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Oral *Candida albicans* Colonization in Completely Edentulous Individuals before and after Complete Denture Rehabilitation

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Abstract

Objectives: The objective of this study is to determine the prevalence of *Candida albicans* in a population of Moroccan completely edentulous patients before and after prosthetic rehabilitation. **Materials and Methods:** Sixteen completely edentulous patients who consulted the CCTD in Casablanca for prosthetic rehabilitation. Samples were collected using sterile swabs prior to denture insertion from saliva, the maxillary mucosa, and the mandibular mucosa. Samples were collected at 2 and 4 months after prosthesis placement from saliva, the maxillary mucosa, the mandibular mucosa, the maxillary prosthesis, and the mandibular prosthesis. These samples were cultured in Petri dishes using Sabouraud medium. Colony isolates were identified using the Api Candida gallery. **Results:** Identification confirmed the presence of *Candida albicans* in the samples collected. The prevalence of *Candida albicans* was higher at T2 (4 months after denture insertion) than at T0 (before denture insertion) at all sampling sites. **Conclusion**: The prevalence of *Candida albicans* is significantly higher among edentulous individuals who wear dentures than among edentulous individuals who do not wear dentures. The combination of factors such as denture wear and reduced salivary flow contributes to the creation of a microenvironment conducive to the growth of *Candida albicans*. These results underscore the crucial importance of maintaining rigorous oral and denture hygiene to minimize fungal colonization and associated complications. Regular dental care and patient education on proper cleaning techniques are essential for reducing the risk of *Candida albicans*-related infections.

Subject Areas

Dentistry

Keywords

Candida Albicans, Completely Edentulous Patients, Acrylic Resins, Colonization, Denture-Related Stomatitis

1. Introduction

The oral cavity harbors a complex microbiome that includes *Candida albicans*, a commensal fungus that can become pathogenic under certain conditions. In edentulous individuals, the presence of a removable denture promotes its colonization due to the characteristics of acrylic surfaces and changes in the oral microenvironment, such as reduced salivary flow and oxygenation. Denture wearers have a higher prevalence of Candida colonization, reaching up to 89%, compared to 45%-65% among non-wearers [1]. This colonization is closely linked to denture stomatitis, the development of which is promoted by poor hygiene, prolonged denture wear, and certain systemic factors. Conversely, in edentulous individuals without dentures, *C. albicans* generally remains a commensal, except in the presence of predisposing factors such as xerostomia, systemic diseases, or antibiotic therapy [2].

The objective of this study is to compare the prevalence of *Candida albicans* among edentulous individuals with and without dentures, to analyze the role of dentures in fungal colonization, and to identify strategies for the prevention and clinical management of associated infections.

2. Materials and Methods

2.1. Study Design

-Part One:

A cross-sectional experimental study (Time 0) involving 16 completely edentulous patients without dentures, measuring the prevalence of *Candida albicans*

-Part Two:

Longitudinal experimental study of the same patients after denture fitting, measuring the prevalence of *Candida albicans* at Time 1 (2 months after denture insertion) and then at Time 2 (4 months after denture insertion).

2.2. Subjects

Our study included 16 completely edentulous patients without dentures from among those seeking care at the removable prosthodontics department of the Casablanca Dental Consultation and Treatment Center.

-Inclusion Criteria:

The 16 participants were selected based on specific criteria:

*Good overall health, thereby ruling out systemic diseases that could cause dry mouth or inflammation of the oral mucosa.

*Motivation and cooperation on the part of the participants selected for our

study, thereby avoiding skeptical individuals who might not show up for their appointments.

*Individuals who were completely edentulous.

*Individuals who had never worn dentures; wearing previous dentures could alter the composition of the oral flora.

-Exclusion criteria:

*Individuals with systemic diseases;

*Individuals with harmful habits such as smoking, drug use, and alcohol consumption; these products, which contain chemical compounds, could alter the condition of the mucous membranes and change the composition of the oral flora or the mucous membranes of individuals with all or some of their natural teeth;

*Completely edentulous individuals who previously wore dentures;

*Individuals who have undergone antibiotic therapy in the past 3 months, as antibiotics may alter the composition of the oral microbiota.

2.3. Variables

The results obtained in our study will be categorized according to:

*Age

*Gender

*Sampling site (saliva, mucosa, maxillary and mandibular prosthetic underside)

*Prosthetic hygiene

*Presence of subprosthetic stomatitis

*Use of medications other than antibiotics.

