

PREVENTION OF CANDIDIASIS IN PATIENTS USING REMOVABLE DENTURES

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ABSTRACT

Background: Despite innovations in orthopedic dentistry, the manufacture of removable dentures belongs to the most popular orthopedic care category. Removable dentures are combined stimuli that affect the mucous membrane and neuro-receptor apparatus. Acrylic plastic prostheses, widely used in prosthetic dentistry, have a negative side mechanical, chemical-toxic, sensitizing, and thermal insulating effect on oral tissue and prosthetic impression area. This is often complicated by a violation of the biocenosis of the oral cavity, the growth of pathogenic microflora that releases toxins, especially an increase in the number of yeast colonies that irritate the oral mucosa and prosthetic stomatitis. According to the WHO, one-fifth of the world's population suffers or has suffered various candidiasis forms at least once. The worldwide increase in the incidence of the disease is primarily related to the fact that this infection is opportunistic, more than half of the world's population is a carrier of fungi of this kind, i.e., in most cases, it is an endogenous infection, which makes candidiasis different from other opportunistic mycoses. **Aims:** The purpose of this study was to study the prevalence of candidiasis in patients using removable dentures and to evaluate the effectiveness and prevention of candidiasis treatment. **Methods:** 100 patients with oral candidiasis of various age groups from 45 to 65 years were observed. Of these, 60 patients with removable plate prostheses; 40 patients with partially removable prostheses. **Results and Discussion:** Chronic forms of candidiasis were diagnosed in 40 patients and with exacerbation of chronic forms of candidiasis-60 people. The number of untreated carious cavities and poor hygienic condition of the oral cavity directly affects the severity of candidiasis. Acute forms of candidiasis were observed mainly in patients with high DMF and PMA indices. The severity of candidiasis depends on the degree and duration of wearing dentures and hygienic conditions - the most severe forms of invasive candidiasis were observed in the presence of removable plate prostheses, the complete absence of teeth, and the use of a prosthesis for more than 10-15 years. A combined lesion of the oral mucosa and the red border of the lips was observed mainly in patients older than 60 years. **Conclusions:** The presence of candidiasis in the oral cavity in patients with removable plate prostheses leads to a statistically significant change in the indicators of local immunity of the oral cavity: an increase in the concentration of serum IgG and IgA and the values of the coefficient of the balance of local immunity factors.

Keywords: *Candidiasis, prosthesis, inflammation, prosthetic dentistry, biochemistry.*

1. INTRODUCTION

Despite innovations in orthopedic dentistry, the manufacture of removable dentures belongs to the category of the most popular types of orthopedic care. The nature of the prosthetic impression area tissue reactions, the development of which is determined by the quality of the prosthesis, the property of the material, the method of fixation, peculiarities of the transmission

of chewing pressure, occlusal relationships, the size of the prosthetic base acquires particular importance in the formation of patients adaptation to removable, as in Figure 1 (Sevbitov *et al.*, 2018; 2019, 2020).

Removable dentures are combined stimuli that affect the mucous membrane and neuro-receptor apparatus. It is known that in 52% of cases, dentures are not fixed when chewing. Furthermore, in 65% of patients using dentures,

various diseases of the prosthetic impression area mucous membrane and pathological processes in supporting tissues develop, according to Figure 2 (Sevbitov *et al.*, 2019; 2020).

Acrylic plastic prostheses, widely used in the practice of prosthetic dentistry, have a negative side mechanical, chemical-toxic, sensitizing, and thermal insulating effect on oral tissue and prosthetic impression area, as seen in Figures 3 and 4 (Sevbitov *et al.*, 2018; 2019; 2020).

This is often complicated by a violation of the biocenosis of the oral cavity, the growth of pathogenic microflora that releases toxins, especially an increase in the number of yeast colonies that irritate the oral mucosa and prosthetic stomatitis. It was also proved that when using adhesive preparations to improve the fixation of removable dentures, the number of yeast colonies increases statistically significantly when sown quantitatively compared with the control group of patients (Sevbitov *et al.*, 2005; Ergesheva *et al.*, 2018).

