INNOVATIVE PUBLICATION
Journal of Effective Learning and Sustainable Innovation
Vol.3 №12 (2025). December
innovativepublication.uz

Microbiological Study of the Oral Cavity in Patients with Chronic Kidney Disease Wearing Removable Partial Dentures

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Annotation The study investigates the dynamics of microbial colonization on removable dentures made from different base materials — acrylic and thermoplastic (nylon). Microbiological analysis demonstrated that, over time, dentures become colonized by microorganisms; however, the level of contamination was significantly higher in acrylic dentures compared to thermoplastic ones. This finding is explained by the structural differences between materials, as acrylic resin possesses higher porosity, facilitating bacterial adhesion and biofilm formation. The theoretical significance of the research lies in its contribution to understanding the nonspecific protective mechanisms of the oral mucosa and the influence of denture base materials on oral microbiocenosis. The results provide insight into the early stages of inflammatory processes and prosthesis intolerance associated with microbial colonization, emphasizing the importance of selecting biocompatible materials and maintaining proper oral hygiene. The study's outcomes can serve as a foundation for developing preventive strategies to improve the biological performance of removable dentures.

Keywords: removable dentures, acrylic resin, thermoplastic nylon, oral microbiota, biofilm formation, mucosal defense, inflammation, biocompatibility.

Introduction

The gradual loss of kidney function leads to systemic alterations affecting various organs and tissues, including the oral cavity. Patients with chronic kidney disease (CKD) often exhibit a high prevalence of dental and periodontal disorders, such as gingivitis, periodontitis, mucosal inflammation, and xerostomia, which are directly related to uremic intoxication and metabolic imbalance [Gazhva S.I., Zagaynov V.E.]. The severity and specific features of oral manifestations largely depend on the functional state of the kidneys and the stage of the disease.

Chronic Kidney Disease (CKD) is defined as the presence of structural or functional kidney abnormalities with or without a decrease in glomerular filtration rate (GFR), lasting for at least three months. Chronic renal failure (CRF), the terminal stage of CKD, is a severe systemic condition leading to disability. In this stage, pronounced metabolic disturbances, immune dysfunction, and endogenous intoxication processes occur [33]. These systemic changes create a favorable environment for microbial colonization and may alter the oral microecology.

Globally, the incidence of CKD continues to rise. According to official data, approximately 23,000 individuals in Uzbekistan suffer from chronic kidney diseases. Hypertension, metabolic syndrome, and diabetes mellitus are major risk factors for the development of CKD. It is estimated that more than one-third of patients with cardiovascular diseases also exhibit signs of renal dysfunction [1,2]. The increasing prevalence is further influenced by non-infectious factors such as environmental conditions, smoking, alcohol consumption, dietary habits, and genetic predisposition.

In patients with CKD, the oral cavity is often considered a “mirror” reflecting the severity of systemic disturbances. Due to reduced salivary flow, altered pH, and decreased antimicrobial activity, the oral mucosa becomes more susceptible to colonization by pathogenic microorganisms and fungi, particularly Candida species. As a result, oral infections and inflammatory processes are more common in this population, negatively affecting mastication, speech, and overall quality of life [4,7].

The use of removable partial dentures is common among CKD patients due to early tooth loss. However, denture base materials differ in their physical and biological properties, which can influence microbial adhesion and growth. Acrylic resins, while affordable and widely used, are porous and may retain microorganisms and residual monomers that can trigger allergic or inflammatory reactions. In contrast, nylon-based thermoplastic materials are more biocompatible and less prone to microbial accumulation due to their smoother surface and absence of residual monomer.

Given these considerations, microbiological evaluation of the oral cavity in CKD patients wearing removable partial dentures is of great clinical significance. Understanding how different prosthetic materials affect oral microbial colonization will contribute to improving the biocompatibility of prostheses, preventing mucosal inflammation, and enhancing the overall quality of life in this vulnerable group of patients.

Methods

Oral fluid samples were collected from the examined patients using the rinsing method from the oral mucosa. For this purpose, sterile test tubes containing 10 mL of isotonic saline solution were prepared [Filova, 2008]. The obtained rinse solution was considered the first dilution. From this material, a series of serial dilutions was prepared in the laboratory. Specific volumes of each dilution were inoculated onto the surface of highly selective differential diagnostic culture media, including anaerobic agar, Endo medium, milk-salt agar, Kalin medium, blood agar, MRS-4 medium, Sabouraud agar, and freshly prepared meat infusion agar (MIA), among others.

