

Original Research Article

Association between periodontal disease severity and glycemic control in patients with type 2 diabetes mellitus

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ABSTRACT

Background: Type 2 diabetes mellitus is a growing public health problem and is closely linked with several chronic complications, including periodontal disease. Poor glycemic control may increase periodontal tissue destruction, while periodontal inflammation may further worsen metabolic control. The study aimed to assess the association between periodontal disease severity and glycemic control among patients with type 2 diabetes mellitus.

Methods: This analytical cross-sectional study included 140 patients with type 2 diabetes mellitus selected by purposive sampling. The study was conducted at the Outpatient Department of Periodontology, Chattogram Maa-O-Shishu Hospital Medical College, Chattogram, Bangladesh, from July 2025 to June 2026. Glycemic control was assessed by HbA1c and periodontal disease severity was evaluated by clinical periodontal examination. Data were analyzed using SPSS version 26.0, applying the Chi-square test and the independent-samples t-test, with $p < 0.05$ considered statistically significant.

Results: Among 140 patients, most were aged 51–60 years (52; 37.1%) and male (82; 58.6%). Poor glycemic control ($\text{HbA1c} \geq 7.0\%$) was observed in 97 patients (69.3% of patients). Moderate periodontitis was the most common finding, with 57 (40.7%), followed by severe periodontitis, with 52 (37.1%). Patients with poor glycemic control had significantly worse periodontal parameters, including higher probing pocket depth, clinical attachment loss, gingival index, plaque index and missing teeth ($p < 0.001$). Poor glycemic control increased with periodontal disease severity, from 41.9% in mild periodontitis to 68.4% in moderate and 86.5% in severe periodontitis, with a significant association ($p < 0.001$).

Conclusions: Periodontal disease severity was significantly associated with glycemic control among patients with type 2 diabetes mellitus. Poor glycemic control was more frequent in moderate and severe periodontitis, indicating the need for routine periodontal assessment and oral hygiene care in diabetes management.

Keywords: Glycemic control, Periodontitis, Periodontal disease, Type 2 diabetes mellitus

INTRODUCTION

Type 2 diabetes mellitus is one of the most important non-communicable diseases worldwide and is strongly associated with chronic complications affecting vascular, renal, neurological, ocular and oral health. The global burden of diabetes is increasing rapidly, with an estimated

536.6 million adults living with diabetes in 2021, projected to rise to 783.2 million by 2045.¹

This rising burden is particularly important in low and middle-income countries, where delayed diagnosis, inadequate glycemic control, limited access to regular follow-up and poor awareness of complications remain

major public health challenges. Periodontal disease is a chronic inflammatory condition affecting the supporting tissues of the teeth, including gingiva, periodontal ligament, cementum and alveolar bone. Severe periodontitis is among the most common chronic oral diseases globally, with the global burden of disease 2017 analysis estimating that there are about 796 million cases worldwide.² Diabetes and periodontal disease are biologically linked through inflammation, impaired neutrophil function, oxidative stress, advanced glycation end products, altered collagen metabolism and changes in the oral microbiome.^{3,4} Poor glycemic control increases susceptibility to periodontal infection and tissue destruction, while periodontal inflammation may worsen insulin resistance and contribute to poor glycemic control.^{4,5}

In Bangladesh, diabetes has become a growing health concern. A systematic review and meta-analysis reported a pooled diabetes prevalence of 7.8% and prediabetes prevalence of 10.1% in the general population.⁶ A more recent national survey-based analysis showed that type 2 diabetes was more common in urban areas (10.8%) than in rural areas (7.4%), while prediabetes affected 31.4% and 27.0% of urban and rural populations, respectively.⁷ This epidemiological pattern reflects the influence of urbanization, sedentary lifestyle, dietary transition, obesity, hypertension and population aging. The clinical relevance of periodontal disease in diabetic patients is substantial. Periodontitis may lead to gingival bleeding, periodontal pocket formation, clinical attachment loss, tooth mobility, tooth loss, pain, impaired mastication, reduced quality of life and increased dental treatment burden. In patients with diabetes, periodontal disease may also indicate poor metabolic control and may contribute to systemic inflammatory load.

