ETIOLOGY AND RISK FACTORS OF STOMATITIS AMONG YEMENI DENTURE WEARERS

Abstract

Denture stomatitis (DS) is a benign condition, usually asymptomatic, that can affect denture wearers patients. The aims of this study is to describe the etiology of DS among Yemeni denture wearers and the risk factors of DS. A cross sectional study was carried out at Prothodontics Departments at the Faculty of Dentistry- Sana'a University, Sana'a city – Yemen. The study group consisted of 288 denture wearers' patients' contracting DS. The microbiological samples were collected by wiping sterile swabs on upper and lower denture fitting surfaces. Then, they were directly cultured for *Candida* in Chromomeric agar media and for bacteria in standard selective media, using standard bacteriological methods. The most common microbial cause of DS was *C. albicans* (58.3%), followed by *S. mutans* (17%), while *S.aureus* (4.9%), *lactobacillus* (3.1%) and *C.glabrata* (4.2%) were less common. There was an association between male patients, older age group and longer period of denture wearers with high risk of contracting candidal DS and bacterial DS. Most of those patients were suffering from DS Type I and few from Type II, but no case of DS Type III was found.

Ending, DS is a condition that commonly affects denture wearers, and should be treated even if asymptomatic. The condition requires a combined treatment approach from both patient and clinician, and the role of the patient must be stressed. Management of aetiological risk factors is key in order to prevent recurrence. Treatment modalities may include: treatment of any underlying systemic risk factors, improvement in the fit of existing dentures, replacement of existing dentures, improved denture hygiene and the use of antifungal agents. Whichever methods are employed, the main aim of treatment is to eradicate the biofilm from the patient's dentures.

Keywords: Denture stomatitis (DS); Candidal DS, Bacterial DS, DS risk factors, Sana'a city, Yemen.

Introduction

Denture stomatitis (DS) is a chronic inflammatory reaction commonly seen in denture wearing patients. Where mild inflammation and redness of the oral mucous membrane occurs beneath a denture[1]. The etiology is considered as multifactorial, with the prosthesis is considered as the prime etiologic factor. Etiological factors include poor denture hygiene, continual and night time wearing of removable dentures, accumulation of denture plaque, age of the denture and dryness of the mouth. Poor-fitting dentures may increase mucosal trauma which play a vital role in type I denture stomatitis and least importance in other types of DS, plaque on the inner

surface of the denture harbors micro-organisms causing inflammation of the mucosa, bacterial and yeast contamination of denture surface in which *C. albicans* has been shown to be highly implicated in the etiology of DS and may account for 90% of cases.[2,3]

C. albicans and *S. aureus* are microorganisms with an elevated adhesion capacity to the oral mucous. This adherence is enhanced *in vitro* when *Candida* is incubated simultaneously with *Streptococcus mutans (S. mutans), Streptococcus sanguis (S. sanguis), Streptococcus salivairus (S. salivairus)* or some other bacteria.[3]

There are many predisposing factors for DS such as oral hygiene, old age, diabetes mellitus, trauma, xerostomia, high carbohydrate diet, use broad spectrum antibiotics and smoking tobacco.[4-6]

Staging different classifications have been proposed, but the reference classification for DS is the one suggested by Newton in 1962, based exclusively on clinical criteria: According to Newton , it can be classified into 3 types: **Type** 1- Localized simple infection with pinpoint hyperemia and is usually trauma induced.[7,8] **Type 2-** Erythematous type, covers the entire or a part of the denture covering area.[7,8] **Type 3-** Granular type, involving the central part of the hard palate and the alveolar ridge.[9] The aims of the study were to determine the different microbial causative agents of denture stomatitis and also detect the risk factors contributing for the severe cases of denture stomatitis (type II and type III).

