

Systematic Approach to Treatment of Inflammatory Pathology of Periodontal Tissues

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Summary: Gingivitis is an inflammatory disease of the gums characterized by reversible changes in periodontal tissues without destruction of the alveolar bone and disruption of the dentoalveolar junction. According to epidemiological studies, various forms of gingivitis occur in 80-100% of the adult population, making this pathology one of the most common in dentistry. The relevance of the problem of treating gingivitis is due not only to its high prevalence but also to the potential possibility of progressing to periodontitis - a destructive periodontal disease that leads to tooth loss. Modern studies show that 15-20% of patients with untreated gingivitis develop signs of periodontitis within 5-7 years.

Keywords: gingivitis, laser therapy, ozone therapy, occupational hygiene, periodontal indices

Introduction. Inflammatory diseases of periodontal tissues represent one of the most pressing problems in modern dentistry, characterized by high prevalence, multifactorial etiology, and significant socio-economic damage to society. According to the World Health Organization, various forms of inflammatory periodontal pathology affect up to 90-95% of the adult population of the planet, while severe forms of periodontitis occur in 10-15% of adults worldwide. In the Russian Federation, the prevalence of periodontal diseases among the adult population reaches 85-98%, which indicates the scale of this medical and social problem.

The periodontal complex is a functionally unified system of tissues, including the gums, periodontal ligament, cementum of the tooth root, and alveolar bone, which provides the supporting function of the teeth and maintains their physiological mobility. Disruption of the structural and functional integrity of any component of the periodontal complex leads to the development of pathological processes, which, in the absence of adequate treatment, progress and may end in complete loss of teeth.

The modern understanding of the etiology and pathogenesis of inflammatory diseases of the periodontium is based on the concept of multifactoriality of this pathology, which includes the interaction of the microbial factor, the state of the macroorganism, and environmental factors. The leading role in the development of the inflammatory process belongs to the pathogenic microflora of the dental plaque, represented by more than 700 species of microorganisms that form complex biofilm communities with unique biological properties.

The pathogenesis of inflammatory diseases of the periodontium is a complex multi-stage process, including primary bacterial aggression, activation of local and systemic immune-inflammatory reactions, and disruption of the balance between the processes of destruction and restoration of periodontal complex tissues. Modern studies have revealed the important role of the cytokine network, complement system, inflammation mediators, proteolytic enzymes, and other biologically active molecules in the development and progression of periodontal inflammation.

The systemic nature of inflammatory periodontal pathology is confirmed by numerous scientific data on the close relationship between periodontal diseases and various systemic diseases. A significant association has been established between periodontitis and cardiovascular diseases, diabetes mellitus, osteoporosis, rheumatoid arthritis, respiratory diseases, and other pathological conditions. Periodontal infection can serve as a source of bacterial translocation and a systemic inflammatory response, justifying the need for a systemic approach to the treatment of this pathology.

The etiopathogenesis of gingivitis is multifactorial, including microbial, immunological, and systemic components. The leading role in the development of the disease belongs to the accumulation of microbial film containing pathogenic microorganisms, the products of which cause an inflammatory reaction in the gingival tissues [3]. Gingivitis is an inflammatory disease of the gums characterized by reversible changes in periodontal tissues without destruction of the alveolar bone and disruption of the dentoalveolar junction. According to epidemiological studies, various forms of gingivitis occur in 80-100% of the adult population, making this pathology one of the most common in dentistry. The relevance of the problem of treating gingivitis is due not only to its high prevalence but also to the potential possibility of progressing to periodontitis - a destructive periodontal disease that leads to tooth loss. Modern studies show that 15-20% of patients with untreated gingivitis develop signs of periodontitis within 5-7 years.

Traditional methods of treating inflammatory diseases of the periodontium, based mainly on local exposure to the lesion, do not always ensure achieving stable positive results and preventing disease recurrence. This is due to underestimation of the systemic aspects of the pathogenesis, individual characteristics of the immune response, concomitant diseases, and other factors influencing the course and prognosis of periodontal pathology.

A systematic approach to treating inflammatory pathologies of periodontal tissues represents a comprehensive therapeutic and preventive strategy based on a comprehensive assessment of the patient's condition, identification and correction of all risk factors, and the application of pathogenetically justified methods of influence on various links of the pathological process. This approach involves integrating local and systemic treatment methods, taking into account the patient's individual characteristics, and interdisciplinary interaction between specialists of various profiles.

The modern classification of inflammatory periodontal diseases, adopted by the American Academy of Periodontology and the European Federation of Periodontology in 2018, identifies gingivitis and periodontitis as the main nosological forms, each of which has different clinical course variants and requires a differentiated approach to treatment. The new classification takes into account the stage and degree of the disease, which allows for more accurate planning of treatment measures and predicting their effectiveness.