A Bangladeshi multicentre study among adults with type 2 diabetes reported periodontal disease in 75.7% of patients, with severe periodontal disease in 35.1% and found that patients with HbA1c $\geq 7\%$ were more likely to have periodontal disease.⁸ International evidence also suggests a positive bidirectional association between periodontal disease and diabetes mellitus.⁹ Furthermore, periodontal treatment has been shown to improve glycemic control and a Cochrane review reported moderate-certainty evidence that subgingival periodontal treatment improves HbA1c in people with diabetes and periodontitis.¹⁰

Despite increasing evidence, periodontal health is still often neglected in routine diabetes care, particularly in resource-limited settings. In Bangladesh, relatively few studies have assessed periodontal disease severity together with HbA1c-based glycemic control using clinical periodontal parameters. There is also limited local evidence to guide the integration of medical and dental care for patients with type 2 diabetes. Therefore, this study was designed to assess the association between periodontal disease severity and glycemic control among patients with type 2 diabetes mellitus.

METHODS

This analytical cross-sectional study was conducted among patients with type 2 diabetes mellitus attending the Outpatient Department of Periodontology, Chattogram Maa-O-Shishu Hospital Medical College, Chattogram, in Bangladesh. The study was carried out from July 2025 to June 2026 to assess the association between periodontal disease severity and glycemic control. A total of 140 patients diagnosed with type 2 diabetes mellitus were included in the study using purposive sampling. Patients aged 30 years and above, diagnosed with type 2 diabetes mellitus and willing to participate were included. Patients with type 1 diabetes mellitus, pregnancy, severe systemic illness, recent periodontal treatment, use of antibiotics within the previous three months or incomplete clinical records were excluded. After obtaining informed written consent, data were collected using a structured questionnaire and clinical examination checklist. Socio-demographic information, including age, sex, residence, education, monthly family income and occupation, was recorded.

Diabetes-related information, including duration of diabetes, treatment modality, family history of diabetes, smoking status and oral hygiene practice, was collected through face-to-face interviews and review of medical records. Glycemic control was assessed by HbA1c level. Patients with HbA1c $< 7.0\%$ were categorized as having good glycemic control and those with HbA1c $\geq 7.0\%$ as having poor glycemic control. Periodontal examination was performed using standard dental instruments. Periodontal disease severity was assessed based on clinical periodontal parameters, including probing pocket depth, clinical attachment loss, gingival index, plaque index and number of missing teeth. According to the severity of periodontal involvement, patients were classified into mild, moderate and severe periodontitis groups.

Data were checked, coded and entered into statistical software for analysis (SPSS, V 26.0). Descriptive statistics were expressed as frequency, percentage, mean and standard deviation. Chi-square test was used to determine the association between periodontal disease severity and glycemic control. An independent-samples t-test was used to compare mean clinical and periodontal parameters between glycemic control groups. A p-value < 0.05 was considered statistically significant.

RESULTS

Among 140 patients, the largest proportion belonged to the 51–60 years age group (52; 37.1%), followed by 41–50 years (39; 27.9%). Male patients were predominant: 82 (58.6%). Most patients were from urban areas (91; 65.0%). Regarding education, primary-level education was the most common, at 42 (30.0%). Nearly half of the patients had a monthly family income of Tk. 20,000–40,000 (69; 49.3%). Homemakers (34; 24.3%) and businessmen (33; 23.6%) were the most common occupational groups. Most