Subjects and Laboratory Methods

Cross sectional study was carried out in the Prosthodontic department at the Faculty of Dentistry- Sana'a University, from 11/2016 to 2/2017 on 288 Yemeni subjects (males and females), aged more than 35 years old. Data were collected by predesigned questionnaire. Samples were collected by wiping premoistened sterile cotton wool swabs on upper and lower denture fitting surfaces. Two swabs were collected for each patient one for mycological and the other for bacteriological investigation. For mycological investigations each sample was inoculated into both media: Sabouraud's dextrose agar and a differential and selective culture medium as Chrom agar Candida. Plates were incubated aerobically for 48 to 72 hours at 37 °C and were identified systematically by Colonial morphology, wet mount preparation, gram stain and germ tube. However for bacteriological investigations samples of *S. mutans* and *S. aureus* were cultured into Mitis Salivarius-Bacitracin agar and blood agar plate media and incubated at 35-37°C for 48 hours with addition 1% Potassium Tellurite. Then, were identified and differentiated from each other by their colonial morphology, catalase test, gram staining and microscopically examine, mannitol and sorbitol fermentation tests, hemolysis and coagulase test. But for *Lactobacillus* species, it were cultured overnight in MRS agar plate and incubated

at 37 $^{\circ}$C and then it were identified by their colonial morphology, gram staining, growth at 15°C and growth at 45°C and catalase test.

Data collection: Data including demographic data of the patients, clinical information, and potential risk factors of DS. The findings were recorded in a form with laboratory results.

Ethical approval

We obtained written consent from all cases. Assent was taken from participants before collecting the specimens. The study protocol was reviewed and approved by the Ethics Committee of Sana'a University, Faculty of Medicine and Health Sciences.

Results

This study was conducted on a total of 288 patients contracting DS attending Prosthetic department at the Faculty of Dentistry- Sana'a University from 11/2016 to 2/2017**.** Male patients were predominant in which they counted 59.4%, while female patients were counted 40.6%. The patients' age ranged from 35-65 years, and most of the patients were at the age group of +65 years, (32.6%). The most common microbial causes of DS was *C. albicans* (58.3%) of the total isolates, while *S. mutans* was the most common bacterial cause of DS(17%), while *S.aureus* (4.9%), *lactobacillus* (3.1%) and *C.glabrata* (4.2%) were less common. There was a highly significant association between male and high risk of contracting *Candida albicans* DS (OR=2.33,CI=1.4 to 3.9, and *p*< 0.001). There was a highly significant association between older age group (65+ years) and the high risk of contracting *Candida albicans* DS (OR=3.62 times, CI=2 to 6.6, with *p* <0.001). When denture fitness was considered, there was a highly significant association between the poor fitness and the high risk of contracting bacterial DS (OR=10.22 times, CI= 5.2 to 20.6, with *p*< 0.001). Also, there was a highly significant association between longer period of 18- over months and the high risk of contracting bacterial DS (the associated OR=2.5 times, CI= 1.4 to 4.5 with *p*< 0.001). Most of patients were suffering from DS Type I in which it was counted 66.7%, while only 33.3% of patients were suffering from DS Type II, but no case of DS Type III occurred in those patients. Also, there was a significant association between good fitness and the high risk of developed DS type II (OR= 1.95 times, CI=1.01 to 3.7, with *p*= 0.03). When periods of having denture were considered, there was a highly significant association between longer period of 18- over months and the high risk of developed DS type II*,* (OR=10.2 times, CI=5.03 to 21.2 with *p*<0.001).

Discussion

The most common microbial cause of DS in the present study was *C. albicans* (58.3%) of the total isolates. This result was similar to that reported by Salerno and Zomorodian[1,10] in

which the most common cause of DS was *C. albicans*. This occurrence of *Candidal DS* with high rate in denture wearers can be explained by the findings in which wearing denture was led to increase the chance of *C. albicans* oral colonization rate from 60 to 100%.[9-12] Oral colonization can be explained by the fact that dentures decrease the flow of oxygen and saliva to the underlying tissue producing a local acidic and anaerobic microenvironment that favours yeast overgrowth.[13, 14]

In this study bacterial denture stomatitis among those patients counted about 29.1% of the total isolates. This result was similar to that reported by Prabha in which bacterial denture stomatitis was the second cause after Candida albicans DS.[15] These results can be explained by the hypothesis of Harold Marcott[16], who assumed that bacteria present in the saliva may also cause ulcer when there is alteration in the salivary pH. Moreover, bacterial load in saliva increases due to caries, periodontal diseases and also other endocrine disorders like hypo-function of salivary glands which leads to decreased secretion and increased oral bacteria.

