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Oral Candida Albicans Colonization In Denture Wearer: A Literature Review

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ABSTRACT

Denture stomatitis is the most prevalent multifactorial, chronic inflammatory oral condition amongs denture wearers. One of the primary roles of dentures in denture stomatitis is their potential to cause irritation and inflammation of the oral tissues. This continuous irritation creates an environment where fungal infections, notably *C. albicans*. The traumatic factors such as mechanical trauma caused by loose prosthesis can increase the risk of tissue penetration and colonization of *Candida* species. This literature review aimed to explore the colonization of *C. albicans* in the denture wearer. The article was conducted of two databases and were limited to the period from 2019 to 2024 with a combination of the following keywords: "oral *Candida albicans*" "colonization" "denture wearer". The results obtained A total of 243 articles were initially identified through the designated keywords in PubMed and Google scholar. After meticulous removal of duplicate articles and application of the inclusion and exclusion criteria, 7 articles met the study's eligibility criteria. *C. albicans* was the predominant species recovered from oral caviproty of both denture wearers and non-denture wearers. *C. albicans* can not only adhere to the oral mucosa but also can colonize the surface of the acrylic denture when it is poorly maintained. The presence of prosthetic appliances changes the microenvironment of the oral cavity through the facilitation of *Candida* colonization and proliferation. The biofilm on the denture can enhance its adhesion adding to its virulence. Wearing of a denture has been found to enhance adhesion of *C. albicans*.

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INTRODUCTION

Denture stomatitis is the most prevalent multifactorial, chronic inflammatory oral condition amongs denture wearers. It affects edentulous people who wear complete or partial dentures, as well as those who use intraoral removable orthodontic appliances and obturators. Denture stomatitis most commonly involves the palate and is more likely to be observed in patients with acrylic dentures than prostheses fabricated using other materials or in other locations. As elderly people are more likely to use dentures, the condition is far more prevalent in older

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populations. Denture stomatitis is also seen in healthy, younger people who wear dentures.(Abuhajar et al., 2023)

The precise pathogenies of denture stomatitis are not known, but infection with *Candida* is most likely to be associated with mucosal trauma induced by ill-fitting dentures, sub-optimal oral hygiene, the nocturnal wearing of dentures, and xerostomia.(Sivaramakrishnan & Sridharan, 2017) The fitting surface of dentures provides a protected environment for the entrapment of yeast cells, which are able to colonize the irregularities in the denture-base and denture-relining materials. This is more likely to occur in patients with other risk factors, such as poor oral hygiene and the continuous wearing of dentures.(Iba et al., 2021)

One of the primary roles of dentures in denture stomatitis is their potential to cause irritation and inflammation of the oral tissues. Ill-fitting dentures can exert pressure on the soft tissues of the mouth, leading to friction and sore spots. This continuous irritation creates an environment where fungal infections, notably *C. albicans*. This fungal can thrive and contribute to the development of denture stomatitis.(Singh et al., 2023)

The role of *C. albicans* in the development of denture stomatitis is associated with the fact that this yeast has the ability to colonize the oral mucosa and the surface of the dentures and build aggregates with oral bacteria. What also increases the incidence of denture stomatitis associated with *Candida* is the fact that thepresence of denture reduces the flow of saliva and oxygen to the tissues below the denture base, which increases the local acidity and anaerobic conditions and thus contributing to the growth of yeasts.(Jovanović et al., 2018) *C. albicans* has the affinity to adhere to the acrylic from which denture is made, and the acrylic resin possesses certain characteristics, such as hydrophobicity, which accelerates adhesion as a major step associated with the formation of biofilm.(Tamura, 2005)

Candida albicans is a common commensal fungus that colonizes the oropharyngeal cavity, gastrointestinal and vaginal tract, and healthy individuals' skin. Approximately, 35%-80% of population are carriers of oral *Candida* species. *Candida spp.* are found in all humans as part of the normal oral flora. The most common species in infected and healthy mouths is *C. albicans.* It is found in over 80% of oral fungal isolates.(Talapko et al., 2021)

The rough surface of the acrylate promotes increased retention of microorganisms and protects them from the forces that tend to remove, leaving the microorganisms trapped by the irregular surface of the prosthesis, even after cleansing. The traumatic factors such as mechanical trauma caused by loose prosthesis can increase the risk of tissue penetration and colonization of *Candida* species. The age of the prosthesis is also an important factor, because it is more difficult to maintain hygiene if prosthesis areworn for a long time and there is a tendency towards toporosity of denture base, which favors the occurrence of infection.(Hasan & Kuldeep, 2015)

There are many cases of denture stomatitis in denture wearer, so this condition of oral infection needs to be a concern. This literature review aimed to explore the colonization of *C. albicans* in the denture wearer. The objective was to enhance awareness in denture wearer to maintain oral hygiene and their denture.

