

Awareness of the Connection between Periodontal Disease and Diabetes Mellitus among Undergraduate and Postgraduate Students in Beed District, Maharashtra

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Received: 25th Aug, 2026 | Revised: 1st Sep, 2026 | Accepted: 5th Sep, 2026 | Available Online: 7th Sep, 2026

ABSTRACT

Background: Periodontal disease and diabetes mellitus are chronic conditions with a well-established bidirectional relationship. Diabetes increases the susceptibility and severity of periodontal disease, while periodontal inflammation may adversely influence glycemic control. Adequate awareness of this oral-systemic association among future healthcare professionals is essential for early identification, prevention, referral, and integrated patient management.

Aim: To assess the awareness of the association between periodontal disease and diabetes mellitus among undergraduate and postgraduate students from medical and dental and other healthcare-related faculties in beed district, Maharashtra.

Materials and Methods: A questionnaire-based cross-sectional study was conducted among 262 undergraduate and postgraduate students belonging to Dental, Medical, Pharmacy, Nursing, Ayurveda, and Homeopathic faculties. Participation was voluntary and anonymous. A structured questionnaire consisting of 21 questions was administered, and responses were collected immediately after completion. The data were coded, tabulated, and statistically analyzed using IBM SPSS Statistics version 29.0. The chi-square test was used to assess associations between categorical variables, with statistical significance set at $p < 0.05$.

Results: Overall, 71.4% of participants were aware that individuals with diabetes have an increased risk of periodontal disease, while 57.6% believed that uncontrolled periodontal disease could make glycemic control more difficult. Awareness that severe periodontitis may adversely affect HbA1c control was reported by 51.5% of participants. Approximately 58.0% recognized periodontitis as the “sixth complication” of diabetes. Although 65.6% believed that professional periodontal treatment could improve blood glucose control, only 52.7% reported that they would routinely screen patients with diabetes for periodontal disease or refer them to a dentist.

Conclusion: The findings demonstrate satisfactory basic awareness of the periodontal disease–diabetes relationship among the participating healthcare students. Strengthening undergraduate and postgraduate curricula through structured interdisciplinary education and clinical training may improve awareness and promote integrated management of patients with diabetes and periodontal disease.

Keywords: Diabetes mellitus; periodontal disease; periodontitis; oral-systemic health; awareness; healthcare students; HbA1c; questionnaire study.

How to cite this article: Sonawane S, Mohkhedkar A, Srivastava H, Andhare M, Sarda S A, Awcha M. Awareness of the Connection between Periodontal Disease and Diabetes Mellitus among Undergraduate and Postgraduate Students in Beed District, Maharashtra. International Journal of Drug Delivery Technology. 2026;16(80s): 1996-2001; DOI: 10.25258/ijddt.16.80s.238

Source of support: Nil.

Conflict of interest: None

INTRODUCTION

Periodontal disease and diabetes mellitus are chronic, highly prevalent conditions that contribute substantially to the global burden of disease. Diabetes mellitus is an

important risk factor for the development and progression of periodontal disease, while periodontitis may adversely influence glycemic control, supporting a clinically relevant bidirectional relationship between the two conditions.^{1,2}

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Evidence from epidemiological and clinical studies indicates that poor glycemic control is associated with increased prevalence and severity of periodontal disease, while periodontal inflammation may contribute to systemic inflammatory burden and impaired metabolic control.^{3,4,5}

The relationship between periodontal disease and diabetes has important implications for comprehensive patient care. Current evidence and consensus recommendations emphasize that periodontal health should be considered as an integral component of diabetes management and that effective communication between dental and medical professionals is important for prevention, early identification, referral, and coordinated management.^{6,7} Recent evidence further supports the need for periodontal assessment among individuals with diabetes and recognition of diabetes-related risk among patients presenting with periodontal disease.^{8,9}

