Research Article

Estimation of glycemic levels with gingival crevicular blood in patients undergoing routine dental treatment: A non-invasive chairside technique

John Rozar Raj[1], Nandhini Subramaniam[2]*

ABSTRACT

Aim: The aim was to evaluate the blood glucose level using gingival crevicular blood (GCB) in patients undergoing routine dental treatment and to correlate the term glucose level of GCB and venous blood. **Background:** Diabetes mellitus is a metabolic disorder characterized by polyphagia, polydipsia, and polyuria. The conventional laboratory methods to diagnose diabetes are more time-consuming and require elaborate equipment. This study was undertaken to evaluate a quick, safe, and non-invasive method to screen for diabetes during the routine periodontal examination. **Materials and Methods:** A total of 30 patients who came for routine dental treatment were chosen. Tooth no. 46 was taken as a standard as it was easy to access. The periodontal examination was done, and blood oozing from gingival crevice was taken on to the test strip which was loaded into the glucometer. Immediately following the collection of GCB sample, venous blood sample was collected and the blood sugar level (RBS) was estimated. The reading obtained from the GCB and venous blood samples was recorded and compared using Karl Pearson's correlation. **Results:** A total of 30 patients were selected which included 16 males and 14 females. The mean value of venous blood and GCB was 115.4 and 116.33, respectively. Karl Pearson's correlation coefficient was 0.009257. Paired *t*-test was to calculate the t value, and there is no big difference between GCB and venous blood levels (P = 0.2395). **Conclusion:** The study indicates that GCB could be used in routine glucometric analysis to patients undergoing dental treatment.

KEY WORDS: Blood, Crevicular, Diabetes, Gingival, Venous

INTRODUCTION

Diabetes mellitus is a metabolic disorder characterized by polyphagia, polydipsia, and polyuria. Diabetes mellitus includes a heterogeneous group of disorders with the common characteristic of altered glucose tolerance and lipid metabolism.[1] There are a variety of complications of diabetes mellitus.[2] Diabetes mellitus is more common in periodontally compromised patients than normal people.[3] The conventional laboratory methods to diagnose diabetes mellitus are more time-consuming and require elaborate equipment. Various studies have been conducted to assess the use of this GCB with self-monitoring devices in the dental office to measure blood glucose and have reported comparable results. Hence, this study was undertaken to evaluate a quick, safe, and non-invasive method to screen for diabetes during the routine periodontal examination. The main objective of this study was to evaluate the blood glucose level using GCB and to correlate the glucometric status of GCB and venous blood in patients undergoing routine dental treatment.

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MATERIALS AND METHODS

The present study was carried out at Saveetha Dental College from December 2018 to January 2019.

A total of 30 patients who came for routine dental treatment were chosen. The details of the study were explained to the patients, and informed consent was obtained. Tooth no. 46 was taken as a standard as it was easy to access.

[1]Department of Oral Medicine and Radiology, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, Tamil Nadu, India, [2]Department of Oral Medicine, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, Tamil Nadu, India

***Corresponding author:** Dr. Nandhini Subramaniam, Department of Oral Medicine, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, 162, Poonamallee High Road, Chennai - 600 077, Tamil Nadu, India. Phone: +9840992569. E-mail: nandhinisubramaniam09@gmail.com

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The patients for the study were selected based on the following criteria.

Inclusion Criteria

- Patients aged 35-75 years
- Patients with gingivitis or moderate periodontitis
- Patients with the presence of bleeding on probing
- Patients with the presence of at least one tooth in the lower posterior segment.

Exclusion Criteria

- Patients with systemic diseases other than diabetes
- Patients who are completely edentulous
- Patients who are under blood thinners.

The periodontal examination was done [Figure 1], and blood oozing from gingival crevice was taken on to the test strip which was loaded into the glucometer and values were obtained [Figure 2]. Immediately following the collection of GCB sample, a patient was sent to the laboratory and venous blood sample was collected [Figure 3], and random blood sugar level was calculated in *in vitro* method. The reading obtained from the GCB and venous blood samples was recorded and statistically analyzed using *t*-test, and the values were compared using Karl Pearson's correlation.