patients had diabetes for 5–10 years (55; 39.3%), followed by >10 years (43; 30.7%). Oral antidiabetic drugs were the most common treatment modality (76; 54.3%). A family history of diabetes was present in 86 patients (61.4% of patients). More than half of the patients were non-smokers (78; 55.7%), while 42 (30.0%) were smokers. Irregular oral hygiene practices were observed in most patients (91; 65.0%). Table 3 shows the distribution of patients according to glycemic control status. Poor glycemic control (HbA1c $\geq 7.0\%$) was observed in 97 patients (69.3%), while good glycemic control (HbA1c $< 7.0\%$) was observed in 43 patients (30.7%). Table 4 presents the distribution of patients according to periodontal disease severity. Moderate periodontitis was the most common finding, with 57 (40.7%), followed by severe periodontitis, with 52 (37.1%). Mild periodontitis was found in 31 (22.1%) of patients. Patients with poor glycemic control

had a higher mean age (55.9 ± 8.7 years), a longer duration of diabetes (9.3 ± 4.6 years) and a higher HbA1c ($8.7 \pm 1.1\%$) compared with patients with good glycemic control. Periodontal parameters were also worse in the poor glycemic control group, including probing pocket depth (5.1 ± 1.2 mm), clinical attachment loss (4.9 ± 1.4 mm), gingival index score (1.9 ± 0.6), plaque index score (2.2 ± 0.7) and missing teeth (5.1 ± 3.3). All differences were statistically significant ($p < 0.001$), except age, which was also significant ($p = 0.002$). Table 6 shows the association between periodontal disease severity and glycemic control status. Poor glycemic control increased with increasing periodontal disease severity. It was present in 13 (41.9%) patients with mild periodontitis, 39 (68.4%) with moderate periodontitis and 45 (86.5%) with severe periodontitis. The association between periodontal disease severity and glycemic control was statistically significant ($p < 0.001$).

Table 1: Socio-demographic characteristics of the study patients (n=140).

Variables	Categories	Frequency (N)	(%)
Age group (in years)	30–40	18	12.9
	41–50	39	27.9
	51–60	52	37.1
	>60	31	22.1
Sex	Male	82	58.6
	Female	58	41.4
Residence	Urban	91	65
	Rural	49	35
Educational status	Illiterate	24	17.1
	Primary	42	30
	Secondary	38	27.1
	Higher secondary and above	36	25.7
Monthly family income	<Tk. 20,000	31	22.1
	Tk. 20,000–40,000	69	49.3
	>Tk. 40,000	40	28.6
Occupational status	Service holder	31	22.1
	Business	33	23.6
	Homemaker	34	24.3
	Retired	22	15.7
	Others	20	14.3

Table 2: Diabetes-related and behavioral characteristics of the study patients.

Variables	Categories	Frequency (N)	(%)
Duration of diabetes	<5 years	42	30
	5–10 years	55	39.3
	>10 years	43	30.7
Treatment modality	Oral antidiabetic drug	76	54.3
	Insulin	24	17.1
	Both oral drug and insulin	40	28.6
Family history of diabetes	Present	86	61.4
	Absent	54	38.6
Smoking status	Smoker	42	30
	Non-smoker	78	55.7
	Former smoker	20	14.3
Oral hygiene practice	Regular	49	35
	Irregular	91	65

Table 3: Distribution of patients according to glycemic control status.

Glycemic control status	HbA1c level	Frequency (N)	(%)
Good glycemic control	HbA1c <7.0%	43	30.7
Poor glycemic control	HbA1c ≥7.0%	97	69.3
Total		140	100

Table 4: Distribution of patients according to periodontal disease severity.

Periodontal disease severity	Frequency (N)	(%)
Mild periodontitis	31	22.1
Moderate periodontitis	57	40.7
Severe periodontitis	52	37.1
Total	140	100

Table 5: Comparison of clinical and periodontal parameters by glycemic control status.

