

The influence of type I diabetes mellitus on dentition and oral health of children and adolescents attending two diabetic centers in Erbil city

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Hemn M. Sarmamy *

Sazgar M. Saber*

Vian O. Majeed*

Abstract

Background and objectives: The aim was to determine the effect of type I diabetes mellitus on eruption time of dentition and to evaluate the dental caries, debris, calculus and gingival index in two groups.

Methods: Type I diabetic children and adolescents with age range (6-14) years who were attending to Layla Qasim Center for Diabetes and The Diabetic Child Association Center in Erbil city were included in this study from December 2010 to March 2011. The dentition of all participants was examined for eruption. Besides, the DMF/dmf index, debris index (DI), gingival index (GI) and calculus index (CI) were evaluated. Data obtained from each group were compared statistically.

Results: When compared to the non-diabetic group, we observed that dental development was as early as (1.6) years in diabetic group. Results also showed that the total mean value of caries experienced (dmft, dmfs, DMFT and DMFS) by the diabetic group was less than that of the control group with significant differences. The gingival index among diabetic group was higher than the control group. The total mean value of simplified debris index in control group was higher than the diabetic group. In contrast, simplified calculus index was less in diabetic group with a significant difference between them.

Conclusion: The findings showed that patients with type I diabetes mellitus had an earlier tooth eruption and plays an important part in the oral health of children.

Keywords: Type I diabetes mellitus, Tooth eruption, Oral health.

Introduction

Diabetes Mellitus (DM) is a group of metabolic disease characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or both. The chronic hyperglycemia of diabetes is associated with long term damage, dysfunction and failure of various organs, especially the eyes, kidneys, nerves, heart and blood vessels. Several pathogenic processes are involved in the development of diabetes which range from autoimmune destruction of the β -cells in the islets of the pancreas with consequent insulin deficiency to abnormalities that result in resistance to insulin action.^{1,2}

Diabetes Mellitus is classified according to the etiology of the disease into type 1

diabetes which mainly affects children and adolescence, and type 2 diabetes. There are other specific types that may occur due to genetic defects of β -cells function, disease of pancreas, drug induced or gestationa diabetes mellitus.³ Oral health complications known to be associated with diabetes include: gingivitis, periodontitis, salivary gland dysfunction, dental caries, tooth loss, burning sensation, taste disturbances and infections such as oral candidiasis. The prevalence and severity of medical and oral health complications may depend on the specific type of diabetes assessed.^{4,5} In Turkey, Orbak⁶ found that there was an early tooth eruption among 5-14 years old diabetic children as well as an increased gingival, calculus and plaque

*Department of P.O.P, College of Dentistry , Hawler Medical University., Erbil, Iraq

indices among diabetes mellitus type I children when compared with control group. The same result had been revealed by Shantanu⁷ in USA who assessed 270 children with type I diabetes mellitus aged (6-14) years old and found that there was an accelerated tooth eruption among diabetic patients accompanied by increased gingival inflammation. The aim of this study was to determine the effect of type I diabetes mellitus on eruption time of dentition and to evaluate the dental caries, debris, calculus and gingival index for both groups.

Methods

In this clinical study all children and adolescent with age range from 6-14 years who were attending to Layla Qasim Center for Diabetes and the Diabetic Child Association Center in Erbil City were included in the study in the period between Dec. 2010 to Mar. 2011.

The inclusion criteria involve:-

- 1-Diabetic patients who do not use drugs that would affect the mouth flora, immune system or the inflammatory response like antifungal drugs for oral candidiasis; in order not to change the oral microflora.
- 2-Patients without periodontal treatment in the last 6 months prior to the assessment.
- 3-Diabetic patients who do not have any sever pathology of the teeth like acute periodontitis.
- 4-Patient consent.

