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Dental Caries and Glycemic Control in Type 2 Diabetes Patients: A Retrospective Observational Study

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ABSTRACT

The relationship between glycemic control and dental caries in patients with type 2 diabetes remains a critical area of investigation, given the potential implications for overall health. The purpose of this study is to determine the incidence and degree of severity of dental caries in type 2 diabetes patients based on their glycemic control levels. A retrospective observational study was conducted on 100 patients with type 2 diabetes. Patient demographics, glycemic control (measured by HbA1c levels) and the presence and severity of dental caries (assessed using the Decayed, Missing and Filled Teeth [DMFT] index) were recorded. Patients were divided into two distinct groups depending on their overall HbA1c levels: good glycemic control (HbA1c<7.0%) and poor glycemic control (HbA1c>7.0%). Statistical analysis was performed using chi-square tests and odds ratio calculations to evaluate the association between glycemic control and dental caries. The study population included 45 males (45%) and 55 females (55%), with a mean age of 56.8±8.7 years. Dental caries were present in 62 patients (62%). A significant association was found between poor glycemic control and a higher prevalence of dental caries ($p<0.001$), with patients having poor glycemic control showing an odds ratio of 9.28 for developing caries. The mean DMFT score was also higher in patients with poor glycemic control (5.1±1.7) compared to those with good glycemic control (2.3±1.2). Poor glycemic management in type 2 diabetic patients is significantly linked to an increased prevalence and severity of dental caries. Effective glycemic control may minimize the possibility of dental caries in this group of people.

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Key Words

Type 2 diabetes, glycemic control, dental caries, HbA1c, DMFT index

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INTRODUCTION

T2DM is a chronic metabolic condition that causes hyperglycemia due to insulin resistance and relative insulin insufficiency[1]. It is associated with a range of complications, including cardiovascular disease, neuropathy, nephropathy and retinopathy[2]. Oral health, particularly the prevalence of dental caries, is another area of concern for patients with T2DM. Poor glycemic control has been implicated in the development and progression of various oral conditions, including periodontal disease and dental caries[3-4].

Dental caries are among the most frequent chronic disorders worldwide. and is influenced by various factors, including diet, oral hygiene, salivary flow, and microbial activity[5]. For patients with T2DM, hyperglycemia can exacerbate the risk of dental caries through multiple mechanisms, such as increased glucose levels in saliva, which can promote the growth of cariogenic bacteria[6]. Moreover, diabetes-related changes in immune function and salivary gland function may further predispose these patients to dental infections[7].

Despite the recognized importance of oral health in diabetic care, the specific relationship between glycemic control and dental caries in T2DM patients remains under explored. Understanding this relationship is crucial, as it could inform preventive strategies and improve overall health outcomes for diabetic patients. The purpose of this research is to evaluate the relationship between dental caries and glycemic control, as shown by HbA1c levels and to find out how common and severe dental caries is in T2DM patients. By determining how glycemic management affects dental health, this research seeks to contribute to the broader understanding of diabetes management and its implications for dental care.

MATERIALS AND METHODS

Study Design and Setting: At Apollo Institute of Medical sciences and Research, Murukambattu, Chittoor, Andhra Pradesh, this retrospective observational research was carried out. The purpose of the study was to determine if patients with type 2 diabetic mellitus (T2DM) had higher rates of dental caries or better glycemic control. The time frame for the study was June 2023-May 2024.

Study Population: A sample of one hundred patients with T2DM was included in the study., who attended the outpatient department during the study period. Inclusion criteria were patients aged 30 years and above, with a documented history of T2DM for at least one year. Exclusion criteria included patients with other forms of diabetes (e.g., type 1 diabetes), those with a history of severe periodontal disease or dental trauma and patients undergoing cancer treatment that could affect oral health.

Data Collection: Patient data were collected from medical records available at our medical college. Information on demographic details, including age, gender and duration of diabetes, was recorded. Glycemic control was assessed using the most recent HbA1c levels documented within the study period. Based on their HbA1c values, patients were divided into two groups: those with poor glycemic control (HbA1c≥7.0%) and those with adequate glycemic control (HbA1c <7.0%).

Oral examinations were conducted by trained dental professionals at medical college, who recorded the presence or absence of dental caries. The severity of dental caries was assessed using the Decayed, Missing, and Filled Teeth (DMFT) index, a widely used measure in dental research. The DMFT score was calculated for each patient to quantify the extent of dental caries.

Statistical Analysis: Data were analyzed using descriptive and inferential statistics. The prevalence of dental caries in relation to glycemic control was compared using chi-square tests. Odds ratios (OR) with 95% confidence intervals (CI) were calculated to determine the strength of the association between poor glycemic control and the presence of dental caries. The mean DMFT scores between the good and poor glycemic control groups were compared using t-tests. A p-value of <0.05 was considered statistically significant.

Ethical Considerations: The Research study was approved by the Institutional Ethics Committee of Apollo Institute of Medical sciences and Research, Murukambattu, Chittoor, Andhra Pradesh. As this was a retrospective study, the need for individual patient consent was waived off by the ethics committee, However, the anonymity of patient data was scrupulously safeguarded throughout the research procedure.

