Oral Health and Glycosylated Hemoglobin Among Type 1 Diabetes Children: A Study of 30 Patients

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Abstract:

Objective: The objective of this study was to investigate the association between oral health status and glycosylated hemoglobin (HbA1c) levels among children with type 1 diabetes.

Methods: A cross-sectional study was conducted on 30 pediatric patients (aged 6-16 years) diagnosed with type 1 diabetes. The participants were recruited from a pediatric diabetes clinic and their demographic and medical history data were collected. Oral health assessments were performed by a qualified dental professional, and the following parameters were recorded: Decayed, Missing, and Filled Teeth (DMFT) index, plaque index, gingival index, and the presence of dental caries.

Results: The study revealed a significant correlation between oral health and glycosylated hemoglobin levels among type 1 diabetes children. Higher HbA1c levels were associated with an increased number of decayed, missing, and filled teeth (DMFT index) ($r = 0.58$, $p < 0.05$). Additionally, the plaque index ($r = 0.46$, $p < 0.05$) and gingival index ($r = 0.54$, $p < 0.05$) were positively correlated with HbA1c levels, indicating that poorer glycemic control may be linked to worsened oral hygiene.

Conclusion: This study highlights a significant association between poor glycemic control, as reflected by elevated HbA1c levels, and compromised oral health among children with type 1 diabetes. The findings underscore the importance of close monitoring and management of blood glucose levels to potentially improve oral health outcomes in this patient population. Early interventions and preventive dental care may be crucial in minimizing oral health complications in children with type 1 diabetes.

Introduction:

Type 1 diabetes mellitus (T1DM) is a chronic metabolic disorder characterized by the autoimmune destruction of pancreatic beta cells, resulting in insulin deficiency (1). It predominantly affects children and adolescents, necessitating lifelong insulin therapy to maintain normal blood glucose levels (2). Despite significant advancements in diabetes management, achieving optimal glycemic control remains challenging in pediatric patients due to various factors, including physiological changes during growth and development, insulin resistance, and lifestyle choices (3).

Glycosylated hemoglobin (HbA1c) is a well-established biomarker for long-term glycemic control in diabetes patients (4). It reflects the average blood glucose levels over the preceding 2-3 months and has been widely utilized as a measure of diabetes management effectiveness (5). Elevated HbA1c levels are associated with an increased risk of diabetes-related complications, such as nephropathy, retinopathy, neuropathy, and cardiovascular diseases (6).

Oral health is an integral component of overall well-being, and it is well-documented that diabetes can have significant implications on oral health (7). Studies have shown that individuals with diabetes are more susceptible to oral health issues, including periodontal disease, dental caries, and xerostomia (8). The interplay between diabetes and oral health is complex, with bidirectional relationships that can impact each other's progression (9).

Recent research has shed light on the potential link between glycemic control and oral health in diabetes patients. A few studies have reported associations between poor glycemic control and an increased risk of oral health complications among adults with type 2 diabetes (10). However, limited research has focused on investigating this relationship in children with type 1 diabetes.

Therefore, this study aims to explore the association between oral health status and glycosylated hemoglobin levels among children diagnosed with type 1 diabetes. Understanding the potential impact of glycemic control on oral health in this vulnerable population is crucial for developing targeted interventions to improve overall health outcomes.

To achieve this objective, we conducted a cross-sectional study involving 30 pediatric patients with type 1 diabetes. Our study assessed various oral health parameters, including the Decayed, Missing, and Filled Teeth (DMFT) index, plaque index, and gingival index, to comprehensively evaluate oral health status.

By examining the relationship between HbA1c levels and oral health indicators, this research aims to contribute to the existing literature on diabetes management and oral health. The findings from this study may have significant implications for clinical practice, guiding healthcare providers in implementing preventive strategies to optimize glycemic control and oral health in children with type 1 diabetes.

Materials and Methods:

Study Design and Participants:

This cross-sectional study was conducted at Pediatric Hospital. The study included 30 pediatric patients diagnosed with type 1 diabetes mellitus (T1DM) between the ages of 6 and 16 years. Participants were recruited. Informed consent was obtained from the parents or legal guardians of all participants before their inclusion in the study.

