Increasing the effectiveness of complex influence on the condition of parodontal tissue in patients with diseases of the digestive system and having fixed dentures

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Abstract. The study is dedicated to analyzing the effectiveness of comprehensive treatment of periodontal tissues in patients with digestive system diseases who use non-removable prostheses. The work considers the connection between periodontal diseases and digestive system disorders, emphasizing the importance of an integrated approach to treatment. A significant number of patients were included in the study, various clinical and biochemical parameters were evaluated, and a comprehensive methodological approach was used, including statistical analysis. The results of the study showed that a combined approach to treatment significantly improved the oral cavity and periodontal condition in these patients, suggesting greater effectiveness of such integrated strategies for treating periodontal diseases in individuals with digestive system disorders and non-removable dental prostheses. The findings of the study are significant for developing more effective methods of treating periodontal diseases, especially for patients with concurrent digestive system diseases. Objective: to develop and evaluate new methods of comprehensive treatment of the periodontium in patients with digestive system diseases who use non-removable prostheses. Materials and Methods: The study was conducted at the Department of Dentistry of Bukhara State Medical Institute in the years 2020–2023. Participants: 138 patients, aged 18–60, including 101 men and 37 women. Age group distribution: 78 people aged 18–39, 39 people aged 40–49, 21 people aged 50–65. All patients suffered from chronic generalized periodontitis of varying severity, had digestive system diseases, and used non-removable prostheses. The main group included 108 patients with gastrointestinal tract exacerbations: 52 with metal bridge prostheses, 28 with metal-ceramic prostheses, and 28 with dental prostheses on dental implants. The control group consisted of 30 patients: 12 with metal bridge prostheses, 10 with dental prostheses on dental implants, and 8 with metal-ceramic prostheses. Results: The treatment improved clinical-hygienic indicators in patients, reducing OHI-S and PMA indices. The microbial population in the oral cavity significantly decreased, particularly the levels of Lactobacillus and Streptococcus mutans. The effectiveness of the treatment was higher in the first group, with improved microflora and a reduction in pathogens. The use of Traumeel-S, HelboBlue, and ALT-Vostok model 03 contributed to

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the improvement of periodontal health. Patients experienced a restoration of metabolic processes in periodontal tissues, an increase in the levels of L-arginine and citrulline, and a decrease in nitrates and urea. The integrated approach proved effective in correcting the condition of the periodontium in patients with gastrointestinal diseases and non-removable prostheses.

1 Introduction

Studies show that problems with the integrity of dental rows are encountered in a significant portion of the Uzbek population in the age group from 20 to 50 years, with a share ranging from 33% to 58% [14]. One of the key directions of orthopedic treatment is not only the restoration of defects in teeth and dental rows using non-removable prostheses, but also the prevention of further tooth decay. Prosthetics, in addition to its function of replacing defects, can serve as a tool for conducting therapeutic and preventive measures [5]. Research conducted by Trezubov V. N. and Al-Haj O. N. showed that inflammatory periodontal diseases were identified in 54.8% of patients, with 29.9% of them having mild chronic catarrhal gingivitis, 10.6% - moderate chronic catarrhal gingivitis, and 14.3% - mild chronic localized periodontitis [6].

One of the main drawbacks of non-removable dental prostheses is their impact on the hygienic cleaning of the oral cavity, which is often difficult or even impossible. Prostheses contribute to the accumulation of plaque and tartar, which promotes the proliferation of a large number of microorganisms [3, 7, 10, 13]. Another negative aspect is the influence of the materials used in the manufacture of orthopedic structures on the composition of the oral microflora, which can lead to disturbances in its balance and activation of pathogenic microflora, contributing to the development of inflammatory diseases [1, 11, 12].

Today in clinical practice, various methods of treating periodontal diseases are widely used, including pharmacological, surgical, and physiotherapeutic methods. However, despite this, the effectiveness of such methods often remains insufficient, especially in the restoration of bone structures of the alveolar process, which makes their implementation in practical healthcare challenging [2]. In light of this, interest in alternative treatment methods, such as plasma therapy, continues to grow.

The high prevalence of inflammatory periodontal diseases in modern society, accompanied by an intensification and deepening of their manifestations, underscores the relevance of searching for new methods of treatment and prevention of these conditions [16, 17, 23, 25]. The problem of treating and preventing inflammatory processes in the periodontium in patients using orthopedic structures, both removable and especially non-removable, remains significant despite the variety of existing methods and comprehensive approaches [19,16,20]. In recent years, changes in methods of treating defects in dental rows have led to the widespread use of non-removable orthopedic structures in dental practice [22, 23, 25]. This is explained by the increasing demands of patients for the quality of treatment, however, the high percentage of complications arising during the treatment and operation of orthopedic structures remains significant [31,32,30]. Therefore, developing and implementing effective measures for the prevention and treatment of complications becomes an important task [28, 29, 27, 26].

2 Objective

The aim of this study is to develop and evaluate the effectiveness of advanced methods for the comprehensive treatment of periodontal tissues in patients suffering from digestive system diseases and using non-removable prostheses.

3 Materials and methods of the study

Within the framework of the study, the recruitment and grouping of patients were conducted taking into account scientific objectives and tasks. This included: 1) comparative statistical analysis to assess the risks of periodontitis; 2) evaluation of the effectiveness of treatment methods for inflammatory diseases of periodontal tissues, especially in patients with digestive system diseases using non-removable orthopedic structures; 3) detailed diagnostics of microcirculation disorders in periodontal tissues. These measures are important for achieving objective results.

