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Original Research Article

Evaluation of oral health status in diabetes mellitus patients: A case-control study

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Abstract

Background: Diabetes mellitus (DM) is a chronic metabolic disorder associated with multiple systemic and oral complications. Oral manifestations may serve as important indicators for early detection and management of dm.
Aim: To comparatively evaluate oral manifestations in patients with type 2 diabetes mellitus and healthy individuals.
Materials and Methods: A case–control study was conducted among 200 subjects, comprising 100 diabetic patients and 100 age-matched healthy controls. Dental caries status was assessed using the DMFT index, periodontal health with the community periodontal index (CPI), and attachment loss scores. Xerostomia and burning mouth sensation (BMS) were evaluated using validated semi-structured questionnaires, while mucosal lesions were identified through clinical examination. Statistical analysis was performed using SPSS V.24 with $p < 0.05$ considered significant.
Results: Diabetic patients demonstrated significantly higher mean DMFT (4.64 ± 2.99), CPI (2.37 ± 1.24), and attachment loss scores compared with controls. Xerostomia (44% vs. 4%), BMS (23% vs. 3%), and mucosal lesions (24% vs. 4%) were also significantly more prevalent among diabetics.
Conclusion: Oral health complications are more frequent in type 2 diabetics, underscoring the need for routine dental examinations, preventive strategies, and early intervention.

Keywords: Diabetes mellitus, Oral health, Periodontal diseases, Xerostomia, Burning mouth syndrome, Oral mucosal lesions.

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1. Introduction

Diabetes mellitus (DM) is a group of metabolic disorders characterized primarily by hyperglycaemia, which is one of its most distinctive features.[1] The global burden of diabetes is projected to rise from 171 million cases in 2000 to 366 million by 2030[2] and to approximately 642 million by 2040.[3] There are two major types of diabetes mellitus: type 1 and type 2. Type 2 DM accounts for nearly 90% of cases and is marked by peripheral resistance with reduced insulin action and insufficient pancreatic β-cell secretion. In contrast, type 1 DM, which constitutes about 10% of cases, results from absolute insulin deficiency caused by autoimmune destruction of pancreatic β cells.

Diabetes mellitus has significant effects on oral tissues, producing characteristic symptoms that may damage dental and oral structures. These changes can also serve as early indicators of the disease during routine oral examinations and screening programs.[4] The condition has been linked to various oral alterations, including changes in salivary flow and composition, fungal infections, dental caries, fissured tongue, median rhomboid glossitis, periodontal destruction, oral lichen planus, parotid gland enlargement, increased susceptibility to infections, and delayed wound healing.[5] It is often associated with potentially malignant conditions such as erythroplakia and leucoplakia, as well as oral manifestations like candidiasis, denture-induced stomatitis, and angular cheilitis. Compared with non-diabetic individuals, diabetic patients are more prone to severe periodontal disease.[6]

The spectrum of oral manifestations in diabetes mellitus includes periodontitis, salivary dysfunction, taste alterations, bacterial, fungal and viral infections, non-candidal soft tissue lesions, oral mucosal diseases, neurosensory conditions, tooth loss, and dental caries. Despite substantial evidence supporting the association between diabetes and oral health,

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awareness among both diabetic patients and healthcare professionals remains limited.

Early identification of diabetes through oral changes, timely referral to oral health specialists, and appropriate treatment planning are crucial. Therefore, general and dental practitioners must be knowledgeable about the diverse oral manifestations of DM. Based on this background, the present study was conducted with the aim of comparatively evaluating oral manifestations in patients with diabetes mellitus and in healthy individuals.

2. Materials and Methods

This study employed a case–control design. The study group consisted of diabetic patients aged 40–60 years, while the control group comprised healthy individuals of the same age range. Exclusion criteria included individuals with tobacco or betel-chewing habits and those unwilling to provide written informed consent. A sample size of 100 subjects was included in each group, selected through convenience sampling. Ethical approval was obtained from the Institutional Ethics Committee (KDDC/Admin./16617/2022).

All participants underwent a comprehensive oral examination under dental chair illumination using a mouth mirror and explorer. A structured questionnaire was administered alongside the clinical examination to collect relevant information. In addition, fasting and postprandial blood glucose levels were obtained for each subject.

3.1. Dental caries status

Caries experience was assessed using the Decayed, Missing, Filled Teeth (DMFT) index, originally proposed by Klein, Palmer, and Knutson in 1938. This irreversible index provides a cumulative measure of caries status by recording the number of decayed (D), missing (M), and filled (F) teeth.

