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Role of Periodontist in Screening Diabetes- A Correlation of Clinical and Biochemical Parameters

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ABSTRACT

Background: The increased prevalence and severity of periodontitis seen in patients with diabetes, especially those with poor metabolic control, has led to the designation of periodontal disease as the "sixth complication of diabetes" and successful periodontal therapy in diabetic patients entails the stabilization of blood glucose to a normal range. Hence, present study evaluates whether the noninvasive method of testing gingival blood glucose, is a reliable tool for screening diabetes in chronic periodontitis patients. **Methods:** The study sample comprised of 75 patients with probing pocket depth of > 4mm and clinical attachment loss of >3mm. Under aseptic measures and proper isolation, after gently probing the gingival sulcus the blood was drawn onto the glucometer strip and the readings were recorded. At the same visit blood was also collected from the index finger onto the glucometer strip. The statistical methods applied were Student's t-test (unpaired) to compare mean values between the two groups and Pearson's correlation for Means and Standard Deviation of the different parameters were calculated. **Results:** There is a positive correlation between GCBG and CFBG with all the clinical parameters. Fasting blood glucose level is negatively associated with age, plaque index and clinical attachment level (r=0.083, r=0.22 and p=0.042, respectively) whereas Post prandial blood glucose level is negatively associated with age, plaque index and probing pocket depth (r=0.117, r=0.099 and r=0.06, respectively). CFBG is slightly positively correlated with age, plaque index and clinical attachment whereas GCBG is strongly associated with probing pocket depth. **Conclusion:** The gingival crevicular blood glucose levels also found a positive correlation with the fasting blood glucose levels and post prandial blood glucose levels, suggesting the use of gingival crevicular blood as a screening marker for diabetes. Also a correlation was found between the gingival crevicular blood glucose levels and the clinical parameters suggesting that the treatment of periodontal disease can be considered as an important factor, which can help in improvement of the blood glucose levels in periodontitis subjects.

Keywords: Diabetes mellitus; Gingival crevicular blood; Periodontitis.

INTRODUCTION

The prevalence of diabetes mellitus is growing rapidly worldwide and is reaching epidemic proportions. The major proportion of this increase is seen occurring in developing countries of the world where the disorder predominantly affects young adults in the economically productive age group. Also there is consensus that the South Asia region will include three of the top ten countries in the world (India, Pakistan and Bangladesh) in terms of the estimated absolute number of people with diabetes.[1] Although the exact reasons why Asian Indians are more prone to type 2 diabetes at a younger age and premature cardiovascular disease (CVD) remain speculative, there is a growing body of evidence to support the concept of the "Asian Indian Phenotype".[2] This term refers to the peculiar metabolic features of Asian Indians characterized by a propensity to excess visceral adiposity, dyslipidemia with low amount of high density lipid (HDL) cholesterol, elevated serum triglycerides and increased small, dense low density lipid (LDL) cholesterol, and an increased ethnic (possibly genetic) susceptibility to diabetes and premature coronary artery disease.[3]

The increased prevalence and severity of periodontitis seen in patients with diabetes, especially those with poor metabolic control, has led to the designation of periodontal disease as the "sixth complication of diabetes" and successful periodontal therapy in diabetic patients entails the stabilization of blood glucose to a normal range.[4] This increased susceptibility does not correlate with increased levels

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of plaque and calculus. Collectively, the data supports the hypothesis that periodontal disease could affect diabetics, especially those with poorly controlled disease. Since type 2 diabetes mellitus is debuting earlier in patients, increasing their length of exposure to the disease, periodontal disease might become a serious health and social problem. Type 2 diabetes mellitus patients had a higher prevalence of periodontal disease as determined by using either periodontal attachment loss or radiographic bone loss parameters, indicating it as a risk factor for periodontal disease.[5] Hence, present study evaluates whether the noninvasive method of testing gingival blood glucose, is a reliable tool for screening diabetes in chronic periodontitis patients and also observes if there is any correlation between gingival crevicular blood glucose level, fasting blood glucose level and postprandial blood glucose level.

