



The Impact of Antiparasitic Therapy on the Dynamics of Inflammatory Periodontal Diseases in Patients with Chronic Intestinal Parasitoses

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Abstract

Introduction: Chronic inflammatory periodontal diseases remain one of the most significant challenges in modern dentistry, affecting a substantial portion of the adult population worldwide. According to systematic reviews, the prevalence of moderate periodontitis reaches 45-50%, while severe forms affect 11-15% of the population, ranking this pathology as the sixth most prevalent condition globally

Methods: A prospective cohort study was conducted to evaluate the effect of antiparasitic therapy on the periodontal status of 80 patients with chronic intestinal parasitoses. The study group comprised 40 patients with verified giardiasis or enterobiasis, while the control group consisted of 40 patients without parasitic infections. Assessments were performed before treatment and at 1, 3, and 6 months post-therapy. Standard periodontal indices (PBI, OHI-S, CPI) and laboratory methods (CRP, ferritin, vitamin B12, eosinophils) were employed.

Results: The results demonstrated that patients with intestinal parasitoses initially exhibited statistically significant higher markers of periodontal inflammation: PBI index 3.8 ± 0.4 points versus 2.1 ± 0.3 points in controls ($P < 0.001$), probing pocket depth 4.2 ± 0.6 mm versus 3.1 ± 0.4 mm ($P < 0.001$). The level of systemic inflammation was significantly elevated: C-reactive protein 8.2 ± 1.5 mg/L versus 3.1 ± 0.8 mg/L ($P < 0.001$). Following antiparasitic therapy, the study group showed substantial improvement across all evaluated parameters. After 6 months of treatment, reductions were achieved in PBI index to 1.9 ± 0.3 points, probing pocket depth to 3.0 ± 0.4 mm, and C-reactive protein level to 3.4 ± 0.7 mg/L. A strong correlation was identified between the decrease in C-reactive protein levels and improvement in PBI index ($r = 0.82$, $P < 0.001$).

Conclusion: The obtained data provide compelling evidence that successful antiparasitic therapy promotes statistically significant and clinically relevant improvement in periodontal health among patients with intestinal parasitoses.

Keywords: Intestinal parasitoses, Periodontal diseases, Antiparasitic therapy, Systemic inflammation, Nutritional status, Comprehensive treatment

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Introduction

Chronic inflammatory periodontal diseases remain one of the most significant challenges in modern dentistry, affecting a substantial portion of the adult population worldwide (1, 2). According to systematic reviews, the prevalence of moderate periodontitis reaches 45-50%, while severe forms affect 11-15% of the population, ranking this pathology as the sixth most prevalent condition globally (3,4). In the Russian Federation, the situation remains concerning - various forms of inflammatory periodontal diseases are diagnosed in 86-90% of the adult population, with the prevalence of periodontitis reaching 98% among individuals over 35 years (5). Epidemiological studies demonstrate a clear age-related dynamic: while initial

manifestations of periodontal inflammation are observed in 65-70% of examined individuals aged 18-25, this rate increases to 85-90% by ages 35-44 (6).

Concurrently, intestinal parasitoses, particularly giardiasis and enterobiasis, continue to represent a serious medical and social problem, especially in developing countries and regions with unfavorable sanitary and hygienic conditions. According to World Health Organization data, approximately 200 million cases of giardiasis are registered annually worldwide, with the true prevalence likely being substantially higher due to a significant proportion of asymptomatic forms and insufficient diagnosis (7). In the Russian Federation, the incidence rate of giardiasis stands at 35.6 per 100,000



population, with this figure reaching 90-110 per 100,000 in certain regions (8). Enterobiasis maintains leading positions among parasitic diseases - its share in the overall structure of parasitoses reaches 68-72%, and among preschool and early school-age children, pinworm infestation rates can reach 20-30% (9).

