

Effectiveness of glucometer in screening diabetes mellitus using gingival crevicular blood

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Abstract

Aim: Study was carried out to evaluate the efficacy of a glucometer for screening diabetes using gingival crevicular blood and to compare the blood glucose levels in the gingival crevicular blood sample and blood sample collected by finger puncture method using glucometers. **Subjects and Methods:** A total of 24 known diabetic patients who fulfilled the selection criteria were selected after obtaining their informed consent. Samples were collected from two sites, i.e., gingival crevice and fingertip which was measured using a self-monitoring device. **Statistical Analysis Used:** Karl Pearson correlation. **Results:** This study revealed the existence of a positive correlation between gingival crevicular blood and capillary blood glucose level ($r = 0.826$), and gingival blood glucose level estimates 68.2% of capillary blood glucose level. Hence, based on the observations of the study using gingival crevicular blood glucose level, capillary blood glucose level may be estimated based on the following regression equation. Capillary blood glucose = $84.66 + 0.77x$ gingival crevicular blood glucose level. **Conclusions:** The intraoral sampling technique is safer, convenient, and cost-effective for the dental practitioner as the sample can be obtained during the routine periodontal examination. It can be concluded that with the regression equation based on the gingival crevicular blood glucose level, capillary blood glucose can be estimated.

Keywords: Crevicular blood, diabetes mellitus, periodontal diseases

Introduction

Diabetes mellitus encompasses a heterogeneous group of disorders with the common characteristic of altered glucose tolerance and lipid metabolism.^[1] Periodontal disease is the sixth 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.^[3]

The conventional laboratory methods to diagnose diabetes mellitus is more time consuming and require elaborate equipments. The advent of self-monitoring devices allows an instantaneous chairside screening of blood glucose and helps the clinician to plan-specific treatment procedures.

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Various studies have been conducted to assess the use of this gingival crevicular blood with self-monitoring devices in the dental office to measure blood glucose and have reported comparable results. Hence, this study was undertaken to evaluate a quick, safe, and noninvasive method to screen for diabetes during the routine periodontal examination.

Aims and objectives

1. To evaluate the efficacy of a glucometer for screening diabetes using gingival crevicular blood
2. To compare the blood glucose levels in the gingival crevicular blood sample and blood sample collected from finger puncture method using a glucometer.

Subjects and Methods

Source of data

The study was conducted after obtaining ethical clearance from the Institutional Ethical Committee. Twenty-four patients with moderate periodontitis and with the history of diabetes were selected among the patients reporting to the department of periodontics, Yenepoya Dental College and Hospital, Mangalore. The details of the study were

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explained to the subject, and informed consent was taken. The subjects for the study were selected based on the following criteria;

Inclusion criteria

- Age 21–70 years
- Patients with moderate periodontitis
- The presence of bleeding on probing
- The presence of clinical attachment loss of 3–4 mm
- The presence of at least one tooth with periodontitis in the upper anterior segment.

Exclusion criteria

- Any underlying systemic disease except diabetes
- Patients on anticoagulant therapy
- Periodontal sites with suppuration
- Any history of periodontal treatment in the last 6 months
- Patients under medication for any systemic disease other than diabetes.

Methods

A tooth from maxillary anterior sextant was selected because this area offers the best access for crevicular blood sample collection. The maxillary anterior sextant was isolated with a cotton roll to prevent salivary contamination and dried with compressed air if required. The periodontal examination was done and blood oozing from gingival crevice was taken on to the test strip which was preloaded into the glucometer (Dr. Morepen®), and the corresponding values were recorded Figure 1.

Immediately following the collection of gingival crevicular blood sample finger puncture blood sample was drawn from patient's finger. The soft surface of the fingertip was wiped with alcohol and allowed to evaporate. The finger was punctured with sterile lancet and drop of blood placed on a test strip of the self-monitoring device Figure 2.



Figure 1: Collection of gingival crevicular blood sample

The reading obtained from the gingival crevicular blood, and finger puncture methods were recorded and compared using Karl Pearson correlation.

Results

A total of 24 diabetic subjects were selected which included, 11 females and 13 males [Table 1] with a mean age of 48.46 years. Blood was drawn from the gingival crevice, and fingertip and the values obtained were analyzed using Karl Pearson correlation [Graph 1], and the following results were obtained.

Comparison between gingival and capillary blood glucose among males and females is given in Table 2 and Graph 2. Among the 11 female patients, mean of gingival crevicular blood glucose level is 243.27, with the mean difference of 33.364 and mean of capillary blood glucose level is 276.64. “t” value is found to be 2.534 and $P = 0.030$. Among the 13 male patients mean of gingival crevicular blood glucose level is 198.38 with mean difference of 37.077. The mean of capillary blood glucose level is 235.46. “t” value is found to be 2.409 and $P = 0.033$.