According to the WHO (2020), one-fifth of the world's population suffers or has at least once suffered various forms of candidiasis (Sevbitov, Ershov, *et al.*, 2020). The worldwide increase in the incidence of the disease is primarily related to the fact that this infection is opportunistic, more than half of the world's population is a carrier of fungi of this kind, i.e., in most cases, it is an endogenous infection, which makes candidiasis different from other opportunistic mycoses (Enina *et al.*, 2019; Turgaeva *et al.*, 2020).

Candidiasis of the oral mucosa is caused by representatives of the conditionally pathogenic microflora of the oral cavity, fungi of the genus *Candida*, which are detected in healthy people in 50% of cases (Utyuzh *et al.*, 2019; Mironov *et al.*, 2020).

Factors predisposing to the development of pathology are:

Local:

1. The oral mucous membrane's integrity is violated due to acute or chronic mechanical, chemical, and iatrogenic trauma.
2. Availability of removable dentures.
3. The use of antimicrobial agents. (Mamedov *et al.*, 2019; Yumashev *et al.*, 2019).

Common:

1. Concomitant pathology: chronic infectious processes (HIV infection), oncological diseases, blood pathology, diseases of the gastrointestinal tract, cardiovascular and endocrine system (diabetes mellitus).
2. Taking medications: antibiotics, corticosteroids, cytostatics, hormonal contraceptives.
3. Hypovitaminosis.
4. Secondary immunodeficiency.
5. Intestinal dysbacteriosis. (Kuznetsova *et al.*, 2018; Platonova *et al.*, 2018).

N. D. Sheklakov in 1976 Proposed a clinical classification of candidiasis:

- poverhnostnye candidiasis of the mucous membranes, skin, nails;
- chronic generalized (granulomatous) candidiasis;
- visceral (systemic) candidiasis of various organs. (Sevbitov *et al.*, 1999; 2004).

The course of the disease distinguishes acute and chronic candidiasis:

- acute pseudomembranous candidiasis (thrush);
- acute atrophic candidiasis;
- chronic hyperplastic candidiasis;
- chronic atrophic candidiasis (Evstratenko *et al.*, 2018; Mazzeo *et al.*, 2013).

By localization, select:

- *Candida* cheilitis;
- which restores candidal cheilitis;
- *Candida* glossitis;
- thrush (Voloshina *et al.*, 2018; Silva *et al.*, 2019).

Clinical picture.

Acute pseudomembranous candidiasis. Patients complain of dryness, burning, increasing with food, swelling of the tongue, the presence of plaque. The mucosa is edematous and hyperemic, covered with a white ("curd") coating; a smooth hyperemic surface is exposed when removed. Body temperature does not increase, lymph nodes are not palpated, see Figure 5.

Acute atrophic candidiasis. Patients complain of burning, dryness, increasing with food, and mucosa swelling. The mucous membrane is bright red, dry, no plaque, visible in

Figure 6.

Chronic hyperplastic candidiasis. Patients complain of dryness, burning, increasing with food, changes in the relief of the mucosa. The mucous membrane is edematous hyperemic, covered with whitish-gray films removed with difficulty, exposing an erosive bleeding surface, as in Figure 7.

Chronic atrophic candidiasis. The mucosa in the area of the prosthetic bed (the mucous membrane of the palate and alveolar processes) is affected. Complaints of dryness and burning increase when eating. There is a bright hyperemic, dry mucosa surface in the prosthetic bed area, erosion and ulcers are possible, as in Figure 8.

Candida angular cheilitis. It is observed with a decrease in the lower third of the face (adentia, poorly made prostheses). Patients complain of burning, dryness, itching of the skin in the corners of the mouth. The swollen and hyperemic skin may form erosion with a slight discharge or dryness. A white, easily removable plaque is detected in Figure 9 (Girardin *et al.*, 2019; Timoshin *et al.*, 2018, 2019).

1.1 Case description.

Patient N, 62 years old, came to the dentist with dry mouth complaints, tingling in the tongue area, bleeding gums, and bad breath.

