Original Research Article

Assessment of denture's continuous wearing as a factor predisposing to chronic atrophic candidiasis in a sample of Lebanese denture wearers: a clinico-microbiological study

ABSTRACT

Background: Chronic Atrophic Candidiasis (CAC), commonly referred to as denture stomatitis, is the most prevalent multifactorial, chronic inflammatory oral condition amongst denture wearers. Denture's continuous wearing isconsidered a risk factor predisposing to CAC. The aim of this study was to evaluate this factor and its relationship with the occurrence of CAC in a Lebanese population.**Material and methods:** Two hundred ninety(161 women, 129 men; age range 40-80 years) were selected for this study. Swab samples from the palate and the palatal surfaces of the upper dentures of these patients were collected and examined mycologically.Denture'scontinuous wearing and colonization by *Candida albicans*were evaluated.**Results:** In our sample of 290 patients, 85 (29.31%) wear their dentures continuously and 170 (58.62%) exhibited clinically and microbiologically CAC. With respect to the patient's age, 41 out of the 65 patients (63.07%) aged between 40 and 60 years showed CAC against 129 (57.33%) who are older than 60.**Conclusion:** ~~Our~~ study supports previous findings that denture continuous use of denture isa significant factor that contributes to CAC.

Keywords: Denture, chronic atrophic candidiasis, Lebanese population.

1. INTRODUCTION

Chronic AtrophicCandidiasis (CAC),also known as denture-related stomatitis, refers to inflammatory changes of the denture-bearing mucosa,mostly the palatal one (Ribeiro *et al.*, 2019).It is a clinical form of oral candidiasis caused by *Candida albicans*, among

other species of fungi colonizing dentures(Sivaramakrishnan and Sridharan, 2017).These opportunistic microorganisms live in biofilm and are very adherent to the dentures' base material, particularly in the presence of microcracks and fissures (Aoun *et al., 2015)*. CAC affects between 17 and 75% of the population wearing dentures, with a slight predominance in elderly females (Abuhajar *et al.*, 2023). Newton divided CAC into three clinically based categories (Newton, 1962): a) Type 1: localized inflammation that could be a sign of the disease's early stages; b) Type 2: widespread inflammation that manifests as a diffuse erythema of the denture-covered mucosa (Figure 1); c) Type 3: inflammatory papillary hyperplasia. Type 2 is the most common of the 3 types.

Figure 1: Intraoral photographs showing the inflammation of the denture-bearing palatal mucosa

Predisposing factors to CAC are usually divided into local and systemic.Among the systemic factors are diabetes mellitus and disorders involving nutritional and immunity deficiencies and impairments. The denture's age, inadequate fitting, poor hygiene, microbial colonization, and continuous use are the most frequently stated local factors (Contaldo *et al.*, 2019; Muhvić-Urek *et al.*, 2020; Galvan *et al.*, 2021; Aoun and Cassia, 2016). The aim of this study was to evaluate the prevalence of denture's continuous wearing and its correlation withCAC in a sample of Lebanese denture wearers.

2. MATERIALS AND METHODS

This study was conducted in accordance with the Helsinki agreement for research on humans.Were included in this study patients who were: 1) between the ages of 40 and 80; 2) wearing an acrylic maxillary denture for over a year; 3) not having any systemic conditions like diabetes, malnutrition, etc. that are known to increase the risk of CAC; 4) not using any drugs that could alter the bacterial flora in the mouth.

Two hundred ninety patients (161 women and 129 men)meeting the inclusion criteria were selected, and their habit of denture's wearing was classified and noted as follows:

- Group 1: regular removal of the denture during the night
- Group 2: continuous use of the denture (regular night and day wearing).
- Group 3: irregular use of the denture.

Additionally, in order to diagnose CAC, a meticulous clinical oral exam was carried out, followed by a quantitative microbiological measurement to assess the presence of *Candidaalbicans* in its virulent form in the selected patient's palatal mucosa and the fitting side of their dentures. The two procedures were performed by the same investigator. The BBL Culture Swabs, sterile devices for collecting and transporting microbiological specimens (Amies, Stuart, and Agar gel), from the Becton-Dickinson (New Jersey, USA) Microbiology System, wereused. Culture of swabs was done in Sabouraud's dextrose agar (dextrose 40 g/l, peptone10 g/l, and agar 20 g/l), chloramphenicol 0.5 g/l, and actidione 0.5g/l. The incubation time was set to 48 hours at 37°C in aerobic conditions.Todifferentiate *Candida albicans* from other species, 0.5 ml of animal serum was added to provoke the filament production.