In this study, there was a highly significant association between males and the high risk of contracting Candida albicans DS (OR= 2.33). The present study results supported the rejection of the null hypothesis which states that there would be no difference between male and female denture wearers in terms of the prevalence of Denture Related Stomatitis (DRS) and colonization by *C. albicans* of the inner surfaces of dentures and attachment surroundings. In a study by Gendreau and Loewy, a higher incidence has been reported in females[17], but this is not always as in this case in which a higher incidence has been reported in males.[18] In the present study, there was a highly significant association between older age group and the high risk of contracting Candida albicans DS (OR=3.62). This study result was different from that reported from Philadelphia by Bouquot[19], in which there was no different in the rate of DS with age, but similar to that reported from UK by Smaancyake[20] in which the highest rate occurred in older adult age groups.

In the current study, there was a highly significant association between longer period of 18-over months and the high risk of contracting Candida albicans DS. This result was similar to that reported by Barbeau in which the risk of developing Candida albicans DS increased with time duration.[21]

Furthermore, there was a highly significant association between the poor fitness and the high risk of contracting bacterial DS (OR=10.22, and $p< 0.001$). This result was similar to that reported by Kulak in which poor–fitness was considered as a prime etiologic factor for contracting bacterial and /or Candida albicans DS.[22] This result explained by those poor-fitting dentures can increase mucosal trauma and ulcer formation. Most ulcers tend to have bacterial growth which sometimes might because of the non harmful normal flora, unless the count

exceeds the normal and permissible levels which increase its ability to colonize both the denture and oral mucosal surfaces and cause stomatitis.[22]

In the present study most of the patients were suffering from DS Type I which counted 66.7%, while only 33.3% of the patients were suffering from DS in Type II, but no case of sever DS in Type III. This results were different from that reported by Pinelli *et al*,[23] and Gendreau and Loewy[24] in which Type II was the most common presentation followed by type III lesions. The high rate of type II and III in other studies might be explained by that poor denture hygiene in their patients which allows the increased growth of pathogenic micro-organisms within the dental plaque on the fitting surfaces of dentures.[24]

Conclusions

DS is a circumstance that commonly affects denture wearers, and should be treated even if asymptomatic. The condition requires a combined treatment method from both patient and clinician, and the role of the patient must be stressed. Management of aetiological risk factors is key in order to prevent recurrence. Treatment modalities may consist of: treatment of any underlying systemic risk factors, improvement in the fit of existing dentures, replacement of existing dentures, improved denture hygiene and the use of antifungal and antibacterial agents. Either methods are employed, the main aim of treatment is to eradicate the biofilm from the patient's dentures. Regular review of patients suffering from DS is essential in order to ensure long-term successful treatment of the condition.

Conflict of interest:

"No conflict of interest associated with this work".

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Table 1: Sex and age distribution of patients suffering from denture stomatitis in the Prosthetic department at the Faculty of Dentistry- Sana'a University clinics from 11/2016 to 2/2017:

Age groups\ Years	Male n=171		Female n=117		Total n=288	
	NO	%	NO	%	NO	%
35-44	34	19.9	44	37.6	78	27.1
45- 54	15	8.8	29	24.8	44	15.3
55- 64	53	31	19	16.2	72	25
65+	69	40.4	25	21.4	94	32.6
Total	171	59.4	117	40.6	288	100
Mean age	59.5 yrs		52.1yrs		56.5 yrs	
S.D	14.4 yrs		16.02 yrs		15.4 yrs	
Median	60 yrs		48 yrs		60 yrs	
Mode	60 yrs		35 yrs		60 yrs	
Max	85 yrs		85 yrs		85 yrs	
Min	35 yrs		35 yrs		35 yrs	