Healthcare students, including medical, dental, pharmacy, nursing, Ayurvedic, and homeopathic students, are future healthcare providers who may encounter patients affected by both periodontal disease and diabetes mellitus. Their knowledge of this oral-systemic association is therefore important for appropriate patient education, early recognition of risk, periodontal screening, referral, and interdisciplinary management.^{10,11} Studies among healthcare professionals and medical students have demonstrated that although awareness of periodontal disease and its systemic implications may be satisfactory, important gaps remain regarding the bidirectional relationship, clinical implications, and appropriate referral practices.^{11,12}

Interprofessional education may help overcome these knowledge and practice gaps by improving understanding of the relationship between oral and systemic health and encouraging collaboration between medical and dental professionals.^{12,13} Recent surveys have similarly reported inadequate formal education regarding the periodontal–diabetes relationship and limited implementation of oral health screening or referral despite recognition of the importance of interdisciplinary care.^{12,13}

Assessing awareness among undergraduate and postgraduate students from different healthcare disciplines can therefore identify deficiencies in knowledge and clinical attitudes and provide a basis for targeted educational interventions. Hence, the present study aimed to assess the awareness of the connection between periodontal disease and diabetes mellitus among undergraduate and postgraduate students from medical, dental, pharmacy, nursing, Ayurvedic, and homeopathic faculties in Beed district, Maharashtra.

MATERIALS AND METHODS

The study population consisted of [N=262] undergraduate and postgraduate students of Dental, Medical, Pharmacy, Nursing, Ayurvedic, Homeopathic faculty. Among these Hundred and Fifty two [152] from Dental and eighty nine [89] from Ayurvedic faculty, fifteen [15] from medical faculty, Four [4] from pharmacy faculty and one [1] from nursing faculty participated in the study. Participation was

voluntary, and all the participants were queried anonymously.

Table 1. Questionnaire

Question	Responses
1. What is your age?	
2. What is your gender?	1. Male, 2. Female
3. What is your current course of study according to educational qualification?	1. Medical, 2. Dental, 3. Pharmacy, 4. Nursing, 5. Ayurvedic, 6. Homeopathic, 7. other
4. Which factor primarily initiates periodontal disease?	1. Bacterial Plaque, 2. Genetics 3. Systemic Illness, 4. Poor Diet
5. Which of the following is an early sign of gingival inflammation?	1. Tooth Mobility, 2. Bleeding on Brushing, 3. Tooth Discoloration 4. Dry Mouth
6. Can severe periodontitis result in advanced alveolar bone loss and premature tooth loss?	1. True, 2. False, 3. Don't Know
7. How would you rate your current gingival health?	1. Excellent, 2. Good, 3. Fair, 4. Poor
8. How frequently do you visit a dentist?	1. Regularly, 2. Only for emergencies 3. Never
9. Do your gums bleed while brushing?	1. Yes, 2. No, 3. Occasionally
10. Have you experienced tooth mobility or a change in tooth position?	1. Yes, 2. No
11. Are you aware that individuals with diabetes have an increased risk of developing periodontal disease?	1. Yes, 2. No
12. Do you believe that uncontrolled periodontal disease can make glycemic control more difficult?	1. Yes, 2. No, 3. Don't Know
13. Do you believe that uncontrolled periodontal disease can make glycemic control more difficult?	1. Yes, 2. No, 3. Don't Know
14. Are you aware that severe periodontitis can adversely affect HbA1c control in patients with diabetes?	1. Yes, 2. No, 3. Don't Know
15. To what extent can successful nonsurgical periodontal therapy (scaling) improve HbA1c levels?	1. No improvement, 2. 0.1–0.2%, 3. 0.3–0.6%, 4. >1.0%
16. Periodontitis is recognized as the "sixth complication" of diabetes?	1. True, 2. False, 3. Don't Know

Do you think professional periodontal treatment (scaling/cleaning) can improve blood glucose control?	1. Yes, 2. No
Would you routinely screen patients with diabetes for periodontal disease or refer them to a dentist?	1. Yes, 2. No, 3. Only if they have symptoms
Have you received formal training or attended a lecture on the oral-systemic link?	1. Yes, 2. No
Are you aware that periodontal disease is a major complication of diabetes, comparable to ocular or renal complications?	1. Yes, 2. No
What was your main source of information about the association between diabetes and periodontal health?	1. Dentist, 2. General Physician 3. Internet, 4. Friends & Family 5. None of these
How would you rate your current knowledge of managing oral infections in patients with diabetes?	1. Excellent, 2. Good, 3. Average, 4. Poor

A questionnaires [Table.1] consists of twenty four [21] questions, and the responses to the questions have been recorded. The questionnaires were collected in person immediately after completion. The data were collected, tabulated and statistically analyzed.

