ABSTRACT:

Diabetes mellitus (DM) is a metabolic disorder with various oral manifestations. Routinely, the elevated serum glucose level in patients is measured using peripheral blood by an invasive technique, using a self monitoring device. The increased prevalence and severity of periodontitis seen in diabetes patients, especially with poor metabolic control led to designation of periodontal disease as 6th complication of DM.

During periodontal examination, bleeding on probing provides a blood sample for non-invasive monitoring of the blood glucose levels thereby providing a chance for early detection and screening of Diabetes mellitus in Dental office. Hence, this study assesses the usefulness of gingival crevicular blood as sample for estimating the glucose level for screening of diabetes mellitus.

KEY WORDS: Diabetes mellitus, chronic periodontitis, gingivalcrevicular blood, capillary finger-prick blood, self-monitoring device.

Introduction:

Diabetes mellitus is one of the most common endocrine diseases with an increasing prevalence worldwide. Untreated diabetes can cause many acute and chronic complications. Diabetes is one of the leading causes of blindness, renal disease and increased mortality mainly from cardiovascular events. Hence it is very important to screen and detect diabetes at an early stage to prevent its progression to serious complications.

Investigators have indicated that there is a large group of patients with mild asymptomatic diabetes mellitus whose disease remains undetected unless blood tests are employed routinely. The blood tests usually employed involve use of a needle prick to collect the sample which is usually painful and uncomfortable for the patient. Hence, it is necessary to search for non-invasive yet sensitive alternative sites for sample collection for glucose estimation.

Diabetes mellitus has various complications and periodontal disease is the 6th complications. Since a large number of patients seek dental treatment every year, a dental clinic can serve as one of the screening centres for diabetes mellitus. Also, periodontal tissues (gums) provide the clinician with gingival crevicular blood (in disease state) or most commonly known as bleeding gums which can be collected painlessly unlike the finger prick or an intravenous sample routinely used, thereby opening doors to alternative sample testing for glucose estimation.
Aim:
This study aims at assessing the usefulness of alternative, non-invasive site of sample collection in screening of diabetes mellitus.

The alternative, non-invasive sites of sample collection is gingival crevicular blood (GCB) which can be collected during routine periodontal examination in diabetic and non-diabetic patients with chronic periodontitis.

Material and Method
The study comprised of 60 diabetic and non-diabetic patients aged 30-60yrs diagnosed with chronic generalized moderate to severe periodontitis divided into 2 groups:

1. **Group 1** – 30 generalized periodontitis (moderate to severe) patients with type II diabetes mellitus. (Figure 1)

2. **Group 2** – 30 generalized periodontitis (moderate to severe) without diabetes mellitus

From the two groups blood samples from the gingival crevice (GCB) and capillary finger blood (CFB) were collected. (Figure 2)

Inclusion and Exclusion factors
Patients free of any systemic conditions contraindicating periodontal probing or periodontal therapy were included. Patients with any disorder accompanied by abnormally low or high hematocrit values, severe cardio-vascular, hepatic, immunologic, renal, hematological, or other organ disorders or those who require antibiotic prophylaxis were excluded from the study.

Clinical protocol: An informed consent was obtained from patients willing to participate in the study. For each measurement only one active site was selected. Sites with suppuration were excluded from the study.

Contamination with saliva was prevented by using gauze and suction. GCB was obtained by probing the area using a William’s Probe and collected directly onto the glucometer strip for glucose estimation (Figure 3). In addition, regular finger prick capillary blood was collected under aseptic conditions and glucose levels estimated using glucometer. (Figures 4-7)

Both samples were analyzed using a Johnson & Johnsons One Touch glucose self-monitoring device according to the manufacturer’s recommendations.

Data so collected was subjected to appropriate statistical analysis.

Results:
The mean blood glucose values of the two different samples from the two groups that is Group I (Diabetics with chronic periodontitis) and Group II (Non-diabetics with chronic periodontitis) are shown in Table 1.
CORRELATION OF GLUCOSE READINGS

GROUP I (Diabetic Patients with Chronic Periodontitis)

When GCB glucose levels were compared to CFB glucose levels in Group I (diabetic patients with chronic periodontitis), the GCB glucose values showed a P-value of 0.216 (≥ 0.005), thus giving no statistically significant results with no significant difference in the means (Table 2, Graph 1). Pearson’s correlation showed a r value of 0.984 showing a statistically significant correlation. (Table 4).

Thus when GCB glucose levels are compared to CFB glucose levels in Group I, the GCB glucose values showed statistically significant correlation with CFB.

GROUP II (Non–Diabetic with Chronic Periodontitis)

When GCB glucose levels were compared to CFB glucose levels in group II (non-diabetic patients with chronic periodontitis), GCB glucose values showed a P-value of 0.049 (≥0.005), thus giving no statistically significant results with no significant difference in the means (Table 3, Graph 2). Pearson’s correlation showed a r value of 0.914 showing a statistically significant correlation (Table 4).

Thus, the results of the study revealed a strong correlation between the GCB glucose levels and CFB glucose levels in both diabetic and non-diabetic groups with chronic generalized periodontitis.