In the second (control) group they were subjects who selected randomly from those children visiting Pedodontic department at the College of Dentistry/ Hawler medical University and not suffer from any systemic disease. All the subjects were of similar age and gender. The age of the patient and the metabolic control of their diabetes were provided through medical case sheets. Both groups were given oral hygiene instructions like tooth brushing twice a day for one week before evaluation.

Clinical examination

Examinations and oral health assessments were performed according to the basic

method of the WHO for the year (1997); subjects were seated in an ordinary chair and examined under fluorescent light.⁸ Dentition was the first thing we looked for on the dental examination. The overall health of the erupted and erupting teeth and the tissues surrounding these teeth was examined. If the tissues surrounding the erupted tooth had at least one of the main symptoms of inflammation, it is assessed as existing. Teeth which manifest caries (DMFS/dmfs) were scored according to the examination protocol that has been advocated by World Health Organization (WHO)⁹ for the year (1987). The level of oral hygiene was estimated with the Simplified Oral Hygiene Index (debris index and calculus index)^{10,11} to evaluate the oral cleanliness. Each of these indices, in turn, is based on numerical determinations representing the amount the debris or calculus found on the selected tooth surface.⁸ Gingival index described by Ioe and Silness¹² was used for diagnosis and assessment of gingival health conditions and the Ramfjord teeth was examined which is the following: (16,21,24,36,41,44) for permanent and (55,61,64,75,81,84) for deciduous, the missing tooth was not substituted.¹³

Statistical analysis

Descriptive statistics include percentages, means and standard deviation, with statistical analysis data by using independent sample t-test for significant differences between two populations.

Results

Out of all the patients attending the two centers (188) only (66) patients fulfilled the inclusion criteria for participation in the study. The study group consisted of 66 subjects with type I diabetes mellitus (33 males, 33 females), age 6-14 years. In the second group (control group) there were 66 healthy subjects who did not suffer from any systemic disease (33 males, 33 females), age 6-14 years with an average age of 10 years.

Tooth eruption

The distribution of erupted teeth in the group with type I diabetes mellitus according to the age is given in the Table(1), and that of the control group is given in The table (2). When comparing the diabetic group with non-diabetic group, we found earlier eruption of teeth in all ages in the study group with a range of (1.6) years than that of control group till age of 14 where all the permanent teeth will be fully erupted in both groups.

Dental caries

Results showed that the mean value of (dmft) in the diabetic group was lower than the control with significant and highly significant differences for both age groups (9-11) and (12-14) respectively, as shown in Table (3). Table (4) demonstrate that the total mean value of (dmfs) in the diabetic group was less than that of control group for both age groups (6-8) and (12-14), while for age group (9-11) the total mean value of (dmfs) in the diabetic group was higher than that of control group, however the differences was statistically not significant.

The result showed that the mean of (DMFT) in the diabetic group was lower than the control with no significant differences between the two groups, as shown in Table (5). In Table (6); there was less caries experience (DMFS) among the diabetics compared to control group, the differences was statistically not significant.

Periodontal health

The gingival index (GI) according to the age groups for both diabetic and control group is seen in Table (7). Results showed that the gingival index among the diabetic group was higher than that in control group, with no statistical difference between them. The results showed that the total mean value of Simplified Debris Index in the control group was higher than that of the diabetic group with significant differences between them for the age group (12-14) years old, as shown in Table (8), while the total mean value of Simplified Calculus Index in the diabetic group was higher than that of the control group with significant difference for the age group (12-14) years old as in Table (9)

Table 1: The number of erupted primary and permanent teeth per person in type I diabetes mellitus

