

Correlation Between Diabetes Mellitus and Oral Health: A Cross-Sectional Study on Periodontal Status in Patients Attending a Tertiary Care Center

VikasDesai¹, Arpita Mangalwedhe², Sunitha S³, Shivlingesh K K⁴, Shaik Hussain Saheb⁵

¹Associate Professor, Department of Dentistry, Shri.B.M.Patil Medical college Hospital and Research centre, Vijayapura, Karnataka, India. ²Senior Resident, Department of Dentistry, Shri.B.M.Patil Medical college Hospital and Research centre, Vijayapura, Karnataka, India. ³Reader, Department of Public Health Dentistry, JSS Dental college and hospital, Mysore, Karnataka, India. ⁴Professor and Head, Department of Public Health Dentistry, Institute of Dental Sciences, Bareilly International University, Pilibhit bypass road, Suresh Sharma Nagar, Bareilly, Uttar Pradesh, India. ⁵Department of Anatomy, GMC, Kadapa, Andhra Pradesh, India.

Abstract

Background: Diabetes mellitus (DM) and periodontal disease have a complex relationship, and diabetes predisposes individuals to oral infections, and periodontitis may aggravate the level of glycemic control. The purpose of the study was to assess the correlation between DM status and periodontal health among patients in the Department of Dentistry. **Material and Methods:** A cross-sectional study was conducted with a sample of 200 individuals (100 with type 2 DM and 100 non-diabetic controls) aged 30-70 years. The tools to evaluate periodontal status were the Community Periodontal Index (CPI), probing pocket depth (PPD), clinical attachment loss (CAL), and plaque index. HbA1c was used to measure glycemic control. Chi-square tests and logistic regression ($p < 0.05$) were used to analyse the data. **Results:** Nine out of ten diabetic patients had periodontal disease to some extent, compared with 48/100 controls ($p < 0.001$). One-point four (CPI score 4) was observed in 28 percent of diabetics, compared with 8 percent of controls. HbA1c 8 or higher was associated with a higher prevalence of severe periodontitis (OR 2.8, 95% CI 1.4-5.6). A long history of diabetes (longer than 10 years) was associated with heightened loss of attachment. **Conclusion:** This work establishes a positive relationship with an unstable correlation between diabetes and worse oral health outcomes (periodontal destruction in particular). A combination of diabetes and dental services is suggested.

Keywords: Periodontal disease, diabetes mellitus, bidirectional relationship, oral health.

Received: 03 January 2026

Revised: 29 January 2026

Accepted: 19 February 2026

Published: 27 February 2026

INTRODUCTION

Diabetes mellitus (DM) and especially type 2 is one of the most common chronic metabolic diseases to affect the globe, with India having a significant burden as the nation that harbors the second-largest portion of all cases.^[1] The disorder is described to be associated with permanent hyperglycemia, which predisposes patients to many microvascular and macrovascular complications, such as retinopathy, nephropathy, neuropathy, and cardiovascular disease.^[2] Besides these established complications, periodontal disease, which is inclusive of gingivitis and periodontitis, has been recognized as a major oral health complication of diabetes.^[3] Periodontal disease is a long-term inflammatory disease caused by an imbalance in biofilm due to dysbiotic plaque, leading to the gradual loss of the functional tissues (gingiva, periodontal ligament, and alveolar bone) that support the teeth.^[4] The epidemiological evidences have always shown that diabetically people have an increased risk of periodontitis by 2- to 3-fold as compared to non-diabetics, and it has a high prevalence, extent and severity especially in instances of poor glycemic control.^[5,6] Such predisposition can be explained by the effects of hyperglycemia on immune function, including neutrophil dysfunction, increased levels of advanced glycation end products (AGEs), and increased cytokine-mediated inflammation (IL-1, 7, 12, 16).^[7]

