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SALIVARY FLOW RATE, SWEET SCORE AND PLAQUE STATUS IN TYPE 1 DIABETES MELLITUS AND NON-DIABETIC SUBJECTS AGED 6 TO 17 YEARS AND THEIR RELATIONSHIP WITH DENTAL CARIES.

Dental Science

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ABSTRACT

Background: The physiological changes in subjects suffering from Type 1 diabetes mellitus (T1DM) have a conspicuous influence on oral health status.

Aims: Evaluate salivary flow rate, plaque accumulation, diet history, glycemic control and its impact on dental caries in T1DM and Controls.

Methods and Material: A Cross-sectional analytical study was performed in a hospital situated in Bengaluru. Hundred subjects suffering from TIDM and 200 age and sex matched controls were selected. Association between Caries risk factors and prevalence of dental caries was obtained.

Results: The mean glycated hemoglobin value in the diabetics was 9.7 ± 1.9. Salivary flow rate and sweet score was lower in the diabetic patients as compared to controls. The prevalence of dental caries and accumulation of plaque was significantly more in T1DM patients (P<0.001).

Conclusions: Dental caries prevalence is higher in T1DM patients.

KEYWORDS

dental caries, oral hygiene, saliva, diabetes mellitus type 1.

INTRODUCTION

Type 1 Diabetes Mellitus (T1DM) has a considerable impact on the general as well as Oral Health. Its association with Dental Caries is not yet fully well understood.[1-3] Metabolic control, oral hygiene status, diet management and changes in salivary flow rate in T1DM patients may have an substantial influence on increased incidence of dental caries.[4] On the other hand, some studies have reported lower incidence of dental caries in type 1 diabetic patients due to restricted diet plans and lower sweet score.[5]

Risk factors for dental caries include oral cariogenic bacteria, unhindered intake of non-milk extrinsic sugar, decreased salivary flow rate, limited fluoride exposure and poor oral hygiene status. Various studies have shown that the levels of cariogenic bacteria, particularly Streptococcus Mutans and Lactobacilli are elevated in diabetic patients. [5,6] Salivary factors such as alteration in the ph, buffering capacity, changes in salivary constituents such as immunoglobulins; salivary calcium has an appreciable role in the progression of dental caries. [7]

The present study was conducted to compare the prevalence of dental caries in type 1 diabetics and non-diabetic subjects and to observe the association of factors such as oral hygiene status, metabolic control of diabetes, salivary flow rate, and sweet score with dental caries experience.

Material and Methods

A Cross-sectional analytical study was carried out for a period of 3 months, between May 2012 to August 2012, comparing the T1DM patients and non-diabetic controls for the prevalence of dental caries, salivary flow rate, plaque accumulation and sweet score using a 24 hours diet history. The present study was reviewed by Institution Ethics Committee of AECS Maaruti College of Dental Science and Research Centre. Informed consent was obtained from the parents/guardians of the participants and an oral assent was obtained from all the participants above 12 years of age.

Children and adolescents with T1DM, aged between 6-17 years (n = 100) and 200 age and sex matched non-diabetic individuals served as controls. The subjects were randomly selected from the Department of Endocrinology of a reputed hospital in Bengaluru. Glycemic control was established by the determination of glycated hemoglobin concentration, a test that evaluates the average amount of glucose in the blood over the last 2-3 months. The patients and their families had a similar socioeconomic status and lived in the same geographic area.

The parents-guardians of the participants completed the questionnaire providing demographic details such as the age, sex, family income, presence or absence of diabetes in the child and duration of diabetic condition. A 24 hours diet history was recorded for the patient with the help of an accompanying parent/guardian. The sweet score was obtained depending on the frequency of sugar exposure and consistency of the sugary food. The participants with a sweet score of greater than 15 were considered to be in the watch out zone for dental caries.[8] Clinical examination of the teeth was performed by a single examiner (KA) under standard conditions using the required armamentarium. The evaluation of the plaque index (PI) was performed according to the technique described by Silness and Loe in 1964. The DMFT index (D: decayed; M: missing; F: filled; S: surfaces of permanent dentition) and deft index (d: decayed; e: extracted; f: filled; s: surfaces of deciduous dentition) were assessed.[9,10] After the completion of the study, the participants were informed about their oral health status and were given adequate oral health education. Unstimulated salivary flow was examined under standard conditions, between 9-10 a.m., at least 1/2 hour after breakfast. During the collection, the participants were in a relaxed sitting position, the patients were told to allow the saliva to accumulate in the floor of the mouth and to expel it every 60 seconds for 5 minutes. The reference value for unstimulated salivary flow was considered as 0.3 ml/ minute.[4]

Descriptive statistics was done to derive the mean and standard deviation for the dependent and independent variables. Student t test was utilized to compare the indices score for DMFT, deft, Plaque index, salivary flow rate and Sweet score in both the groups. P value was considered significant at P < 0.001. Association among various independent variables and Dental Caries experience was done using one-way ANOVA.

