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TREATMENT OF OPEN WOUNDS OF THE MAXILLOFACIAL REGION

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Abstract: This article analyzes the clinical characteristics, diagnostic principles, and modern treatment approaches for open wounds of the maxillofacial region. The etiology of injuries, the degree of tissue damage, and the risk of infection are shown to be the main factors in selecting appropriate treatment tactics. Timely and anatomically accurate primary surgical management plays a decisive role in preventing complications. Comprehensive treatment includes antibacterial therapy, local antiseptics, reconstructive surgery, and rehabilitation measures. The use of physiotherapy and functional exercises contributes to faster recovery of mastication and speech functions. The results demonstrate that a staged comprehensive approach reduces the frequency of infectious complications and improves functional and aesthetic outcomes. Early diagnosis and high-quality primary surgical treatment also significantly improve the patient's quality of life and social adaptation.

Keywords: Maxillofacial region, open wound, primary surgical treatment, infection prevention, antibiotic therapy, reconstructive surgery, rehabilitation, scar deformity, functional recovery, aesthetic outcome.

Introduction

The maxillofacial region is one of the most important anatomical areas of the human body in both functional and aesthetic aspects. Complex physiological processes such as breathing, mastication, speech, facial expression, and sensory perception are performed in this region. Therefore, injuries occurring in this area, especially open wounds, significantly affect not only local tissues but also the overall condition of the organism. Open wounds of the maxillofacial region most commonly occur as a result of domestic trauma, road traffic accidents, occupational injuries, sports trauma, and criminal incidents. In many cases, such injuries involve simultaneous damage to the skin, subcutaneous tissue, muscles, blood vessels, nerves, salivary glands, bone structures, and oral cavity organs. This makes treatment complicated and requires a comprehensive and highly qualified medical approach. Due to the rich vascular supply of the maxillofacial area, there is a high risk of infection spread, development of phlegmon and abscesses, as well as functional impairment and cosmetic deformities. Improper or delayed primary surgical treatment may lead to scar deformities, contractures, facial asymmetry, and disturbances of mastication and speech. Therefore, early diagnosis, rational primary surgical management, infection prevention, and timely reconstructive procedures are of great importance.

Modern dentistry and maxillofacial surgery widely apply microsurgical techniques, atraumatic suture materials, antiseptics, antibacterial therapy, and regenerative methods, which significantly improve treatment outcomes. However, complications still occur in clinical practice, maintaining the relevance of this problem. Thus, optimization of treatment strategies for open wounds of the maxillofacial region, improvement of functional and aesthetic outcomes, and reduction of complications remain important and актуal tasks of modern medicine.

Relevance

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Open wounds of the maxillofacial region represent one of the most common conditions encountered in traumatology and maxillofacial surgery. In recent years, the frequency of these injuries has increased due to the growth of road traffic accidents, domestic trauma, and sports-related injuries. Since the facial region plays a crucial functional and aesthetic role, even minor trauma may lead to disturbances in mastication, speech, breathing, and the patient's psycho-emotional state. The rich vascularization of maxillofacial tissues promotes rapid spread of infection and may result in severe complications such as phlegmon, abscesses, and osteomyelitis. In addition, inadequate primary surgical treatment often causes rough scar formation, deformities, contractures, facial asymmetry, and impairment of chewing and speech functions. These consequences significantly reduce quality of life and require long-term rehabilitation.

Aim

To analyze modern diagnostic and surgical approaches in the management of open wounds of the maxillofacial region and to develop an effective treatment algorithm aimed at improving functional and aesthetic outcomes.

