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Periodontal-systemic awareness and treatment attitudes among diabetic Indian patients: A Kanpur city study

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Abstract:

Poor awareness of the bidirectional relationship between periodontal disease and diabetes mellitus is a major problem that may affect glycemic control and periodontal health. Therefore, it is of interest to assess the knowledge, attitude and periodontal status among 547 adults with diabetes attending a dental teaching hospital and associated medical facility in Kanpur. Data were collected using a pre-tested 30-item questionnaire and clinical periodontal examination including OHI-S, plaque index, gingival index, probing pocket depth and clinical attachment loss. The mean knowledge score was $45.84 \pm 26.63\%$, with 62.9% showing fair knowledge, while the mean attitude score was $60.09 \pm 20.76\%$, with 59.4% demonstrating a positive attitude toward periodontal treatment. Thus, data shows the need for integrated medical-dental education strategies emphasizing routine periodontal evaluation and periodontal treatment as part of comprehensive diabetes care.

Keywords: Diabetes mellitus (DM), periodontitis, awareness, knowledge, periodontal treatment

Background:

Diabetes mellitus is a chronic metabolic disorder characterized by hyperglycemia and progressive multisystem involvement. In addition to retinopathy, nephropathy, neuropathy and cardiovascular disease, oral complications constitute an important but frequently overlooked component of the overall disease burden [1, 2]. Hyperglycemia alters host response, collagen turnover, microvascular function and wound healing, thereby increasing susceptibility to periodontal destruction [3]. Conversely, chronic periodontal inflammation may increase systemic inflammatory burden and insulin resistance, with potential adverse effects on metabolic control [4]. This bidirectional relationship has established periodontitis as an important complication of diabetes and highlights the need for greater integration of oral and systemic health care [5, 6]. India bears a substantial burden of diabetes, placing a large population at long-term risk of complications and impaired quality of life [7]. Preventive oral care is relatively simple to implement and may support comprehensive diabetes management when incorporated into routine health care [8]. Clinical and epidemiological studies have shown that individuals with diabetes frequently exhibit greater periodontal destruction, poorer oral health indicators and higher treatment needs than individuals without diabetes [9-11]. Evidence from systematic reviews further suggests that periodontal therapy may produce a modest improvement in glycated hemoglobin, reinforcing the clinical importance of early periodontal detection and treatment [12, 13]. Despite this evidence, questionnaire-based studies across different populations have consistently showed limited awareness of the diabetes-periodontitis relationship, irregular dental attendance and inadequate preventive practices [14-18]. Therefore, it is of interest to report the knowledge and awareness of systemic and periodontal complications, attitudes toward periodontal treatment and their relationship with demographic characteristics, diabetes-related

factors, health-care utilization and periodontal status among diabetic patients attending a hospital in Kanpur.

Materials and Methods:

This was a cross sectional study based on questionnaire conducted on diabetic patients attending the outpatient department of the Department of Periodontology, Rama Dental College, Hospital and Research Centre, Kanpur and Rama Hospital, Mandhana, Kanpur. The institutional ethics committee approved the ethical clearance and informed consent was obtained from all participants prior to enrolment. There were 547 patients with known history of diabetes mellitus. The sample size had been determined for the proportion of participants who were expected to be aware of the relationship between diabetes and periodontal disease and the minimum sample size was 547. An attempt was made to recruit people from both rural and urban areas. The participants were men and women adults with diabetes who could give valid informed consent in Hindi or English and could comprehend the study information explained verbally. Patients who refused to participate, who had received antibiotics in the previous six months, who were receiving steroid therapy and pregnant or lactating women were excluded. A closed-ended questionnaire was used for data collection, which was developed after reviewing literature and validated for face and content by senior faculty members. The questionnaire contained 30 items grouped into six categories: demographic profile; medical status; health behaviors; knowledge of diabetes-associated systemic complications; knowledge of periodontal complications of diabetes; and attitude toward periodontal treatment. The content validity index was reported as 1.0. Clinical periodontal examination was performed by a single examiner with the use of a mouth mirror, explorer and UNC-15 probe. The periodontal parameters recorded were Simplified Oral Hygiene Index (OHI-S), Plaque Index (Silness and Loe), Gingival Index (Loe and Silness),

