Frequency and Pattern of Oral Manifestations and Oral Hygiene Practices among Cases with Diabetes Mellitus in Ajman, United Arab Emirates

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Abstract *Diabetes Mellitus* is a metabolic syndrome of heterogeneous etiology characterized by hyperglycemia which is due to insulin effect deficiency, and results in abnormal metabolism of fat, carbohydrate and protein. Diabetes is considered as a risk factor for oral health impairment/not on equal risk for oral complications which are mostly due to poor diabetes control, buffering capacity and cleansing of saliva is diminished, altered immune system.

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1. Introduction

To determine the frequency and pattern of oral manifestations in patients with Diabetes Mellitus and to assess factors associated with oral manifestations in patients with Diabetes Mellitus

A hospital based study adopted a prospective cross-sectional design. All subjects (both Type I and II) with diabetes, attend department of internal medicine Gulf Medical College Hospital and Research Centre, Ajman, UAE An interviewer-administered questionnaire was designed and used for data collection.

Standard methods of systematic sequential **examination** for any clinical manifestations in respect to infection control using sterile disposable diagnostic instrument, cheek retractors, and periodontal probes. Examination of oral cavity done to find out any oral lesion and to correlate the symptoms with the signs observed and for periodontal evaluation.

The Statistical package SPSS 20 version, with a descriptive and inferential analysis. All data will be expressed as frequency and percentage, frequencies and percentage. The level for statistical significance for all hypothesis will be set at a minimum of $p<0.05$.

A total 404 subjects with Diabetes Mellitus with age ranged from 16-79 years. Majority (42.4%) of the subjects were in the age group 46-60 years, 61.1% were males and 38.9% were females. In regards to diabetes type, 91.4% of the subjects were diagnosed as having type II Diabetes.

32.1% of the subjects were firstly diagnosed at age over 40 years.

76.0% of the subjects had family history of type I and 19.7% of type II, 4.3% had family history without knowing the exact type.

In regard to diabetes duration, 76.3% of patients had diabetes history less than 5 years on the other hand only 5.3% of subjects were having more than 16 years diabetes history. Hb_{A1c} level was less than 7% in 80.8% of the subjects. 30.7% of the subjects were taking insulin injection for diabetes control. Smokers consist 22.6% of the sample.

Some diabetic subjects had other systemic diseases in addition, 60 (16.8%) subjects had hypertension also, one of them had Grinspan's syndrome in whom lichen planus found also as a reticular type in both sides buccal mucosa.

Halitosis found in 60.65% followed by dry mouth in 59.1%, only 9.8% complain from burning sensation, which is cited in the tongue in 5.5% and in oral mucosa in 4.6% of the subjects. While both recurrent oral ulceration and reticular lichen planus were found in 8 subjects located on buccal mucosa and tongue. Males show frequent oral findings in older age, poor controlled groups had periodontitis. Oral lesions showed no significant relation to the age of the subjects, diabetes type and family history of diabetes. Disturbance of taste sensation shows a significant association with duration of diabetes by using Chi-square test.

Diabetes mellitus prevalence has been increasing, it affects people of all ages, both gender. When it's not controlled can result systemic and oral manifestations and

complications. Prevention and management of diabetes and its oral complications requires proper medical monitoring, life style change, routine professional dental, oral checkups and a rigorous home care.

Diabetes Mellitus is a syndrome of metabolic disease of heterogeneous etiology, characterized by hyperglycemia which is due to insulin effect deficiency, and results in abnormal metabolism of fat, carbohydrate and protein. It is the commonest endocrine disorder of childhood and adolescence, which impairs physical and emotional development [1,2]. As many systemic diseases, Diabetes Mellitus affects host response as primary immuno deficiencies or secondary defects caused by lack of nutrients or change in the local tissue, commonly reflected in the oral tissue [3].

Diabetes is considered as a risk factor for oral health impairment [4,5,6]. On the other hand not all diabetic patients at same risk, variations are related to the differences in the diabetes status, duration of diabetes, age at diagnosis, presence of organ complication and HbA$_1$c level may play role. Poor oral hygiene, gingivitis, heavy plaque, calculus accumulation, periodontitis were found in diabetic type I children and adolescents [2,7,8]. There is two directional relationship between periodontal disease and diabetes mellitus that makes diabetes an important disorder to dentists and to dental patients [9].