2.4. Materials

*Sterile plastic swabs (3 × 16 × 3)

*An insulated carrying case

*Culture medium for the genus Candida (Sabouraud medium)

*An electronic scale for accurately measuring the amount of culture medium

*A hot plate for preparing the medium

*A bottle for sterilization

*An autoclave for sterilizing the prepared medium

*A biological safety cabinet (vertical laminar flow hood)

*Sterile small and medium-sized Petri dishes, (3 × 16 × 3)

*A 37˚C incubator

*The Candida API gallery

*Sterile plastic loops

*Saline solutions

*Sterile pipettes.

2.5. Methods:

-Samples at T0:

Using sterile swabs, collect a saliva sample with the first swab: place the cotton

tip of the swab under the tongue.

*Collect a sample from the palatal mucosa using a second swab: rub the cotton tip of the swab against the palate.

*Sample collection from the mandibular mucosa using a third swab: rub the cotton tip of the swab against the mandibular ridge.

*The swabs are sealed and then placed in an insulated bag.

This procedure is performed for all 16 participants in our study.

-Preparation of Sabouraud culture medium

Using a sterile spoon, take a portion of Sabouraud culture medium; use an electronic scale to measure the exact amount of culture medium required for a given volume of distilled water (45.5 g per liter). On a hot plate, the mixture is heated until it comes to a boil (stirring continuously to prevent the medium from burning).

The solution is poured into a bottle and then sterilized in an autoclave.

-Inoculation of the culture medium:

After the bottle has been sterilized and cooled, Petri dishes are opened and filled with the culture medium solution inside the biological safety cabinet (fume hood), (20 mL of solution per Petri dish). We wait for the medium to gel while it is still under the hood, then begin inoculating the dishes using swabs 1, 2, and 3 from the 16 candidates (swipe the cotton tip of the swab across the surface of the agar in a Z-shaped pattern).

-Incubation:

After inoculation, place the Petri dishes in an incubator at 37 ˚C for 48 hours.

-Reading:

After incubation, record the number of colonies present in each dish:

1 (salivary), 2 (palatal mucosa), and 3 (mandibular mucosa) for each of the 16 subjects (See Figure 1).

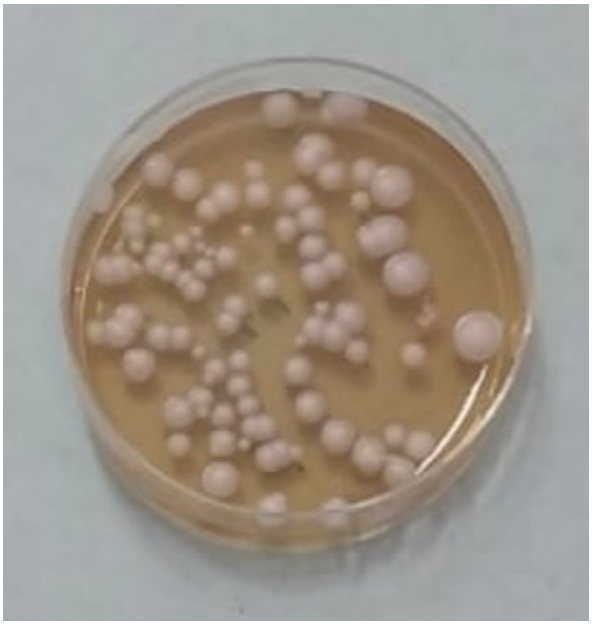


Figure 1. Culture of *Candida spp.* on "Sabouraud Agar" selective medium.

-Sampling at T1 and T2:

These 5 steps are repeated for all 16 candidates: at time point T1 (2 months) and then at time point T2 (4 months).

-Identification:

Macroscopic identification: based on the shape, color, and appearance of the colonies.

Biochemical identification: using the Api Candida assay kit, which consists of miniaturized biochemical tests; with a sterile loop, a sample is taken from a colony (insert the tip of the loop into the colony), place the loop in a saline solution, homogenize the mixture on an electric vortex mixer, then, using a sterile pipette, take a sample, fill the wells of the Candida array, and place the array in the incubator for 48 hours (See Figure 2).