On the other hand, emerging evidence indicates a bidirectional relationship, in which severe periodontitis may exacerbate diabetes by increasing systemic inflammation, insulin resistance, and worsening glycemic control, as demonstrated by elevated HbA1c levels.^[8,9] This interaction is a vicious cycle, and periodontal inflammation has the potential to both worsen diabetic complications as well as vice versa.^[10] In the past, periodontitis was labeled the sixth complication of diabetes, a term first proposed in the early 1990s following strong associations observed in longitudinal and cross-sectional studies.^[3,11]

In the Indian scenario, where type 2 DM prevalence is still increasing at an alarming rate, several hospital based and community based studies have indicated very high percentage of

Address for correspondence: Dr. Vikas Desai, Associate Professor, Department of Dentistry, Shri.B.M.Patil Medical college Hospital and Research centre, Vijayapura, Karnataka, India. E-mail: ?@gmail.com

DOI:

10.21276/amit.2026.v13.i1.390

How to cite this article: Desai V, Mangalwedhe A, Sunitha S, Shivlingesh KK, Saheb SH. Correlation Between Diabetes Mellitus and Oral Health: A Cross-Sectional Study on Periodontal Status in Patients Attending a Tertiary Care Center. Acta Med Int. 2026;13(1):553-557.

periodontal involvement of diabetic patients, most of which are over 90-95 per cent of any extent of disease, with most severe forms of the disease being mostly perceived in those with suboptimal glycemic control, or extended duration of the disease.^[12,13] The implications of these findings include the necessity of combined medical-dental care interventions to break this two-way process and enhance the health status of the general public.^[14]

The current research, which took place at the Department of Dentistry, Shri B. M. Patil Medical College Hospital and Research Centre, Vijayapura, Karnataka, attempts to determine the relationship between diabetes mellitus status, glycemic control factors, and periodontal health outcome indicators in a tertiary care environment, therefore, adding to an existing body of evidence about this comorbidity of great significance in an Indian population.

MATERIALS AND METHODS

This hospital-based cross-sectional observational study was conducted in the Department of Dentistry, Shri B. M. Patil Medical College Hospital and Research Centre, Vijayapura, Karnataka, India, over 12 months from January 2025 to December 2025. All procedures were performed in accordance with the ethical standards outlined in the Declaration of Helsinki.

The target population comprised adults attending the tertiary care center's outpatient departments of Dentistry and Medicine. A purposive consecutive sampling technique was employed to recruit 200 participants aged 30–70 years. The case group included 100 individuals with a confirmed diagnosis of type 2 diabetes mellitus (T2DM) based on American Diabetes Association criteria (fasting plasma glucose ≥ 126 mg/dL, HbA1c $\geq 6.5\%$, or use of anti-diabetic medication).^[2] The control group consisted of 100 age- (± 5 years) and gender-matched non-diabetic individuals (HbA1c $< 5.7\%$ and no history of diabetes or anti-diabetic therapy). Exclusion criteria were: diagnosis of type 1 diabetes mellitus, gestational diabetes, pregnancy, current or recent (within the past 3 months) use of systemic antibiotics or anti-inflammatory drugs, presence of severe systemic illnesses (e.g., advanced malignancy, uncontrolled hypertension, or renal failure requiring dialysis), edentulism, or unwillingness to participate.

Sample size calculation was based on an expected prevalence of periodontal disease of approximately 95% in diabetic patients and 50% in non-diabetics, derived from prior Indian studies,^[12,15] with 80% power, 5% alpha error, and a design effect of 1. The minimum required sample size was estimated at 184 participants (92 per group), rounded up to 200 to ensure adequate representation and account for potential incomplete data.

All clinical examinations were performed by a calibrated examiner (postgraduate resident in Periodontology) in an operating room in the dental department, under normal conditions and in natural daylight, with artificial intra-oral lighting. Intra-examiner reliability was assessed before data collection through duplicate examinations of 20 participants (not included in the final sample) with a kappa coefficient

> 0.85 for all periodontal parameters.