Table 2: The isolated microbes that causes denture stomatitis among patients attending the Prosthetic department at Faculty of Dentistry, Sana'a university clinics from 11/2016 to 2/2017:

Micro-organisms	NO	%
S. mutans	49	17
S. aureus	14	4.9
Lactobacillus	9	3.1
C. albicans	168	58.3
C. glabrate	12	4.2
No pathogen	36	12.5
Total	288	100

Table 3: The association between candidal stomatitis and denture fitness and period of having denture

Variables	Candidal stomatitis n= 168		OR	CI	χ^2	*p*
	No	%				
Denture fitness						
Good n= 52	32	61.5	1.2	0.16- 2.3	0.27	0.6
Fair n= 99	65	65.7	1.6	0.94- 2.7	3.3	0.06
Poor n= 137	71	51.8	0.6	0.36- 0.99	4.55	0.03
Period of having denture						
6- 12 months n= 21	17	81	3.26	1- 11.8	4.77	0.028
12- 18 months n= 105	16	15.2	0.04	0.02- 0.07	126	<0.001
18- over months n= 162	135	83.3	14.1	7.66- 26	95.2	<0.001
Total	168	58.3				

OR Odd ratio>1 (at risk) CI Confidence intervals 95% χ^2 Chi square ≥3.84 *P*-value<0.05(significant)

Table 4: The association between bacterial stomatitis and denture fitness and period of having denture

Variables	Bacterial stomatitis n= 84		OR	CI	χ^2	p
	No	%				
Denture fitness						
Good n= 52	5	9.6	0.21	0.07- 0.58	11.7	<0.001
Fair n= 99	9	9.1	0.15	0.07- 0.33	29.4	<0.001
Poor n= 137	70	51.1	10.22	5.2- 20.6	60.8	<0.001
Period of having denture						
6- 12 months n= 21	3	14.3	0.38	0.1- 1.43	2.43	0.11
12- 18 months n= 105	21	20	0.48	0.26- 0.87	6.7	<0.001
18- over months n= 162	60	37	2.5	1.4- 4.5	11.1	<0.001
Total n= 288	**84**	**29.1**				

OR Odd ratio>1 (at risk) CI Confidence intervals 95% χ^2 Chi square ≥3.84 P-value<0.05 (significant)

Table 5: Clinical classification of DS, xerostomia and co-systemic diseases among patients attending the Prosthetic department at the Faculty of Dentistry, Sana'a university clinics.

Variables	Number	%
Classification of Denture stomatitis		
Denture stomatitis Type I	192	66.7
Denture stomatitis Type II	96	33.3
Denture stomatitis Type III	0	0
Xerostomia	0	0
Systemic diseases		
Diabetic mellitus	6	2.1
Hypertension	16	5.6

Table 6: The denture stomatitis type II associated with denture fitness and period of having denture.

Variables	Denture stomatitis type II n= 96		OR	CI	χ^2	P
	No	%				
Denture fitness Good n= 52	24	46.2	1.95	1.01- 3.7	4.69	0.03
Fair n= 99	30	31.3	0.81	0.46-1.41	0.62	0.42
Poor n= 137	42	30.7	0.79	0.5- 1.34	0.84	0.35
Period of having denture **6- 12 months n= 21**	6	28.6	0.8	0.26- 2.3	0.23	0.6
12- 18 months n= 105	6	5.7	0.06	0.02- 0.16	56.7	<0.001
18- over months n= 162	84	51.9	10.2	5.03-21.2	57.1	<0.001

OR Odd ratio>1 (at risk) CI Confidence intervals 95% χ^2 Chi square ≥3.84 *P*-value<0.05 (significant)