MATERIALS & METHODS

The study sample comprised of 75 patients in the age group of 25- 70 years with presence of debris and calculus, clinical signs of gingival inflammation, bleeding on probing present, probing pocket depth of > 4mm and clinical attachment loss of >3mm. The study was carried out in the Department of Periodontology and Implantology, Vananchal Dental College and Hospital, Garhwa, Jharkhand in collaboration with the Department of Biochemistry, Vananchal Dental College and Hospital, Garhwa, Jharkhand. Patient who hadtaken a course of anti-inflammatory or antimicrobial therapy within the previous 3 months, pregnant and lactating women and patients with history of tobacco, smoking or alcohol were excluded from the study. The blood was drawn through the gingival sulcus by gentle probing. Along with this, blood was also collected from a finger prick and when the blood glucose levels were 140mg/dl, the patient was sent for further laboratory examination. Full mouth examination (excluding third molars) were conducted for allpatients. Six sites were examined for each tooth (mesiobuccal, midbuccal, distobuccal, mesiolingual, midlingual, and distolingual). The Periodontal parameters included were plaque Index (PI),[6,7] Gingival Bleeding Index (GBI),[8] Periodontal probing depth (PPD) and Clinical attachment level (CAL)

Under aseptic measures and proper isolation, after gently probing the gingival sulcus the blood was drawn onto the glucometer strip and the readings were recorded. At the same visit blood was also collected from the index finger onto the glucometer strip. When the blood glucose levels were found to be > 140 mg/dl patient was asked to get further investigations done.

In biochemical parameters, fasting blood glucose and post prandial blood glucose levels was measured by Enzymatic Analysis. To estimate gingival blood glucose level, blood was collected from the gingiva of the tooth showing gingival bleeding after 10 seconds. Another factor kept in mind during site selection was to avoid all those sites where purulent discharge was evident. To keep the process simple, tooth in upper anterior arch which fulfilled the criteria, was selected. Clinical history and intraoral findings were recorded. A detailed periodontal examination was done using UNC-15 probe. The recording assistant was allowed to sit close enough to the examiner, so that instructions and codes could be easily heard and the examiner could see that, findings were recorded correctly.

Statistical analysis of data were performed with a software program, SPSS (Statistical Presentation System Software) version - 16.0 for windows. The statistical methods applied were Student's t-test (unpaired) to compare mean values between the two groups and Pearson's correlation for Means and Standard Deviation of the different parameters were calculated for the entire study population and for males and females separately, p values from all statistical tests were presented, and were considered statistically significant at $p<0.05$. If p-value is less than 0.01, in that case the significance level will be 99%, otherwise (p-value greater than 0.05) mean difference is considered as non-significant.

RESULTS

The mean and the standard deviation for the biochemical parameters in periodontitis subjects were calculated and shown in table 1. The mean and standard deviation for fasting and post prandial blood glucose levels were 159.20 mg/dl ± 36.10 and 155.84 mg/dl ± 32.35, respectively.

Table 1: Biochemical Parameters in Periodontitis Subjects

Variable	Mean	Std. Deviation
Fasting blood sugar (mg/dl)	159.20	36.10
Postprandial blood sugar (mg/dl)	155.84	32.35

The mean and the standard deviation for the clinical parameters in periodontitis subjects were calculated and shown in [Table 2]. The mean and standard deviation for plaque index, probing pocket depth and clinical attachment level were 1.94 ± 0.54,5.69 ± 1.00 and 5.75 ± 0.83 respectively.

Table 2: Clinical Parameters in Periodontitis Subjects

Variable	Mean	Std. Deviation
Plaque Index	1.94	0.54
Probing Pocket Depth	5.69	1.00
Clinical Attachment Level	5.75	0.83

Karl Pearson's product-moment correlation coefficient was calculated between clinical parameters and biochemical parameters [Table 3]. There is a positive correlation between GCBG and CFBG with all the clinical parameters. Fasting blood

glucose level is negatively associated with age, plaque index and clinical attachment level (r=0.083, r=0.22 and p=0.042, respectively) whereas Post prandial blood glucose level is negatively associated with age, plaque index and probing pocket depth (r=0.117, r=0.099 and r=0.06, respectively). CFBG is slightly positively correlated with age, plaque index and clinical attachment whereas GCBG is strongly associated with probing pocket depth.

