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CONTEMPORARY APPROACHES TO PROPHYLAXIS AND THERAPY OF DENTAL-ORIGIN INFLAMMATORY BONE DISEASES IN THE MAXILLOFACIAL REGION: EVIDENCE FOR MULTIDISCIPLINARY COLLABORATION

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Abstract:

Dental-origin inflammatory bone diseases represent a significant clinical challenge in contemporary oral and maxillofacial surgery, encompassing a spectrum of pathological conditions ranging from localized osteitis to severe osteomyelitis with systemic complications. These conditions arise from the spread of odontogenic infections through anatomical pathways, leading to progressive inflammatory and destructive processes within the maxillary and mandibular bone structures.

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

INTRODUCTION. The epidemiological burden of odontogenic inflammatory bone diseases continues to escalate globally, with current estimates indicating that dental-origin infections account for approximately 70-80% of all osteomyelitis cases in the maxillofacial region. This increasing prevalence is attributed to multiple factors, including the rising incidence of complex carious lesions, delayed treatment of endodontic pathology, increasing complexity of dental procedures, and the growing population of immunocompromised patients requiring dental care.

The pathophysiology of dental-origin inflammatory bone diseases involves a complex cascade of molecular and cellular events initiated by bacterial invasion from odontogenic sources. The progression from localized periapical infection to bone involvement requires the breach of natural anatomical barriers, including the periodontal ligament space, cortical bone perforation, and subsequent spread through haversian systems and medullary spaces. Contemporary understanding emphasizes the role of polymicrobial biofilm communities, including both aerobic and anaerobic species, which demonstrate enhanced virulence and antibiotic resistance compared to planktonic bacterial populations.

Modern diagnostic approaches have revolutionized the early detection and characterization of odontogenic bone pathology. Advanced imaging modalities, including cone-beam computed tomography (CBCT), magnetic resonance imaging (MRI), and nuclear medicine techniques such as single-photon emission computed tomography (SPECT) and positron emission tomography (PET), provide unprecedented visualization of bone architecture, inflammatory activity, and treatment response. These technologies enable precise anatomical localization, assessment of disease extent, and real-time monitoring of therapeutic interventions.

The molecular basis of inflammatory bone destruction in odontogenic infections involves complex interactions between bacterial virulence factors, host immune responses, and bone remodeling mechanisms. Key mediators include matrix metalloproteinases (MMPs), receptor activator of nuclear factor κB ligand (RANKL), osteoprotegerin (OPG), and various cytokines such as interleukin-1β (IL-1β), tumor necrosis factor-α (TNF-α), and interleukin-6 (IL-6). Understanding these pathways has opened new therapeutic targets for intervention and has informed the development of adjunctive biological therapies.

Contemporary prophylactic strategies encompass multiple levels of intervention, from population-based preventive measures to individualized risk assessment protocols. Primary prevention focuses on oral health promotion, fluoride applications, dietary counseling, and early childhood caries prevention programs. Secondary prevention emphasizes timely diagnosis and treatment of odontogenic pathology through regular dental examinations, radiographic screening, and prompt endodontic intervention. Tertiary prevention targets high-risk populations, including patients with diabetes mellitus, immunosuppression, bisphosphonate therapy, and previous history of odontogenic infections.

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The therapeutic landscape for dental-origin inflammatory bone diseases has evolved significantly with the integration of evidence-based medicine principles and personalized treatment approaches. Surgical management protocols now incorporate minimally invasive techniques, guided tissue regeneration, and computer-assisted surgery planning. Antibiotic stewardship programs have refined antimicrobial selection based on culture-guided therapy, pharmacokinetic optimization, and resistance pattern surveillance. Adjunctive therapies, including hyperbaric oxygen therapy, photodynamic therapy, and growth factor applications, have shown promising results in complex cases.

The complexity of odontogenic inflammatory bone diseases necessitates a multidisciplinary approach involving collaboration between oral and maxillofacial surgeons, endodontists, periodontists, oral pathologists, radiologists, infectious disease specialists, and other healthcare professionals. This collaborative model ensures comprehensive patient evaluation, optimal treatment planning, coordinated care delivery, and improved clinical outcomes. Evidence from systematic reviews and meta-analyses consistently demonstrates superior results when multidisciplinary teams manage complex odontogenic infections compared to single-specialty approaches.

Risk stratification and personalized medicine principles have become integral to contemporary management protocols. Patient-specific factors, including age, comorbidities, immune status, medication history, and socioeconomic considerations, are systematically evaluated to optimize treatment strategies. Pharmacogenomic testing for antibiotic metabolism, bone turnover markers for monitoring treatment response, and inflammatory biomarkers for risk assessment represent emerging tools for personalized care.