The relevance of studying the relationship between these two pathologies is underscored by the existence of a substantial number of refractory and aggressive forms of periodontitis that respond poorly to standard treatment protocols. The traditional approach, comprising professional hygiene, antiseptic treatment, and local anti-inflammatory therapy, frequently proves insufficiently effective in 18-23% of patients, indicating the presence of systemic factors sustaining chronic inflammation in periodontal tissues (10, 11). Contemporary research demonstrates that chronic parasitic infections can act as such systemic triggers, establishing a persistent pro-inflammatory status in the body (12-14).

The pathogenetic mechanisms through which intestinal parasitoses influence periodontal status involve several interconnected processes. Primarily, chronic parasitic infection leads to constant antigenic stimulation of the immune system, accompanied by elevated levels of pro-inflammatory cytokines, including tumor necrosis factor- α (TNF- α), interleukins IL-1 β and IL-6 (15). These mediators of systemic inflammation can potentiate destructive processes in the periodontium by activating osteoclasts and stimulating the production of matrix metalloproteinases (16, 17). Secondly, intestinal parasitoses cause impaired nutrient absorption, leading to deficiencies in iron, zinc, B vitamins, and vitamin D, which play a crucial role in maintaining oral mucosal integrity and regulating local immune responses (18-20). Iron-deficiency anemia, detected in 38-45% of patients with chronic giardiasis, is associated with impaired epithelial cell proliferation and reduced neutrophil activity, thereby weakening the periodontal defense barrier (21-23).

Despite accumulating evidence linking systemic factors and periodontal health, comprehensive studies investigating the direct dynamics of periodontal tissue status following etiotropic treatment of intestinal parasitoses remain absent. Existing publications are predominantly descriptive in nature and do not permit evaluation of the cause-effect relationship between parasite eradication and improvement in dental status. Addressing this knowledge gap appears critically important for developing comprehensive approaches to treating inflammatory periodontal diseases.

The aim of the present study was to evaluate the dynamics of clinical and laboratory parameters of periodontal status in patients with chronic intestinal parasitoses following antiparasitic therapy. To achieve this aim, the following objectives were set: to compare the baseline periodontal status between patients with verified intestinal parasitoses and the control group; to assess the level of systemic

inflammation and nutritional status in both groups; to analyze changes in clinical periodontal indices at 1, 3, and 6 months after successful antiparasitic therapy; to investigate the correlation between the dynamics of dental parameters and normalization of laboratory markers. Conducting this research will substantiate the necessity of incorporating parasitosis screening into the examination algorithm for patients with refractory forms of inflammatory periodontal diseases.

Materials and Methods

Study Design and Setting

This prospective comparative cohort study was conducted between January 2023 and September 2024 at the Dental Clinic of the North Ossetian State University Faculty of Dentistry in Vladikavkaz, Republic of North Ossetia-Alania, in collaboration with the university's clinical diagnostic center. The study was performed in accordance with the principles of the Declaration of Helsinki and approved by the Local Ethics Committee (Protocol No. 45-L dated December 15, 2022). All participants provided written informed consent for participation and processing of personal data.

Study Population and Eligibility Criteria

The study included 80 patients aged 18 to 50 years, divided into two comparable groups. The study group comprised 40 patients with verified intestinal parasitoses (giardiasis or enterobiasis) and diagnosed chronic generalized catarrhal gingivitis or stage I-II periodontitis. The control group consisted of 40 patients without parasitic infections, matched by age, gender, and dental status. Exclusion criteria for both groups included: severe periodontitis (stage III-IV), exacerbation of chronic somatic diseases, pregnancy and lactation, antibiotic therapy, non-steroidal anti-inflammatory drugs or immunosuppressants within 3 months prior to study initiation, and smoking.

A standardized diagnostic and therapeutic algorithm was implemented to ensure consistent patient management throughout the study period (Figure 1). The protocol comprised sequential phases, initiating with comprehensive assessment integrating periodontal, parasitological and laboratory evaluations. Following confirmed parasitosis diagnosis, Stage 1 involved targeted antiparasitic therapy with subsequent eradication verification. Successful parasite elimination enabled progression to Stage 2, focused specifically on anti-inflammatory periodontal treatment, followed by Stage 3 dedicated to nutritional rehabilitation and maintenance therapy. This standardized protocol was uniformly applied to all study group participants, ensuring consistent treatment implementation and monitoring.

