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The Association Between Type 1 Diabetes and The Severity of Periodontitis In Children

Ashraf Abdelkader[1]*, Mohamed el tonsy[2], Mansoor Ali Atya[3], Ahmed Safaa Waly[4]

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Aadj@azhar.edu.eg

ABSTRACT

Aim: primary goal of this research was to demonstrate the link between severity of periodontal disease and type 1 diabetes in children. **Subjects and Methods:** this prospective study included total of 40 children aged 5 to 12 years were included in this study, and the evaluation of periodontal disease was done using "Gingival Index (GI), Plaque Index (PI), and Clinical Attachment Loss (CAL)"; the blood glucose level was assessed using "Glycosylated hemoglobin (HbA1c percent)"; and the patients were reevaluated after 3 months, 6 month and 9 month intervals. **Results:** The study comprised 40 children, 23 females and 17 males, with a mean age of 8.52 4.16. The two groups did not differ much. Both groups' mean gingival index, plaque index, and clinical attachment level decreased over time. Group 1 had significantly lower mean gingival index, plaque index, and clinical attachment level scores than group 2 at baseline and three months post-intervention. Both groups' mean HbA1c percent dropped with time. This decrease was only seen in group 2, and only between baseline and 9 months post-intervention in group 1. **Conclusion:** Determining the risk of periodontitis and associated consequences in poorly treated diabetic children should be a priority in this study. Children with severe periodontitis should also have their blood glucose levels checked.

KEYWORDS

Gingival Index (GI), Plaque Index, diabetes, periodontal, children.

1. Department of Pediatrics, Faculty of Medicine, Al-Azhar University, Cairo (boys), Egypt
2. Department of Clinical pathology, Faculty of medicine, Al-Azhar University, Assiut (Boys), Egypt
3. Department of periodontology, vision Colleges, Jeddah, Saudi Arabia,
4. Department of Pedodontic and Oral health, Faculty of Dental Medicine, Al-Azhar University, Assiut, Egypt .

* Corresponding Author e-mail: ashraf1977@azhar.edu.eg

INTRODUCTION

Type 1 diabetes (formerly known as insulin-dependent diabetes or juvenile diabetes) is characterized by a lack of insulin production due to autoimmune destruction of the pancreatic insulin-producing cells. In susceptible individuals, diabetes appears to be triggered by environmental variables such as viral infections and food rather than lifestyle factors. Type 1 diabetes usually begins in childhood or early adulthood. Type 1 diabetes accounts for 5–10% of all diabetes cases, but more than 90% of diabetes diagnoses are in those under the age of 25. Hyperglycemia causes complications such as diabetic ketoacidosis, nephropathy, neuropathy, cardiovascular disease, and acute coronary syndrome. The good news is that many people with type 1 diabetes do not develop major long-term problems. Glucose monitoring and insulin therapy are usually used to treat it[1].

Most people have inflammatory periodontal diseases, which can affect up to 90% of the world's population if they also have gingivitis and periodontitis[2]. The deposition of the subgingival biofilm, which causes inflammation in the periodontal tissues, is the first step in periodontitis. However, there are many other factors that make someone more likely to get the disease, even if they have a lot of plaque. There are many environmental factors that can cause periodontitis, but diabetes is considered one of the most important[3]. The tissue damage caused by chronic inflammation in the periodontal tissues (loss of attachment, breakdown of periodontal ligament fibers, and alveolar bone resorption) is mostly irreversible, but there are some actions that can be taken. It is also usually not painful, so it may go unnoticed for years until the patient goes to a dental professional. The effects of periodontitis, such as bleeding gums, poor aesthetics, recurrent infections, tooth mobility, and tooth loss, can all have a negative effect on daily living and quality of life. This can affect function, comfort, self-confidence, social interactions, and food choices[4].

Diabetes has been linked to an increased risk of periodontitis in epidemiological studies. Most studies have focused on type 2 diabetes, but type 1 diabetes appears to have a similar effect on periodontitis risk. The increased risk of periodontitis is known to be dependent on glycemic control, as is the risk of all diabetes complications. Thus, well-controlled diabetes with HbA1c around 7% (53 mmol/mol) or lower appears to have little effect on periodontitis risk. The risk increases exponentially with glycemic control. Overall, diabetes patients have a 2-3 fold increased risk of periodontitis[5].