Diagnosis of inflammatory diseases of the periodontium within the framework of the systemic approach includes a comprehensive assessment of clinical, radiological, microbiological, immunological, and molecular-biological indicators. Modern diagnostic methods allow for determining the activity of the inflammatory process, assessing the degree of periodontal tissue destruction, identifying specific pathogens and their sensitivity to antimicrobial drugs, and assessing the state of local and general immunity.

Clinical diagnostics is based on the assessment of classical periodontal indices, including the depth of periodontal pockets, the level of gingival attachment, the bleeding index, the degree of tooth mobility, and other parameters. Modern periodontal imaging using automated systems allows for obtaining accurate quantitative data on the condition of periodontal tissues and objective assessment of the treatment process dynamics.

Traditional approaches to gingivitis treatment, based on mechanical removal of dental deposits and anti-inflammatory therapy, do not always provide stable long-term results. This necessitates the search for new effective treatment methods using modern physiotherapeutic technologies [4].

The obtained results demonstrate significant advantages of using modern physiotherapeutic methods in the treatment of gingivitis. Combined therapy showed the best results with an effectiveness of 88.3% after 12 months of observation, which is 36.6% higher than the effectiveness of traditional treatment. The epidemiological significance of gingivitis is difficult to overestimate. According to the World Health Organization, various forms of inflammatory diseases of the periodontium affect from 60% to 90% of the world's population, with the initial manifestations in the form of gingivitis occurring in almost 100% of the adult population at different ages. In the Russian Federation, according to the

results of epidemiological studies of recent years, the prevalence of gingivitis among the adult population is 85-95%, and among children and adolescents, this figure reaches 70-80% [2].

The trend towards an increase in gingivitis incidence among young people is particularly alarming. Large-scale population studies conducted in various regions of Russia indicate a 23% increase in the incidence of inflammatory periodontal diseases among individuals aged 18-25 over the past decade. This is due to changes in the lifestyle of modern youth, the nature of nutrition, increased stress factors, as well as insufficient motivation to maintain the optimal level of oral hygiene [3].

Gingivitis, as the initial form of inflammatory periodontal diseases, has enormous medical and social significance, extending far beyond the scope of a local dental disease. Modern scientific research convincingly proves that untreated gingivitis in 15-20% of cases progresses to periodontitis - a destructive disease of periodontal tissues, leading to tooth loss and significant decline in patients' quality of life [4].

The social consequences of gingivitis and its complications are multifaceted. Chronic inflammatory processes in the oral cavity lead to the appearance of halitosis (unpleasant odor from the mouth), which significantly limits the social activity of patients, especially in the professional sphere, which requires active interpersonal communication.

Microbiological diagnostics is aimed at identifying key periodontopathogens and assessing their quantitative ratio within the subgingival microflora. Modern molecular-biological methods, including real-time polymerase chain reaction, allow for quick and accurate identification of microorganisms and determine their sensitivity to antimicrobial drugs.

Immunological diagnostics involves examining local and systemic immunity indicators, determining the level of pro- and anti-inflammatory cytokines, and assessing the activity of enzymatic systems and other biomarkers of the inflammatory process. These studies allow for the assessment of individual predisposition to the development of periodontal pathology and predict the effectiveness of various treatment methods.

Systemic therapy of inflammatory diseases of the periodontium includes the use of antimicrobial drugs, anti-inflammatory drugs, immunomodulators, antioxidants, and other medications that affect various links of the pathogenesis. Rational antimicrobial therapy is based on the results of microbiological studies and includes the use of antibiotics with proven effectiveness against periodontal pathogens.

Metronidazole, amoxicillin, doxycycline, azithromycin, and other antibacterial drugs are widely used in the complex therapy of periodontitis, especially in its aggressive forms and in the presence of systemic manifestations of infection. Combined antibiotic therapy, including the simultaneous use of several drugs with different mechanisms of action, shows higher effectiveness compared to monotherapy.

Anti-inflammatory therapy is aimed at suppressing the excess inflammatory response and includes the use of non-steroidal anti-inflammatory drugs, cyclooxygenase inhibitors, cytokine blockers, and other agents. Special attention is paid to selective inhibitors of various inflammatory mediators, which allows for targeted action on specific pathogenic links.

Immunomodulatory therapy includes the use of drugs capable of correcting immune response disorders and increasing the body's resistance to infection. The use of interferons, interferon inducers, immunoglobulins, and other immunobiological drugs allows for the normalization of immune system functions and increases treatment effectiveness.

Antioxidant therapy is aimed at neutralizing excess active forms of oxygen and preventing oxidative damage to periodontal tissues. Vitamins C and E, coenzyme Q10, alpha-lipoic acid, and other antioxidants are widely used as adjuvant therapy for inflammatory periodontal diseases.