Parasitological Diagnostic Methods

Verification of parasitic infections was performed using

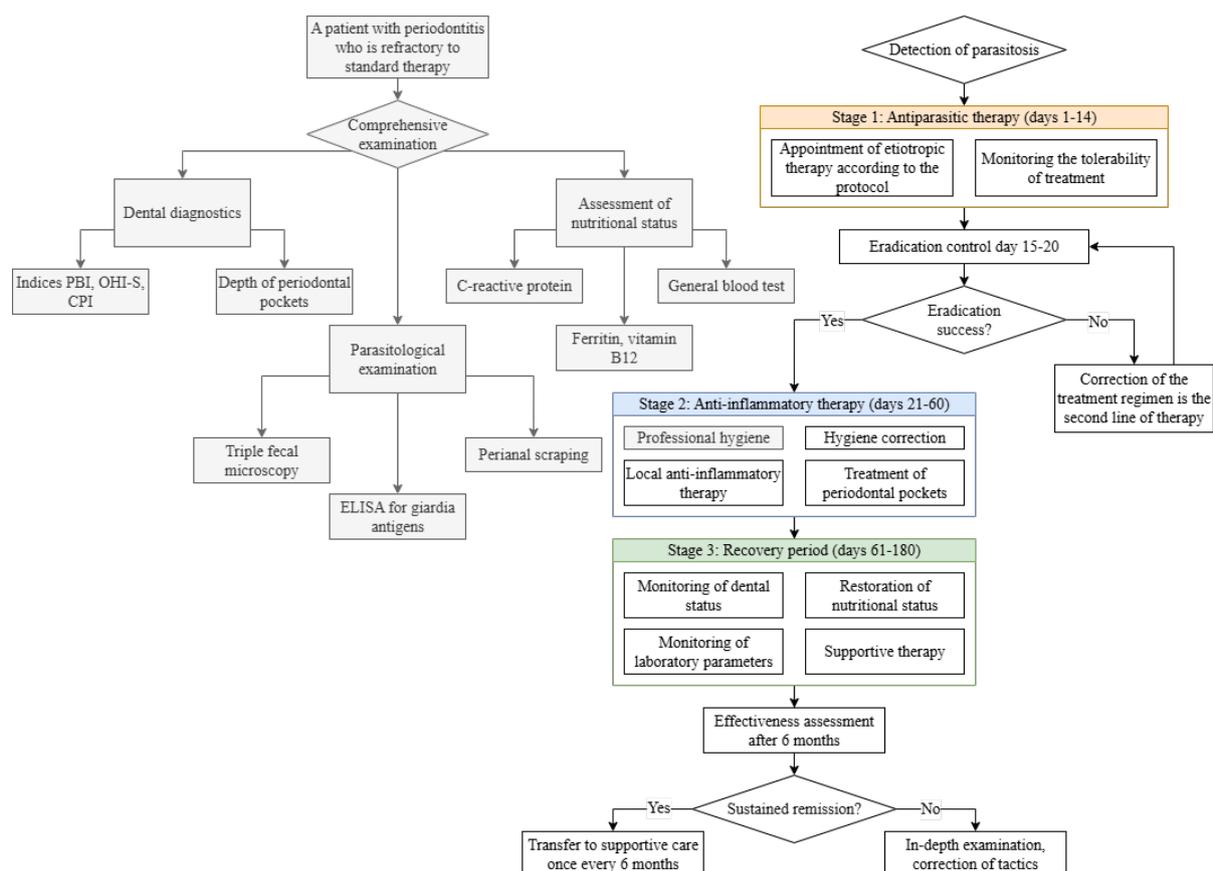


Figure 1. Diagnostic and Treatment Algorithm for Refractory Periodontitis with Concomitant Intestinal Parasitoses

a combination of laboratory methods. Microscopic stool examination was conducted three times at 2-3 day intervals using both native smear and Lugol's iodine staining techniques (24). Enzyme-linked immunosorbent assay (ELISA) for *Giardia lamblia* antigen in stool was performed using commercial "RIDASCREEN Giardia" test systems according to manufacturer's instructions (25). Enterobiasis diagnosis was established using classical perianal swab with subsequent microscopy (26).