In the study conducted at the Department of Dentistry of Bukhara State Medical Institute from 2020 to 2023, 138 patients aged 18-60 years participated. The gender and age composition was as follows: 59 men (58.42%) and 19 women (51.3%) aged 18-39 years (total 78 people), 28 men (27.72%) and 11 women (29.7%) aged 40-49 years (total 39 people), 14 men (13.86%) and 7 women (19.0%) aged 50-65 years (total 21 people). In total: 101 men and 37 women. All patients had chronic generalized periodontitis of various degrees of severity. The main criteria for inclusion were digestive system diseases and the use of non-removable prostheses.
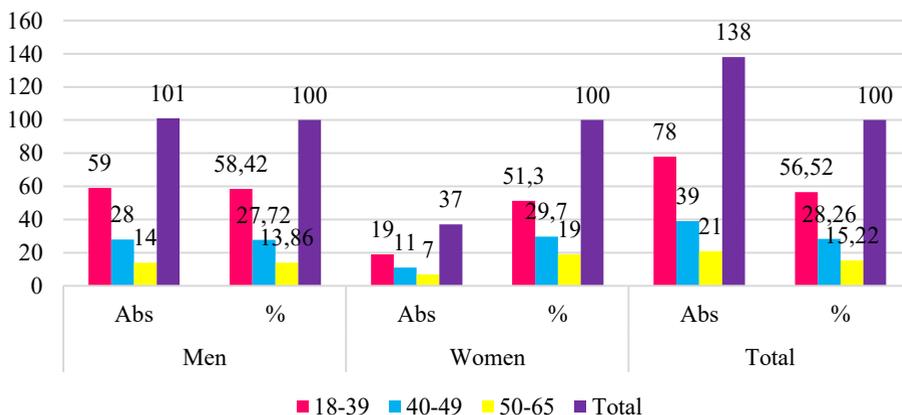

Fig. 1. Distribution of patients by gender and age, n=138

A group of 108 patients with exacerbations of gastrointestinal diseases was studied. Of these: 52 with metal bridge prostheses, 28 with metal-ceramic prostheses, 28 with dental prostheses on dental implants. A control group of 30 patients was formed: 12 with metal bridge prostheses, 10 with dental prostheses on dental implants, 8 with metal-ceramic prostheses (Table 1).

Table 1. Analysis of types of prostheses among 138 patients in different groups.

Type of Prosthesis	Group 1, n=56	Group 2, n=52	Control Group (30 patients)
	Abs. (%)	Abs. (%)	Abs. (%)
Metal Bridge Prostheses	25 (44,6)	27 (51,9)	12 (40,0)
Metal-Ceramic Prostheses	16 (28,6)	14 (26,9)	8 (26,7)
Prostheses on Dental Implants	15 (26,8)	11 (21,2)	10 (33,3)
Total	56 (100)	52 (100)	30 (100)

Three groups of patients were formed. The third group (n=30) had no gastrointestinal diseases but used non-removable prostheses. They showed no signs of periodontal

inflammation. A comprehensive approach was used to assess gastrointestinal diseases. Diagnoses were made based on clinical examination and endoscopy. The second group (n=52) consisted of patients with non-removable prostheses. In the first group (n=56), patients had gastrointestinal diseases and non-removable prostheses.

For additional therapy, "Traumeel-S" was used. The treatment included injections of a 2 ml solution, administered under the mucous membrane twice a week, for a total course of 5 injections. The drug has anti-inflammatory, analgesic, anti-exudative, antihemorrhagic, venotonic, immunomodulating, and reparative effects. The effectiveness of the drug is due to the activation of the body's protective mechanisms and normalization of functions disrupted by the pathological process. The drug includes plant and mineral components that contribute to the improvement of periodontal condition. For instance, calcium and plant substances strengthen the vascular walls and reduce swelling. Homeopathic doses of mercury reduce the intensity of the inflammatory process. Other components prevent bleeding and hematoma formation. Pain relief is achieved through the combined action of several components. Plant components activate metabolic processes and promote regeneration, strengthening immunity.

Within the framework of the therapy course for the first group of patients, a comprehensive approach was used. One of the key elements was the application of the sensitizing fluid HelboBlue, which increases the sensitivity of pathogenic microorganisms to antibacterial therapy. The procedure was carried out using the ALT-Vostok model 03 device, which meets the technical standards TSh 64-15302652-002:2010. This device has high efficiency and safety in medical use. The distance between the light guide and the wound surface varied, with a total irradiation time of 10 minutes in the first phase and 5 minutes in the second phase. This was followed by local intraoral hyperbaric oxygen therapy. Each patient also underwent hygienic procedures, including the removal of dental deposits and curettage of periodontal pockets. General treatment was also prescribed. This complex of methods formed the developed method of additional therapy aimed at improving clinical outcomes. The evaluation of treatment results was based on the disappearance of clinical signs of inflammation and the analysis of the progression of periodontitis. Monitoring of patients' condition was carried out before the start of treatment and on the 7th, 14th, and 30th days after the start of therapy. This allowed for the collection of complete information on the impact of procedures at each stage of recovery and to assess the effectiveness of treatment at different stages of the disease.

The clinical examination of patients with periodontal diseases included a questionnaire and an examination. The questionnaire helped identify the main complaints, the duration of the disease, and risk factors. The examination included an assessment of the condition of the oral cavity, teeth, gums, and mucous membrane, using a dental mirror. The collection of anamnesis included general and dental histories. Treatment included instruction in oral hygiene, professional hygiene, orthopedic or surgical intervention. Patients were also consulted by other specialists. The examination was conducted before the start of treatment and on the 7th, 14th, and 30th days of treatment to assess the effectiveness of the therapy.

