

Significance of Gingival Crevicular Blood as an Innovative, Intraoral Diagnostic Tool for Estimation of Random Blood Glucose, HbA1c and C-Reactive Protein Levels in Undiagnosed Diabetic Population- A Systematic Review

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Abstract: Diabetes mellitus (DM) is a complex metabolic disorder characterized by chronic hyperglycemia. Diabetes mellitus (DM) is undiagnosed in approximately half of the patients actually suffering from disease. In addition, the prevalence of DM is more than twice as high in patients with periodontitis when compared to periodontally healthy subjects. Periodontitis is the sixth most common complication of diabetes making it a major risk factor influencing the incidence and severity of periodontal related problems. As a dental professional it is our duty to screen and diagnose diabetic population visiting us based on the clinical complaint and oral findings. Gingival crevicular blood (GCB) oozing out from the periodontal pocket during probing can be used to estimate the random blood glucose levels, HbA1c and C-Reactive Protein levels to identify patients unaware of their diabetic status. This review article throws light on the significance of GCB for evaluation of blood glucose levels for diagnosing undiagnosed diabetic population.

Key words: Diabetes Mellitus • Periodontitis • Gingival Crevicular Blood • Glucometer.

INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disorder with an estimated prevalence of 7% in industrialized countries of which nearly half the cases are undiagnosed. India has nearly 33 million diabetic subjects today with an overall prevalence rate of 4.3% [1]. Type 2 DM, i.e. NIDDM constitutes nearly 70% of population in any country, with a prevalence of 2.4% in rural population and 11.6% in urban population [2]. The chronic hyperglycemia of diabetes is associated with a wide range of complications like diabetic retinopathy, atherosclerotic cerebrovascular, cardiovascular and peripheral vascular diseases, peripheral neuropathy, progressive renal

dysfunction, delayed wound healing and periodontitis [3]. The prevalence of diabetes mellitus in patients with periodontitis is greater than in periodontally healthy patients. Therefore a high number of patients with periodontitis may have undiagnosed diabetes mellitus [4]. By this close interrelationship between diabetes and periodontitis, it can be assumed that the dental practitioners are extremely likely to encounter an increasing number of undiagnosed diabetes patients with periodontitis [5].

Periodontal disease is considered to be the sixth complication of diabetes. The interrelationship between diabetes mellitus and periodontitis has been studied for many years.

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Relationship between Diabetes And Periodontitis [7]: Diabetes and Periodontitis seem to interact in a bidirectional manner³. Both these conditions can produce disability and clinicians have long assumed that these diseases are biologically linked [3]. The presumed link between diabetes mellitus and periodontitis is considered to stem from an increased susceptibility of people with diabetes to many types of infections, though this hypothesis has been questioned [3]. The diabetic state impairs the gingival fibroblast synthesis of collagen and glycosaminoglycan, enhances crevicular fluid collagenolytic activity, results in the loss of periodontal fibres, loss of the alveolar supporting bone, loosening and finally exfoliation of the teeth [3]. One plausible biologic mechanism why diabetics have more severe periodontal disease is that glucose-mediated advanced glycation end products (AGE) accumulation would affect migration and phagocytic activity of mononuclear and polymorphonuclear phagocytic cells, resulting in the establishment of a more pathogenic subgingival flora [3]. The maturation and gradual transformation of this subgingival microflora into an essentially Gramnegative flora will in turn constitute, via the ulcerated pocket epithelium, a chronic source of systemic challenge⁸. This in turn triggers both an infection mediated pathway of cytokine upregulation, especially with secretion of TNF-alpha and IL-1 and a state of insulin resistance, affecting glucoseutilizing pathways [8]. Excessive local secretion of TNF-alpha and IL-1 also mediates destruction of connective tissue and alveolar bone evident in periodontal disease [3]. That high glucose levels decrease migration of periodontal ligament cells which compromises wound healing in periodontitis. From the epidemiological data regarding diabetes mellitus coupled with the possible close interrelationship between diabetes and periodontitis, it can be assumed that the dental practitioner and especially the periodontist are extremely likely to encounter an increasing number of undiagnosed diabetes patients with periodontitis and the clinicians who perform periodontal therapy must be especially aware and knowledgeable regarding the disease [5].

Importance Of Early Detection: The early diagnosis of diabetes, therefore, might help to prevent its long-term complications that are responsible for the high morbidity and mortality of these patients [3]. Conversely, there is increasing evidence in controlled studies to indicate that severe oral infections of any type, including generalized periodontitis, may increase insulin resistance and

possibly interfere with metabolic control of diabetes mellitus [3]. So it has been suggested that prevention and management of periodontitis may be important to the successful management of NIDDM and that physicians treating patients with NIDDM should be alert to the signs of severe periodontitis [7]. But it has been seen that the patients are often reluctant to seek medical evaluation and are resentful that the dentist would require medical consultation as a condition for receiving dental treatment. In such cases it is preferable for the dentist to perform screening blood glucose tests before starting the treatment [7].