RESULTS

A total of 30 patients were selected which included 16 males and 14 females [Figure 4]. The mean value of venous blood and GCB was 115.4 and 116.33, respectively. Karl Pearson's correlation coefficient was 0.009257. Paired *t*-test was to calculate the *t* value. "*t*" value was found to be 1.699 and their result was not statistically significant ($P = 0.2395$). There was no statistical significance between GCB and venous blood levels. The present study showed a positive correlation between venous blood glucose levels.

Karl Pearson's Correlation

Mean Value of Venous Blood - 115.4
Mean Value of Gingival Crevicular Blood - 116.33
Pearson's correlation® - 0.009257
P-value is 0.239555
The result is not significant at p<0.05

DISCUSSION

Diabetes mellitus is a clinically and genetically heterogeneous group of disorders affecting the metabolites of carbohydrates and proteins.

Hyperglycemia is due to the deficiency of insulin secretion caused by pancreatic B-cell dysfunction which is also called as type I diabetes mellitus and/or

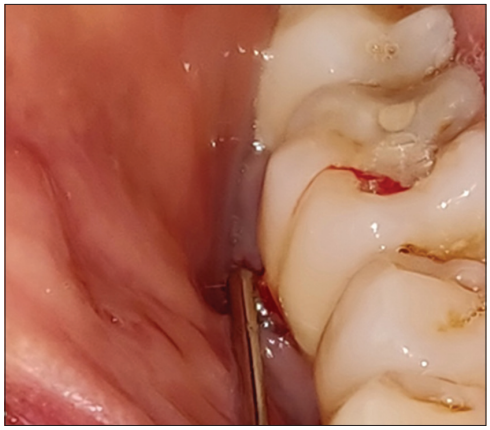

Figure 1: Periodontal examination

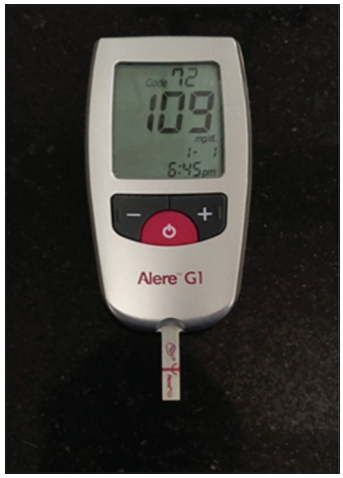

Figure 2: Glycemic value of gingival crevicular blood

Figure 3: Collection of venous blood

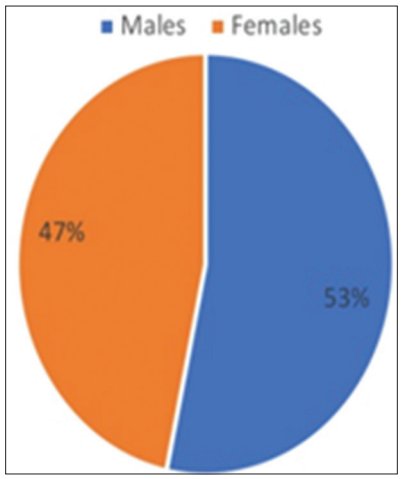

Figure 4: Sex distribution

insulin resistance in the liver and muscle which is also called as type II diabetes mellitus.[3]

Various studies prove that periodontal therapy exerts beneficial effects on diabetes mellitus control.[4] Certain studies reveal a strong evidence that diabetes is a risk factor for gingivitis and periodontitis and level of glycemic control appears to be an important determinant in this relationship.[5] Diabetes is undiagnosed in approximately one-half of the patients with the disease.[6] In many studies, the prevalence and severity of gingivitis had been demonstrated to be high in individuals with diabetes.[7] A greater level of gingival inflammation was observed in diabetics than in non-diabetics with a high level of inflammation in patients with poor glycemic control.[8] The number of bleeding sites was found to decrease as glycemic control improved.[9]

Periodontal inflammation is known to produce ample extravasated blood during diagnostic procedures. It is possible that GCB from probing may be an excellent source of blood for glucometric analysis using the technology of portable glucose monitors. The American Diabetic Association recommended that the prediction error of blood glucose monitoring devices falls within 15% of the laboratory standard. A study by Shetty *et al.* also demonstrated a strong correlation between GCB and capillary blood glucose levels.[10]