Candida albicans colony counts expressed in colony-forming unit (CFU)/ml collected from the denture surfaces and the palates were noted.Patient's age, gender, denture wearing status, and CACwere statistically evaluated.

3. RESULTS

Our sample of Lebanese population consisted of 290 acrylic maxillary denture wearers, 161 females (55.51%) and 129 males (44.48%). The patient's age ranged between 40 and80 years, with a mean of 64.25 years;out of the total 290 patients, 65 (22.41%) aged between 40 and 60 years, whereas the rest, 225 (77.58%), were older than 60(Table 1).

Variable		**n**	**%**
Age (years)	40-60	65	22.41
	> 60	225	77.58
Gender	Males	129	44.48
	Females	161	55.51

Table 1: Percentage distribution of sample according to age and gender

Of the 290 patients in our study, 85 (29.31%) wear their dentures continuously (group 2), 138 (47.58%) take them out at night (group 1), and 67 (23.10%) wear them irregularly(group 3) (Table 2).

Denture wearing	**n**	**%**
Group 1	138	47.58
Group 2	85	29.31
Group 3	67	23.10

	290	99.99

Table 2: Percentage distribution of status of denture wearing

In terms of gender, women made up 52.17% (72 out of 138) of the patients in group 1, 68.23% (58 out of 85) in group 2, and 46.26% (31 out of 67) in group 3 (Table 3).

Gender	**Female**	**Male**
Group 1	52.17% (72 out of 138)	47.82% (66 out of 138)
Group 2	68.23% (58 out of 85)	31.76% (27 out of 85)
Group 3	46.26% (31 out of 67)	53.73% (36 out of 67)

Table 3: Percentage distribution of status of gender in each group

170 out of 290 (58.62%), 82 females and 88 malesexhibited clinically and microbiologically CAC (*Candida* palate and denture colonization were confirmed). On the other hand, 120 patients (41.37%), 41males and 79 females, had healthy palatal mucosa without any inflammation signs (Table 4).

	CAC +	**CAC -**	**Total**
Male	88 (68.21%)	41 (31.78%)	129
Female	82 (50.93%)	79 (49.06%)	161
Total	170	120	290

Table 4: Association between gender and CAC; CAC +: presence of CAC. CAC -: absence of CAC

With respect to the patient's age, 41 out of the 65 patients (63.07%), aged between 40 and 60 years, showed CAC against 24 (36.92%), whereas for the second age group (> 60years),129 patients out of 225 (57.33%) exhibited CAC while 96 (42.66%) had a healthy mucosa (Table 5).

	CAC +	CAC -	Total
Age (years) 40-60	41 (63.07%)	24 (36.92%)	65
Age (years) > 60	129 (57.33%)	96 (42.66%)	225
Total	170	120	290

Table 5: Association between age groups and CAC; CAC +: presence of CAC. CAC -: absence of CAC

4. DISCUSSION

It has been widely admitted that both systemic and local predisposing factors are behind the etiology of CAC.Among the local factors is the continuous use of the denture (regular night and day wearing) (Sartawi *et al.*, 2021; Raghavendra Swamy *et al.*, 2018). This was explained by the fact that placing the oral mucosa in constant contact with the denture base diminishes the saliva's protective function and stops the mucosa from receiving enough oxygen, which lowers the mucosal resistance to microbial and mechanical aggressions (Sartawi *et al.*, 2021). For that, patients should be advised on meticulous plaque control and the avoidance of the nocturnal wearing of dentures, usually for eight hours per day (Sartawi *et al.*, 2021; Raghavendra Swamy *et al.*, 2018).

In ~~our~~ study, denture day and night wearing, or continuous use of the denture, was seen to be linked to CAC in 58.62% of the cases. This finding supports the ones of many researchers who conducted similar studies in different populations (Bilhan *et al.*, 2009; Kossioni, 2011; Navabi*et al.*, 2013; Sahebjamee *et al.*, 2011).

According to our study, CAC linked to continuous denture wear affects both sexes (male: 68.21%, female: 50.93%), particularly those in the 40–60 age range(63.07%).

This can be explained by the permanent usage of the denture for social and aesthetic purposes, especially for this age group.

Finally, there are certain limitations to our study, which aims to assess the impact of continuous denture usage on CAC in a sample of the Lebanese population. Definitive conclusions must be postponed until further study supports our findings due to the small number of patients evaluated.

5. CONCLUSION

A combination of different factors appears to be responsible for CAC. According to the present study, the day and night use of the denturesas well as its colonization by *Candida*,particularly *Candida albicans,* are among these factors.On the other hand, the age and gender of the patientare unrelated predictors of the disease.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Authors hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

CONSENT

As per international standards, written consent has been collected and preserved by the authors.

