



COMPARISON OF GINGIVAL CREVICULAR BLOOD WITH FINGER PRICK BLOOD IN DIAGNOSTIC EFFICACY OF ASSESSMENT OF BLOOD GLUCOSE LEVEL.

Dental Science

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ABSTRACT

Aim : To compare gingival crevicular blood and finger prick blood glucose measurements using self monitoring device.

Methods : 30 gingivitis and 30 periodontitis patients were enrolled in the study. Blood oozing from the gingival crevices of anterior teeth following periodontal probing (GCF-B) and finger prick blood (FPB) was taken and was analysed by self monitoring device (Accucheck).

Results : There was significant positive correlation between the two readings for both gingivitis ($r=0.901, p=0.000<0.05$) and periodontal patients ($r=0.981, p=0.000<0.05$). The paired t test showed a significant difference in the readings for both gingivitis patients ($t=13.773, p<0.05$) and periodontal patients ($t=9.078, p<0.05$). There was significant difference between the blood glucose level readings drawn from index finger and gingival crevicular for gingivitis patients ($t=13.773, p<0.05$) and periodontal patients ($t=9.078, p<0.05$). This study concludes that though there is significant positive correlation existing between the two readings, there is significant difference between the readings.

Conclusion : Blood obtained during routine periodontal probing cannot be used for estimation of blood glucose levels in periodontitis patients.

KEYWORDS

accucheck, gingival crevicular blood, diabetes.

COMPARISON OF GINGIVAL CREVICULAR BLOOD WITH FINGER PRICK BLOOD IN DIAGNOSTIC EFFICACY OF ASSESSMENT OF BLOOD GLUCOSE LEVEL.

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction, and failure of various organs, especially the eyes, kidneys, nerves, heart, and blood vessels.¹ Periodontal disease is now considered to be the sixth complication of diabetes mellitus and diabetes act as a major risk factor for it.² India is home to 69.1 million people with DM and is estimated to have the second highest number of cases of DM in the world after China in 2015.³ The prevalence of DM in India ranges from 5–17%, with higher levels found in the southern part of the country and in urban areas.⁴ However, most of these cases usually remain undetected at early stage increasing the potential complications of diabetes mellitus in later stages.⁵

Since the dental clinicians are often encountered with patients with diabetes in day-to-day practice, a noninvasive manner of blood glucose estimations are often necessary in routine dental practice. Although various blood glucose estimation test are available such as conventional laboratory blood glucose estimation, glycated hemoglobin estimation, and oral glucose tolerance test, most of them are complex, time taking, and invasive procedures. Hence, the screening for diabetes in the dental office is usually accomplished through analysis of patient's history, symptoms, and the conventional laboratory methods that may not reflect their current blood glucose status. Therefore, there is a need of a quick, chair-side, noninvasive diagnostic mode to determine blood glucose levels in periodontal patient suffering from diabetes mellitus in dental practice.

Gingival crevicular blood oozed during periodontal probing might be an excellent source of blood for glucometric analysis using the self-monitoring glucose device (Accucheck) instead of conventional venous blood glucose. It could also be used for screening of diabetes mellitus in suspected population. Therefore, a study has been designed to find the applicability, reliability, and efficacy of gingival crevicular blood in glucose estimation with the use of Accucheck compared to other available method such as finger prick estimation. Hence, this study was designed to compare gingival crevicular blood and finger prick blood glucose measurements using self monitoring device.

MATERIALS AND METHODS

30 gingivitis and 30 periodontitis patients were enrolled in the study. Blood oozing from the gingival crevices of anterior teeth following

periodontal probing and finger prick blood was taken and was analysed by self monitoring device (accucheck).

Informed consent was obtained from each participant before conducting the trial. The inclusion criteria included individuals who were aged 20-70 years of age and patients diagnosed with gingivitis and periodontitis with and without diabetes mellitus.

The exclusion criteria included individuals undergoing treatment for anemia, polycythemia, gout, dialysis, or any other disorder that could cause an abnormal variation in the hematocrit and with any requirement of antibiotic premedication. In addition, individuals on medication that can interfere with coagulation/supplemental Vitamin C that could interfere with the glucose test strip oxidation reaction, individuals with history of any systemic diseases, and individuals who were previously diagnosed as diabetic and under medications for diabetes to avoid confounding bias were also excluded from the study. Sites with profuse bleeding were preferred as donor sites and sites with suppurations were avoided. To obtain a clean sample, probing was repeated when necessary until a sufficient quantity of blood was collected in the capillary tube (FIG 1). The blood obtained from the gingival bleeding was transferred to a test strip preloaded in a self-monitoring glucometer (Accu-Chek Active, Roche Diagnostics, USA) which will report blood glucose measurements in mg/dl within 15–30 s. The regular peripheral finger stick blood was collected from patient's fingers by wiping the pad of the finger with alcohol, allowing it to dry and then punctured with a sterile lancet (FIG 2). The blood was drawn onto the test strip preloaded in the glucometer. Both samples from each individual were taken at the same visit.



figure 1: Blood in capillary tube



FIG 2 puncture with lancet

STATISTICAL ANALYSIS

Statistical analysis was done by Paired t test and The Karl Pearson's correlation coefficient.

RESULTS

Table 1: Mean and Standard Deviation of readings of Gingivitis Patients and periodontitis patients

Reading (Gingivitis)	Mean	N	Std. Deviation
Index Finger	104.5333	30	24.03408
Gingival	78.2333	30	22.34322
Reading (Periodontitis)	Mean	N	Std. Deviation
Index Finger	185.4333	30	117.28794
Gingival	151.3333	30	105.77150

The Karl Pearson's correlation coefficient between the blood sugar level readings of samples drawn from index finger and gingival crevice shows a significant positive correlation in both gingivitis patients and periodontal patients.