Statistical Analysis

After data collection, the completed forms were checked for completeness and accuracy. The corrected data were coded and entered into Microsoft Excel and subsequently subjected to statistical analysis using IBM SPSS Statistics for Windows, Version 29.0 (IBM Corp., Armonk, New York, USA). Continuous variables were summarized using the mean and standard deviation (mean $\pm$ SD), while categorical variables were expressed as frequencies and percentages [n (%)]. The chi-square (χ^2) test was used to determine the association between categorical variables. All statistical tests were two-tailed, with a 95% confidence level, and a p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 262 participants aged 18–49 years were included, with a mean age of 22.24 ± 4.12 years. Females constituted 70.6% (n = 185) and males 29.4% (n = 77) of the sample.

Table 2. Course of study according to educational qualification

Q: What is your educational qualification and current course of study?

Course of study	Post-graduate n (%)	Under-graduate n (%)	Total n (%)	p-value
Ayurveda	0 (0.0)	89 (39.4)	89 (34.0)	0.001
Dental	30 (83.3)	122 (54.0)	152 (58.0)	
Medical	3 (8.3)	12 (5.3)	15 (5.7)	
Nursing	0 (0.0)	2 (0.9)	2 (0.8)	
Pharmacy	3 (8.3)	1 (0.4)	4 (1.5)	

Dental students formed the largest course group (58.0%), followed by Ayurveda (34.0%), medical (5.7%), pharmacy (1.5%), and nursing students (0.8%). Bacterial plaque was identified as the primary initiating factor of periodontal disease by 79.0% of participants, while 86.6% correctly identified bleeding during brushing as an early sign of gingival inflammation. Overall, 71.8% recognized that severe periodontitis can result in alveolar bone loss and premature tooth loss. Regular dental visits were reported by only 25.2% of participants, whereas 51.1% visited only during emergencies.

Table 3. Awareness of the increased risk of periodontal disease among individuals with diabetes according to educational qualification

Q: Are you aware that individuals with diabetes have an increased risk of developing periodontal disease?

Response category	Post-graduate n (%)	Under-graduate n (%)	Total n (%)	p-value
No	1 (2.8)	74 (32.7)	75 (28.6)	0.001
Yes	35 (97.2)	152 (67.3)	187 (71.4)	

According to Table 2, Dental students represented the largest course group overall (58.0%), followed by Ayurveda students (34.0%). Most postgraduates were from dentistry (83.3%), whereas undergraduates were mainly from dentistry (54.0%) and Ayurveda (39.4%). Educational qualification was significantly associated with course of study ($p = 0.001$). According to Table 3, awareness that diabetes increases the risk of periodontal disease was reported by 71.4% overall. Awareness was substantially higher among postgraduates (97.2%) than undergraduates (67.3%), and the association was statistically significant ($p = 0.001$).

Table 4. Belief regarding the effect of uncontrolled periodontal disease on glycemic control according to educational qualification

Q: Do you believe that uncontrolled periodontal disease can make glycemic control more difficult?

Response category	Post-graduate n (%)	Under-graduate n (%)	Total n (%)	p-value
Don't know	5 (13.9)	71 (31.4)	76 (29.0)	.011
No	2 (5.6)	33 (14.6)	35 (13.4)	
Yes	29 (80.6)	122 (54.0)	151 (57.6)	

According to Table 4, More than half of the participants (57.6%) believed that uncontrolled periodontal disease can make glycemic control more difficult, while 29.0% were unsure. Agreement was higher among postgraduates (80.6%) than undergraduates (54.0%), yielding a statistically significant association ($p = 0.011$). According to Table 5, Just over half of the participants (51.5%) knew that severe periodontitis can adversely affect HbA1c control; 30.9% were unsure. Awareness was markedly greater among postgraduates (83.3%) than undergraduates

(46.5%), and the association was statistically significant ($p=0.001$).