Main part

The maxillofacial region is one of the most complex anatomical areas of the human body and performs vital functional and aesthetic roles. It consists of the skin, subcutaneous fat, fascia, mimetic and masticatory muscles, blood vessels, lymphatic structures, peripheral nerves, salivary glands, and facial bones. The vascular network in this region is extremely rich, especially branches of the facial and maxillary arteries, which explains the profuse bleeding observed after trauma. However, the same vascularization accelerates reparative regeneration and promotes relatively fast wound healing compared to other body areas. The trigeminal nerve provides sensory innervation, while the facial nerve controls facial expression; therefore, their injury leads to anesthesia, paresthesia, or paralysis of facial muscles. Damage to mimetic muscles causes visible asymmetry and aesthetic defects. The oral cavity contains a large number of microorganisms, so almost every open wound in this area should be considered potentially contaminated. Venous anastomoses connect facial veins with intracranial venous sinuses, allowing infection to spread toward the cavernous sinus and causing life-threatening complications such as thrombosis or meningitis. Dense arrangement of tissues facilitates rapid spread of inflammation into fascial spaces and the neck. The presence of teeth and saliva also affects healing due to continuous bacterial contamination and moisture. Salivary gland injury may result in salivary leakage and fistula formation. Edema in this region may compromise airway patency in severe trauma. Functional disturbances include impaired mastication, speech articulation, swallowing, and breathing. Because of these features, surgical management must restore each anatomical layer separately. Accurate knowledge of topographic anatomy is essential to preserve nerve function and facial symmetry. Cosmetic outcome is especially important due to social and psychological impact. Therefore, anatomical and physiological characteristics determine diagnostic approach, treatment tactics, and prognosis of open maxillofacial injuries.

Open wounds of the maxillofacial region occur due to various mechanical and physical factors affecting facial tissues. The most common causes include road traffic accidents, domestic trauma, occupational injuries, sports accidents, and interpersonal violence. In children falls are predominant, while in adults high-energy trauma is more frequent. Depending on the mechanism,

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wounds are classified as incised, lacerated, contused, punctured, chopped, bitten, and gunshot injuries. According to depth, they may be superficial or deep involving muscles, glands, or bones. Communication with the oral cavity automatically makes the wound contaminated because of bacterial flora. Injuries may be isolated or combined with fractures of the mandible or maxilla. Vascular or nerve damage indicates severe trauma requiring urgent intervention. According to microbial contamination wounds are divided into clean, conditionally clean, and infected types. Timing of treatment also influences classification as fresh or delayed wounds. Tissue loss leads to defects that may require reconstructive surgery. Bite wounds have a particularly high risk of infection due to polymicrobial contamination. Gunshot injuries often produce extensive tissue destruction and necrosis. Blunt trauma usually causes crushed wound edges with impaired circulation. Correct classification determines antibiotic choice and surgical strategy. It also helps predict healing complications such as necrosis or scar formation. Evaluation of mechanism provides information about foreign bodies inside the wound. Energy of trauma correlates with severity of tissue damage. Therefore, etiological and classification assessment is essential for planning rational management and preventing complications.

Clinical manifestations of open maxillofacial wounds depend on the depth and structures involved. The most common symptoms include pain, bleeding, swelling, and visible tissue defect. Facial asymmetry appears when mimetic muscles or facial nerve branches are damaged. Limited mouth opening indicates involvement of masticatory muscles or temporomandibular joint trauma. Loss of sensation suggests trigeminal nerve injury. Continuous salivary discharge points to salivary duct damage. Bone fractures cause deformity, malocclusion, and abnormal mobility. Diagnosis begins with careful history taking to determine mechanism and time of injury. Inspection evaluates wound edges, contamination, and foreign bodies. Palpation helps detect bone discontinuity and crepitus. Probing assesses depth and communication with oral cavity. Radiography is used to identify fractures and retained fragments. Computed tomography provides detailed evaluation of bone and deep soft tissues. Ultrasound helps visualize salivary glands and hematomas. Neurological examination assesses motor and sensory function. Laboratory tests reveal inflammatory markers and infection severity. Differential diagnosis distinguishes simple wounds from complex combined injuries. Early identification of airway risk is crucial in extensive trauma. Assessment of vascular integrity prevents delayed hemorrhage. Accurate diagnosis determines surgical timing and treatment method. Prompt evaluation reduces risk of infection and deformity. Comprehensive examination is therefore the key to successful management of maxillofacial open injuries.