Age (years)	Incisors *N8		Canine N4		Molar N8 Primary	Premolar N8 permanent	First molar N4 permanent	Second molar N4 permanent	Total N28
	Primary	Permanent	Primary	Permanent					
6	7.3	0.7	4.0	-	8.0	-	0.8	-	20.8
7	3.75	4.25	4.0	-	8.0	-	4.0	-	24.0
8	2.0	6.0	3.7	0.3	7.4	0.6	4.0	-	24.0
9	-	8.0	3.1	0.9	7.1	0.9	4.0	-	24.0
10	-	8.0	2.0	2.0	3.5	4.5	4.0	0.25	24.25
11	-	8.0	1.5	2.5	1.5	6.5	4.0	0.25	24.25
12	-	8.0	0.5	3.5	1.5	6.5	4.0	0.5	24.5
13	-	8.0	0.4	3.6	0.8	7.2	4.0	3.25	26.25
14	-	8.0	-	4.0	-	8.0	4.0	4.0	28.0

*N: No. of teeth

Table 2: The number of erupted primary and permanent teeth per person in non-diabetics

Age (years)	Incisors *N8		Canine N4		Molar N8 Primary	Premolar N8 permanent	First molar N4 permanent	Second molar N4 permanent	Total N28
	Primary	Permanent	Primary	Permanent					
6	8.0	-	4.0	-	8.0	-	-	-	18.0
7	4.5	3.5	4.0	-	8.0	-	3.75	-	23.75
8	4.3	3.7	4.0	-	8.0	-	3.75	-	23.75
9	0.7	7.3	4.0	-	8.0	-	4.0	-	24.0
10	0.7	7.3	3.5	0.5	7.0	1.0	4.0	-	24.0
11	0.2	7.8	1.5	2.5	1.5	6.5	4.0	-	24.0
12	0.1	7.9	1.25	2.75	1.5	6.5	4.0	0.9	24.9
13	-	8.0	1.5	2.5	1.5	6.5	4.0	0.9	24.9
14	-	8.0	-	4.0	-	8.0	4.0	4.0	28.0

*N: No. of teeth

Table 3: Caries experience (dmft) of deciduous teeth in the diabetic and control groups by age groups

Age (years)	Diabetic group * dmft			Control group Dmft			P value
	No.	Mean	±SD	No.	Mean	±SD	
6-8	20	5.9	2.7	20	7.5	3.7	0.227
9-11	24	4.5	2.4	24	5.7	1.8	0.048**
12-14	22	0.8	2.08	22	5.8	1.7	0.001***

*d: decay m:missing f: filling t: teeth
 ** Significant
 *** Highly Significant

Table 4: Caries experience (dmfs) of deciduous teeth in the diabetic and control groups by age groups

Age (years)	Diabetic group dmfs			Control group Dmfs			P value
	No.	Mean	±SD	No.	Mean	±SD	
6-8	20	16.9	10.3	20	20.4	15.8	0.45
9-11	24	16.5	13.0	24	14.0	6.2	0.33
12-14	22	1.2	1.5	22	9.7	4.1	0.68

*d: decay m:missing f: filling s: surface

Table 5: Caries experience (DMFT) of permanent teeth in the diabetic and control groups by age groups

Age (years)	Diabetic group DMFT			Control group DMFT			P value
	No.	Mean	±SD	No.	Mean	±SD	
6-8	20	1.6	1.4	20	1.8	1.6	0.651
9-11	24	3.5	1.2	24	4.0	0.8	0.162
12-14	22	7.2	4.6	22	8.1	2.2	0.37

Table 6: Caries experience (DMFS) of permanent teeth in the diabetic and control groups by age groups

Age (years)	Diabetic group DMFS			Control group DMFS			P value
	No.	Mean	±SD	No.	Mean	±SD	
6-8	20	2.1	2.3	20	2.5	2.4	0.29
9-11	24	5.4	1.7	24	5.6	3.0	0.79
12-14	22	12.2	9.8	22	12.5	4.5	0.89

Table 7: Gingival Index (GI) of permanent teeth in the diabetic and control groups by age groups

Age (years)	Diabetic group GI			Control group GI			P value
	No.	Mean	±SD	No.	Mean	±SD	
6-8	20	1.2	0.3	20	1.1	0.3	0.281
9-11	24	1.3	0.37	24	1.2	0.29	0.22
12-14	22	1.5	0.3	22	1.4	0.3	0.56