Table 5. Awareness of the adverse effect of severe periodontitis on HbA1c control according to educational qualification

Q: Are you aware that severe periodontitis can adversely affect HbA1c control in patients with diabetes?

Response category	Post-graduate n (%)	Under-graduate n (%)	Total n (%)	p-value
Don't know	4 (11.1)	77 (34.1)	81 (30.9)	0.001
No	2 (5.6)	44 (19.5)	46 (17.6)	
Yes	30 (83.3)	105 (46.5)	135 (51.5)	

Overall, 71.4% of participants were aware that individuals with diabetes have an increased risk of periodontal disease, while 57.6% believed that uncontrolled periodontal disease could make glycemic control more difficult. Awareness that severe periodontitis may adversely affect HbA1c control was reported by 51.5% of participants. Approximately 58.0% recognized periodontitis as the “sixth complication” of diabetes. Although 65.6% believed that professional periodontal treatment could improve blood glucose control, only 52.7% reported that they would routinely screen patients with diabetes for periodontal disease or refer them to a dentist. Statistically significant associations between educational qualification and awareness were observed for diabetes-related periodontal risk, glycemic control, HbA1c control, recognition of periodontitis as a complication of diabetes, and routine periodontal screening/referral ($p \leq 0.011$). Overall, Postgraduate participants generally demonstrated significantly better awareness and preventive practices than undergraduate participants for several parameters ($p < 0.05$). Overall, the findings indicate relatively good awareness of basic periodontal concepts but important gaps in knowledge regarding the periodontal–diabetes relationship, particularly among undergraduate participants.

DISCUSSION

The present study demonstrated that most participants possessed a reasonable understanding of basic periodontal health; however, awareness of the periodontal disease–diabetes relationship was comparatively inconsistent. Although 71.4% of participants were aware that individuals with diabetes have an increased risk of periodontal disease, only 57.6% recognized that uncontrolled periodontal disease may make glycemic control more difficult, and 51.5% were aware that severe periodontitis may adversely affect HbA1c control. These findings are clinically important because diabetes and periodontitis are recognized as biologically and epidemiologically interconnected chronic inflammatory conditions.^{3,4} Recent systematic reviews and contemporary reviews have continued to demonstrate a positive bidirectional association, with diabetes increasing the risk and severity of periodontal disease and periodontitis being associated with impaired metabolic control.^{8,14}

Only 58.0% of participants recognized periodontitis as the “sixth complication” of diabetes. Although the terminology of “sixth complication” originates from earlier literature, the finding suggests that the systemic importance of periodontal disease is still not fully appreciated among a considerable proportion of healthcare students.¹⁴ Current evidence emphasizes that periodontitis should be incorporated into the broader management of diabetes because periodontal inflammation may contribute to systemic inflammatory burden and poorer glycemic control. A notable finding of the present study was the significant difference between undergraduate and postgraduate participants. Postgraduates demonstrated substantially greater awareness regarding the increased risk of periodontal disease in individuals with diabetes, the possible adverse effect of uncontrolled periodontal disease on glycemic control, and the influence of severe periodontitis on HbA1c control. These findings suggest that greater academic exposure and clinical experience may contribute to improved understanding of oral-systemic relationships. Similar observations have been reported among medical students, in whom awareness of periodontitis and its relationship with systemic health was identified as an important area requiring further educational attention.¹¹

Despite relatively satisfactory awareness of some aspects of the association, knowledge did not consistently translate into intended clinical practice. In the present study, 65.6% of participants believed that professional periodontal treatment could improve blood glucose control, whereas only 52.7% reported that they would routinely screen patients with diabetes for periodontal disease or refer them to a dentist. This discrepancy between awareness and intended practice is consistent with evidence from healthcare-provider surveys demonstrating that recognition of the diabetes–periodontitis relationship does not necessarily result in routine oral health assessment or referral.^{12,13}