Diabetes increases periodontitis prevalence, extent (number of affected teeth), and severity. Patients with diabetes have been reported to have multiple recurring periodontal abscesses..

Inflammation, immune function, neutrophil activity, and cytokine biology are thought to be involved in the diabetes-periodontitis link[6]. Systemic markers of inflammation are elevated in both type 1 and type 2 diabetes[7]. Inflammatory mediators like interleukin-1 (IL-1) and tumor necrosis factor (TNF) are increased in diabetic periodontal tissues[8].

Studies on the Gila River Indian Community, a Native American population with a high prevalence of diabetes, first suggested a deleterious impact of periodontal disease on diabetes. Severe periodontitis was linked to poor glycemic control (HbA1c >9.0 percent, 75 mmol/mol) at two-year follow-up, suggesting periodontitis may be impairing diabetes control[9]. Other research has linked advanced periodontitis to higher diabetes consequences such cardiovascular issues, retinopathy, neuropathy, and proteinuria[10].

The primary goal of this study was to investigate if there a relationship between severity of periodontitis and type I diabetes in children.

PATIENTS AND METHODS

This prospective, non-randomized interventional clinical trial done from February 2019 to April 2021, included 40 children who had previously been diagnosed with type 1 diabetes, according to the American Diabetes Association[11]. They were chosen from the pediatric outpatient clinic at Al Ansari specialist hospital in Yanbu, KSA. All patients were informed about the research techniques and signed an informed permission form before to the trial. The study was conducted in accordance with the Helsinki Declaration of Ethical Principles and with the agreement of an ethical committee.

Patients´ ages range from 7 to 14 years old, of both sexes. The patients were divided into two groups, each with a different degree of periodontal alteration. Group I included 20 patients with well-controlled diabetes. Group II consisted of 20 patients who had poorly controlled diabetes.

All of our patients were subjected to:

- Through history taking (age, gender, place of residence, duration of diabetes, presence of any diabetes complications, history of any dental consultations in the previous 6 months).

- Clinical examination (anthropometric measurements of "weight, height, and body-mass index (BMI)," systemic examination of "chest, heart, and abdomen," intraoral examination of "Gingival index GI[12], Plaque index PI[13], Clinical attachment loss CAL[14]".
- Glycosylated hemoglobin (HbA1c %), by high performance liquid chromatography (HumaNexA1c, Germany).
- Glycemic control through calorie restriction, activity encouragement, and the use of insulin therapy.
- Dental treatment program (Dental treatment program included both curative and preventive components) Curative care was provided to meet all of the children's treatment needs, which included dental prophylaxis and restorative care. Mechanical and chemical control of periodontal diseases were included in the preventive component: (Mechanical control) health education A-Tooth brushing, B-Flossing (Chemical control): Topical antimicrobial agent application in the clinic (Cuteca "oral solution"), and then how to apply oral solutions three times daily.
- Re-evaluation of the patient (after 3 months, 6 months, and 9 months).

Statistical analysis

It was carried out using the SPSS computer package version 25.0 (IBM SPSS Statistics for Windows, Armonk, NY: IBM Corp., USA). For descriptive statistics: the means and standard deviations were used for quantitative variables. For analytic statistics: A repeated measures ANOVA with a Greenhouse-Geisser correction test was applied to assess differences in means of quantitative variables within the same group at different follow up periods with Bonferroni post hoc correction to determine where the significance specifically exist, while Mann Whitney *U* test was used to assess differences in means of quantitative variables between the two groups at each follow up period. The statistical methods were verified, assuming a significant level of $p < 0.05$ and a highly significant level of $p < 0.001$.

RESULTS

The study included 40 children who met the inclusion and exclusion criteria, 23 females and 17 males, with a mean age 8.52 ± 4.16 ranged between 5 – 12 years . They were divided into two equal groups: those who had controlled diabetes and those who did not. In terms of mean age and gender distribution, there was no significant difference between the two groups.

During the various follow-up periods, there was a significant decrease in the mean gingival index, plaque index score, and clinical attachment level score in both groups. A comparison of the two groups revealed that the mean gingival index, plaque index score, and clinical attachment level score in group 1 were significantly lower at the baseline and third month post-intervention. However, their mean values at the 6th and 9th months were insignificantly lower in Group 1 compared to Group 2. (Tables1,2 and figure 1).

