INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH AND ANALYSIS

ISSN(print): 2643-9840, ISSN(online): 2643-9875

Volume 09 Issue 04 April 2026

DOI: 10.47191/ijmra/v9-i4-37, Impact Factor: 8.685

Page No. 1737-1742

The Relationship Between Oral Hygiene and Dentures Fungal Infections

Abdulridha T. Sarhan[1*], Raad S Hamadh[2], Muslim R Shaker[3], Amin J Mohammad[4], Haider M Abd Aoun[5]

[1,2,3,4,5]University of Hilla, College of Dentistry, Babylon, Iraq

Corresponding Author: Abdulridha T. Sarhan

ABSTRACT: Good denture hygiene though reduces the risk of fungal infection, but fungal overgrowths can also be seen in good oral hygienic patients. Dental prosthesis wearers have high prevalence of oral fungal infection. Removable Acrylic dentures are another potential pathway with an ideal environment for the fungus causing denture related disease. Infections by the genus *Candida* spp. are fungal microbes that derive from local and systemic conditions, with a range of infections ranging from superficial to systemic blood stream assaults which display very high morbidity and mortality features. A multitude of antifungals is available, with various indications, dosing regimens, and adverse effects and drug interactions. A few of the antifungal medications can be formulated in oral suspension, pastilles and additional tablets or intravenous agents. This paper aims to study the association of oral hygiene and dentures fungi because of the fungal infections.

KEYWORDS: Oral Infection, Denture Stomatitis, Oral Candidiasis, Denture Fungal Infections.

INTRODUCTION

Oral fungal infection is a frequent condition seen in denture wearers. Unfortunately, a large percentage of patients with denture wear are afflicted with an oral infection [1, 2]. *Candida* spp. in denture wearers, prevalence reaches 60 to 100 %. Denture stomatitis (DS) or thrush is a local infection in the oral cavity caused due to yeast or fungus. It is due to overgrowth of bacteria called *Candida* spp. [3]. The non-communicable kind of the infection which impact projecting palatal and gingival mucosa Denture sore mouth and prosthetic stomatitis [4, 5] are referred to as DS. An unfavorable environmental condition that causes a population of yeasts responsible for denture stomatitis (DRS) present is using removable acrylic dentures in the long term. Denturerelated stomatitis (DRD) is a mucosal inflammatory process, which results from the wearing of (removable partial or full) dentures, as evidenced by inflammatory change and erythema of oral mucosa covered by the dentures [6]. Usually diagnosed with inflamed palatal mucosa. Fungal infections in humans occur as a result of defects in immune system. Even in the patients less likely to be highly vulnerable higher incidence of MIs are observed among different countries [7]. Local compromising factors are poor salivation, poor oral hygiene, dentition use, diabetes mellitus after nutritional deficiency and HIV infection /AIDS [8]. Oral candidiasis is usually a localized infection and very rarely develops as fungal systemic disease, in contrast the oral non- filamentous fungal infections that are typically indicative of disseminated diseases [9, 10]. These fungi are currently the most frequent causes of infections and may have primo-rectal lesions by mycosis systems for oral manifestations [11, 12]. The primary objective of this study was to investigate the oral mucosa (in contact with the prosthetic base) and identify the affected local factors (oral hygiene, fungal infections, dominance of prosthetic substrates, and evolution of denture-related diseases).

MATERIALS AND METHODS

This study was a sectional, randomized clinical trial done at the dental clinics, College of Dentistry, Hilla University, Babylon, Iraq. The data were obtained from the patients. A case sheet with general information, subjective and objective symptoms, as well as the study protocol were provided. Patients were asked to wear the dentures before examining their mouths. Eating, drinking, smoking and removal of the denture from the mouth were forbidden prior to this examination. The studied patients included 200 selected participants (80 men and 120 women) with a clinical mucosa, aged from 37–72 years old, who wore complete or partial prostheses. The age was classified into five groupings, of 70 years, with all patients being referred to a specific prosthodontics and oral medicine specialist. In addition to the measured differences in fungal infections, sex differences were also evident. The patients were having their case history taken by the operator for the first time and subsequently filling a questionnaire form. Data

were obtained about demographics of the patient (age, gender and type of dentures), complete or partial, and three types of denture stomatitis.