Parameters	Good glycemic control (n=43)	Poor glycemic control (n=97)	P value
	Mean±SD	Mean±SD	
Age (in years)	50.8±9.2	55.9±8.7	0.002
Duration of diabetes, (in years)	6.1±3.4	9.3±4.6	<0.001
HbA1c (%)	6.5±0.3	8.7±1.1	<0.001
Fasting blood glucose (mmol/l)	7.1±0.9	10.4±2.1	<0.001
Probing pocket depth (mm)	3.4±0.8	5.1±1.2	<0.001
Clinical attachment loss (mm)	3.0±0.9	4.9±1.4	<0.001
Gingival index score	1.2±0.5	1.9±0.6	<0.001
Plaque index score	1.4±0.6	2.2±0.7	<0.001
Missing teeth (number)	2.4±2.1	5.1±3.3	<0.001

Table 6: Association between periodontal disease severity and glycemic control status.

Periodontal disease severity	Good glycemic control N (%)	Poor glycemic control N (%)	Total N (%)	P value
Mild periodontitis	18 (58.1)	13 (41.9)	31 (100.0)	<0.001
Moderate periodontitis	18 (31.6)	39 (68.4)	57 (100.0)	
Severe periodontitis	7 (13.5)	45 (86.5)	52 (100.0)	
Total	43 (30.7)	97 (69.3)	140 (100.0)	

DISCUSSION

The present study demonstrated a significant association between periodontal disease severity and glycemic control among patients with type 2 diabetes mellitus. Poor glycemic control, defined as HbA1c ≥7.0%, was observed in 97 patients (69.3%), while moderate and severe periodontitis were found in 57 (40.7%) and 52 (37.1%) patients, respectively. The proportion of poor glycemic control increased progressively with periodontal severity, from 13 (41.9%) in mild periodontitis to 39 (68.4%) in moderate periodontitis and 45 (86.5%) in severe periodontitis ($p<0.001$). This finding supports the concept that poor metabolic control and periodontal tissue destruction are closely related. The present findings are comparable to a Bangladeshi multicentre study by Hasan et al in which periodontal disease was reported in 75.7% of patients with type 2 diabetes and severe periodontal

disease in 35.1%.⁸ The severe periodontitis rate in the present study (37.1%) was very close to their finding, suggesting that advanced periodontal involvement is common among Bangladeshi diabetic patients.

Similarly, Singh et al observed periodontal destruction in more than 95% of type 2 diabetic patients in India.¹¹ The higher prevalence in that study may be due to differences in sampling, periodontal assessment criteria, age distribution and the inclusion of patients with varying durations of diabetes. In the present study, patients with poor glycemic control had significantly worse periodontal parameters than those with good glycemic control. Mean probing pocket depth was higher in the poor control group (5.1±1.2 mm versus 3.4±0.8 mm) and mean clinical attachment loss was also higher (4.9±1.4 mm versus 3.0±0.9 mm, both $p<0.001$). These results are consistent with Stoicescu et al, who reported that patients with

HbA1c $\geq 7\%$ had higher plaque accumulation, probing depth, clinical attachment loss and fewer remaining teeth than patients with HbA1c $< 7\%$.¹² Rahim et al also found that uncontrolled type 2 diabetic patients had worse CPI scores, greater loss of attachment, poorer oral hygiene and more missing teeth than controlled diabetic and non-diabetic participants.¹³

The proportion of poor glycemic control in this study (69.3%) was slightly higher than that reported by Stoicescu et al (57.15%) and Romano et al (63.5%).^{12,14} This difference may reflect delayed diagnosis, dietary patterns, treatment adherence, socioeconomic constraints and limited integration of dental care into diabetes follow-up in Bangladesh. Romano et al further showed that severe periodontitis was associated with approximately an eightfold higher risk of uncontrolled diabetes, which supports the strong gradient observed in the present study, in which 86.5% of patients with severe periodontitis had poor glycemic control.¹⁴ The present study also found higher gingival index, plaque index and number of missing teeth among patients with poorly controlled diabetes.