Periodontal Examination Protocol

Dental examination included comprehensive periodontal assessment using standardized indices. The Oral Hygiene Index-Simplified (OHI-S) was used to evaluate hygiene status (27). The Papillary Bleeding Index (PBI) was recorded 30 seconds after probing the gingival sulcus of all teeth. The Papillary-Marginal-Alveolar Index (PMA) was utilized to assess the prevalence of inflammatory process (28). The Community Periodontal Index (CPI) was determined using a World Health Organization probe (29). Probing pocket depth was measured at six points around each tooth using a graduated periodontal probe.

Laboratory Methods

Laboratory investigations included venous blood collection from all participants. Complete blood count was performed on an automated hematology analyzer with

mandatory differential leukocyte count and eosinophil quantification. C-reactive protein level was determined by immunoturbidimetric method. Serum iron concentration was measured using the ferrozine colorimetric method, ferritin level by immunochemiluminescent analysis, and vitamin B12 content by enzyme-linked immunosorbent assay.

Therapeutic Protocol and Follow-up

Patients in the study group received standard antiparasitic therapy according to clinical guidelines. For giardiasis, nitazoxanide was prescribed at 400 mg three times daily for 7 days or albendazole 400 mg once daily for 5 days. For enterobiasis, mebendazole 100 mg was administered as a single dose with repeat administration after 2 weeks. Treatment efficacy was monitored 14 days after therapy completion through repeated parasitological examination. The observation protocol included four visits. During the initial visit, all participants underwent complete clinical and laboratory examination. Subsequent follow-up visits were conducted at 1, 3, and 6 months after completion of antiparasitic therapy, during which repeated dental examination and laboratory assessment were performed.

Statistical Analysis

Statistical analysis was conducted using IBM SPSS Statistics 23.0. Quantitative parameters were described using mean

and standard deviation ($M \pm SD$). Qualitative variables were presented as absolute values and percentages. Intergroup comparison of quantitative parameters was performed using Student's *t*-test for normally distributed data and Mann-Whitney *U* test for non-normal distributions. Comparison of qualitative characteristics was conducted using χ^2 test. Intragroup dynamics were assessed using repeated measures ANOVA. Correlation analysis was performed using Pearson's correlation coefficient. The level of statistical significance was set at $P < 0.05$.

Results

Study Group Characteristics

Initial comparative analysis of demographic and clinical parameters between the study and control groups revealed no statistically significant differences in baseline characteristics. As demonstrated in Table 1, the groups were well-matched for all demographic parameters. The mean age of patients in the study group was 35.2 ± 8.7 years compared to 36.8 ± 9.1 years in controls ($P > 0.05$). Gender distribution showed no significant differences: the study group included 24 females (60%) and 16 males (40%), while the control group contained 22 females (55%) and 18 males (45%). Body mass index values were comparable between groups: 23.8 ± 3.2 kg/m² in the study group versus 24.1 ± 2.9 kg/m² in controls ($P > 0.05$).

Comparative Analysis of Baseline Dental and Laboratory Parameters

Comparative analysis of baseline parameters revealed statistically significant differences between groups across all measured indices. As presented in Table 2, patients in the study group demonstrated significantly higher periodontal inflammation scores: PBI index 3.8 ± 0.4 points versus 2.1 ± 0.3 points in controls ($P < 0.001$) and OHI-S index 2.9 ± 0.5 points versus 1.8 ± 0.4 points ($P < 0.001$). Probing pocket depth measurements showed significantly greater values in the study group (4.2 ± 0.6 mm versus 3.1 ± 0.4 mm in controls, $P < 0.001$).