RESULTS AND DISCUSSION

This study is a research of 200 patients (80 male (40%) and 120 female (60%), including complete denture wearers (44 male / 56 Female) and 100 Patients with partial denture wearers. As demonstrated in **Table 1**, there were 80 males (40%) and 120 females (60%) patients in the study group respectively. Founded Median age (40 > 70) years of included age range and mean age is for all contributed patients 66 - years. The majority (56 / 69%) of female patients had complete dentures and more male than female patients were found to have partial dentures 44 (31%) in comparison is shown in **Table 2.** However, the higher fungal infection was compared with patient ranges from 50 – 60 years **(Table 3)** and a high frequency patient were determined as microbiological for age examination. There was no clinical inflammation of the palatal mucosa in 100 full denture wore users (44 male / 31% and 56 female / 69%) out of 200 patients who were surveyed throughout this study, or partial denture used as well (36 male / 18% and 64 Female / 22%). There are 3 types of stomatitis infection **(Table 4):** type 1 localized infection hyperemia (congestion excess blood in the vessels) type 2 more diffuse erythema (redness of mucosa), and type 3 inflammatory hyperplasia (inflammation presence). Type 1 was more common, and a higher proportion (96 / 48 %) were reported than with two other type **(Table 4)**.

Table 1: The Distributions of Patients According to Type of Denture and Gender.

Type of denture		Gender		Total %
		Male	Female	
Full	No.	44	56	100
	%	22	28	50
Partial	No.	36	64	100
	%	18	32	50
Total	No.	80	120	200
	%	40	60	100

Table 2: The Type of Denture Users According to the Gender and Age.

Type of denture	Gender	Patient Age Ranges					Total	%
		< 40	41-50	51-60	61-70	> 70		
Full denture	Male	2	6	16	12	8	44	22
	Female	4	4	28	20	0	56	28
Partial denture	Male	3	5	3	17	8	36	18
	Female	0	20	12	16	16	64	32
Total		9	35	56	6	32	200	100
%		2	20	28	31	16	100	

Table 3: Levels of Fungal Infection According to the Type of Denture and Gender.

Type of denture	Gender	Levels of infection according to fungal growth				Total	%
		No / 0	Few / 1	Midst / 2	Intensive / 3		
Full denture	Male	4	20	8	12	44	22
	Female	8	12	12	24	56	28
Partial denture	Male	4	8	8	16	36	18
	Female	8	20	12	24	64	32
Total		24	60	40	76	200	100
%		12	30	20	38	100	100

Table 4: Types of Fungal Infection According to the Type of Denture and Gender.

Type of denture	Gender	Types of denture stomatitis *			Total	%
		Type 1	Type 2	Type 3		
Full denture	Male	16	24	4	44	22
	Female	20	28	8	56	28
Partial denture	Male	24	8	4	36	18
	Female	36	20	8	64	32
Total		96	80	24	200	100
%		48	40	12	100	

*** The three types of denture stomatitis:**

Type 1 - Localized inflammation hyperemia (excess of blood in the vessels).

Type 2 - More diffuse erythema (redness of the mucosa).

Type 3 - Inflammatory hyperplasia (enlargement of tissue)