TABLE (1) *Comparison between the studied groups as regard gingival index (GI) at different follow up periods*

GI follow up period	Group 1 Mean ± SD	Group 2 Mean ± SD	P value
At base	1.6 ± 0.3	1.8 ± 0.3	0.004*
At 3rd month	1.4 ± 0.3	1.6 ± 0.3	0.04*
At 6th month	1.2 ± 0.1	1.3 ± 0.3	0.16
At 9th month	0.7 ± 0.4	0.9 ± 0.5	0.17
P value	0.001*	0.001*	

*: Significant.

1: Significance between at base and 3rd month periods.

2: Significance between at base and 6th month periods.

3: Significance between at base and 9th month periods.

4: Significance between 3rd month and 6th month periods.

5: Significance between 3rd month and 9th month periods.

6: Significance between 6th month and 9th month periods.

TABLE (2) *Comparison between group I and II as regard Plaque Index (PI) scores at different follow up periods*

PI follow up period	Group 1 Mean ± SD	Group 2 Mean ± SD	P value
At base	1.7 ± 0.2	2.1 ±0.4	0.0003*
At 3rd month	1.5 ± 0.3	1.8 ± 0.3	0.003*
At 6th month	1.4± 0.3	1.5 ± 0.4	0.3
At 9th month	0.6 ± 0.4	0.8 ± 0.4	0.1
P value	0.001*	0.001*	

*: Significant.
[1]: Significance between at base and 3rd month periods.
[2]: Significance between at base and 6th month periods.
[3]: Significance between at base and 9th month periods.
[4]: Significance between 3rd month and 6th month periods.
[5]: Significance between 3rd month and 9th month periods.
[6]: Significance between 6th month and 9th month periods.

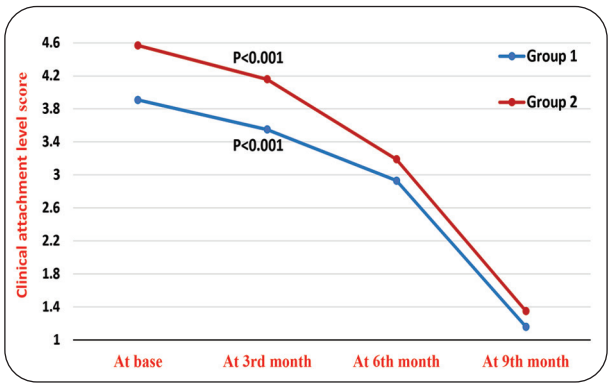

Fig. (1) The mean Clinical Attachment Level score in both groups at different follow up periods.

The mean glycated hemoglobin percent (HbA1c percent) decreased in both groups over the various follow-up periods. This decrease was observed only in group 2, whereas in group 1, it was observed only between the mean levels at baseline and the 9th month post-intervention. A comparison of the two groups revealed that group 1 had a significantly lower mean HbA1c percent at the baseline, third, and sixth months post-intervention. (Table 3).

TABLE (3) *Comparison between group I and group II regarding glycated hemoglobin percent (HbA1c%) at different follow up periods*

HbA1c% follow up periods	Group 1 Mean ± SD	Group 2 Mean ± SD	P-value
At base	7.85 ± 0.46	10.21 ± 1.59	< 0.001*
At 3rd month	7.74 ± 0.79	9.71 ± 1.48	< 0.001*
At 6th month	7.59 ± 0.66	8.33 ± 1.07	0.012*
At 9th month	7.41 ± 0.52	7.76 ± 0.84	0.121
P-value	0.138 [3]	<0.001*[2-5]	

*: Significant.
[2]: Significance between at base and 6th month periods.
[3]: Significance between at base and 9th month periods (In group 1, P-value = 0.007*).
[4]: Significance between 3rd month and 6th month periods.
[5]: Significance between 3rd month and 9th month periods.

DISCUSSION

Inflammation is a key feature of both diabetes and periodontal disease, and inflammatory processes are up-regulated in diabetic periodontal tissues. It's important to know how diabetes affects the periodontium and how periodontitis affects diabetes control.

Therefore, the current study discussed the findings in order to improve the bidirectional relationship between diabetes and inflammatory periodontal diseases in children.