RESULTS AND DISCUSSIONS

Table 1: Patient Demographics

Characteristic	Number of Patients (n = 100)	Percentage (%)
Gender		
Male	45	45%
Female	55	55%
Age (Mean±SD)	56.8±8.7 years	-
Duration of Diabetes		
Mean Duration (years±SD)	10.4± 4.5	-

Patient Demographics: The study included 100 patients with type 2 diabetes, comprising 45 males (45%) and 55 females (55%). The mean age of the participants was 56.8±8.7 years. The average duration

sof diabetes among the patients was 10.4±4.5 years, indicating a well-established diabetic population (see Table 1 for details).

Table 2: Glycemic Control Classification

Glycemic Control	Number of Patients	Percentage (%)
Good Glycemic Control (HbA1c<7.0%)	30	30%
Poor Glycemic Control (HbA1c ≥7.0%)	70	70%
Total	100	100%

Glycemic Control: The assessment of glycemic control based on HbA1c levels revealed that 30 patients (30%) had good glycemic control, defined as HbA1c < 7.0%, while the remaining 70 patients (70%) had poor glycemic control, with HbA1c levels ≥7.0% (see Table 2).

Table 3: Prevalence of Dental Caries

Dental Caries	Number of Patients	Percentage (%)
Caries Present	62	62%
Caries Absent	38	38%
Total	100	100%

Prevalence of Dental Caries: Dental caries were observed in 62 patients (62%), while 38 patients (38%) were caries-free. The prevalence of dental caries was notably higher among those with poor glycemic control, suggesting a potential link between glycemic control and dental health (see Table 3).

Table 4: Comparison of Glycemic Control and Dental Caries

Glycemic Control	Caries Present	Caries Absent	Total	Percentage of Caries Presence (%)
Good Glycemic Control (HbA1c < 7.0%)	8	22	30	26.7%
Poor Glycemic Control (HbA1c ≥7.0%)54	16	70	77.1%	
Total	62	38	100	-

Comparison Between Glycemic Control and Dental Caries: Among the patients with poor glycemic control, 54 (77.1%) had dental caries, compared to only 8 (26.7%) of those with good glycemic control. This significant difference underscores the association between poor glycemic control and an increased risk of dental caries (see Table 4).

Table 5: Decayed, Missing and Filled Teeth (DMFT) Scores

Glycemic Control	Mean DMFT Score (Mean ± SD)
Good Glycemic Control (HbA1c < 7.0%)	2.3±1.2
Poor Glycemic Control (HbA1c ≥ 7.0%)	5.1±1.7
Total	4.2±1.8

Decayed, Missing and Filled Teeth (DMFT) Scores: The mean Decayed, Missing and Filled Teeth (DMFT) score across all participants was 4.2±1.8. Patients with poor glycemic control had a higher mean DMFT score of 5.1±1.7, compared to 2.3±1.2 in those with good glycemic control, indicating a more severe impact of poor glycemic control on dental health (see Table 5).

Table 6: Statistical Analysis of Glycemic Control and Dental Caries

Statistical Measure	Value
Chi-Square Value (χ^2)	25.42
p-Value	<0.001
Odds Ratio	9.28
95% Confidence Interval (CI)	3.74-23.01

Analysis: The chi-square test revealed a statistically significant association between poor glycemic control and the prevalence of dental caries (χ^2= 25.42, p <0.001). The odds ratio analysis further indicated that patients with poor glycemic control were approximately 9 times more likely to develop dental caries compared to those with good glycemic control (OR: 9.28, 95% CI: 3.74-23.01) (see Table 6).