The method used to assess the level of oral hygiene is based on the oral hygiene index (OHI-S) by Greene-Vermillion (1964), including the indices of dental plaque (DI) and calculus (CI). The examination includes an assessment of the periodontium, the presence of inflammation, tooth mobility, and the depth of gingival pockets. The periodontal index (PI) is calculated by summing the scores for each tooth and dividing by the total number of teeth. The PI determines the degree of gum involvement: PI from 0.1 to 1.0 - initial stage, PI up to 4.0 - moderate degree, PI above 4.5 - severe form. The CPITN index is classified by probing of teeth and is determined by zones. The assessment of the periodontal condition includes PMA and IA indices. The Ramfjord periodontal disease index (1959) is used to assess teeth

and takes into account the exposure of the tooth root. The index values reflect the degree of activity of the pathological process.

For the biochemical analysis of arginine, citrulline, nitrates, and nitrites content in oral fluid, patients spit samples into special tubes on an empty stomach in the morning. Avoiding the consumption of colorants three days before collecting samples to prevent distortion of results, the samples were subjected to quantitative analysis.

Arginine was analyzed using the S. Sakaguchi method with α-naphthol. 5 ml of the solution was passed through an absorption column, washed with 0.3% NaCl solution, then cold α-naphthol and urea solution were added, followed by sodium hypobromite reagent. After incubation and measuring the optical density, the results were recorded on a spectrophotometer.

Citrulline was determined by the Gornall and Hunter method, incubating the sample with urease, then conducting a reaction with diacetyl monoxime after centrifugation.

The concentration of nitrates and nitrites was determined by diazotization reaction with Griess reagent, using a standard set of reagents from the company "NOVA".

For the analysis of periodontopathogenic bacteria (Actinobacillus actinomycetemcomitans, Porphyromonas gingivalis, Tannerella forsythensis, Prevotella intermedia, and Treponema denticola), a multiprimer polymerase chain reaction was used on samples from dental plaque and periodontal pockets. Samples were collected using a sterile cotton swab, then rinsed in isotonic sodium chloride solution, and placed in sterile containers for the suspension of microorganisms.

For the diagnosis of intestinal dysbiosis, the Industry Standard 91500.11.0004-2003 was applied. Fecal samples were analyzed within 2 hours of collection, using various culturing mediums. Identification of colonies to the species level was performed using "Lachema" diagnostic kits, and bacterial seeding was determined by counting colony-forming units per 1 g of material. The lability and variability of the intestinal microflora were taken into account, and the diagnosis of dysbiosis was made after repeated studies with an interval of 2 to 5 days.

Within the scope of the study, for statistical data processing, computer technology with the Windows 10 operating system and specialized software suites were used. For quantitative characteristics, the method of calculating the mean (M) and the standard error of the mean (m) was applied to enhance the accuracy and reliability of statistical conclusions.

For the analysis of qualitative characteristics, relative proportions and their standard errors were calculated to achieve a more comprehensive understanding of the distribution of features in the sample.

To compare independent groups by quantitative indicators, the Student's t-test was used, allowing for the assessment of the degree of differences and establishing the statistical significance of the observed differences.

Hypothesis testing was conducted by comparing the actual level of significance (p) with the established threshold value (0.05). If $p < 0.05$, the null hypothesis was rejected in favor of the alternative, indicating statistically significant differences between the groups.

4 Results and discussion

Pathogenetic connections between diseases of internal organs and oral cavity pathologies are evident against the background of systemic mechanisms. Disturbances in regulatory mechanisms associated with dysfunction of the digestive organs play a central role in initiating inflammatory processes in the periodontium. Significant changes in the metabolism of connective tissue, disturbances in mineral exchange, and vitamin deficiencies create favorable conditions for the development of gingivitis and periodontitis. The pathology of the gastroduodenal area in patients with inflammatory periodontal processes underscores the

interrelationship between gastroenterological and dental diseases. A deep understanding of these systemic interrelations promotes a more effective approach to the diagnosis and treatment of diseases affecting both internal organs and the periodontium.

During the course of the study, it was established that among all participants in Groups 1 and 2 with chronic diseases of the digestive organs, the dominant pathology is inflammatory processes of the periodontium. Each participant was diagnosed with the aforementioned periodontal diseases (Fig. 2).
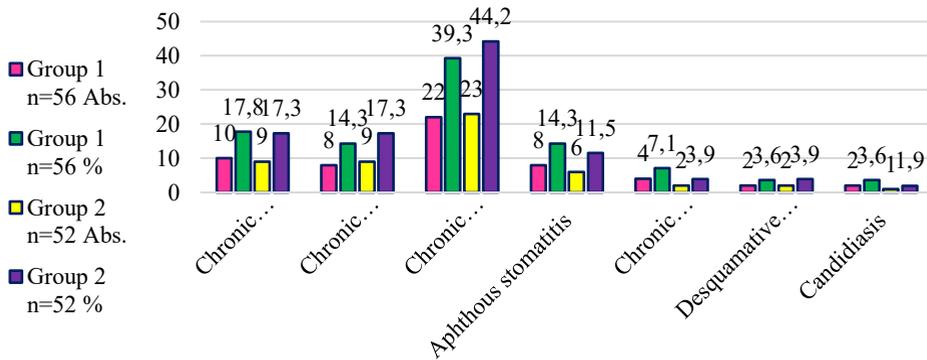

