart review; b) availability of FMX in the patients' charts; and c) availability of hemoglobin A1c (HbA1c) values documented in the records of diabetic patients.

Of the 68 diabetic patient cases, 17 diabetic cases were excluded because they lacked all of the inclusion criteria. For each of the remaining 51 patients, two nondiabetic patients, who had FMX taken in this same period (2002-04), were matched on age (±5 years) and gender.

All of the study participants were ethnic Chinese American adults. Data on age, gender, and socioeconomic status (SES) were also extracted from the medical records. We defined any patient who was documented with incomes below 200 percent of the federally defined poverty level as "low SES," and any patient who did not as "nonlow SES" (5).

Radiographic Examination and Assessments. Full mouth (periapical and posterior bitewing) dental radiographs were evaluated for several parameters including the following:

- missing teeth: the number of missing teeth based on a complete dentition of 32 teeth;
- bone loss: the mesial and distal bone levels for each tooth measured by a millimeter caliper. This device was used to measure the distance from the cementoenamel junction to the height of the interproximal crest of bone.

Two examiners performed medical data abstraction, but a single examiner evaluated radiographic evidence of bone loss scores for each of the 153 records.

Reliability of Oral Health Measurements. Repeated measurements were made by the same examiner on a subsample of patients (15 diabetic cases) to evaluate the measurement error. The mean difference between the first and second measurements for alveolar bone loss was 1.3 mm [standard deviation (SD) = 9.77 mm]. Measurements were identical in 50 percent of the sites. Reproducibility within 1 mm was 91.5 percent, and within 2 mm was 98.8 percent. Intraclass correlation coefficients (ICC) were also derived as measures of reliability of the oral health measurements used in the main study. ICC ranged from 0.65 to 0.99, with 5 out of 16 measurements having excellent reliability (ICC > 0.75). Reliability was higher for measurements using the cutoff point of 5 mm.

Statistical Analysis. The SAS statistical package, version 8.2 (SAS Institute Inc., Cary, NC) was used for all the statistical analyses described earlier. We used an α error of 0.05 to evaluate the significance of all of the statistical tests performed.

Percentages, means, and SDs were derived to describe the demographic characteristics, missing teeth, and bone loss measurements of 51 cases and 102 controls. Spearman correlation coefficients were derived to test the association between HbA1c levels and oral health indicators (continuous variables) among diabetic patients, as the normality of distribution of HbA1c levels and almost all oral health measures among diabetics was rejected by the Shapiro–Wilk test for normality ($P < 0.05$), with the exception of the number of missing teeth ($P = 0.39$).

Results

Demographic characteristics, general and oral health conditions in the diabetic cases, and nondiabetic controls are shown in Table 1. The case group consisted of 32 females (62.75 percent) and 19 males (37.25 percent), and the control group consisted of 64 females (62.75 percent) and 38 males (37.25 percent).

In our analysis using the Spearman correlation coefficients (Table 2) to determine the crude association between HbA1c and oral indicators, the proportion of sites with bone loss greater than 5 mm in the mesial areas of teeth was significantly correlated with higher HbA1c ($r = 0.35$, P-value = 0.01). This analysis also found that the number of teeth with mesial bone loss of greater than

Table 1
Description of Demographic Characteristics and Oral Conditions by Case Status

	Diabetic case ($n = 51$)	Nondiabetic control ($n = 102$)
Age*	65.06 (10.78)	64.01 (10.74)
Gender: female	62.75%	62.75%
Current smokers	8.00%	8.33%
Socioeconomic status: below poverty	90.20%	92.16%
Average hemoglobin A1c*	7.39 (1.21)	–
Missing teeth*	11.02 (4.86)	9.76 (5.48)
Mean bone loss (mm)*	2.83 (1.03)	2.72 (0.93)
Mesial bone loss (mm)*	2.82 (1.04)	2.69 (0.94)
Distal bone loss (mm)*	2.83 (1.02)	2.74 (0.94)
Number of teeth with mean bone loss of ≥3 mm*	8.02 (6.16)	7.98 (6.47)
Number of teeth with mean bone loss of ≥5 mm*	1.47 (2.48)	1.19 (2.76)
Proportion of teeth with mean bone loss of ≥3 mm*	0.41 (0.31)	0.37 (0.29)
Proportion of teeth with mean bone loss of ≥5 mm*	0.08 (0.16)	0.06 (0.13)

* Values given are means and standard deviations (in parentheses).

Table 2
Spearman Correlation Coefficients between Hemoglobin A1c (HbA1c) Levels and Oral Indicators among Diabetics Only

	Spearman correlation coefficient (with HbA1c)	*P*-value
Number of missing teeth	−0.17	0.22
Mesial bone loss	0.25	0.08
Distal bone loss	0.21	0.14
Mean bone loss	0.23	0.10
Number of teeth with mean bone loss of ≥3 mm	0.25	0.07
Number of teeth with mean bone loss of ≥5 mm	0.24	0.09
Number of teeth with mesial bone loss of ≥3 mm	0.25	0.08
Number of teeth with mesial bone loss of ≥5 mm	0.37	0.01*
Number of teeth with distal bone loss of ≥3 mm	0.24	0.09
Number of teeth with distal bone loss of ≥5 mm	0.25	0.08
Proportion of teeth with mean bone loss of ≥3 mm	0.23	0.11
Proportion of teeth with mean bone loss of ≥5 mm	0.23	0.11
Proportion of teeth with mesial bone loss of ≥3 mm	0.25	0.08
Proportion of teeth with mesial bone loss of ≥5 mm	0.35	0.01*
Proportion of teeth with distal bone loss of ≥3 mm	0.23	0.10
Proportion of teeth with distal bone loss of ≥5 mm	0.22	0.11

* Significant at 0.05 level.

5 mm was correlated to increasing HbA1c ($r = 0.37$, P-value = 0.01).

Discussion

Based on the findings from this pilot study, we recommend that physicians in the health center routinely refer their diabetic patients for oral examinations and treatment to improve the oral health of these patients. We also recommend the addition of a dental referral item into the health center's standard medical examination form in order to remind physicians of the importance of dental care in managing diabetes. We recommend that the medical history form of the dental department include the following:

- At the dental visit, the date of diabetes diagnosis should be documented.
- At the time of dental examination and radiographs, the patient's HbA1c level should be documented in the dental chart. If the test is older than 6 months, a new test should be ordered.
- A more thorough smoking history should be documented, including history of ever smoking, number of cigarettes per day, length of abstinence, etc.

The findings in Table 2 show a trend of increasing periodontal bone loss correlated to poorer diabetic control. They support findings from other published studies on periodontal disease and type 2 diabetes (6,7). However, given our small sample size, future studies including more patients are needed to confirm the association.

Our study was restricted to only those patients who were diagnosed with type 2 diabetes and for whom the diagnosis was documented in their medical records. We realize that many diabetic patients may not have been diagnosed. Hence, any undiagnosed, asymptomatic, or misdiagnosed patient may not be included as a case and may have been present in the control pool. Using medical records as the data source incorporates bias from the South Cove physician or dentist and limits the information available to the investigator.

Despite the limitations of a retrospective study, our preliminary findings of the oral health status of this community will add to a very small number of health studies in the Asian-American population (8). This is one of the first oral studies based in a community health center in a Chinese American population. Further studies are needed to better understand the oral disease levels of Chinese Americans with type 2 diabetes.

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