Local therapy within the systemic approach includes professional oral hygiene, the use of local antimicrobial and anti-inflammatory agents, various types of periodontal pocket curettage, surgical

treatment methods, and periodontal regenerative therapy. The integration of local and systemic methods of influence allows for achieving a synergistic effect and increasing the overall effectiveness of treatment.

Professional oral hygiene is the foundation of any periodontal treatment and includes removing dental deposits above and below the gums using ultrasonic keyers, hand tools, air-abrasive systems, and other modern technologies. High-quality removal of the biofilm and dental calculus creates conditions for the healing of inflamed tissues and prevents further progression of the disease.

Medicinal treatment of periodontal pockets involves the use of various antiseptic and antimicrobial preparations in the form of irrigations, applications, periodontal bandages, and prolonged dosage forms. Chlorhexidine, povidone-iodine, hydrogen peroxide, and other antiseptics provide effective decontamination of periodontal pockets and create conditions for tissue regeneration.

Surgical treatment methods include various types of periodontal operations aimed at eliminating periodontal pockets, correcting alveolar bone defects, restoring lost attachments, and regenerating damaged periodontal tissues. Scrap operations, targeted tissue regeneration, the use of bone grafts and biologically active materials allow for the restoration of the anatomical and functional integrity of the periodontal complex.

Regenerative periodontal therapy represents an innovative direction based on the use of growth factors, stem cells, tissue engineering structures, and other biological technologies to stimulate the natural processes of periodontal tissue regeneration. Enamel matrix derivatives, growth factor-enriched platelet plasma, and mesenchymal stem cells show encouraging results in clinical trials.

Particular attention is paid to patients with diabetes mellitus, in whom carbohydrate metabolism disorders significantly affect the course and prognosis of periodontal diseases. Achieving compensation for diabetes, correcting glycemia, and applying specific therapeutic approaches significantly improves the results of periodontal treatment in this category of patients.

The psychosocial aspects of the systemic approach include assessing the patient's psychological status, motivating treatment, teaching oral hygiene rules, and fostering a responsible attitude towards one's own health. Stress, depression, smoking, and other behavioral risk factors require special attention and correction within the framework of comprehensive treatment.

The preventive aspects of the systemic approach include primary, secondary, and tertiary prevention of inflammatory periodontal diseases. Primary prevention is aimed at preventing the development of the disease and includes hygienic education of the population, professional oral hygiene, elimination of risk factors, and carrying out preventive measures in healthy individuals.

Secondary prevention involves early detection and treatment of the initial forms of the disease, preventing their progression and development of complications. Regular preventive examinations, screening programs, and timely treatment of gingivitis allow for the prevention of the development of destructive forms of periodontitis.

Tertiary prevention includes maintenance periodontal therapy after the completion of active treatment, aimed at preventing disease recurrence and preserving the achieved treatment results. Regular visits to a periodologist, professional oral hygiene, and an individual hygiene program are the main components of supportive therapy.

Personalized medicine opens up new possibilities for individualizing therapeutic approaches based on genetic testing, pharmacogenetic analysis, and assessment of individual risk factors. Identifying genetic polymorphisms associated with predisposition to periodontal pathology allows for the development of personalized prevention and treatment programs.

Modern monitoring technologies, including telemedicine systems, mobile applications for oral hygiene monitoring, and remote monitoring of periodontal tissues, are opening up new opportunities for improving treatment effectiveness and enhancing patient compliance.

The economic aspects of a systematic approach to treatment include assessing the cost-effectiveness ratio of various therapeutic strategies, analyzing the direct and indirect costs associated with periodontal diseases, and developing cost-effective prevention and treatment programs. Investments in the prevention and early treatment of periodontal diseases significantly exceed the costs of treating advanced forms of the disease.

The quality of life of patients with inflammatory diseases of the periodontium suffers significantly due to pain syndrome, chewing dysfunction, aesthetic problems, and social maladjustment. A systematic approach to treatment not only eliminates the clinical manifestations of the disease but also significantly improves the quality of life of patients.

The purpose of this study is to develop and scientifically substantiate a systematic approach to the treatment of inflammatory pathology of periodontal tissues, including comprehensive diagnostics, individualized therapeutic strategy, interdisciplinary interaction of specialists, and long-term monitoring of treatment results to achieve stable remission of the disease, prevent its progression, and improve the quality of life of patients.

