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Original Article

Periodontal health status of children with type 1 diabetes mellitus

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Abstract

Aim: Type 1 diabetes mellitus (DM1) is the most common chronic disease in children and adolescents. The purpose of this study was to determine the relationship between Type 1 diabetes mellitus and periodontal health and also the effect of metabolic control level on both periodontal and dental health.

Material and Methods: A Total of, 152 patients, of which 76 subjects with type 1 diabetes (DM1) and 76 healthy individuals were participated in this study. The subjects were also categorized with regard to gender and metabolic control levels. Periodontal health was assessed by recording plaque index (PI), gingival index (GI), pocket depth (PD) and bleeding on probing (BOP); while the dental status was determined by Decayed, Missing and Filled Teeth index (DMFT).

Results: All periodontal scores were found to be significantly higher in DM1 group, whereas DMFT scores were similar in DM1 group and healthy controls. The glycemic control levels did not seem to have an impact on periodontal parameters (PI, GI, PD, BoP) and DMFT scores. Also, there were no statistically significant correlations between periodontal parameters and DMFT scores, and HbA1c values.

Conclusion: Diabetes seems to be associated with poor periodontal health status regardless of the metabolic control level in adolescents, but not with increased caries risk.

Keywords: Children; Dmft; Periodontal; Type 1 Diabetes.

INTRODUCTION

Type 1 diabetes mellitus (DM1) is a metabolic dysfunction characterized by hyperglycemia resulting from definitive deficiency in insulin secretion caused by autoimmune illness and genetic factors (1). It occurs at an early age and daily administration of insulin is required due to deficient insulin production. Diabetes is an important risk factor on oral health, since it is associated with an increased risk of inflammatory periodontal diseases which was described as the sixth complication of diabetes, together with retinopathy, nephropathy, neuropathy, macrovascular disease and altered wound healing (2).

The relationship between diabetes and periodontal disease has been investigated in many years and as a result a two-way relation was reported (3). The diabetes is a risk factor for periodontal disease, whereas the risk for periodontal disease is greater with a poor diabetic control (4).

In a consensus report, the authors reported that the blood glucose levels expressed as HbA1C in individuals with or without diabetes were adversely affected by severe periodontal disease (5).

On the other hand, glycemic status of the diabetic patients has an impact on periodontal health as well as salivary pH and buffering capacity (6). One of the main reasons of developing caries and periodontal inflammation in diabetic patients might be due to the change in the saliva properties. Some of the studies have been determined the diabetes as a risk factor for prevalence of decayed, restored or missing teeth (7,8); however contrasting results have been presented (9,10). Therefore, more studies are required to investigate the difference of oral health conditions and periodontal status in children with DM1.

The aim of the present case control study was to examine the periodontal and dental treatment needs of children with DM1, and to evaluate if a lack of metabolic control is associated with poorperiodontal and dental health.

MATERIALS and METHODS

Study Population

The study included DM1 patients who were referred to Gazi University Faculty of Dentistry from the Department of Pediatric Endocrinology, Faculty of Medicine for

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detailed dental consultation From 552 DM patients, only 95 attended their appointments and 76 of these patients fulfilled the inclusion criteria as described below. A control group randomly selected from the systemically healthy patients attended the clinic for orthodontic evaluation. The inclusion criteria for all participants are as follows:

Patients at 10-18 years old, under control for DM1 for at least 2 years or more in Pediatric Endocrinology clinic for regulation of their blood glucose levels and treated by insulin injection, had no orthodontic treatment before, no other systemic diseases, no genetic or congenital craniofacial anomalies participated in the DM1 group.

Control group consisted of patients at 10-18 years old, minimum crowding, no systemic diseases, no genetic or congenital craniofacial anomalies, no periodontal, orthodontic, prosthetic or surgical treatment before.

Patients in both groups were excluded if they used any medications that could affect the oral health and had any other systemic disases.

All participants were informed about the study procedures, and were required to fill out a consent form and a medical history questionnaire. The informed consent forms prepared according to Helsinki Declaration were signed by every patient or their legal guardian for the ones under the age of 18. Ethical approval was taken from Institutional Review Board (25/10/2010, No: 99).

Clinical evaluation

Patients were asked for their brushing habit and brushing at least once a day was the prerequisite to evaluate the patients in the study. All subjects in the DM1 and control groups were examined by the same periodontist (CG). The periodontal status was recorded using the plaque index (11), gingival index (12), pocket depth and bleeding on probing. The dental status using the decayed, missing and filled teeth (DMFT) scores was assessed both clinically and radiographically by an endodontist (MG).