Denture-related fungal proliferation Most removable prosthetic devices can be related to dentureassociated traumatic necrotic lesions of yeast [13]. DS is an inflammatory disease involving the palatine mucosa and hotbeds. It has a multi-faceted origin. It is known that the disease may be caused by trauma associated with ill-fitted dentures, poor oral hygiene, denture wear during sleep periods, denture plaque and bacteria accumulation as well a fungal infection. Stomatitis [14, 15] is what it is called. The severity of this disease is attributed to various factors such as denture wearing, plaque on denture, Bad fitting and occlusal instability systemic diseases like diabetes and hypertension, age of the denture [16]. In our study yeast infected less than 50% females and higher growth was observed in female as compared to male group [17] whereas microbiological candida detection in denture plaque has reported previous studies moderate, high and heavy, that is also recognized one of the main risk factor for DS. *Candida* had been associated with DS, but no study confirmed the quantity of *Candida* in palatal tissue or on the surface of a denture, as per Newton's classification [18]. Newton Type I refers to trauma from ill-fitting denture without use of antifungal drugs whereas Newton Type II and III are mediated with antifungal medications. Thus, knowledge of Candida colonization at palatal mucosa and denture tissue surface according to Newton's classification will be very useful the DS management [19]. Factors such as patient sex, age, systemic diseases, smoking habit, denture material used, inadequate stability of the denture and nighttime wearing as well as dentures' age have been shown to be significant in development risk of DS [20, 21]. The annoying stomatitis caused by removable prosthetic appliances occurs more often in the upper arch. The females showed a higher bacterial/fungal load than the males and yeast presence had similar microbiological manifestations (none, few, midst and intensive yeasts growths) in females [22]. We also noted a smaller number of UNINF patients compared with other groups. Other studies, however reported the higher prevalence of denture-related stomatitis in men than women [23, 24]. The percentage of upper denture women was also higher than that of men in the studied three age groups. Comprehensive studies may provide further understanding of factors responsible for this gender difference in prevalence which could be psychosocial and dental [25, 26]. However, these were distinctly different in such a way that gender differences were seen when measuring the total number of yeast colonies in all subjects. In the age group being studied, too. It shows that the blueberry full grown is dissimilar at a senior but with multifarious phases of the yeast infecting at tender years [27, 28].. In particular, the amount of yeast in female group shows a growth trend with age group. We also observed the same phenomenon when measuring intensity of yeast proliferation. There was a greater prevalence of female to male balanced growth and vigorous yeast growth. As such, invalidation of results can be undertaken to make inferences from cohorts of patients within very wide age bands [29,30,31]. For example, Figueiral *et al*. Exclusion criteria were: age <75 years. For each age category of patients the number of females who were untouched was less than that of males. Patients who were denture wearers and 50 years old or less had more frequent infections with more species diversity among infecting strains. Therefore, dentists should always be aware of the palatal mucosa of all their older denture patients, especially if these dentures have been worn for decades [32, 33]. We have been able to reject the null hypothesis that there was no difference in rates of infection due to species of Candida between the genders where complete denture wearers are concerned. But, if their study group of patients are in similar age (in 10 years), hypothesis cannot be falsified [34, 35]. Hygiene denture practices have been evidenced as being essential to prevent creating a reservoir based on the dry, porous structure of the surface biofilm hosting fungi microorganisms facilitating reinfection process [36,37,38]. Several studies have also demonstrated a correlation between non-optimal denture maintenance and increased risk (and prevalence) of denture stomatitis [39, 40]. Furthermore, poor denture hygiene was

associated with higher colonization of dentures and oral mucosa for the *Candida* spp. Moreover, removable denture patients apparently had more severe inflammation stomatitis [41, 42]. Denture accumulation of plaque and oral hygiene predispose Candida sp. virulence and contributes to the Candida stomatitis [43].

CONCLUSIONS AND RECOMMENDATIONS

These are thought to be the contributing factors to denture stomatitis. Usage of the denture in day-to-day life, the upkeep of a denture, and Candida spp. colonization on dentures certain yeasts (in particular that of *Candida albicans*. At that point, the patient's age and sex no longer had any predictive value in regard to this disease. In dentate patients, hygiene of denture and removal of the denture at night are key steps to prevent diseases of oral mucosa, which need education and motivation. You or the patient with denture stomatitis may have different signs and symptoms. The most common are, but not limited to: **1.** Pain or discomfort when swallowing. **2.** Pain in the mouth or throat. **3.** White or red patches on the tongue, gums, lips, inner cheeks or roof of mouth **4.** Canker sores or fissures at the corners of the mouth. Denture stomatitis also causes swelling and sensitive tissues in the mouth. It is prevalent among denture wearers and usually happens in areas where the appliance touches the gums. Good dental hygiene, including regular visits to the dentist can lower the risk of infections related to denture stomatitis.