Quality improvement initiatives and clinical outcome research have established standardized protocols for managing odontogenic inflammatory bone diseases. Evidence-based guidelines from professional organizations provide frameworks for diagnosis, treatment selection, antibiotic prescribing, and follow-up care. Implementation of clinical pathways, treatment algorithms, and quality metrics has improved care consistency and patient outcomes across diverse healthcare settings.

The integration of digital health technologies, including telemedicine, electronic health records, artificial intelligence-assisted diagnosis, and patient monitoring applications, has enhanced care coordination and accessibility. These innovations facilitate interdisciplinary communication, enable remote consultation capabilities, and support evidence-based decision-making through clinical decision support systems.

This comprehensive review aims to synthesize current evidence regarding contemporary prophylactic and therapeutic strategies for dental-origin inflammatory bone diseases, evaluate the effectiveness of multidisciplinary care models, and provide evidence-based recommendations for optimizing patient outcomes through collaborative healthcare delivery in the maxillofacial region. Odontogenic osteomyelitis of the jaw bones is a serious problem of modern dentistry and maxillofacial surgery, characterized by inflammatory-destructive damage of the bone tissue of the alveolar processes of the upper and lower jaws of an infectious nature. This pathology can develop as a complication of odontogenic infectious processes, leading to the formation of large-scale bone defects, dysfunction of the dentofacial system, and a significant decrease in the quality of life of patients.

Epidemiological data indicate a steady increase in the spread of odontogenic osteitis. This is associated with an increase in the frequency of complicated forms of caries, periodontitis, an unsatisfactory state of oral hygiene in a large part of the population, as well as an increase in the number of invasive dental interventions. The frequency of jaw osteomyelitis development is 2.8-5.2% of the total number of inflammatory diseases in the maxillofacial region, with odontogenic origin being detected in 80-95% of cases. The pathogenesis of odontogenic ostitis is a complex multifactorial process that includes primary infection of bone tissue with pathogenic microorganisms in the odontogenic focus, disruption of microcirculation and nutrition of bone tissue, activation of inflammatory mediators and cytokines, disproportionate processes of bone formation and bone absorption. Anaerobic and facultative-anaerobic microorganisms play a leading role in the development of the disease, which form polymicrobial compounds with high resistance to antibacterial therapy. Traditional approaches to the treatment of odontogenic ositis are based on the principles of surgical cleaning of the focus of infection, appropriate antibacterial therapy, and symptomatic treatment. However, a one-way approach does not always provide the best treatment results, especially in the presence of widespread destructive processes, recurrent forms of the disease, or concomitant pathology[5].

Modern trends in medicine are increasingly favoring a personality-oriented multidisciplinary approach that combines the efforts of specialists from

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various fields to achieve the highest treatment effectiveness.

Odontogenic ostitis in adults and children is a heterogeneous group of inflammatory diseases of the jaw bone tissue, characterized by progressive damage to the cortical and spongy bones, which can have a significant impact on the quality of life, the chewing system, and social activity of patients. According to epidemiological studies, the frequency of odontogenic osteomyelitis varies within the range of 0.8-2.1 per 100,000 population, while maxillary osteomyelitis accounts for up to 90% of all cases of osteomyelitis of the facial skeleton. In some cases, despite a "good-quality" course, the severity of symptoms, the frequent development of complications in the form of pathological fractures, the formation of drainage pathways, and the development of sepsis create a significant clinical and social burden. Over the past twenty years, the understanding of the etiopathogenesis of odontogenic ostitis has significantly deepened and has largely transitioned from mechanical explanations to a multifactorial model, including the microbiological component, the characteristics of the local and systemic immune response, genetic predisposition to the development of inflammatory diseases, as well as the anatomical and physiological features of blood supply and innervation of the jaw bones. The results of molecular-biological and immunohistochemical studies confirm the role of the imbalance of pro- and anti-inflammatory cytokines, disorders of the complement system, and innate immunity in the pathogenesis of bone destruction. At the same time, there is growing interest in studying the role of biofilm-forming microorganisms, including resistant strains of staphylococci, streptococci, and anaerobic flora, which indicates the need to revise approaches to antibacterial therapy. The concept of persistent inflammation, supported by disruptions in the processes of restoring microbial films and bone tissue, explains the chronicity of the process and the tolerance of some patients to standard therapy.

The clinical heterogeneity of odontogenic osteitis (variability of debut age, localization of the process, dynamics of symptoms, spectrum of complications) determines urgent tasks for early differentiation of risk and prognosis, as well as the development of personalized treatment strategies. In this regard, the role of combining clinical, laboratory, microbiological, and visualization biomarkers for more accurate phenotyping of patients, predicting the course of the disease, selecting optimal therapy, and monitoring the effectiveness of treatment is increasing.

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.

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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