Examination: the gums are hyper-milled, swollen, the tongue is covered with a grayish-white bloom, the teeth are imprinted on the lateral surfaces of the tongue, the palate is edematous, the oral cavity is not sanitized (Figure 10).

Medical history: suffered a sore throat, pneumonia, sinusitis, and sepsis.

The patient repeatedly took antibiotics without nystatin or levorin.

The suspicion of candidosis has been confirmed by a smear taken before treatment. In a smear in large quantities, found elements of the fungus.

Prescribed treatment:

- sanitation of the oral cavity
- rational prosthetics
- rinsing soda solution of the oral cavity to release it from mucus;

Apply TYCVEOLUM with thymol for 15-20 minutes, two times a day.

On the third day, the patient subjectively noted improvement. The clinical picture also

changed for the better, and on the eighth day - the puffiness disappeared, hyperemia, the mucous became pale pink, the tongue cleared, dry mouth disappeared.

The patient noted an improvement in overall health, increased efficiency, and portability of physical activity. In addition, a smear taken after treatment showed the absence of fungal cells.

This study aimed to study the prevalence of candidiasis in patients using removable dentures and to evaluate the effectiveness and prevention of candidiasis treatment.

2. MATERIALS AND METHODS

2.1 Materials

It was observed 100 patients that came from a private clinic for 90 days, with oral candidiasis of various age groups from 45 to 65 years. Of these, 60 patients with removable plate prostheses; 40 patients with partially removable prostheses. Chronic forms of candidiasis were diagnosed in 40 patients and exacerbated chronic forms of candidiasis-60 people.

2.2 Methods

At the stage of clinical examination, all patients had their life history and diseases analyzed by examining the oral cavity of the patients. To identify carious cavities, general (examination, probing) and additional (X-ray, radiology) methods were used, and the localization of carious cavities, fillings, and extracted teeth was recorded. We paid attention to the nature of the existing injuries during a visual examination of the oral mucosa. To indicate changes in the mucous membrane color, moisture content, the severity of the vascular pattern, the presence of pathological elements, including primary and secondary, signs of keratinization and inflammation. The intensity of dental caries damage was determined by calculating the DMF indices. The hygienic condition of the oral cavity was assessed by the Green-Vermillion index (1964). The prevalence of gum inflammation was determined using the PMA index in the Parma modification (1976), which is indicated in % and bleeding according to the Muleman method (1971).

The diagnosis of oral mucosal candidiasis is detected and confirmed based on clinical and laboratory signs.

The criterion for the diagnosis of oral candidiasis was the detection of 10–15 or more

yeast cells insight.

2.2.1 Laboratory research

All patients with oral candidiasis underwent the following laboratory tests:

Microscopy of the direct smear from the mucous membrane of the oral cavity to confirm the diagnosis of oral candidiasis. Yeast cells of a round or oval shape with characteristic daughter budding cells, as well as the accumulation of long filaments of the pseudomycelium, allow making a preliminary diagnosis (Araviyski R.A., Gorshkova G.A., 1995).

Cultural diagnostics of scraping from the affected areas of the oral mucosa to identify the pathogen and determine the sensitivity to antifungal preparations were carried out on the micro panel "Fungi test", USA. The serial microdilution method investigated yeast sensitivity to amphotericin B, ketoconazole, itraconazole, and fluconazole, nystatin clotrimazole in two concentrations (maximum and minimum), which allowed us to differentiate the fungi according to their sensitivity.

Assessment of parameters of local immunity of the oral cavity - secretory immunoglobulins (A, G).

2.2.2. Candida Antibodies Blood Test, IgA, IgG

The Candida antibody test is used to detect systemic candidiasis by looking for the antibodies that form the immunity to Candida, in this research, it was monitored IgG and IgA. The test recognizes when levels of these antibodies are particularly high, signaling an overgrowth of Candida.

To perform the test, 10 ml of blood samples were collected by venipuncture from the patients (Fang-Qiu Li *et al.*, 2013; Yanming Meng *et al.*, 2020).

The IgA test was performed in 50 patients following the instructions of the manufacture (DRG, 2021).

The IgG test was performed on 50 patients following the instructions of the manufacture (Day, 2021).