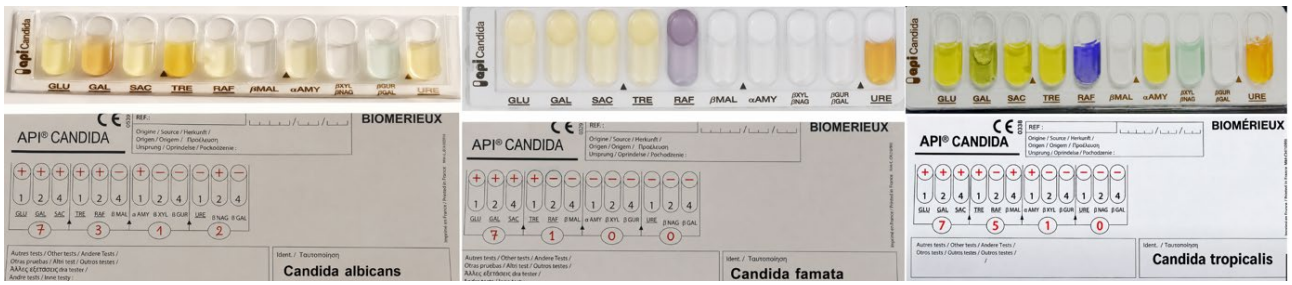


Figure 2. Biochemical identification using the Api Candida gallery.

The coloration of the wells results from a biochemical reaction that allows us to identify the different species of Candida (yeasts).

-Statistical Analysis

For data processing and analysis, the various variables were cross-tabulated to obtain means with standard deviations, from which we calculated significance levels using SPSS software

3. Results:

3.1. Microbiological Results

The results of the microbiological tests are presented in the table (below) according to the different time points: T0, T1, and T2 (Table 1).

3.2. Distribution of Results

-Gender:

Our study included 11 men and 5 women who met the inclusion and exclusion criteria and remained cooperative, which allowed us to collect the various data (4 months of wearing total prostheses).

We calculated the average CFU for each gender and categorized the results by sampling site and time of sampling (Table 2).

We assigned a value of 300 CFU to Petri dishes showing a uniform layer of colonization.

Table 1. Total and average number of *Candida albicans* isolates (CFU) at T0, T1, and T2.

Patients	CFU (Saliva)		CFU (Maxillary Mucosa)		CFU (Mandibular Mucosa)		CFU (Maxillary Denture)		CFU (Mandibular Denture)	
	Sum	Mean	Sum	Mean	Sum	Mean	Sum	Mean	Sum	Mean
All patients at T0	0	0	154	9.62	25	1.56				
All patients at T1	49	3.06	352	22	318	19.87	217	13.56	303	18.93
All patients at T2	659	41.1875	686	42.875	489	30.5625	1207	75.4375	975	60.9375

Table 2. Results by patient sex.

Distribution by Sex	Men	Women
Mean number of *Candida albicans* isolates (CFU) by sex	16.88 (26.74%)	46.23 (73.25%)

We found the following results:

The average number of *Candida albicans* isolates (CFU) by patient sex is 73.25% among women, compared to 26.74% among men.

-Age:

In this study, patients were divided by age into a first group of those under 50 years old and a second group of those 50 years old or older.

Five patients were under 50 years old, and 11 patients were 50 years old or older.

Table 3. Results by patient age.

Breakdown by age	<50 ans	≥50 ans
Average number of *Candida albicans* isolates (CFU) by age	25.83 (49.10%)	26.77 (50.89%)

The average number of *Candida albicans* isolates (CFU) by patient age is: 49.10% for patients under 50 years of age, compared to 50.89% for patients 50 years of age or older (Table 3).

-Sampling site and time of sampling:

The study includes 16 participants, a figure that falls short of the statistical criteria needed to establish a connection between wearing the prosthesis and a higher load of *Candida albicans*, even though all findings suggest this correlation; additional factors might also influence the elevated *Candida albicans* load, including decreased salivary flow, changes in acidity, and increased porosity of the prosthesis (See Figure 3).