Table 8: Debris Index Simplified (DI-S) of the diabetic and control groups by age groups

Age (years)	Diabetic group DI-S			Control group DI-S			P value
	No.	Mean	\pm SD	No.	Mean	\pm SD	
6-8	20	9.1	2.7	20	10.6	4.1	0.114
9-11	24	11.7	1.7	24	13.0	2.4	0.08
12-14	22	10.5	2.3	22	12.2	1.9	0.04*

*significant

Table 9: Calculus Index Simplified (CI-S) of the diabetic and control groups by age groups

Age (years)	Diabetic group CI-S			Control group CI-S			P value
	No.	Mean	\pm SD	No.	Mean	\pm SD	
6-8	20	1.1	0.9	20	0.7	0.9	0.163
9-11	24	2.0	1.9	24	1.7	1.6	0.621
12-14	22	5.0	1.2	22	2.4	2.9	0.01*

*significant

Discussion

Children with diabetes endure many problems during the course of their life. Dentition and oral health problems are among these. In this study the effects of diabetes on tooth eruption and oral health were evaluated by using clinical findings.⁶ Eruption is the cutting of the tooth through oral mucosa, and it is seen in the mouth by the upright action of the tooth through the crista of the gums. It is a regular physiological process of growth and no inflammation occurs under normal conditions. However, it has been shown that diseases containing metabolic instabilities like diabetics weaken the resistance to inflammation in individuals.¹⁴ Indeed, in our study, gingival inflammation accompanied eruption in the diabetic individuals at a higher rate than in the non-diabetic ones. Our study results are compatible with that of Bohatka et al¹⁵, who reported early dental development in diabetic children less than 11.5 years old. Also Adler et al.¹⁶ have suggested that metabolic disorders as responsible for the early eruption. This result is incongruent with common knowledge (especially for the eruption of canine and premolars). The present study showed that the the mean (dmft, dmfs, DMFT and DMFS) for the diabetic patients were lower than that for the control group. The lower caries experience may be contributed to the fact that the diabetics traditionally been counseled to consume a diet low in refine carbohydrates, especially sucrose, and the modern dietary advices, the soft drinks and other sugar containing sweets could be replaced with those containing non-cariogenic sweeteners. Less snacking may be another explanation for the decrease in dental caries in diabetics compared to controls. The results of our study is in agreement to many authors.¹⁷⁻²⁰

This study also reported that the mean value of (DI-S) in the control group was higher than that of the diabetic group, with significant differences, and dental caries is plaque related disease as proved by numerous studies.²¹⁻²³ Less frequency of the

snacks can slow down the production of debris in diabetics compared to controls. This result comes in agreement with many studies.^{20,24,25} The result of present study showed that the total mean value of (CI-S) in the diabetic group was higher than that of the control group, this comes in agreement with Siudikiene²⁵ and Orbak⁶, in which they found that the difference between the diabetic and control groups in the amount of calculus. Increased calculus formation reported I patient with diabetes, may be due to an increased concentration of salivary calcium in parotid and submandibular saliva of subjects with type I diabetes in addition to elevated salivary proteins and urea which lead to heavy calculus formation. The prevention of periodontal breakdown in diabetic patients is mostly based on the education of the individual. Thus, patients should be informed about the importance of oral health for diabetics, and they should be taught that the main symptom of periodontal disease is gingival bleeding.²⁶ Plaque and calculus deposits, which are the most important pathogenic factors of periodontopathy in the oral cavity, should be removed through careful self-care and regular professional care to reduce the risk of periodontitis for diabetics. Patients should also learn how to brush their teeth correctly, which should be done at least twice a day, and how to use dental floss and sometimes chlorhexidine digluconate 0.2%.The pediatrician's concern is to maintain good metabolic control and to make diabetic patients aware of a diet that suits their unique nutritional needs. The obligation of the dentist to the patient is to evaluate and help maintain good oral hygiene.

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