The control group was composed of 30 patients, and it provided the baseline of comparison to the infected patients. The statistical analysis was done using Student's T-test (Fang-qiu Li *et al.*, 2013; Yanming Meng *et al.*, 2020).

3 RESULTS AND DISCUSSIONS

3.1 Results

The diagnosis of chronic atrophic candidiasis was made in 26 patients (26 %). Exacerbation of chronic atrophic candidiasis was diagnosed in 43 patients (43 %). The diagnosis of chronic hyperplastic candidiasis of the oral cavity was made to 13 (13 %) patients; 17 (13.3 %) patients who applied were diagnosed with exacerbation of chronic hyperplastic candidiasis. Pseudomembranous candidiasis of the oral cavity was diagnosed in 1 (1 %) patients.

The severity of candidiasis depends on the degree and duration of wearing dentures and hygienic conditions - the most severe forms of invasive candidiasis were observed in the presence of removable plate prostheses, the complete absence of teeth, and the use of a prosthesis for more than 10-15 years.

It should be noted that the combined lesion of the oral mucosa and the red border of the lips was observed mainly in patients older than 60 years.

The number of untreated carious cavities and poor hygienic condition of the oral cavity directly affects the severity of candidiasis. Acute forms of candidiasis were observed mainly in patients with high DMF and PMA indices.

As a result of the conducted enzyme immunoassay of the blood of patients with chronic forms of candidiasis, 80.5 % of patients have an increased content of immunoglobulins A, G in the blood serum, 9.4 % - a reduced content of immunoglobulins A and G, 7.7 % - a negative value of immunoglobulins A and G, 11.2 % - the content of immunoglobulins corresponded to normal values. In the examined patients with exacerbations of chronic forms of candidiasis, the results were obtained: 13.8 % - a reduced content of immunoglobulins A, G in the blood serum, 84.2 % - an increased content of immunoglobulins A and G, 8.6 % - the content of immunoglobulins corresponded to normal values. Most of the treated patients diagnosed with chronic oral candidiasis have an increased content of immunoglobulin G (Table 2).

3.2 Discussions

All patients with various forms of candidiasis of the oral mucosa are recommended to carry out the following treatment and follow the recommendations.

It was necessary to correct the pathological

processes of the mucous membrane of the prosthetic impression area in the shortest possible time, detected at various stages of orthopedic treatment by applying physiotherapeutic methods (laser therapy, ozone therapy), and presented in Table 1.

To accelerate the regeneration of the prosthetic impression area tissues, the use of antioxidant and epithelial agents (TYCVEOLUM, thymol mixture with milk thistle oil, wikasol) was recommended; with long-term non-healing lesions, the use of plasma therapy (plasma lifting), immune correction (galavit, gepon) were recommended.

To stimulate the adaptation processes of prosthetic impression area tissues, it was necessary to consider the general self-health of the patient and the emotional attitude in complex dental treatment so that visits to the dentist are not perceived by stress, "hellish pain," or aversion.

Oral hygiene using soda rinses and toothpaste containing bicarbonate (blend-a-honey bicarbonate) or active oxygen (oxidizing).

The hygienic condition of removable laminar dentures is achieved by daily cleaning the denture with a gel paste and using tablets for cleaning. Professional cleaning of removable dentures should use a special device in the clinic of the type "Microcline" (if necessary, every two weeks).

Modify the diet of the patients to a limited intake of flour products from white flour, starchy foods, sweets, and fizzy drinks.

4. CONCLUSIONS

1. Removable plate prostheses have a negative effect on the oral mucosa, cause a decrease in its protective properties, which contributes to an increase in the intensity of candidiasis: 60% of patients with removable plate prostheses in the oral cavity had the maximum intensity of candidiasis.
2. The presence of candidiasis in the oral cavity in patients with removable plate prostheses leads to a statistically significant change in the indicators of local immunity of the oral cavity: an increase in the concentration of serum IgG and IgA and the values of the coefficient of balance of local immunity factors.