3.2. Periodontal status

Periodontal health was evaluated using the Community Periodontal Index (CPI) as recommended by the World Health Organization (WHO), with examinations carried out using a CPITN-C probe. Loss of attachment scores were also recorded.

XerostomiaIt was assessed clinically by observing mirror-stickiness to the mucosa and through a semi-structured questionnaire adapted from Fox et al.,[9] which had been pretested for clarity and reliability in 10 individuals. The questionnaire included items on subjective sensations of dry mouth, difficulty in swallowing, and dryness while eating.

3.3. Burning mouth sensation (BMS):

It was evaluated clinically and through a validated semi-structured questionnaire by Lakshmi et al. Patients were asked about persistent oral burning or pain within the past 12 months, its location, severity, and variation throughout the day.

3.4. Oral mucosal lesions

Any additional mucosal findings were clinically examined, and diagnoses were established based on accepted clinical criteria.

3.5. Data analysis

Data were entered in Microsoft Excel and analyzed using SPSS version 24. Descriptive statistics, including mean and standard deviation (SD), were calculated for continuous variables, while frequencies and percentages were reported for categorical variables. Independent t-tests were applied for continuous data, and Pearson's chi-square test was used to compare categorical variables. A p-value of <0.05 was considered statistically significant.

3. Results

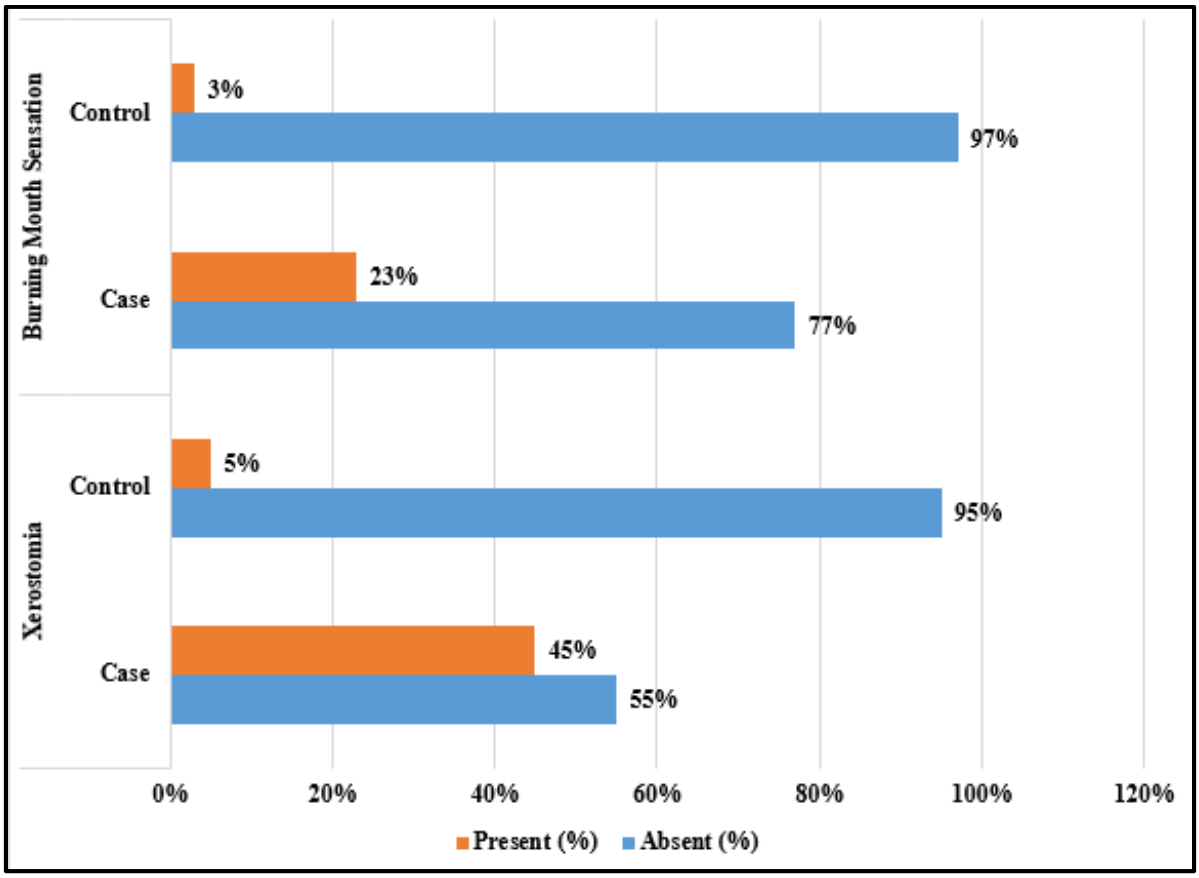
A total of 200 subjects were examined, comprising 100 diabetic patients in the case group and 100 healthy individuals in the control group. In relation to dental caries status, the mean DMFT score for the case group was 4.64 ± 2.99, which was significantly higher than the control group's mean score of 3.20 ± 1.99. This difference was highly significant with a p-value of less than 0.001. These findings indicate that diabetic patients had a greater burden of decayed, missing, and filled teeth compared with non-diabetic individuals.