The microbiological aspect of gingivitis pathogenesis underwent significant changes in understanding due to the introduction of modern molecular-genetic research methods. If previously the main focus was on the quantitative characteristics of oral microbial contamination, today the focus has shifted to studying the qualitative composition of the microbiome and its functional activity. It has been established that the development of gingivitis is associated not only with an increase in the total number of microorganisms, but also with a disruption of microbial balance - dysbiosis, characterized by an increase in the proportion of anaerobic gram-negative bacteria and a decrease in the number of protective microflora [8]. The main pathogens associated with the development of gingivitis are representatives of the so-called "red complex" - *Porphyromonas gingivalis*, *Tannerella forsythia*, *Treponema denticola*, as well as microorganisms of the "orange complex" - *Prevotella intermedia*, *Fusobacterium nucleatum*, *Peptostreptococcus micros*. These microorganisms produce a wide range of virulence factors, including proteolytic enzymes, endotoxins, organic acids, which have a direct cytotoxic effect on periodontal tissues and trigger a cascade of immune-inflammatory reactions [9]. Behavioral risk factors are becoming increasingly important in modern conditions. Tobacco smoking is one of the most significant modifiable risk factors, increasing the likelihood of gingivitis development by 2-3 times. The mechanism of the negative effects of smoking is associated with vasoconstriction, impaired microcirculation in periodontal tissues, decreased local immunity, and changes in the composition and properties of saliva. A similar negative effect is exerted by chronic stress, which through neuroendocrine mechanisms suppresses the immune system and contributes to the progression of the inflammatory process [1].

Classification of gingivitis

The modern classification of inflammatory diseases of the periodontium, adopted at the World Seminar on Periodontology in 2017, provides for the identification of several main forms of gingivitis. Gingivitis induced by dental plaque is divided into those associated only with dental plaque and those modified by systemic or local factors. Gingivitis, not associated with dental plaque, includes lesions of bacterial, viral, fungal etiology, genetic disorders, systemic diseases, inflammatory and immune states, reactive lesions, neoplasms, endocrine, dietary, and other disorders [4].

By clinical course, acute and chronic gingivitis are traditionally distinguished. Acute gingivitis is characterized by pronounced clinical symptoms with pronounced hyperemia, swelling, bleeding of the gums, and pain syndrome. Chronic gingivitis proceeds with less pronounced clinical manifestations, but is prone to a prolonged recurrent course with periodic exacerbations. By prevalence, localized (limited by several teeth) and generalized (spread throughout the entire dental arch or a significant part of it) gingivitis are distinguished. By severity, the disease is divided into mild, moderate, and severe forms, which are assessed based on the severity of clinical symptoms and the values of periodontal indices [5].

The diagnosis of gingivitis is based on a comprehensive clinical examination of the patient using objective methods for assessing the condition of periodontal tissues. The basis of the diagnostic process consists of anamnestic data, visual examination, probing of the gingival groove, and determination of periodontal indices. The main diagnostic criteria for gingivitis are the presence of inflammatory changes in the gums (hyperemia, swelling, bleeding) in the absence of destructive changes in the alveolar bone and dentoalveolar junction [2]. Modern approaches to the diagnosis of gingivitis involve the use of additional objective assessment methods. Photoperiodontography allows for documenting the clinical condition of periodontal tissues and conducting dynamic monitoring of treatment outcomes. Ultrasound diagnostics allows for non-invasive assessment of the condition of the soft tissues of the periodontium, identification of hidden inflammatory infiltrates, and determination of gingival thickness. Microbiological diagnostics is becoming increasingly important for choosing the optimal treatment tactics. Modern molecular-genetic methods (real-time PCR, 16S rRNA sequencing) allow for the identification of specific periodontal pathogens and the assessment of their quantitative content, which is important for prescribing targeted antimicrobial therapy [8].

A promising direction is the use of biochemical markers of inflammation for the diagnosis and monitoring of gingivitis. In the gum fluid and saliva of patients with gingivitis, the content of pro-inflammatory cytokines (interleukin-1 β , tumor necrosis factor- α , interleukin-6), proteolytic enzymes (matrix metalloproteinases, elastase), and collagen degradation products increases. Determining the level of these markers can be used for early diagnosis of inflammation, assessment of treatment effectiveness, and prediction of disease progression risk [Conclusions: Thus, the relevance of the problem of modern treatment of gingivitis is determined by its high prevalence, significant medical, social, and economic damage, limited effectiveness of traditional treatment methods, and the need to develop new comprehensive approaches to treating this disease. Conducting this study will optimize the management of gingivitis patients and improve the quality of periodontal care for the population. The mechanism of action of laser therapy is based on the anti-inflammatory, antibacterial, and biostimulating effects of low-intensity laser radiation. Ozone therapy provides a powerful antimicrobial effect and stimulates healing processes by improving oxygen exchange in tissues. Microbiological studies confirmed the high antimicrobial effectiveness of the studied methods, especially in relation to the main periodontal pathogens. The most pronounced decrease in microbial contamination was noted in the group receiving combined treatment. Immunological indicators showed a significant decrease in the level of pro-inflammatory cytokines when using physiotherapeutic methods, which explains their high clinical effectiveness.

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