

Original Research

The significance of Gingival Crevicular Blood in the Screening of Diabetes Mellitus in Dental Practice

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Abstract

Aim: To evaluate whether blood from gingival tissues during routine periodontal examination can be used for determining glucose levels.

Methods: Thirty patients with gingivitis or periodontitis and bleeding on probing (BOP) were chosen. The following clinical periodontal parameters were noted: probing depth, BOP, gingival bleeding index, and periodontal disease index. Blood samples were collected from gingival crevicular blood (GCB) and capillary finger-prick

blood (CFB). These samples were analyzed using a glucose self-monitoring device.

Results: Descriptive statistical analysis has been carried out in the present study. Data were analyzed using a Pearson's correlation coefficient and Student's *t*-test. A *r*-value of 0.97 shows very strong correlation between CFB and GCB, which was statistically highly significant ($P < 0.0001$).

Conclusion: The authors conclude that GCB may serve as potential source of screening blood glucose during routine periodontal examination in

populations with an unknown history of diabetes mellitus.

Keywords: blood glucose self-monitoring, diabetes mellitus, gingival hemorrhage, periodontal diseases

Introduction: The increasing prevalence of obesity and physical inactivity due to population growth, aging, urbanization has prompted the rise in the incidence of diabetes mellitus (DM). The prevalence of DM for all age groups worldwide was estimated to be 2.8% in 2000 and 4.4% in 2030.¹ The countries with the largest number of people with DM will be India, China, and the United States by 2030. It is estimated that every fifth person with DM will be an Indian.² Because of these sheer numbers, the economic burden due to diabetes in India is among the highest in the world.² About half of diabetic patients are undiagnosed³, as DM is asymptomatic in its early stage and can remain undiagnosed for many years. Screening for type 2 DM would alone lead to earlier recognition of cases, with the potential to intervene earlier in the disease course. Thus, early diagnosis may prevent long term complications.³

Community screening is not a cost-effective approach to screening for DM.^{4,5,6} It may best be performed in primary care as part of a review of a patient's health. Other settings such as dental clinics may be appropriate. There are large numbers of patients who seek dental treatment each year and there is an association between periodontal disease and DM. The two reinforce each other.^{7,8,9} The dentist may play an important role in the health team by participating in the search for undiagnosed asymptomatic DM.

In this study we used a readily available self-monitoring device (SMD) as a simple method for rapid monitoring of the glucose level in the blood. We

compared the blood glucose level between gingival crevicular blood (GCB) and capillary finger prick blood (CFB). The purpose of this study was to assess the usefulness of an SMD for the estimation of the GCB glucose level during routine periodontal examinations

Materials and Methods:

Selection criteria: The study population was recruited from patients visiting the department of Periodontology. A total of 30 patients with the age range of 25 to 70 years with gingivitis or periodontitis with at least one site with positive bleeding on probing (BOP), were randomly selected for the study. Exclusion criteria included the following clinical conditions: any indication for antibiotic prophylaxis, any bleeding disorder, severe systemic disease such as cardiovascular, renal, hepatic, immunologic, or hematological disorders, and any medication interfering with the coagulation system. All the required clinical data was collected with the informed consent of the subjects in the study.

Clinical examination: Data was recorded by using the probing depth, BOP, gingival bleeding index (GBI)¹⁰, and periodontal disease index (PDI).¹¹

All of the sites were probed by a Williams probe, inserted into the gingival sulcus, as is commonly done during a periodontal examination. When the probe was removed, the gingival crevice was observed for bleeding.¹² One site with profuse BOP was chosen for testing. The sites most commonly selected were the interproximal area of the maxillary premolar and molar regions. These areas were isolated with cotton rolls to prevent saliva contamination and dried with compressed air, and the remaining fluid in the site was wiped out using a piece of gauze.

Collection of GCB and CFB: For the collection of the GCB sample, we selected a readily available SMD (ARKAY GLUCOCARD 01, One Touch Horizon Blood Glucose Monitoring System, USA) (Fig 1) with a compact design that facilitated intraoral collection requiring only a small quantity of blood for an accurate reading. The SMD was introduced intraorally with the test strip in place and blood was allowed to flow onto its reactive area according to the manufacturer's instructions. (Fig 2)

The test strip was prevented from contacting the tooth, and its entry into the sulcus was also avoided. Immediately after measuring the GCB, the CFB was assessed using the same Glucocard. The pad of the finger was wiped with alcohol, allowed to dry, and then punctured with a sterile lancet. A CFB sample was drawn onto the test strip preloaded in the SMD. (Fig 3) The GCB and CFB glucose readings were recorded. These CFB readings were viewed as "casual" readings because they were taken without regard to the time of meals. Study participants with elevated casual readings were referred to primary care providers for a more detailed medical evaluation.¹³

Results: The study was subjected to the descriptive statistical analysis. Results of continuous measurements were presented as mean±standard deviation (SD) (min–max) while the results of categorical measurements were presented as number (%). Significance of the study has been assessed at a 5% level of significance. The

Pearson's correlation has been used to find the correlation between the variables, and the significance of correlation has been obtained using the Student's *t*-test.

