

## STORING DENTURES OVER NIGHT AND THE INFLUENCE ON BACTERIALS COLONIZATION OF ACRYLIC SURFACES

Maria Bolat<sup>1</sup>, Dan Nicolae Bosînceanu<sup>1</sup>, Nita Bogdan Vasile<sup>2</sup>, Raluca-Elena Baciuc<sup>1</sup>, Balcos Carina<sup>3</sup>, Dana Gabriela Budală<sup>1</sup>

<sup>1</sup>"Gr. T. Popa" U.M.Ph. - Iași, Romania, Faculty of Dentistry, Implantology, Removable Dentures, Dental Technology

<sup>2</sup> Dentist, Private Practice, Iasi, Romania

<sup>3</sup>"Gr. T. Popa" U.M.Ph. - Iași, Romania, Faculty of Dentistry, Department of Prevention

\* Corresponding author: , Nita Bogdan Vasile , *e-mail*: bogdan.nyta@gmail.com

### ABSTRACT

**Introduction:** As the adhesion of microorganisms to the surfaces of the dentures is a prerequisite for microbial colonization, the development of methods that can reduce the adhesion of *C. albicans* may represent a significant advance in the prevention of dentures-induced stomatitis. Although due to the increase in awareness about oral health care, the number of edentulous patients has decreased, but there are still a large number of denture wearers in countries such as Romania.

**Keywords:** provisional crown, fixed prosthodontics, bis-acrylic, PMMA, artificial saliva.

### INTRODUCTION.

The loss of natural teeth, either due to aging or other variable reasons has a direct impact on the functionality as well as the psychosocial behavior of the patient's life. It is practically considered to be an inadequate health care problem that compromises the quality of life [1–3].

The presence of a biofilm - ie structured microbial communities that are attached to a surface and embedded in an exopolymer matrix - on dentures has been associated with severe systemic disorders, especially in dependent elderly. Oral bacteria have been implicated in bacterial endocarditis, aspiration pneumonia, chronic obstructive pulmonary disease [4,5].

Although due to the increase in awareness about oral health care, the number of edentulous patients has decreased, but there are still a large number of denture wearers in countries such as Romania [4-6].

The denture plaque is a complex aggregate that contains more than 108 organisms per milligram and involves more than 600 prokaryotic species. Different species collaborate on based on the type of dentures, the support structure of the prostheses in implants, mucous support, and dental support, and the location of the

treatment in prosthetic treatment to restore the anterior or posterior area. [7,8].

The fixed prosthesis had a better influence on quality of life than the partially detachable ones, according to the assessment of health status generated by the oral health status. In addition, the location of the prosthetic treatment has an impact on the patient's health. [9,10].

### LITERATURE REVIEW.

Millions of people around the world have lost all their teeth and the prevalence of total edentation increases with age. In Europe, the prevalence of edentulousness between 65 and 74 years varies from 12.8% in Italy to 69.6% in Iceland [11].

*Candida* spp. are more often isolated from the inner surface of dentures compared to the outer one.

Therefore, treatment of denture-induced stomatitis should include cleaning the dentures and disinfection in addition to administering a systemic or local antifungal.

Although these treatments show some effectiveness, they aim to inactivate microorganisms after the surface of the

colonized prosthesis [12,13].

As the adhesion of microorganisms to the surfaces of the dentures is a prerequisite for microbial colonization, the development of methods that can reduce the adhesion of *C. albicans* may represent a significant advance in the prevention of dentures-induced stomatitis [14].

For all conditions tested, the results showed that *C. albicans* adhesion was not influenced by saliva. There is no consensus in the literature on the effect of saliva in adhesion of *C. albicans*. Some authors found an increase in *C. albicans* adhesion to salivary film-coated materials, while others observed a decrease in adhesion [15].

This divergence of results could be attributed to differences in materials used as substrates to test *Candida* adhesion.

In a random sampling of 10% of an elderly population in Denmark among individuals dentures wearers, those wearing a complete or partial removable upper denture were found to have dental stomatitis (65%) or healthy palatal mucosa (35%), and *Candida albicans* was present in 86.5% and 75% of the respective groups [16,17].

Another study performed in patients with dental stomatitis confirmed this finding, determining that 92% have *C. albicans* present. *C. albicans* exists in a form of yeast and hypha; form hyphae were more common in the group with dental stomatitis (77%) than in the group with healthy mucosa (47%) [18].

