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Correlation Between Glycemic Control and Oral Mucosal Lesions in Patients with Type 2 Diabetes Mellitus: A Cross-Sectional Study

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Abstract: Diabetes mellitus (DM) is a complex metabolic disorder associated with numerous systemic and oral complications. Oral mucosal lesions (OMLs) represent a less-explored consequence of poor glycemic control in type 2 diabetes mellitus (T2DM). This cross-sectional study investigates the correlation between glycemic control and the prevalence of OMLs in T2DM patients. A total of 250 participants were categorized based on their glycated hemoglobin (HbA1c) levels into well-controlled (HbA1c $\leq 7\%$), moderately controlled (HbA1c 7.1–8.9%), and poorly controlled (HbA1c $\geq 9\%$) groups. Results revealed a significantly higher prevalence of OMLs in patients with poor glycemic control ($p < 0.001$). Specific lesions such as candidiasis, lichen planus, and xerostomia were notably more frequent among these patients, correlating strongly with elevated HbA1c levels. Statistical analyses underscored that poor glycemic control is an independent risk factor for the development of OMLs. This study provides new insights into the intricate relationship between metabolic control and oral health in T2DM patients, emphasizing the necessity of integrated healthcare approaches to mitigate these oral complications.

Keywords: Type 2 diabetes mellitus, oral mucosal lesions, glycemic control

Introduction: Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder characterized by persistent hyperglycemia resulting from insulin resistance, impaired insulin secretion, or both. As the prevalence of T2DM continues to rise globally, its systemic and oral health implications are increasingly being recognized. Recent estimates suggest that more than 537 million adults worldwide are living with diabetes, a number projected to reach 643 million by 2030 (Sun et al., 2022). The growing burden of T2DM necessitates comprehensive research into its associated complications, including those affecting oral health.

Oral manifestations of diabetes are diverse, encompassing periodontal disease, dry mouth, candidiasis, and oral mucosal lesions (OMLs). Among these, OMLs remain relatively understudied despite their potential impact on the quality of life and overall health of T2DM patients (Martins et al., 2021). OMLs, such as leukoplakia, lichen planus, and recurrent aphthous stomatitis, are increasingly recognized as conditions exacerbated by poor glycemic control. Hyperglycemia has been implicated in impairing immune function, altering salivary composition, and creating a conducive environment for microbial proliferation, all of which contribute to the development of OMLs (Singh et al., 2023).

The pathophysiological mechanisms linking T2DM to OMLs are multifactorial and complex. Chronic hyperglycemia leads to the formation of advanced glycation end products (AGEs), which trigger oxidative stress and inflammation. These processes are hypothesized to disrupt oral epithelial integrity and immune defenses, thereby predisposing individuals to mucosal lesions (Kim et al., 2023). Additionally, diabetes-induced neuropathy and angiopathy may contribute to delayed healing and increased susceptibility to infections in the oral cavity.

Previous studies have established the relationship between poor glycemic control and periodontal disease; however, the association between glycemic control and OMLs is less well defined. Understanding this relationship is crucial for optimizing the management of oral health in T2DM patients. While some research has highlighted the increased prevalence of OMLs in diabetic populations, most studies lack stratification based on glycemic control levels, limiting their clinical applicability (Gupta et al., 2021).

This study aims to address this gap by systematically evaluating the correlation between glycemic control, as measured by glycated hemoglobin (HbA1c), and the prevalence of OMLs in patients with T2DM. By categorizing participants into well-controlled, moderately controlled, and poorly controlled groups, this study seeks to provide statistically robust evidence linking hyperglycemia to specific OMLs. Furthermore, this research contributes novel insights into the prevalence patterns of different types of OMLs across glycemic control strata, underscoring the importance of interdisciplinary approaches to diabetes care.

The findings of this study are expected to have significant clinical implications, emphasizing the need for regular oral examinations and collaborative care involving endocrinologists and dental professionals. Moreover, the results may inform targeted interventions to reduce the burden of OMLs and improve the overall quality of life in individuals with T2DM. By advancing our understanding of the interplay between glycemic control and oral health, this research aligns with global efforts to enhance the holistic management of diabetes.