Early diabetes detection could identify diabetes-related complications at an earlier stage, suggesting the value of screening to discover unrecognized illness, manage existing complications and prevent the progression of disease [6]. Periodontal disease is considered to be the sixth complication of diabetes. The interrelationship between diabetes mellitus and periodontitis has been studied for many years [7].

Glucometers And Gingival Crevicular Blood: For over 100 years, various methods have been used to measure glucose level in biological fluids, but the search for more specific, sensitive and simple method continues. 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 glucose³. Portable glucose monitors can be used for the estimation of blood glucose in dental set up also. Periodontal disease itself is associated with gingival bleeding and if the patient is diabetic, it is more severe. Bleeding from the gingival tissues is found to be further pronounced if the diabetic patient's condition is poorly controlled or is in association with undiagnosed diabetes. Thus ample extravasated blood is produced during routine diagnostic procedures [3]. Probing during a periodontal examination is more familiar to the practitioner and less traumatic than a finger-puncture with a sharp lancet. This blood oozing during routine periodontal examination can be the source for the estimation of blood glucose is more severe [9].

Glucometers are commonly used by diabetic patients for home monitoring of blood glucose levels. Recently, more sensitive self-monitoring devices have been developed for testing small amounts (<2microlitre) of blood obtained from areas much less sensitive than fingertips, such as the forearm, upper arm, thigh, or base

of thumb. In general, accuracy of these novel glucometers has been acceptable^[7]. The conventional laboratory methods that are employed to screen for diabetes are time consuming and elaborate equipment are needed to employ these techniques. The advent of blood glucose monitors allows the clinician to assess blood glucose at the chair side. In contrast to laboratory methods, results are obtained instantaneously, which helps the clinician to decide if further confirmatory test are required to diagnose diabetes [8].

In healthy situations glucose levels in gingival crevicular fluid are considerably lower than blood glucose levels. Thus the question arises whether glucose levels measured in blood samples obtained during periodontal examination are sufficiently related to glucose levels measured in capillary finger stick blood (CFB) [6]. Inflammatory markers are seen raised markedly in undiagnosed diabetic population which signify the severity and progression of the disease. Three most common markers are C - reactive protein, TNF-alpha and IL-6. Studies show that elevated CRP levels are a strong independent predictor of type 2 diabetes and may mediate associations of TNF-alphaR2 and IL-6 with type 2 diabetes [10]

The introduction of glucose self-monitoring device provided diabetic patients with a simple method for rapid daily monitoring of their disease. Self- monitoring uses one drop of finger puncture whole blood placed on a test strip impregnated with glucose oxidoreductase. Periodontal inflammation with or without the complicating factor of diabetes mellitus is known to produce ample extravasated blood during diagnostic procedure. Routine probing during periodontal inflammation is more familiar to a dental practitioner and less traumatic than a finger puncture with a sharp lancet. It is possible that gingival blood from probing may be excellent source for glucometric analysis using portable glucose self monitoring device [11].

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Glucometers are commonly used by diabetic patients for home monitoring of blood glucose levels. Recently, more sensitive self-monitoring devices have been developed for testing small amounts of blood obtained from areas much less sensitive than fingertips, such as the forearm, upper arm, thigh, or base of thumb. In general, accuracy of these novel glucometers has been acceptable and may actually allow for totally painless testing of blood oozing from the gingival crevices of patients with mild or moderate gingivitis during routine periodontal examination[5]. This might be of considerable interest to the dental practitioner since this glucometer, if sufficiently accurate, could be a simple and relatively inexpensive inoffice screening device for any patient suspected to have diabetes, or a way to monitor blood sugar levels in known diabetics. In previous studies, in-office screening of gingival blood glucose level in known diabetics and periodontitis patients has been evaluated[3]. However; these devices have required considerably larger blood volumes than those that usually ooze from the crevice after probing in mild or moderate gingivitis. Blood from the gingival crevice after probing is generally a mixture of capillary blood and gingival crevice fluid, an inflammatory exudate. In particular in healthy situations glucose levels in gingival crevice fluid are considerably lower than blood glucose levels. Thus, the question may arise whether glucose levels measured in blood samples obtained during periodontal examination are sufficiently related to glucose levels measured in capillary finger stick blood (CFB) [13]. And the answer is definitely yes as we compare the blood glucose levels obtained from GCB accurately matches the capillary blood values.

CONCLUSION

Based on a critical review of various studies performed on this particular field it has been shown either increased sensitivity or specificity that gingival crevicular blood collected during diagnostic periodontal examination may be an excellent source of blood for glucometric analysis. In addition, the technique described is safe, easy to perform and comfortable for the patient and might therefore help to increase the frequency of diabetes screening in dental offices.

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