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DOES DIABETES INFLUENCE ORAL HEALTH IN CHILDREN?

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Abstract

Background and aims: *Diabetes has a high prevalence in both pediatric as well as adult populations in present times. Dental caries represents also a very serious problem form the health point of view in all population. Our study wishes to emphasize the relation between diabetes and oral health status in pediatric patients, also inquiring upon their awareness of the link between the two.* ***Material and method:*** *15 diabetic patients were compared with 15 non-diabetic matching patients.* ***Results:*** *The study concluded in showing the importance of a correct oral hygiene in all patients with emphasize in cases of diabetic patients.* ***Conclusions:*** *Awareness of the link between diabetes and oral health status should be promoted not only by dentists but also by their general medicine practitioner as well as diabetes specialists and nutrition specialist.*

key words: *Children, diabetes, oral health, oral hygiene habits, pediatric dentistry*

Background and aims

According to the World Health Organization, in 2014 there were 422 million people with diabetes worldwide (type 1 and 2) and it was expected at that time that diabetes will be the seventh leading cause of death worldwide. Diabetes is a major problem that needs to be tackled in a multidisciplinary way. In 2016 diabetes has been the 7th cause for death [1].

In 2014 the global prevalence of diabetes among adults was 8.5% and has been rising more rapidly in middle and low-income countries.

According to several studies, including that of SEARCH for Diabetes in Youth, it has been reported that type 1 diabetes is the most common in children. This study also found a 23% increase in type 1 diabetes among young Americans between 2001 and 2009, and a 21% increase in type 2 diabetes probably caused by an increase in sedentary lifestyle and obesity. in the same age group [2].

Type 1 diabetes or insulin-dependent is characterized by deficient insulin production and requires daily administration of insulin. The cause of type 1 diabetes is not known, and it is not preventable with current knowledge. The major sequelae of type 1 diabetes include

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dysfunction of several organs, such as that of the kidneys, eyes, and heart and young patients are eventually affected by growth and developmental disorders.

The pathogenesis of type 2 diabetes is heterogeneous. In combination with insulin resistance and B-cell dysfunction, it is also associated with reported obesity that causes lipid metabolism disorders (gluco- and lipotoxicity) [3]. During the first years the secretion of insulin is generally preserved but it does not allow a sufficient response to the increased resistance to insulin [2,4].

The goal is to reduce insulin resistance and thus protect B cells [5]. According to Sheen et al, there are two possible approaches, one based on lifestyle modifications and the other using pharmacological approaches, the best of which is considered complementary.

Dental caries represents a major public health problem worldwide and they are also considered to be the most widespread noncommunicable disease (NCD). In the 2015 Global Burden of Disease Study, dental caries represented the most prevalent disease, ranking first for decay of permanent teeth (2.3 billion people) and 12th for deciduous teeth (560 million children). In low-income countries, most dental caries goes untreated and teeth affected by caries are often extracted when they cause pain or discomfort. Severe dental caries can impair quality of life as the presence of dental caries may cause difficulties in eating and sleeping, and in its complicated stages (abscesses), may cause chronic systemic infection. Dental caries have also been associated with adverse growth patterns. Furthermore, tooth decay is a frequent cause of absence from school or work.

In The Lancet, the NCD Risk Factor Collaboration (NCD-RisC) presents a robust and timely analysis of trends in diabetes prevalence [6]. NCD-RisC estimates that the number of people with diabetes quadrupled between 1980 and 2014. Among risks Overweight and obesity, together with physical inactivity, are responsible for a substantial proportion of the global diabetes burden [7].

The association between caries and diabetes has been studied in many studies [8,9]. Dental caries as well as type 2 diabetes can be prevented through simple and cost-effective population-wide and individual interventions, recommending hygiene and dietary measures at early ages where sedentary lifestyle is increasing [10]. Otherwise their treatment is costly and is sometimes unavailable in low- and middle-income countries.

Seeing as both diseases are related to lifestyle and dietary habits, we wanted to study the relationship between diabetes and oral health status in children by assessing their oral health status and their knowledge on the relationship between diabetes and oral health.

Material and method

Study design and patients

The diabetic population included in our study consisted of 15 children and young adolescents with ages between 5 and 17 years, who underwent treatment in the Paediatric Clinic in Cluj-Napoca and benefitted from dental treatments in the Pediatric Dentistry Department of the Iuliu Haţieganu University of Medicine and Pharmacy in Cluj-Napoca during the period of one month. This group was age and sex matched to 15 non-diabetic patients from the same two clinics. The inclusion criteria consisted in children who underwent treatment in both clinics during the same month. For each diabetic patient there was a match in the non-diabetic group. The diabetics had no other systemic disease and their charts were complete. The non-diabetic patients were also cleared of any systemic disease and had complete charts in both

clinics. Also, there were no tooth structural anomalies within the two groups.

