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Algorithm For The Replantation Procedure Following Extraction of The Causative Tooth in Acute and Chronic Osteitis

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Abstract: Acute and chronic osteitis of the jawbone represents a severe odontogenic inflammatory condition that often leads to progressive destruction of bone tissue and loss of the causative tooth. Traditional treatment strategies primarily focus on extraction of the affected tooth, which frequently results in functional and aesthetic defects of the dentoalveolar system. In this context, tooth replantation after extraction has emerged as an organ-preserving alternative aimed at maintaining natural dentition and restoring normal masticatory function. This study presents a comprehensive algorithm for replantation in patients with acute and chronic osteitis based on modern diagnostic and surgical principles. The approach integrates advanced imaging techniques, including cone-beam computed tomography, microbiological assessment, and evaluation of periodontal microcirculation, to improve patient selection and treatment planning. Surgical intervention includes atraumatic extraction, thorough debridement of infected tissues, endodontic treatment of the extracted tooth, and retrograde root canal filling with biocompatible materials followed by replantation and stabilization. Clinical outcomes demonstrate high rates of successful healing and osteointegration, with significant improvement in functional recovery compared to conventional extraction methods. The proposed algorithm reduces postoperative complications, preserves alveolar bone structure, and enhances long-term prognosis. These findings support the effectiveness of tooth replantation as a viable and reliable treatment option for managing odontogenic osteitis in appropriately selected patients.

Keywords: Osteitis, Tooth Replantation, Odontogenic Infection, Alveolar Process, Endodontic Treatment, Surgical Dentistry, Jawbone Tissue, Inflammatory Diseases

Introduction

Osteitis develops as a consequence of an infectious process spreading beyond the periodontal ligament space into the bone tissue of the alveolar process. In its acute course, the process is characterized by a pronounced inflammatory reaction with the formation of a purulent focus; in its chronic course, it is characterized by sclerotic changes in the bone tissue with periodic exacerbations.

Modern approaches to the treatment of odontogenic osteitis include not only sanitation of the infectious focus but also attempts to preserve the causative tooth through endodontic treatment followed by replantation. This method makes it possible to avoid tooth loss and the need for prosthetics, thereby preserving the natural function of the dentoalveolar system.

The success of replantation depends on many factors: timeliness of diagnosis, the correct algorithm for surgical intervention, the quality of endodontic treatment of the extracted tooth, the condition of the alveolar bone tissue, and adherence to the postoperative patient management protocol.

Acute and chronic inflammatory processes of the maxillofacial region remain one of the most pressing problems in modern dentistry and maxillofacial surgery, characterized by a high incidence rate, a tendency to progress, and the risk of developing serious complications [1]. The problem becomes particularly relevant due to the need to preserve the dentition in young and middle-aged patients, for whom the extraction of a causative tooth can lead to significant functional and aesthetic impairments [2].

Modern achievements in microsurgery, endodontics, and regenerative medicine are opening up new opportunities for organ-preserving treatment of inflammatory processes in the jawbones [3]. The implementation of high-tech diagnostic methods, such as cone-beam computed tomography (CBCT), intraoral microscopy, and laser Doppler flowmetry, allows not only for an accurate assessment of the extent of the inflammatory process but also for determining the viability of periodontal tissues at the replantation planning stage [4].

At the same time, despite significant progress in understanding the pathogenesis of jawbone osteitis, many issues regarding surgical treatment remain unresolved. There is no unified algorithm for performing replantation after the extraction of a causative tooth in various forms of osteitis, the criteria for selecting patients for organ-preserving surgeries have not been sufficiently studied, and personalized approaches to choosing optimal treatment tactics

depending on the stage of the inflammatory process have not been developed [5]. Inflammatory diseases of the maxillofacial region hold a leading position in the structure of dental pathology. According to the WHO, acute and chronic osteitis of the jawbones account for 15–25% of all visits to maxillofacial surgeons, while traditional treatment often leads to tooth loss and the formation of dentition defects [6].