When assessing periodontal health using the Community Periodontal Index (CPI), the mean CPI score for the case group was 2.37 ± 1.24, whereas the control group showed a mean of 2.01 ± 1.03. The difference between the two groups was statistically significant ($p = 0.026$), demonstrating poorer periodontal status among diabetics. Further evaluation of periodontal attachment loss revealed a mean score of 0.26 ± 0.48 in the case group compared with 0.08 ± 0.27 in the control group, a difference that was highly significant ($p = 0.001$). This finding highlights that periodontal destruction was more evident in diabetic patients. (**Table 1**).

Table 1: Comparison of oral health parameters between diabetic cases and controls

Parameter	Group	N	Mean	SD	*p*-value
DMFT Score	Case	100	4.64	2.99	<0.001
	Control	100	3.20	1.99	
CPI Score	Case	100	2.37	1.24	0.026
	Control	100	2.01	1.03	
Attachment Loss	Case	100	0.26	0.48	0.001
	Control	100	0.08	0.27	

*Values are mean ± SD; *p*-values from independent *t*-test.



Graph 1: Prevalence of xerostomia and burning mouth sensation in case and control groups

With regard to salivary gland dysfunction, xerostomia was observed in 44% of diabetic patients, while only 4% of the control group reported similar symptoms. This marked difference between the groups indicates that xerostomia was significantly more prevalent among individuals with diabetes. Similarly, burning mouth sensation was reported in 23% of diabetics compared with just 3% of the controls, again showing a higher occurrence in the diabetic population (**Graph 1**).

The evaluation of oral mucosal findings demonstrated that a variety of lesions were present among diabetic patients, with a statistically significant difference between cases and controls ($p = 0.014$). In the diabetic group, 24% of patients had one or more mucosal lesions, compared with only 4% of controls. Specific lesions identified in the diabetic group included oral lichen planus (8%), fissured tongue (6%), candidiasis (4%), and angular cheilitis (3%). Less common findings in this group included angular cheilitis with fissured tongue (1%), angular cheilitis with oral lichen planus (1%), and median rhomboid glossitis (1%). In contrast, such lesions were almost absent in the control group, except for isolated cases of fissured tongue (1%) and oral lichen planus (2%). Overall, the findings clearly indicate that diabetic patients presented with a higher prevalence of both common and less frequent mucosal changes compared to their healthy counterparts (**Table 2**).

Table 2: Distribution of other mucosal findings in case and control groups

Parameter	Case (n=100)	Control (n=100)	Total (N=200)	*p*-value
Angular Cheilitis	3 (3.0%)	1 (1.0%)	4 (2.0%)	0.014
Angular Cheilitis with Fissured Tongue	1 (1.0%)	0 (0.0%)	1 (0.5%)	
Angular Cheilitis with OLP	1 (1.0%)	0 (0.0%)	1 (0.5%)	
Fissured Tongue	6 (6.0%)	1 (1.0%)	7 (3.5%)	
OLP	8 (8.0%)	2 (2.0%)	10 (5.0%)	
Median Rhomboid Glossitis	1 (1.0%)	0 (0.0%)	1 (0.5%)	
Candidiasis	4 (4.0%)	0 (0.0%)	4 (2.0%)	
No Finding	76 (76.0%)	96 (96.0%)	172 (86.0%)	
Total	100 (100.0%)	100 (100.0%)	200 (100.0%)	

*OLP = Oral Lichen Planus.

