

Clinical And Laboratory Substantiation of an Algorithm for the Prevention and Treatment of Inflammatory Complications After Complex Tooth Extraction

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Abstract:

Inflammatory complications following complex tooth extraction are one of the most pressing issues in outpatient surgical dentistry. According to various studies, the incidence of inflammatory post-extraction complications ranges from 5% to 30%, depending on the complexity of the intervention, the patient's somatic status, and the prevention protocols applied. Alveolitis, periostitis, phlegmons, and osteomyelitis of the extracted tooth sockets not only significantly impair patients' quality of life but also require additional courses of antibacterial therapy, surgical debridement, and prolong rehabilitation periods.

Keywords: *complex tooth extraction, inflammatory complications, alveolitis, post-extraction period, antibacterial prophylaxis, antiseptic treatment, local anesthesia, surgical dentistry, tooth socket, rehabilitation.*

Introduction

Complex tooth extraction remains one of the most common surgical interventions in outpatient dental practice. According to WHO statistics and national medical registries, more than 300 million tooth extractions are performed annually worldwide. A significant portion of these are technically complex cases, including dystopic, impacted, and multi-rooted teeth, as well as extractions in patients with concomitant somatic pathologies [1]. Despite significant advances in anesthesiology, antiseptics, and surgical techniques, inflammatory complications in the post-extraction period retain their high clinical significance [2]. The most common among them is alveolitis, which is recorded in 1–4% of standard tooth extractions and in 25–35% of cases involving the removal of impacted lower wisdom teeth. Periostitis, abscesses, and phlegmons of the peripharyngeal space pose a life-threatening risk to the patient and require inpatient treatment [3]. The pathogenesis of post-extraction inflammatory complications is multifactorial [4]. The following factors play a decisive role: disruption of blood clot formation and stabilization in the tooth socket, microbial contamination of the surgical site, the traumatic nature of the intervention, the patient's immune status, the presence of chronic odontogenic infection foci in the oral cavity, and the patient's non-compliance with post-operative recommendations [5]. The role of anaerobic microflora (*Prevotella intermedia*, *Porphyromonas gingivalis*, *Fusobacterium nucleatum*) in initiating the inflammatory process in the post-extraction socket deserves special attention [6,7].

Existing approaches to complication prevention vary significantly across different clinics and national healthcare systems. The lack of a unified consensus on indications for systemic antibiotic

prophylaxis, the choice of antiseptic solutions for topical application, and methods for stimulating tissue regeneration creates serious inconsistencies in clinical practice. A number of studies have demonstrated the high efficacy of the topical application of chlorhexidine-containing preparations, collagen-based hemostatic materials, and platelet-rich plasma (PRP/PRF), but their comparative evaluation within a single protocol remains insufficiently studied [8].

The objective of the study is to develop and clinically substantiate an optimized protocol for the prevention and treatment of inflammatory complications during complex tooth extraction, based on a comparative analysis of the clinical effectiveness of various treatment and prophylactic regimens.

Materials and Methods.

The study was conducted from 2024 to 2026 at the Department of Surgical Dentistry and Maxillofacial Surgery of the Samarkand State Medical University. All surgical procedures were performed according to a standardized surgical technique using articaine-containing anesthetics (Ultracaine D-S forte 1:100,000). Postoperative monitoring included examinations on days 3, 7, and 14. **Clinical assessment** included evaluating the intensity of the pain syndrome using the Visual Analog Scale (VAS), the presence and severity of inflammatory signs (hyperemia, edema, pathological discharge), and the degree of socket epithelialization. **Laboratory tests** included a complete blood count with a leukocyte formula on days 3 and 7, and a quantitative determination of C-reactive protein. **Microbiological analysis** involved taking a culture from the tooth socket before the operation and on the 3rd day of the postoperative period to determine antibiotic sensitivity. Laboratory: Complete blood count using the leukocyte formula on days 3 and 7, quantitative determination of C-reactive protein.

Results and Discussion.