In the Republic of Uzbekistan, the prevalence of inflammatory diseases of the maxillofacial region is approximately 12.8–18.5 per 1,000 adult population (National Clinical Protocol of the Ministry of Health of the Republic of Uzbekistan, 2024), with acute osteitis diagnosed in 34–42% of patients with odontogenic inflammatory processes. Chronic forms of the disease occur in 28-35% of patients and often lead to the need to remove the causative tooth with subsequent prosthetics[7]. Despite certain achievements in the field of conservative treatment, there are few works in domestic literature dedicated to the development of tooth replacement algorithms for osteitis. This has determined the relevance of this study.

Inflammatory processes in the maxillofacial region represent one of the most pressing issues in modern dental practice. According to WHO data, the incidence of acute and chronic osteitis of the maxillary bones reaches 18-25 cases per 1,000 adult population, with a significant portion of patients ending in traditional treatment involving the extraction of a caudate tooth[8]. In the Republic of Uzbekistan, the prevalence of odontogenic osteitis is 12.8–18.5 per 1,000 adult population (National Clinical Protocol of the Ministry of Health of the Republic of Uzbekistan, 2024). Acute forms are diagnosed in 34-42% of patients, chronic forms in 28-35% of patients with inflammatory processes of the maxillofacial region[9]. Despite the successes achieved in conservative treatment, a number of issues remain insufficiently studied: selection criteria for transplantation, optimal timing for surgery, surgical intervention algorithm, and prediction of treatment outcomes.

The aim of the study is to develop and scientifically substantiate an algorithm for performing replacement surgery after causal tooth extraction in acute and chronic osteitis based on the comprehensive application of modern diagnostic and surgical treatment methods.

Materials and Methods

The study was conducted between 2022 and 2024. The research type is prospective controlled with elements of comparative analysis. The study included 156 patients aged 18 to 55 years with a verified diagnosis of acute or chronic osteitis of the jaw bones, who were scheduled for caudate tooth extraction. The main group consisted of 82 patients using the developed replantation algorithm; the average age in this group was 34.6±8.2 years. The control group included 74 patients receiving standard treatment (tooth extraction without replacement); their average age was 36.1±7.8 years.

Inclusion criteria: age 18-55; presence of acute or chronic osteitis of the jaw bones of odontogenic origin; indications for extracting the causative tooth; absence of severe somatic diseases; informed consent of the patient. Exclusion criteria: systemic connective tissue diseases, diabetes mellitus in the decompensation stage, oncological diseases of the maxillofacial region, pregnancy, and mental illnesses that hinder cooperation.

Clinical methods included thorough medical history collection, dental examination with determination of oral hygiene indices (OHI-S), papillary-marginal-alveolar index (PMA), periodontal index (PI), assessment of tooth mobility, percussion, palpation of regional lymph nodes.

Instrumental examination methods included radiography in standard projections, panoramic jaw tomography, and conical-beam computed tomography (CLCT) with the construction of three-dimensional reconstructions to assess the volume and localization of destructive changes in bone tissue.

Laboratory research methods included general blood analysis with determination of leukocyte formula and ESR, biochemical blood analysis (C-reactive protein, fibrinogen), microbiological examination of root canal contents and destruction foci with determination of antibiotic sensitivity.

Special diagnostic methods included laser Doppler flowmetry to assess microcirculation in periodontal tissues, electrodontometry to determine pulp viability, and transillumination to identify tooth crown cracks.

Surgical treatment was performed under local anesthesia (ultracaine 4% with adrenaline 1:100000) using the developed algorithm, which included: traumatic removal of the causal tooth while preserving the periodontal ligament, alveolar curettage with removal of granulation tissue and necrotic masses, treatment of the tooth root with antiseptic

solutions (0.05% chlorhexidine bigluconate, 3% hydrogen peroxide), retrograde filling of root canals with a mineral trioxide aggregate (MTA), and tooth replantation with fixation with a composite splint for 2-3 weeks.

Post-operative observation was conducted at 1, 3, 7 days, 2 weeks, 1, 3, 6 months, and 1 year, evaluating clinical parameters, radiological picture, and the functional state of the transplanted tooth.

Statistical processing of the obtained data was performed using the SPSS software package version 26.0. The significance of differences between groups was assessed using Student's t-test for quantitative variables and the $\chi 2$ test for qualitative indicators; differences were considered statistically significant at $p < 0.05$.

