Screening for Diabetes mellitus using gingival crevicular blood
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Abstract
Aim: To compare the glucose levels in gingival crevicular blood and capillary blood from finger puncture of diabetic with non-diabetic population and to assess the correlation of GBGL with CBGL.
Methods: Thirty patients with moderate to severe periodontitis were selected. Periodontal examination was performed using a William’s graduated probe and periodontitis was classified according to AAP (American Academy of Periodontology). Blood oozing from gingival tissues during periodontal examination was collected on the strip of the Glucose self-monitoring device (Accuchek, Roche Diagnostics, Germany). Then the finger stick capillary blood was drawn as controls. Statistical analysis was performed using student-t test and Pearson’s correlation coefficient. Results: The prevalence of diabetes in periodontal patients was found to be 46.67%. The GBGL (gingival blood glucose levels) and CBGL (capillary blood glucose levels) derived from all samples were 150.93mg/dl and 156.36mg/dl respectively. Highly significant differences between diabetic and non-diabetic periodontal patients were found with respect to GBGL and CBGL. Highly significant correlation between CBGL and GBGL (p<0.001) was found. Conclusions: Both the GBGL and CBGL were significantly greater in diabetics than their non-diabetic counterparts and the GBGL correlated with CBGL.

Key words: Diabetes Mellitus; Gingival sulcular blood levels; Capillary blood glucose levels; Periodontitis.

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Introduction

Diabetes mellitus encompasses a heterogeneous group of disorders with the common characteristics of altered glucose tolerance or impaired lipid and carbohydrate metabolism (1). Periodontal disease is the sixth most common complication of diabetes, making it a major risk factor influencing the incidence and severity of periodontal related problems (2). The prevalence of diabetes mellitus in patients with periodontitis is greater than in periodontally healthy patients. Therefore a high number of patients with periodontitis may have undiagnosed diabetes mellitus (3).

Epidemiologic studies have also been used to explain the relationship between periodontal disease and severity of diabetic state. However, occurrence of complications, mode of therapy, duration of diabetes, age of patient and degree of control of diabetes have been used as indicators of the disease in these studies (4). Global prevalence rate (WHO) of diabetes mellitus in the year of 2000 was 2.8% and likely to increase twofold by 2030(4.4%). Incidence of diabetes in India is estimated to be 20.2 per 1000 persons and prevalence rate is 12.1 % in adults (5, 6).

The introduction of self-monitoring provided diabetic patients with a simple method for rapid daily monitoring of their disease. Self-monitoring devices use one drop of finger punctured whole blood placed on a test strip impregnated with glucose oxidoreductase.

Periodontal inflammation with or without the complicating factor of diabetes mellitus is known to produce ample extravasated blood during diagnostic procedure. Routine probing during periodontal inflammation is more familiar to a dental practitioner and less traumatic than a finger puncture with a sharp lancet. It is possible that gingival blood from probing may be excellent source for glucometric analysis using portable glucose self monitoring device (7).

The purpose of this pilot study was to compare the glucose levels in gingival crevicular blood and capillary blood from finger puncture diabetic with non-diabetic population and to assess the correlation of GBGL with CBGL.

Material and methods

A total of thirty patients participated in the present study. Nineteen males and eleven females with moderate to severe periodontitis were selected from the outpatient department. Patients with history of diabetes were also included for the study, on the basis of history and medical records furnished by the patients (only three patients were known diabetes) among the entire sample. The blood samples were all taken during routine clinical examination where patients usually had their food when they came to the clinics. In known diabetic patients the sample drawn was 4 hours after taking medication. We have carried out the random blood sugar levels in our patients as this is the simple and initial chairside screening method for detection of diabetes in previously undiagnosed condition.

Patients with history of anemia, polycythemia, cardiovascular events, nutritional deficiencies, dialysis, or supplemental vitamin C (which may lead to any elevated results), other hepatic, immunologic, renal, hematological or organ impairment were excluded from the study. Also patients with periodontal pus exudates were excluded from the study. Patients aged 20 years and above had to have at least one tooth with periodontitis in the upper anterior segment (easy accessibility) for inclusion in the study. Clinical history and intraoral findings were recorded. A detailed periodontal examination was done using William’s graduated probe and classified according to AAP (American Academy of Periodontology) (2) as moderate (Periodontal pocket depth 3-5mm) and severe (Periodontal depth ≥ 6mm).
Screening for Diabetes using GCF

Patients were asked to rinse with Chlorhexidine mouthwash. The upper anterior segment was isolated with cotton roll. A plastic capillary tube of 2mm bore marked up to 3µl was used for collection of blood from the gingival sulcus and a probing force of approximately 0.2N was used to elicit bleeding from the site. The Accu-chek Active Glucometer (Roche Diagnostics, Germany) monitoring device was loaded with the active test strip (impregnated per cm with glucose dye oxidoreductase 0.7µ) and 2µl of blood was transferred on to the test strip. The testing time was about 10 seconds. Then the regular finger stick capillary blood was collected. Both samples were analyzed and readings were recorded.

