Comparative clinical evaluation of glycosylated haemoglobin level in healthy and chronic periodontitis patients: A chairside diagnostic method

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ABSTRACT

Objective and Background: Glycosylated haemoglobin (HbA1c) level can consequently be interpreted as an average of the blood glucose present over the past 3–4 months. Periodontitis is associated with glycemic control in patients with diabetes. The purpose of this study was to determine the level of HbA1c in healthy and periodontitis patients who were previously not diagnosed with diabetes mellitus.

Materials and Methods: A total of 40 patients were selected for study and divided into two groups. Group 1 included patients with a healthy periodontium, and Group 2 included patients suffering from chronic periodontitis. Finger stick blood was collected by special collection unit (A1CNOW® Bayer Health Care, Tarrytown New York, USA), for estimating level of HbA1c.

Result: Both groups showed similar HbA1c levels clinically with slight increase in levels in the test group, but was statistically significant (test - 5.66 ± 0.35%, control - 5.17 ± 0.3% P = 0.003).

Conclusion: Indians are at a high-risk of developing periodontitis and diabetes. These data suggest a possible link between periodontitis and glycemic control in nondiabetic individuals, periodontal disease may be a potential contributor to the development of type 2 diabetes.

Key words: Chronic periodontitis, diabetes mellitus, finger stick blood, glycosylated haemoglobin

Periodontitis is an inflammatory disease of the supporting tissues of the teeth caused by specific microorganisms or group of specific microorganisms, and it seems to be a risk factor for incident diabetes and is the sixth complication of diabetes. Hyperglycemia and the resulting advanced glycation end-product formation is one of the several pathways thought to lead to the microvascular and macrovascular complications of diabetes.1,2 A popular theory is that, inflammatory mediators interleukin-6 and tumor necrosis factor-alpha generated within the inflamed periodontal tissues or in response to oral bacteria that translocate into the systemic circulation, interfere with the actions of insulin receptors, thereby decreasing insulin sensitivity.3

Because of a large number of patients who seek dental treatment each year, the dentist may increase his importance as a member of the health team by participating in the search for undiagnosed asymptomatic diabetes. The early detection of subclinical diseases by various screening procedures is making considerable progress in reducing the progression of certain chronic diseases such as diabetes.4

The primary methods used to diagnose diabetes mellitus and monitor blood glucose levels have been the fasting blood glucose and oral glucose tolerance tests but these tests require fasting by the patient and is highly dependent on patient compliance and are useful only for the immediate time period in which the test is administered. To overcome all this recently a glucose assay called the glycosylated

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haemoglobin (HbA1c) assay has been developed which does not require fasting, does not rely on patient compliance and gives an indication of blood glucose levels over an extended period of time.\[^5\]

HbA1c assay test is based on the knowledge that blood glucose becomes irreversibly bound to haemoglobin molecules. The higher the level of blood glucose, the greater the amount that biodynamically and irreversibly binds to the haemoglobin molecule. Since the average lifespan of a red blood cell is 120 days, HbA1c levels reflect glycemic control over the previous 1–3 months. The HbA1c assay was originally used only to monitor the blood glucose levels of diabetics, but, with improvements in the assay, it currently affords an additional means of diagnosing the diabetic.\[^5,6\]

Diabetes treatment guidelines are based primarily on the establishment and maintenance of HbA1c levels <7%. Every percentage point drop in HbA1c is associated with an estimated 40% decrease in microvascular complications.\[^7\]

The purpose of this study was to examine the association between periodontitis and HbA1c in adults and to determine if HbA1c is elevated in patients with periodontitis who have not been diagnosed with diabetes. We hypothesized that patients with periodontitis had higher HbA1c levels than healthy patients.

MATERIALS AND METHODS

A total of 40 patients were selected for the study from the Out Patient Department of Periodontics, Rungta College of Dental Sciences and Research, Kohka-Kurud, Bhilai, Chhattisgarh and were divided into two groups Group 1 included patients with a healthy periodontium (probing depths [PDs] ≤4 mm and bleeding on probing [BOP] ≤15% and no clinical attachment loss) and Group 2 included patients suffering from chronic periodontitis (having at least five teeth with PD ≥5 mm, BOP and clinical attachment loss (>1 mm) on >5 teeth or radiographic bone loss). Patients with antibiotic prophylaxis, any bleeding disorder, severe systemic diseases such as cardiovascular, renal, hepatic, immunologic, or hematological disorders, and any medication interfering with the coagulation system were excluded from the study. Clinical parameters such as plaque index, gingival index, modified sulcular bleeding index, and probing pocket depth were recorded prior to the commencement of the study.

Ethics approval was gained from the ethical committee of our institution before implementation of the study while written informed consent was obtained from all the participants at the beginning of this study.