3. The quality of orthopedic treatment of patients with partial and complete edentulous and quality of removable dentures depends on many factors, as follows: tissue conditions of the prosthetic impression area; level of health (psycho-emotional disorders, pathology of internal organs and systems); design features of a removable denture;- materials used; side effects of the prosthesis on the tissue of the prosthetic impression area; oral hygiene of the patient and dentures; aesthetic effect.

5. DECLARATIONS

5.1. Study Limitations

No limitations were known at the time of the study.

5.2. Acknowledgements

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5.3. Funding source

The authors funded this research.

5.4. Competing Interests

There is no conflict of interest in this study.

5.5. Open Access

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6. HUMAN AND ANIMAL-RELATED STUDIES

6.1. Ethical Approval

The study conforms to strobe guidelines. All procedures performed in studies involving human participants were in accordance with the ethical standards of the Sechenov University ethics committee (protocol № 10-16) and with the 1964 Helsinki declaration and its later amendments.

6.2. Informed Consent

All human subjects' rights have been protected by the Sechenov University ethics committee and written informed consent was obtained from all subjects who participated in the study.

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Figure 1. Patient with removable dentures



Figure 2. Lesion of the hard palate mucosa during adaptation to removable prostheses



Figure 3. Removable upper jaw plate prosthesis



Figure 4. Poor hygienic condition of the prosthesis



Figure 5. *Acute pseudomembranous candidiasis*



Figure 6. *Acute atrophic candidiasis*



Figure 7. *Chronic hyperplastic candidiasis*

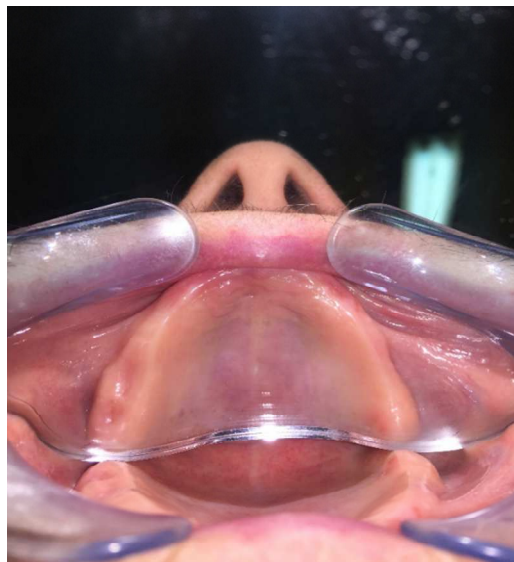


Figure 8. *Chronic atrophic candidiasis*



Figure 9. *Candida angular cheilitis*



Figure 10. *Patient N, 62 years old, Candidomycosis of the oral mucosa*

Table 1. Characteristics of anti-Candida drugs

Medicines	Form and dosage	Comments
Clotrimazole	Tablets. 10mg 5 p / day. Up to 14 days *	Dissolve slowly and completely.
Nystatin	Suspension. 5ML (500 000U) 4 times / day for up to 14 days * OR Pills. 200,000 Units 5p / day. Up to 14 days *	Put in mouth and hold in mouth for as long as possible, then swallow. OR Dissolve in the mouth slowly and completely.
Amphotericin B	Suspension. 1ML (100mg) 4 times / day. Up to 14 days *	Place directly on the tongue. Distribute by mouth and swallow.
Fluconazole	Tablets. 100 MG / day up to 14 days *	C.glabrola and C.Krusei are usually resistant.
Ketoconazole	Pills. 200MG / day Up to 14 days *	It is necessary to take an acidic medium with orange juice on an empty stomach for absorption.

* Patients with immunosuppressive conditions may require longer therapy.

Treatment should be continued for another 48 hours after resolving clinical symptoms.

Table 2. Results of the IgG and IgA Candida Antibodies Blood Test

Diagnosis	% of patients have an increased content of IgA and G	% of patients have a reduced content of IgA and G	% of patients have a negative value of IgA and G	% of patients have the content of IgA and G corresponded to normal values
Chronic forms of candidiasis	80.5	9.4	7.7	11.2
Exacerbations of chronic forms of candidiasis	84.2	13.8	-	8.6