

# **DYNAMICS OF MICROPHYSIOLOGICAL CHANGES IN THE ORAL CAVITY DURING THE USE OF PLATE DENTURES**

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Plate (removable) dentures are used to restore chewing function, speech, and aesthetic appearance in patients with complete or partial edentulism. However, prolonged use of dentures leads to changes in the microbiological and microphysiological balance of the oral cavity. These changes are dynamic (time-dependent) and are associated with both local (oral) and systemic effects.

Main directions of microphysiological changes:

**a) Changes in microcirculation (blood flow)**

- Plate dentures exert continuous mechanical pressure on the palatal and alveolar ridge mucosa.
- This constant pressure alters blood circulation in the mucosa of the hard palate and alveolar ridge.
- Studies using laser Doppler flowmetry have shown that during the first 1–3 months of denture use, mucosal perfusion decreases, followed by partial recovery during the adaptation period.
- Prolonged pressure and microtrauma can change the morphology of capillaries, causing hyperemia and edema.
- These processes may lead to atrophy, vascular thickening, and the formation of local ischemic areas.

**b) Morphofunctional changes in the mucosa**

- Histological studies have demonstrated that under the denture:
  - ✓ Epithelial thickness decreases, and the proliferative capacity of basal cells weakens.
  - ✓ The level of keratinization (hardening of surface cells) becomes disrupted.
- These changes create favorable conditions for the development of denture stomatitis (inflammation associated with denture wear).
- The inflammatory process is accompanied by angiogenesis (formation of new blood vessels) and the activation of local immune responses.
  - ✓ Secretory immune elements such as IgA, lysozyme, and lactoferrin show variable changes.
  - ✓ If the inflammation becomes prolonged, chronic mucositis and atrophic alterations develop.

**c) Microbiological and biofilm changes**

- A biofilm (a multilayer microbial structure) forms on the surface of plate dentures.
- This biofilm:
  - ✓ Is resistant to mechanical cleaning,
  - ✓ And develops resistance to antimicrobial agents.
- The main microorganisms involved include:
  - ✓ *Candida albicans* (fungus),
  - ✓ *Streptococcus*, *Actinomyces*, *Lactobacillus*, *Veillonella*, and others.

- With long-term use, the microbial diversity of the oral microbiome decreases, leading to dysbiosis (imbalance).
- In healthy conditions, species such as *Streptococcus mitis* and *Rothia mucilaginosa* dominate, whereas during stomatitis, opportunistic bacteria such as *Staphylococcus aureus* and *Enterococcus faecalis* become more prevalent.
- Dysbiosis causes the biofilm to degrade the prosthetic surface, and microcracks in the denture material promote deeper microbial colonization.

d) Changes in saliva secretion and biochemical composition

- Plate dentures influence salivary flow through both mechanical and reflex mechanisms.
- In the initial period of denture use, salivary flow decreases, leading to:
  - ✓ A sensation of dry mouth (xerostomia),
  - ✓ Difficulty in chewing and speaking,
  - ✓ Increased biofilm accumulation.
- After the adaptation period, salivary secretion may gradually stabilize.

In the composition of saliva:

- The levels of amylase and protease enzymes change,
- The pH level decreases,
- The antioxidant system (catalase, glutathione peroxidase) weakens.
- These changes facilitate microbial adhesion and enhance the chemical erosion of the denture material.

e) As an immunological response:

- Plate dentures activate the local immune response system.
- Levels of secretory IgA, lactoferrin, and lysozyme in oral secretions increase; however, with chronic stimulation, these indicators show fluctuations.
- During stomatitis, irregular variations in these parameters are observed, creating favorable conditions for the chronic progression of inflammation.

Dynamic stages of changes:

| Stage                                 | Period         | Main Processes   |
|---------------------------------------|----------------|--|
| I. Early Adaptation                   | 2–4 weeks      | Decrease in microcirculation in response to mechanical pressure, epithelial stress reaction, initial biofilm formation |
| II. Stabilization Stage               | 1–3 months     | Adaptation of the microbiome and mucosa, reduction of local inflammation, restoration of salivary composition          |
| III. Chronic Adaptation and Dysbiosis | After 6 months | Maturation of biofilm, development of dysbiosis, increased risk of stomatitis, mucosal atrophy, and vascular changes   |

- Clinical findings:
  - ✓ Denture stomatitis (the most common complication)
  - ✓ Reduced salivary flow → dry mouth (*xerostomia*)
  - ✓ Microbial imbalance → increased susceptibility to fungal and bacterial infections

- ✓ Mucosal injury → pain, burning sensation, unpleasant taste
- ✓ Denture material degradation → due to biofilm formation and enzymatic activity
- Preventive and management measures:
  - ❖ Daily cleaning and disinfection of dentures
    - ✓ Mechanical brushing + special denture cleaning solutions (containing chlorhexidine, hypochlorite, or peroxide)
    - ✓ Ultrasonic baths provide additional cleaning effectiveness.
- Removing dentures at night
  - ✓ Essential for mucosal oxygen exposure and tissue regeneration.
- Use of antimicrobial and antifungal solutions
  - ✓ Preparations based on *nystatin*, *clotrimazole*, or *chlorhexidine* can be applied for preventive purposes.
- Regular renewal and adjustment of denture materials
  - ✓ Aged or microcracked acrylic dentures promote biofilm accumulation.
- Balancing the oral microbiota
  - ✓ Probiotics (e.g., *Lactobacillus reuteri*, *Bifidobacterium*) help restore microbiome balance.
  - ✓ Mouth rinses (fluoride-containing or antiseptic) reduce microbial growth.
  - ✓ Proper diet (low in sugar, water-rich foods) and adequate water intake help stimulate saliva secretion.

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## Summary

### **Dynamics of Microphysiological Changes in the Oral Cavity During the Use of Plate Dentures Hajiyev J.G., Safaraliyev F.R., Sadigov O.M.**

Although the use of removable (plate) dentures plays an important role in restoring function and aesthetics for completely or partially edentulous individuals, their continuous use leads to a number of microphysiological and microbiological changes in the oral cavity. These changes are dynamic and

interrelated processes formed by both the mechanical impact of the denture and the body's adaptive mechanisms.

At the microbiological level, the biofilm formed on the surface of dentures gradually develops into a complex microbiome structure. The proliferation of *Candida albicans* and various bacterial species within this biofilm causes an imbalance among microorganisms — dysbiosis. Dysbiosis can lead not only to local infections but also to alterations in systemic immune responses. This, in turn, contributes to chronic inflammation, hyperemia, and atrophic changes in the tissues that are in constant contact with the denture.

Overall, the use of removable dentures induces complex microbiological, physiological, and immunological changes in the oral cavity. Managing these changes requires a multidisciplinary approach — including the improvement of denture technology, patient education, and reinforcement of preventive care — to achieve optimal results, ensuring both the functional longevity of the denture and the long-term preservation of the patient's oral health.