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS), version 11.0.

Results

Thirty patients (19 males and 11 females) took part in this study with the mean age of 49.8 years (males - 53.6 years and females - 43.1 years). There was only one female patient of juvenile diabetes of age 22 years with moderate periodontitis. Prevalence of diabetes in periodontal patients was found to be 46.67% (males - 47.3% and females - 45.4%).

Table 1: GBGL and CBGL levels in relation to age group and gender

<table>
<thead>
<tr>
<th>Age group</th>
<th>GBGL</th>
<th>CBCL</th>
</tr>
</thead>
<tbody>
<tr>
<td>22 – 50 years</td>
<td>163.00 ±75.50</td>
<td>167.20 ±75.52</td>
</tr>
<tr>
<td>51 and more</td>
<td>138.86 ±74.00</td>
<td>145.53 ±72.30</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>158.10 ±83.74</td>
<td>163.36 ±80.87</td>
</tr>
<tr>
<td>Female</td>
<td>138.54 ±56.51</td>
<td>144.27 ±60.23</td>
</tr>
</tbody>
</table>

Student’s t test

The GBGL (gingival blood glucose levels) and CBGL (capillary blood glucose levels) derived from all samples were 150.93mg/dl and 156.36mg/dl respectively. No significant difference between GBGL and CBGL was observed in relation to age and gender (Table 1). Statistical analysis using students ‘t’ test showed highly significant differences between diabetic and non-diabetic periodontal patients with respect to GBGL and CBGL (Table 2). The glucose level in capillary blood was greater than that of crevicular blood in both the groups.

Table 2: Comparison of diabetic and non-diabetic periodontal patients with respect to GBGL and CBGL

<table>
<thead>
<tr>
<th>Study group</th>
<th>GBGL</th>
<th>CBGL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-diabetic</td>
<td>99.87±16.07</td>
<td>105.75±16.02</td>
</tr>
<tr>
<td>Diabetic</td>
<td>209.28±72.10</td>
<td>214.21±70.64</td>
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*Student’s t test, p<0.001

Figure 1: Correlation between GBGL (mg/dl) and CBGL (mg/dl) in total patients

Correlation between GBGL and CBGL in the total sample was analyzed using Pearson correlation coefficient. Highly significant correlation between CBGL and GBGL (p<0.001) was found (figure 1).

Discussion

Glucose testing with the Accu-Chek active self-monitoring device is sensitive, since it can provide results with just 2- 3µl of blood within 5 seconds. GBGL collected during periodontal examination may be an excellent source of blood, safe, easy to perform and comfortable to the patient. Highly significant correlations (r=0.9934, p<0.001) were found between GBGL and CBGL consistent with
Screening for Diabetes using GCF

many studies (7-13). The use of gingival crevicular blood to measure glucose is likely to be more acceptable to the dental professional and the patient because provider and patients anticipate oral intervention in the dental office. Persons can reliably be screened for diabetes by measuring glucose in gingival crevicular blood sample, since probing and gingival crevicular blood collection took only approximately 2 min and did not increase the patient’s discomfort. Using a fine capillary tube (2mm) diameter may minimize the contamination of GBGL with calculus, debris, or inflammatory exudates. Similarly a bent pipette was used by one study (7).

There are very few studies done for screening Diabetes mellitus using gingival crevicular blood in India (14, 15) where the incidence rate of DM is increasing at an alarming rate. Hence if the dentist participate in the challenge of identifying undiagnosed diabetes by the routine screening of patient especially those with pronounced gingival inflammation (12), it would really prove beneficial for mankind.

Generally lower reading in the gingival crevicular blood pointed to considerable contamination with gingival exudates (9, 13), but that we attempted to minimize it by using a thin capillary tube in our study. Also the isolation procedure and rinsing with chlorhexidine can minimize the inflammatory load of GBGL. The difference between glucose level in GBGL and CBGL samples was said to be unacceptable for clinical purposes according to Muller (8), but still we would suggest that though capillary/venous blood samples used for diabetes mellitus screening is gold standard, the gingival crevicular blood may prove to be promising approach for routine dental office screening for diabetes mellitus in periodontal patients. During routine dental examination the blood sugar level estimation using gingival crevicular blood would definitely contribute greatly to patients who have undiagnosed diabetes mellitus.

Conclusions
Both the GBGL and CBGL were significantly greater in diabetics than their non-diabetic counterparts and the GBGL correlated with CBGL.

New investigations have definitely acknowledged a clinically relevant two-way relationship between periodontitis and diabetes mellitus which are significant for the dentist in daily practice and for a physician as well. Though capillary/venous blood samples used for diabetes mellitus screening is gold standard, the gingival crevicular blood may prove to be promising approach for routine dental office screening for diabetes mellitus in periodontal patients.

References
Screening for Diabetes using GCF