Xerostomia, has been reported in people with diabetes. The constant dryness of the oral soft tissues will in turn cause pain and inflammation, patients with xerostomia are more predisposed to periodontal infection and tooth decay [6,9].

Taste dysfunction has been reported more frequently occurring in patients with poorly controlled diabetes in comparison to healthy controls. Salivary dysfunction can contribute to elevation of detection thresholds of test [6]. Burning mouth syndrome (BMS) is a painful condition can affect diabetic patients. It is mainly caused by neuropathies and changes in the small vessels of the oral tissues [10].

Poor glycemic control in adults with diabetes have been associated significantly with oral candid infection. Hypo function of salivary glands may also increase the oral candidal carriage state in adults with diabetes [6,10].

High prevalence of lichen planus and recurrent aphthous stomatitis had been reported in diabetic patients, which might be due to chronic immunosuppression [6,10]. Saliva thought to function in part by formation of a protective tenacious film or pellicles, can serve as the receptors for initial bacterial colonization, which leads to formation dental plaque which in turn, is responsible for initiating of the most common oral infections: caries and periodontal disease [11]. Nearly 64% of patients with diabetes may have gingival inflammation compared with 50% of subjects without diabetes [12].

The classical clinical complications of diabetes mellitus are nephropathy, retinopathy, neuropathy, poor wound healing and macrovascular disease. Periodontal disease was proposed as the sixth complication of diabetes mellitus [9]. Vascular abnormalities, non enzymatic glycosylation, altered collagen metabolism, altered monocytic response, imbalance in lipid metabolism, neutrophil dysfunction, and change in host response to periodontal pathogen account for differences in periodontal tissue distraction 13. The risk of periodontitis development in patients with diabetes is three times higher than the general population as reported [6].

It is well-known that the buffering capacity and cleansing of saliva is diminished in patients with diabetes mellitus which results in an increased incidence of dental caries, especially in those with xerostomia [14,15]. Enamel Hypoplasia may results from high level of fluoride or from disturbances in calcium and phosphate metabolism, can occur in type I diabetes [16]. Facial paraesthesia, tremormay occur as a result of neuropathy.

The impact and incidence of Diabetes-related complications on public health is alarming. The oral complications discussed above have been associated with Diabetes Mellitus can be prevented or significantly delayed with early diagnosis, improved diabetes management and public awareness of diabetes risk factors and complications. Oral manifestations are common diabetic complications found across the world. Due to the increasing incidence of diabetes mellitus in the Gulf countries, the incidence of oral manifestations has increased significantly. Early diagnosis and treatment is the mainstay to prevent the complications of diabetes mellitus.

The results of the research may help to assess the need for casting the oral health care program (Screening clinic) at Gulf Medical College Hospital and Research Centre, Ajman, UAE, which is a comprehensive approach to maintain oral health of diabetic patients' in order to reduce the oral complications, thereby gradually reducing the economic burden to the health care system, patients, and community. The primary objective of the study is to determine the prevalence and pattern of oral manifestations in patients with Diabetes Mellitusand to assess the association between oral manifestations and status of diabetes control, socio-demographic characteristics and duration of Diabetes Mellitus

2. Objectives of the Study

2.1. Primary Objective

To determine the frequency and pattern of oral manifestations in patients with Diabetes Mellitus

2.2. Secondary Objectives

To assess the factors associated with oral manifestations in patients with Diabetes Mellitus
To determine the association between oral manifestations and
  status of diabetes control
  socio-demographic characteristics
  duration of Diabetes Mellitus

3. Materials and Methods

This hospital based study adopted a prospective cross-sectional design. All subjects (both Type I and II) with diabetes who have visited Gulf Medical College Hospital and Research Centre, Ajman, UAE were considered irrespective of their age, gender and duration of diabetes and willing to take part in the research were asked to sign a written consent form.

GMU Ethics and Research Committees approved the study before starting the research. Efforts were made not to include patient's name, telephone number and other identification which may jeopardize the confidentiality issue.

A questionnaire was designed as an interviewer-administered and used for data collection. Items in the questionnaire were carefully selected from relevant previously published articles. The questionnaire had both open ended and closed ended questions, questions related to subjects' age and gender, education, occupation, nationality, Type and duration of diabetes, details of diabetic management were also included. Clinical examination of oral cavity was done to obtain data relevant to the oral manifestations. The questionnaire is divided into four sections: socio-demographic characteristics, details of Diabetes Mellitus, oral hygiene practices and examination of oral cavity.