REFERENCES

1) Bell A, Kasi A. Oral Mucositis (https://www.ncbi.nlm.nih.gov/books/NBK565848/). In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan. Accessed 1/16/2025.
2) McReynolds DE, Moorthy A, Moneley JO, Jabra-Rizk MA, Sultan AS. Denture stomatitis-An interdisciplinary clinical review (https://pubmed.ncbi.nlm.nih.gov/36988151/). J Prosthodont. 2023 Aug;32(7):560-570. Accessed 1/16/2025.
3) Merck Manual, Professional Version. Stomatitis (Oral Mucositis) (https://www.merckmanuals.com/professional/dental-disorders/symptoms-of-dental-andoral-disorders/stomatitis). Last reviewed 1/2024. Accessed 1/16/2025.
4) Budtz Jorgensen, E. The significance of *Candida albicans* in denture stomatitis. Scand J Dent Res. 1974; 82, 151–190. Google ScholarPubMedWorldCat
5) Webb, B.C., Thomas, C.J., Willcox, M.D., Harty, D.W. and Knox, K.W. *Candida*-associated denture stomatitis. Aetiology and management: a review. Part 2. Oral diseases caused by Candida species. Aust Dent J 1998; 43, 160–166. Google ScholarCrossrefPubMedWorldCat
6) Budtz-Jørgensen, E. Oral mucosal lesions associated with the wearing of removable dentures. J Oral Pathol Med 1981; 10, 65–80. Google ScholarCrossrefWorldCat
7) Kulak, Y., Arikan, A. and Kazazoglu, E. Existence of *Candida albicans* and microorganisms in denture stomatitis patients. J Oral Rehabil 1997; 24, 788–790. Google ScholarCrossrefPubMedWorldCat
8) Theilade, E., Budtz-Jørgensen, E. and Theilade, J. Predominant cultivable microflora of plaque on removable dentures in patients with healthy oral mucosa. Arch Oral Biol 1983; 28, 675–680. Google ScholarCrossrefPubMedWorldCat
9) Redfern, J. L., Tosheva, S. Malic, M. Butcher, G. Ramage & J. Verran. The denture microbiome in health and disease: an exploration of a unique community. Letters in Applied Microbiology 2022; 75, 2, 1, 195–209, https://doi.org/10.1111/lam.13751
10) Baena-Monroy, T., Moreno-Maldonado, V., Franco-Martínez, F., Aldape-Barrios, B., Quindós, G. and Sánchez-Vargas, L.O. *Candida albicans*, *Staphylococcus aureus* and *Streptococcus mutans* colonization in patients wearing dental prosthesis. Med Oral Patol Oral Cir Bucal. 2005; 10 Suppl. 1, E27-39. Google Scholar Pub Med World Cat.
11) Brown, J.L., Young, T., McKloud, E., Butcher, M.C., Bradshaw, D., Pratten, J.R. and Ramage, G. An in vitro evaluation of denture cleansing regimens against a poly-microbial denture biofilm model. Antibiotics 2022; (Basel) 11, 113. GoogleScholarCrossrefPubMedWorldCat
12) Bulad, K., Taylor, R.L., Verran, J. and McCord, J.F. Colonization and penetration of denture soft lining materials by *Candida albicans*. Dent Mater 2004; 20, 167–175. Google ScholarCrossrefPubMedWorldCat
13) Campos, M.S., Marchini, L., Bernardes, L.A.S., Paulino, L.C. and Nobrega, F.G. Biofilm microbial communities of denture stomatitis. Oral Microbiol Immunol. 2008; 23, 419–424. Google ScholarCrossrefPubMedWorldCat
14) Coco, B.J., Bagg, J., Cross, L.J., Jose, A., Cross, J. and Ramage, G. Mixed *Candida albicans* and *Candida glabrata* populations associated with the pathogenesis of denture stomatitis. Oral Microbiol Immunol 2008; 23, 377–383. Google Scholar Cross ref Pub Med World Cat.
15) Delaney, C., O'Donnell, L.E., Kean, R., Sherry, L., Brown, J.L., Calvert, G., Nile, C.J., Cross, L. et al. Inter kingdom interactions on the denture surface: implications for oral hygiene. Biofilm 2019; 1, 100002. Google Scholar World Cat.