probing pocket depth (PPD) and clinical attachment loss (CAL). OHI-S values were categorized conventionally as good (0.0-1.2), fair (1.3-3.0) and poor (3.1-6.0). Six sites per tooth were probed and the deepest reading per tooth was recorded. CAL was measured from the cemento-enamel junction to the bottom of the pocket, taking into consideration any gingival enlargement or recession. These measurements enabled simultaneous evaluation of oral hygiene, gingival inflammation and cumulative periodontal destruction. Data were analyzed statistically using SPSS and MS Excel. All data were presented as mean $\pm$ SD for continuous variables and as numbers and percentages for categorical variables. The group comparisons were done by chi-square test, Mann-Whitney test or Kruskal-Wallis test, depending on the data. Spearman correlation coefficients were used to assess the correlation between knowledge, attitude and periodontal parameters. A p value <0.05 was considered statistically significant.

Results:

The study population had a mean age of 52.53 ± 17.65 years. The age group 40-60 years was the largest group (41.0%) followed by the age group above 60 years (37.7%). The sample consisted of 51.4% males. Education wise, 38.6% had primary education, 28.2% had tertiary education, 17.9% had no education and 15.4% had secondary education. Almost half of those who participated (48.6%) had no idea what type of diabetes they have, 36.6% said they have type 2 diabetes and 14.8% said they have type 1 diabetes. The duration of diabetes was less than 5 years for 43.0% and 5-9 years for 36.6%, with 19.4% having had diabetes for 10 years or more. Fewer than half (48.3%) visited diabetes care providers annually and most participants did not visit the dentist on a regular basis but only when they felt they needed it. Knowledge was uneven across domains. Awareness was relatively higher for delayed wound healing (71.1%), neuropathy (65.1%), renal disease (63.8%), ocular disease (60.0%) and the need for routine dental consultation (56.1%). By contrast, awareness was much lower for gingivitis (23.2%), periodontal abscess (27.8%), halitosis (28.0%), early tooth loss (31.6%), xerostomia (38.9%) and the effect of gum disease on blood glucose control (41.7%). The mean knowledge score was $45.84 \pm 26.63\%$; 22.5% of participants had good knowledge, 62.9% fair knowledge and 14.6% average knowledge. Attitude toward periodontal treatment was more favorable than knowledge. Positive responses were highest for the usefulness of brushing and flossing for gum health (58.7%), the benefits of periodontal treatment in reducing gum bleeding and tooth mobility and prolonging tooth survival (55.0%), routine mouthwash use for bleeding gums and bad breath (53.7%), special hygiene needs around implants in diabetic patients (49.4%) and recall visits every 3-6 months after periodontal therapy (48.8%). The mean attitude score was $60.09 \pm 20.76\%$; 59.4% had a positive attitude, 20.8% were neutral and 19.7% were negative. Periodontal examination showed mean OHI-S, PI and GI values of 1.82 ± 0.71 , 1.01 ± 0.81 and 1.01 ± 0.87 , respectively, indicating a generally fair oral hygiene and mild to moderate plaque-related gingival inflammation. Mean PPD was 3.81 ± 2.49 mm and mean CAL was 4.29 ± 1.06 mm, suggesting that clinically relevant

periodontal destruction was common in the study group. Knowledge scores varied significantly by age, gender, education, diabetes type, duration of disease and patterns of medical and dental attendance (all $p < 0.001$). The highest knowledge was found in participants with tertiary education ($70.02 \pm 21.63\%$) and in those attending dental care every 6 months ($89.09 \pm 7.33\%$), while the lowest scores were observed among participants without formal education ($20.92 \pm 15.75\%$) and those who visited the dentist only when they perceived a need ($31.08 \pm 17.30\%$). Male participants had higher knowledge scores than females ($59.58 \pm 25.19\%$ vs $31.33 \pm 19.48\%$). Attitude scores showed a similar pattern. Participants with tertiary education ($74.15 \pm 19.58\%$), those who reported regular annual diabetes care visits ($70.88 \pm 18.56\%$) and those attending dental visits every 6 months ($90.80 \pm 9.98\%$) had the most favorable attitudes. In contrast, participants with no formal education and those not routinely visiting medical or dental care providers had substantially lower scores. Age-related differences were smaller but still significant ($p = 0.033$), with more favorable attitudes in younger participants. Periodontal status also differed significantly across participant characteristics. Worse OHI-S, plaque accumulation, gingival inflammation and attachment loss were consistently seen among females, participants with no formal education, those unaware of their diabetes type, those with diabetes duration of at least 10 years and those who did not attend medical or dental reviews regularly. Participants visiting dental care every 6 months had the best periodontal profile, with mean OHI-S 1.13 ± 0.34 , PI 0.42 ± 0.50 , GI 0.22 ± 0.42 , PPD 2.17 ± 0.54 mm and CAL 3.20 ± 0.97 mm. Correlation analysis demonstrated that better knowledge was associated with better attitude ($\rho = 0.506$, $p < 0.001$) and with lower OHI-S, PI, GI, PPD and CAL values (ρ from -0.449 to -0.586 ; all $p < 0.001$). A more favorable attitude was also associated with lower periodontal scores, although the correlation was weaker for OHI-S, PI and GI than for PPD ($\rho = -0.413$, $p < 0.001$) and CAL ($\rho = -0.225$, $p < 0.001$). Collectively, these findings suggest that awareness and treatment orientation were closely linked to periodontal health (Table 1-3).