A pilot study was conducted on 20 diabetic volunteers to assess the response of participants, feasibility, and adequateness to use the questionnaire before conducting the actual study. The research conditions of the pilot study were similar to the actual study, pilot study participants were excluded from the actual study.

Investigators identified potential participants from the list of appointments of each day. Assistance of clinic staff /nurse was obtained with recruitment of potential participants. After determining that patient fulfilled the inclusion criteria who are an outpatient, not pregnant with diabetes type I or II, the consent form and the information sheet were discussed. After obtaining consent, the confirmed cases were interviewed for collecting information pertaining to socio-demographic characteristics, Diabetes Mellitus, and Oral manifestations. Then the investigators performed the structured interviews and recorded all responses on the questionnaire. Oral health care practices, personal habits such as smoking, alcohol drinking habits were also elicited to determine their influence on oral manifestations.

Every participant examined thoroughly by standard methods of examination for any clinical manifestations in respect to infection control using sterile disposable diagnostic instrument, cheek retractors, periodontal probes. Examination of oral cavity done to find out any oral lesion and to correlate the symptoms with the signs observed.

Periodontal Evaluation – loss of epithelial attachment and probing depth was recorded with a calibrated periodontal probe graduated in millimeters. Probing the depth was measured from the gingival margin to the base of the pocket, considering a healthy sulcus as <3 mm. The level of epithelial attachment was evaluated from the cemento-enamel junction to the base of the sulcus, considering a healthy sulcus as <3 mm. Scoring of Periodontal Disease Index: is as follows:

Periodontal index	
6 1	6
6	1 6

1= central incisor, 6=first molar
Six Ramfjord selected teeth.
Score Criteria
4: < or = 3 mm from CEJ.
5: 3-6 mm from CEJ.
6: > 6 mm apically to CEJ.

Calculation: Total sores ÷ No. of teeth examined
Scores 1, 2,3 are for gingivitis
Scores 4,5,6 periodontitis
-All areas (M, D, B, L) is scored as a one unit. Only fully erupted teeth are scored.
CEJ: cement enamel Junction. Each of the present teeth in the table is given a score, and then the mean of the scores was calculated to represent the periodontal score of the patient. The diagnosis of oral manifestations was based up on clinical findings alone done by the oral medicine specialist.

The data was scanned for completeness, and responses coded and entered into the Excel spread sheet. Data processing carried out by the Statistical package PASW 18 version, with a descriptive and inferential analysis. All data expressed frequencies and percentage. The level for statistical significance for all analyses was set at a minimum of $p<0.05$.

4. Results

A total 404 subjects with Diabetes Mellitus (both Type I and II) who have visited the GMCHRC participated in the research with age ranged from 16-79 years.

Majority (42.4%) of the subjects were in the age group 46-60 years, 61.1% were males and 38.9% were females as displayed in Table 1 & Table 2. 55.8% were Arabs, the rest are of different nationalities, 62.5% were employed, while 37.5% were not (old age or house wives), 3.4% of them were unmarried or divorced.

Table 1. Age distribution of the sample

Age	No	%
< 30 years	37	9.0
31-45 years	161	39.8
46-60 years	1	42.4
> 61 Years	35	8.8
Total	399	100.0

Note: With regard to age 5 patients did not reveal their age, hence the only 399 patients were recorded their age

Table 2. Gender distribution of the sample

Gender	Frequency	Percent
Male	247	61.1
Female	157	38.9
Total	404	100.0

4.1. Diabetes Status

In regards to diabetes type, 91.4% of the subjects were diagnosed as having type II Diabetes, 32.1% of the subjects were firstly diagnosed at age over 40 years as shown in Table 3. 76.0% of the subjects had family history of type I and 19.7% of type II, 4.3% had family history without knowing the exact type.

Table 3. Age at diagnosis of diabetes

Age at diagnosis of diabetes	Frequency	Percent
< 10 years	40	10.1
11-20 Years	8	2.0
21-30 years	48	12.1
31-40 years	114	28.8
41-50 years	127	32.1
> 51 years	59	14.9
Total	396	100.0
Total	404	

Note: With regard of age at diagnosis 8 subjects did not mention the age at time diabetesdiagnosis.

In regard to diabetes duration, 76.3% of patients had diabetes history less than 5 years on the other hand only 5.3% of subjects were having more than 16 years diabetes history as revealed in Table 4.

