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Original Article

Gingival Crevicular Blood: A Fast, Safe, Noninvasive and Chairside Method of Diabetic Screening

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Abstract

Objective: This paper is aimed towards evaluating, whether the blood oozing during routine periodontal examination can be used for evaluating blood glucose levels.

Methods: A total of 60 patients, 30 diabetic and 30 non-diabetic (40 male and 20 female age 28-68 years) with moderate to severe periodontitis were included in the study. Periodontal pocket probing was performed, Blood oozing from gingival tissues of anterior teeth following periodontal pocket probing was collected with the strip of a glucose self-monitoring device (Sugarchek by Wockhardt Limited, India). As control, capillary blood was taken. Statistical analysis was performed by Pearson's correlation coefficient.

Results: The comparison between gingival crevicular blood andcapillary blood showed a very strong correlation with an r value of 0.984 ($P < 0.001$).

Conclusions: As a positive correlation was found between the gingival crevicular blood glucose levels (CrBGL) and capillary blood glucose (CBGL), the results suggest that blood oozing during routine periodontal examination may be used for diabetic screening in dental office settings.

Keywords: Diabetes mellitus, Periodontitis, Gingival crevicular blood**.**

Introduction:

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both.[1,2] Incidence of diabetes in India is estimated to be 20.2 per 1000 persons and prevalence rate is 12.1 % in adults.[3,4]

Diabetes mellitus is associated with a wide range of complications, such as retinopathy, nephropathy, neuropathy, micro- and macrovascular disease, altered wound healing, and periodontitis.[5] Periodontal disease is considered to be the sixth complication of diabetes.[6] The interrelationship between diabetes mellitus and periodontitis has been studied for many years.[7] 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.[8]

Over the past several years, several methods have been developed to measure glucose level in biological fluids, but the search for more specific, sensitive and simple method is still going on. Since centuries, the clinicians are sending venous blood, or urine samples for determining glucose levels to clinical biochemistry laboratories. But these days portable glucose monitors are in use both as a bed side testing of glucose in hospitals and for home testing conducted by patients under living conditions. These portable glucose monitors can be used for the estimation of blood glucose in dental set up also.[9]

The early diagnosis of diabetes, however, might help to prevent its long-term complications that are

responsible for the high morbidity and mortality of diabetes patients. Routine probing during a periodontal examination is more familiar to the dental practitioner and less traumatic than a finger-puncture with sharp lancet. It is possible that gingival crevicular blood from probing may be an excellent source of blood glucometric analysis using the technology of portable glucose monitors.

Therefore the aim of the present study was to compare blood glucose level from patient's gingival crevicular blood and finger puncture method using a self-monitor so as to determine whether gingival crevicular blood during routine periodontal examination can be used for determining glucose levels.

Materials and Methods:

A total of 60 patients (40 male and 20 female; age range 28 to 69 years) were selecting from patients visiting the outpatient department of dental college. Patients with moderate to severe periodontitis were screened and included in the study. Patients were examined and periodontal status was recorded with William's graduated probe. Patients were classified according to AAP (American Academy of Periodontology) as moderate periodontitis with pocket depth of 3-5 mm and severe periodontitis with pocket depth of > 6mm.). After taking patients personal history and medical history, 60 patients were selected. Patients were divided in in to 2 groups:

1. Test group – 30 known diabetic patients.
2. Control group – 30 non-diabetic patients.

Patients with any of the following conditions were excluded from the study: requirement for antibiotic premedication; any disorder that is accompanied by an abnormally low or high hematocrit, e.g. polycythemia vera, anemia, dialysis; intake of substances that interfere with the coagulation system, e.g., coumarin derivatives, nonsteroidal antiinflammatory drugs, heparin; actual severe cardiovascular, hepatic, immunologic, renal, hematological, or other organ disorders. After obtaining institutional ethical committee clearance a written and informed consent was obtained from all the participants of the study. Prior to probing, all the subjects were asked to rinse oral cavity with 0.2% chlorhexidine in order to minimize microbial load in the oral cavity. Glucose self-monitoring device (Sugarchek by Wockhardt Limited, Mumbai, India) was used according to the manufacturer's recommendations. [Figure 1] Maxillary anterior teeth were selected for taking samples and the sites were air dried to prevent contamination with saliva and with GCF. After the periodontal examination gingiva was probed with the William's graduated probe and Bleeding gingival sites were selected. [Figure 2] Site with more profuse bleeding was chosen for gingival crevicular blood. The blood oozing from gingival tissues was collected with the strip of a glucometer and then reading was taken [Figure 3] Sites with suppuration were excluded from the study. After recording blood glucose level from gingival crevicular blood another blood sample was obtained from one of the patient's finger. The soft surface of the fingertip was wiped with alcohol and the alcohol was allowed to evaporate. Sampling was carried out using an auto-lancet device to puncture the skin, and the blood drop was then collected by the strip of glucometer device for analysis and again the reading was taken.