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METHODS

This study conducted search for articles using two key databases, namely PubMed and Google Schoolar. The search criteria involved specific keywords, including “oral *Candida albicans*” "colonization" "denture wearer". The article selection adhered to the guideline established by the Preferred Reporting Items for Systematic Reviews and Meta analyses (PRISMA) protocol.

The process involved eliminating duplicate articles, and further refinement cluded articles published within 2019 – 2024 and those published in the English language. Book sections, studies involvoing animals, review articles, and conference proceedings were excluded. Data extraction encompassed a range of variables such as author names, article titles, publication years, study designs.

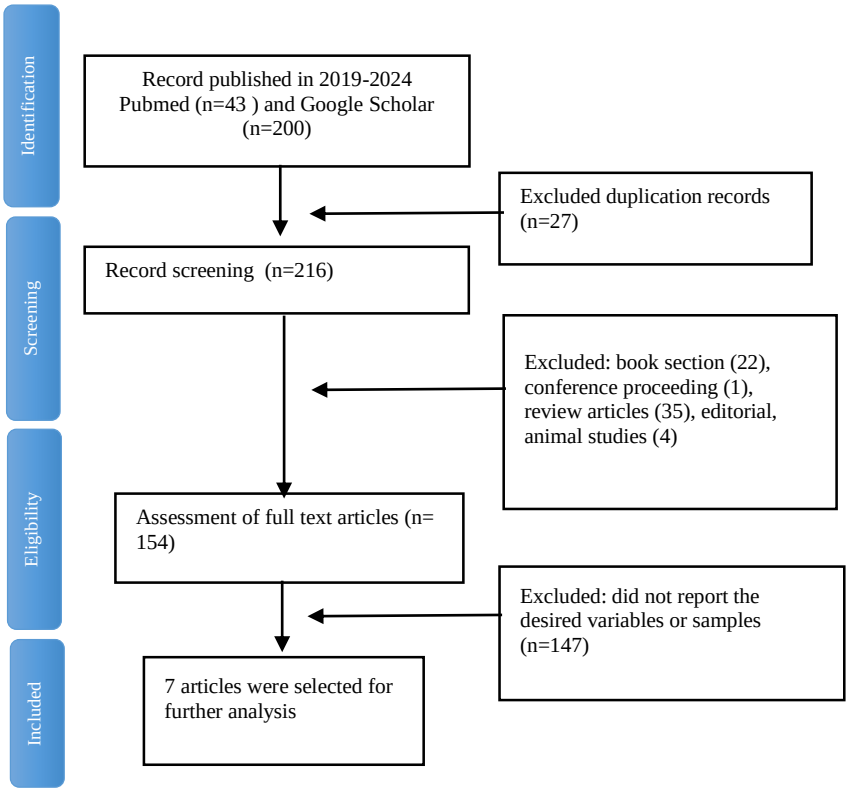

Figure 1 The article selection process flow diagram

RESULTS AND DISCUSSION

The article selection process is outlined in Figure 1. A total of 243 articles were initially identified through the designated keywords in PubMed and Google scholar. After meticulous removal of duplicate articles and application of the inclusion and exclusion criteria, 7 articles met the study’s eligibility criteria. Table 1 provides a summary of the extracted data from the selected studies. Of the 7 articles included studies, 5 were categorized as experimental studies, the other articles were cross sectional study. Each of these studies and prospective case series. Each of these studies focused relation between denture wearers and heavy

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growth of *C. albicans.* The denture was factor for oral colonization of *Candida* species and biofilm formation.