4. Discussion

4.1. Identification of Candida Species

In our study, we identified three species of Candida:

- *Candida albicans*
- *Candida famata*

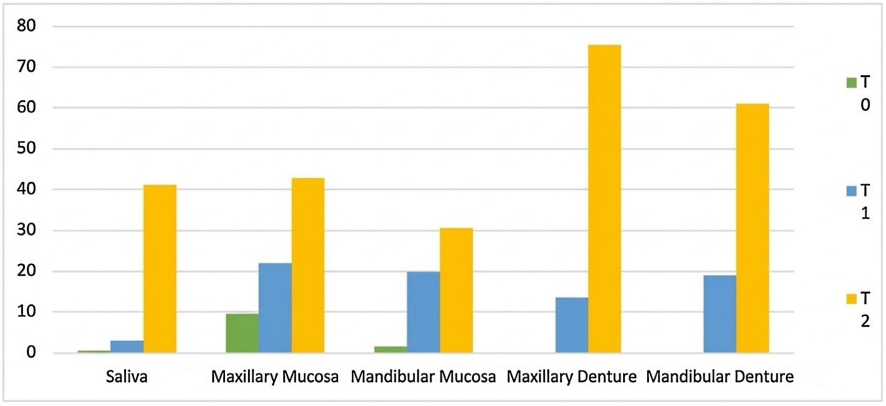


Figure 3. Variation in the average number of *Candida albicans* isolates (CFU) by sampling site and time.

- *Candida tropicalis*

The presence of *Candida albicans* confirms that it is the most commonly found species in the oral cavity. Jasminka T. and colleagues explained that *Candida albicans* is a commensal organism present in various regions of the human body and is also the species most frequently identified as the cause of oral candidiasis [3]. However, other species such as *Candida parapsilosis* and *Candida krusei* can also be pathogenic to humans. Calderone and Fonzi [4] demonstrated that *Candida albicans* is the most virulent species of Candida and the primary organism associated with infection.

4.2. *Candida albicans* and Variables

-Prevalence of *Candida albicans* and Sex

We found a significant difference in the prevalence of *Candida albicans* between women and men ($p < 0.05$).

The overall prevalence of *Candida albicans* in our study was 73.25% among women compared to 26.74% among men.

Our results are consistent with those of Al-Mobeireek [5], who found a higher prevalence of *Candida albicans* following prosthetic placement among female patients than among male patients.

-Prevalence of *Candida albicans* and Age

We found no significant difference between the prevalence of *Candida albicans* and patient age (over 50 years and under 50 years) ($p > 0.05$).

The study by Marsh *et al.* [6] supports our findings, as they found no significant difference in salivary prevalence between denture wearers over 80 years of age and younger subjects between 20 and 39 years of age.

-Prevalence of *Candida albicans*, Sampling Site, and Timing of Sampling

The results of our study show a significant difference in the overall prevalence of *Candida albicans* across the different sampling sites between T0, T1, and T2 ($p < 0.05$).

In saliva, the prevalence increased from 1.11% at T0 to 92.04% at T2; in the

maxillary mucosa, it increased from 12.91% at T0 to 57.55% at T2; in the mandibular mucosa, it increased from 3% at T0 to 58.78% at T2; on the maxillary prosthesis, it increased from 13.56% at T1 to 84.76% at T2; and finally, on the mandibular prosthesis, it increased from 23.70% at T1 to 76.29% at T2.

Studies conducted worldwide confirm this increase in the detection of *Candida albicans* following prosthetic use.

For example, Daniluk *et al.* [7] found that the prevalence of *Candida albicans* on the oral mucosa increased with denture wear (28.9% without dentures versus 66.7% with dentures) ($p = 0.0003$).

Wei *et al.* [8] found a prevalence of *Candida albicans* on the oral mucosa of 36.07% in men without dentures compared to 66.67% in men wearing dentures, and 56% in women without dentures compared to 64.15% in women wearing dentures.

Al-Mobeireek [5] observed a prevalence of *Candida albicans* in saliva, as determined by blood agar culture, of 10.3% prior to denture insertion, compared to 31% after 3 months of denture wear.

Mohammed *et al.* [9] reported positive growth of *Candida albicans* in saliva in 9 patients out of a population of 43 individuals.

Kinkela Devcic *et al.* [10] observed a significant difference ($p < 0.001$) in the prevalence of *Candida albicans* in saliva before and after wearing dentures (62.5% to 97.5%) and *Candida krusei* (7.5% to 40%).

Jafari *et al.* [11] found that the mean colony burden of *Candida albicans* on the oral mucosa increased from 50 CFU/mL in subjects without full dentures to 586 CFU/mL in subjects with full dentures ($p = 0.001$). These values represent microbial burden rather than prevalence.

Nair *et al.* [12] observed an increase in the detection of *Candida albicans* on the prosthetic inner surface, from 0% (1 month) to 20% (6 months) to 33.3% (1 year of prosthetic wear).

