Clinical implication of blood glucose monitoring in general dental offices: the Ehime Dental Diabetes Study


ABSTRACT

Objective: We examined whether general dentists can contribute to the detection of patients with undiagnosed diabetes and prediabetes by monitoring blood glucose in dental clinics.

Research design and methods: A total of 716 patients who visited clinics for dental treatment were enrolled and classified into 3 groups (mild, moderate, and severe) according to Kornman’s criteria for periodontitis. The correlations between the casual blood glucose level, presence or absence of the history of diabetes, and/or severity of periodontitis were evaluated.

Results: 68 patients (9.5%) had hyperglycemia (blood glucose ≥200 mg/dL). Of these patients, 20 (29.4%) did not have a history of diabetes. Blood glucose tended to be higher with greater periodontitis severity. Of the 3 groups, the severe periodontitis group had the highest proportion of patients with hyperglycemia (p<0.0001).

Conclusions: Patients with dental problems could be screened for diabetes, especially undiagnosed diabetes. General dentists could function as practitioners to screen for diabetes.

Trial registration number: UMIN-CTR 000014877.

Key messages

- The results of our study indicate that about 1 in 10 patients visiting the dentist for dental problems has hyperglycemia (blood glucose ≥200 mg/dL), regardless of the history of diabetes. Of these patients, approximately one in three had no history of diabetes.
- The enrolled patients were classified into three groups (mild, moderate, and severe) for periodontitis; the severe group had the highest proportion of patients with hyperglycemia (p<0.0001).
- The prevalence of diabetes in the patients with dental issues in the present study (23.9%) is much higher than the estimated prevalence (7.6%) in the Japanese population. This report describes the need for general dentists to assist physicians by screening patients for hyperglycemia.

RESEARCH DESIGN AND METHODS

This study enrolled patients in Japan visiting general dentists who were members of the Ehime Dental Diabetes Study Group and had received training before starting their practice. Patients with edentulous jaws were excluded, resulting in 716 patients who agreed to participate. This study was approved by the institutional review board at Ehime University Hospital, and the study protocol was registered in the UMIN clinical trial registry (UMIN 000014877). All participants provided signed informed consent before undergoing any procedure.

A questionnaire regarding their history of diabetes mellitus (DM) was completed by all of the participants. The periodontal
condition was assessed using periodontal pocket depth (PD) and resorption of the supporting bone. The distance from the cement–enamel junction of the tooth to the bone crest was evaluated as proximal bone loss and calculated as the percentage of the total root length. Tooth stumps and dental implants were excluded. Patients with ≥20 functional teeth (n=528) were divided into three groups according to Kornman’s criteria for PD and bone loss: 3 no to mild periodontitis (mild), moderate periodontitis (moderate), and severe periodontitis (severe). Samples of finger capillary blood were casually obtained from all patients. Blood glucose was measured using Precision Xceed (Abbott Diabetes Care Inc., Alameda, California, USA).

GraphPad Prism 5 (GraphPad Software Inc, San Diego, California, USA) was used for statistical analyses. The results were compared between those with (DM group) and without (non-DM group) a history of diabetes. Continuous variables were compared using t tests, and categorical variables were compared using χ² tests. One-way analysis of variance followed by Tukey’s HSD (honest significant difference) test was used to compare the differences between the three groups based on Kornman’s criteria. p Values <0.05 were considered statistically significant for all tests.

RESULTS

There were 716 patients (313 men and 403 women) who participated, with a mean age of 61.1±14.4 years (range 21–90 years) (table 1). A history of diabetes was present in 151 patients (21.1%). The mean blood glucose level for all of the patients was 133.0±56.0 mg/dL; of the 68 patients (9.5%) with hyperglycemia (≥200 mg/dL) (table 1), 20 (29.4%) did not have a history of diabetes.

The mean blood glucose levels were 183.2±73.9 and 119.6±40.8 mg/dL in the DM and non-DM groups, respectively (p<0.0001). The incidences of hyperglycemia in the current study population compared to the general population was reasonable (24.2% vs 7.6%). Moreover, the incidence of hyperglycemia in the non-DM group was 3.5%. Diabetes is considered as a risk factor for oral disease including periodontitis and dental caries. 