Results:

All the study participants were selected between the ages 6 – 17 years. The study population included both males and females; there were 43 (43%) males and 57 (57%) females among cases. The Control group comprised 110 (55%) males and about 90 (45%) female subjects. (Table 1).

In this study attempt was made to understand Dental Caries experience using DMFT and deft scores. The DMFT score range was divided into 4 categories. Among the diabetics 10 (9.3%) subjects had no caries experience 42(39.2%) study subjects had caries ranging from 1-5 DMFT Score. Higher caries experience of more than 10 was noticed

among 20 (18.6%) individuals. The assessment made on the control group showed that there were 112(74.7%) subjects in this group with lower caries experience of 1-5 DMFT. There were no individuals having DMFT score of 10 or more. There was a clear difference in caries experience between Study and Control groups. The higher DMFT is significantly associated with Cases compared to Controls (P<0.001). As age group consisted of children 6-17 years in both groups the caries experience of the primary teeth was also estimated. Both lower deft scores and high DMFT score were noticeably associated significantly again in study group. The DMFT and deft scores were calculated for both study and control groups. As we noticed a significant difference in these scores between the two groups an attempt was made to establish statistical association between caries risk factors and prevalence of dental caries in both the groups.

Salivary flow rates of diabetics with a mean of 0.21 ± 0.24 mL and non-diabetics with a mean of 0.52 ± 0.22 mL. The mean glycemic control was 9.7 ±1.9. Poor metabolic control and lower salivary flow rate was significantly associated with increase prevalence of dental caries (P <0.001). Sweet score was 12.9±9.7 in controls and 10.6±5.6 in diabetic subjects. Higher sweet score, greater than 15 was significantly associated with the causation of dental caries (P <0.001)

The plaque is the basic causative factor in initiation of Caries and periodontal disease. The estimation of the plaque deposits are important to predict and Control Oral diseases. This investigation assessed plaque levels using Silness and Loe plaque index. The score 0 (excellent) was never noticed in any individual belonging to both groups. The score (0.1-0.9) was predominant in both the groups of children compared to other scores. The score ranging from 2 to 3 (poor) was found in only Juvenile diabetic children. The mean dental plaque scores were significantly higher in Juvenile diabetics compared to Controls (P<0.001) (Table 4).

There were 17 (15.8%) children suffering from less than 3 years. Majority (69) of diabetic children were having this condition between 3-6 years. There were also 21 (19.6%) children suffering since more than 6 years. The information with regard to the duration of diabetic condition was estimated to understand the role of diabetic duration on study variables like dental caries and periodontal disease. The mean duration was estimated to be 4.1±3.6, increase in duration was significantly associated with greater prevalence of dental caries (p<0.001).

Table 1. Showing demographic details of the study participants

Demographic details	Type 1 Diabetic subjects	Non-diabetic subjects		
Age in years	Numbers	Percentage %	Number	Percentage %
6-11yrs	47	47	115	57.5
12-17	53	53	85	42.5
Gender distribution	Numbers	Percentage %	Number	Percentage %
Male	43	43	110	55
Female	57	57	90	45

Both the groups were age and sex matched

Table 2. Showing comparison of mean DMFT, deft and Plaque score among the two groups

Indices score	Type 1 Diabetic subjects	Non-diabetic subjects	P value
	mean±SD		
DMFT	6.55 ± 5.80	2.44 ± 2.12	<0.001
Deft	3.66 ± 4.80	1.22 ± 1.09	<0.001
Plaque index score	1.02 ± 0.47	0.65 ± 0.41	<0.001

Table 3. Comparison between factors influencing dental caries incidence and DMFT/deft status among patients with type 1 diabetes mellitus and controls.

Parameters	Non –Diabetic patients	Diabetic patients
Salivary flow rate	0.52±0.22	0.21±0.24
Sweet score	12.9±9.7	10.6±5.6
Plaque score	0.65 ± 0.41	1.02 ± 0.47
DMFT	2.44 ± 2.12	6.55 ± 5.80
Deft	1.02 ± 0.47	3.66 ± 4.80

Table 4. Association between factors affecting Dental Caries and DMFT/deft status among patients suffering from type 1 diabetes mellitus.