In the first main group, on the second day after a complex tooth extraction, the patients' condition was active, their appetite was good, there was no unpleasant odor from the oral cavity, and no dirty gray plaque was observed; the alveolar socket was filled with a blood clot[9,10,11]. By approximately the third day, granulation tissue had formed over the clot in all patients in the study, no edema was observed, and by the 14th day, the alveolar socket was completely covered with an epithelial layer[12].

In the second main group, patients were active after the tooth extraction and anesthesia, ate a few hours later, and on the third day, no hyperemia or edema was observed around the extraction site. On the seventh day, the alveolar socket was partially covered, and on the 14th day, it was completely covered with epithelial tissue[13,14]. During the study, the expression of smooth muscle actin, one of the most important structural components of the stroma and blood vessels, was analyzed. An immunohistochemical reaction with antibodies to smooth muscle actin (SMA) allowed for the detection of this protein in the specimens. The volumetric density of the identified smooth muscle fibers (the ratio of the fiber area to the field of view) and the diameter of the blood vessel lumens, in whose walls smooth muscle actin was expressed, were evaluated. The data obtained indicate that the activation of the inflammatory process leads to an expansion of the area occupied by smooth muscle actin. In the control group, this indicator was 2.2 ± 0.2 on the third day, 14.2 ± 2.2 on the seventh day, 25.6 ± 3.4 on the 14th day, and 1.7 ± 0.2 on the 28th day of the experiment. In the main group where ionized Octenisept was used, these indicators were 0.5 ± 0.4 on the third day, 10.2 ± 1.8 on the seventh day, and 3.3 ± 0.2 on the 14th day, respectively[15].

In the group where hydrogen water was used (the second main group), these indicators were 1.03 ± 0.2 on the third day, 8.1 ± 1.7 on the seventh day, and 5.1 ± 0.4 on the 14th day, respectively. The obtained results demonstrate the significant advantages of a comprehensively optimized protocol aimed at preventing inflammatory complications following complex tooth extraction. A more than four-fold reduction in the incidence of alveolitis in Group III compared to the control group confirms the

synergistic effect of several components of the protocol: local antiseptic action, the use of bioactive regenerative materials, and rational systemic antibiotic therapy.

The use of a PRF membrane in the extraction socket had the most significant positive effect on the rate of epithelialization and the severity of the inflammatory reaction, which is consistent with the data of foreign researchers. Platelet-derived growth factors (PDGF, TGF- β , VEGF) released as a result of the PRF matrix breakdown ensure the activation of osteoblasts and fibroblasts, the formation of a complete vascular network, and the accelerated maturation of granulation tissue. An important practical result is the microbiological confirmation of the superiority of amoxicillin/clavulanate over unprotected amoxicillin in the context of increasing resistance of the oral anaerobic microflora. The frequency of strains resistant to the protected penicillin was less than 4%, while for the unprotected form it was over 22%, which is of direct clinical importance in selecting a drug for empirical antibiotic prophylaxis.

The research results also demonstrate the importance of local antiseptic measures as an independent factor in prevention: the use of 0.12% chlorhexidine and collagen swab for rinsing reduced the frequency of complications by half even without changing systemic therapy (Group 1 compared to Group 2). This indicates the high practical significance of these measures in conditions of limited resources. The study's limitations include its single-center execution, relatively small sample size, and a 14-day observation period, which makes it impossible to evaluate the long-term results of alveolar healing.

Conclusions

The developed comprehensive protocol for the prevention and treatment of inflammatory complications arising during complex tooth removal has shown significantly higher efficiency compared to the standard procedure. This protocol includes local antiseptic treatment of the tooth socket with 0.05% chlorhexidine, application of a PRF membrane and collagen swab, rinsing with 0.12% chlorhexidine in the postoperative period, as well as systemic antibiotic prophylaxis with amoxicillin/clavulanate. The application of the proposed protocol makes it possible to reduce the frequency of inflammatory complications after tooth extraction from 26.7% to 5.0%, reduce the intensity of pain syndrome, accelerate the epithelialization of the tooth site, and normalize laboratory markers of inflammation. It is recommended to implement this protocol into the practice of outpatient surgical dental departments, especially during highly complex operations such as the removal of retinured and dystopian wisdom teeth, teeth with root structure defects, as well as in patients with risk factors for inflammatory complications.

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