A total of 60 patients with partial edentulism were examined.

Among them, 20 individuals formed the control group (without CKD), and 40 patients were diagnosed with chronic kidney disease (CKD) who had been wearing removable partial dentures for 2 to 3 years. Of these, 20 patients used nylon-based (thermoplastic) dentures, and 20 used acrylic-based dentures.

Results: The composition of the oral mucosal microflora varied depending on the material used for the fabrication of removable partial dentures. When thermoplastic (nylon-based) dentures were used, the total count of aerobic microorganisms in the oral cavity was 7.6 CFU/mL, which was 1.6 times lower than in patients wearing acrylic removable dentures. The number of anaerobic microorganisms in patients with thermoplastic dentures was 6.51 CFU/mL, 1.4 times lower than that of the acrylic denture group. The number of Candida species in patients with thermoplastic dentures was 3.4 CFU/mL, which was 1.7 times lower than in those wearing acrylic dentures.

Oral Microflora in Patients Wearing Nylon Dentures

		Lg M ± m CFU/mL	
№	Microbial Groups	Microbial Count (Lg M ± m CFU/mL)	
		Normal	With Nylon Dentures
1	Total anaerobes	5,69±0,15	6,51±0,14
2	Total aerobes	5,30±0,17	7,60±0,32
3	Staphylococci	4,15±0,14	5,30±0,16
4	Streptococci	2,15±0,10	4,11±0,17
5	*Escherichia* spp.	0	1,30±0,11
6	*Proteus* spp	1,30±0,01	2,10±0,12
7	*Candida* spp.	2,15±0,18	3,4±0,22

Oral Microflora in Patients Wearing Acrylic Dentures

		Lg M ± m CFU/mL	
№	Microbial Groups	Microbial Count (Lg M ± m CFU/mL)	
		Normal	With Acrylic Dentures
1	Total anaerobes	*5,69±0,15*	*9,14±0,14*
2	Total aerobes	*5,30±0,17*	*12,160±0,32*
3	Staphylococci	*4,15±0,14*	*5,8±0,16*
4	Streptococci	*2,15±0,10*	*5,11±0,17*
5	*Escherichia* spp.	*0*	*1,2±0,11*
6	*Proteus* spp	*1,30±0,01*	*2,40±0,12*
7	*Candida* spp.	*2,15±0,18*	*5,9±0,22*

The microbiological data clearly indicate that thermoplastic (nylon) dentures exhibit lower microbial contamination levels compared with acrylic ones. The smoother and less porous surface of nylon restricts bacterial and fungal adhesion, whereas the microporous structure of acrylic resin facilitates the accumulation of microbial biofilm.

Moreover, the absence of residual monomer in nylon enhances its biocompatibility and reduces the risk of inflammatory or allergic reactions in the oral mucosa.In contrast, acrylic dentures tend to accumulate bacterial plaque and show a higher prevalence of opportunistic microorganisms, which may contribute to mucosal irritation, stomatitis, and altered local immune response. These findings are particularly important in CKD patients, whose immune resistance and salivary antimicrobial function are already compromised. Thus, nylon-based thermoplastic materials are considered more biologically compatible and hygienically favorable for prosthetic rehabilitation in this patient group.

Discussion of Results

Microbiological studies revealed that over time, removable dentures become colonized by microorganisms. However, the number of microbial colonies was significantly higher in acrylic dentures than in thermoplastic (nylon-based) ones. This difference is

primarily attributed to the structural properties of the materials — acrylic resin is more porous, which facilitates bacterial adhesion and biofilm formation, while nylon has a smoother, less porous surface that resists microbial accumulation.

The findings of this study highlight that thermoplastic materials provide a more favorable environment for maintaining microbial balance in the oral cavity, thereby reducing the risk of inflammatory complications and secondary infections in denture wearers. Patients using acrylic dentures exhibited higher levels of *Candida* spp. and pathogenic bacteria, which may contribute to mucosal irritation, stomatitis, and allergic reactions caused by residual monomer release.

From a theoretical perspective, this research expands the understanding of the nonspecific defense mechanisms of the oral mucosa and the impact of different denture materials on oral microbiocenosis. The detailed study of microbial colonization dynamics helps elucidate the early mechanisms of inflammation and intolerance to dental prostheses. These results may serve as a scientific basis for developing preventive measures aimed at minimizing microbial contamination and improving the biocompatibility of denture materials.