Parameters	mean	SD	F-value	P-value
Salivary flow rate	0.21	0.24	8.54	<0.001
Sweet score	10.6	5.6	9.79	<0.001
Plaque score	1.02	0.47	2.43	<0.001
Metabolic control of T1DM	9.7	1.9	2.45	<0.001
Duration of T1DM	4.1	3.6	3.56	<0.001
DMFT	11.41	2.75	1.45	<0.001
Deft	8.76	4.34	1.56	<0.001

Discussion

The normal diet of diabetic children is low in the content of fermentable carbohydrates which serves as a substrate for cariogenic bacteria. In the present study higher caries experience in both primary and permanent teeth must have been the result of more frequent food intake than its content and consistency. Study conducted by Sarnat et al demonstrated that starch-rich diet and frequent meals as well as longer eating time in diabetics with similar caries experience in Type 1 diabetic compared to healthy population.[8] Another study conducted by Miko S et al reported a higher mean DMFT score (p <0.001), higher decayed (p<0.0001), and more filled (p <0.001) teeth than in the non-diabetic subjects indicating greater caries predilection in the Type 1 diabetics the findings were similar to the present study.[9] The Type 1 diabetes as a systemic complication may lead to behavioral changes in the subjects. The psychological impact of the disease process itself discourages subjects in following good dietary and oral hygiene habits.

The persistent hyperglycemia due to poor glycemic control in diabetic subjects leads to micro vascular changes in the blood vessels, as well as basement membrane alteration in the salivary glands, this leads to increased secretion of Glucose from the ductal cells of the salivary glands thereby increasing glucose content in saliva.[10] Tagelsir et al. also showed a greater incidence of untreated caries in diabetics as a result of neglect of Oral health due to more grave general health problem. The Type 1 diabetes as a systemic complication may lead to behavioral changes in the subjects.[11]

The mean plaque index scores were also significantly higher in diabetics compared to control group. Our study is in line with the study conducted by Amaral et al. who showed higher dental plaque in diabetics. In a study conducted by Costa et al. the score of visible plaque index were higher in diabetics .[12] This study was carried out in patients older than 10 year of age, they concluded that the possible explanations would be the influence of preadolescence and adolescent age which may sometimes lead to resistance against Oral hygiene, our study had subjects aged 6-17 years, many times resistance against good oral hygiene is possible and also the regularity of oral hygiene practices may not be strictly maintained. The higher levels of plaque scores may be secondary to the increased calculus in diabetic patients. Further the salivary factors like quantity and quality may also lead to plaque accumulation. The main alteration observed in saliva of Type 1 diabetics are hypo salivation, alteration in composition particularly those related to the levels of glucose, calcium, magnesium and proteins.[13] The higher protein content of saliva and decreased production compared to healthy subjects could further help in formation of dental plaque in type 1 diabetic patients. There is a possibility of decreased immune response against oral micro flora in diabetic patients which may further aid in development of relatively higher levels of dental plaque in diabetics.

Saliva has an anti-cariogenic action, due to reduced salivary flow dental caries may progress more aggressively.[14] When there is poor glycaemic control, the dehydration caused by polyuria probably increases the osmotic gradients of the blood vessels in relation to the salivary glands, limiting the salivary secretion.[4] The results of the present study show significant reduction of nonstimulated salivary flow rates in diabetic individuals, which is consistent with the findings of Busato et al.,[15] and Moreira et al.,[16]

Since Dental Caries is as a result of intersection of various host, agent,

environment and time factor, duration of Diabetic condition can also play a pivotal role in the causation of dental caries. In a study reported by Gun E Sandberga et al. reported patients with longer duration of diabetes had more carious lesions.[17] Another study conducted by Fábio M. et al. found that duration of diabetes is significantly associated with dental caries.[18] The present findings in our study are also similar to these studies the possible reason for increased dental caries in such patients is probably due to many reasons like constant supply of glucose due to altered permeability of blood vessels. Also changes in composition and flow of saliva and microbial load in the oral cavity may result in increased dental caries in these Type 1 diabetics.[16]

Conclusions

The lower salivary flow rate, poor oral hygiene, duration of diabetic condition and poor metabolic control in diabetics could have been related to their higher prevalence of dental caries in permanent and primary teeth. However the present study has some limitations, salivary constituents, ph of saliva and buffering capacity of saliva which play a crucial role in causation of dental caries,(16) have not been taken into account, more extensive longitudinal studies are required to evaluate various such parameters. As this specific group involved more adolescents there is a possibility of psychological and behavioral changes which may impair health behavior. Qualitative studies taking into account emotional, psychological and behavioral aspect in TIDM subjects should be performed to explore such possibilities.

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