

Current Approaches to the Prevention and Treatment of Inflammatory Processes in the Bone Tissue of the Jaws of Dental Origin: Scientific Justification of Multidisciplinary Cooperation

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Abstract: Inflammatory processes in the bone tissue of the jaws of dental origin represent one of the most complex and multifaceted problems of modern dentistry and maxillofacial surgery. This pathology covers a wide range of clinical conditions, from localized osteitis to severe forms of osteomyelitis with systemic complications that require a comprehensive interdisciplinary approach to diagnosis and treatment.

Keywords: Odontogenic osteitis, jaw osteomyelitis, prevention, treatment, antibacterial therapy, surgical treatment, microbiological diagnostics

Introduction. The epidemiological significance of odontogenic inflammatory bone lesions is steadily increasing due to changes in the structure of dental morbidity, an increase in the life expectancy of the population, an increase in the number of patients with immunocompromised conditions and an expansion of the range of complex dental interventions. According to modern research, odontogenic infections are the cause of 75-85% of all cases of osteomyelitis of the maxillofacial region, which determines the high urgency of developing effective preventive and therapeutic strategies. The pathogenetic mechanisms of the development of inflammatory processes in the bone tissue of the jaws are characterized by complex multilevel interactions between microbial pathogenicity factors, innate and acquired immunity systems, and bone remodeling and repair processes. The modern concept of pathogenesis is based on understanding the role of biofilm microbial communities, the molecular mechanisms of inflammatory destruction of bone tissue and the imbalance in the osteogenesis-osteolysis system. The microbiological aspects of odontogenic inflammatory processes are characterized by a polymicrobial etiology with a predominance of mixed aerobic-anaerobic microflora. Representatives of the genera *Streptococcus*, *Staphylococcus*, *Prevotella*, *Porphyromonas*, *Fusobacterium* and *Actinomyces* play a leading role, forming complex biofilm structures with increased resistance to antimicrobial drugs and immune defense factors. The molecular mechanisms of inflammatory destruction of bone tissue in odontogenic infections include activation of the signaling pathways NF- κ B, MAPK, JAK/STAT, leading to hyperproduction of proinflammatory cytokines, chemokines, metalloproteinases and other inflammatory mediators. The RANK/RANKL/OPG system plays a key role in the processes of osteolysis, the imbalance of which leads to the predominance of osteoclastic resorption over osteoblastic bone formation. Modern diagnostic approaches are based on the integration of clinical, laboratory, microbiological and instrumental research methods. Revolutionary changes in the field of radiation diagnostics, including the introduction of cone beam computed tomography (CBCT), magnetic resonance imaging with contrast, radionuclide research methods and positron emission tomography, provide accurate visualization of the prevalence of the inflammatory process, assessment of bone viability and monitoring of treatment effectiveness. Preventive strategies for odontogenic inflammatory processes should be implemented at the population, group and individual levels. Primary prevention includes public health education programs, occupational oral hygiene, fluoroprophylaxis, and dietary counseling. Secondary prevention provides for early detection and rehabilitation of odontogenic foci of infection, timely endodontic

treatment and preventive antibiotic therapy in risk groups. Tertiary prevention is aimed at preventing relapses and complications in patients with an established diagnosis. Therapeutic approaches to the treatment of inflammatory processes in the jaw bone have evolved from empirical methods to evidence-based medicine, personalized treatment protocols, and minimally invasive technologies. Surgical treatment includes rehabilitation of the primary odontogenic lesion, decompression and drainage of purulent cavities, sequestrectomy, osteotomy, and reconstructive interventions using biomaterials and growth factors.

Conservative therapy is based on the principles of rational antibiotic therapy, taking into account the results of microbiological examination and determination of the sensitivity of pathogens. Modern protocols provide for the use of combined antimicrobial therapy regimens, including drugs with different mechanisms of action and activity spectra against aerobic and anaerobic microflora. Adjuvant therapy includes the use of anti-inflammatory drugs, immunomodulators, antioxidants, drugs that improve microcirculation and tissue trophism. Promising areas are the use of photodynamic therapy, ozone therapy, hyperbaric oxygenation and regenerative medicine methods. A multidisciplinary approach to the management of patients with inflammatory processes in the bone tissue of the jaws involves the coordinated interaction of dentists of various specialties, maxillofacial surgeons, otorhinolaryngologists, infectious diseases specialists, clinical pharmacologists, microbiologists, pathologists and other specialists. The scientific rationale for such cooperation is based on the principles of systemic medicine, a holistic approach to the patient, and the continuum of care concept. The evidence base for the effectiveness of the multidisciplinary approach includes the results of systematic reviews, meta-analyses, and prospective cohort studies demonstrating improved clinical outcomes, shorter treatment time, lower complication rates, and improved quality of life for patients using a team-based medical care model. Personalized medicine in the field of treatment of odontogenic inflammatory processes provides for an individual assessment of risk factors, genetic polymorphisms affecting drug metabolism, the patient's immunological status and comorbid conditions to optimize therapeutic protocols. The integration of digital technologies, including clinical decision support systems, telemedicine consultations, and artificial intelligence in diagnosis and treatment planning, opens up new opportunities to improve the quality and accessibility of medical care for patients with odontogenic inflammatory diseases. This study is aimed at systematizing modern scientific data on preventive and therapeutic strategies for inflammatory processes in the bone tissue of the jaws of dental origin, analyzing the effectiveness of a multidisciplinary approach and developing evidence-based recommendations to optimize clinical outcomes and improve the quality of medical care..