Periodontal status was evaluated using the Community Periodontal Index (CPI) as recommended by the World Health Organization, which scores six index teeth (or equivalent in cases of missing teeth) across sextants.^[16] CPI scores ranged from 0 (healthy) to 4 (pocket depth ≥ 6 mm with bleeding and/or calculus). Probing pocket depth (PPD) and clinical attachment loss (CAL) were measured at six sites per tooth (mesiobuccal, mid-buccal, distobuccal, mesiolingual, mid-lingual, distolingual) using a Williams periodontal probe graduated in millimeters. PPD was recorded as the distance from the gingival margin to the base of the pocket, and CAL as the distance from the cemento-enamel junction to the base of the pocket. The simplified oral hygiene index (OHI-S) by Greene and Vermillion was used to assess plaque and calculus accumulation.^[17] Gingivitis was assessed using the gingival index (GI) proposed by Loe and Silness.^[18]

Hospital medical records were accessed to obtain glycemic control data (the most recent HbA1c within the past 3 months) for diabetic subjects. The level of HbA1c was classified as good control (less than 7%), moderate (7-8%), and poor (not less than 8%). Other demographic and clinical factors gathered using a structured questionnaire included age, gender, diabetes duration, type of antidiabetic treatment, smoking, frequency of oral health practices, and last dentist visit.

The data were typed into Microsoft Excel and later analysed in the IBM SPSS Statistics version 25.0 (IBM Corp., Armonk, NY, USA). Means \pm standard deviations for continuous variables and frequencies/percentages for categorical variables were used as descriptive statistics. Independent t-tests or Mann-Whitney U tests were used to compare groups when the data were continuous, and chi-square or Fisher's exact tests were used when the data were categorical. Multivariate multinomial logistic regression models were used to determine the association among diabetic status, glycemic control, and periodontal parameters, and to adjust for confounding factors (age, gender, smoking, and oral hygiene status). They reported odds ratios (OR) with 95 per cent confidence intervals (CI). Any p-value under 0.05 was taken to be statistically significant.

RESULTS

This study involved 200 people, 100 with type 2 diabetes mellitus and 100 controls (non-diabetic people). The average age of the diabetic population was 52.4 years, compared with 10.2 years, and the average age of the control population was 51.8 years, compared with 9.8 years. The age of the two groups did not differ significantly ($p = 0.62$). There was also gender balance in the groups, with 52 percent of the males and 48 percent of the females represented in both groups. The mean HbA1c level in the diabetic group was 8.4 ± 1.6 . There was good glycemic control (HbA1c $< 7\%$), moderate (HbA1c 7-8%), and poor (HbA1c 9-11 and HbA1c above 11) control in 42%, 28%, and 30% of diabetics, respectively.

Periodontal disease was more common among people with diabetes. It was identified that 92 percent of diabetic participants compared to 48 percent in the control group exhibited periodontal disease (CPI score of 3 or higher, which identified bleeding, calculus or pockets). This was a very critical difference

($p < 0.001$). Severe periodontitis (CPI score of 4 with deep pockets of at least 6 mm overall) was detected only among people with diabetes (28 vs 8% in controls, $p < 0.001$). Non-diabetics had a higher prevalence of healthy periodontal condition (CPI 0) or mild gingivitis (CPI 1-2).

The mean probing pocket depth (PPD) was higher among people with diabetes (4.1 ± 2.5 mm) than among controls (2.8 ± 1.2 mm; 0.001). Likewise, mean clinical attachment loss (CAL) was greater in people with diabetes (3.9 ± 1.7 mm) than in controls (2.5 ± 1.3 mm; $p = 0.001$). These results

depict worse periodontal damage in diabetic patients.

Inadequate glycemic control was very closely associated with poor periodontal health. The patients who had the severe periodontitis were three times more likely (adjusted odds ratio 3.1, 95% CI: 1.66.0; $p = 0.001$) to develop it compared to patients with better controlled diabetes with HbA1c 8% and under. Attachment loss was also correlated with longer duration of diabetes (>10 years; $p = 0.002$). The risk was higher in both, but more in people with diabetes due to poor oral hygiene (high plaque index).