Fig. 2. Characteristics of the periodontal tissue condition, n=108

In both groups, the distribution of mild chronic generalized periodontitis accounted for 17.8% (10 people) in the first and 17.3% (9 people) in the second group. Moderate periodontitis was present in 14.3% (8 people) and 17.3% (9 people) respectively. Severe generalized periodontitis was more frequently observed in the second group - 44.2% (23 people) compared to 39.3% (22 people) in the first. Aphthous stomatitis occurred in 14.3% (8 people) of the first group and 11.5% (6 people) of the second group. Chronic generalized catarrhal gingivitis was found in 7.1% (4 people) in the first group and 3.9% (2 people) in the second. Desquamative glossitis and candidiasis were less common, with similar frequencies in both groups. Both groups showed a similar trend in the distribution of periodontal diseases, with some variations in the percentage of individual pathologies. Clinical symptoms prompting dental care included difficulties in chewing food, painful sensations during eating and dental care, and increased tooth mobility.

During the preclinical assessment of study participants, signs of inflammation and destruction in the periodontium and dentomaxillary system were detected. Of the 56 patients in the first group, 46.4% (26 people) suffered from pain during chewing and hygienic procedures, indicating increased sensitivity. In the second group (52 patients), similar complaints were identified in 55.8% (29 people). Tooth mobility, observed in 33.9% of the first group and 30.8% of the second, indicates progressing periodontitis. Disturbances in masticatory function were noted by 19.6% and 13.5% of patients respectively, possibly due to mechanical or neuropathic reasons. A study of gastrointestinal diseases was conducted, using anamnesis, clinical examination, and diagnostic methods; the results are presented in Table 2.

Table 2. Gastrointestinal diseases in the studied groups, n=108

Gastrointestinal Disease	Group 1, n=56		Group 2, n=52	
	Abs.	%	Abs.	%
Peptic Ulcer Disease of the Stomach and Duodenum	28	50,0	24	46,2
Gastritis	19	33,9	23	44,2
Nonspecific Ulcerative Colitis	9	16,1	5	9,6
Total	56	100	52	100

Peptic ulcer diseases of the gastrointestinal tract were predominant in both groups: 50% in the first (28 people) and 46.2% in the second (24 people), followed by gastritis: 33.9% (19 people) and 44.2% (23 people) respectively. Nonspecific ulcerative colitis was less common: 16.1% (9 people) and 9.6% (5 people).

The study revealed that patients with chronic catarrhal gingivitis experienced itching, bleeding, and mild gum pain, with the integrity of the tooth-gum connection maintained and the presence of supragingival deposits.

In mild periodontitis, symptoms included gum bleeding, tooth sensitivity, and bad breath. The depth of periodontal pockets was up to 3 mm, OHI-S and PMA indices were elevated, with PI at 2.94 ± 0.11 and 2.90 ± 0.14.

Moderate periodontitis was characterized by severe bleeding, burning, and pain. Periodontal pockets were 4-5 mm, OHI-S indices were 2.21 ± 0.14 and 2.23 ± 0.11, PMA 47.42 ± 1.35 and 46.21 ± 1.44, PI 4.89 ± 0.17 and 4.96 ± 0.14.

In severe periodontitis, there was pain, gum bleeding, and tooth mobility. Periodontal pockets ranged from 5-8 mm, PMA indices were 69.76 ± 2.28 to 70.10 ± 2.30, PI 6.54 ± 0.16 and 6.57 ± 0.14.

The study identified a direct correlation between the severity of inflammatory processes in the gums and the activity of peptic ulcer disease (PUD) of the gastrointestinal tract. Mild forms of chronic gingivitis and periodontitis often accompanied the initial stages of PUD and superficial gastritis caused by Helicobacter pylori. Moderate and severe stages of periodontitis were associated with more complex cases of PUD, including multiple ulcers and erosive gastroduodenitis against the backdrop of chronic atrophic gastritis, also linked to Helicobacter pylori. More serious inflammatory and destructive changes in the periodontium were observed in patients with intense involvement of the antral part of the stomach caused by Helicobacter pylori, likely related to decreased mucosal resistance. The treatment plan for prosthetic preparation in patients with PUD associated with Helicobacter pylori should include treatment of the infection.

A correlation was found between the severity of chronic periodontitis and the activity of peptic ulcer disease (PUD), especially in moderate and severe forms of periodontitis. The analysis of clinical forms of periodontitis and PUD revealed that chronic catarrhal gingivitis occurred in 1.8-3.6% of patients across all degrees of PUD. Mild periodontitis was more commonly found in first-degree PUD (16.1% and 9.6% in the first and second groups). Moderate periodontitis was associated with second-degree PUD (10.7% and 13.5%). Severe periodontitis correlated with third-degree PUD (33.9% and 32.7%). Cases of aphthous stomatitis, desquamative glossitis, and candidiasis were also noted, but their relationship with the severity of PUD requires further investigation.

The oral microflora is a complex system that includes over 800 types of microorganisms. Its balance can be disrupted due to systemic diseases, affecting the quantity of resident microorganisms. Factors such as caries, malocclusions, and poor-quality prostheses contribute to the activity of pathogenic microflora, in which local immunity plays a crucial role.