Moreover, inflammatory cells with a large number of hyphae were observed in those with dental stomatitis (65%) compared to those with healthy palatal mucosa (14%).

Although *C. albicans* has 18 different strains and may be more pathogenic than other species in the genus, the ability to colonize the oral mucosa and complete dentures may result from its role as an opportunistic pathogen, taking advantage of

the continued wear of dentures, poor hygiene of dentures, older and therefore poorly adapted dentures or systemic factors such as smoking or an immunocompromised condition [19,20].

The type of dentures, salivary pH and microbiological findings were not statistically significant, but another recent study looked at potential risk factors associated with dental stomatitis could not use multivariate analysis to determine a single predictor of its severity. The authors indicated that other studies should be considered to investigate new variables [21].

An interview and clinical examination of 71 dentures wearers found that wearing dentures overnight, poor hygiene, and cleaning dentures were statistically significant for the prevalence of stomatitis. The cleaning methods used were washing (60.6%), brushing with toothpaste (24%) and keeping in water (15.4%). The questionnaire also asked where dentures were stored when not worn (water, moisture or dry), but no findings were reported [22].

There is uncertainty about what effect storage can have on the elements that have been proven to contribute to the development of prosthetic stomatitis due to a lack of research in the literature on how dentures are stored overnight. With the risk of negative consequences if stomatitis develops, identifying the proper overnight storage of dentures necessitates more research [23].

This is especially relevant because studies have revealed that the inside surface of the prosthesis is the main reservoir for *C. albicans*. As a result, a systematic study was conducted to determine the impact of overnight storage conditions on *C. albicans* colonization of the denture. Complete denture acrylic resin can undergo polymerization contraction followed by water adsorption, resulting in dimensional

alterations. Because overnight storage conditions can alter adaptation, especially over time, a secondary study topic was investigated: the effect of overnight storage conditions on the stability of complete denture dimensions [24,25].

OVID Medline (1976 to November 2020) and SCOPUS (1960 to November 2020) were systematically searched to find randomized controlled trials or comparative studies on patient satisfaction, intervention, comparison, and outcome (PICO), "Do overnight storage conditions affect *C. albicans* colonization in patients wearing complete dentures?" [26].

The search methodology combined the use of the keywords "prosthesis \*", "denture \*", "acrylic resin \*", "storage", "night", "overnight", "wet", "dry", "water \*". , and "solution" and relevant terms of the medical subject (Mesh) headings using the link words or and times. During the initial search, the included articles were limited to English.

Following the removal of duplicate papers, all titles and abstracts were evaluated using the inclusion and exclusion criteria. Human studies, randomized controlled trials, or comparative studies that included fully edentulous patients treated with complete prostheses and investigated the influence of overnight storage conditions on *C. albicans* colonization, as well as research written in English, were all included.

Any research that did not employ overnight or at least 8 hours for storage conditions were excluded. We looked for and analyzed relevant full-text papers as well as those for which no abstract was available. After that, a manual search was carried out.

The authors, study design, aims, treatment groups, overnight storage period, regimen, and person to clean were all collected for all selected papers. Storage,

tracking, and important outcomes are all pre-controlled.

"Do differing overnight storage conditions have an influence on the dimensional stability of complete dentures or acrylic resins in patients wearing dentures?" is a secondary inquiry. was also mentioned.

In vivo or in vitro comparative investigations were the inclusion criteria. Any research that did not employ overnight or at least 8 hours for storage conditions were excluded. We looked for and analyzed relevant full-text papers as well as those for which no abstract was available. Finally, a manual search was carried out.

Authors, study design, aims, treatment groups, overnight storage period, specimen used, follow-up, outcomes, and significant results were all collected for the secondary research question.

A total of 162 studies were found after searching the web database. There were 159 studies left after the duplicates were removed. The full-text papers were examined after the titles and abstracts were reviewed and the inclusion and exclusion criteria were applied. The systematic review comprised four studies for the main research issue.

The online database search was followed by a manual search through the references of the included studies, but no additional studies were selected. For the secondary research question, they have

2 full-text studies were evaluated, which included one of the studies in the primary research question. A manual search through the references of the included studies, as well as a manual search led to an additional study, which resulted in a total of 3 studies included for the secondary research question.

Three randomized controlled trials and one comparative research were included in

the four studies that assessed the influence of overnight storage conditions on *C. albicans* colonization, however a meta-analysis was not possible due to differences in study design and observed results.