Table 4: Correlation of the various parameters

Variables	Gingival Crevicular Blood Glucose Level (mg/dl	Capillary Figure Prick Blood Glucose Level (mg/dl)	Fasting Blood Glucose Level (mg/dl)	Post Prandial Blood Glucose Level (mg/dl)
	R	r	r	R
Age	0.138	0.175	-0.083	-0.117
Plaque index	0.012	0.04	-0.22	-0.099
Pobing pocket depth	0.022	0.016	0.03	-0.06
Clinical attachment level	0.073	0.079	-0.042	0.05

r = Pearson's correlation value

Table 5: Correlation of Various Biochemical Parameters

Variable	Capillary Finger prick Blood Glucose Level (mg/dl)	Fasting blood Glucose Level (mg/dl)	Post Prandial Blood Glucose Level (mg/dl)
	r	r	R
Gingival Crevicular Blood Glucose Level (mg/dl)	0.887**	0.435**	0.476**

r = Pearson's correlation value; * correlation is significant at 0.05;
**correlation is significant at 0.01.

[Table 5] shows the association between the various biochemical parameters in periodontitis study population. The capillary finger prick blood glucose levels were positively associated with GCBG levels (r=0.887). The fasting blood glucose levels and the post prandial blood glucose levels were found to be significant (r=0.435 and r=0.476, respectively).

DISCUSSION

Diabetes is undiagnosed in approximately one-half of patients with the disease. The American Diabetes Association recommends that screening for diabetes should start at the age of 45 years and be repeated every 3 years in individuals without risk factors for diabetes and earlier and more often in individuals with risk factors for diabetes. Moreover, testing at a younger age or more frequently should be carried out in individuals who are obese, have a first-degree relative with diabetes, are members of a high-risk ethnic population, delivered a baby weighing 4.05 kg or were diagnosed with gestational diabetes mellitus, are hypertensive (>140/90 mm Hg); 6) have an high density lipid cholesterol level <35 mg/dL and/or a triglyceride level >250 mg/dL; or 7) had impaired glucose tolerance on a previous testing or impaired fasting glucose.

Among the subjects with blood glucose levels >140 mg/dl, in the periodontitis group 45 of 75 had undiagnosed diabetes, suggesting that a majority of the Indian population is unaware of their systemic condition.

Probing Pocket Depth is a crucial and mandatory procedure in diagnosing periodontitis and evaluating the success of periodontal therapy. The mean probing pocket depth was found to be 5.69 ± 1. This clinical study provided the evidence that statistically strong correlation exists between GBGL and CBGL. Parker et al,[9] reported a significant correlation between sulcular and capillary blood glucose, (r = 0.8) which was consistent with the present study (r = 0.98). Beiker et al,[10] also reported a positive correlation in a study using a glucometer device to compare capillary and sulcular blood glucose levels (r = 0.98). This is a much stronger relationship than reported by Tsutsui et al.[11] (r - 0.782).

However, the correlation between the two measures can be influenced by a variety of factors such as site of sample collection, sampling methodology, type of instrument used and duplicate sampling. Regarding site of sample collection, Strauss et al,[12] reported that GCB samples were suitable to screen for diabetes in persons with sufficient bleeding on probing to obtain a sample without touching the tooth or the gingival margin (i.e., in patients having the basic clinical signs of gingivitis or periodontitis). Also, the method of collection of sulcular blood is critical because the resultant glucose values may be altered if there is any contamination of the collected sample by the oral tissues or tissue products. Past intraoral blood glucose studies by Beiker et al,[10] Khader et al,[13] have transferred blood onto the test strip by wiping blood directly from the hemorrhagic gingival tissue.

Similarly, in the present study GCBG and CFBG levels were compared with the periodontal parameters, the correlation coefficients were insignificant (p>0.05). The probable explanation for these changes could be that no attempt has been made to judge the quality of the plaque based on the microbiological study, so this is in support with the specific plaque hypothesis. Shetty S et al,[14] studied a previously unsuspecting periodontal population for diabetes using capillary tube method for collection

of the blood sample. However, as majority of the patients are usually apprehensive whenever invasive techniques are used, we have incorporated the non-invasive method in this study where the blood oozing out during routine periodontal examination is investigated for diabetes. Shrivastava S et al,[15] suggested that a diagnosis of diabetes should only be based on venous plasma glucose values determined in the laboratory. Portable blood glucose devices should not be used as diagnostic tools for diabetes mellitus and such devices should only be used for the monitoring of blood glucose control during treatment for screening.