Results

When analyzing the structure of inflammatory diseases of the maxillofacial region in the study group, it was established that acute osteitis was diagnosed in 89 patients (57.1% of the total sample), and chronic osteitis in 67 patients (42.9%). Among the acute forms, acute purulent periostitis predominated (52 patients, 58.4%), followed by acute osteomyelitis (37 patients, 41.6%). In the structure of chronic forms, chronic granulating periodontitis with the formation of parotid cysts predominated (43 patients, 64.2%), while chronic osteomyelitis was diagnosed in 24 patients (35.8%).

Analysis of the localization of the inflammatory process showed that lower jaw involvement was significantly more frequent in 98 patients (62.8%), compared to upper jaw involvement in 58 patients (37.2%; $p < 0.05$). In the lower jaw area, the molars were most frequently affected (72 patients, 73.5%), while in the upper jaw area, the premolari and molars were affected with equal frequency (29 cases each, 50.0%)[10,11].

When laboratory studies were conducted in patients with acute osteitis, characteristic signs of the inflammatory process were identified: leukocytosis ($12.8\pm2.4\times109$/l versus $6.2\pm1.1\times109$/l in the control; $p < 0.001$), increased ESR (28.5 ± 6.3 mm/h versus 8.4 ± 2.1 mm/h in the control; $p < 0.001$), and elevated C-reactive protein levels (18.7 ± 4.2 mg/l versus 2.1 ± 0.8 mg/l in the control; $p < 0.001$).

During the microbiological examination of root canal contents and destruction foci, the following were most frequently identified: Streptococcus mutans (67.3% of patients), Staphylococcus epidermidis (54.8%), Enterococcus faecalis (42.9%), and anaerobic bacteria of the Bacteroides genus (38.5%). Mixed microflora was detected in 78.2% of patients.

The results of applying the developed replantation algorithm showed its high efficiency. Successful healing of transplanted teeth was achieved in 74 patients of the main group (90.2%), which significantly exceeded the results of the control group, where satisfactory functional results after prosthetics were obtained in only 52 patients (70.3%; $p < 0.01$).

During radiological monitoring 6 months after surgery, signs of successful osteointegration (formation of a new periodontal ligament, absence of destruction foci, preservation of alveolar bone contours) were identified in 68 patients (82.9%) of the main group. Ankylosis of the root with alveolar bone tissue, which does not interfere with tooth function, developed in 6 patients (7.3%). Unsatisfactory results with the development of root resorption and the need for repeated removal were noted in 8 patients (9.8%)[12].

Functional treatment outcomes were evaluated 12 months after surgery. Complete restoration of chewing function was achieved in 72 patients of the main group (87.8%), which significantly exceeded the indicators of the control group (58 patients, 78.4%; $p < 0.05$). The absence of pain sensations during exertion was noted in 76 patients (92.7%) of the main group compared to 61 patients (82.4%) of the control group ($p < 0.05$).

Post-operative complications in the main group were minimal: transient biting pain for 2-3 weeks in 12 patients (14.6%), and minor mobility of the transplanted tooth that did not require additional treatment in 8 patients (9.8%). No serious complications (purging, osteomyelitis, complete tooth loss in the early postoperative period) were observed.

Discussion

The results obtained indicate the high effectiveness of the developed tooth replacement algorithm for acute and chronic osteitis of the maxillofacial region. Healing success (90.2%) and functional treatment results (87.8% full restoration of masticatory function) are comparable to data from leading foreign clinics and surpass traditional treatment methods[13]. Key success factors include: careful selection of patients based on comprehensive diagnostics,

including CLCT and laser Doppler flowmetry; traumatic removal techniques with maximum preservation of periodontal structures; thorough sanation of the alveoli and root canals; and the use of modern biocompatible materials for retrograde filling[14,15.

The advantages of the method are: preserving the natural tooth and avoiding the need for prosthetics, restoring full masticatory function, preventing atrophy of the alveolar process, and high economic efficiency compared to implantation.

Conclusion

The developed algorithm for performing replacement surgery after extracting a causal tooth in acute and chronic osteitis demonstrates high clinical efficacy and allows for the preservation of natural teeth in 90.2% of patients. A comprehensive approach, including modern diagnostic methods, non-traumatic surgical techniques, and adequate postoperative care, ensures successful osteointegration and restoration of the function of transplanted teeth in the long term.

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