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Periodontal status in adolescents with Type 1 Diabetes mellitus in a South African study population

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Keywords
Adolescents, Periodontitis, Type I Diabetes, Prevalence, Periodontal disease, Metabolic control.

Background
Periodontal disease (PD) can be considered a comorbidity of diabetes mellitus[1]. The relationship between Type I Diabetes mellitus (T1DM) and periodontal disease (PD) has been less extensively studied compared to Type II Diabetes Mellitus (T2DM). According to the International Diabetic Federation , the number of children and adolescents with type 1 diabetes in 2021 was 1.2 million people with 184,100 newly diagnosed cases each year[2]. This study investigated the periodontal status of adolescents with type 1 Diabetes in a South African population.

Aim
This study investigated the prevalence of periodontal disease in adolescents with Type 1 diabetes mellitus in a South African population.

Method
A cross-sectional study was conducted on 58 adolescent patients diagnosed with T1DM. Periodontal parameters were evaluated to establish the periodontal status of these individuals. PD was diagnosed according to the American Academy of Periodontology and the European Federation of Periodontology 2017 classification[3,4].

Results
Findings of the 58 T1DM adolescents, showed 44 patients (75.86%) had gingivitis, 6 (10.34%) had periodontitis, and 8 (13.79%) adolescents showed a healthy periodontal status. When relating the individuals' diabetic control to their periodontal status; 7 of the 8 patients with clinical periodontal health, 40 of the 44 gingivitis patients, and 4 of the 6 periodontitis patients found uncontrolled diabetes; No statistically significant association between periodontal status and metabolic control, p=0.231 was found

Conclusion
Despite a higher prevalence of periodontal disease compared to periodontal health among adolescents in the study, a correlation between periodontal diagnosis and metabolic control in adolescents with T1DM was not discernible which may be ascribed to limitations in the sample size. Therefore, future research endeavours should consider employing larger sample sizes to better elucidate potential relationships.

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1. INTRODUCTION
PD is prevalent worldwide[5]. Reports indicate that a substantial portion of the global population, approximately 90%, have gingivitis, while around 14% suffer from periodontitis[6,7]. Gingivitis affects only gingival connective tissues, periodontitis is characterised by collagen and connective tissue loss as well as bone loss and results in compromised tooth structure, function, and stability. Periodontitis[8] is prevalent among individuals diagnosed with T1DM and may exacerbate glycaemic control [8–10]. T1DM, a subtype of DM, is characterised by absolute insulin deficiency[11,12] and predominantly affects children and adolescents.

Recent research recognises PD as a comorbid condition to DM, owing to dysbiotic changes in the periodontal microbiome triggering an inflammatory response shared by both conditions[1]. Moreover, there is evidence suggesting improved diabetic control with reduced circulating pro-inflammatory mediators and improved lipid profiles observed,

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following periodontal therapy[15]. The association between PD and DM in adults has been well-established[16]. T1DM, in younger population groups, such as adolescents, are limited [17]. The study investigated the periodontal status of T1DM adolescents in a South African population.

2. METHODS

2.1 Study Hypothesis

This study investigated the prevalence of periodontal disease in adolescents with Type 1 diabetes mellitus in a South African population

2.2 Study population:

A total of 58 adolescents (between the ages of 12 to 18 years) with T1DM were examined and assessed for PD at the Tygerberg Oral Health Center (Faculty of Dentistry). Patients included in the study had been diagnosed with diabetes at least 12 months prior.

Adolescent patients diagnosed with T2DM, taking medications that are implicated in drug-influenced gingival enlargement (phenytoin, nifedipine and cyclosporine) or those with other known chronic and or immunosuppressive systemic diseases, human immunodeficiency virus (HIV) and haematological deficiencies were excluded from the study.

2.3 Data collection:

A convenience sampling method was used to source patients from the Tygerberg Adult Endocrinology outpatient clinic between January- November 2019. At this clinic, patients were monitored for their metabolic disease control.

A structured interview was conducted, and patient records were accessed for diabetes-related data such as, HbA1c level and patient demographics. Patients were then referred to the Tygerberg Oral Health Centre for further clinical examination.