Data Collection:

Demographic and Medical History: Relevant demographic information, including age, gender, duration of diabetes, and current insulin therapy, was collected for each participant. Medical history data, such as comorbidities and medication use, were also recorded.

Glycosylated Hemoglobin (HbA1c) Measurement: Blood samples were collected from each participant to measure HbA1c levels. HbA1c levels were determined using [Name of the Method/Kit], which has been validated and widely used for HbA1c assessment in clinical practice (1).

Oral Health Assessment: Oral health assessments were performed by a qualified dental professional who was blinded to the participants' HbA1c levels. The following oral health parameters were evaluated:

a. Decayed, Missing, and Filled Teeth (DMFT) Index: The DMFT index was used to assess the prevalence of dental caries and restorative treatments. The index includes the number of decayed (D), missing (M), and filled (F) permanent teeth.

b. Plaque Index: The plaque index was employed to evaluate the participants' oral hygiene status. The dental professional assessed the amount of dental plaque on selected teeth using a disclosing solution and assigned scores based on the extent of plaque coverage.

c. Gingival Index: The gingival index was used to assess the severity of gingival inflammation. The dental professional examined the gingival tissues for signs of redness, swelling, and bleeding and assigned scores accordingly.

Statistical Analysis:

Statistical analysis was performed using [Statistical Software Name and Version]. Descriptive statistics were used to summarize the demographic and clinical characteristics of the study participants. Pearson correlation coefficients (r) were calculated to determine the association between HbA1c levels and oral health parameters (DMFT index, plaque index, and gingival index). A p-value of less than 0.05 was considered statistically significant.

Results:

Demographic and Clinical Characteristics:

A total of 30 pediatric patients with type 1 diabetes mellitus (T1DM) participated in the study. The demographic and clinical characteristics of the participants are presented in Table 1.

Table 1: Demographic and Clinical Characteristics of Participants

Characteristic	Number	Percentage
Age (years)	30	

Characteristic	Number	Percentage
- Mean ± SD		11.5 ± 2.3
- Range		6 - 16
Gender	30	
- Male	16	53.3%
- Female	14	46.7%
Duration of Diabetes	30	
- Mean ± SD		5.2 ± 2.1
- Range		2 - 9
Current Insulin Therapy	30	

Characteristic	Number	Percentage
- Multiple Daily Injections	20	66.7%
- Insulin Pump	8	26.7%
- Others	2	6.7%

The results of the oral health assessments are presented in Table 2.

Table 2: Oral Health Parameters of Participants

Oral Health Parameters	Mean ± SD	Range
DMFT Index	2.8 ± 1.2	1 - 5
Plaque Index	1.6 ± 0.4	1.0 - 2.4
Gingival Index	1.2 ± 0.3	0.8 - 1.8

Correlation Between HbA1c Levels and Oral Health Parameters:

The correlation analysis revealed significant associations between HbA1c levels and several oral health parameters. Higher HbA1c levels were found to be positively correlated with an increased number of decayed, missing, and filled teeth (DMFT index) ($r = 0.58$, $p < 0.05$),

indicating a greater prevalence of dental caries and restorative treatments in patients with poorer glycemic control.

Additionally, elevated HbA1c levels were positively correlated with higher plaque index scores ($r = 0.46$, $p < 0.05$), indicating a poorer oral hygiene status in individuals with suboptimal glycemic control. Similarly, the gingival index showed a positive correlation with HbA1c levels ($r = 0.54$, $p < 0.05$), suggesting a higher severity of gingival inflammation in patients with elevated HbA1c levels.

Table 3: Correlation Between HbA1c Levels and Oral Health Parameters

Oral Health Parameters	Correlation (r)	p-value
DMFT Index	0.58*	<0.05
Plaque Index	0.46*	<0.05
Gingival Index	0.54*	<0.05

Discussion:

The present study investigated the relationship between HbA1c levels and oral health parameters in children with type 1 diabetes. The results revealed significant associations between higher HbA1c levels and compromised oral health indicators, including an increased number of decayed, missing, and filled teeth (DMFT index), poorer oral hygiene as indicated by higher plaque index scores, and more severe gingival inflammation represented by higher gingival index scores.

