International Journal of Preventive Medicine

Reliability of Gingival Blood Sample to Screen Diabetes in Dental Hospital

Suneetha Koneru, Rambabu Tanikonda[1]

Department of Periodontics, Vishnu Dental College, Bhimavaram, Andhra Pradesh, India, [1]Department Conservative Dentistry and Endodontics, Vishnu Dental College, Bhimavaram, Andhra Pradesh, India

Correspondence to:
Dr. Suneetha Koneru, Department of Periodontics, Vishnu Dental College, Bhimavaram, Andhra Pradesh, India. E-mail: konerusuneetha@gmail.com

ABSTRACT

Background: Early detection and treatment of diabetes mellitus may reduce the burden of diabetes and its complications. Screening of undiagnosed diabetes with gingival blood sample in patients attending to the dental hospital and to check the reliability with standard method.

Methods: Five hundred and fifty new patients age ranged from 30 to 50 years were randomly selected. Of 550 patients examined, gingival blood samples of 454 patients were collected from bleeding site and analyzed with self-monitoring device. Blood glucose values were recorded. In addition, all the patients were advised for the second visit with overnight fasting for fasting Blood glucose assessment. Among them, 442 patients returned for fasting blood glucose assessment in laboratory with blood glucose analyzer.

Results: In the total of 454 patients gingival blood glucose assessment with self-monitoring device, 64 patients showed ≥200 mg/dL, which indicates diabetes, and the other 390 patients showed ≤200 mg/dL, which indicates patients are not diabetic. Whereas, the results of the laboratory blood glucose analysis, 24 (5.43%) patients showed ≥126 mg/dL, 36 (8.14%) patients showed 100–125 mg/dL and the other 382 patients are not diabetic. Comparison of blood glucose measurements by two methods showed sensitivity 96.66% and specificity 99.47%.

Conclusions: The results of the present study showed blood obtained from periodontal pocket probing is a reliable sample to screen diabetes in periodontal disease population. Early diagnosis of diabetes in the dental hospitals can help improve the patient's oral health and overall health status by helping patients avoid or reduce complications from diabetes.

Keywords: Diabetes, prediabetes, risk factor, screen, undiagnosed

INTRODUCTION

Diabetes mellitus (DM) is a group of disorders associated with a quantitative reduction in insulin production or a qualitative reduction in the action of insulin leading to changes in carbohydrate, protein, and lipid metabolism and accumulation of glucose in the bloodstream.[1] The prevalence of type 2 diabetes for all age groups worldwide was 2.8% in 2000 and estimated to be 4.4% in 2030.[2,3] The prevalence rate of diabetes in India in urban areas is 9%, in rural areas also increased to 3% of the total population, and the ratio of patients with unknown to known diabetes is 1.8:1.[3] This can be primarily attributed to the fact that the condition is usually undetected in its early stages in most individuals, whereas in other individuals, the existing symptoms are often overlooked

because of ignorance or negligence on the part of the patient.[2] Clinical studies have established that periodontal diseases are more prevalent and of greater severity in patients with diabetes than in nondiabetic patients.[4-7]

Screening for diseases is to identify those who have an increased likelihood of developing a disease or experiencing an increase in disease severity as a first step in disease prevention and control.[8] There will be a greater likelihood of a favorable prognosis when a disease is discovered while it is still relatively incipient.[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.[10,11] To our knowledge, there are very limited studies on screening of undiagnosed diabetes with gingival blood in dental patients. Therefore, the aim of this study is screening of undiagnosed diabetes with gingival blood sample in patients attending to the dental hospital and to check the reliability with standard method.

METHODS

Study design
After receiving the approval of the Ethical Committee, RMDC and H, 550 patients age ranged from 30 to 50 years were randomly selected from the outpatient Department of Periodontics.

Participants
Patients with no known previous history of diabetes and having any risk factors like family history of diabetes, hypertension, high cholesterol, overweight/obesity with at least one tooth that bleed on probing were included in the study. Patients with known diabetes, pregnancy, any other systemic diseases were excluded from the study. Fifty-six patients rejected to participate in the study. Patients either with known diabetes ($n = 32$) or with no gingival bleeding ($n = 28$) were excluded from the study.