Table 4. Duration of diabetes

Duration	Frequency	Percent
< 5 Years	305	76.3
6-15 Years	74	18.5
> 16 Years	21	5.3
Total	400	100.0
Total	404	

Note: Only 4 subjects did not mention the duration of diabetes in this study.

Hb_{A1c} level was less 7% in 80.8% of the subjects, where as 19.2% of the patients were poorly controlled in the last 3 months before study, 30.7% of the subjects were taking insulin injection for diabetes control, the rest were treated with food control and tablets.

Regarding diagnosed diabetes complications, neuropathy found in 61.1%, nephropathy in 5.4% and retinopathy in 4.7%. Subjects whom smokers consist 22.6% of the sample.

Some diabetic subjects had other systemic diseases in addition, 60 (16.8%) subjects had hypertension also, one of them had Grinspan's syndrome in whom lichen planus found also as a reticular type in both sides buccal mucosa. Table 5 displays diabetic subjects with systemic diseases.

Table 5. Diabetic subjects with other systemic diseases

Systemic diseases	Frequency	%
No systemic diseases	64	17.9
Dyslipidemia & Dyslipidemia with other diseases	176	49.2
Hypertension & Hypertension with other diseases	73	20.4
other diseases	45	12.6

4.2. Oral Findings

Other oral findings as shown in Table 6. Halitosis found in 60.65% followed by dry mouth in 59.1%, only 9.8% complain from burning sensation, which is cited in the tongue in 5.5% and in oral mucosa in 4.6% of the subjects. While both recurrent oral ulceration and reticular lichen planus were found in 8 subjects located on buccal mucosa and tongue.

Table 6. Oral findings

Oral findings	Frequency	Percent
Halitosis	240	60.1
Dry mouth	236	59.1
Taste disturbance	148	38.8
Oral infection (fungal)	31	11.3
Burning sensation	24	9.8
RUA*	5	2.0
MRG*	4	1.1
LP*	3	0.7

*RAU=Recurrent aphthousulceration, MRG=median rhomboid glossitis, LP=lichen planus.

In regard to dental prostheses 59 subjects had dental prostheses, 53 fixed, and 4 removable.

Gender had no significant association with oral findings in diabetic patients although 64.5% of subjects were with candidal infection, 63.4% were with dry mouth, 63.8% were with halitosis, 64.2% were with taste disturbance, 66.7% were with burning mouth, all were males, whereas RAU and LP found more in females, MRG equally distributed among subject's gender.

Periodontal index was measured for all subjects, the majority had no periodontitis, 10.8% of the them had measurement of less or equal to 3 mm from sulcus to cement –enamel junction (score 4), 69.6% of them belong to 46-60 years age group, 54.5% of them of less than 5 years duration of diabetes and all were of type II, 63.2% of subjects with score 4 were controlled, 36.85% were poorly controlled.

In regard to periodontitis, 1.4% of subjects with score 5 (3-6 mm measured from bottom of the sulcus to cement – enamel junction) were belonged to same age group (46-60 years), with equal distribution to 3 durations of diabetes given, subjects were equally distributed in both types of diabetes, 66.7% of subjects with score 5 were controlled while 33.35% were poorly controlled. No significant gender deference was found in Table 7.

Table 7. Gender distribution of periodontal index.

Scores	Percent in all patients	Male	Female
4	10.8	78.3%	21.7%
5	1.4	33.3%	66.7%

Oral lesions showed no significant relation to the age of the subjects whoever we found differences among distribution of oral lesions in different age groups as revealed in Table 8.

Table 8. Age distribution of oral lesions

Age group	% Dry mouth	%Halitosis	%taste distur.	%Burning	%RAU	%LP	%MRG	%Infection
11-20	15.8	15.1	17.0	12.5	20		0	6.6
21-30	12.4	13.0	13.6	16.7	0		0	13.3
31-40	30.9	29.4	26.5	20.8	0		25	33.3
41-50	27.0	28.6	26.5	25.0	40		50	33.3
>51	13.5	13.9	16.3	25.0	40		25	13.3

Table 9. Relation of diabetes duration and oral findings

Duration in years	% Dry mouth	%Halitosis	%taste distur.	%Burning	%RAU	%LP	%MRG	%Infection
<5	71.7	72.6	66	47.8	40	0	50	51.7
5-15	21.9	20.7	26.5	26.1	0	75	0	27.6
>15	6.4	6.8	7.5	26.1	60	25	50	20.7

Disturbance of taste sensation shows a significant association with duration of diabetes by using Chi-square test, P value < 0.01, other oral findings did not.