Discussion

Diabetes mellitus is clinically and genetically heterogeneous group of disorders affecting the metabolites of carbohydrates and proteins. Hyperglycemia is due to deficiency of insulin secretion caused by pancreatic B cells dysfunction and/or insulin resistance in liver and muscle.^[4]

Examination of the available data reveals a strong evidence that diabetes is a risk factor for gingivitis and periodontitis

Table 1: Sex distribution among the 24 subjects

	Number of subjects	Percentage
Females	11	45.8
Males	13	54.2
Total	24	100

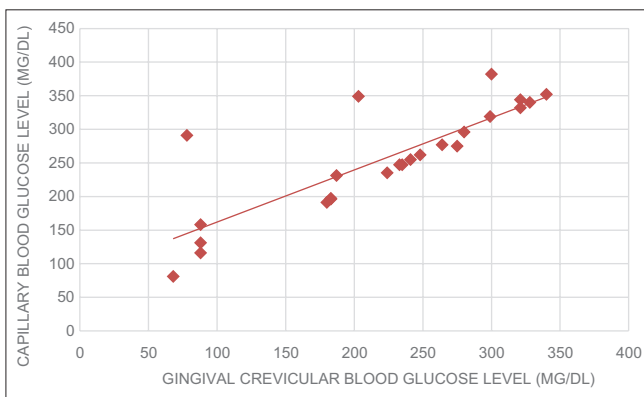
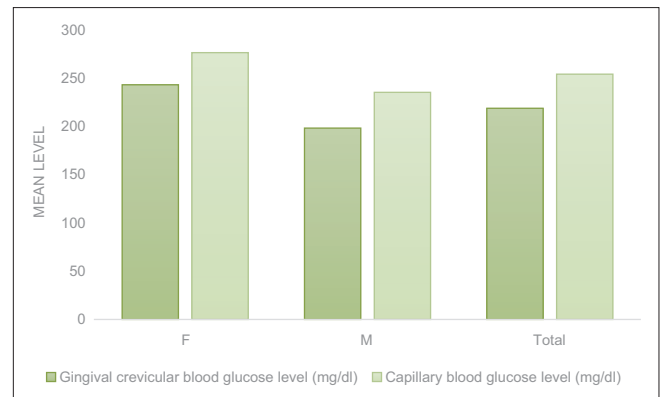


Figure 2: Collection of capillary blood sample

Table 2: Comparison between gingival crevicular and capillary blood glucose among males and females

Sex	n	Minimum	Maximum	Mean	SD	Median	Mean difference	SD of difference	t	P
Female										
Gingival crevicular blood level (mg/dl)	11	88	340	243.27	77.007	241.00	33.364	43.672	2.534	0.030
Capillary blood glucose level (mg/dl)	11	131	382	276.64	81.677	275.00				Significant
Male										
Gingival crevicular blood level (mg/dl)	13	68	328	198.38	90.884	233.00	37.080	55.496	2.409	0.033
Capillary blood glucose level (mg/dl)	13	81	340	235.46	78.027	247.00				Significant

SD: Standard deviation

**Graph 1:** Karl Pearson correlation coefficient $r = 0.826$, and $r^2 = 0.682$ **Graph 2:** Correlation between gingival blood glucose level and capillary blood glucose level

and level of glycemic control appears to be an important determinant in this relationship.^[5]

In many studies, the prevalence and severity of gingivitis had been demonstrated to be high in individuals with diabetes.^[5,6] A Greater level of gingival inflammation was observed in diabetics than in nondiabetics with a high level of inflammation in subjects with poor glycemic control.^[7] The number of bleeding sites was found to decrease as glycemic control improved.^[8]

In our study, the efficacy of a glucometer for the screening of diabetes using gingival crevicular blood was evaluated. Samples were collected from gingival crevice after periodontal examination and finger puncture method using sterile lancet. Both samples were measured using a self-monitoring device and the values obtained were compared using Karl Pearson correlation which showed a positive correlation between gingival crevicular blood and capillary blood glucose level.

In the earlier studies, the collection of blood sample from gingival crevice has been done using a disposable plastic pipette. However, in this study, the glucometer strips with the sensor at the tip of the strip was placed directly over the site once the

bleeding was induced after probing. This was much easier to perform and less time consuming since no additional tools, and skills are necessary to collect gingival crevicular blood. Here, the venous blood was not analyzed using laboratory method and instead, capillary blood itself was taken as the control.

A study by Shetty *et al.* also demonstrated a strong correlation between gingival crevicular blood and capillary blood glucose levels.^[9] The same methodology was followed which is safe, easy to perform, and comfortable for the patient and may therefore help to increase the frequency of screening diabetes mellitus in dental office.

Considerable effort has been made in the past few years with regard to the development of a noninvasive method to measure blood glucose in routine dental practice. The information available from a single laboratory test may not reflect the current blood glucose status of the patient during treatment procedures. Hence, regular monitoring of their blood glucose using glucometer during recall visits may be a better alternative.

This study revealed that there is a positive correlation between capillary blood glucose level and gingival crevicular blood

glucose level as $r = 0.826$, and gingival blood glucose level estimates 68.2% of capillary blood glucose level. Based on the results obtained in this study, from the gingival crevicular blood glucose level, the capillary blood glucose level may be estimated based on the following regression equation.

Capillary blood glucose = $84.66 + 0.77x$ gingival crevicular blood glucose level.

Conclusion

The intraoral sampling technique is safer, convenient, and cost-effective for the dental practitioner as the sample can be obtained during routine periodontal examination and referred to the physician, for the further medical management of diabetes.

Research has explored the dental office as a strategic venue for glucose testing, examining the possibility of using gingival crevicular blood for screening diabetes, and also for regular monitoring of their blood glucose during recall visit which is a better alternative than the elaborate laboratory procedures.

Further studies may be carried out using larger sample size and in periodontal patients on supportive periodontal therapy.

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Conflicts of interest

There are no conflicts of interest.

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