16) Figueiral, M.H., Azul, A., Pinto, E., Fonseca, P.A., Branco, F.M. and Scully, C. Denturerelated stomatitis: identification of etiological and predisposing factors – a large cohort. J Oral Rehabil 2007; 34, 448–455. Google Scholar Cross ref Pub Med World Cat.
17) Fujinami, W., Nishikawa, K., Ozawa, S., Hasegawa, Y. and Takebe, J. Correlation between the relative abundance of oral bacteria and *Candida albicans* in denture and dental plaques. J Oral Biosci 2021; 63, 175–183. Google ScholarCrossrefPubMedWorldCat
18) Garbacz, K., Kwapisz, E. and Wierzbowska, M. Denture stomatitis associated with small-colony variants of *Staphylococcus aureus*: a case report. BMC Oral Health 2019; 19, 219. Google ScholarCrossrefPubMedWorldCat
19) Garg, R. and Garg, R.K. Denture hygiene, different strategies. Webmed Central Dentist 2010; Google ScholarWorldCat
20) Gauch, L.M.R., Pedrosa, S.S., Silveira-Gomes, F., Esteves, R.A. and Marques-da-Silva, S.H. Isolation of *Candida* spp. from denture-related stomatitis in Pará, Brazil. Braz J Microbiol 2018; 49, 148–151. Google ScholarCrossrefPubMedWorldCat
21) Gendreau, L. and Loewy, Z.G. Epidemiology and etiology of denture stomatitis. J Prosthodont 2011; 20, 251–260. Google ScholarCrossrefPubMedWorldCat
22) Gleiznys, A., Zdanavičienė, E. and Žilinskas, J. *Candida albicans* importance to denture wearers. A literature review. Stomatologija 2015; 17, 54–66. Google ScholarPubMedWorldCat
23) Grischke, J., Szafranski, S.P., Muthukumarasamy, U., Haeussler, S. and Stiesch, M. Removable denture is a risk indicator for peri-implantitis and facilitates expansion of specific periodontopathogens: a cross-sectional study. BMC Oral Health 2021; 21, 173. Google ScholarCrossrefPubMedWorldCat
24) Hannah, V.E., O'Donnell, L., Robertson, D. and Ramage, G. Denture stomatitis: causes, cures and prevention. Prim Dent J 2017; 6, 46–51. Google ScholarCrossrefPubMedWorldCat
25) Jackson, S., Coulthwaite, L., Loewy, Z., Scallan, A. and Verran, J. Biofilm development by blastospores and hyphae of *Candida albicans* on abraded denture acrylic resin surfaces. J Prosthet Dent. 2014; 112, 988–993. Google ScholarCrossrefPubMedWorldCat
26) Jerônimo, L.S., Esteves Lima, R.P., Suzuki, T.Y.U., Discacciati, J.A.C. and Bhering, C.L.B. 2022; Oral candidiasis and COVID-19 in users of removable dentures: is special oral care needed? Gerontology 68, 80–85. Google ScholarCrossrefPubMedWorldCat
27) Le Bars, P., Kouadio, A.A., N'Goran, J.K., Badran, Z. and Soueidan, A. Relationship between removable prosthesis and some systemics disorders. J Indian Prosthodont Soc 2015; 15, 292–299. Google ScholarCrossrefPubMedWorldCat
28) Lewis, N., Parmar, N., Hussain, Z., Baker, G., Green, I., Howlett, J., Kearns, A., Cookson, B. et al. Colonisation of dentures by Staphylococcus aureus and MRSA in out-patient and inpatient populations. Eur J Clin Microbiol Infect Dis 2015; 34, 1823–1826. Google ScholarCrossrefPubMedWorldCat
29) Mizugai, H., Isogai, E., Hirose, K. and Chiba, I. Effect of denture wearing on occurrence of *Candida* species in the oral cavity. J Appl Res 2007; 7, 250–254. Google ScholarWorldCat
30) 30. Monteiro, D.R., de Souza Batista, V.E., Caldeirao, A.C.M., Jacinto, R.C. and Pessan, J.P. Oral prosthetic microbiology: aspects related to the oral microbiome, surface properties, and strategies for controlling biofilms. Biofouling 2021; 37, 353–371. Google ScholarCrossrefPubMedWorldCat
31) Morse, D.J., Smith, A., Wilson, M.J., Marsh, L., White, L., Posso, R., Bradshaw, D.J., Wei, X. et al. Molecular community profiling of the bacterial microbiota associated with denturerelated stomatitis. Sci Rep 2019; 9, 10228. Google ScholarWorldCat
32) Mousa, M.A., Alam, M.K., Ganji, K.K., Khader, Y., Lynch, E. and Kielbassa, A.M. Prospective case series on possible effects of local factors on the development of halitosis in new complete denture wearers. Quintessence Int. 2022; 53, 218–225. Google ScholarPubMedWorldCat
33) Mukai, Y., Torii, M., Urushibara, Y., Kawai, T., Takahashi, Y., Maeda, N., Ohkubo, C. and Ohshima, T. Analysis of plaque microbiota and salivary proteins adhering to dental materials. J Oral Biosci. 2020; 62, 182–188. Google ScholarCrossrefPubMedWorldCat
34) O'Donnell, L.E., Robertson, D., Nile, C.J., Cross, L.J., Riggio, M., Sherriff, A., Bradshaw, D., Lambert, M. et al. The oral microbiome of denture wearers is influenced by levels of natural dentition. PLoS One 2015; 10, e0137717. Google ScholarWorldCat
35) O'Donnell, L.E., Smith, K., Williams, C., Nile, C.J., Lappin, D.F., Bradshaw, D., Lambert, M., Robertson, D.P. et al. 2016; Dentures are a reservoir for respiratory pathogens. J Prosthodont 25, 99–104. Google ScholarCrossrefPubMedWorldCat