The HbA1c values records were taken from the endocrinology clinic. The DM1 patients were divided into three subgroups according to their glycemic control as poor (HbA1c>%9), moderate (HbA1c=%7-9) and well (HbA1c<%7) controlled, and the relationship between type of glycemic control and periodontal and DMFT scores were evaluated.

Plaque control programme and oral hygiene instructions

After recording periodontaland DMFT parameters, all subjects underwent oral hygiene instructions. The etiology of periodontal diseases and its relationship with DM was described and the effects of periodontal diseases on alveolar bone and gingiva were demonstrated on a study model. If there was a need for mechanical oral hygiene therapy, the patients were treated with ultrasonic and hand instruments by the periodontist (CG). And then, all DM1 patients were placed on a recall maintenance programme in 6 months.

Statistical analysis

The data were analyzed using SPSS for Windows, version 16.0 (SPSS Inc., Chicago, IL, USA). The normality of the data was checked with Shapiro-Wilks (n <50) tests. The differences between groups were determined using Student t-test. To investigate the effect of glycemic control on periodontal parameters and DMFT scores, one way-ANOVA was used. The correlations between the periodontal parameters and DMFT scores, and HbA1c values were evaluated by using Spearman's rho analysis. The level of significance were set at p<0.05. The sample size was determined so that the differences between the groups could be analyzed with 90% accuracy.

RESULTS

The ages of the subjects were similar and no significant difference was found between the mean values of the groups (p>0.05). The mean age of DM1 group was 14.16 years (38 boys, 38 girls) and it was 14 years (38 boys, 38 girls) for the control group. Also, the number of daily brushing didnot show any significant difference between groups (p>0.05).

The comparison of the difference for PI, GI, PD and BoP and DMFT scores between DM1 and control groups was shown in Table 1. DMFT score did not show significant differences between control and DM1 groups; however, all periodontal parameters were significantly higher in DM1 group when compared with controls (p<0.001).

Table 1. The comparison of the periodontal parameters and DMFT scores between control and DM1 groups

	DM1 (n=76)			Control (n=76)			
	Mean± std.dev	Min	Max	Mean± std.dev	Min	Max	p
PI	1.16±0.34	0.42	1.96	0.78±0.32	0.05	1.45	<0.001*
GI	1.21±0.29	0.12	1.96	0.95±0.31	0.15	1.22	<0.001*
PD	2.10±0.30	1.19	2.83	2.00±0.22	1.54	2.34	<0.001*
BoP	0.35±0.20	0.00	0.99	0.18±0.19	0.00	2.54	<0.001*
DMFT	5.75±5.65	0.00	0.12	4.34±2.91	0.00	0.30	0.06

*:Statistically significant
PI, plaque index; GI, gingival index; PD, pocket depth; BoP, bleeding on probing; DMFT, decayed decayed, missing and filled teeth.

The mean follow up time of DM1 patients was 5.23±3.12 years. All DM1 patients were in insulin treatment and the mean of their HbA1C levels, which indicated the blood glucose concentration in the past 3 months, was 8.23±1.70%. The distribution of DM1 patients according to their glycemic control status were shown in Table 2. When the differences of periodontal parameters and DMFT scores in terms of glycemic control groups were evaluated, no differences with regard to metabolic control were observed (p>0.05) (Table 3). In other words, all periodontal parameters as well as DMFT scores were found similar between the patients with poor-controlled, mild-controlled and well-controlled diabetes. There were no statistically significant correlation between periodontal parameters and DMFT scores, and HbA1c values (p>0.05) (Table 4).

Table 2. Distribution of diabetes patients according to metabolic control levels.

	n	Age (year)	Female/Male	HgA1c
Well-controlled	18	13.83±2.33	10/8	%6.43±0.33
Moderate-controlled	37	14.00±2.50	17/20	%7.76±0.50
Poor-controlled	21	14.75±2.42	11/10	%10.60±1.04

*The data presented as mean±std.dev

Table 3. The comparison of periodontal parameters and DMFT scores between subjects with different glycemic control levels.

	Poor-controlled (n=21)	Mild-controlled (n=37)	Well-controlled (n=18)	
	mean±std.dev	mean±std.dev	mean±std.dev	p
PI	1.30±0.37	1.11±0.30	1.06±0.33	0.053
GI	1.28±0.30	1.20±0.20	1.12±0.38	0.234
PD	2.08±0.39	2.10±0.28	2.08±0.39	0.963
BoP	0.38±0.23	0.32±0.17	0.35±0.22	0.634
DMFT	0.06±0.05	0.06±0.06	0.04±0.04	0.484

*: Statistically significant
The differences between the glycemic control groups were tested by using one way-ANOVA
PI, plaque index; GI, gingival index; PD, pocket depth; BoP, bleeding on probing; DMFT, decayed missing filled teeth.