The study of oral microflora in patients and healthy individuals showed differences in colonization resistance. Lactobacilli were found in a quantity of 1.8 ± 0.2 CFU/cm² on the gums and in smaller amounts on other sites. Streptococcus mutans was detected in high concentrations on the gums (2.04 ± 0.1 CFU/cm²) and the tongue. E.coli were found only on the tongue (1.2 ± 0.1 CFU/cm²), while Staphylococcus was prevalent in the gums (4.83 ± 0.6 CFU/cm²), on the cheeks, and the tongue. Streptococcus salivarius and Streptococcus mitis predominated on the gums. Klebsiella was not detected at all, and Candida fungi were present on the gums and tongue but absent on the cheeks and palate.

In the study of oral microflora in patients with periodontitis and non-removable prostheses, changes in microorganisms were examined. Swabs collected from different

mucosal sites revealed 387 aerobic and 95 anaerobic microorganisms, with a predominance of gram-positive bacteria (788 species), gram-negative (95 species), and yeast-like fungi (83 species), including 12 species of opportunistic microorganisms.

There was a significant increase in the colonization density of microorganisms, 3-5 times higher than in healthy individuals, especially for Candida fungi. The growth in numbers of Candida albicans, Candida pseudotuberculosis, Candida kruses, and Candida tropicalis was pronounced on the cheeks and gums.

This confirms the connection between the gastrointestinal tract and oral microflora: changes in the gut microbiome in various pathologies can affect the oral flora, contributing to inflammatory processes in the periodontium. This indicates the need for a comprehensive approach to the treatment of gastrointestinal and oral cavity diseases.

The study of oral microflora in patients with periodontitis and non-removable prostheses revealed significant changes. Lactobacilli were found in the gums (1.12 ± 0.15 CFU/cm²) and on the tongue (0.9 ± 0.02 CFU/cm²), absent on the cheeks and palate. E.coli were more prevalent on the gums (2.23 ± 0.10 CFU/cm²) and tongue (2.12 ± 0.10 CFU/cm²), less so on the cheeks. Streptococcus mitis was evenly distributed throughout the oral cavity, while Streptococcus salivarius predominated in the gums and on the tongue. Staphylococcus was mainly detected in the gums and on the tongue, Streptococcus mutans on the tongue and cheeks. Klebsiella was present in all areas, especially in the gums. Candida fungi demonstrated high colonization density, particularly in the gums and on the cheeks.

An increase in colonization of both resident and opportunistic microorganisms was observed, indicating a correlation between inflammatory periodontal diseases and changes in oral microflora. These findings underscore the importance of studying the oral microbiome in patients with gastrointestinal diseases to understand their impact on inflammatory processes in the periodontium.

The oral microflora study in patients with periodontitis showed an increase in colonies of Klebsiella, particularly on the gums (lg 2.45 ± 0.12 CFU/ml), and bacteria E.coli, present on the gums and cheeks (lg 2.23 ± 0.10 CFU/ml). A decrease in the number of Streptococcus and Lactobacillus was noted, indicating a disruption in the balance of microflora and a decrease in colonization resistance.

Comparative analysis of oral fluid microflora revealed a reduction in the barrier functions of colonization resistance in patients, with an increase in colonies of Staphylococcus, Peptostreptococcus, Escherichia, and the emergence of colonies of Proteus and Staphylococcus aureus (65%). In healthy individuals, Str.salivaruis, Veillonella, and Peptostreptococcus predominated, followed by Str.mitis and Str.mutans. Gram-negative bacteria were rare (Table 12).

These data confirm changes in the oral microbiome in patients with periodontitis against the background of gastrointestinal diseases and indicate a complex interaction between oral microflora and overall health. The study highlights that an imbalance in the oral microbiome can reflect global changes in the body related to gastrointestinal functioning disorders.

In the study of oral fluid in patients with periodontitis and gastrointestinal diseases, L-arginine, nitrates, urea, and citrulline were analyzed. An increase in nitrates was observed in patients (142.93 ± 12.53 and 143.11 ± 13.54 μmol/L compared to 115 ± 6.28 μmol/L in healthy individuals), indicating active nitrogen microbial activity in PUD. L-arginine was decreased in patients (9.65 ± 3.88 and 9.98 ± 4.11 μmol/L versus 19.24 ± 3.80 μmol/L in healthy individuals), which may reflect changes in metabolism. Urea and citrulline also showed differences (14.25 ± 3.15 and 15.05 ± 2.85 μmol/L in patients compared to 8.56 ± 3.21 and 18.42 ± 1.87 μmol/L in healthy individuals).

Based on the results, conservative periodontal therapy for patients with gastrointestinal diseases is recommended, including low-intensity laser therapy (LILT) and injections of Traumeel S. LILT improves microcirculation and biochemical processes in the periodontium,

while Traumeel S is effective in treating inflammation without adverse effects on the gastrointestinal tract. This combination contributes to the restoration of the oral microbiological balance and improves patients' quality of life.

The next phase of our study examined the results of comprehensive treatment of the first group of patients with periodontitis, non-removable prostheses, and gastrointestinal diseases. In addition to standard procedures, Traumeel-S was used in the form of 5 injections of 2 ml each. This drug enhances the body's defensive capabilities.