Table 1: Sociodemographic and diabetes-related characteristics of the study participants

Variable	Category	n (%)
Age	<20 years	38 (6.9)
Age	20-39 years	79 (14.4)
Age	40-60 years	224 (41.0)
Age	>60 years	206 (37.7)
Gender	Male	281 (51.4)
Gender	Female	266 (48.6)
Education	None	98 (17.9)
Education	Primary	211 (38.6)
Education	Secondary	84 (15.4)
Education	Tertiary	154 (28.2)
Type of diabetes	Do not know	266 (48.6)
Type of diabetes	Type 1	81 (14.8)
Type of diabetes	Type 2	200 (36.6)
Duration of diabetes	<5 years	235 (43.0)
Duration of diabetes	5-9 years	200 (36.6)
Duration of diabetes	≥ 10 years	106 (19.4)
Annual diabetes care visit	Yes	264 (48.3)
Annual diabetes care visit	No	151 (27.6)
Annual diabetes care visit	Recent diagnosis	132 (24.1)

Dental visits	Only when needed	329 (60.1)
Dental visits	Annually	163 (29.8)

Dental visits	Every 6 months	55 (10.1)
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Table 2: Selected knowledge and attitude responses regarding diabetes and periodontal health

Domain	Item	Response	n	%
Knowledge	Uncontrolled high blood sugar causes ocular disease	Yes	328	60.0
Knowledge	Prolonged uncontrolled high blood sugar causes renal disease	Yes	349	63.8
Knowledge	Uncontrolled high blood sugar causes neuropathy	Yes	356	65.1
Knowledge	Uncontrolled high blood sugar causes delayed wound healing/infection	Yes	389	71.1
Knowledge	Gum disease affects blood glucose control	Yes	228	41.7
Knowledge	High blood sugar causes gingivitis	Yes	127	23.2
Knowledge	High blood sugar causes periodontal abscess	Yes	151	27.8
Knowledge	Routine dental consultation is necessary in diabetes	Yes	306	56.1
Attitude	Brushing and flossing are sufficient for maintaining gum health	Agree	321	58.7
Attitude	Mouthwash is used routinely for bad breath/bleeding gums	Agree	294	53.7
Attitude	Calculus should be removed regularly once in 6 months	Agree	147	26.9
Attitude	Periodontal treatment helps maintain healthy blood sugar	Agree	126	23.0
Attitude	Implants require special oral care in diabetic patients	Agree	270	49.4
Attitude	Post-periodontal therapy recall every 3-6 months is required	Agree	267	48.8

Table 3: Summary of periodontal findings and their association with knowledge and attitude

Parameter	Mean ± SD	Correlation with knowledge	Correlation with attitude
OHI-S	1.82 ± 0.71	rho = -0.477, p<0.001	rho = -0.153, p<0.001
Plaque Index	1.01 ± 0.81	rho = -0.520, p<0.001	rho = -0.107, p=0.012
Gingival Index	1.01 ± 0.87	rho = -0.565, p<0.001	rho = -0.112, p=0.009
Probing pocket depth (mm)	3.81 ± 2.49	rho = -0.586, p<0.001	rho = -0.413, p<0.001
Clinical attachment loss (mm)	4.29 ± 1.06	rho = -0.449, p<0.001	rho = -0.225, p<0.001
Knowledge score (%)	45.84 ± 26.63	-	rho with attitude = 0.506, p<0.001
Attitude score (%)	60.09 ± 20.76	rho with knowledge = 0.506, p<0.001	-

Discussion:

In the present study, diabetic patients in Kanpur showed moderate awareness of systemic complications, whereas knowledge of oral implications remained inadequate. This finding is clinically important because diabetes and periodontitis share a bidirectional relationship and failure to recognize oral manifestations may delay preventive care and allow periodontal destruction to progress [1-6]. The mean knowledge score of 45.84% indicates that awareness remained incomplete even among patients receiving hospital-based care. Familiarity with ocular, renal, neurological and wound-related complications was greater than awareness of gingivitis, periodontal abscess, halitosis, xerostomia and premature tooth loss. This pattern suggests that oral manifestations of diabetes may receive less emphasis during patient counseling than systemic complications. Only 41.7% of participants were aware that periodontal disease could influence blood glucose control. This limited awareness is particularly concerning because patients who do not understand the relationship between periodontal infection and metabolic control may underestimate the importance of routine periodontal examination. Previous studies have similarly shown that individuals with diabetes frequently demonstrate inadequate recognition of oral complications, poor utilization of dental services and limited preventive practices [9]. These findings emphasize the need to include periodontal health in routine diabetes education rather than treating oral care as a separate issue. The mean attitude score was higher than the knowledge score, indicating that favorable attitudes alone may not ensure adequate understanding. Participants were more likely to agree with general recommendations regarding brushing, flossing, mouthwash use, implant maintenance and periodontal recall than to identify specific oral complications

associated with diabetes. This discrepancy suggests that many patients may value oral care without understanding the biological reasons for their increased periodontal susceptibility. Similar gaps between general oral health attitudes and disease-specific knowledge have been reported among diabetic populations in India, Jordan, Saudi Arabia and other settings [12-18]. Education emerged as one of the strongest and most consistent determinants of awareness and periodontal health. Participants with tertiary education showed significantly higher knowledge and attitude scores together with more favorable periodontal findings. This gradient may reflect differences in health literacy, access to information, comprehension of professional counseling and ability to navigate health-care services. Better education may also enable patients to recognize early symptoms, adopt preventive practices and seek professional care before advanced periodontal destruction occurs. Regular access to health-care services was another important determinant. Participants attending annual diabetes consultations and six-monthly dental visits had the highest knowledge and attitude scores together with the most favorable periodontal parameters. Repeated contact with health professionals may reinforce awareness, encourage self-care and facilitate early intervention. This finding has direct practical relevance because oral health counseling can be incorporated into routine diabetes follow-up without requiring a separate educational program. A clear relationship was also observed between longer diabetes duration and poorer periodontal findings. Prolonged hyperglycemia promotes advanced glycation end-product accumulation, impaired neutrophil function, altered collagen metabolism, exaggerated inflammatory responses and delayed wound healing. These biological alterations may progressively increase susceptibility to

periodontal breakdown. In the present study, longer diabetes duration was associated with poorer OHI-S, PI, GI, PPD and CAL values, supporting the concept that prolonged metabolic dysregulation has cumulative adverse effects on periodontal tissues. Alessa and Fathi reported inadequate patient awareness regarding periodontal-systemic interrelationships, with only 48% recognizing the association between diabetes and periodontal health, emphasizing the need for targeted patient education [19]. In contrast, Gupte and Shetty found generally favourable diabetes-related knowledge among dental practitioners; however, inconsistent chairside screening and limited medical-dental communication remained important barriers to integrated patient care [20]. This study has several limitations. Its cross-sectional design precluded causal inference and the hospital-based sample may not fully represent all individuals with diabetes in the wider community. The questionnaire assessed self-reported knowledge and attitudes rather than actual oral health behavior and glycemic control markers such as HbA1c were not correlated with questionnaire responses. Nevertheless, the relatively large sample, combined questionnaire and clinical assessment and detailed subgroup analyses provide a useful representation of patient awareness and periodontal status in a North Indian hospital setting. Overall, the study showed a substantial gap between established scientific knowledge regarding the diabetes-periodontitis relationship and patient awareness in routine clinical care. Greater collaboration between physicians and dental professionals, integration of oral health education into diabetes counseling and structured referral for periodontal screening may help reduce this gap and improve long-term oral and systemic health outcomes.

Conclusion:

Diabetic had showed moderate knowledge of systemic and periodontal complications but generally positive attitudes toward periodontal treatment. Higher education, knowledge of diabetes type and regular medical and dental visits were associated with better awareness and periodontal status. Targeted oral health education and routine periodontal screening should therefore be integrated into diabetes care.

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