36) 36. Olms, C., Yahiaoui-Doktor, M., Remmerbach, T.W. and Stingu, C.S. Bacterial colonization and tissue compatibility of denture base resins. Dent J (Basel) 2018; 6, 20. Google ScholarCrossrefPubMedWorldCat
37) Pereira-Cenci, T., Del Bel Cury, A.A., Crielaard, W. and Ten Cate, J.M. Development of *Candida*-associated denture stomatitis: new insights. J Appl Oral Sci 2008; 16, 86–94. Google ScholarCrossrefPubMedWorldCat
38) Ramage, G., Tomsett, K., Wickes, B.L., LÛpez-Ribot, J.L. and Redding, S.W. Denture stomatitis: a role for *Candida* biofilms. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2004; 98, 53–59. Google ScholarCrossrefPubMedWorldCat
39) Salerno, C., Pascale, M., Contaldo, M., Esposito, V., Busciolano, M., Milillo, L., Guida, A., Petruzzi, M. *et al*. *Candida*-associated denture stomatitis. Med Oral Patol Oral Cir Bucal 2011; 16, e139–e143. Google ScholarPubMedWorldCat
40) Shi, B., Wu, T., McLean, J., Edlund, A., Young, Y., He, X., Lv, H., Zhou, X. *et al*. The denture-associated oral microbiome in health and stomatitis. M Sphere 1, e00215–e00216. 2016; Google ScholarCrossrefPubMedWorldCat
41) Tsutsumi, C., Takakuda, K. and Wakabayashi, N. Reduction of *Candida* biofilm adhesion by incorporation of prereacted glass ionomer filler in denture base resin. J Dent 2016; 44, 37-43. Google ScholarCrossrefPubMedWorldCat
42) Verhaeghe, T.V., Wyatt, C.C. and Mostafa, N.Z. The effect of overnight storage conditions on complete denture colonization by *Candida albicans* and dimensional stability: a systematic review. J Prosthet Dent 2020; 124, 176–182. Google ScholarCrossrefPubMedWorldCat
43) Zlatarić, D.K., Celebić, A. and Valentić-Peruzović, M. The effect of removable partial dentures on periodontal health of abutment and non-abutment teeth. J Periodontol 2002; 73, 137–144. Google ScholarCrossrefPubMedWorldCat

There is an Open Access article, distributed under the term of the Creative Commons Attribution – Non Commercial 4.0 International (CC BY-NC 4.0) (https://creativecommons.org/licenses/by-nc/4.0/), which permits remixing, adapting and building upon the work for non-commercial use, provided the original work is properly cited.