Table 1 Data extracted from included studies

No	Authors	Title	Publication Year	Study Design	Results
1	Manikandan, Saranya; Vinesh, E; Selvi, D. Thamarai; Kannan, R. Kamala; Jayakumar, Arun; Dinakaran, J(Manikandan et al., 2022)	Prevalence of *Candida* among Denture Wearers and Nondenture Wearers	2022	Cross-sectional study	-Denture wearers with oral *Candida* had a higher prevalence of candidiasis associated denture stomatitis - There was a significant relation between denture wearers and heavy growth of *C. albicans* and *C. krusei* in saliva culture.
2	Maja Kinkela Devcic,Suncana Simonic-Kocijan, Jelena Prpic , Igor Paskovic,Tomislav Cabov,Zoran Kovac, Irena Glazar (Kinkela Devcic et al., 2021)	Oral Candidal Colonization in Patients with Different Prosthetic Appliances	2021	Experimental	Subjects who have PMMA-based dentures more frequently exhibit *Candida* colonization, with *C. albicans* being the predominant species.
3	Ebtihal Mohamed Madar , Khaled Saad Abdulrahman Al-Khames, and Hassan Abdulwahab Al-Shamahy(Madar et al., 2024)	The Effect of Denture wearing and Fixed Orthodontic Appliance on Increasing the Colonization Rate of Candida in the Oral Cavity	2024	Experimental	- Denture patients, the mean of the buccal *Candida* count was 83.8 CFU/mL. - Non prosthesis controls, the value were significantly lower than those of the denture or orthodontic patients, the mean of the buccal *Candida* count was 57,8 CFU/ml.

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No	Authors	Title	Publication Year	Study Design	Results
4	Yasser Khaled, Bindiya K Pahuja(Khaled & Pahuja, 2019)	Identifying the Different Kinds of Oral *Candida* Species in Denture Wearing Patients	2019	Experimental	-Candida species distribution in 20 group I diabetic patients: 4 types of *Candida* species were identified. *C. albicans* was seen in 12 (60%) patients - Candida species distribution in 20 group II non-diabetic patients: *C. albicans* was seen in 11 (55%) patients - Candida species distribution in 20 group III healthy denture wearers: *C. albicans* was seen in 7 (35%) patients.
5	Mohammed A Al-Iabani, Abdalhaq Hussin Alhasani, Ameen Abdullah Yahya Al-Akwa and Hassan Abdul Wahab Al-Shamahy(Alhasani et al., 2020)	Biofilm Formation and Antifungal Susceptibility of *Candida* Isolates Oral Cavity of Denture Wearer and Free Denture Individuals	2020	Experimental	-There were significant quantitative differences in biofilm formation between *Candida* species isolates from denture patients compared to isolates from denture-free individuals (54.2% versus 19.2%) (p = 0.001 -The present study proved that *C. albicans* is still the major isolate from oral cavity, but non-albicans species colonization is raised; denture was factor for oral colonization of *Candida* species, and biofilm formation.

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No	Authors	Title	Publication Year	Study Design	Results
6	Mousa, Mohammed A; Lynch, Edward; Kielbassa, Andrej M.(Mousa et al., 2020)	Denture-related stomatitis in new complete denture wearers and its association with Candida species colonization: a prospective case-series	2020	Prospective case-series	The most prevalent type of Candida at baseline was C albicans, followed by non-C albicans species (C glabrata). Counts of Candida species significantly increased from the day of insertion to the first month (P < . 05), but there were no significant changes between the first and second month (P > . 05)
7	Taebunpakul, Patrayu; Jirawechwongsakul, Pimporn (Taebunpakul & Jirawechwongsakul, 2021)	Palatal Inflammation and the Presence of *Candida* in Denture-Wearing Patients	2021	Experimental	The proportion of patients with a large amount of *Candida* colonization in the DS group (40.38%) was higher than in the non-DS group (26.67%), the amount of *Candida* colonization between the two groups was not significantly different.