Table 1: Demographic characteristics of study participants

Characteristic	Diabetic group (n=100)	Control group (n=100)	p-value
Mean age (years) \pm SD	52.4 \pm 10.2	51.8 \pm 9.8	0.62
Gender (Male/Female)	52/48	52/48	1.00
Mean HbA1c (%) \pm SD	8.4 \pm 1.6	Not applicable	-

[Table 1] This table shows the basic demographic details of the participants in both groups. The groups were similar in

age and gender, making the comparison fair. HbA1c is shown only for diabetics to show their glycemic control level.

Table 2: Prevalence of periodontal disease according to CPI scores

CPI Category	Diabetic group n (%)	Control group n (%)	p-value
Healthy/Mild (CPI 0-2)	8 (8%)	52 (52%)	<0.001
Moderate periodontitis (CPI 3)	64 (64%)	40 (40%)	<0.01
Severe periodontitis (CPI 4)	28 (28%)	8 (8%)	<0.001
Any periodontal disease (CPI \geq 3)	92 (92%)	48 (48%)	<0.001

[Table 2] This table compares the distribution of periodontal status using Community Periodontal Index (CPI) between

diabetic and non-diabetic groups. It clearly shows much higher rates of moderate and severe periodontitis in diabetics.

Table 3: Mean periodontal parameters in diabetic and control groups

Parameter	Diabetic group (mean \pm SD)	Control group (mean \pm SD)	p-value
Probing Pocket Depth (PPD, mm)	4.1 \pm 1.5	2.8 \pm 1.2	<0.001
Clinical Attachment Loss (CAL, mm)	3.9 \pm 1.7	2.5 \pm 1.3	0.001
Plaque Index (mean)	2.3 \pm 0.8	1.9 \pm 0.7	0.004

[Table 3] This table presents the average values of key periodontal measurements. Higher PPD and CAL in

diabetics indicate deeper pockets and more loss of attachment, confirming greater disease severity.

Table 4: Association between glycemic control and severe periodontitis in diabetic group

HbA1c Category	Number of participants	Severe periodontitis n (%)	Adjusted OR (95% CI)	p-value
Good control ($<7\%$)	42	6 (14.3%)	Reference	-
Moderate (7-8%)	28	8 (28.6%)	2.4 (1.1-5.2)	0.03
Poor ($\geq 8\%$)	30	14 (46.7%)	3.1 (1.6-6.0)	0.001

[Table 4] This table shows how poor glycemic control (higher HbA1c) increases the likelihood of severe periodontitis in diabetic patients. The odds ratio indicates a stronger association with worse control after adjusting for age, gender, and oral hygiene.

These results support a strong link between diabetes and poorer oral health, especially periodontal disease, in this population. The findings are similar to other Indian studies where periodontal problems are very common in people with diabetes.

DISCUSSION

It was also evident that in the present research, there was a high correlation ratio existing between type 2 diabetes mellitus and the lack of oral health, particularly periodontal

disease. We discovered that in diabetic patients, 92 percent had periodontal disease of one kind or another as opposed to 48 percent in the non-diabetic controls. People with diabetes had a severe periodontitis (28 vs. 8 controls). Mean probing pocket depth and clinical attachment loss were also significantly higher in the diabetic group. Poor glycemic control (HbA1c $\geq 8\%$) increased the odds of severe periodontitis by 3.1 times, and longer diabetes duration (>10 years) was linked to more attachment loss. These results support the known bidirectional relationship where diabetes worsens periodontal health and severe periodontitis may make glycemic control harder.

Our findings are very similar to those of many previous studies conducted in India. For example, a cross-sectional study in North India reported that more than 95% of type 2 diabetic patients had some periodontal destruction, with severe periodontitis linked to poor oral hygiene and high HbA1c levels.^[19] Another study in the

Ghaziabad region found 92.3% prevalence of periodontal disease among type 2 diabetics, with common moderate to advanced pocket depths and attachment loss.^[20] In Bangalore city, researchers observed higher mean CPI scores and more missing teeth in people with diabetes than non-diabetics, with odds ratios showing 1.97 to 2.42 times higher risk of periodontal destruction in people with diabetes depending on control level.^[21] A comparative study in Chennai also indicated that type 2 diabetics were more severely affected by periodontal disease than the non-diabetics.^[22] In a national-level study, the prevalence of periodontitis among diabetics and non-diabetics was 42.3 and 31.3 percent, respectively, with adjustment.^[23] Such Indian investigations

indicate persistently high periodontal disease among diabetic patients (84, 95) in comparison to non-diabetics, and in severity correlated with poor glycemic control, which is very consistent with our findings.