Methodology: This cross-sectional study was conducted in Gujranwala Medical College among 250 patients diagnosed with T2DM, recruited from tertiary care centers between January 2023 and June 2023. Participants were stratified into three groups based on HbA1c levels: well-controlled ($\leq 7\%$), moderately controlled (7.1–8.9%), and poorly controlled ($\geq 9\%$). The sample size was calculated using Epi Info software, assuming a 95% confidence interval, 80% power, and an anticipated prevalence of OMLs in diabetic patients of 40%, resulting in a minimum sample size of 216. To account for potential dropouts, the sample size was increased to 250.

Inclusion criteria included patients aged 30–70 years with a confirmed diagnosis of T2DM for at least one year and no history of systemic conditions other than diabetes. Exclusion criteria encompassed individuals with type 1 diabetes, gestational diabetes, or recent antibiotic or antifungal use. Verbal informed consent was obtained from all participants prior to enrollment.

Data were collected through detailed clinical examinations and structured questionnaires. Oral examinations were performed by trained dental professionals to identify and categorize OMLs, including candidiasis, lichen planus, and xerostomia. HbA1c levels were measured to assess glycemic control, and other clinical parameters, such as fasting glucose levels, were recorded.

Statistical analysis was conducted using SPSS version 26. The prevalence of OMLs was compared across the three glycemic control groups using chi-square tests, and the association between HbA1c levels and specific OMLs was analyzed using logistic regression. A p-value <0.05 was considered statistically significant.

Results

Table 1: Demographic Characteristics of Study Population

Characteristic	Well-Controlled (n=80)	Moderately Controlled (n=90)	Poorly Controlled (n=80)
Age (years), mean ± SD	55.3 ± 9.8	57.2 ± 8.7	58.6 ± 9.3
Gender (Male/Female)	35/45	40/50	38/42
Duration of T2DM (years), mean ± SD	6.2 ± 2.5	7.3 ± 2.8	8.5 ± 3.1

Table 2: Prevalence of OMLs Across Glycemic Control Groups

Lesion Type	Well-Controlled (%)	Moderately Controlled (%)	Poorly Controlled (%)	p-value
Candidiasis	10 (12.5%)	22 (24.4%)	35 (43.8%)	<0.001
Lichen Planus	8 (10.0%)	18 (20.0%)	28 (35.0%)	<0.001
Xerostomia	15 (18.8%)	30 (33.3%)	40 (50.0%)	<0.001

Table 3: Association Between HbA1c Levels and OMLs (Logistic Regression)

Lesion Type	Odds Ratio (95% CI)	p-value
Candidiasis	2.8 (1.9–4.1)	<0.001
Lichen Planus	2.5 (1.7–3.8)	<0.001
Xerostomia	2.9 (2.1–4.3)	<0.001

Explanation of Results: Table 1 highlights the demographic characteristics, showing similar distributions across groups. Table 2 demonstrates a significant increase in OML prevalence with

worsening glycemic control. Table 3 confirms the independent association between high HbA1c levels and OMLs.

Conclusion

This study underscores the significant correlation between poor glycemic control and the prevalence of oral mucosal lesions in patients with T2DM. By identifying specific lesions associated with elevated HbA1c levels, this research fills critical gaps in understanding the systemic-oral health link in diabetes. Future studies should explore targeted preventive strategies and interdisciplinary management approaches.

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. *Diabetes Res Clin Pract.* 2022;183:109119. doi:10.1016/j.diabres.2021.109119.
2. Martins MD, Marques TM, Bussadori SK, Correa ME, Santos-Silva AR. Oral manifestations of diabetes mellitus: A cross-sectional study. *J Oral Pathol Med.* 2021;50(9):920-927. doi:10.1111/jop.13155.
3. Singh AK, Kashyap A, Verma V, Verma A, Gupta SK. Impact of glycemic control on oral health in type 2 diabetes mellitus: A systematic review. *Diabetes Metab Syndr.* 2023;17(2):102631. doi:10.1016/j.dsx.2023.102631.
4. Kim JY, Choi JH, Lee SH, Park JH. Oxidative stress and inflammation in diabetic oral mucosa: Implications for mucosal lesions. *Free Radic Biol Med.* 2023;188:376-383. doi:10.1016/j.freeradbiomed.2023.05.003.
5. Gupta S, Mathur A, Jain S, Sardana D, Agarwal S. Prevalence of oral mucosal lesions in diabetes mellitus and its association with glycemic control. *Diabetes Ther.* 2021;12(6):1815-1825. doi:10.1007/s13300-021-01057-8.
6. Bissong M, Azodo C, Agbor M, Nkuintchua T. Oral health status of diabetes mellitus patients in Cameroon. *Odontostomatol Trop.* 2020;43(171):33-40. doi:10.4314/ot.v43i171.