Upon the complete analysis of the study conducted on 30 patients, the blood glucose in GCB was able to be determined in only 25 patients, of which 88% was diagnosed with periodontitis and 12% with gingivitis (Graph 1). In the remaining 5 cases, the volume of blood procured on probing was insufficient for the estimation. Of the 25 successfully tested patients, 3 revealed elevated blood glucose levels from the normal. According to the epidemiological data on DM in urban India, the ratio of the unknown to known diabetic population is 1.8:1 and the prevalence of undiagnosed DM is estimated to be 7.2%; whereas in the present study, it was found to be 12%.¹⁴ The blood glucose estimations from the GCB sample ranged from 43 to 243 mg/dL with a mean of 96.48±62.38 mg/dL and those obtained from the CFB ranged from 70 to 344 mg/dL with a mean of 131.9±61.1 mg/dL (Table 1).

Pearson's correlation coefficient showed a positive correlation between GCB and CFB. The linear relationship was derived for the GCB and CFB (Table 2 and Graph 2) with *r*-value of 0.97, suggestive of a very strong correlation between CFB and GCB, which was proved to be statistically highly significant with a P value <0.0001.



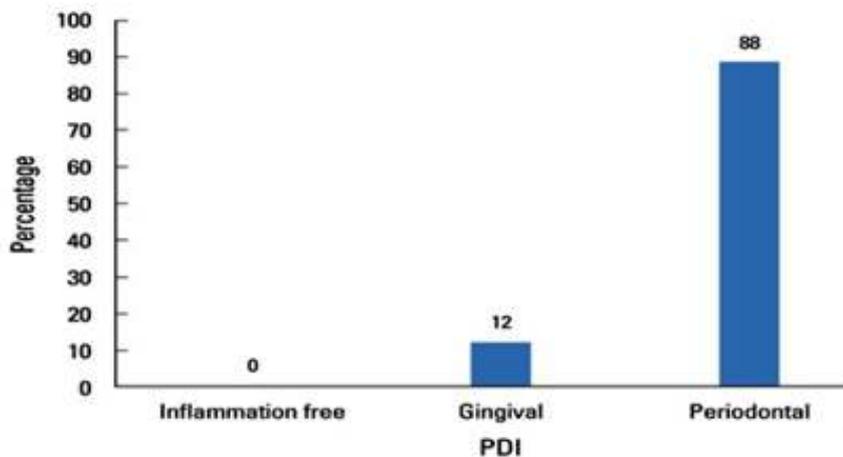
Fig 1: Glucocard Blood Glucose Monitoring Instrument strip for GCB



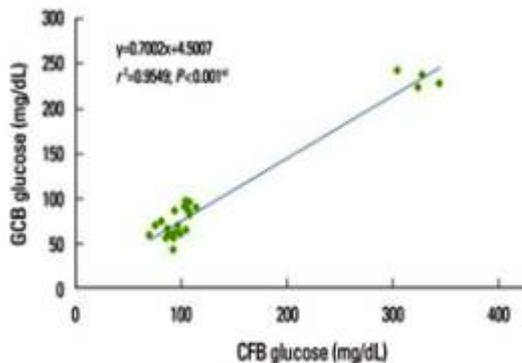
Fig 2: Intraoral placement of the test



Fig 3: CFB sample was drawn onto the test strip for recording CFB glucose



Graph 1: Distribution of periodontal disease index (PDI) score.



Graph 2: Linear regression analysis of GCB and CFB readings

Descriptive statistics.	
Variable	Range
CFB glucose (mg/dL)	70.00–344.00
GCB glucose (mg/dL)	43.00–243.00

SD: standard deviation, CFB: capillary finger-prick blood, GCB: gingival crevical

Table 1: Descriptive Statistics variables between GCB and CFB

Pearson's correlation between CFB and GCB glucose.	
Glucose (mg/dL)	Pearson's correlation
CFB vs. GCB	0.977

CFB: capillary finger-prick blood, GCB: gingival crevical blood.
*Indicates high statistical significance.

Table 2: Pearson's correlation coefficient showed a positive correlation between GCB and CFB

Discussion

DM is a complex metabolic disorder. Periodontitis is considered as the sixth complication of DM.¹⁵ Data has shown that the prevalence of the DM is greater among individuals with periodontitis than healthy individuals. Adequate blood is extravasated from the gingival crevice during routine oral

examination in dental clinics. With regard to the significance of early detection of DM and the need for an easy and quick method for screening for DM, we planned to use this extravasated blood from the gingival crevice for estimation of the blood glucose level using SMD.

The results of the present study were in concordance

with the study conducted by Shetty et al.¹⁶ Strauss et al.¹⁷ reported that GCB samples were suitable to screen for DM in individuals with sufficient BOP. However, they failed to give results in individuals with little or no BOP. Sarlati et al.¹⁸ reported that GCB is useful for testing blood glucose during routine periodontal examinations in subjects diagnosed with DM and periodontitis, but not in those without DM. The present study reiterates the results by Parker et al.¹⁹ and Beikler et al.²⁰ by showing a strong correlation between blood glucose measured in GCB and CFB when diabetic and nondiabetic patients with moderate to advanced periodontitis were examined. Khader et al.²¹ reported that GCB can be considered as an acceptable source for measuring the blood glucose level. In contrast to the above study, Muller and Behbehani²² failed to obtain any correlation between GCB and CFB.

The results of the present study revealed a higher correlation between GCB and CFB even with a smaller sample size. However, a large study sample should be able to demonstrate robustness in the correlation between GCB and CFB.

From the above discussion, it can be concluded that GCB may serve as a potential source for screening of blood glucose during routine periodontal examination in populations with an unknown history of DM. This study sheds light on the noninvasive method of screening the individuals not suspected of DM, using GCB blood samples. Thus, with minimal cost and time investment for patients and clinicians, dental professionals can play a critical role in supporting their patients overall health where the technique is found to be safe, easy to perform, and comfortable to the patient.

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