Low percentage of most of oral findings were in diabetes duration more than 15 years on the other hand highest percentage of findings were found in less than 5 years duration Table 9.

The majority of subjects were type II diabetes, no significant association found between any of the oral findings and the type of diabetes although all findings had high percentage in type II.

The family history of both types of diabetes showed no significant association with oral findings, although most of the findings were in subjects with family history of Type II diabetes mellitus.

There was no significant association between diabetes control and oral findings. Most of oral findings were higher percentage in poor controlled subjects with Hb_{A1c} level more than 7% Table 10.

Table 10. Diabetes control and oral findings

Control ofdiab.	% Dry mouth	%Halitosis	%taste ditur	%Burning	%RAU	%LP	%MRG	%Infection
Controlled	57.3	79.1	71.1	77.3	20	74.2	50	10
Poor controlled	65.8	20.9	28.9	22.7	80	25.8	50	90

Diabetes control done by food, medications or insulin injection or combination of them, 58.5% of subjects treated with tablets had dry mouth., 72.4% of subjects treated with injection had halitosis.

Halitosis, dry mouth, halitosis, test disturbance by using Chi-square test, where P value was <0.05 shows a significant association insulin injection. All patients with median rhomboidglossitis were treated with tablets, Table 11.

Table 11. diabetes treatment and oral findings

Treatment of diabetes	Dry mouth	Halitosis	Test ditur.	Burning	RAU	LP	MRG	Infection
Tablets%	58.5	60.8	38.1	9.0	1.8	75	1.2	10.6
Injection%	68.5	72.4	47,.5	7.7	20	25	0	7.1

5. Discussion

Most of the oral findings were in subjects with family history of type II diabetes, as the majority of our sample had family history of type II Diabetes mellitus.

Many of subjects had diabetes complications due micro vascular changes, others had hypertension and dyslipidemia that could results from diabetes complications, macrovascular complications could be a leading cause of death in those patients [6].

An increase in the duration and /or late diagnosis of diabetes, will result in an alteration in almost all tissues structure and their response including oral cavity [1], hence 76.3 of% of our sample had less than 5 years duration, and 28.8% were 31-40 years old at diagnosis, that explain the significance of dry mouth and all oral findings of high percentage in patients with diabetes duration less than 5 years.

In addition, in our study we found that controlled diabetic patients showed low percentage of oral findings than non controlled, this finding agreed with Quirino MR, Birman EG, Paula CR study results, with exception some of the findings were of a high percentage in controlled diabetes as halitosis, test disturbances and burning sensation that may attribute to the side effect of diabetes treatment specially insulin injection.

The sixth most prevalent complication of diabetes mellitus is the periodontal diseases following the other diabetic complications [13]. It was the most frequent oral complication of diabetes as reported, compared to other oral manifestations such as dental caries and dry mouth. Diabetic patients with poor glycemic control have severe and more frequent periodontitis. Early detection and treatment of these oral manifestations may help in the earlydiagnosis of diabetes and in achieving better glycemic control. Therefore, the early identification of diabetes oral complications should done and included in the ultimate diabetes care, for better diabetes control and reduce its complications. Periodontal changes are the first clinical manifestation of diabetes as evidences suggest [6].

Grinspan's syndrome is the triad of diabetes mellitus, hypertension oral lichen planus, is reported, drug therapy for hypertension and diabetes mellitus is capable of producing lichenoid reactions of the oral mucosa, whether Grinspan's syndrome is an iatrogenically induced syndrome is the question arises [18], only one subject with hypertension found to have it in our study.

J Ghabanchiet alfound that MRG (6.43%) diabetic patients and (1.53%) of control group had MRG, In which the study was done on Iranian population only. There was a significant difference in the prevalence of MRG, between diabetic patients and control group. MRG showed no association with other variables (age, sex, duration of DM, drugs [2]. In comparison to our study which is done on a sample of different ethnicity and nationality show no such significant association.

It is not yet established by which mechanism, diabetes predisposes to high candidal infections. However it is widely recognized that high salivary glucose levels in diabetic patients favors yeast growth [19,20] but Quirino *et al.* found that subjects with hyposalivation had high frequency of Candida albicans infections [21].