A total of 125 complete edentulous patients with complete dentures were included in the research. Only one out of 14 research gave information on the participants' gender (7 men, 25 women) and only one study supplied the mean age (85.9 5.9 years). Two studies included dental school students, and two studies included institutionalized patients.

Participants from the dental school were engaged in two studies. Dry storage, water storage, water storage with an alkaline peroxide-based cleaning tablet, and water storage with 0.5 percent sodium hypochlorite were all employed in the study for overnight storage. Overnight storage was defined as 8 hours or more of storage time, or simply as overnight storage.

When storage conditions were applied, Stafford et al. found that the average density of *C. albicans* colony-forming units reduced from 161.7 142.8 to 12.5 13.4.

When water storage conditions were employed, the value climbed from 179.3 171.4 to 320.8 101.4. In dry storage settings, the prevalence of *C. albicans* decreased from 100% to 58%, but maintained at 100% in water storage conditions. The only statistics used were descriptive statistics.

The incidence of *C. albicans* was lowest in storage in the presence of alkaline peroxide tablets, especially when compared to the water storage group in both the forming and mature biofilms, according to Duyck et al., however the difference was not statistically significant ( $P = .06$ ).

The number of *C. albicans* in the growing biofilm ( $P.05$ ) and mature biofilm ( $P.01$ ) was statistically substantially lower in the presence tablets storage group compared to

the water storage group. The number of *C. albicans* in forming and mature biofilms was the same in the tablet storage group.

The overnight storage treatments were either storage and drying for 8 hours, followed by storage in water, or dry storage for 8 hours, followed by storage in artificial saliva for 16 hours or 8 hours in distilled water, followed by 16 hours in artificial saliva. The duration of the tracking ranged from two minutes (the interval between them was unknown) to thirty days.

Optical equipment or optical equipment with a software application were used to measure the outcomes of the dimensional change. Stafford et al. found an average overall contraction of 0.0267 mm (0.05 percent) with a range of 0.002 to 0.055 mm (0.005 percent to 0.1 percent) using descriptive statistics, which was regarded minor from a clinical standpoint.

The highest dimensions change was found when the fully hydrated prostheses were dried in the first 8 hours, according to Abd Shukor et al., although the statistical significance of dimensional changes was reduced with cyclic drying. While dimensions variations were seen in different types of resin, they were so minor as to be clinically meaningless.

Finally, according to Garcia Lda et al, acrylic resin stored overnight in distilled water had the largest change in size compared to the control groups (stored exclusively on land), which was statistically significant ( $P.05$ ), and the groups with 8 hours of land storage had the smallest amount of dimensional change.

## CONCLUSIONS

Based on the findings of this systematic review, the following conclusions were drawn:

1. The nocturnal pre-storage cleaning regime has a significant importance in reduction of *C. albicans* colonization of complete dentures.
2. The use of an alkaline peroxide cleaning tablet should be recommended if the standard of this program is compromised.
3. If a tablet is not available, overnight dry storage with clinically minor alterations to the full prosthesis' dimensional stability is an alternative.
4. If the pre-storage cleaning process is compromised, storing the complete prosthesis in water alone is not recommended since it may encourage *C. albicans* colonization.
5. If it is reasonable to assume that oral

hygiene and dental prosthesis are unsatisfactory in the elderly and are strongly linked to dental stomatitis and more serious systemic diseases, the study findings may be extremely relevant for the target population by providing evidence for a clinical guide - currently lacking - for the storage and maintenance of prostheses overnight.

6. Although we all know that dentures should be cleaned on a regular basis, it is evident that there are no evidence-based guidelines to help prosthetic wearers make the best decisions for their health. Their verbal communication. This absence of clear instructions makes it difficult for denture users to properly care for their dentures. The majority of denture wearers, according to most surveys, do not keep their dentures clean.