Table 2: Karl Pearson's Correlation Coefficient between glucose levels in the blood drawn from index finger and gingival crevice.

Type of Patients	N	Correlation	p-value
Gingival	30	0.901	0.000
Periodontal	30	0.988	0.000

Scatter diagrams

Figure 3: scatter diagram of gingivitis patients

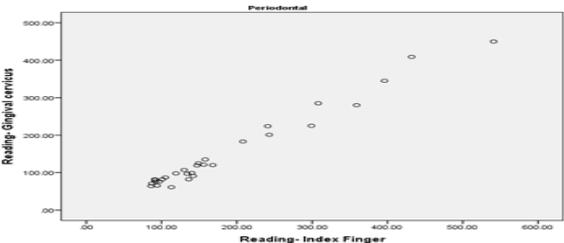
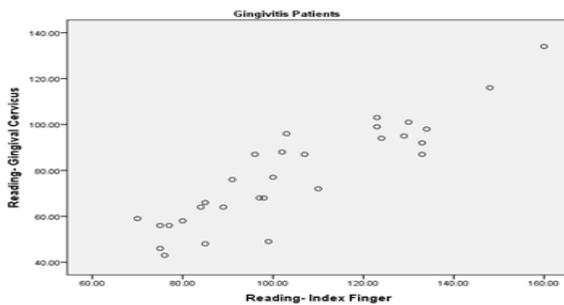


Figure 4: scatter diagram of periodontitis patients

Paired t test was conducted to test the hypothesis that there is no significant difference between the blood glucose level readings drawn from index finger and gingival crevice. The results are given in the following table for both the type of patients.

Table 3: result of paired t test

Type of patients	Mean of paired differences	Std. Deviation of paired differences	t value	Degrees of freedom	P value
Gingival	26.30	10.46	13.773	29	0.000
Periodontal	34.10	20.57	9.078	29	0.000

The above table indicates that there is significant difference between the blood glucose level readings drawn from index finger and gingival crevice for gingivitis patients (t=13.773, p<0.05) and periodontal patients (t=9.078, p<0.05).

DISCUSSION

The primary methods used to diagnose diabetes mellitus and monitor blood glucose levels have traditionally been fasting blood glucose, a combination of fasting blood glucose with a 2-hour test after glucose loading (2-hour post prandial) and oral glucose tolerance test.⁶ These tests require fasting by the patient, tend to be highly dependent on patient compliance, and results are available at a subsequent visit (second appointment). Thus, more than one appointment is usually needed to assess the glycemic status and make necessary therapeutic decisions. Also, the information from a single laboratory test may not reflect patient's current blood glucose status. Monitoring their blood glucose during the office visit may be a better alternative.

It may be more convenient for the dental surgeon to obtain blood sample from the gingival site. Stein and Nebbia⁷ were the first to describe a chair-side method of diabetic screening with gingival blood. They transferred blood onto the test strip by wiping blood directly from hemorrhagic gingival tissue. Tsutsui et al.⁸ reported the rubbing of blood onto the test strip from a blood-laden dental curette. Rubbing or direct wiping of intra-oral blood on to the test strip will not produce a uniformly timed reaction and may damage the strip's chemical indicator surface⁹. Also, significant contamination may occur from saliva and oral debris present at the wiped gingival area or from plaque and crevicular fluid on the dental curette from its entry into the gingival sulcus. American Diabetes Association in their consensus statement on blood glucose monitoring (1987)¹⁰ said that manual timing of the test strip reaction and the wiping of the test strip are significant sources of error when using glucose self monitors.

In this study, ACCU-CHEK Active, Roche Diagnostics, USA is the glucometer used to measure the glucose levels in the blood which oozes out during routine probing. Measuring blood glucose with a glucometer is very sensitive since it can provide results with 2-3µl of blood within 10 seconds. It is less time consuming procedure and does not require any additional tools like sharp lancet for puncture. Even in case of very low gingival bleeding, glucose measurement is possible with a glucometer, due to low volume of blood (3µl) required to perform the analysis¹¹.

In present study there was a significant difference between GCB and F.P.C values indicating both cannot be considered as same. The value of GCB was reported to be lower in every individual as compared to FPB. A simple stimulation such as mastication, trauma and inflammation is sufficient to produce GCF (gingival crevicular fluid). Gingivitis and periodontitis is known to have higher level of GCF. It cannot be ruled out that gingival crevicular fluid is not mixed with the GCB. GCF is known to have glucose as its constituent; hence the blood sugar content cannot be accessed correctly. Similar finding was reported in study by Muller et al who concluded that there is no usefulness of gingival crevicular blood as bleeding on probing was not sufficient in every third case.¹²

On the contrary Parker et al examined diabetic patients with unknown periodontal status and wherein a very strong correlation was observed between gingival crevicular, finger prick capillary and the corrected intravenous blood glucose measurements.¹³ In another work by Beikler T et al 2002 wherein, a strong correlation was observed between GCB and finger stick capillary measured blood glucose when diabetic and non-diabetic patients with moderate to advanced periodontitis were examined.¹⁴ In study by Kaur H et al a strong positive correlation was reported, similar findings was reported by Gaikwad S.^{15,16}

CONCLUSION

Present study failed to prove the authenticity of gingival crevicular blood as a screening tool in diabetes mellitus. The two values had significant difference implying that both cannot be considered as

equivalent. Hence care should be exercised while interpretation results of blood sugar obtained from gingival crevices. Further study on a larger population is desirable to establish the much hyped relation

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