Candida is a commensal microorganism in the oral cavity. However, when host immune system is compromised or there are local predisposing conditions, these fungi can cause oral and systemic infection (candidiasis). The presence of prosthetic appliances changes the microenvironment of the oral cavity through the facilitation of *Candida* colonization and proliferation. Besides, the appliance itself adheres to the mucosal surface, thus preventing the physiological cleansing and normal saliva flow. It was demonstrated that 93.8% of subjects with prosthetic appliances were positive for *Candida* spp. compared to 65% of the subjects who did not wear any appliance. Available data on *Candida* colonization in denture wearers show the percentage of positive findings in 80–100% of the subjects compared to 45–65%

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in denture-free subjects. hose patients had a significantly decreased salivary flow rate which further facilitates the development of *Candida* colonies.(Buranarom et al., 2020) Subjects with metal framework-based dentures were less prone to *Candida* colonization and had better values of salivary flow rate. Regardless of the material used for dentures, all patients need regular dental check-ups and good oral hygiene maintenance, both of which will provide a better quality of life for denture wearers and prevent the development of oral diseases.(Kinkela Devcic et al., 2021)

Denture wearer is highly prone to develop *Candida*-associated denture stomatitis (CADS) due to the conversion of the normal oral commensal *Candida* spp. into a pathogen under favorable conditions. (Perić et al., 2024) Immunocompromised status, trauma from the prosthesis, other systemic conditions, and improper maintenance of the dentures by the patient are few of the causative agents which turn the oral balance into an unhealthy and unsuitable foundation for the wearing of the prosthesis. *C. albicans* has been the most frequent species of *Candida* in causing denture stomatitis.(Gleiznys et al., 2015) This yeast has the ability to colonize different areas of the oral cavity due to the specific interactions between the two. It has been known to adhere even to complement receptors and some sugar residues that are present on the host surfaces. Tissue invasion by this species causes infection of the oral mucosa. *C. albicans* can not only adhere to the oral mucosa but also can colonize the surface of the acrylic denture when it is poorly maintained. The biofilm on the denture can enhance its adhesion adding to its virulence. Wearing of a denture has been found to enhance adhesion of *C. albicans*.(Manikandan et al., 2022)

C. albicans was the commonest yeast found on patients dentures, followed by *C. glabrata* and *C. tropicalis*. In another study, *C. albicans*, *C. glabrata* and *C. tropicalis* represented 80% of isolates from clinical infections. In terms of frequency distribution, some studies have shown that *C. tropicalis* was the second most prevalent species identified. However, contrasting results have been found in other studies, in which *C. glabrata* was the most common yeast after *C. albicans. C. albicans* and non-albican species of *Candida* can be identified in denture stomatitis with or without diabetes. But more diversity of *Candida* species were observed in patients with diabetes and denture stomatitis which indicates there is influence of diabetes on *Candida* species variation. Even in healthy denture wearing individuals also showed presence of *Candida non albicans*. Most common species was *C. albicans* as supported by various studies. Prevalence *of C. glabrata* was higher in the presence of inflammation. Presence of *C. parapsilosis* was seen in patients with diabetes mellitus (Khaled & Pahuja, 2019)

C. albicans was the predominant species recovered from oral cavity of both denture wearers and non-denture wearers. In a recent studies *C. albicans* was reported as the major agents of stomatitis. Positive biofilms were more observed with denture patients 64/104 (54.2%) versus 19.2% in non-denture wearer isolated strains. The association (odds ratio) between denture wear and biofilm formation was 4.97, with 95% CI = 1.7 - 14 and significant p value (p = 0.001) (Table 3). The majority of *Candida* species recovered from the dentures (biomaterials) (54.2%) have higher capacity to produce biofilm. *Candida* species are frequently found in the normal microbial flora of humans, which facilitates their encounter

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through implanted biomaterials and host surfaces. The devices become colonized by *Candida* which forms biofilm, the detachment of which can result in infections. Dentures therefore, represent a major risk factor associated with oral *Candida* infections.(Alhasani et al., 2020)(Devi et al., 2015)

CONCLUSION

C. albicans was the predominant species recovered from oral cavity of both denture wearers and non-denture wearers. *C. albicans* can not only adhere to the oral mucosa but also can colonize the surface of the acrylic denture when it is poorly maintained. The presence of prosthetic appliances changes the microenvironment of the oral cavity through the facilitation of *Candida* colonization and proliferation. The biofilm on the denture can enhance its adhesion adding to its virulence. Wearing of a denture has been found to enhance adhesion of *C. albicans*.

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