Similar findings were reported by Alahmari et al who found periodontal disease to be frequent among diabetic patients and associated with glycemic status.¹⁵ Yu et al also reported a relationship between poor glycemic control and adverse oral health outcomes, including reduced permanent teeth.¹⁶ These similarities suggest that chronic hyperglycemia may contribute to periodontal breakdown through impaired host response, increased inflammatory mediators, altered collagen metabolism, microvascular dysfunction and delayed wound healing.^{3,4} Systematic reviews and meta-analyses support the biological and epidemiological plausibility of this association. Stöhr et al reported a bidirectional association, in which diabetes increased the incidence of periodontitis by 24% and periodontitis increased the incidence of diabetes by 26%.⁹

Nascimento et al also reported that diabetes increased the risk of periodontitis incidence or progression by 86%.¹⁷ Furthermore, interventional evidence suggests clinical relevance: Simpson et al found moderate-certainty evidence that periodontal treatment improves glycemic control in diabetic patients with periodontitis.¹⁰ Chen et al reported HbA1c reductions of approximately 0.51% at 3 months and 0.55% at 6 months after periodontal therapy, while D'Aiuto et al found a 0.6% HbA1c reduction after intensive periodontal treatment at 12 months.^{18,19} However, Engebretson et al did not find a significant improvement in HbA1c after nonsurgical periodontal therapy, indicating that the treatment effect may vary with baseline HbA1c, disease severity, treatment intensity, follow-up duration and changes in diabetes medications.²⁰

Clinically, the findings indicate that periodontal assessment should be considered an important component of routine diabetes care. Patients with poor glycemic control should receive oral hygiene counselling, periodontal screening and timely referral for periodontal

treatment. Similarly, dentists should consider poor periodontal status as a possible marker of inadequate glycemic control and encourage medical follow-up. Integrated physician-dentist collaboration may help reduce oral complications, improve quality of life and potentially enhance metabolic control among patients with type 2 diabetes mellitus.

Limitations

This study was limited by its cross-sectional design, small sample size, single-center setting and purposive sampling technique. Therefore, a causal relationship could not be established and the findings may not be generalizable to all patients with type 2 diabetes mellitus.

CONCLUSION

This study concluded that periodontal disease severity was significantly associated with glycemic control among patients with type 2 diabetes mellitus. Poor glycemic control was more common among patients with moderate and severe periodontitis and periodontal parameters were worse in patients with HbA1c $\geq 7.0\%$. These findings suggest that periodontal assessment and oral hygiene care should be integrated into routine diabetes management.

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Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Sun H, Saeedi P, Karuranga S, Pinkepank M, Ogurtsova K, Duncan BB, et al. IDF Diabetes Atlas: Global, regional and country-level diabetes prevalence estimates for 2021 and projections for 2045. *Diab Res Clin Pract.* 2022;183:109119.
2. Bernabe E, Marcenes W, Hernandez CR, Bailey J, Abreu LG, Alipour V, et al. Global, regional and national levels and trends in burden of oral conditions from 1990 to 2017: a systematic analysis for the global burden of disease 2017 study. *J Dent Res.* 2020;99(4):362-73.
3. Barutta F, Bellini S, Durazzo M, Gruden G. Novel insight into the mechanisms of the bidirectional relationship between diabetes and periodontitis. *Biomed.* 2022;10(1):178.
4. Păunică I, Giurgiu M, Dumitriu AS, Păunică S, Pantea Stoian AM, Martu MA, et al. The bidirectional relationship between periodontal disease and diabetes mellitus—a review. *Diagnostics.* 2023;11;13(4):681.
5. Borgnakke WS. Current scientific evidence for why periodontitis should be included in diabetes management. *Front Clin Diab Health.* 2024;11;4:187.
6. Akhtar S, Nasir JA, Sarwar A, Nasr N, Javed A, Majeed R, et al. Prevalence of diabetes and pre-diabetes in Bangladesh: a systematic review and meta-analysis. *BMJ Open.* 2020;10(9):36086.