Laboratory parameters similarly demonstrated marked

intergroup differences. C-reactive protein levels were 2.6-fold higher in the study group (8.2 ± 1.5 mg/L versus 3.1 ± 0.8 mg/L in controls, $P < 0.001$). Peripheral blood eosinophil counts reached $7.8 \pm 1.2\%$ in the study group compared to $2.1 \pm 0.5\%$ in controls ($P < 0.001$). Nutritional status parameters were significantly compromised in parasitosis patients: ferritin levels measured 28.4 ± 6.2 µg/L versus 45.6 ± 8.1 µg/L in controls ($P < 0.001$), while vitamin B12 concentrations were 215.8 ± 35.4 pg/mL versus 298.6 ± 42.3 pg/mL ($P < 0.001$).

Dynamics of Parameters Following Antiparasitic Therapy

Implementation of antiparasitic therapy was associated with significant improvement in all measured parameters within the study group. As shown in Table 3, the most pronounced positive dynamics were observed in systemic inflammation markers. C-reactive protein levels decreased from 8.2 ± 1.5 mg/L to 4.1 ± 0.9 mg/L at 1 month post-treatment ($P < 0.001$), reaching 3.4 ± 0.7 mg/L by month 6. Peripheral blood eosinophil counts normalized within 1 month of therapy, declining from $7.8 \pm 1.2\%$ to $2.4 \pm 0.6\%$ ($P < 0.001$).

Nutritional status parameters demonstrated slower normalization kinetics. Ferritin levels increased from 28.4 ± 6.2 µg/L to 42.7 ± 7.2 µg/L over the 6-month treatment period ($P < 0.001$). A similar trend was observed for vitamin B12, with concentrations rising from 215.8 ± 35.4 pg/mL to 290.4 ± 41.8 pg/mL during the observation period ($P < 0.001$).

Dynamics of Dental Parameters

As presented in Table 4, antiparasitic therapy was accompanied by significant improvement in all dental parameters. The PBI index decreased from 3.8 ± 0.4 points to 1.9 ± 0.3 points at 6 months post-treatment ($P < 0.001$). The OHI-S index showed improvement from 2.9 ± 0.5 points to 1.7 ± 0.3 points ($P < 0.001$). Probing pocket depth reduced from 4.2 ± 0.6 mm to 3.0 ± 0.4 mm ($P < 0.001$).

Table 1. Baseline Characteristics of Study Participants

Parameter	Study Group (n=40)	Control Group (n=40)	P-value
Demographic Characteristics			
Age (years)	35.2 ± 8.7	36.8 ± 9.1	0.423
Females, n (%)	24 (60.0)	22 (55.0)	0.648
Body mass index (kg/m ²)	23.8 ± 3.2	24.1 ± 2.9	0.654
Periodontal Disease Parameters			
Periodontal disease duration (months)	28.4 ± 6.2	26.9 ± 5.8	0.267
Stage I periodontitis, n (%)	25 (62.5)	27 (67.5)	0.638
Stage II periodontitis, n (%)	15 (37.5)	13 (32.5)	0.638

Table 2. Comparative Analysis of Baseline Dental and Laboratory Parameters

Parameter	Study Group (n=40)	Control Group (n=40)	P-value
Dental Parameters			
PBI Index (points)	3.8 ± 0.4	2.1 ± 0.3	< 0.001
OHI-S Index (points)	2.9 ± 0.5	1.8 ± 0.4	< 0.001
Probing pocket depth (mm)	4.2 ± 0.6	3.1 ± 0.4	< 0.001
CPI Index (points)	3.2 ± 0.5	2.0 ± 0.3	< 0.001
Laboratory Parameters			
C-reactive protein (mg/L)	8.2 ± 1.5	3.1 ± 0.8	< 0.001
Eosinophils (%)	7.8 ± 1.2	2.1 ± 0.5	< 0.001
Ferritin (µg/L)	28.4 ± 6.2	45.6 ± 8.1	< 0.001
Vitamin B12 (pg/mL)	215.8 ± 35.4	298.6 ± 42.3	< 0.001

Table 3. Dynamics of Laboratory Parameters in the Study Group Following Antiparasitic Therapy