At the Tygerberg Oral Health Centre, periodontal disease-related parameters were recorded by carrying out a periodontal examinations by a single examiner (MA) using a Williams probe recorded on a periodontal chart. An orthopantomogram and periapical radiographs were used to assess alveolar bone levels[20]. The patient's periodontal status was diagnosed as Clinical health, Gingivitis or Periodontitis according to the EFP/AAP Periodontal classification (2017)[21,22].

2.4 Study permissions:

Ethical approval was granted by the relevant Research Ethics committees (Biomedical Research and Ethics_Committee (BMREC), the Health Research Ethic Committee (HREC) of the University of the Western Cape and the Stellenbosch University Health Research Ethics Committee (SU HREC)). All necessary permissions and consent were obtained.

2.5 Data analysis:

The diabetic control of these adolescent patients was compared to their periodontal disease. The data was analyzed using STATA (Stata Corp. 2017. Stata Statistical Software: Release[15]. College Station, TX: Stata Corp LLC). Descriptive statistics represented by frequencies and percentages for categorical data and mean (standard deviation) or median (Interquartile Ranges) for continuous data, depending on the distribution of data. For categorical data, a Chi square test was utilized. For continuous data, a t-test was utilized to demonstrate contrast between two groups else an ANOVA was utilized for group sizes greater than[2]. In the event that the data did not fulfill the assumptions for the above stated tests, a non-parametric equivalent was used. Level of significance was established at a p-value of less than 0.05[4].

3. Results

The sample of 58 participants, with a mean age of 15. 4 years, comprised more females than males (37 versus 21). The majority of the participants presented with gingivitis (75.86%), followed by periodontitis (10.34%) and periodontal health (13.79%), respectively. Fifty-one of the participants (87.92%) had uncontrolled diabetes with HbA1c levels ≥ 7%, with an average of 9.24% (SD = 2.05).

Table 1: Basic sample demographic table

		Healthy	Gingivitis	Periodontitis	Total	p-value
Total (N)		8 (13,8)	44 (75,9)	6 (10,3)	58	
AGE, mean (SD)		14.9 (2.6)	14.5 (1.8)	16.3 (2.6)	14.8 (2.1)	0.14
HbA1c-cat	Controlled	3 (38%)	10 (23%)	2 (33%)	15 (26%)	0.52
	Uncontrolled	5 (63%)	34 (77%)	4 (67%)	43 (74%)	
Sex	Male	2 (25%)	18 (41%)	1 (17%)	21 (36%)	0.47
	Female	6 (75%)	26 (59%)	5 (83%)	37 (64%)	

Table 2: Clinical Periodontal Parameters:

Clinical Parameters	Level	Healthy N=8	Gingivitis N= 44	Periodontitis N= 6	Total N= 58	p-value
PROBING POCKET DEPTHS	0-3mm	8 (100%)	40 (91%)	0 (0%)	48 (83%)	<0.001
	4 mm	0 (0%)	4 (9%)	6 (100%)	10 (17%)	
RADIOGRAPHIC BONE LOSS	No bone loss	8 (100%)	44 (100%)	0 (0%)	52 (90%)	<0.001
	Radiographic bone loss	0 (0%)	0 (0%)	6 (100%)	6 (10%)	
BLEEDING, median (IQR)		7.9 (7.3, 8.9)	53.0 (27.4, 64.8)	70.8 (32.3, 81.5)	47.4 (19.2, 65.7)	<0.001
Periodontitis Stage, Grade and extent	Stage I, Grade B, localized Stage I, Grade B, localized Stage II, Grade C, generalized	n/a	n/a	3 2 1		

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Table 3: Correlation between PD and Metabolic Control

Healthy (baseline)	OR (95% Confidence Interval)	p-value
Gingivitis: HbA1c-cat Uncontrolled	0.713 (-0.88 to 2.31)	0,381
Periodontitis: HbA1c-cat Uncontrolled	0.182 (-2.04 to 2.4)	0,872

Most of the patients, 43 (74%) had uncontrolled diabetes with HbA1c ≥ 7% (Table 1), which echoed through periodontal health, gingivitis and periodontitis, but this was not found to be statistically significant. It is no more likely that you are an uncontrolled DM patient than a controlled DM if you have periodontitis or gingivitis compared to healthy gingiva or gingivitis compared to healthy gingiva. (Table 3).

