Prevalence and Microbial Detection of Denture Induced Stomatitis among Individuals Attending Dental Clinics in Duhok City

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Abstract

Background & Objectives: Denture stomatitis is an inflammatory change in the mucosa of the oral cavity in denture bearing areas mostly in upper residual ridge characterized by erythema and many microbial causes are behind of the diseases. This study aimed to determine the prevalence of denture induced stomatitis among population and detection of microbial profile causing denture stomatitis among persons wearing upper removable prosthesis in Duhok province.

Methods: A cross sectional study was performed on patients with Denture induced stomatitis. The data was collected during one year from February 2020 to February 2021.The study involved 46 patients had denture induced stomatitis (26 male and 20 females). The prevalence rate of dentures stomatitis and the associated factors were analyzed .

Results: Denture stomatitis showed as type I (58.70%), type II (36.96%) and type III (4.35%). Type I rate was the highest and followed by type II and type III denture stomatitis. Yeasts such as Candida albicans 14 (30.43%) was predominant followed by Cryptococcus glabrata 4 (8.7%), Cryptococcus laurentii 4 (8.7%) and Candida famata 1 (2.17%) in cases with denture stomatitis. The predominant bacterial microorganisms were gram positive in accordance to oxygen requirements mostly was facultative aerobes.

Conclusion: The study revealed three types of denture stomatitis; type I, type II and type III stomatitis; Regarding microbial detection; Candida albicans was the most identified yeast and facultative aerobic Gram positive bacterial accounted mostly compared with, aerobic and anaerobic.

Keywords: Denture induced stomatitis, Microbial detection, Prevalence.

Introduction

Denture stomatitis, is an inflammatory change in the oral mucosa of the denture bearing areas mostly in the upper residual ridge, known as denture sore mouth[1]. Denture stomatitis can be considered as erythema of the oral mucosal tissues occupied by the denture.[2,3]It is usually painless and asymptomatic. The prevalence of denture stomatitis is approximately 50 %, with an increasing demand of population to denture wearers; the range of denture stomatitis could increase.[4–6]Incorrect denture hygiene lead to a reservoir for microorganisms caused by debris (food) accumulation, surface scratches, and biofilm formation, which contribute to the inflammatory changes that arises in the neighboring mucosa and subsequently lead to denture stomatitis.[7] Furthermore, denture stomatitis may develop in a healthy people who using denture during night. The predisposing and

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etiological factors of denture stomatitis include trauma of tissue associated with occlusal conflict, defects of denture, denture age, improper hygiene of denture, and continuous denture wearing during day and night as it encourage and stimulate the growth of bacteria and yeast in denture bearing area, adding their colonization of oral mucosa and intaglio surface of the denture.[2,8] Perhaps, response to the pathogenic Candida species, primarily *Candida albicans* infection and bacterial species are the second cause in many incidences of the diseases.[9,10] The most common candida species regarded in previous studies[8,11] was C. albicans, these species were responsible causes for denture stomatitis, however, other species such as C. glabrata, C. tropicalis, C. Cryptococcus laurentii pseudotropicalis, C. lipolytica, C krusei, C. guilliermondii, and C. parapsilosis have been isolated from non-denture and denture users.[8,11] Uses of dentures for long term are considered to be the most significant risk factor for colonization of Candida species on the mucosa surface.[12] Even if the Candida glabrata is isolated with C. albicans, in denture stomatitis, C. glabrata, different from C. albicans, which does not undergo morphogenesis and is considered less infectious.[11,13–15] The study aims to identify the incidence of denture stomatitis and the microbial species in patient with denture induced stomatitis.