Parameter	Before Treatment	1 Month After Treatment	3 Months After Treatment	6 Months After Treatment
C-reactive protein (mg/L)	8.2±1.5	4.1±0.9*	3.7±0.8*	3.4±0.7*
Eosinophils (%)	7.8±1.2	2.4±0.6*	2.2±0.5*	2.1±0.4*
Ferritin (µg/L)	28.4±6.2	32.1±5.8	38.9±6.5*	42.7±7.2*
Vitamin B12 (pg/mL)	215.8±35.4	245.6±38.2	278.9±40.1*	290.4±41.8*

*Statistically significant difference compared to "Before Treatment" values ($P < 0.05$)

Table 4. Dynamics of Dental Parameters in the Study Group Following Antiparasitic Therapy

Parameter	Before Treatment	1 Month After Treatment	3 Months After Treatment	6 Months After Treatment
PBI Index (points)	3.8±0.4	2.9±0.3*	2.3±0.3*	1.9±0.3*
OHI-S Index (points)	2.9±0.5	2.4±0.4*	2.0±0.3*	1.7±0.3*
Probing pocket depth (mm)	4.2±0.6	3.8±0.5*	3.4±0.4*	3.0±0.4*
CPI Index (points)	3.2±0.5	2.7±0.4*	2.3±0.3*	1.9±0.3*

*Statistically significant difference compared to "Before Treatment" values ($P < 0.05$)

Temporal Relationship of Parameter Normalization

Analysis of parameter normalization kinetics revealed distinct temporal patterns following antiparasitic therapy. Systemic inflammation markers (C-reactive protein, eosinophils) demonstrated the most rapid improvement, with significant reductions observed within the first month post-treatment. Dental parameters showed gradual improvement throughout the observation period, with the most substantial enhancement in bleeding indices occurring between months 1 and 3. Nutritional status parameters exhibited the slowest normalization kinetics, approaching control group values only by month 6.

Correlation analysis revealed a strong positive correlation between reduction in C-reactive protein levels and improvement in PBI index ($r = 0.82$, $P < 0.001$). A moderate inverse correlation was established between ferritin level elevation and reduction in probing pocket depth ($r = -0.64$, $P < 0.01$). These findings suggest that the beneficial effects of antiparasitic therapy on periodontal health are mediated through both reduction of systemic inflammation and gradual normalization of nutritional status.

Discussion

The present study demonstrates the comprehensive impact of antiparasitic therapy on periodontal status in patients with chronic intestinal parasitoses. Our findings establish that successful parasite eradication leads to statistically significant improvement in clinical periodontal health parameters, manifested through reduced bleeding indices, improved hygiene metrics, and decreased probing depths. These therapeutic effects demonstrated sustained progression throughout the observation period, reaching maximum efficacy by the sixth month post-treatment.

Analysis of laboratory parameter dynamics revealed distinct temporal patterns in normalization rates. The most rapid improvement was observed in systemic inflammation markers—C-reactive protein levels and

peripheral blood eosinophil counts decreased significantly within the first month following antiparasitic therapy. This kinetic pattern correlated with early enhancement of clinical dental parameters, particularly the Papillary Bleeding Index (30). Such temporal relationships suggest that reduction of systemic inflammatory response represents a key mechanism mediating the beneficial effects of parasite eradication on periodontal health. These findings align with previous research documenting rapid improvement in inflammatory markers following successful antiparasitic treatment (31, 32).

Normalization of nutritional status parameters progressed more gradually. Ferritin and vitamin B12 levels demonstrated progressive elevation throughout the observation period, approaching control group values only by the sixth month. This kinetic pattern correlated with gradual improvement in parameters such as probing depth and Community Periodontal Index (33). Existing literature confirms that micronutrient deficiencies significantly contribute to the pathogenesis of inflammatory periodontal diseases, as iron and B vitamins are essential for normal epithelial cell proliferation and immune system function (34-36). Our results substantiate these findings and suggest that nutritional status recovery represents a second crucial mechanism ensuring long-term periodontal improvement following parasitic infection elimination.

