

## Utility Of Gingival Crevicular Blood For Assessment Of Blood Glucose In Individuals With Diabetes Mellitus And Evidence Of Periodontitis

Dr. Mohammed Feroz.T.P<sup>1</sup>, Dr. Shashikanth Hegde<sup>2</sup>, Dr. Rajesh Kashyap.S<sup>3</sup>

<sup>1</sup>(Reader, Dept. of Periodontics, Mahe Institute of Dental Sciences & Hospital, Mahe, India)

<sup>2</sup>(Prof & Head, Dept. of Periodontics, Yenepoya dental College & Hospital, Mangalore, India)

<sup>3</sup>(Professor, Dept. of Periodontics, Yenepoya dental College & Hospital, Mangalore, India)

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**ABSTRACT : Background:** Diabetes mellitus is a common finding in the medical history of patients receiving treatment for periodontal disease. Bleeding from the gingival tissues is considered to be more in poorly controlled diabetics than in good or moderately controlled diabetics. Periodontal inflammation with or without the complicating factor of diabetes mellitus is known to produce ample extravasated blood during the diagnostic procedures. Routine probing during a periodontal examination is more familiar to the practitioner and less traumatic than a finger puncture with a sharp lancet. Gingival crevicular blood from probing may be an excellent source of blood for glucometric analysis using glucometers. **Aim:** To determine the efficiency of gingival crevicular blood obtained on routine probing for assessment of blood glucose levels using glucometer. To compare the glucose levels in the gingival crevicular blood and sample obtained from finger puncture method using glucometer. **Material and Methods:** 50 patients with history of diabetes mellitus were examined for the study. The labial aspect of upper anterior teeth, irrespective of their probing depths were chosen for glucose measurement. Bleeding sites were isolated, blood sample was taken in a micropipette and transferred on to the blood glucose test strip using a filler. Following gingival crevicular blood sampling, blood sample was taken from one of the patients' finger for glucometric analysis. **Result:** A strong correlation ( $r = 0.946$ ,  $p,0.001$ ) between gingival crevicular and blood sample obtained using finger puncture method. There were no significant differences between capillary and crevicular blood glucose even with increasing blood glucose levels. **Conclusion:** The results suggests that gingival crevicular blood can provide an acceptable source for measuring blood glucose using glucometer. The use of micropipette was a reliable method for collecting gingival crevicular blood sample.

**Keywords** - Chair side screening of blood glucose, Diabetes mellitus, Gingival crevicular blood glucose, Non-invasive, Glucometer.

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### I. INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder. Diabetes mellitus is associated with a wide range of complications such as retinopathy, nephropathy, neuropathy, micro and macrovascular disease, altered wound healing and periodontitis. Diabetes mellitus is a common finding in the medical history of patients receiving treatment for periodontal disease. Bleeding from the gingival tissues is considered to be more in poorly controlled diabetics than in good or moderately controlled diabetics [1]

An increase in the risk and severity is considered by some investigators to be a complication of diabetes. Case reports suggest that successful periodontal therapy in diabetic patients must include the stabilization of blood glucose levels to near normal range. However, stable blood glucose levels alone will not reduce the degree of periodontal inflammation, unless the bacterial etiology of periodontal disease is also treated. The periodontist frequently manages diabetic patients using limited information about their blood glucose control. Often the only information available is from a single laboratory test that may not reflect their current blood glucose status. Monitoring their blood glucose during the office visit may be a better alternative [1].

Periodontal inflammation with or without the complicating factor of diabetes mellitus is known to produce ample extravasated blood during the diagnostic procedures. Routine probing during a periodontal examination is more familiar to the practitioner and less traumatic than a finger puncture with a sharp lancet. Gingival crevicular blood from probing may be an excellent source of blood for glucometric analysis using glucometers [1]

A study was conducted to determine the efficiency of gingival crevicular blood obtained on routine probing for assessment of blood glucose levels using glucometer.

## II. Objectives

To evaluate the efficiency of gingival crevicular blood for determining blood glucose level during routine periodontal examination using glucometer.

To compare the glucose levels in the gingival crevicular blood and sample obtained from finger puncture method using glucometer.

## III. Methodology

### 3.1 Clinical protocol

50 patients with history of diabetes mellitus with following criteria were selected

- Patients with age group of 45-60 years.
- Patients with intact upper anterior teeth having grade II – grade III bleeding.
- Patients without any requirement for antibiotic premedication.
- Patients with abnormally low or high hematocrit Eg: Polycythemia Vera, Anemia were excluded.
- No history of intake of substances that interfere with the coagulation system Eg: Coumarin derivatives, Non-steroidal anti-inflammatory drugs, heparin
- Patients with use of excessive supplemental ascorbic acid that may interfere with the glucose strip oxidation reaction were not included in the study
- No history of severe cardiovascular diseases, hepatic diseases, immunological disorders, renal diseases, hematological disorders.

Ethical clearance was obtained from the ethical committee review board for this study and informed patients' consent was taken for each patient.

## IV. Procedure

The labial aspect of upper anterior teeth, irrespective of their probing depths were chosen for glucose measurement. Gingival bleeding score was assessed by Muhleman and Son criteria. William's Periodontal probe was used for probing. Bleeding sites were isolated, blood sample was taken in a micropipette and transferred on to the blood glucose test strip using a filler. During this time, test strip was inserted into the glucose monitor. Test strip draws blood by capillary action and the results were obtained within 5 seconds. Following crevicular blood sampling, blood sample was taken from one of the patients' finger. The finger was punctured with a sterile lancet and blood drawn with capillary action by the glucose strip.