Materials and methods

A cross sectional study performed on patients with Denture induced stomatitis. The data was collected during one year from February 2020 to February 2021. This study was carried out on 46 patients diagnosed with denture induced stomatitis (26 males and 20 female) attended Duhok educational dental center, Prosthodontics department in collage of dentistry - Duhok university and Duhok central laboratory. The criterion of participating in the current research was recording information such as age, sex, duration of dentures usage, period of denture wearing (night or day time), oral and denture hygiene mucosa, smoker or nonsmoker. However, some criteria were excluded in this study such as patients having immune deficient diseases, diabetes mellitus, long term corticosteroids and antibiotics in order to not interfere with the results. The diagnosis of denture stomatitis was classified according to the previous research[3]: Type I: pinpoint hyperemia localized inflammation. Type II: More diffuse redness (erythema) including, all or part of the mucosa covered by denture. Type III: nodular or papillary inflammatory hyperplasia, mostly occur on the alveolar ridge with Angular cheilitis and on the central hard palate. Samples were collected from patients after recording the case history. Then the collected swabs (within the gel) were transported to the laboratory (within one hour) under aseptic conditions. The samples were processed for microbiological examination, culturing on sabouraud dextrose agar (SDA), MacConkey agar, Chocolate and Blood agar for microbial isolation. In cases of mixed culture colony, samples were sub-cultured for one day to identify bacterial species and two days for yeast to purify it. Microbial colonies were diagnosed and identified using a microscopic and an automated biochemical analysis system (VITEK-2 machine) for confirmation. The principle of use of VITEK 2 system (bioMérieux Clinical Diagnostics; VITEK 2 YST ID and VITEK® 2 GP ID card) were followed according to the instructions of manufacturers and previous researches.[16–18] Statistical analysis was conducted to consider the association between denture stomatitis factors. The effects of factors were analyzed by general linear models using GenStat software (GenStat 17th edition, 2014). The initial data on denture stomatitis was converted into percentage. Then a logistic regression was used to determine the effect of factors on denture stomatitis. The data were

presented as a percentage and a p-value typically ≤ 0.05 was used to estimate the significant differences between factors. Letters were used to indicate significant differences between/among groups. The current study was approved by the ethics committee of Kurdistan Board of Medical Specialties.

Results

This study included case history and lab examination of 46 denture stomatitis patients attended clinic. Male accounted (56.52%) and female (43.48%) with an average age ranged from 35 years old and above. There was no significant effect of gender (p value <0.37) on the prevalence of denture stomatitis. Furthermore, there were no sex differences in relation to the patient age that had denture stomatitis. Table (1).

Table (1). The prevalence of denture stomatitis in both gender in different ages .

Gender	Age (%)			Count No. (%)
	35-50 y	51-60 y	61 and more	
Female	3 (15)	4 (20)	13 (65)	20 (43.48)
Male	3 (11.54)	13 (50)	10 (38.46)	26 (56.52)
Count (%)	6 (13.04)	17 (36.96)	23 (50)	46 (100)

In all patients, denture stomatitis was found in the palatal denture bearing area; however, only in 2 (4.5 %) cases of them were seen clinically associated with angular cheilitis. The high percentage of denture stomatitis patients were recorded as type I (58.70%) followed by type II (36.96%) and type III (4.35%) stomatitis. The following figures describe the different types of denture stomatitis. Figure (1).
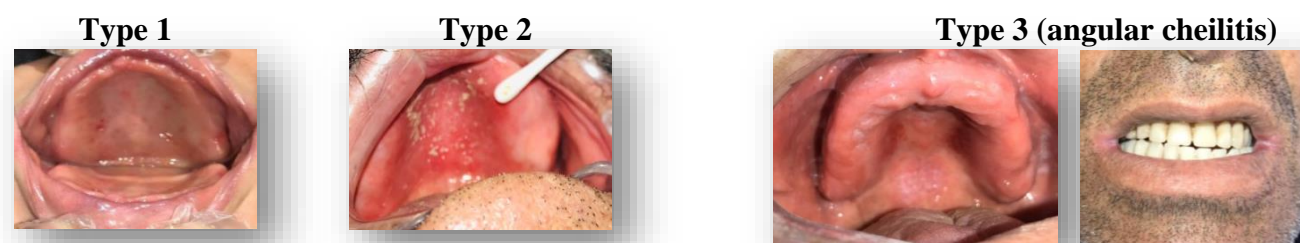

Type 1 **Type 2** **Type 3 (angular cheilitis)**

Figure (1): Classes of denture induced stomatitis and pictures taken from patients in this study .

The frequency of denture stomatitis types in patient wearing denture at night were significantly higher (*p* value <0.001) than those worn at daytime only. Table(2),Table(3).

Table (2): Effect of wearing denture at night and day time P value <0.05.