Procedure
A special case history proforma was prepared for a systematic and methodical recording of all observations which included a detailed case history and clinical examination, along with the written consent of the patient for willingness to participate in the study. For all the 454 patients, a gingival blood sample was collected from bleeding site with the help of a small plastic syringe and analyzed with self-monitoring device. A minimum of 0.3 μL of blood is required for assessment of blood glucose using self-monitoring device (one touch, Johnson and Johnson). In addition, all the Patients were advised for the second visit with overnight 8 h fasting for fasting

Blood glucose assessment. Four patients who were found to be diabetic and eight patients who were found to be nondiabetic by chair side assessment failed to report for further assessment. Of those 442 (202-males, 240-females) patients returned for fasting blood glucose assessment in laboratory with (Digital Colorimeter, EliCO CL157) patients with abnormal blood glucose values were advised to consult a physician for appropriate care [Figure 1].

Statistical analysis
Blood glucose values of all the patients were subjected to descriptive statistical analysis with SPSS version 16 software (Chicago, IL, USA). Number of patients identified as prediabetes and diabetes were analyzed for both self-monitoring glucose meter assessment and laboratory blood glucose assessment.

RESULTS

Mean age of the patients investigated is 42.45 ± 6.60. In the 454 patients gingival blood glucose assessment with self-monitoring device, 64 patients showed ≥ 200 mg/dL which indicates diabetes, and the other 390 patients showed ≤ 200 mg/dL, which indicates patients are not diabetic. Whereas, the results of the laboratory blood glucose analysis, 24 (5.43%) patients showed ≥ 126 mg/dL which indicates diabetes, 36 (8.14%) (patients showed 100–125 mg/dL which indicates prediabetic state and the other 382 patients are not diabetic (<100 mg/dL). Among the 240 male patients 13 patients were diabetic and 20 were in prediabetic status and in 202 female patients, 11 patients were diabetic and 16 were in prediabetic status [Table 1]. When compared male and females in both methods, Chi-square test values were not significant [Table 2]. Table 3 shows the comparison of gingival blood sample measurement with laboratory blood glucose assessment. Comparison of gingival blood sample measurements obtained by glucometer with the blood sample assessed in the laboratory showed sensitivity 96.6% and specificity 99.47% [Table 3].
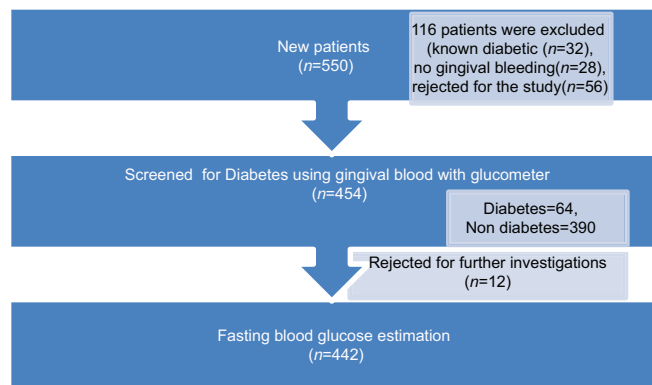

Figure 1: Outline of study design

We also considered the risk factors for diabetes, 122 patients were with risk factors and 320 patients were without any risk factors. The prevalence of risk factors [Figure 2] like hypertension, sedentary lifestyle, family history, and overweight was significantly higher in the patients with abnormal blood glucose levels.

DISCUSSION

Early detection and treatment of DM may reduce the burden of diabetes and its complications. This is most important in a high-risk population. Screening for diabetes should start at 40 years of age and to be repeated every 3 years in persons without risk factors, and earlier and more often in those with risk factors for diabetes.[10,11] Unfortunately, more than 50% of the diabetic subjects in India remain unaware of their diabetes status, which adds to the disease burden.[12,13] This underscores the need for mass awareness and screening programs to identify and reduce the burden due to diabetes in India.[14,15]

Table 1: Distribution and percentage of patients investigated as prediabetes, diabetes

Number of patients investigated	Prediabetes (%)	Diabetes (%)
n=442	36 (8.14)	24 (5.43)
Males-202	20 (9.9)	13 (5.9)
Females-240	16 (6.66)	11 (4.58)