Table 4. The relationship between the periodontal parameters and DMFT scores, and HgA1c values.

		PI	GI	PD	BoP	DMFT
HbA1c	r	0.190	0.044	-0.920	0,047	0,075
	p- value	0.101	0,709	0,427	0,688	0,519

*Spearman's rho, r=correlation coefficient

DISCUSSION

DM1 is the most common chronic disease in children and adolescents (13). The incidence rate of this disease continue to rise by approximately 3% to 4% every year, and relative increased were the highest in central and eastern European countries from 1989 to 2003 (14). The possibility to meet diabetic children, especially with periodontal problems, in dental clinics has been increased. Dental clinicians have to know to deal with periodontal problems in children especially the one with systemic problems, since the periodontal problems are not limited to adults only.

Most of the previous studies in children with systemic diseases especially diabetes demonstrating higher periodontal problems (15,16). The risk for periodontal destruction increased with diabetes (5).Thus, control of the systemic conditions is of importance for periodontal health.

This case-control study showed that children with type 1 diabetes had poor periodontal health when compared to healthy controls. Similar results were reported by Dakovic and Pavlovic (17) who compared the periodontal health in diabetic and healthy adolescents and as a result indicated higher plaque and gingival inflammation in subjects with Type I diabetes. In a systematic review (18), the plaque index was reported significantly higher in diabetic patients, while the type of diabetes (I and II) had an impact on gingival index and bleeding on probing scores. The differences became significant for subjects with type I diabetes. Since the gingival inflammatory response to microorganisms was shown to be exaggerated by diabetes (19), higher bleeding on probing scores, an important indicator of disease activity, might be expected in diabetic patients. Karjalainen and Knuuttila (20) reported that the bleeding on probing was higher in newly diagnosed diabetic children before the beginning of the insulin therapy. The result of that study clearly demonstrates the effect of diabetes on gingival health.

In our study, to provide cumulative effect of glycemic control level on periodontal status, not a single measurement of HbA1c which reflects only previous 3 months (4), was used. The average of all HbA1c values since the initial diagnosis of the disease was evaluated to define the glycemic control groups. There were no differences observed in terms of periodontal health and dental health among subjects with different glycemic control levels in our study. Our results are in contrast with a review (21) reported higher risk of more severe periodontal disease in diabetic patients with poor metabolic control. In some studies, the metabolic control reported to have an effect on periodontal status (22,23). Diabetic patients with poor metabolic control were found at a higher risk for suffering from more severe periodontal problem (24). On the other hand, there are several studies reported no association between periodontal status and HgA1c and also, the duration of diabetes and periodontal health (25,26). Busato et al.(7) reported that the oral health of DM1 adolescents was impaired regardless of metabolic control. In addition, Bacic et al.(27) reported no effect of metabolic control of diabetes, HgA1c, on severity of periodontal disease; however, the diabetic patients required periodontal treatment more than healthy individuals.

There are also contradictory results about relationship between caries incidence and DM1. Orbak et al.(28) reported higher incidence of decayed teeth in diabetic children at age 5-14 years old with poor metabolic control. Subramaniam et al. (29) reported higher DMFT scores in diabetic children compared to healthy patients. On the other hand, some of the studies demonstrated lower number of decayed teeth (8,30), while the others reported similar number of decayed teeth in both diabetic and healthy individuals (9,31). However, no relationship between DMFT scores and DM1 was observed in our study which was in accordance with the previous studies suggest that the young diabetic individuals exhibit similar levels of caries with systemically healthy individuals (32, 33). This result might be due to the diabetic patients were under control more than 2 years, and as the Lamster et al. (34) suggested, carbonhydrate-restricted diet might be the reason of decreased incidence of decayed teeth.

The diabetic children are under risk for periodontal problems during their whole life and the childhood is a critical period for the acquisition of the certain habits. The basic prevention strategy should be primarily based on giving an oral hygiene education to both the children and their parents and also regular periodic controls. The present study suggests that children with type I diabetes have poorperiodontal condition than healthy controls regardless of the metabolic control level, but not increased caries risk. However, more clinical prospective and randomized studies are needed to establish definitive conclusions.

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