The finding that only 37.8% of participants had received formal training or attended a lecture regarding the oral-systemic relationship is particularly relevant. A systematic review examining interprofessional education and collaborative care reported deficiencies in healthcare professionals’ understanding of the relationship between diabetes and periodontal disease and limited referral practices.⁶ Similarly, a recent survey of endocrinologists and general physicians found that many practitioners had received little information about the oral-systemic relationship during their professional education, despite expressing willingness to incorporate oral health screening into their practice.¹² These findings support the need for structured interdisciplinary education during undergraduate and postgraduate healthcare training.

The present findings also have implications for the clinical management of patients with diabetes. Current Indian clinical practice guidelines jointly developed by the Indian Society of Periodontology and the Research Society for the Study of Diabetes in India emphasize the bidirectional relationship between periodontal disease and diabetes and recommend collaboration between dental and medical

professionals.⁹ Contemporary evidence also indicates that periodontal therapy may produce modest improvements in glycemic control, although the magnitude and long-term clinical significance of this effect remain under investigation.^{15,16} Therefore, healthcare professionals should recognize periodontal health as an important component of comprehensive diabetes care rather than treating oral and systemic diseases as completely independent conditions.¹⁷

The results of the present study are also relevant to preventive healthcare in India, particularly because the participants represented several healthcare disciplines. The inclusion of dental, medical, Ayurvedic, pharmacy, nursing, and homeopathic students provides a broader perspective on awareness than studies restricted to a single professional group. Improving knowledge across disciplines may facilitate early recognition of periodontal disease, appropriate patient counselling, and timely referral. The need for such collaborative approaches is supported by recent evidence emphasizing that medical and dental professionals should work together in patient-centred management of individuals with diabetes or those at risk of hyperglycemia.^{12,17}

Overall, the findings suggest that although healthcare students possess a reasonable basic awareness of periodontal health and diabetes, important gaps remain concerning the systemic significance of periodontitis, HbA1c control, periodontal screening, referral, and the potential benefits of periodontal treatment. Strengthening oral-systemic health education through structured lectures, case-based learning, interdisciplinary seminars, and clinical referral protocols may help translate theoretical knowledge into appropriate preventive and clinical practice.

CONCLUSION

Overall, the study included 262 predominantly young participants (mean age: 22.24 ± 4.12 years), with females constituting 70.6% of the sample. Most participants demonstrated satisfactory basic knowledge of periodontal health and recognized the bidirectional relationship between diabetes and periodontal disease. Postgraduate participants demonstrated substantially greater awareness than undergraduates regarding the increased risk of periodontal disease in individuals with diabetes, the potential adverse effect of uncontrolled periodontal disease on glycemic control, and the influence of severe periodontitis on HbA1c control. Similarly, postgraduates more frequently rated their knowledge of managing oral infections in patients with diabetes as good or excellent, indicating a higher perceived level of clinical knowledge. However, knowledge regarding the expected magnitude of HbA1c improvement following nonsurgical periodontal therapy did not differ significantly between postgraduates and undergraduates. Likewise, although postgraduates were more likely to believe that professional periodontal treatment could improve blood glucose control, this difference was not statistically significant.

However, important knowledge and practice gaps remained, particularly regarding the effect of severe periodontitis on HbA1c control, recognition of periodontitis

as the sixth complication of diabetes, routine periodontal screening or referral of patients with diabetes, regular dental attendance, and formal training on the oral-systemic relationship. Postgraduate participants generally exhibited better knowledge, awareness, preventive practices, and self-rated competence than undergraduates, with statistically significant differences observed for several key variables ($p < 0.05$). Nevertheless, educational qualification was not significantly associated with certain basic periodontal concepts, self-reported gingival health, gingival bleeding, tooth mobility, expected HbA1c improvement following periodontal therapy, or sources of information. These findings emphasize the need to strengthen undergraduate curricula through structured interdisciplinary education, formal clinical training, and greater emphasis on the early identification, prevention, and integrated management of periodontal disease among individuals with diabetes.

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