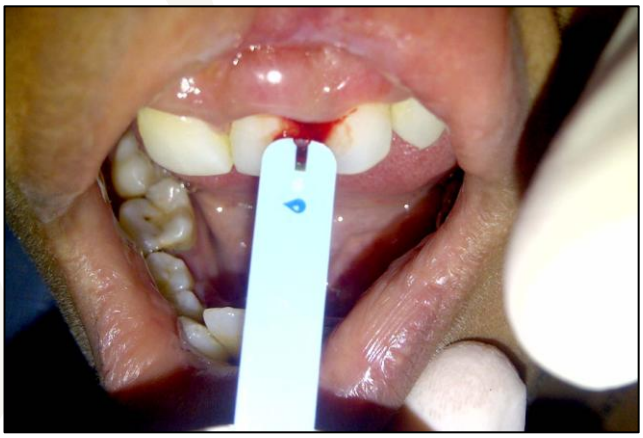
The data obtained were tabulated and analysed using Statistical Package for Social Sciences, version 16.0 (SPSS). Means and standard deviations were calculated for gingival blood glucose levels and capillary blood glucose levels in study and control groups.

To compare the mean values of gingival blood glucose levels and capillary blood glucose levels between the study subjects and control group, Independent sample 't' test was used. For all the comparisons P-value of 0.05 or less was used for statistical significance.

Figure 1: Glucose Self-Monitoring Device (Sugarchek by Wockhardt Limited, Mumbai, India)

Figure 2: Bleeding on Probing During Routine Clinical Examination.

Figure 3: Gingival Crevicular Blood Sampling for Direct Glucose Measurement with the Glucose Self-Monitoring Device.



Results:

Sixty patients (40-males and 20-females) took part in this study with the mean age of 46.2 years (males 45.5 years and females 47.7 years). The capillary blood glucose (CBGL) levels showed significant difference between test and control groups ($P<0.05$) [Table 1] and similarly significant difference was found between test and control groups in gingival crevicular blood glucose levels (CrBGL) ($p<0.05$). [Table 2] There is no statistically significant difference observed between the CrBGL value and the CBGL values in the diabetic group and non-diabetic group – suggestive of that gingival crevicular blood can be used as an alternative for estimation of blood glucose level in diabetic as well as in non-diabetic patients. [Table 3][Figure 4]

Correlation between CBGL and CrBGL in the total sample were analyzed with "Pearson correlation coefficient" using the SPSS version 16 (statistical and data analysis). Highly significant correlation (r = 0. 984) was found between CBGL and CrBGL in both test and control samples as r = 0. 908 and r = 0. 969 respectively at p<0.05 [Table 4].

Table 1: Comparison of CBGL among test and control groups.

Group	N	Mean (mg/dl)	SD	t- value	P value
Test	30	152.83	13.62	14.55	0.0001*
Control	30	108.77	9.46		

*= significant at P<0.001
CBGL - Capillary blood glucose level.

Table 2: Comparison of CrBGL among test and control groups.

Group	N	Mean (mg/dl)	SD	t- value	P value
Test	30	150.13	14.85	14.35	0.0001*
Control	30	104.53	9.07		

*= Significant at P<0.001
CrBGL - Crevicular blood glucose level

Table 3: Mean, standard deviation and P value of CrBGL and CBGL in diabetic and non-diabetic group.

Group	Diabetic Group		Non Diabetic Group	
	CrBGL (mg/dl)	CBGL (mg/dl)	CrBGL (mg/dl)	CBGL (mg/dl)
Mean	150.13	152.83	104.53	108.77
SD	14.85	13.62	9.07	9.46
P value	0.4*		0.08†	

*= Non Significant
† = Non-Significant.

Table 4: Relationship between CBGL and CrBGL.

Group	Number	r-value	P value
Test	30	0.908	0.0001*
Control	30	0.969	
Combined	60	0. 984	

*=significant

Discussion:

In India, DM is one of the major diseases of concern as the incidence rate of DM is increasing at an alarming rate but there are very few studies done for screening Diabetes mellitus using gingival crevicular blood in India.[10,11] Hence dentist can play an important role in identifying undiagnosed diabetes by the routine screening of patient especially those with pronounced gingival inflammation.[12]

Blood glucose testing with the self-monitoring devices is sensitive method, since it can give results with small amount of blood and is very less time consuming. CrBGL collected during periodontal examination is an excellent source of blood, safe, easy to perform and comfortable to the patient. Moreover, the technique described is more familiar and less traumatic to the patient than a finger-puncture.[13] Studies in the past have also found significant correlations between CrBGL and CBGL.[14-16]

The use of gingival crevicular blood to measure blood 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 is less time consuming and did not increase the patient's discomfort.[14]

The strong correlation obtained in the present study on comparison between the various blood glucose measurements indicates the feasibility of using gingival crevicular blood as an alternative to the Finger prick blood in accordance to the previous studies. On analysis of our study, finger prick capillary blood glucose showed a slightly higher mean value than gingival crevicular blood glucose mean value, this may be due to contamination of gingival crevicular fluid which dilutes the glucose concentration producing lower measurements in gingival crevicular blood.[17]

According to Muller The difference between glucose level in CrBGL and CBGL samples was unacceptable for clinical purposes.[18] Though capillary/venous blood samples used for diabetes mellitus screening is gold standard, but the gingival crevicular blood may prove to be promising approach for routine dental office screening for diabetes mellitus in periodontal patients.

Conclusions:

Within the limitations of this study, the following conclusion can be made that gingival crevicular blood collected during diagnostic periodontal examination may be an excellent source of blood for glucometric analysis. 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. The technique is safe, easy to perform, and comfortable for the patient and therefore, helps to increase the frequency of diagnosing diabetes during routine periodontal therapy. Thus, the dentist may increase his importance as a member of the health

team by participating in the search for undiagnosed asymptomatic DM.

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