Similarly, this study also compared the correlation between the GCBG levels and the biochemical parameters i.e. fasting blood glucose levels and the post prandial blood glucose levels. A positive correlation was found between these parameters with r = 0.435 and r = 0.476 respectively. The results obtained from this study clearly pointed out the importance of the early detection of diabetes in a population comprised of patients predominantly having gingival and periodontal diseases. To elucidate the exact relationship between gingival crevicular blood glucose level, fasting blood glucose level and post prandial blood glucose level, further longitudinal and interventional studies with greater sample size should be carried out.

CONCLUSION

Although not a test to diagnose diabetes, such a screening is an important aid in identifying those for whom follow-up tests regarding possible diabetes are warranted. Such patients should not be overlooked in the absence of a positive history for diabetes and should definitely be screened for diabetes, for which gingival blood glucose monitoring holds definite promise. Furthermore, the costs associated with the purchase of a readily available glucometer and individual test strips is extremely modest. Thus, with minimal cost and a limited investment of time for patients and clinicians, dental professionals can play a critical role in supporting their patients overall health.

The gingival crevicular blood glucose levels also found a positive correlation with the fasting blood glucose levels and post prandial blood glucose levels, suggesting the use of gingival crevicular blood as a screening marker for diabetes. Also a correlation was found between the gingival crevicular blood glucose levels and the clinical parameters suggesting that the treatment of periodontal disease can be considered as an important factor, which can help in improvement of the blood glucose levels in periodontitis subjects. Also the risk of the patient to develop diabetes can be decreased in periodontally healthy subjects by increasing awareness amongst them.

REFERENCES

1. King H, Rewers M. Diabetes in adults is now a Third World 1. problem. The WHO Ad Hoc Diabetes Reporting Group. Bull World Health Organ. 1991;5P: 643-8.
2. Anjana R.M, All MK, Pradeepa R, Deepa M, Datta M., R. Unnikrishnan, M. Rema & V. Mohan. The need for obtaining accurate nationwide estimates of diabetes prevalence in India - Rationale for a national study on diabetes. Indian J Med Res. 2011; 133:369-380.
3. Loe H. Periodontal disease. The sixth complication of diabetes mellitus. Diabetes Care. 1993;16 (Suppl l):329-334.
4. Fatemeh Sarlati, Elham Pakmehr, Kimia Khoshru, Nasrin Akhondi. Gingival Crevicular Blood for Assessment of Blood Glucose Levels. J Periodontol Implant Dent. 2010;2(l):17-24.
5. Guglielmo Campus, Abeer Salem, Sergio Uzzau, Edoardo Baldoni and Giancarlo Tonolo. Diabetes and Periodontal Disease: A Case-Control Study. J Periodontol. 2005;76:418-425.
6. Peter S. Indices in dental epidemiology, in peter's (ed) Essentials of Preventive and Community Dentistry, 3r ed. New Delhi, India; Arya Publishing House; 2006:123-231.
7. Loe H. The plaque index and the retention index systems. J Periodontal 1967;38:610-616.
8. Ernest Newbrun. Indices to Measure Gingival Bleeding. J Periodontol 1996;67:555-561.
9. Parker RC, Rapley JW, Isley W, Spencer P, Killoy WJ. Gingival crevicular blood for assessment of blood glucose in diabetic patients. J Periodontol 1993;64: 666-672.
10. Beikler T, Kuczek A, Petersilka G, Flemmig TF. Indental-voffice screening for diabetes mellitus usingvgingival crevicular blood. J Clin Periodontol 2002;29:v216-218.
11. Tsutsui P, Rich SK, Schonfeld SE. Reliability of intraoral blood for diabetes screening. J Oral Med 1985; 40:62-6.
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. 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;4:179-182.
14. Shetty S, Kohad R, Yeltiwar R, Shetty K. Reagent Test Strips: A Method to Detect Diabetes in a Periodontal Population. J Periodontol 2011;82:1548- 1555.
15. Shrivastava S, Vishwakarma A, Nayak P, Gupta R, Shende V, Beera A. Gingival crevicular blood: Can it be used as a better diagnostic aid for screening of blood glucose. International Journal of Women Dentists, 2014;l(l):23-27.

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