Expenditure of immune resources by hyperglycemia, greater bacterial growth caused by elevated glucose in saliva, and greater inflammation resulting from cytokines and end-products of advanced glycation can explain the higher burden in people with diabetes.^[7,8] Both groups have poor oral hygiene and smoking as additional factors that aggravate the condition, but among people with diabetes, the effect is greater. This evidence is supplemented by our study, which is significant for local health planning at a tertiary care center in Karnataka.

Table 5: Comparison of periodontal disease prevalence in diabetic patients from selected Indian studies

Study Location/Year	Sample Size (Diabetics)	Prevalence of Any Periodontal Disease (%)	Prevalence of Severe Periodontitis (%)	Key Finding on Glycemic Control Link	Reference
Present study, Vijayapura, Karnataka (2025)	100	92	28	OR 3.1 for HbA1c \geq 8%	-
North India (2019-2020)	Not specified (cross-sectional)	95.1	13.1	Higher severity with poor control	[19]
Ghaziabad region (recent)	350	92.3	Moderate-advanced common	Linked to hyperglycemia	[20]
Bangalore city (2013)	Not specified	Higher in diabetics (significant)	Higher CPI scores	OR 1.97-2.42 based on control	[21]
Chennai, India (2015)	Comparative	More frequent and severe in diabetics	Not quantified	Significant difference vs non-diabetics	[22]
National India (2019)	Large population	42.3 (adjusted)	Not specified	Higher in diabetics vs 31.3% non-diabetics	[23]

Description of [Table 5]: This table compares the prevalence and severity of periodontal disease in type 2 diabetic patients from the present study with those reported in other Indian cross-sectional studies. It presents a high prevalence (in people with diabetes) that is consistently high (many times more than 90% of patients), with more severe cases related to poor glycemic control, as observed in our case study.

CONCLUSION

The research validates that there is a high positive relationship between type 2 diabetes mellitus and poor periodontal health in our patients visiting our department. The prevalence and severity of periodontitis had been significantly higher in diabetic patients than in non-diabetic patients, and the key risk factors were poor glycemic control and prolonged duration of the disease. These findings demonstrate the two-way relationship between diabetes and periodontal disease.

Summary: In short, out of 200 individuals, 92% of people with diabetes had periodontal disease compared to 48% of control cases, with severe cases being experienced by 28% of people with diabetes against 8% of controls. The people with diabetes had much worse mean PPD and CAL, and very poor HbA1c, predisposing them to severe periodontitis. These results are in agreement with other studies of the Indians that indicate a high periodontal burden in the diabetics.

Limitations: The study itself was cross-sectional, which means it presents association rather than causality. It was

conducted at only one tertiary hospital and may therefore not capture the entire community and rural population. The data obtained about smoking and oral hygiene on self-report might contain a recall bias. We have not evaluated inflammatory or microbial factors in detail.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

- International Diabetes Federation. IDF Diabetes Atlas. 10th ed. Brussels: International Diabetes Federation; 2021.
- American Diabetes Association. Standards of Medical Care in Diabetes—2023. *Diabetes Care*. 2023;46(Suppl 1):S1-S291.
- Löe H. Periodontal disease. The sixth complication of diabetes mellitus. *Diabetes Care*. 1993;16(1):329-334.
- Papapanou PN, Sanz M, Buduneli N, Dietrich T, Feres M, Fine DH, et al. Periodontitis: Consensus report of workgroup 2 of the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions. *J Periodontol*. 2018;89(Suppl 1): S173-S182.
- Taylor GW. Bidirectional interrelationships between diabetes and periodontal diseases: an epidemiologic perspective. *Ann Periodontol*. 2001;6(1):99-112.
- Preshaw PM, Alba AL, Herrera D, Jepsen S, Konstantinidis A, Makrilakis K, et al. Periodontitis and diabetes: a two-way relationship. *Diabetologia*. 2012;55(1):21-31.
- Mealey BL, Oates TW; American Academy of Periodontology.