7. Talukder A, Sara SS, Hossain MT, Nath CD, Rahman R, Hussain S, et al. Rural and urban differences in the prevalence and determinants of Type-2 diabetes in Bangladesh. *PLoS One.* 2024;19(4):298071.
8. Hasan SM, Rahman M, Nakamura K, Tashiro Y, Miyashita A, Seino K. Relationship between diabetes self-care practices and control of periodontal disease among type2 diabetes patients in Bangladesh. *PLoS One.* 2021;16(4):249011.
9. Stoehr J, Barbaresco J, Neuenschwander M, Schlesinger S. Bidirectional association between periodontal disease and diabetes mellitus: a systematic review and meta-analysis of cohort studies. *Scient Rep.* 2021;11(1):13686.
10. Simpson TC, Clarkson JE, Worthington HV, MacDonald L, Weldon JC, Needleman I, et al. Treatment of periodontitis for glycaemic control in people with diabetes mellitus. *Cochrane Datab Syst Rev.* 2022;4:689.
11. Singh M, Bains VK, Jhingran R, Srivastava R, Madan R, Maurya SC, et al. Prevalence of periodontal disease in type 2 diabetes mellitus patients: A cross-sectional study. *Contemp Clin Dentist.* 2019;10(2):349-57.
12. Stoicescu M, Calniceanu H, Ţig I, Nemeth S, Tent A, Popa A, et al. Significant aspects and correlation between glycemic control and generalized chronic periodontitis in type 2 diabetes mellitus patients. *Exp Ther Med.* 2021;22(1):671.
13. Rahim A, Hassan S, Ullah N, Noor N, Ahmed, Rafique R, et al. Association and comparison of periodontal and oral hygiene status with serum HbA1c levels: a cross-sectional study. *BMC Oral Health.* 2023;23(1):442.
14. Romano F, Perotto S, Mohamed SE, Bernardi S, Giraudi M, Caropreso P, et al. Bidirectional association between metabolic control in type-2 diabetes mellitus and periodontitis inflammatory burden: a cross-sectional study in an Italian population. *J Clin Med.* 2021;10(8):1787.
15. Alahmari MM, AlShaiban HM, Mahmood SE. Prevalence and associated factors for periodontal disease among type I and II diabetes mellitus patients: a cross-sectional study. *Healthcare.* 2023;11(6):796.
16. Yu SY, Lee SK, Yang B, Lee H, Jeon HJ, Lee DH. Glycemic control and oral health outcomes in patients with diabetes: insights from a nationwide Korean survey. *J Korean Med Sci.* 2024;24:324.
17. Nascimento GG, Leite FR, Vestergaard P, Scheutz F, Lopez R. Does diabetes increase the risk of periodontitis. A systematic review and meta-regression analysis of longitudinal prospective studies. *Acta Diabetol.* 2018;55(7):653-67.
18. Chen YF, Zhan Q, Wu CZ, Yuan YH, Chen W, Yu FY, et al. Baseline HbA1c level influences the effect of periodontal therapy on glycemic control in people with type 2 diabetes and periodontitis: a systematic review on randomized controlled trials. *Diab Ther.* 2021;12(5):1249-78.
19. D'Aiuto F, Gkranias N, Bhowruth D, Khan T, Orlandi M, Suvan J, et al. Systemic effects of periodontitis treatment in patients with type 2 diabetes: a 12 month, single-centre, investigator-masked, randomised trial. *Lancet Diab Endocrinol.* 2018;6(12):954-65.
20. Engbretson SP, Hyman LG, Michalowicz BS, Schoenfeld ER, Gelato MC, Hou W, et al. The effect of nonsurgical periodontal therapy on hemoglobin A1c levels in persons with type 2 diabetes and chronic periodontitis: a randomized clinical trial. *JAMA.* 2013;18:310.

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