Table 2: Comparison of blood glucose assessment by two methods in male and females

Sample	Chi-square test	*P*
Gingival blood sample evaluated by glucometer (454)		
Males-207	3.410	0.065
Females-247		
Venous blood sample evaluated by colorimeter (442)		
Males-202	2.419	0.120
Females-240		

Table 3: Comparison of the gingival blood sample measurements obtained by glucometer with blood sample assessed in laboratory

	Blood sample assessed in laboratory		Test outcome positive and test outcome negative
	Condition positive	Condition negative	
Blood sample assessed by glucometer	True positive 58	False positive 2	Positive predictive value-96.6%
	False negative 2	True negative 380	Negative predictive value-99.47%
	Sensitivity 96.66%	Specificity 99.47%	

The results of this study conducted to screen patients with diabetes in the dental hospital using gingival blood with self-monitoring device showed 64 (13.2%) patients were with abnormal blood glucose levels, which indicate as diabetic. When the same patients subjected to laboratory fasting blood glucose assessment, 60 patients were with abnormal blood glucose levels (8.14% showed prediabetic status and 5.43% is diabetic). Among the 202 male patients, 33 patients showed abnormal blood glucose levels suggestive of diabetes, whereas 240 female patients were screened for diabetes 27 patients were with abnormal glucose levels. This increase in the number of females with abnormal glucose levels may be due to greater psychological stress in Asian women as suggested by the authors in their study.[16]

When the risk factors are taken into account, 122 patients were associated with risk factors and 320 patients were without any risk factors. Prevalence of diabetes is significantly associated with risk factors. In a study conducted by the authors, prevalence of risk factors in urban areas is better documented.[17] There is higher prevalence of risk factors such as smoking, obesity, hypertension dyslipidemia, sedentary habits and metabolic syndrome. In a longitudinal study from urban India smoking and sedentary habits increased over time.[18]

The role of obesity in the pathogenesis of type 2 diabetes is complex and is confounded by many heterogeneous factors.[18] In a study conducted in North India concluded that there was a strikingly high prevalence of abdominal obesity and generalized obesity as determined by body fat percentage in type 2 diabetic individuals.[19]

Primary disease prevention and control activities are meant to delay disease onset and control disease severity. There is a huge window of opportunity for prevention, considering the number of modifiable risk factors among the prediabetes group only when the prediabetic stage is identified at earlier, in which periodontist has a key role.[20]
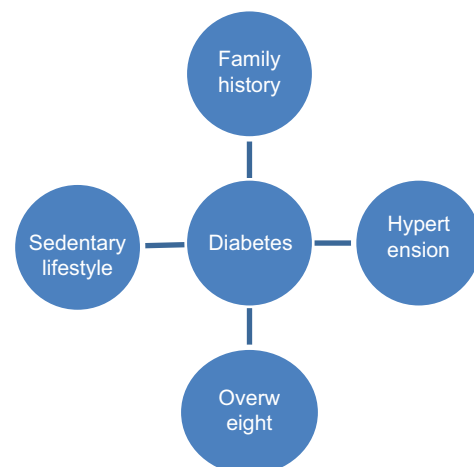

Figure 2: Risk factors for diabetes

Authors developed a clinical guidelines for dental care providers to identify patients with undiagnosed diabetes by means of a periodontal disease examination, as well as asking questions about self-reported or self-measured waist circumference, self-reported age, self-reported weight, self-reported oral health status, self-reported race or ethnicity and family history of diabetes.[21]

In view of the growing number of people with undiagnosed diabetes and the increased risk for periodontal patients, diabetes screening at the time of the dental visit seems to offer a promising approach.[22,23]

The limitation of the study includes as with most diagnostic tests, an abnormal result should be repeated to rule out laboratory error and should be coupled with an evaluation by a physician before a diagnosis can be made.

CONCLUSIONS

The results of the present study showed blood obtained from periodontal pocket probing is a reliable sample to screen diabetes in periodontal disease population. Early diagnosis of diabetes in the dental hospitals can help improve the patient's oral health and overall health status by helping patients avoid or reduce complications from diabetes. However, the present study could also be carried out with a larger survey population for a more effective screening.

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