There were 187 patients (35.4%) in the mild periodontitis group, 286 patients (54.2%) in the moderate periodontitis group, and 55 patients (10.4%) in the severe periodontitis group. The mean blood glucose levels in these groups were 110.0±41.5, 137.6±57.7, and 156.1±71.1 mg/dL, respectively. The glucose level in the mild periodontitis group was significantly lower than the levels in the moderate periodontitis and severe periodontitis groups (p<0.0001). The glucose level in the moderate periodontitis group demonstrated a tendency to be lower than that in the severe periodontitis group (p=0.07). However, the severe periodontitis group had the highest proportion of patients with hyperglycemia: 5/187 patients (2.6%) in the mild periodontitis group, 25/286 patients (8.7%) in the moderate periodontitis group, and 13/55 patients (22.8%) in the severe periodontitis group (p<0.0001). In this study, approximately one-quarter of the patients with dental issues had diabetes, regardless of their diabetes history. Furthermore, blood glucose levels were higher with more severe periodontitis in patients without diabetes but who had hyperglycemia.

The prevalence of diabetes in the patients with dental issues in this study (171 patients; 23.9%), as assessed by combining the patients in the DM group with those in the non-DM group with hyperglycemia, is much higher than the estimated prevalence (7.6%) in the Japanese population aged 20–79 years. Even when comparing our sample in the same age range (20–79 years), the difference in prevalences remained unaltered (24.2% vs 7.6%). Moreover, the incidence of hyperglycemia in the non-DM group was 3.5%. Diabetes is considered as a risk factor for oral disease including periodontitis and dental caries.

It was also shown that severe periodontitis adversely affects glycemic control in diabetes and glycemia in non-diabetes participants. The higher prevalence of DM and hyperglycemia in the current study population compared to the general population compared to the general population was reasonable.

<table>
<thead>
<tr>
<th>Table 1 Dental patients’ characteristics and blood glucose data</th>
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<tbody>
<tr>
<td><strong>Total</strong></td>
</tr>
<tr>
<td>n</td>
</tr>
<tr>
<td>Female/male</td>
</tr>
<tr>
<td>Age (years)</td>
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<tr>
<td>Blood glucose (mg/dL)</td>
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<tr>
<td>Hyperglycemia (≥200 mg/dL)</td>
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<tr>
<td>Severity of periodontitis (≥20 functional teeth)</td>
</tr>
<tr>
<td>Mild</td>
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<tr>
<td>Moderate</td>
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<tr>
<td>Severe</td>
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<td>55 (10.4)</td>
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<td>Data are represented as n, n (%), or mean±SD.</td>
</tr>
</tbody>
</table>
Periodontitis is the most prevalent chronic disease worldwide, and many patients see their dentists more often than their primary care physicians. Therefore, patients seeking care for dental problems could be screened for diabetes, especially undiagnosed diabetes. Self-management practices for periodontitis, such as frequent tooth brushing to decrease dental plaque, are reportedly correlated with attitudes about diabetes. A dental recall system, which aims to maintain oral health after treatment completion, provides a valuable chance to monitor blood glucose on a regular basis. General dentists could function as valuable practitioners in the total healthcare system, particularly for diabetes.

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**Contributors** TaH, Kenji Shigematsu, SK, HS, SI, HM, KN, HI, MF, and HY collected the clinical data. TaH, WN, and ToH were primarily responsible for data collection and analysis. RK, YT, HiO, Keita Shimizu, HH, and HaO contributed to the interpretation of the findings and the final editing of the manuscript. SH wrote the manuscript and is the guarantor and, as such, had full access to all the data in the study and takes responsibility for the integrity of the data and accuracy of the data analysis.

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**Competing interests** None declared.

**Ethics approval** The institutional review board at Ehime University Hospital.

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**Data sharing statement** No additional data are available.

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**REFERENCES**