REFERENCES

- Abuhajar, E., Ali, K., Zulfiqar, G., Al Ansari, K., Raja, H. Z., Bishti, S., & Anweigi, L. (2023). Management of chronic atrophic candidiasis (denture

stomatitis)-a narrative review. *International journal of environmental research and public health*, *20*(4), 3029. https://doi.org/10.3390/ijerph20043029.

- Aoun, G., & Cassia, A. (2016). Evaluation of denture-related factors predisposing to denture stomatitis in a lebanese population. *Materia socio-medica*, 28(5), 392–396. https://doi.org/10.5455/msm.2016.28.392-396.

- Aoun, G., Cassia, A., & Berberi, A. (2015). Effectiveness of a chlorhexidine digluconate 0.12% and cetylpyridinium chloride 0.05% solution in eliminating candida albicans colonizing dentures: a randomized clinical in vivo Study. *The journal of contemporary dental practice*, *16*(6), 433–436. https://doi.org/10.5005/jp-journals-10024-1702.

- Bilhan, H., Sulun, T., Erkose, G., Kurt, H., Erturan, Z., Kutay, O., & Bilgin, T. (2009). The role of Candida albicans hyphae and Lactobacillus in denture-related stomatitis. *Clinical oral investigations*, *13*(4), 363–368. https://doi.org/10.1007/s00784-008-0240-6.

- Contaldo, M., Romano, A., Mascitti, M., Fiori, F., Della Vella, F., Serpico, R., & Santarelli, A. (2019). Association between denture stomatitis, candida species and diabetic status. *Journal of biological regulators and homeostatic agents*, 33(3 Suppl. 1), 35-41.

- Galvan, R., McBride, M., Korioth, T. V., & Garcia-Godoy, F. (2021). Denture hygiene as it relates to denture stomatitis: a review. *Compendium of continuing education in dentistry (Jamesburg, N.J.: 1995)*, 42(4), e1–e4.

- Kossioni A. E. (2011). The prevalence of denture stomatitis and its predisposing conditions in an older Greek population. *Gerodontology*, *28*(2), 85–90. https://doi.org/10.1111/j.1741-2358.2009.00359.x.

- Muhvić-Urek, M., Saltović, E., Braut, A., & Kovačević Pavičić, D. (2020). Association between Vitamin D and candida-associated denture stomatitis. *Dentistry journal*, 8(4), 121. https://doi.org/10.3390/dj8040121.

- Navabi, N., Gholamhoseinian, A., Baghaei, B., & Hashemipour, M. A. (2013). Risk factors associated with denture stomatitis in healthy subjects attending a dental school in southeast iran. *Sultan Qaboos University medical journal*, *13*(4), 574–580. https://doi.org/10.12816/0003318.

- Newton, A. V. (1962). Denture sore mouth. *British Dental Journal*, 112, 357-360.

- Raghavendra Swamy, K. N., Alla, R. K., Mohammed, S., & Konakanchi, A. (2018). The role of antifungal agents in treating denture stomatitis. *Research Journal of Pharmacology and Technology*, 11, 1365–1369. https://doi.org/10.5958/0974-360X.2018.00254.8.

- Ribeiro, A. B., de Araújo, C. B., Silva, L. E. V., Fazan-Junior, R., Salgado, H. C., Ribeiro, A. B., et al. (2019). Hygiene protocols for the treatment of denture-related stomatitis: local and systemic parameters analysis - a randomized, double-blind trial protocol. *Trials*, 20(1), 661. https://doi.org/10.1186/s13063-019-3854-x.

- Sahebjamee, M., Basir Shabestari, S., Asadi, G., &Neishabouri, K. Predisposing factors associated with denture induced stomatitis in complete denture wearers. *Shiraz University Dental Journal*, 2011, 11, 35-39.

- Sartawi, S. Y., Abu-Hammad, S., A Salim, N., & Al-Omoush, S. (2021). Denture stomatitis revisited: a summary of systematic reviews in the past decade and two case reports of papillary hyperplasia of unusual locations. *International journal of dentistry*, *2021*, 7338143. https://doi.org/10.1155/2021/7338143.

- Sivaramakrishnan, G., Sridharan, K. (2017). Alternatives to antifungal therapy for denture stomatitis: a systematic review and meta-analysis. *Saudi Journal of Oral Sciences,* 4, 67–71. https://doi.org/ 10.4103/sjos.SJOralSci_22_17.