## REFERENCES

1. Crispin, B.J., Caputo, A.A., Color stability of temporary restorative materials, *J Abduo J*, 1. Jose A, Coco BJ, Milligan S, Young B, Lappin DF, Bagg J, et al. Reducing the incidence of denture stomatitis: Are denture cleansers sufficient? *J Prosthodont*. 2010;19:252-57.
2. Nevzatoğlu EU, Özcan M, Kulak-Ozkan Y, Kadir T. Adherence of *Candida albicans* to denture base acrylics and silicone-based resilient liner materials with different surface finishes. *Clin Oral Investig*. 2017;11:231-36.
3. Vural C, Özdemir G, Kurtulmus H, Kumbuloglu O, Özcan M. Comparative effects of two different artificial body fluids on *Candida albicans* adhesion to soft lining materials. *Dental Materials Journal*. 2010;29:206–12.
4. Santos VR, Gomes RT, de Mesquita RA, de Moura MD, França EC, de Aguiar EG, et al. Efficacy of Brazilian propolis gel for the management of denture stomatitis: A pilot study. *Phytother Res*. 2018;22:1544-47.
5. Amin WM, Al – Ali MH, Salim NA, Al – Tarawneh SK. A new form of intra oral delivery of antifungal drugs for the treatment of denture induced oral candidosis. *European J Dent*. 2019;3:257-66.
6. Vasconcelos LC, Sampaio MC, Sampaio FC, Higino JS. Use of *Punica granatum* as an antifungal agent against candidosis associated with denture stomatitis. *Mycoses*. 2013;46:192-96.
7. Vojdani M, Zibaei M, Khaledi AAR, Zomorodian K, Ranjbar MA, Boshehri S. In vitro study of the effect of clotrimazole incorporation into silicone denture liner on fungal colonization. *Shiraz Univ Dent J*. 2009;9(Suppl. 1):19-23.

8. Li L, Redding S, Dongari-Bagtzoglou A. *Candida glabrata*: an emerging oral opportunistic pathogen. *J Dent Res* 2017; 86: 204–15
9. Yoshijima Y, Murakami K, Kayama S et al. Effect of substrate surface hydrophobicity on the adherence of yeast and hyphal *Candida*. *Mycoses* 2019; 53: 221–6.
10. Luo G, Samaranayake LP. *Candida glabrata*, an emerging fungal pathogen, exhibits superior relative cell surface hydrophobicity and adhesion to denture acrylic surfaces compared with *Candida albicans*. *APMIS* 2012; 110: 601–10
11. Park SE, Periathamby AR, Loza JC. Effect of surface-charged poly[methyl methacrylate] on the adhesion of *Candida albicans*. *J Prosthodont* 2013; 12: 249–54
12. Dhir G, Berzins DW, Dhuru VB, Periathamby AR, Dentino A. Physical properties of denture base resins potentially resistant to *Candida* adhesion. *J Prosthodont* 2017; 16: 465–72.
13. Park SE, Blissett R, Susarla SM, Weber HP. *Candida albicans* adherence to surface modified denture resin surfaces. *J Prosthodont* 2018; 17: 365–9
14. Puri G, Berzins DW, Dhuru VB et al. Effect of phosphate group addition on the properties of denture base resins. *J Prosthet Dent* 2018; 100: 302–8
15. Redding S, Bhatt B, Rawls HR, Siegel G, Scott K, Lopez-Ribot J. Inhibition of *Candida albicans* biofilm formation on denture material. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2019; 107: 669–72
16. Zamperini CA, Machado AL, Vergani CE, Pavarina AC, Giampaolo ET, da Cruz NC. Adherence in vitro of *Candida albicans* to plasma treated acrylic resin. Effect of plasma parameters, surface roughness and salivary pellicle. *Arch Oral Biol* 2010; 55: 763–70.
17. Hauser J, Zietlow J, Koeller M et al. Enhanced cell adhesion to silicone implant material through plasma surface modification. *J Mater Sci- Mater Med* 2019; 20: 2541–8
18. Bazaka K, Jacob MV, Crawford RJ, Ivanova EP. Plasma-assisted surface modification of organic biopolymers to prevent bacterial attachment. *Acta Biomater* 2011; 7: 2015–28.
19. Yildirim MS, Hasanreisoglu U, Hasirci n, Sultan N. Adherence of *Candida albicans* to glow-discharge modified acrylic denture base polymers. *J Oral Rehabil* 2015; 32: 518–25.
20. Li Y, Kuai P, Huo P, Liu C. Fabrication of CuO nanofibers via the plasma decomposition of Cu[OH]2. *Mater Lett* 2009; 63: 188–90.
21. Yildirim MS, Kesimer M, Hasirci N, Kilic, N, Hasanreisoglu U. Adsorption of human salivary mucin MG1 onto glow-discharge plasma treated acrylic resin surfaces. *J Oral Rehabil* 2006; 33: 775–83.
22. Zamperini CA, Machado AL, Vergani CE, Pavarina AC, Rangel EC, da Cruz NC. Evaluation of fungal adherence to plasmamodified polymethylmethacrylate. *Mycoses* 2011; 54: 344–51.