Clinical investigations

The study consists of a transversal, descriptive epidemiological inquiry done on 15 diabetic and 15 nondiabetic children with ages between 5 and 17. For each patient an informed consent of taking part in our study was obtained from their parents or legal guardians.

All participants were given a questioner in order to register their information regarding their type of diabetes, the frequency of their diabetic hypoglycemic crises, their oral hygiene habits, frequency in dental appointments, other data such as dry mouth sensation, changes in taste sensations and their knowledge linking diabetes with oral pathologies.

Also, every participant was subjected to an oral examination that allowed the assessment of the DMFT (Decay-Missing-Filling Teeth) Index, OHI-S Index (Oral Hygiene Index-Simplified) and the SBI Index (Sulcus Bleeding Index). The examination kit consisted of mirror, dental probe, 5 mm scaled-periodontal probe [11].

Data concerning their glycemic indexes were obtained from their charts from their last appointment in the medical clinic.

Statistical analysis

All data was coded in an Excel Spreadsheet and descriptive statistics as well as some correlations were done using the software.

Results

From the examined diabetic patients 14 (93,33 %) were affected by type 1 Diabetes and were all treated with daily insulin injections while only one patient (6,66%) had type 2 diabetes and was treated with Metformin.

The amount of years that have passed since they were diagnosed with diabetes is synthetized in Table 1.

Table 1. Results concerning the duration of the diabetes diagnosis.

Duration of Diabetes	Number of children	Percentage
Less than 5 years	10	66,67%
Between 5 and 9 years	4	26,67%
More than 9 years	1	6,67%

The glycemic balance was assessed from the values of the HbA1 dosage at their last appointment and is presented in Table 2.

Table 2. Glycemic balance of the examined diabetic population.

HbA1	Glycemic ballance	Number of children
<7,5%	Good	1
Between 7,5% and 9%	Acceptable	4
>9%	Fair	10

While assessing the oral hygiene habits of the diabetic patients we observed that while they needed sugary snacks sometimes to recover form a hypoglycemic crisis, only 20% of the affected children used to brush their teeth of the sugary intake while 80 % took no oral hygiene preventive measures.

When assessing the knowledge of our pediatric diabetic patients concerning a link between the diabetes and the status of oral health we observed that 93,3% of the patients were unaware of a possible link between the 2.

Diabetic patients also presented other oral symptoms related to the diabetes, and they can be assessed in Table 3. It was observed that 46,67% of the patients suffered from some type of oral discomfort.

Table 3. Oral symptoms affecting pediatric diabetic patients.

Symptom	Number of children affected
Dry mouth	1
Burning of the mucosa	2
Infections in the oral cavity	4

The frequency of brushing their teeth was compared between the diabetic and the non-diabetic patients from our study. The results can be seen in Table 4.

Table 4. Comparison between brushing habits between diabetic and non-diabetic children.

Frequency of Tooth-brushing	Number of children		Percentage	
	Diabetic	Non-diabetic	Diabetic	Non-diabetic
>2 times/day	4	2	27%	13%
2 times/day	5	8	33%	53%
1 times/day	5	4	33%	27%
occasionaly	1	1	7%	7%

Table 5. The frequency of using complimentary oral hygiene products.

Other oral hygiene products	Number of children		Percentage	
	Diabetic	Non-diabetic	Diabetic	Non-diabetic
Mouthwash	2	7	13%	47%
Interdental Tooth brush	0	0	0%	0%
Dental Floss	2	1	13%	7%
None	11	8	74%	53%

Table 6. OHI-S scores for the studied populations.

OHI-S	Number of children		Percentage	
	Diabetic	Non-diabetic	Diabetic	Non-diabetic
<1.2	2	2	13%	13%
1.3<OHI-S<3	12	10	80%	67%
3.1Ohi-S<6	1	3	7%	20%

The frequency of using other oral hygiene products was also assessed and it was synthetized in Table 5.

While analyzing the frequency of dental appointments it was observed that 67% of the diabetic children had their last appointment within the last 6 months while the rest of 33% had their appointment within the last year. For the non-diabetic patients 67% had their appointment within the last year, 26% had never been to the dentist before and 7% had their appointment within the last 6 months.

The OHI-S Index allows for the dentist to do a quick assessment of the oral hygiene status and is of the used in screening studies. For both components (Plaque and Calculus) there is the same coding:

- Absence of plaque/calculus on the dental surface
- Presence in the gingival third of the surface of plaque/calculus
- Presence on 2/3 of the dental surface of plaque / calculus
- Presence on more than 2/3 on the dental surface of plaque / calculus.

