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Original Article

Estimation of gingival crevicular blood glucose level for the screening of diabetes mellitus: A simple yet reliable method

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ABSTRACT

Aim: This study was designed to assess the reliability of blood glucose level estimation in gingival crevicular blood(GCB) for screening diabetes mellitus.
Materials and method: 70 patients were included in study. A randomized, double-blind clinical trial was performed. Among these, 39 patients were diabetic (including 4 patients who were diagnosed during the study) and rest 31 patients were non-diabetic. GCB obtained during routine periodontal examination was analyzed by glucometer to know blood glucose level. The same patient underwent for finger stick blood (FSB) glucose level estimation with glucometer and venous blood (VB) glucose level with standardized laboratory method as per American Diabetes Association Guidelines.[1] All the three blood glucose levels were compared. Periodontal parameters were also recorded including gingival index (GI) and probing pocket depth (PPD).
Results: A strong positive correlation (r) was observed between glucose levels of GCB with FSB and VB with the values of 0.986 and 0.972 in diabetic group and 0.820 and 0.721 in non-diabetic group. As well, the mean values of GI and PPD were more in diabetic group than non-diabetic group with the statistically significant difference ($p < 0.005$).
Conclusion: GCB can be reliably used to measure the blood glucose level as the values were closest to glucose levels estimated by VB. The technique is safe, easy to perform and non-invasive to the patient and can increase the frequency of diagnosing diabetes during routine periodontal therapy.

1. Introduction

Advances in science and technology, over the last century, have greatly expanded our knowledge about the relationship of periodontitis with systemic diseases. Periodontal diseases and diabetes mellitus (DM) are closely associated and are highly prevalent chronic diseases with many similarities in pathobiology.[2]

DM is a complex disease of multiple conditions and syndromes which have glucose intolerance in common.[3] DM is associated with a wide range of complications, such as retinopathy, nephropathy, micro and macro vascular diseases, altered wound healing and periodontitis.[4] DM is the one of the most frequent metabolic disorders with estimated prevalence of 7% in industrialized countries of which nearly half of cases are undiagnosed. India has nearly 33 million diabetic subjects today with an overall prevalence rate of 4.3%.[5]

Type 2 DM i.e. non-insulin dependent diabetes mellitus (NIDDM) constitutes nearly 90% of diabetic population in any country, with a prevalence of 2.4% in rural population and 11.6% in urban population.[6] The current classification of periodontal disease and conditions lists DM associated gingivitis under dental plaque induced gingival diseases modified by systemic factors.[7]

The level of diabetic control is a more important aspect than plaque control in relation to the severity of gingival inflammation. Periodontitis has been proposed as a sixth complication of DM.[8] The early diagnosis of diabetes, however, might help to prevent its long-term complications that are responsible for the high morbidity and mortality of diabetic patients.[9]

Routine probing during a periodontal examination is more familiar to the practitioner and less traumatic. It is possible that gingival crevicular blood (GCB) from probing may be an excellent

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source of blood glucometric analysis using the technology of portable glucose monitors and therefore no extra procedure, e.g. finger puncture with sharp lancet, is necessary to obtain blood for glucometric analysis.

Even in the case of very low gingival crevicular bleeding, a glucose measurement is possible with the self-monitoring device. Also, the sampling procedure is much easier to perform and less time-consuming. The present study was planned therefore to assess the GCB for estimation of blood glucose level, and to compare this glucose level with that of finger stick blood (FSB) and venous blood (VB)in diabetic and non-diabetic subjects.

2. Materials and methods

The study population comprised of patients visiting the Department of Periodontics, Government Dental College and Hospital, Ahmedabad, Gujarat, India. Ethical clearance for study was taken from institutional ethical committee. All the patients, underwent the study had been fully informed and given written consent for the study procedure as per Declaration of Helsinki. A randomized, double-blind clinical trial was performed over 70 adult patients comprising 28 males and 42 females. Initially, among these 35 patients were known diabetic (diabetic group) and rest 35 patients were unaware of their glycemic status (non-diabetic group). The inclusion criteria for the study were: subjects in the age group of 20–70 years, subjects having at least twenty remaining teeth and patients with moderate to advanced periodontitis.

The exclusion criteria were: subjects with intake of supplemental ascorbic acid [vitamin C], which could interfere with the glucose test strip oxidation reaction, subjects with history of prolonged usage drugs that interfere with the coagulation system, e.g. coumarin derivatives, non-steroidal anti-inflammatory drugs (NSAID),subjects previously diagnosed with polycythemia, severe anemia or those undergoing renal dialysis or subjects with history of severe cardiovascular, hepatic, immunologic, renal, hematological, or other organ impairment, pregnant woman and nursing mothers, subjects with any history of periodontal treatment during past 6 months, requirement for antibiotic premedication or need for any medication, tooth with suppuration or any disorder that can cause abnormally low or high hematocrit value.

Blood from three regions was assessed for blood glucose estimation: gingival crevice, finger bed and anterior cubital vein. For the estimation of blood glucose level using GCB, the test site was isolated with cotton roll and air-dried. The glucometer(-Optium Xceed glucometer-IInd generation) was turned on by insertion of the test strip in the provided slot(Fig. 1). UNC-15 probe was gently passed along the gingival sulcus. A blood drop was allowed to touch into the test area of the strip (Fig. 2). The result of the test was displayed on the screen of the glucometer, after around 20 s. The value was recorded.

For the estimation of blood glucose level using FSB, the soft surface of the fingertip was wiped with surgical spirit and the spirit was allowed to evaporate. Inserting the test strip into its slot turned on the glucometer. The surface of the finger was then punctured with a sterile lancet and the drop of blood oozing was allowed to be drawn into the test area of the strip (Fig. 3). After the test time around 20 s, the result of the test was displayed on the screen of the glucometer. The value was recorded.

Immediately after these two tests, the estimation of blood glucose level using VB was carried out. Blood was obtained by venepuncture from the anterior cubital vein, using a sterile syringe and needle (Fig. 4). 2 ml of blood was collected in a plane bulb. With the help of automated chemistry analyzer the venous blood glucose level was recorded.

Fig. 1. Insertion of glucometer test strip.

Fig. 2. Estimation of blood glucose using gingival crevicular blood (GCB) with glucometer.

Fig. 3. Estimation of blood glucose using finger stick blood (FSB) with glucometer.

Recording of periodontal parameters was also done including gingival index (GI) and probing pocket depth (PPD), taken by UNC-15 periodontal probe.

The data was tabulated and subjected to statistical analysis which included mean and standard deviations of all the parameters, Karl Pearson correlation coefficient, unpaired '*t*' test and associated '*p*' values.

3. Statistics and results

The GCB glucose level estimation in a total of 70 subjects showed that among the 35 subjects with unknown glycemic status, 4 subjects were diabetic (new diabetic patients). So finally, the study comprised 39 diabetic patients (diabetic group) and 31 non-diabetic subjects (non-diabetic group). For the diabetic group, the blood glucose levels were in the range of 92–262 mg/dl, with a