Regarding the clinical parameters investigated, the results indicated that the mean value of gingival index score, plaque score and clinical attachment level were significantly higher in the poorly controlled group than in the well-controlled group. This finding is consistent with Orbak R., 2008, who compared two groups of diabetic children aged 5–9 years and 10–14 years to two control groups of similar age and discovered a significant statistical difference in GI and PI scores between the diabetic and control groups[15].

Furthermore, both groups experienced a steady improvement in GI, PI, and CAL from the beginning to the end of the trial. This could be ascribed to the fact that the participants maintained excellent glycemic control throughout the research, as well as the effectiveness of the dental program therapy in lowering the microbial causative agents of periodontal disorders which is also consistent with Orbak R,. 2008[15].

During the different follow-up periods, there was a decrease in mean glycated hemoglobin percent (HbA1c percent) in both groups, and this decrease was more noticeable in group 2 with poorly controlled diabetes, which was significant at all times of the study, whereas this decrease in glycated hemoglobin in group 1 with well controlled diabetes was significant only at the beginning and end of the study (9th month). This is attributed to all of our patients' good glycemic control and the effective dental treatment program used during this study, and this reduction was consistent with Teeuw W. (2010).

The study has several limitations, including a limited sample size and the absence of blinding or randomization. Additionally, we did not assess the intervention's long-term outcome (greater than 9 months). In addition to budgetary and time constraints, we were scared about losing follow-up cases (particularly with a small sample size). Additionally, blind and randomized trials require several sites for validity, which is challenging to organize. To establish the bidirectional association between periodontitis and HbA1c percent in diabetic children, a randomized, double-blind, multicentric clinical research with a bigger sample size and a longer duration of follow-up is required.

CONCLUSION

From this study, it can be concluded that poorly controlled diabetic children should be placed on an oral hygiene prophylactic regimen to decrease their risk of periodontitis and its complications. Also, children with severe periodontitis should be screened for their blood glucose levels.

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جامعة الأزهر أسيوط
مصر

الأزهـــر
مجلة أسيوط لطب الأسنان

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العلاقة بين مرض السكري من النوع 1 وشدة التهاب اللثة عند الأطفال

اشرف عبدالقادر *1 ، محمد التونسى2 ، منصور على عطية3 , احمد صفاء والى4

1. قسم الاطفال ، كلية الطب، جامعة الازهر، القاهرة (بنين)، مصر
2. قسم باثولوجيا الطبية, جامعة الازهر ,اسيوط (بنين), مصر
3. قسم امراض اللثة , كليه رؤية ,جدة, السعوديه
4. قسم طب اسنان اطفال وصحة الفم ، كلية طب الاسنان، جامعة الازهر,اسيوط,مصر

* البريد الإلكتروني: ASHRAF1977@AZHAR.EDU.EG

الملخص:

الهدف: على الرغم من حقيقة أنه ليس من الأعراض السريرية لمرض السكري ، لا يزال يشار إلى التهاب اللثة باسم «النتيجة المزمنة السادسة لمرض السكري. التهاب اللثة هو ثلاث مرات أكثر شيوعا بين مرضى السكري مما كانت عليه في عموم السكان. ونتيجة لذلك، يعتقد أن مرض السكري عامل خطر للإصابة بالتهاب اللثة. يظهر مرض اللثة في وقت سابق في مرضى السكري مما كانت عليه في عموم السكان. وكان الهدف الرئيسي من هذا البحث لإثبات الصلة بين شدة مرض اللثة و مرض السكر من النوع الأول للأطفال.

المواد والاساليب: وقد شمل هذا التقييم ما مجموعه 40 طفلا تتراوح أعمارهم بين 7 و14 عاما. وتم تقييم أمراض اللثة باستخدام «مؤشر GI (GINGIVAL)، ومؤشر البلاك (PI)، وفقدان المرفق السريري (CAL)»؛ تم تقييم مستوى السكر في الدم باستخدام «الهيموغلوبين الجليكوز لات HBA1C) في المئة)»؛ وأعيد تقييم المرضى بعد 3 أشهر و6 أشهر و9 أشهر.النتائج: وجدنا علاقة واضحه بين أمراض اللثة والسكري من النوع 1

الخلاصة: . أظهر كل من أمراض اللثة والسكري من النوع 1 ارتباطا ثنائي الاتجاه ، وفقا لبيانات الدراسة.

الكلمات المفتاحية: : مؤشر اللثه ، مؤشر تكون البلاك ، مرض السكرى ، لثوى ، طفل.