Yanshen *et al.* [13] observed that the prevalence of C. spp. increased from 3.0 on the day of denture insertion to 3.7 CFU/g (+0,19) after 7 days of wearing a full denture, and to 4,7 CFU/g (+0,1) after 30 days of wearing.

Tanaya *et al.* [14] found a significant difference in the prevalence of *Candida albicans* in saliva between 0, 1 month, and 3 months of wearing a partial denture, with a 9% increase in prevalence at 3 months.

Moussa *et al.* [15] observed a significant difference in the prevalence of *Candida albicans* between the day of full-mouth denture insertion and 1 month after denture placement; this study also showed that the species with the highest prevalence was *Candida albicans*, followed by *Candida glabrata*.

In our study, we found a higher overall prevalence of *Candida albicans*, with a significant difference ($p < 0.05$) at prosthetic sites compared to oral sites.

The overall prevalence of *Candida albicans* was 57.55% at T2 on the maxillary mucosa, compared to 84.76% on the maxillary denture. The overall prevalence of

Candida albicans was 58.78% at T2 on the mandibular mucosa, compared to 76.29% on the mandibular denture.

The study by Avon *et al.* [16] confirms this higher colony burden at prosthetic sites, as they found a count of 5.43×10^3 CFU/mL on the maxillary mucosa with stomatitis, compared to 1.61×10^5 CFU/mL on the maxillary denture with stomatitis. These values represent microbial burden rather than prevalence.

None of the patients followed during our study adhered to prosthesis hygiene guidelines. This observation highlights the need to strengthen preventive strategies with our patients, including education on oral and prosthetic hygiene. However, our results do not establish a causal relationship between inadequate hygiene, increased prosthesis porosity, and *C. albicans* burden.

Volchkova *et al.* [17] provided in-vitro evidence on the effectiveness of denture-cleaning agents against Candida on prosthetic surfaces. These results should not be seen as proof of clinical progress resulting from patient hygiene practices but rather as an indication of the cleaning agent's efficacy in vitro against Candida.

The study by Carvalho *et al.* [18] revealed an 18.3% decrease in the prevalence of yeasts on the palatal mucosa following oral and prosthetic hygiene measures ($p = 0.039$). This finding concerns yeasts collectively and should not be interpreted as specific to *Candida albicans* unless species-specific results were reported.

Furthermore, Nikhath *et al.* [19] observed a significant difference, with Candida colonization increasing on rough surfaces compared to polished surfaces. These findings suggest that denture surface characteristics may influence microbial colonization.

5. Conclusions

Oral colonization by *Candida albicans* is significantly more prevalent among edentulous individuals who wear removable dentures than among those who do not. Dentures promote yeast adhesion and biofilm formation due to the properties of their materials and changes in the oral microenvironment (decreased salivary flow, reduced oxygenation, and increased acidity), thereby increasing the risk of denture-associated stomatitis. Conversely, in edentulous individuals without dentures, *C. albicans* generally remains a commensal, except in the presence of contributing factors such as xerostomia, antibiotic therapy, or immunosuppression.

These results underscore the importance of rigorous denture hygiene, regular clinical follow-up, and the replacement of dentures when necessary. They also highlight the value of new preventive strategies, particularly the use of prosthetic materials that are less conducive to fungal adhesion (CAD/CAM resins, silver nanoparticle coatings), as well as complementary approaches such as probiotics, enzymatic treatments, and antifungal agents. These measures help limit Candida colonization and improve the oral health of edentulous individuals.

Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] Martins, M., Henriques, M., Ribeiro, A.P., Fernandes, R., Gonçalves, V., Seabra, Á., *et al.* (2010) Oral Candida Carriage of Patients Attending a Dental Clinic in Braga, Portugal. *Revista Iberoamericana de Micología*, **27**, 119-124. https://doi.org/10.1016/j.riam.2010.03.007

[2] Fajri, L., Benfdil, F., Merzouk, N., El Mohtarim, B. and Abdedine, A. (2008) Diagnostic et Gestion des Lésions Muqueuses d'origine Prothétique Chez L'édenté Complet. *Actualités Odonto-Stomatologiques*, **243**, 225-238. https://doi.org/10.1051/aos:2008033

[3] Talapko, J., Juzbašić, M., Matijević, T., Pustijanac, E., Bekić, S., Kotris, I., *et al.* (2021) *Candida albicans*—The Virulence Factors and Clinical Manifestations of Infection. *Journal of Fungi*, **7**, Article 79. https://doi.org/10.3390/jof7020079

[4] Calderone, R.A. and Fonzi, W.A. (2001) Virulence Factors of *Candida albicans*. *Trends in Microbiology*, **9**, 327-335. https://doi.org/10.1016/s0966-842x(01)02094-7

[5] Al-Mobeireek, A. (2003) Qualitative Changes in Oral Flora before and after the Insertion of Removable Prosthesis. *Pakistan Oral & Dental Journal*, **23**, 51-56.