For the OHI=S Index, the most commonly used surfaces of teeth are: Buccal surfaces of teeth 16, 11, 26, 31 and lingual surfaces of 36, 46, In deciduous dentition the teeth taken into account are 54,51,64,71,74,84.

The two components of the index reveal the status of oral hygene of the patient. A OHI-S Index score can represent:

- Between 0 and 1.2- optimal hygiene
- Between 1.3 and 3- acceptable hygiene
- Between 3.1 and 6- poor hygiene

The results of the OHI-S index for our diabetic and non-diabetic patiens can be seen in Table 6.

The DMFT Index also presented similar values between the diabetic and non-diabetic children taken into our study. The average DMFT Index for both populations was between 6 and 7. However it was observed that there was a difference among the two studied populations between the values of the components. In for the diabetic population there was a higher value of the F (filling) component in comparison with the D (decay), for the diabetic population, while for the non-diabetic population it was the reverse: a higher D in comparison with F. It can also be correlated with the frequency of appointments in the dental office.

The SBI Index was also assessed for the two groups of patients. This index combines the clinical signs of gingival inflammation as well as the provoked bleeding, as first sign for gingivitis. After a gentile probing of the periodontal sulcus, the bleeding that occurs in the papillae and on the mucosa can be scored as following:

- Normal, no bleeding
- Normal papillae and mucosa but small bleeding after probing
- Inflammation of the papillae and gingiva, discrete edema and small bleeding
- Significant inflammation, color changes of the gingiva and bleeding when probing
- Ulcerations of the mucosa

The results after assessment are multiplied by 100 in order to have a percentage.

- <10% normal index
- 10-20% small gingival inflammation
- 20-50% moderate gingival inflammation
- >50% generalized gingival inflammation

It was observed that 53% of the diabetic patients and 40% of non-diabetic patients presented an SBI index lower than 10% while the others presented an SBI values between 10 and 20%. No subjects presented moderate or severe gingival inflammation. The results can also be correlated with the pre-pubertal and pubertal age of most patients and also with the changes in the mixed dentition.

Discussion

More than 66% of the diabetic participants in our study had a glycemic imbalance. The study is consistent with the ADA consortium that states that only a percentage between 30 and 50 % of the pediatric diabetic patient reach recommended values [12]. It is important to insure a better self-control of the glycemic values by doing more frequent glycemic post-prandial tests in order to avoid hypoglycemic crisis during night-time that are dangerous especially under 5 years of age when they can affect cognitive performances.

Informing the parents upon the complications and risks that can arise from a lack of consistence in controlling the glycaemic measures is essential [13].

Analysing the results of our study in regard with the importance of toothbrushing after consumption of sweets it is important to increase awareness of the risks through more campaigns for prevention. The message should not be delivered only by dentists but also by general doctors, diabetes specialists and nutrition specialists, even more so, as 93% of the diabetic patients stated that they have not been informed about the link that exists between diabetes and oral health status. The studied groups also presented questionable oral hygiene habits as they were not using auxiliary hygiene methods even though some of them brushed 2-3 times a day.

The results of the study are in accordance with studies from the literature in concluding that an early debut of the diabetes increases the

necessity for implementing preventive measures for dental caries. In this study, as well as in other studies it was emphasized that independent of a satisfactory oral hygiene, the diabetic patients that have difficulties controlling the disease present a higher risk of developing gingivitis [14]. Oral health complications related to diabetes affect the primary periodontium as early as age 6 and possibly earlier [15].

Our study reveals the lack of awareness of pediatric diabetes patients as well as their parents regarding the existent relationship between the oral health status and diabetes. We must emphasize that only 33%of the diabetic patients from the studied group consult with a dentist at least 1 time throughout the year and addressing their gingivitis is important in order to prevent periodontal problems. Also, the results of our studies emphasized the complications brought by a faulty or incomplete treatment plan for diabetes that should also address oral health implications. The diabetic patient has not actually realized of the gravity of his illness from an oral health-status -point of view and sometimes not even from a general status point of view.

From an administrative point of view, the diabetic patient has his treatment covered by programs from the National Health Institute, however, the treatment of oral complications linked to diabetes are not included in the covered treatment package. As there is a little coverage of all oral and dental treatments covered by national health programs of insurance, the diabetic patient who has an increased predisposition to oral health problems, without the proper prevention system is even more vulnerable.

Conclusions

The results of our study show an important lack of information regarding the bidirectional relation that exists between oral health status and periodontal disease. Unfortunately, nowadays the prevention linked with oral health takes a second place in the list of priorities when it should be first.

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