4. DISCUSSION

Diabetes mellitus and periodontitis are prevalent conditions impacting a significant portion of the population. Over 1.2 million children and adolescents are diagnosed with type 1 diabetes (IDF, 2021). Among adolescents, gingivitis is the most common form of periodontal disease, while periodontitis shows a lower prevalence of approximately 1.7%, as reported in a recent systematic review. Studies across various regions indicate differing prevalence rates, though gingivitis consistently appears more frequently than periodontitis[24–28]. Data aggregation could be explained by the relatively recently revised classification system for periodontitis, which unified previous subtypes into a single condition. Additionally, variations in socioeconomic status may potentially impact the distribution of disease, where a higher socioeconomic status is sometimes reported to be associated with better access to medication, dental care, and health information disease[29].

Age and HbA1c are recognised risk factors of periodontitis[4,30]. This study examined the relationship between HbA1c levels and periodontal status. Most participants with gingivitis and periodontitis, in this study, had uncontrolled diabetes (HbA1c > 7%), though no statistically significant association was found. The limited number of periodontitis cases may be attributed to sample size constraints. Notably, a Brazilian study of 168 young adults with type 1 diabetes reported gingivitis and periodontitis rates of 20.8% and 5.9%, respectively[31]. Similarly, an Italian study involving 120 patients found a predominance of gingivitis[32]. Considering that this study focussed on a limited age group, particularly under-reported in current literature, it resulted in a reduced sample size and restricted the conclusions.

The severity of periodontitis in this diabetic population (Table 2) was assessed, with most cases (n=5) showing localized disease and only one case presenting generalised disease (>30% involvement). Five of the six patients with periodontitis were classified as Stage I (early/mild), characterised by pocket depths ≥4 mm and bone loss under 15%. Three patients demonstrated a slow progression rate (Grade A), while two exhibited a moderate progression rate (Grade B). Due to HbA1c levels exceeding 7%, these patients were classified as Grade B (n=1) or Grade C (n=2). Although greater disease severity might be expected, considering the early onset of disease, these adolescents may still be in the initial stages of disease progression[4, 33]. Systemic diseases can exacerbate periodontal disease by altering the inflammatory response due to focal irritants and infections[34].

The study found no association between periodontal disease and glucose metabolic control, indicating that type 1 diabetic patients with controlled or uncontrolled HbA1c levels were equally likely to present with periodontal health or disease.
This study faced several limitations. Firstly, the cross-sectional study design restricted the researcher to include only participants who presented at a single point in time, potentially excluding those who did not present during that specific period. Secondly, the sample size was limited, affecting the generalisability of the findings. Additionally, the participants were sourced from a tertiary hospital, which resulted in a sample predominantly composed of patients with poorly controlled Type 1 Diabetes Mellitus (T1DM).

Recommendations

Continuous efforts should be made to enhance access to diabetes education programs that incorporate lifestyle modifications, blood glucose self-monitoring, and insulin management. It is also crucial to consider periodontitis as a potential comorbidity in diabetic patients. Broad patient education on oral hygiene and regular dental check-ups are recommended.

Further research should explore the relationship between periodontal disease and metabolic control in adolescents with insulin-dependent diabetes mellitus. Future studies should include a larger sample size, consider socioeconomic factors, and assess a broader range of periodontal parameters, including the gingival index, plaque index, calculus index, tooth decay, and number of missing teeth.

5. CONCLUSION

For adolescents with Type 1 diabetes mellitus, gingivitis was the most prevalent condition, followed by periodontal health, with periodontitis being the least prevalent. Additionally, most of the sample exhibited poorly controlled Type 1 diabetes mellitus. Budget constraints prevented concurrent testing of metabolic control. Future studies should involve larger sample sizes that are longitudinal over time, as this would provide insight of disease progression in such populations.

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CPD questionnaire on page 570

The Continuing Professional Development (CPD) section provides for twenty general questions and five ethics questions. The section provides members with a valuable source of CPD points whilst also achieving the objective of CPD, to assure continuing education. The importance of continuing professional development should not be underestimated, it is a career-long obligation for practicing professionals.