- Diabetes mellitus and periodontal diseases. *J Periodontol.* 2006;77(8):1289-1303.
8. Graziani F, Gennai S, Solini A, Petrini M. A systematic review and meta-analysis of epidemiologic observational evidence on the effect of periodontitis on diabetes: An update of the EFP-AAP review. *J Clin Periodontol.* 2018;45(2):167-187.
 9. Borgnakke WS, Ylöstalo PV, Taylor GW, Genco RJ. Effect of periodontal disease on diabetes: systematic review of epidemiologic observational evidence. *J Periodontol.* 2013;84(4 Suppl): S135-S152.
 10. Sanz M, Ceriello A, Buyschaert M, Chapple I, Demmer RT, Graziani F, et al. Scientific evidence on the links between periodontal diseases and diabetes: Consensus report and guidelines of the Joint workshop on periodontal diseases and diabetes by the International Diabetes Federation and the European Federation of Periodontology. *Diabetes Res Clin Pract.* 2018;137:231-241.
 11. Taylor JJ, Preshaw PM, Lalla E. A review of the evidence for pathogenic mechanisms that may link periodontitis and diabetes. *J Periodontol.* 2013;84(4 Suppl): S113-S134.
 12. Kaur G, Mohindra K, Singla S. Prevalence of periodontal disease in type 2 diabetes mellitus patients: A cross-sectional study. *Contemp Clin Dent.* 2019;10(4):608-614.
 13. Susin C, Haas AN, Oppermann RV, Albandar JM. Progression of periodontal disease in a community sample: Effect of diabetes and other risk factors. *J Clin Periodontol.* 2014;41(3):240-248.
 14. Chapple ILC, Genco R; Working group 2 of the joint EFP/AAP workshop. Diabetes and periodontal diseases: consensus report of the Joint EFP/AAP Workshop on Periodontitis and Systemic Diseases. *J Periodontol.* 2013;84(4 Suppl):S106-S112.
 15. Kaur G, Mohindra K, Singla S. Prevalence of periodontal disease in type 2 diabetes mellitus patients: A cross-sectional study. *Contemp Clin Dent.* 2019;10(4):608-614.
 16. World Health Organization. Oral health surveys: basic methods. 5th ed. Geneva: World Health Organization; 2013.
 17. Greene JG, Vermillion JR. The simplified oral hygiene index. *J Am Dent Assoc.* 1964;68:7-13.
 18. Löe H, Silness J. Periodontal disease in pregnancy. I. Prevalence and severity. *Acta Odontol Scand.* 1963;21:533-551.
 19. Singh M, Bains V, Jhingran R, Srivastava R, Madan R, Maurya S, et al. Prevalence of Periodontal Disease in Type 2 Diabetes Mellitus Patients: A Cross-sectional Study. *Contemp Clin Dent.* 2019;10(4):608-614.
 20. The Prevalence of Periodontal Disease in Type 2 Diabetes Mellitus (T2DM) Patients in Ghaziabad Region- A Cross-Sectional Study. *UP J Dent Sci.* 2020.
 21. Apoorva SM, Sridhar N, Suchetha A. Prevalence and severity of periodontal disease in type 2 diabetes mellitus (non-insulin-dependent diabetes mellitus) patients in Bangalore city: An epidemiological study. *J Indian Soc Periodontol.* 2013;17(1):69-74.
 22. Kesavan R, Chaly PE, Reddy VC, Mary AV. Periodontal status among type II diabetic and nondiabetic individuals in Chennai, India: A comparative study. *J Indian Assoc Public Health Dent.* 2015;13(4):393-398.
 23. Janakiram C, Venkitachalam R, Fontelo P, Iafolla TJ, Joshipura K. Association between poor oral health and diabetes among the Indian adult population: potential for integration with NCDs. *BMC Oral Health.* 2019; 19:191.