Wearing denture at night	Type I	Type II	Type III
Yes	18	15	2
Non	8	3	0

Assessment the effect of smoking on denture stomatitis rate was non-significant Table(3). However, people who were smoker (56.52%) tend to had higher denture stomatitis rate than nonsmoker (43.48%). In term of cleaning denture, 46 denture induced stomatitis patients used three methods for denture cleaning, the percentage of patient used tap water (54.35%) was significantly higher (*P.* value <0.05) than cleaning denture with tap water and denture cleanser (28.26%).

The lowest prevalence was found in patients who used tooth paste brush (17.39 %) for washing denture Table (3).

Table(3): The effect of denture stomatitis predisposing factors, (smoking, wearing, daily cleaning, washing and period of usage) on the incidence of denture stomatitis among people.

Denture stomatitis factors		Percentage	p value
Smoking	Yes	56.52	0.378
	No	43.48	
Night wearing	Yes	82.22	0.001
	No	17.78	
Cleaning daily	every day	33.33	< 0.001
	every 3 days	60	
	every week	6.67	
Denture washing	tap water	54.35	<0.05
	tap water cleanser	28.26	
	tooth paste	17.39	
Denture usage	1-5 y	48.89	0.881
	5 -10 y	51.11	

In current study microbiological examination were performed for 46 patients to identify both yeasts (candida) and bacterial species. After culturing of swab samples, candida and both grams positive and negative bacteria were diagnosed and identified in patient with denture stomatitis. Then yielding bacterial growths were subculture for subsequently microscopic examination and reconfirmed by biomechanical test (VITEK 2 system). The prevalence of Candida species among 46 patients had denture stomatitis was about 50%, the predominant species was candida albicans (30.43%) followed by C. glabrara (8.7%), Cryptococcus laurentii (8.7%) and C. famata (2.17%). In relation to the denture stomatitis types Candida species had a significant variation (P<0.0001) among denture stomatitis species (Table(4); P<0.0001). The predominant bacterial species revealed in the current study was gram positive bacterial species with further classification were done according to the oxygen required (facultative anaerobic, aerobic and anaerobic bacteria). The highest percentages (P<0.0001) of bacterial species determined by VITEK in denture stomatitis was facultative anaerobes;52.17%, Table (4).

Table (4): Relation of denture stomatitis to the prevalance of Candida and bacterial species infections. Subscribt letter indicate significant different at P value <0.005.

Candidal species	Denture stomatitis types %			Count
	I	II	III	No (%)
C. famata	100	0	0	1 (2.17%) [a]
C. glabrata	25	75	0	4 (8.7%) [b]
Cryptococcus laurentii	25	75	0	4 (8.7%) [b]
C. albicans	21.4	64.3	14.3	14 (30.43%) [c]
Non	91.3	8.7	0	23 (50%) [d]
Oxygen required	Denture stomatitis types %			Count

	I	II	III	No (%)
Aerobic	50	50	0	6 (13.04%)
Anaerobic	66.67	16.67	16.67	6 (13.04%)
Facultative anaerobic	54.17	41.67	4.17	24 (52.17%)
Facultative anaerobic + aerobic	66.67	33.33	0	3(6.52%)
Non	71.43	28.57	0	7 (15.22%)

The main bacterial species obtained from collected swab samples were belonging to Streptococci (41.28%) and Staphylococci (23.89%) genus. The main bacterial species detected in all cases are shown in Table(5).

Table(5):Percentage of different bacterial species detected among denture stomatitis patients using VITEK kit.

Bacterial species	Percentage (%)
Enterococcus faecuim	2.17
Gemella morbillorum + Rothia dentocariosa	2.17
Kocuria kristinae	2.17
Kocuria varians	2.17
Kytococcus sedentarius	4.35
Rhodotorula mucilaginosa + Glutinitis	2.17
Rothia dentocariosa	2.17
Rothia dentocariosa + Mucilaginosa + Gemella morbillorum	2.17
Staphylococcus aureus	13.04
Staphylococcus aureus + Granulicatella adicens	2.17
Staphylococcus aureus + Bacillus	2.17
Staphylococcus aureus + E coli	2.17
Staphylococcus aureus + Bacillus	2.17
Staphylococcus sciuri + Kocuria kristnae	2.17
Streptococcus oralis + Mitis + Granulicatella adiacens	2.17
Streptococcus mitis	8.7
Streptococcus mitis + E. coli	2.17
Streptococcus oralis + Mitis + Parasanguinis + Pneumoniae	2.17
Streptococcus pluranimalium	2.17
Streptococcus pneumonia	6.52
Streptococcus pyogenes	2.17
Streptococcus thoraltenesis	10.87
Streptococcus thoraltenesis + E coli	2.17
Stretococcus salivarus	2.17