[6] Marsh, P.D., Percival, R.S. and Challacombe, S.J. (1992) The Influence of Denture-Wearing and Age on the Oral Microflora. *Journal of Dental Research*, **71**, 1374-1381. https://doi.org/10.1177/00220345920710070501

[7] Daniluk, T., Tokajuk, G., Stokowska, W., Fiedoruk, K., Sciepuk, M., Zaremba, M.L., *et al.* (2006) Occurrence Rate of Oral *Candida albicans* in Denture Wearer Patients. *Advances in Medical Sciences*, **51**, 77-80.

[8] Wei, X., Zhou, X.D., Li, B.Q., Li, J.Y. and Xiao, X.R. (2006) Correlation of Oral *Candida spp*. and Denture-Wearing in Healthy Elderly. *West China Journal of Stomatology*, **24**, 39-41+47.

[9] Mohammed, H.A. (2018) Microbial Contamination of Removable Denture before and after Insertion. *Al-Yarmouk Journal*, **10**, 49.

[10] Kinkela Devcic, M., Simonic-Kocijan, S., Prpic, J., Paskovic, I., Cabov, T., Kovac, Z., *et al.* (2021) Oral Candidal Colonization in Patients with Different Prosthetic Appliances. *Journal of Fungi*, **7**, Article 662. https://doi.org/10.3390/jof7080662

[11] Jafari, A.A. (2014) The Comparison of Predominant Oral Micro-Flora in Subjects with and without Complete Denture Referred to Yazd Dentistry Department. *Journal of Community Health Research*, **3**, 196-204.

[12] Nair, V.V., Karibasappa, G.N., Dodamani, A. and Prashanth, V.K. (2016) Microbial Contamination of Removable Dental Prosthesis at Different Interval of Usage: An in Vitro Study. *The Journal of Indian Prosthodontic Society*, **16**, 346-351. https://doi.org/10.4103/0972-4052.176536

[13] Yanishen, I.V. (2017) Microecology of the Oral Cavity in the Period of Adaptation to Removable Dentures. *International Scientific and Practical Conference*, **6**, 13-17.

[14] Tanaya, Dhawan, P., Tandan, P., Madhukar, P., Mahesh, S. and Jain, M. (2021) Time Dependent Oral Microflora Changes in Removable Partial Denture Wearers. *Indian Journal of Public Health Research & Development*, **12**, 373-380. https://doi.org/10.37506/ijphrd.v12i2.14161

[15] Mousa, M.A., Lynch, E. and Kielbassa, A.M. (1985) Denture-Related Stomatitis in New Complete Denture Wearers and Its Association with Candida Species Colonization: A Prospective Case-Series. *Quintessence International*, **51**, 554-565.

[16] Avon, S.L. (2019) Comparaison de deux techniques de prélèvement *in Vivo* et la

dynamique du développement de la plaque prothétique chez des porteurs de prothèse sains et atteints de stomatite prothétique associée à *Candida albicans*. Université de Laval.

[17] Volchkova, I.R., Yumashev, A.V., Borisov, V.V., Doroshina, V.I., Kristal, E.A. and Repina, S.I. (2021) Influence of Removable Denture Cleaning Agents on Adhesion of Oral Pathogenic Microflora *in Vitro*: A Randomized Controlled Trial. *The Open Dentistry Journal*, **14**, 656-664. https://doi.org/10.2174/1874210602014010656

[18] Carvalho, J.F., Maurício, P.J., Proença, L. and do Nascimento, T.M.S. (2011) Changes in Oral-Microflora of Patients with Prosthesis on Hygiene Protocol. *Journal of Dental Research*, **90**, 477.

[19] Nikhath, S., Ahmed, S., Nandini, V.V., Lathief, J. and Boruah, S. (2023) An *in Vitro* Comparison of Microbial Adhesion on Three Different Denture Base Materials and Its Relation to Surface Roughness. *Cureus*, **15**, e37085.