The strong correlation between C-reactive protein reduction and PBI improvement identified in our study deserves particular attention. This relationship supports the hypothesis that systemic inflammation associated with parasitic invasion plays a pivotal role in maintaining inflammatory processes in periodontal tissues (37-39). These findings are consistent with research demonstrating elevated proinflammatory cytokine levels in chronic parasitoses (40, 41). We postulate that parasite eradication interrupts constant antigenic stimulation of the immune system, leading to decreased production of

proinflammatory mediators and consequent reduction of inflammatory responses in periodontal tissues (42-47).

An important aspect of our research is the demonstration that certain dental parameters continued to improve throughout the entire observation period, even after successful antiparasitic therapy and laboratory parameter normalization. This finding indicates the presence of long-term beneficial effects of eradication therapy and emphasizes the importance of extended follow-up for this patient category. Such delayed effects may be associated with gradual restoration of microcirculation in periodontal tissues, normalization of local immune responses, and enhancement of reparative processes.

When comparing our results with previous research, it should be noted that most prior studies focused either on investigating parasitosis prevalence in patients with periodontal diseases or analyzing the efficacy of various antiparasitic treatment regimens. Our study represents one of the few investigations that tracked both clinical and laboratory parameter dynamics over a sufficiently extended post-treatment period. This approach enabled not only confirmation of the relationship between parasitoses and periodontal status, but also identification of temporal patterns in functional recovery.

The clinical significance of our research lies in substantiating the necessity of incorporating intestinal parasitosis screening into the examination algorithm for patients with refractory periodontitis. Our data indicate that undiagnosed parasitic invasion may underlie insufficient treatment efficacy in some patients with conventional therapy-resistant periodontal diseases. In such cases, antiparasitic therapy can significantly enhance dental treatment outcomes and achieve sustained remission.

It should be emphasized that the positive effect of antiparasitic therapy on periodontal status appears independent of parasite species. Our study observed similar improvement dynamics in dental parameters for both giardiasis and enterobiasis patients. This suggests that the crucial role belongs not to specific characteristics of particular parasites, but rather to common pathogenetic mechanisms associated with maintaining systemic inflammation and impairing nutritional status.

Conclusion

Our study established the comprehensive beneficial effects of antiparasitic therapy on periodontal status in patients with chronic intestinal parasitoses. The results demonstrate that successful parasite eradication leads to statistically significant and clinically relevant improvement across all investigated parameters. Particularly noteworthy is the reduction in PBI from 3.8 ± 0.4 to 1.9 ± 0.3 points at 6 months post-treatment, indicating a 50% decrease in inflammatory response within periodontal tissues. Substantial improvement was also observed in probing

depth, which decreased from 4.2 ± 0.6 mm to 3.0 ± 0.4 mm, reaching values characteristic of the control group.

The identified dynamics of laboratory parameters represent another crucial aspect. C-reactive protein levels decreased from 8.2 ± 1.5 mg/L to 3.4 ± 0.7 mg/L, indicating significant reduction in systemic inflammation. Normalization of nutritional status manifested through increased ferritin levels from 28.4 ± 6.2 μ g/L to 42.7 ± 7.2 μ g/L and vitamin B12 from 215.8 ± 35.4 pg/mL to 290.4 ± 41.8 pg/mL. Particularly notable is the strong correlation between C-reactive protein reduction and PBI improvement ($r=0.82$), confirming the relationship between systemic inflammation and periodontal tissue status.

The obtained data provide compelling evidence supporting the necessity of incorporating intestinal parasitosis screening into the examination algorithm for patients with refractory inflammatory periodontal diseases. A comprehensive approach combining antiparasitic therapy with conventional dental treatment enables achievement of sustained clinical remission in this patient category. The identified patterns emphasize the importance of interdisciplinary collaboration in modern dental practice and the necessity of considering patients' general somatic status when planning periodontal treatment. Investigation of long-term outcomes following combined therapy and its impact on oral microbiome represent promising directions for future research.

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Authors' Contribution

All the authors participated equally in the organization of the experiment and the preparation of the manuscript.

Competing Interests

The authors declare that there is no conflict of interest

Ethical Approval

The study was performed in accordance with the principles of the Declaration of Helsinki and approved by the Local Ethics Committee (Protocol No. 45-L dated December 15, 2022). All participants provided written informed consent for participation and processing of personal data.

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