7. Farah CS, Lynch N, McCullough MJ. Oral fungal infections: An update for the general practitioner. *Aust Dent J.* 2010;55 Suppl 1:48-54. doi:10.1111/j.1834-7819.2010.01198.x.
8. Darwazeh AMG, Al-Dwairi ZN. The relationship between oral lichen planus and diabetes mellitus. *J Contemp Dent Pract.* 2019;20(6):702-706. doi:10.5005/jp-journals-10024-2561.
9. Mealey BL, Ocampo GL. Diabetes mellitus and periodontal disease. *Periodontol 2000.* 2007;44:127-153. doi:10.1111/j.1600-0757.2007.00213.x.
10. Al-Maweri SA, Halboub E, Warnakulasuriya S, Al-Soneidar WA, Al-Motlaq M. Oral health status and treatment needs of diabetic patients: Systematic review and meta-analysis. *J Diabetes Complications.* 2018;32(4):501-511. doi:10.1016/j.jdiacomp.2018.01.001.
11. Soares MSM, Moyses SJ, Saraiva MCP. Prevalence of oral mucosal conditions in diabetic patients: A systematic review and meta-analysis. *Braz Oral Res.* 2020;34:e019. doi:10.1590/1807-3107bor-2020.vol34.0019.
12. Aguiar SM, Siqueira JTT, Teixeira MJ. Relationship between oral burning sensation and diabetes mellitus: A clinical study. *J Oral Rehabil.* 2013;40(4):e300-305. doi:10.1111/joor.12030.
13. Chalmers JM, Ettinger RL. Aging, diabetes, and oral health. *Clin Geriatr Med.* 2008;24(3):485-497. doi:10.1016/j.cger.2008.03.006.
14. Hu S, Wang Y, Yang Y, Xiang D, Wang D. Xerostomia in patients with diabetes mellitus: A literature review. *Clin Oral Investig.* 2022;26(9):5453-5461. doi:10.1007/s00784-022-04613-8.
15. Naik D, Mukherjee S. Pathophysiology of diabetes-induced oral manifestations: A review. *Int J Diabetes Dev Ctries.* 2020;40(3):361-370. doi:10.1007/s13410-019-00803-5.
16. Darwazeh AMG, Al-Dwairi ZN. Oral candidosis in patients with diabetes mellitus. *J Oral Pathol Med.* 2019;48(9):793-798. doi:10.1111/jop.12863.
17. Lalla E, Cheng B, Lal S, Tucker S, Greenberg E, Golub LM, et al. Periodontal changes in patients with diabetes mellitus: A 2-year longitudinal study. *J Periodontol.* 2006;77(10):1743-1750. doi:10.1902/jop.2006.060002.
18. Arigbede AO, Babatope BO, Bamidele MK. Periodontitis and systemic diseases: A literature review. *J Indian Soc Periodontol.* 2012;16(4):487-491. doi:10.4103/0972-124X.106878.

19. Raval GN, Merchant NK. Oral health and its association with glycemic control in diabetes patients: A hospital-based study. *J Assoc Physicians India*. 2022;70(5):11-17. doi:10.4103/japi.JAPI_144_21.
20. Mirza BA, Majeed F, Ahmed N. Relationship of oral mucosal lesions with glycemic control in diabetic patients: A case-control study. *Pak J Med Sci*. 2020;36(5):1134-1140. doi:10.12669/pjms.36.5.2015.