DISCUSSION:

DM is one of the most frequent metabolic disorders with estimated prevalence of 7% in industrialized countries of which nearly half the cases are undiagnosed (Hadden and Harris 1987).2

Considerable effort has been made in the past few years to develop painless and non-invasive methods to measure blood glucose in patients with diabetes mellitus using glucometers so as to avoid the trauma of drawing venous blood every time. One of the most commonly used sites to obtain blood is from the pad of the index finger. Even though this is less traumatic than venous blood, it is painful for the individual. Since periodontal inflammation is known to produce ample extravasate of blood during diagnostic periodontal examination,1 no extra procedure, such as, finger puncture with a sharp lancet is required to obtain blood for glucometric analysis.

The measurement of glucose through GCB involves a quick and simple intraoral procedure with minimal cost; dental professionals may be motivated to implement diabetes screening using a GCB sample and feel comfortable and confident in doing so.

Hence, this study assesses the usefulness of the site specific samples that is GCB for estimating the glucose level intra-orally during routine periodontal examination and to compare it with the standard peripheral blood samples.
The present study utilizes Johnson & Johnson One Touch Horizontal glucometer for estimating GCB glucose values as it works on the same principle as laboratory glucose analyzer (Glucose oxidase method), but requires very little blood sample (1 - 3µl) to perform the analysis providing fairly accurate results within seconds. The sampling procedure applied in this study is much easier to perform and less time-consuming (as no sophisticated armamentarium is necessary to collect GCB).

In the present study, by comparing the glucose values of GCB and CFB in group I (Diabetic Patients with Chronic Periodontitis) and group II (Non-Diabetic Patients with Chronic Periodontitis), a very strong correlation was observed with no statistically significant difference in their means. (Table 2 & 3)

Similarly intergroup comparison of GCB glucose values in group I and group II showed a statistically significant mean differences (p value <0.005) which may be attributed to the prevailing differences in glycemic control of the diabetic patients when compared to non-diabetic patients. (Tables 1)

Therefore, the inference of this study reveals that GCB may be used as an alternative non-invasive testing site for estimation of glucose levels.

The results of this study is in agreement with the studies conducted in 1993, wherein a very strong correlation was observed among GCB, CFB and the intravenous blood glucose measurements on examination of diabetic patients with unknown periodontal status. However the sampling procedure that was applied in the present study is much easier to perform and less time-consuming, since no additional tools are necessary to collect GCB.6

The present study is not in agreement with a study conducted in 2004 which failed to provide any evidence for the usefulness of GCB for testing blood glucose level during routine periodontal examination and there was no effort made to prevent contamination of the sample. But in our study all the precautions were taken to prevent contamination of the sample. 5

**Conclusion:**

Within the limitations of this study, it can be concluded that GCB collected during diagnostic periodontal examination may be an excellent source of blood for glucometric analysis. Screening for diabetes using GCB samples have to be encouraged as the technique is safe, easy to perform, and comfortable for the patient and therefore, helps to increase the frequency of diagnosing diabetes mellitus during routine periodontal therapy which provides a more objective indicator for referral to physicians than traditional methods.

**REFERENCES:**


**List of abbreviations.**

1. DM – Diabetes Mellitus
2. GCB - Gingival Crevicular blood
3. CFB – Capillary finger blood

**TABLES**

**Table 1: Mean, Standard Deviation and Range values in Group I & II**

<table>
<thead>
<tr>
<th>Group</th>
<th>Sample Number</th>
<th>GCB</th>
<th>CFB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I- Type II DM with CGP</td>
<td>30</td>
<td>Mean</td>
<td>176.56</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Standard Deviation</td>
<td>66.15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Range</td>
<td>90-352</td>
</tr>
<tr>
<td>Group II CGP</td>
<td>30</td>
<td>Mean</td>
<td>122.53</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Standard Deviation</td>
<td>47.03</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Range</td>
<td>78-352</td>
</tr>
</tbody>
</table>

**Table 2: Differences between GCB and CFB in Group I**

<table>
<thead>
<tr>
<th>Comparison between</th>
<th>Mean Difference</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>GCB v/s CFB</td>
<td>3.067</td>
<td>0.216</td>
</tr>
</tbody>
</table>

Student t Test

p value ≤ 0.005 – statistically significant
Table 3: Differences between GCB and CFB in Group II

<table>
<thead>
<tr>
<th>Comparison between</th>
<th>Mean Difference</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>GCB v/s CFB</td>
<td>9.767</td>
<td>0.049</td>
</tr>
</tbody>
</table>

Student t Test

p value ≤ 0.005 – statistically significant

Table 4: Correlation between GCB and CFB in Group I & II

<table>
<thead>
<tr>
<th>Pearson correlation</th>
<th>Group I</th>
<th>Group II</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r value</td>
<td>P value</td>
</tr>
<tr>
<td>GCB v/s CFB</td>
<td>0.984</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Pearson’s Correlation

p value ≤ 0.001 – statistically significant

**GRAPHS**

**Graph 1: Scatter diagram of relation between GCB and CFB in Group I**
Graph 2: Scatter diagram of relation between GCB and CFB in Group II

PHOTOGRAPHS

Figure 1: Group I - Chronic Generalized Periodontitis With Type II Diabetes Mellitus
Figure 2: Group II - Chronic Generalized Periodontitis

Figure 3: Collection of Gingival Crevicular Blood
Figure 4: Swabbing the pad of the index finger with surgical spirit

Figure 5: The lancet in position on the index finger
Figure 6: Placement of Test Strip to the Bleeding Site

Figure 7: Glucometer showing reading