Estimation of glycosylated haemoglobin

Estimation of HbA1c was measured using a commercially available test kit (A1CNOW\(^+\)) [Figure 1]. Finger stick blood was collected by using needle [Figures 2 and 3] and collected it in supplied blood collector [Figure 4] and then fully inserted into sampler body and shaked well 6–8 times. Now preparation of the cartridge is done, the cartridge was used within 2 min after opening the packet, and then test cartridge was inserted into monitor by matching the codes [Figure 5]. Now sample preparation was started, we need to wait till the SMPL displays on the screen then base of the sample was removed and diluted sample dispensed completely [Figure 5] and removed immediately then we need to wait for 5 min until the display counts down as we the result is displayed the cartridge was removed from the monitor and discarded it [Figure 6].

Statistical analysis was done using the \(t\)-test. The analysis was performed using a statistical software program SPSS software version 17.0 (IBM corporation, Chicago, IL, USA).

RESULT

There is a potential for systemic exposure to periodontal pathogens and pro-inflammatory mediators associated with periodontitis.
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A total of 40 samples were taken, out of which 20 were a test and 20 were controls and data obtained was subjected to statistical analysis.

The comparison of select characteristics between periodontitis cases and healthy controls is shown in Table 1. Graph 1 gives the distribution of HbA1c values in periodontitis cases and healthy controls. Mean HbA1c values were 5.66 ± 0.35% in test and 5.17 ± 0.3% in controls. However, HbA1c levels showed slight difference clinically, but the difference was statistically significant (P = 0.003*).

DISCUSSION

Diabetes mellitus is one of a number of highly prevalent metabolic disorders, constituting a huge global public health burden. It is predicted that 300 million people will have diabetes by 2025 worldwide, and at least 366 million people will have diabetes by 2030. Most of this growth, driven principally by an increasing prevalence of type 2 diabetes mellitus, is occurring in developing countries. [8]

Diabetes diagnoses are based on repeated casual, fasting or postprandial blood glucose assessments. Nowadays, HbA1c is a commonly used treatment endpoint in clinical trials and it may be used as a stand-alone diagnostic measure for diabetes and can be performed quickly and easily in a dental office setting. In this study, non-fasting blood glucose levels was compared between periodontally healthy patients and those with periodontal disease. [9]

The onset of diabetes is preceded by inflammation, which leads to pancreatic beta-cell dysfunction and apoptosis, as

Table 1: Comparison of selected characteristics between test and controls

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Test</th>
<th>Control</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>38.9±13.4</td>
<td>40.1±14.4</td>
<td>0.8</td>
</tr>
<tr>
<td>Range</td>
<td>21-57</td>
<td>24-57</td>
<td></td>
</tr>
<tr>
<td>Sex n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>12 (60)</td>
<td>10 (50)</td>
<td>0.65</td>
</tr>
<tr>
<td>Female</td>
<td>8 (40)</td>
<td>10 (50)</td>
<td></td>
</tr>
<tr>
<td>HbA1c (%)</td>
<td>5.66±0.35</td>
<td>5.17±0.3</td>
<td>0.003*</td>
</tr>
</tbody>
</table>

*P<0.5 significant. SD=Standard deviation
Clinical and metabolic evaluation of one‑stage, full‑mouth, 4–6% normal
>8% action suggested to improve diabetes control.
<7% good diabetes control
7–8% moderate diabetes control

A limitation of the study design is that we selected only 40 sample size, but the large sample size is required for confirmation of the result.

Association guidelines indicate the following,[11]
• 4–6% normal
• <7% good diabetes control
• 7–8% moderate diabetes control
• >8% action suggested to improve diabetes control.

Although statistically significant, correlations in the current study were small and suggested that ≤8% of the variation in HbA1c values are associated with the extent of periodontal disease. Our results also are consistent with other reports that collectively suggest that periodontitis is associated with elevated blood glucose levels in adults who have not been diagnosed with diabetes.[9]

Nibali et al. compared non‑fasting blood glucose levels between periodontally healthy patients and those with advanced disease. Glucose, as well as high density and low‑density lipid cholesterol levels, was significantly higher in periodontitis cases than controls. In contrast, we found a small, but negative, correlation between HbA1c and the number of sites with PD ≥5 mm and ≥6mm in cases.[12]

In a study done by Wolff et al., adjusted HbA1c levels were slightly, but statistically significantly higher in periodontitis cases versus healthy controls. They did not find an evidence of a dose‑dependent relationship between the disease extent and HbA1c elevations. They suggest that, there may be a threshold, above which the periodontitis affects the HbA1c values in the general population, and this finding needs to be confirmed in larger studies.[9]

Ide et al. did not find a significant association between periodontal disease and incident diabetes after adjusting for confounding factors in a large prospective follow‑up study.[13]

A limitation of the study design is that we selected only 40 sample size, but the large sample size is required for confirmation of the result.

CONCLUSION

HbA1c levels were slightly elevated in chronic periodontitis cases than in controls. This preliminary finding is consistent with earlier reports that chronic periodontitis is associated with elevated blood glucose in adults without diabetes and may increase one’s risk for type‑2 diabetes.

Further studies with larger sample sizes are needed to clarify the causal relationship between chronic periodontitis and HbA1c levels in nondiabetics.

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Conflicts of interest
There are no conflicts of interest.

REFERENCES