The regimen included the sensitizing fluid HelboBlue, which increases the sensitivity of microorganisms to antibacterial therapy. HelboBlue application was carried out using the ALT-Vostok model 03 device, compliant with TSh 64-15302652-002:2010, with technical parameters including voltage 110-220 V, power 10 W, radiation range 660-670 nm, total radiation power 1.0 W, and exit aperture area of 4 cm²

The study compared the results of periodontitis treatment in two groups of patients. The first group (56 individuals) received standard therapy plus Traumeel S and LILT (Low-Intensity Laser Therapy). The second group (52 individuals) underwent standard treatment only. The aim of the analysis was to determine whether the additional treatments improve outcomes compared to standard methods. The analysis included a comparison of clinical characteristics and disease index indicators of periodontitis before and after therapy, with a focus on chewing food, sensations during eating and dental care, and tooth mobility (Fig. 3).
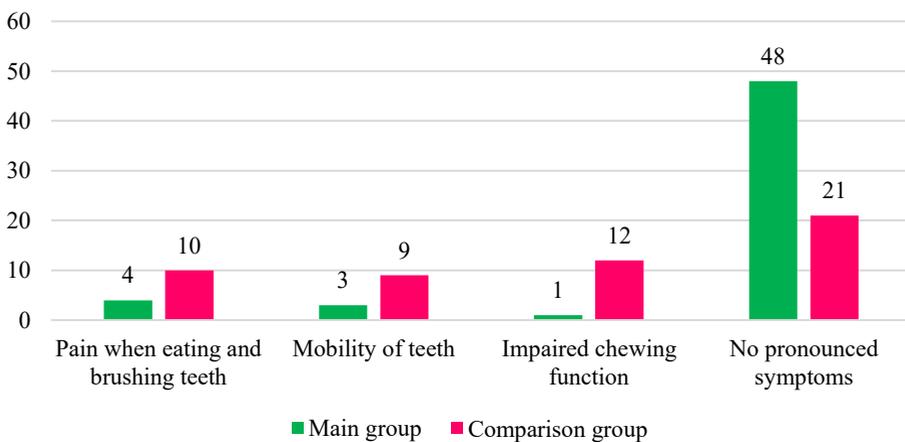

Fig. 3. Clinical symptoms among patients in the first and second groups in absolute numbers after treatment, n=108

In the first group (56 patients), after treatment, pain during eating and tooth brushing remained in 7.1% of patients, tooth mobility in 5.4%, and chewing disturbances in 1.8%. A total of 85.7% of patients were symptom-free. In the second group (52 patients), a larger number of patients retained symptoms: pain in 19.2%, tooth mobility in 17.3%, chewing disturbances in 23.1%, and symptom-free patients were 40.4%. The comparison showed that in the first group, pain decreased by 2.7 times, tooth mobility by 3.2 times, and chewing disturbances by 12.8 times compared to the second group. This indicates the greater effectiveness of comprehensive therapy.

An analysis of the biochemical composition of oral fluid in patients before and during treatment (7, 14, 30 days) was conducted, focusing on changes in key markers to assess the dynamics of inflammation and therapy effectiveness (Table 3).

Table 3. Comparative analysis of the dynamics of changes in the biochemical composition of oral fluid against the background of conducted therapy in patients of the first and second groups, n=108 (μmol/L)

Days	Value		Value in Control Group n=30	P
	Group 1 n=56	Group 2 n=52		
L-arginine				
Before Therapy	9,65±3,88	9,98 ±4,11	19,24 ±3,80	0,0198
7	10,74±1,84	10,21±1,11		0,0136
14	16,21±1,03*	12,87±1,15		0,0212
30	16,54±2,15*	13,01±1,08		0,0214
Nitrates				
Before Therapy	142,93±12,53	143,11±13,54	115,02±6,28	0,0186
7	132,18±5,41	138,14±4,44		0,0197
14	121,66±3,15*	129,78±3,11		0,0287
30	120,12±3,24*	129,11±3,44		0,0281
Citrulline				
Before Therapy	10,72 ±0,88	10,48 ±0,74	18,42 ±1,87	0,0196
7	12,98 ±0,94	11,15 ±0,85		0,0199
14	16,20 ±1,15*	14,20 ±1,18		0,0144
30	16,72 ±1,08*	14,98 ±1,21		0,0146
Urea				
Before Therapy	14,25 ±3,15	15,05 ±2,85	8,56 ±3,21	0,0154
7	11,21 ±2,74	13,26 ±2,52		0,0158
14	9,91 ±1,14	10,96 ±1,16		0,0168
30	9,54 ±1,21	10,22 ±1,52		0,0171

Note: *-result is statistically significant (p<0.05) compared to the data of the second group of patients.

The level of L-arginine in the first group significantly increased by the 14th and 30th days (16.21±1.03 and 16.54±2.15 μmol/L respectively), differing from the second group (p<0.05), indicating improved microcirculation in the periodontium. Nitrate levels decreased more in the first group (121.66±3.15 and 120.12±3.24 μmol/L), suggesting reduced oxidative stress. Urea also decreased to 9.54±1.21 μmol/L. Citrulline increased in the first group (16.72±1.08 μmol/L), exceeding the second group's figures, confirming the effectiveness of the treatment.

The results demonstrate a higher efficacy of treatment in the first group, evidenced by improvements in both clinical and biochemical indicators (p<0.05). Differences in the microbial composition of oral fluid between the groups, as reflected in Table 4, also confirm the effectiveness of comprehensive therapy in the first group.