Discussion

This study displayed that patients wear denture during night time mostly affected by denture stomatitis compare to patient did not wear it[19]. As well as the patient did not clean their denture and not readjust it after a long period of time had a denture stomatitis more frequently than those clean it regularly and reconstruct it. In the current study, patients used conventional method of denture cleaning, such as tap water, had denture stomatitis. this could be do you to ignored oral and denture hygiene. Perhaps patients are either unable or not motivated to clean their dentures properly, therefore a simple effective denture cleaning method such as denture tablet, sodium hypochlorite in low concentration plus water and brush with tooth paste that remove and inhibit microorganisms on fitting surface of acrylic resin denture should be advocated.[1,2,13] Patients with 65 years old

and above were more likely to progress denture induced stomatitis. Denture stomatitis were more popular in elderly patients who wearing removable dentures, where others factors found to be contributed like denture age and oral candidal infection.[20]In this study, the high percentage of denture stomatitis patients was presented with type I, this is due to unknown causes as it is asymptomatic and painless. At the onset, it had a sign but not symptom then followed by type II and type III which were symptomatic but in other word the most common denture induced stomatitis sort was Newton type II this due to symptomatic reason .[21] The mean age of existing denture induced stomatitis despite the fact that the denture stomatitis does not have symptoms or considered as asymptomatic as its in type I but in type II and III patients may complain of locally or generalized soreness, slight bleeding, swelling in the involved area as well as halitosis, xerostomia, burning sensation, or dysgeusia (alterations of tastes). The intensity of these symptoms is variable ranging from 20% to 70% of patients with denture stomatitis. In these circumstances, the patient does not relay the use of a denture to the experienced symptoms.The results showed that the prevalence of angular cheilitis was around 4.35%, which was greater than the frequency resulted by Patil[22] and Mozafari,[23] the recorded of angular cheilitis about 1.9% and 2.5% respectively. However, other reported 5% of angular cheilitis,[24] which was higher than prevalence recorded in current study. Furthermore, 17 % of angular cheilitis had been shown by Zwiri.[4] Perhaps the variations in the occurrence of diseases may due to interaction of more than one factor including the poor oral hygiene and the cognitive in populations did not follow the proper instructions. Another explanation could be mechanical aspects like incorrect making a denture and the freeway space is not an average (decrease vertical dimension).The microbiological examination in this study, signified that the Candida albicans is the most common species isolated from the denture stomatitis cases, followed by C. glabrata. Other yeasts such as Cryptococcus laurentii and C. famata also presented in denture induced stomatitis cases. Isolation of fungi other than C. albicans had been recorded as variant species in different researches. Other researchers found that C. tropicalis was the most second encountered Candida species [8,25-26] whereas Lewis[27] stated that C. glabrata which displays part of its pathogenic effects by the production of such hydrolytic enzymes which may cause violation of the epithelial surface.[14,16,28] The predominant bacterial species identified in this study was gram positive bacterial species with sub classification of bacteria in relation to their oxygen requirement. The highest percentages of isolated bacteria by VITEK 2 system in denture stomatitis cases was facultative anaerobic bacteria. Streptococci and Staphylococci accounted highest prevalence among other bacterial species detected in denture stomatitis patients, this finding was in accordance with that recorded by[6] they found that the predominant microorganism isolated was gram positive cocci. In other hand the most predominant species was Staphylococcus aureus present so S. aureus and S. epidermidis were the most frequent Staphylococcus species as seen by .[13] These bacteria could be opportunistic microorganisms colonize individuals with lesions of denture stomatitis .[13]

Conclusion

Denture wearers should be instructed to clean the dentures and mouth regularly. Furthermore, to wear dentures only during day time and should be recalled for dentures and oral cavity examination. The results revealed three types of denture

stomatitis, type I, type II and type III. This study concluded that C. albicans was the most identified yeast type, followed by C. glabrata and Cryptococcus laurentii infection in denture stomatitis cases. The

predominant bacterial that obtained was gram positive bacterial species according to (oxygen required) mostly (facultative, aerobic, anaerobic).

Conflicts of interest

There were no conflicts of interest.

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