Furthermore, the study underscores the importance of selecting denture base materials not only for their mechanical and aesthetic properties but also for their biological compatibility. Regular professional monitoring and hygienic care are essential for preventing microbial overgrowth, particularly in patients with systemic diseases or reduced immune resistance. Future research could focus on assessing the effects of surface modifications or antimicrobial coatings on reducing microbial colonization and improving long-term oral health outcomes in denture wearers.

References

1. Dewhirst F.E., Chen T., Izard J., Paster B.J., Tanner A.C., Yu W.H., Lakshmanan A., Wade W.G. The human oral microbiome // J. Bacteriol. - 2010. - Vol. 192, N 19. - P. 5002-5017.
2. Ioannidou E., Shaqman M., Burleson J., Dongari-Bagtzoglou A. Periodontitis case definition affects the association with renal function in kidney transplant recipients // Oral Dis. – 2010. - N 16(7). – P. 636–642.
3. Козлов В.И., Гурова О.А., Кучук А.В., Азизов Г.А. Мониторинг состояний и расстройств микроциркуляции крови в клинической практике // Клиническая гемостазиология и гемореология в сердечно-сосудистой хирургии: материалы 7 Всероссийской конференции с международным участием. - Москва, 2015. - С. 202-203.

4. Rikhsieva D. U., Salimov O. R. FEATURES OF BONE METABOLISM DURING LACTATION //Journal of Academic Leadership. – 2022. – Т. 21. – №. 2.
5. Рихсиева Р. Д., Салимов О. Р. ПОРАЖЕНИЯ ПОЛОСТИ РТА И ИЗМЕНЕНИЕ РН СЛЮНЫ В РАЗНЫХ ТРИМЕСТРАХ БЕРЕМЕННОСТИ //ПРОБЛЕМЫ И ПЕРСПЕКТИВЫ РАЗВИТИЯ НАУКИ И ОБРАЗОВАНИЯ В XXI ВЕКЕ. – 2021. – С. 282-286.
6. Салимов О. Р., Рихсиева Д. У. СОСТОЯНИЕ ТВЕРДЫХ ТКАНЕЙ ЗУБОВ У ЖЕНЩИН В ПЕРИОД ЛАКТАЦИИ //Eurasian Journal of Medical and Natural Sciences. – 2022. – Т. 2. – №. 12. – С. 240-244
7. Kamil W., Al Habashneh R., Khader Y., Al Bayati L., Taani D. Effects of nonsurgical periodontal therapy on C-reactive protein and serum lipids in Jordanian adults with advanced periodontitis // J .Periodontal. Res. – 2011. – Vol.46. – P.16–21
8. Landray M.J., Wheeler D.C., Lip G.Y. et al., 2004; Vischer U.M., 2006].
9. National Kidney Foundation KD: Clinical practice guidelines for chronic Kidney disease: Evaluation, classifi cation and stratifi cation //Am. J. Kidney Dis. - 2002. - №39[Suppl 1].-S1–S266]
10. Changes in the microflora of the oral cavity in women during lactationO.P. Салимов Д.У. Рихсиева https://doi.org/10.57231/j.idmfs.2022.1.2.034
11. Салимов, О. Р. (2017). Комплексная реабилитация пациентов с частичным отсутствием зубов, направленная на профилактику прогрессирующей атрофии тканей протезного ложа. *Medicus*, *14*(2), 62-64.
12. Salimov, O., & Pulatova, B. (2020). THE ELABORATION OF MATHEMATICAL MODELS FOR FORECASTING THE ESTIMATION OF THE EFFICIENCY OF THE LOCK FIXATION (ATTACHMENT) OF DENTURES ON NATURAL TEETH AND IMPLANTS. *European Journal of Research volume*, *5*(2), 46-57.
13. Salimov, O. R., Alieva, N. M., Rikhsieva, D. U., & Akhmedov, M. R. (2022). Changes in the microbiocenosis of oral employment in women in the first year of lactation. *Journal of Pharmaceutical Negative Results*, 799-808.
14. Salimov, O. R., Alieva, N. M., Rikhsieva, D. U., & Akhmedov, M. R. (2022). Changes in the microbiocenosis of oral employment in women in the first year of lactation. Journal of Pharmaceutical Negative Results, 799-808.
15. Салимов, О. Р. (2022). ЧАККА-ПАСТКИ ЖАҒ БЎҒИМИ ДИСФУНКЦИЯСИНИ КОМПЛЕКС ДАВОЛАНШ УСУЛЛАРИ. Uzbek Scholar Journal, 10, 469-475.