6. Conclusion

Diabetes mellitus prevalence has been increasing, it affects people of all ages, both gender. When it's not controlled can result systemic and oral manifestations and complications. Prevention and management of diabetes and its oral complications requires proper medical monitoring, life style change, routine professional dental, oral checkups and a rigorous home care.

Suggestion

Promotion of oral health programs for diabetic patients is essential.

References

[1] Sperling MA, Jenson BK. Diabetes. Nelson textbook of pediatrics. 16th edition, USA: WB Saunders Company, 2000; pp 1348-49, 1768-86, 2183-210.

[2] Ghabanchi. J, AndishehTadbir. A, Darafshi.R and Sadegholvad. M. The Prevalence of Median Rhomboid Glossitis in Diabetic Patients: A Case-Control Study. 2011, 13 (7): 503-506.

[3] Madejczyk M, Buchanek T. Oral health of patients with diabetes mellitus-literature review. WiadLek 2001; 54 (9-10): 556-61.

[4] Meyle J, Gonzalez J. Influences of systemic disease on periodontitis in children and adolescents. Periodontol 2001; (26): 92-112.

[5] Moore P, Guggenheimer J, Etzel K, Weyant R, Orchard T. Type I diabetes mellitus xerostomia, and salivary flow rates. Oral Surg Oral Med Oral Pathol Oral RadiolEndod 2001; 92 (3): 281-91.

[6] Awatif Y. Al-Maskari, Masoud Y. Al-Maskari, and Salem Al-Sudairy. Oral Manifestations and Complications of Diabetes Mellitus. SultanQaboosUniv Med J. 2011; 11 (2): 179-186.

[7] Ervasti T, Knuuttila M, Pohjamos L, Haukipuros K. Relation between control of diabetes and gingival bleeding. J Periodontol 1991; 56 (3): 154-7.

[8] Karjalainen KM, Knuuttila MLE. The onset of diabetes and poor metabolic control increases gingival bleeding in children and adolescents with insulin-dependent diabetes mellitus. J Clin Periodontal 1996 B; (23) 1060-7.

[9] Ira B. Lamster, EvanthiaLalla, Wenche S. Borgnakke. The relationship between oral health and diabetes mellitus. *JADA* 2008; (139): 19S-24S.

[10] Jonathan A. Ship, Diabetes and oral Health An overview. JADA, 2003; 134 (1): 45-105.

[11] Malanud D. Diabetes and oral health promotion: A survey of disease prevention behavior. JADA 2000; (131): 1333-41.

[12] Al-Bandar J, Tinoco E. Global epidemiology of periodontal diseases in children and young persons. Periodontology 2002; (29): 153-76.

[13] Ryan M, Cranu O, Kamer A. The influence of diabetes on the periodontal tissues. JADA 2003; (134): 345-405.

[14] Blanco J, Bartolome B, Martinez E, Saavedra P, Blanco F. Bucco-dental problems in patients with diabetes mellitus (1): Index of plaque and dental caries. Med Oral 2003; 8 (2): 97-109.

[15] Lopez M, Colloca M, Paez R, Schullmach J, Koss M, Chervonagura A. Salivary characteristics of diabetic children. Braz Dent J 2003; 14 (1): 26-31.

[16] Karjalainen KM, Knuuttila MLE. Relationship between caries and level of metabolic balance in children and adolescents with insulin-dependent diabetes mellitus. Caries Res 1997; 31 (1): 13-8.

[17] Carranza FA, Newman mg. Clinical periodontology. 8th edition, WB Saunders Company 1996; pp. 61-71, 108.

[18] SalihH.M.Aljabri. Grinspan's syndrome. Journal of the American Academy of Dermatology; Volume 30, Issue 4, Page 671, April 1994.

[19] Guggenheimer J, Moore PA, Rossie K, Myers D, Mongelluzzo MB, Block HM, Weyant R, Orchard T. Insulin-dependent diabetes mellitus and oral soft tissue pathologies: II. Prevalence and characteristics of Candida and Candidal lesions. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2000; 89: 570-6.

[20] Soysa NS, Samaranayake LP, Ellepola AN. Diabetes mellitus as a contributory factor in oral candidosis. Diabet Med 2006; 23: 455-9.

[21] Quirino MR, Birman EG, Paula CR. Oral manifestations of Diabetes mellitus in controlled and uncontrolled patients. Braz Dent J 1995; 6: 131-6.