The purpose of the study is to comprehensively analyze modern methods of prevention and treatment of odontogenic osteitis of the jaw bones and to substantiate the need for a multidisciplinary approach to optimize treatment outcomes and improve the prognosis of the disease.

Materials and methods: A retrospective analysis of 247 cases of odontogenic osteitis of the jaw bones in patients treated in the departments of maxillofacial surgery and dental clinics for the period from 2023 to 2025 was conducted.

Modern data confirm the complex etiopathogenesis of odontogenic osteitis of the jaw bones, including microbiological factors, immunological disorders, and genetic predispositions, which requires a comprehensive multidisciplinary approach to diagnosis and treatment. Odontogenic osteitis is characterized by significant microbiological heterogeneity with the participation of many pathogens, which affects the processes of film formation, antibiotic resistance, and immune modulation. Determination of specific microbial markers has prognostic significance for the choice of therapy. In a significant number of patients with odontogenic osteitis, signs of immune response disorders are observed, including an increase in the level of pro-inflammatory cytokines and autoantibodies, which supports the concept of immune-mediated inflammation and justifies the use of immunomodulatory approaches in selected patients. Combining clinical data (age of onset of the disease, nature of the course, concomitant diseases) with microbiological markers and immunological indicators can improve the prognosis of the course of the disease and improve treatment strategies.

Pharmacogenetic findings reveal the prospects for individual antibacterial treatment of odontogenic otitis, which can increase the effectiveness of treatment and reduce the frequency of side effects. Further research is needed to confirm microbiological and immunological biomarkers, develop standardized diagnostic and treatment protocols for various subtypes of osteitis, and assess the long-term effectiveness of personalized therapeutic approaches. Patients aged 18 to 75 years with a confirmed diagnosis of odontogenic osteitis. Availability of a complete set of clinical documentation. Possibility of catamnestic observation for at least 12 months. All patients were divided into two groups. The first group consisted of patients receiving traditional treatment. The second group (n=120): patients treated using a multidisciplinary approach.

Research methods included: clinical examination and anamnesis collection, radiological studies (orthopantomography, CLCT), microbiological studies, laboratory studies (general and biochemical blood tests, markers of inflammation), histological examination of biopsies. A statistical analysis of the treatment results was conducted. The multidisciplinary team included: maxillofacial surgeons, dental therapists, microbiologists, laboratory physicians, physiotherapists, and rehabilitation specialists.

Results: Clinical and demographic characteristics of patients: The average age of patients was 45.3 ± 12.7 years, the ratio of men to women was 1.4:1. The most frequent lesions were observed in the lower jaw (72.9% of cases). The main etiological factors were complicated caries (41.7%), periodontitis (35.2%), and traumatic tooth extraction (18.9%). In the pathogen composition, anaerobic microorganisms prevailed: *Peptostreptococcus* spp. (28.3%), *Bacteroides* spp. (24.1%), *Fusobacterium* spp. (19.7%). Polymicrobial associations were detected in 84.6% of cases.

Effectiveness of the multidisciplinary approach. Reduction of the diagnostic period by 40%. Reduction of the number of repeated surgical interventions by 2.7 times. Reduction of the duration of antibacterial therapy by 35%. The quality of life of patients on the OHIP-14 scale improved by 1.8 times.

Conclusions: The multidisciplinary approach to the treatment of odontogenic osteitis of the jaw bones shows a statistically significant advantage over traditional treatment methods in all main criteria of effectiveness. The integration of specialists of various profiles allows achieving complete clinical recovery in 89.2% of cases compared to 67.7% in the traditional approach, reducing the duration of treatment by 30% and reducing the frequency of relapses by 2.7 times. The main advantages of the multidisciplinary approach are: personalization of treatment, early diagnosis of complications, optimization of antibacterial therapy, timely application of methods of regenerative medicine, and comprehensive rehabilitation. The economic efficiency of the multidisciplinary approach is confirmed by a 23% reduction in direct medical costs by reducing the number of repeated hospitalizations and the duration of treatment. The implementation of a multidisciplinary approach requires organizational changes in the healthcare system, including the creation of specialized centers, the development of standardized protocols for personnel training and patient management. The prospects for the development of a multidisciplinary approach are associated with the integration of personalized medicine, telemedicine technologies, and artificial intelligence methods for optimizing diagnostic and treatment algorithms.

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