**Fig 1.** Bleeding on probing



**Fig 2.** Collection of gingival crevicular blood sample



**Fig 3.** Gingival crevicular blood sample



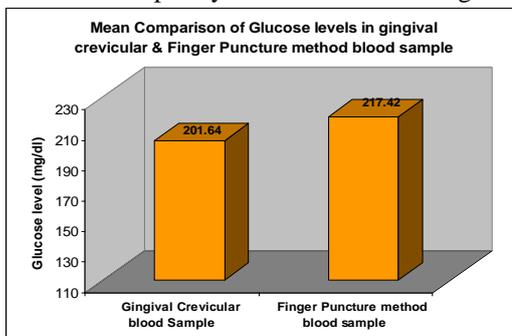
**Fig 4** Finger puncture method transferred on to the blood glucose test strip

V. Results

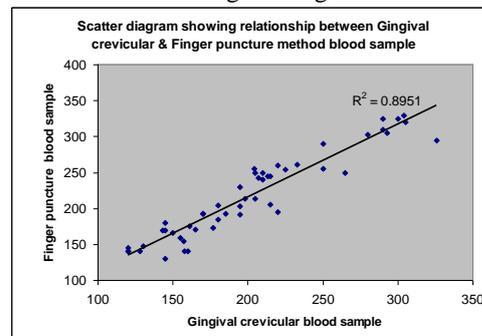
**Table 1:** Comparison of blood glucose values obtained by Gingival crevicular blood sampling and finger puncture method:

Sample no	Crevicular blood sample (mg/dl)	Finger puncture method (mg/dl)	Sample no	Crevicular blood sample (mg/dl)	Finger puncture method (mg/dl)
1	120	145	26	280	303
2	170	193	27	195	230
3	195	191	28	128	140
4	205	213	29	215	245
5	145	180	30	170	193
6	150	166	31	225	254
7	356	295	32	215	205
8	157	155	33	210	240
9	304	329	34	130	148
10	165	171	35	293	305
11	180	185	36	120	140
12	161	175	37	290	310
13	155	159	38	300	325
14	233	261	39	265	250
15	177	173	40	250	255
16	185	193	41	250	290
17	220	260	42	290	325
18	195	203	43	210	250
19	120	140	44	207	243
20	220	195	45	204	255
21	158	140	46	145	130
22	180	204	47	145	170
23	160	140	48	193	214
24	143	170	49	305	320
25	213	245	50	205	250

The data obtained by both the methods described in the methodology were statistically analyzed using Karl Pearson’s coefficient of correlation. The result of our study revealed a strong correlation ( $r = 0.946$ ,  $p, 0.001$ ) between gingival crevicular and blood sample obtained using finger puncture method. There were no significant differences between capillary and crevicular blood glucose even with increasing blood glucose levels.



**Graph I:** Mean comparison of glucose levels in gingival crevicular & figure puncture method blood sample.



**Graph II:** Scatter diagram showing relationship between gingival crevicular & figure puncture method blood sample

VI. Discussion

Diabetes increases the risk of both severe periodontitis and for the incidence of periodontal disease progression by approximately 2-3 fold.

- **Tellervo Ervasti et al 1984 (3)** examined the periodontal health status of 50 adult diabetics and 53 healthy controls. The diabetic group was further divided into three subgroups according to the control of diabetes. Poorly controlled diabetics suffered significantly more from gingival bleeding than those with good or moderate control
- **Katz J 2001 (5)** analyzed 10,590 subjects for normal and abnormal (higher than 120mg/dl) serum glucose levels, their periodontal status reflected as CPITN was correlated with their glucose level category. The results of the study reflect a significant association between elevated blood glucose levels and periodontal disease as measured by CPITN.

The result of our study revealed a strong correlation  $r = 0.946$  ( $p < 0.001$ ) between gingival crevicular and finger puncture blood glucose level measured. The above results agree with those reported by **Beikler et al 2002 [2]**. He evaluated whether blood oozing from gingival tissues during routine periodontal examination can be used for determining glucose levels.

The present study is also in agreement with other study by **Parker et al 1993[1]** who reported that 92% of the gingival crevicular blood glucose measurements with the non-wipe glucose self monitor were within 15% of the true glucose concentration. In contrast to the previous studies, the sampling procedure that was applied in the present study is much easier to perform and less time consuming. Self monitoring devices used in the studies reported by **Parker et al 1993** required manual timing and wiping of the blood on the test strip leaving a shade of color that is proportional to the blood glucose concentration. The amount of blood collected were 10-15  $\mu\text{l}$  in the above studies. The introduction of new glucometers, even in the case of very low gingival crevicular bleeding, a glucose measurement is possible as the one which is used in our study due to the low amount of blood (1 $\mu\text{l}$ ) necessary to perform the analysis and the results were obtained within 5 seconds as suggested by the manufacturer.

## VII. Conclusion

There was statistically significant correlation ( $p < 0.001$ ) between gingival crevicular blood and blood sample obtained by finger puncture method. Overall mean of glucose levels in gingival crevicular blood was 201.64 mg/dl and finger puncture method blood sample was 217.42 mg/dl. The results of the present study suggests that gingival crevicular blood can provide an acceptable source for measuring blood glucose using glucometer. The use of micropipette was a reliable method for collecting gingival crevicular blood sample.

Future studies using gingival crevicular blood sample and venous blood sample are required to assess the correlations, since the measurements from the laboratory glucose analyzer are considered to be the true values for the glucose concentration. Evidence suggests that there is also a natural physiologic drop in the glucose concentration as it passes from a capillary (such as in the gingival crevice) area into a venous area due to the normal cellular uptake of glucose.

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