4. Discussion

Diabetes mellitus (DM) is a chronic systemic disorder characterized by hyperglycaemia resulting from insulin deficiency or resistance, which disrupts carbohydrate, protein, and fat metabolism.[7] Owing to impaired immune defences, diabetic patients are predisposed to a wide range of oral manifestations, including dental caries, periodontal disease, angular cheilitis, xerostomia, burning mouth sensation, and other mucosal pathologies.[8] The present study compared the oral health status of diabetic patients with healthy controls and demonstrated significant differences across several indices. The mean DMFT score was higher among the diabetic group (4.64 ± 2.99) compared to the controls (3.20 ± 1.99), with this difference being highly significant. Periodontal health, evaluated using CPI, also revealed higher scores among diabetics (2.37 ± 1.24) compared to controls (2.01 ± 1.03). Furthermore, loss of attachment scores was markedly greater in diabetic individuals (0.26 ± 0.48) than in healthy controls (0.08 ± 0.27). These findings confirm that both dental caries experience and periodontal destruction are more pronounced in patients with diabetes.

Salivary dysfunction was another prominent finding, with xerostomia reported in 44% of diabetic patients compared to only 4% of controls. Burning mouth sensation followed a similar trend, affecting 23% of diabetics as opposed to 3% of non-diabetics. In addition, mucosal lesions were considerably more prevalent among diabetic individuals, with 24% of the case group exhibiting one or more lesions compared to 4% in the control group. Specific lesions identified included angular cheilitis (3%), fissured tongue (6%), oral lichen planus (8%), candidiasis (4%), and median rhomboid glossitis (1%). Certain combined presentations such as angular cheilitis with fissured tongue (1%) and angular cheilitis with oral lichen planus (1%) were noted exclusively in diabetic patients, while such lesions were largely absent among controls, except for isolated cases of fissured tongue (1%) and OLP (2%). These data reinforce the association between diabetes and increased susceptibility to diverse oral pathologies.

The indices used in the study DMFT for caries and CPI for periodontal status were chosen due to their reproducibility, ease of application, and established reliability in oral health epidemiology. Attachment loss was assessed with the CPITN-C probe, which allows for a sextant-based evaluation of periodontal breakdown by recording the highest score within each sextant. Xerostomia was evaluated both clinically and through a semi-structured questionnaire developed by Fox et al,[9] retested for clarity in 10 individuals. Similarly, burning mouth sensation was assessed clinically and by a validated questionnaire proposed by Lakshmi et al.[10] Mucosal lesions were identified through clinical examination, with diagnoses established based on accepted criteria.

The findings of this study are consistent with those reported in earlier investigations. Rawal et al.[11] demonstrated mean DMFT values of 5.71 in diabetics and 3.16 in healthy controls, while Almusawi et al.[12] found caries prevalence in 84% of diabetic patients. In terms of periodontal health, Ravindran et al.[13] reported that 88% of diabetics had CPI scores ≥1 compared to 43% of controls, while Kesavan et al[14] showed significantly higher prevalence of shallow pockets and attachment loss among diabetics than among non-diabetic individuals.

Salivary dysfunction was also a consistent finding across studies. Almusawi et al.[12] reported xerostomia in 66% of diabetics, higher than the 44% observed in the present study but still reflective of a strong association. Burning mouth sensation has also been linked with diabetes; Rad et al.[15] demonstrated a strong correlation, aligning with the current findings where 23% of diabetics reported BMS compared to 3% of controls.

Finally, mucosal lesions were significantly more prevalent in diabetics in the present study, corroborating the work of Mohsin et al.[16] who found that 68% of diabetic patients presented with at least one lesion compared with 39% of healthy individuals. These findings further emphasize the heightened risk of oral mucosal alterations in individuals with diabetes.

Overall, this study adds to the growing body of evidence demonstrating that diabetes mellitus adversely affects oral health by increasing susceptibility to dental caries, periodontal disease, xerostomia, burning mouth syndrome, and oral mucosal lesions.

5. Conclusion

This case–control study demonstrated that oral manifestations, including xerostomia, periodontal disease, dental caries, oral candidiasis, burning mouth sensation, and a range of mucosal lesions such as angular cheilitis and oral lichen planus, are more frequently observed in patients with type 2 diabetes compared to healthy individuals. These findings highlight the importance of regular dental examinations, maintenance of optimal oral hygiene, and early diagnosis of oral complications in diabetic patients to ensure timely and effective management.

6. Source of Funding

None.

7. Conflict of Interest

None.

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