Past intraoral blood glucose studies have transferred blood onto the test strip by wiping blood directly from the hemorrhagic gingival tissue with the test strip itself or by rubbing blood onto the test strip from a blood-laden dental curette. Rubbing or direct wiping of intraoral blood onto the strip will not produce a uniformly timed reaction and may damage the strip's chemical indicator surface. 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.[11,12] In this study, the blood was collected by placing the tip of the strip directly over the bleeding site to avoid contamination. Stein and Nebbia used the interdental gingival papilla prick method with test strips to screen patients with high gingival blood glucose, and Müller and Behbehani[13] studied a previously unsuspecting periodontal population for diabetes using the same method. However, because the majority of the patients are usually apprehensive whenever invasive techniques are used, we have incorporated the non-invasive method where the blood oozing out during routine periodontal examination is checked for diabetes.

In our study, the efficacy of a glucometer for the screening of diabetes using GCB was evaluated. The samples were collected from gingival crevice after periodontal examination and venous blood using a syringe. Both the samples were measured using a self-monitoring device, and the values obtained were compared using Karl Pearson's correlation which showed a positive correlation between GCB and capillary blood glucose level.

In the earlier studies, the collection of blood sample from gingival crevice has been done using a disposable plastic pipette. However, in this study, the glucometer strips with the sensor at the tip of the strip were placed directly over the site once the bleeding was induced after probing. This was much easier to perform and less time-consuming since no additional tools and skills are necessary to collect GCB. Here, the capillary blood was not analyzed, and instead, venous blood was analyzed using laboratory methods and was taken as the control.

Considerable effort has been made in the past few years with regard to the development of a non-invasive method to measure blood glucose in routine dental practice. The information available from a single laboratory test may not reflect the current blood glucose status of the patient during treatment procedures. Hence, regular monitoring of their blood glucose using glucometer during recall visits may be a better alternative.

CONCLUSION

The intraoral sampling technique is safer, convenient, and cost-effective for the dental practitioner as the sample can be obtained during routine periodontal examination and referred to the physician, for the further medical management of diabetes. The study indicates GCB could be used in routine glucometric analysis to patients undergoing dental treatment. The study with a larger sample size has to be done to evaluate its diagnostic accuracy.

REFERENCES

1. Stein N. Diabetes and periodontal diseases. J Peridontol 2000;71:664-78.
2. Ardakani MR, Moeintaghavi A, Haerian A, Ardakani MA, Hashemzadeh M. Correlation between levels of sulcular and capillary blood glucose. J Contemp Dent Pract 2009;10:10-7.
3. American Diabetes Association. Diagnosis and classification of diabetes mellitus position statement. Diabetes Care 2005;29:537-42.
4. Mealey B. Position paper. Diabetes and periodontal diseases. J Periodontol 2000;71:664-78.
5. Rhodes CJ. Type 2 diabetes-a matter of beta-cell life and death? Science 2005;307:380-4.
6. Mealey BL, Oates TW, American Academy of Periodontology. Diabetes mellitus and periodontal diseases. J Periodontol 2006;77:1289-303.
7. Cutler CW, Machen RL, Jotwani R, Iacopino AM. Heightened gingival inflammation and attachment loss in type 2 diabetics with hyperlipidemia. J Periodontol 1999;70:1313-21.
8. Ervasti T, Knuuttila M, Pohjamo L, Haukipuro K. Relation between control of diabetes and gingival bleeding. J Periodontol 1985;56:154-7.

9. Consensus statement on self-monitoring of blood glucose. Diabetes Care 1987;10:95-9.
10. Shetty N, Shankarapillai R, Mathur LK, Manohar B, Mathur A, Jain M. Gingival crevicular blood: As a non-invasive screening tool for diabetes mellitus in dental clinics. J Indian Soc Periodontol 2013;17:472-7.
11. Khader YS, Al-Zu'bi BN, Judeh A, Rayyan M. Screening for type 2 diabetes mellitus using gingival crevicular blood. Int J Dent Hyg 2006;4:179-82.
12. Strauss SM, Wheeler AJ, Russell SL, Brodsky A, Davidson RM, Gluzman R. The potential use of gingival crevicular blood for measuring glucose to screen for diabetes: An examination based on characteristics of the blood collection site. J Periodontol 2009;80:907-14.
13. Müller HP, Behbehani E. Screening of elevated glucose levels in gingival crevice blood using a novel, sensitive self-monitoring device. Med Princ Pract 2004;13:361-5.

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