

A CROSS-SECTIONAL INVESTIGATION INTO THE LEVELS OF GLYCOSYLATED HEMOGLOBIN IN INDIVIDUALS WITH PERIODONTITIS COMPARED TO THOSE WITHOUT: A COMPARATIVE STUDY

Dr. Neelam Das , Dr. Prateek Singh , Dr. Lynn Johnson , Dr. Shruti Gupta , Dr. Janardhana Amaranath B.J ,Dr. Anshul Chandra , Dr. Pihoo Ranjan

Rama Dental College Hospital & Research Centre, Rama University, Mandhana, Kanpur, UP;

Email Id: - drneelamdass@ramauniversity.ac.in

Abstract

Background: Periodontal diseases are believed to be the sixth chronic complication of diabetes mellitus along with retinopathy, nephropathy, neuropathy, macro vascular disease, and altered wound healing. The present study was intended to identify the relationship between periodontitis and the glycaemic control in non-diabetic individuals by comparing the HbA1c levels in periodontitis patients and non-periodontitis individuals who have not been diagnosed as diabetic.

Materials and Methods: A cross-sectional observational study with a total of 90 subjects has been designed. The subjects recruited for the study were divided equally into two groups (Cases=45 & controls=45). The case group contained subjects without diabetes but with chronic periodontitis and the control group included individuals without diabetes and periodontitis. HbA1c levels have been estimated on both the groups by D-10 high performance liquid chromatography method and the values were compared by using independent t-test.

Results: The result had shown a statistically significant higher mean HbA1c level in the case group when compared with the healthy controls (p-value = 0.02).

Conclusion: The result suggests that there is a relationship between periodontitis and glycaemic control in non-diabetic individuals.

Keywords: Periodontitis; Diabetes Mellitus, Glycosylated Hemoglobin A1C, Glycaemic Control, Periodontal therapy, HbA1c.

Introduction

Periodontal diseases are believed to be the sixth chronic complication of diabetes mellitus along with retinopathy, nephropathy, neuropathy, macro vascular disease, and altered wound healing.¹ Some of the

theories suggest that the factors such as advanced glycation end products, changes in collagen fibres and altered immune function in diabetic individuals will result in impaired polymorphonuclear leukocyte function thereby facilitating the bacterial persistence in the tissues. The accumulation of advanced glycation end products results from prolonged and chronic hyperglycemia will further increase the secretion of pro-inflammatory cytokines such as tumor necrosis factor- α and prostaglandin E-2, and hence increases the risk of alveolar bone loss and attachment loss approximately three-fold when compared to non-diabetic individuals.² The two-way relationships between diabetes and periodontitis have been supported with many evidences, with diabetes increasing the risk for periodontitis, and periodontal inflammation negatively affecting the glycemic control.³ Various reports states that the close relationship between periodontitis and diabetes has been established as one utilizes the reciprocal influence on the other.⁴ Several studies have proven that periodontal treatment of diabetic patients has shown reduction in their HbA1c levels after three months follow up.⁵ However, it stays indistinct whether periodontal status influences HbA1c in non-diabetics. Evidences reveals that the bacteria and its end products present in the periodontal tissues will stimulate fibroblasts, keratinocytes and macrophages to release inflammatory mediators such as tumor necrosis factor alpha (TNF- α), prostaglandin E2, interleukin IL-1 β , 6 and 12, granulocyte colony-stimulating factor (G-CSF) and chemokines. The elevation of these mediators in the systemic circulation will interfere with the actions of insulin receptors, thereby decreasing insulin sensitivity.⁶ Hence the present study was planned to determine the association between periodontitis and glycemic control by comparing the glycosylated hemoglobin levels in periodontitis patients and non-periodontitis individuals who have not been diagnosed as diabetic.

Material and Methods

A cross-sectional study was designed. After obtaining the ethical approval from the ethical committee of our institution a total of 90 samples (45-cases & 45-controls) were obtained from the Department of Periodontology, Rama Dental College Hospital & Research Centre in Kanpur. Patient information sheet has been given to the participants who have been selected for the study and the informed consent is obtained from them. After taking a brief history, the oral hygiene status, bleeding on probing, periodontal pocket depth and clinical attachment loss were assessed. In the case group, participants without diabetes but with clinical attachment loss of ≥ 5 mm and periodontal pocket depth ≥ 5 mm in more than 30% of the sites are selected. In the control group, participants with healthy periodontium and without any systemic diseases have been selected. Pregnant women, individuals with systemic diseases and who have been taking antibiotics within the last 6 months prior to the study have been excluded from the study. Then 3 ml of blood is collected from antecubital vein of the test and control group in lavender top vacutainer

using standard laboratory procedures. The blood drawn is then labeled and transported to the laboratory biochemistry section to assess for HbA1c levels. The D-10 HbA1c Program with the Bio-Rad D-10 Hemoglobin Testing System was used to estimate the glycosylated hemoglobin A1C levels in the study group.

Statistical Analysis

Statistical analysis was done using independent t-test. The analysis is performed using statistical software program SPSS version 22.