Table 4. Qualitative and Quantitative Composition of Oral Fluid in the Control Group and in Patients of the First and Second Groups with Inflammatory Processes of the Periodontium Against the Background of Gastrointestinal Diseases After Conducted Therapy (lg M±m, CFU/ml)

№	Microorganism Groups	The microbial count in 1 milliliter of saliva		
		Control group n=30	Therapy outcomes	
			Group 1 n=56	Group 2 n=52
1	Lactobacilli	4,55±0,11	4,05±0,12*	3,15±0,11
2	Peptostreptococci	2,65±0,15	2,70±0,15*	3,60±0,15
3	Staphylococcus aureus	0	0,33±0,10*	2,43±0,18
4	Staphylococcus epidermidis	4,02±0,15	3,06±0,15	4,06±0,19
5	Streptococcus salivarius	4,21±0,15	4,12±0,08*	3,18±0,12
6	Streptococcus mutans	2,07±0,10	2,44±0,09*	3,56±0,19
7	Streptococcus mitis	2,52±0,11	2,90±0,08*	3,84±0,09
8	Escherichia coli	0,74±0,01	0,85±0,02	1,85±0,11

Continuation of Table 4.

9	Proteus	0,21±0,01	0,52±0,03*	1,21±0,13
10	Klebsiella	0,82±0,02	0,96±0,04	1,15±0,08
11	Veillonella	2,32±0,10	2,68±0,12	2,89±0,14
12	Candida (fungi)	2,03±0,18	2,18±0,12*	3,24±0,16
13	Total aerobic count	5,25±0,12	5,33±0,10	6,85±0,54
14	Total anaerobic count	5,61±0,14	5,27±0,11	3,71±0,35

After treatment of inflammatory periodontal processes in patients with gastrointestinal tract disorders, differences in oral fluid microbiota were observed between the two groups:

Group 1 (n=56):

Lactobacilli decreased to 4.05±0.12 lg CFU/mL (higher than in the control group).

Peptostreptococci decreased to 2.70±0.15 lg CFU/mL.

Staphylococcus aureus decreased to 0.33±0.10 lg CFU/mL.

Decrease in levels of Staphylococcus epidermidis, Streptococcus salivarius, Streptococcus mutans, and Streptococcus mitis.

Low levels of Escherichia coli, Proteus, and Klebsiella.

Candida count also decreased.

Second group (n=52):

Lactobacilli decreased to 3.15±0.11 lg CFU/mL.

Peptostreptococci increased to 3.60±0.15 lg CFU/mL.

Staphylococcus aureus was higher at 2.43±0.18 lg CFU/mL.

Higher levels of Staphylococcus epidermidis, Streptococcus salivarius, Streptococcus mutans, Streptococcus mitis, Escherichia coli, Proteus, and Klebsiella.

Greater amount of Candida compared to the first group.

The analysis indicates that in the first group, the microbiota remained closer to the control, suggesting a more favorable microbiological profile after treatment. The results of microorganism occurrence frequency after treatment are shown in Figure 4, where an increase in beneficial and a decrease in pathogenic microorganisms was observed in the first group, unlike the second group, where the changes were less pronounced. This indicates a higher treatment efficacy in the first group.
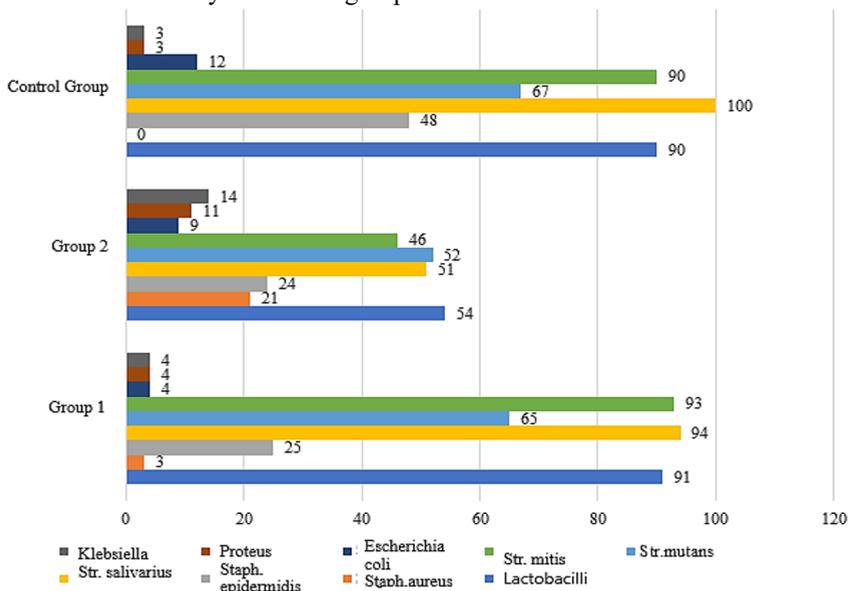

Fig. 4. Frequency of microorganism occurrence in the oral cavity in the first and second groups after treatment, in absolute numbers.

The analysis of clinical-hygienic indicators after treatment in patients from both groups compared to the control group revealed the following:

Oral Hygiene Index (OHI-S):
First group: Decreased to 1.01±0.04.
Second group: Decreased to 1.88±0.14.
Control group: Recorded at 0.87±0.10.
Significance level (p): 0.005.

Plaque-Mouthwash-Adjusted (PMA) Index:
First group: Decreased to 23.17±2.28.
Second group: Decreased to 32.14±3.25.
Control group: Recorded at 18.11±1.02.
Significance level (p): 0.005.

Periodontal Index (PI):
First group: Decreased to 0.91±0.03.
Second group: Decreased to 2.11±0.44.
Control group: Recorded at 0.68±0.01.
Significance level (p): 0.005.

These results demonstrate a significant improvement in clinical-hygienic indicators in the first group compared to the second, approaching the metrics of the control group, indicating a more effective therapeutic intervention in the first group. Analysis of microbial population density in different oral cavity areas of patients with fixed prostheses and inflammatory periodontal diseases after treatment revealed the following results.