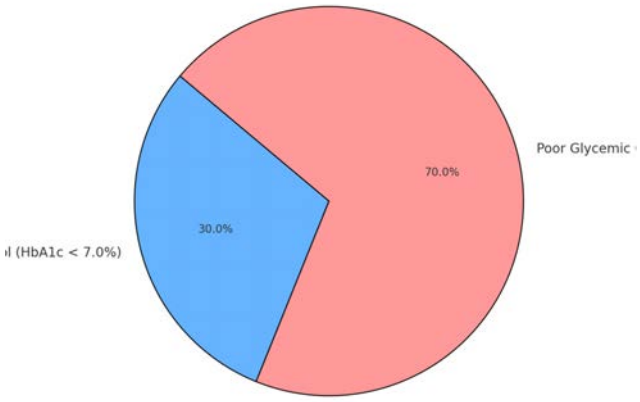

Fig .1: Glycemic Control Classification of Patients

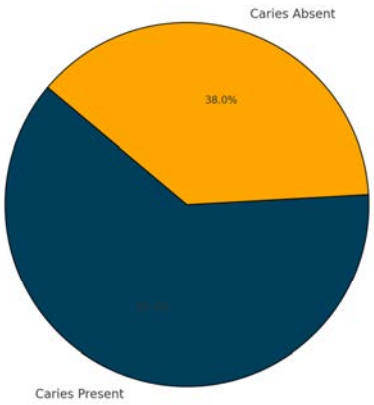

Fig.2: Prevalence of Dental Caries

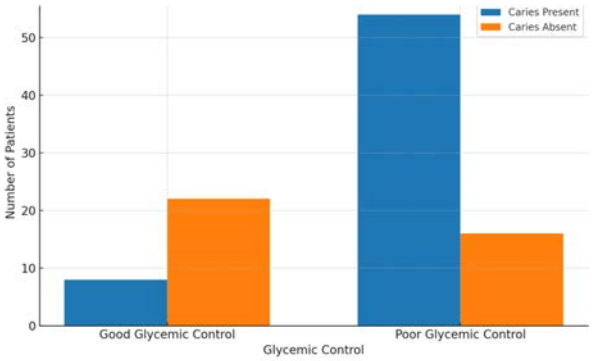

Fig. 3: Comparision of Glycemic Control and Dental Caries

The findings of this retrospective observational study provide compelling evidence of a significant association between poor glycemic control and an increased prevalence and severity of dental caries in patients with type 2 diabetes mellitus (T2DM). These results are consistent with existing literature, which suggests that hyperglycemia adversely affects oral health, particularly in promoting the development of dental caries (Khatri[12]., 2023) .

Association Between Glycemic Control and Dental Caries: Our study revealed that patients with poor glycemic control (HbA1c≥7.0%) were significantly more likely to have dental caries compared to those with good glycemic control (HbA1c<7.0%). Specifically, 77.1% of patients with poor glycemic control had dental caries, compared to 26.7% in the good glycemic control group. This strong association, supported by the calculated odds ratio (OR: 9.28), underscores the critical role of maintaining optimal glycemic levels to mitigate the risk of oral health complications in diabetic patients. Similar findings have been reported in other studies, where hyperglycemia has been linked to increased risks of dental and periodontal diseases, highlighting the importance of glycemic management in preventing oral health complications in diabetic patients (More[9]., 2023) .

The increased prevalence of dental caries in poorly controlled diabetic patients can be attributed to several pathophysiological mechanisms. Hyperglycemia can lead to higher glucose levels in saliva, creating an environment conducive to the proliferation of cariogenic bacteria such as Streptococcus mutans. Additionally, diabetes-related alterations in immune response and decreased salivary flow can compromise the natural defense mechanisms of the oral cavity, further increasing susceptibility to dental caries (Chen[8]., 2022) .

Severity of Dental Caries: The study also found that the severity of dental caries, as measured by the Decayed, Missing, and Filled Teeth (DMFT) index, was significantly higher in patients with poor glycemic control. The mean DMFT score in the poor glycemic control group was 5.1±1.7, compared to 2.3±1.2 in the good glycemic control group. This finding highlights not only the increased risk of developing dental caries but also the potential for more severe dental disease in patients with poorly controlled diabetes. The higher DMFT scores in these patients may reflect cumulative damage over time, exacerbated by chronic hyperglycemia. This is consistent with systematic reviews that have shown an increased risk of dental pathologies, including caries and tooth loss, in patients with poor glycemic control (Ahmadinia[7]., 2022) .

These results emphasize the importance of early and regular dental assessments for diabetic patients, particularly those with suboptimal glycemic control, to prevent the progression of dental caries and associated complications[13-14].

Clinical Implications: These findings have important clinical implications for the management of patients with T2DM. Given the established link between poor glycemic control and dental caries, it is imperative that oral health be considered a key component of comprehensive diabetes care. Regular dental check-ups and proactive oral hygiene practices should be encouraged, especially for patients struggling to maintain adequate glycemic control. Furthermore, healthcare providers should consider integrating dental assessments into routine diabetes management protocols to facilitate early detection and treatment of dental issues (Bin Rakhis[11]., 2022) .

The study also suggests that improved glycemic control could play a significant role in reducing the burden of dental caries in diabetic patients. Therefore, interventions aimed at optimizing blood glucose levels should be prioritized, not only to prevent the classic complications of diabetes but also to protect oral health (Surlari[10]., 2023).

Limitations: First, the retrospective design may introduce selection bias, as only patients with available HbA1c data and dental records were included. Second, the study relied on recorded HbA1c levels, which may not reflect long-term glycemic control accurately. Other factors, such as eating habits, oral hygiene practices and socioeconomic level, that may influence dental caries risk, were not considered. Future research should take these characteristics into account to provide a more thorough knowledge of the association between controlling blood sugar and dental caries in patients with T2DM.

CONCLUSION

This study found a link between poor glycemic control (HbA1c≥7.0%) and higher frequencies and severity of dental caries in type 2 diabetic patients. Patients with poor glycemic control were found to be approximately 9 times more likely to develop dental caries, with higher DMFT scores indicating greater severity. These findings underscore the importance of incorporating regular dental assessments into diabetes management and highlight the critical need for maintaining optimal glycemic control to reduce the risk of dental complications in this population.

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