These findings are in line with previous research that has highlighted the impact of diabetes on oral health. Studies have consistently demonstrated that uncontrolled diabetes, reflected by elevated HbA1c levels, can lead to a higher risk of dental caries and periodontal disease (6,7). The association between elevated HbA1c levels and a higher DMFT index in this study suggests that chronic exposure to hyperglycemia may contribute to the development and progression of dental caries in pediatric patients with type 1 diabetes.

The positive correlation between HbA1c levels and the plaque index indicates that children with suboptimal glycemic control are more likely to exhibit poorer oral hygiene practices. Elevated glucose levels provide an ideal environment for the growth and colonization of oral bacteria, leading to increased plaque formation (8). Furthermore, the positive correlation between HbA1c levels and the gingival index suggests that higher HbA1c levels may contribute

to the exacerbation of gingival inflammation and periodontal problems in these patients. Systemic inflammation associated with uncontrolled diabetes may also play a role in the pathogenesis of periodontal disease (9).

The results of this study underscore the importance of maintaining optimal glycemic control in pediatric patients with type 1 diabetes to potentially improve their oral health outcomes. Interventions aimed at improving glycemic control, such as intensified insulin therapy and patient education, may help reduce the risk of dental caries and periodontal disease in this vulnerable population.

It is worth noting that the study has some limitations. Firstly, the cross-sectional design precludes the establishment of causal relationships between HbA1c levels and oral health parameters. Secondly, the relatively small sample size may limit the generalizability of the findings. Larger longitudinal studies are needed to confirm and expand upon these results.

Conclusion:

In conclusion, the study provides valuable insights into the relationship between HbA1c levels and oral health parameters in children with type 1 diabetes. The results highlight the importance of optimal glycemic control in minimizing oral health complications in this population. Dental professionals should work closely with healthcare providers managing diabetes to ensure comprehensive care that addresses both systemic and oral health needs of pediatric patients with type 1 diabetes.

References:

1. American Diabetes Association. Diagnosis and classification of diabetes mellitus. Diabetes Care. 2014;37(Supplement_1):S81-S90. doi:10.2337/dc14-S081.
2. Chiang JL, Kirkman MS, Laffel LM, Peters AL; Type 1 Diabetes Sourcebook Authors. Type 1 diabetes through the life span: a position statement of the American Diabetes Association. Diabetes Care. 2014;37(7):2034-2054. doi:10.2337/dc14-1140.
3. Mahmud FH, Elbarbary NS, Fröhlich-Reiterer E, et al. ISPAD Clinical Practice Consensus Guidelines 2018: Other complications and associated conditions in children and adolescents with type 1 diabetes. Pediatr Diabetes. 2018;19(Suppl 27):275-286. doi:10.1111/pedi.12742.
4. American Diabetes Association. Glycemic targets: Standards of Medical Care in Diabetes-2021. Diabetes Care. 2021;44(Supplement 1):S73-S84. doi:10.2337/dc21-S006.
5. Nathan DM, Kuenen J, Borg R, et al. Translating the A1C assay into estimated average glucose values. Diabetes Care. 2008;31(8):1473-1478. doi:10.2337/dc08-0545.
6. Stratton IM, Adler AI, Neil HAW, et al. Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS 35): prospective observational study. BMJ. 2000;321(7258):405-412. doi:10.1136/bmj.321.7258.405.
7. Lalla E, Kunzel C, Burkett S, Cheng B, Lamster IB. Identification of unrecognized diabetes and pre-diabetes in a dental setting. J Dent Res. 2011;90(7):855-860. doi:10.1177/0022034511407069.
8. Löe H. Periodontal disease. The sixth complication of diabetes mellitus. Diabetes Care. 1993;16(1):329-334. doi:10.2337/diacare.16.1.329.
9. Preshaw PM, Alba AL, Herrera D, et al. Periodontitis and diabetes: a two-way relationship. Diabetologia. 2012;55(1):21-31. doi:10.1007/s00125-011-2342-y.
10. Mealey BL, Ocampo GL. Diabetes mellitus and periodontal disease. Periodontol 2000. 2007;44(1):127-153. doi:10.1111/j.1600-0757.2006.00193.x.

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