The study encompassed two groups: the first group (56 patients) and the second group (52 patients). The analysis yielded the following results:

Lactobacillus: In the first group, the concentration of lactobacilli in various oral cavity regions was as follows: gum 3.95±0.15, cheek 2.11±0.01, tongue 3.21±0.01, and palate 2.01±0.10 CFU/cm². In the second group, these values were noticeably lower: gum 2.12±0.11, cheek 1.08±0.01, tongue 1.84±0.03, and palate 1.50±0.01 CFU/cm².

E.coli: E.coli levels remained similar in both groups, with a slight elevation in the first group: gum 2.40±0.10 and 2.30±0.10, cheek 1.42±0.10 and 1.40±0.10, tongue 2.62±0.02 and 2.24±0.04, palate 1.44±0.08 and 1.25±0.01 CFU/cm², respectively, for the first and second groups.

Streptococcus mitis and salivarius: Levels of these microorganisms also demonstrated higher values in the first group compared to the second.

Staphylococcus: Presence of this microorganism was only registered in the second group.

Streptococcus mutans: Presence of this bacterial species was higher in the first group, particularly on the gums.

Klebsiella: Absent in the first group but present in the second, especially on the gums and tongue.

Candida genus fungi: Their density was higher in the second group, indicating differences in the microbiological profile after treatment.

These results point to a more effective reduction in the density of pathogenic microorganisms in the first group, indicating the higher efficacy of the comprehensive treatment applied. Thus, the presence of higher concentrations of beneficial microorganisms, such as lactobacilli and streptococci, in the first group, and reduced amounts of pathogens, such as Staphylococcus and Klebsiella, demonstrate the favorable impact of the therapy on the oral cavity's microbiological profile.

5 Conclusions

With the increased severity of peptic ulcer diseases (PUD), there is an escalated severity of periodontal diseases. Chronic periodontitis of mild degree was detected in 17.6% of patients, which is associated with early stages of PUD. Progression of PUD correlates with increased severity of periodontitis: among patients with moderate and severe periodontitis, cases were observed in 15.7% and 41.7% respectively. These findings underscore the importance of assessing periodontal status during PUD treatment, particularly in cases of Helicobacter pylori infection, necessitating a comprehensive therapeutic approach.

Study of oral cavity microbiota in patients with periodontal diseases, using fixed prostheses, revealed a significant increase in microbial colonization density compared to the control group of healthy individuals. Particularly high colonization density is observed in Candida genus fungi. The average prevalence of Candida fungi in the control group is 1.29±0.2 CFU/cm², whereas in the periodontal disease group it reaches 3.39±0.15 CFU/cm², which is 2.6 times higher.

Analysis of oral fluid microbiota identified substantial deviations from the norm in patients with periodontal diseases. Reduction in lactobacilli quantity to 0.44 of the control group level indicates imbalance in beneficial microbiota. Presence of Staphylococcus aureus and significant increase in Proteus (by 9.9 times) and Klebsiella (by 2.4 times) suggest disturbances capable of provoking inflammatory processes. Decrease in total anaerobic count to 0.65 also indicates a shift in balance towards aerobes.

Patients with peptic ulcer disease (PUD) exhibit statistically significant deviations in the biochemical composition of oral fluid compared to the control group. The nitrate level (142.93±12.53 µmol/L and 143.11±13.54 µmol/L, respectively) exceeds the parameters of the control group (115±6.28 µmol/L) by 24-25%. The concentration of L-arginine (9.65±3.88 µmol/L and 9.98±4.11 µmol/L) decreases by half compared to the control group (19.24±3.80 µmol/L). Urea levels (14.25±3.15 µmol/L and 15.05±2.85 µmol/L) increase by 1.7 times compared to the control group (8.56±3.21 µmol/L). The level of citrulline (10.72±0.88 µmol/L and 10.48±0.74 µmol/L) decreases by 1.9 times compared to the control group (18.42±1.87 µmol/L). These changes may serve as important markers in the diagnosis and treatment of PUD and accompanying periodontal problems.

Inclusion of Traumeel-S and LFDT in the comprehensive therapy of patients with periodontal diseases using fixed prostheses and PUD leads to significant improvement in clinical and biochemical parameters. A 2.7-fold reduction in pain during eating and tooth brushing, a 3.2-fold improvement in tooth mobility, and a significant 12.8-fold improvement in chewing function are observed. Substantial changes are also noted in the biochemical parameters of oral fluid. Urea levels decrease from 14.25±3.15 µmol/L to 9.54±1.21 µmol/L, citrulline concentration increases from 10.72±0.88 µmol/L to 16.72±1.08 µmol/L. Additionally, nitrate levels decrease from 142.93±12.53 µmol/L to 120.12±3.24 µmol/L, and L-arginine levels increase from 9.65±3.88 µmol/L to 16.54±2.15 µmol/L. Noticeable reduction is also recorded in the concentration of Candida genus fungi in the oral cavity, which decreases from 4.38±0.20 to 2.18±0.12. Lactobacillus density decreases from 3.95±0.15 to 2.12±0.11 in the gums, from 2.11±0.01 to 1.08±0.01 on the cheek, from 3.21±0.01 to 1.84±0.03 on the tongue, and from 2.01±0.10 to 1.50±0.01 on the palate. Similarly, the level of Streptococcus mutans decreases from 2.15±0.02 to 1.44±0.08. Some indicators, such as Staphylococcus and Klebsiella levels, reached zero values.

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