Results

The total number of participants taken for the study was 90. Out of which 45 were cases and 45 were controls. After obtaining the HbA1c values of all the participants, four participants were excluded from the case group as they were showing the HbA1c value of more than 6.4%.

| | | Sex | | Total |
|-------|---------|--------|-------|-------|
| | | Female | Male | |
| Group | Case | 13 | 38 | 41 |
| | | 31.7% | 68.3% | 100% |
| | Control | 18 | 27 | 45 |
| | | 40% | 60% | 100% |
| Total | | 31 | 55 | 86 |

Table 1: Gender Distribution in Cases and Controls

Hence, the number of samples selected in cases is 41 and the number of samples selected for controls are 45 with a total of 86 samples. Among the 41 cases, 28 participants are males and 13 participants are females. And among the controls, 27 participants are males and 18 participants are females (Table 1).

| | Groups | N | Mean | SD |
|-----|---------|----|-------|-------|
| Age | Case | 41 | 46.83 | 8.535 |
| | Control | 45 | 37.42 | 7.124 |

Table 2: Distribution of Age in cases and controls

The mean age of participants in the case group is 46.83 (8.535) and the mean age of participants in the control group is 37.42 (7.124) (Table 2).

| Group Statistics | | | | | | |
|------------------|---------|----|--------|----------------|-------------|---------|
| | Groups | N | Mean | Std. Deviation | T statistic | p-value |
| HbA1c % | Case | 41 | 5.4902 | .41821 | 2.420 | 0.024 |
| | Control | 45 | 5.2867 | .40317 | | |

Table 3: Comparison of HbA1c values between cases and controls

Independent t test is used to compare HbA1C level between cases and control. The mean HbA1c value among the case group is 5.49 (0.418) and the mean HbA1c value in the control group is 5.28 (0.403). We observed a significant difference in mean hemoglobin level between the groups with $p=0.024$ (Table 3).

Discussion

Periodontitis is a low grade infection which is thought to have the ability to cause low grade systemic inflammation. Periodontitis may increase the insulin resistance by releasing the pro-inflammatory mediators into systemic circulation and there by inducing the glycemic control.⁷ Although there are several studies to support the effectiveness of periodontal therapy in reducing the glycemic level in diabetic patients with periodontitis, there are only limited studies to support the effect of periodontitis that influencing the glycemic control in non-diabetic individuals. Hence, the present study was conducted to estimate the glycosylated hemoglobin levels in patients with periodontitis who have not been diagnosed as diabetic and to compare their levels with healthy individuals.

A total of 90 participants having the age of 30 and above were selected and grouped into cases and controls with 45 participants in each group. After obtaining the informed consent the blood samples were collected from each participant to estimate the HbA1c percentage. Out of 45 participants in the case group, four of them had the HbA1c level of more than 6.4%. As they have fallen in the diabetic range those participants were omitted from the study according to the exclusion criteria. So the total number of samples selected for comparing the HbA1c values among the cases and controls are 86, with 41 samples in the case group and 45 samples in the control group.

The mean HbA1c values of the case and control group are 5.49 ± 0.41 and 5.28 ± 0.40 respectively. The mean HbA1c value for the case group is slightly higher when compared with the control group and it is statistically significant with the p-value of 0.024. The current study result is in accordance with the studies conducted by Rajan P et al and TS. Srinivasa et al which reveals that there is a link between periodontitis and glycemic control.^{8,9} Nibali et al have found significant increase in the non-fasting blood glucose among the periodontitis patients.¹⁰

Teeuw WJ et al conducted a study to identify whether dental office can be an ideal location for screening diabetes with a specific focus on periodontitis patients. They have found a significant rise in HbA1c values among the periodontitis patients when compared with healthy periodontium. Among the severe periodontitis patients with unknown metabolic status, 18.1% of the subjects were newly diagnosed as diabetic and they have arrived at a conclusion of considering a dental office as a suitable location for screening diabetes.¹¹ In the present study, four subjects (6.5, 6.6, 6.8 and 12.4 respectively) in periodontitis case group among the previously undiagnosed diabetic cases (9.75%) have been newly diagnosed as diabetic during the study. This suggests that periodontitis can be considered as early sign or a risk factor for diabetes mellitus. Rao Deepika PC and Saxena RM have found a slight increase in the HbA1c levels in the severe periodontitis patients the results were statistically insignificant. However, the patients with severe periodontitis who were over-weighted had a significantly high rise in HbA1c levels.¹² The study conducted by Joshipura et al found slightly higher pre-diabetes/diabetes risk in the subjects as the periodontal attachment loss and pocket depth increases, but it was statistically insignificant.¹³ Ide Ret al had conducted a 7-year prospective study to identify whether diabetic incidence increases with periodontitis in 5848 non-diabetic subjects. In their study the unadjusted analysis revealed significantly higher incidence of diabetes in moderate to severe periodontitis patients, but the significance was lost after adjusting for sex, smoking, BMI, triacylglycerol, hypertension, HDL cholesterol and γ -glutamyl transpeptidase. Hence, they have concluded that there is no clear-cut relationship between periodontitis and risk of pre-diabetes/diabetes.¹⁴

Taboza et al proved significantly higher mean HbA1c in the moderate to severe periodontitis subjects when compared with no/mild periodontitis.¹⁵ Rao Deepika PC and Saxena RM have found statistically significant higher mean HbA1c in over-weight category when compared with normal BMI group among the non-diabetic individuals. Studies suggest the prevalence of higher glycemic levels as age advances, and there are evidences that also suggest the higher prevalence of periodontal diseases among the aged individuals.^{16,17} However in the present study we did not consider the severity of periodontitis, the BM index and the age of the individual that might affect the reliability of the study. So further studies

considering the age with equal distribution among both the groups and with a larger population would provide a superior accuracy for the study.

Conclusion

The study suggests that there is a link between periodontitis and glycemic control in non-diabetic individuals. It also proves that periodontitis is an early sign for diabetes mellitus. Hence a dental professional have a crucial role in identifying high risk patients and also to take necessary actions to reduce the development of diabetes and its complications. However, considering the age, severity of periodontitis and the BMI index of the periodontitis subjects would have shown a better reliability for the study. So a further research with a larger sample size and consideration of the age, severity of periodontitis and BMI index of periodontitis subjects is necessary to identify the clear-cut link between periodontitis and glycemic control.

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