Primary surgical treatment is the most important stage in the management of open wounds of the maxillofacial region and largely determines the final functional and cosmetic outcome. The procedure begins with adequate anesthesia, usually local infiltration or regional nerve block, while in extensive trauma general anesthesia may be required. The wound is first irrigated with sterile saline and antiseptic solution to remove debris and reduce bacterial contamination. Mechanical cleaning eliminates dirt, teeth fragments, and foreign bodies. Devitalized and necrotic tissues are carefully excised while preserving viable structures as much as possible. Hemostasis is achieved using ligation, electrocoagulation, or compression. The surgeon must inspect the wound layer by layer to identify damage to muscles, nerves, salivary ducts, and vessels. Deep structures are repaired anatomically starting from mucosa or periosteum followed by muscle reconstruction. Restoration of muscle continuity is essential to maintain facial expression and oral competence. Salivary duct injuries require microsurgical suturing to prevent fistula formation. Bone fragments are repositioned and fixed if fractures are present. Drainage is

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placed in contaminated wounds to prevent hematoma and infection. Skin closure is performed using atraumatic sutures with minimal tension. Cosmetic lines and natural folds are considered to reduce visible scars. Early closure within the golden period improves healing and reduces infection risk. Antibiotic prophylaxis accompanies the procedure. Proper primary surgical management significantly decreases complications and ensures better functional recovery.

Drug therapy plays a crucial supportive role in the treatment of open maxillofacial injuries and aims to prevent infection and support tissue healing. Broad-spectrum antibiotics are prescribed immediately after injury due to high microbial contamination of the oral cavity. Combination therapy is often preferred to cover aerobic and anaerobic flora. Metronidazole is commonly added when anaerobic infection is suspected. Tetanus prophylaxis must be provided according to vaccination status. Anti-inflammatory medications reduce edema and tissue reaction. Analgesics are administered to control pain and improve patient comfort. Antiseptic solutions are used regularly for local wound irrigation and oral hygiene. Detoxification therapy may be required in severe trauma with systemic response. Antihistamines help reduce inflammatory swelling and allergic reactions. Immunomodulatory agents may enhance tissue resistance to infection. Adequate hydration supports metabolic processes and healing. Nutritional support with high protein intake accelerates regeneration. Anticoagulants may be used carefully in vascular injuries to prevent thrombosis. Monitoring of body temperature and blood parameters helps evaluate treatment effectiveness. Early antibiotic therapy significantly reduces the risk of cellulitis and abscess formation. Proper medication protocol shortens hospitalization time. Rational pharmacological support is therefore an integral component of complex treatment.

Reconstructive surgery is required in cases where significant tissue loss or deformity occurs after maxillofacial trauma. The main goal is restoration of both function and facial aesthetics. Small defects may be closed by local tissue mobilization and layered suturing. Larger defects require local rotational or advancement flaps. Skin grafting is applied when surrounding tissue is insufficient for closure. Full-thickness grafts provide better cosmetic appearance in visible areas. Microsurgical free flaps are used in extensive injuries with combined tissue loss. Bone defects are corrected using osteosynthesis with plates or screws. Titanium fixation systems ensure stable bone healing. Soft tissue contour must be recreated to restore facial symmetry. Secondary scar revision may be performed after initial healing. Functional reconstruction includes restoration of lip competence and oral opening. Reconstruction of salivary ducts prevents chronic fistulas. Nerve repair improves sensory and motor recovery. Timing of reconstruction may be immediate or delayed depending on wound condition. Early reconstruction often provides better psychological outcome for patients. Multidisciplinary approach involving surgeons and prosthodontists is often necessary. Rehabilitation therapy supports adaptation after surgery. Modern reconstructive techniques significantly improve quality of life and social reintegration of patients.

Complications of open maxillofacial wounds may develop both in the early and late postoperative periods and significantly influence treatment outcomes. The most frequent early complication is infection due to heavy bacterial contamination from the oral cavity and external environment. Cellulitis and abscess formation can spread rapidly through fascial spaces of the face and neck. In severe cases infection may extend to the mediastinum or intracranial venous sinuses causing life-threatening conditions. Osteomyelitis may occur when bone tissue becomes infected, especially in mandibular fractures. Secondary hemorrhage can appear because of vessel erosion or inadequate hemostasis. Salivary fistula develops when parotid duct injuries are not

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properly repaired. Nerve damage may result in persistent paresthesia or facial muscle paralysis. Late complications include hypertrophic scars and keloids which lead to cosmetic deformities. Contractures may restrict mouth opening and impair mastication. Malocclusion may appear if fractures heal incorrectly. Chronic pain syndromes sometimes develop after nerve trauma. Psychological stress and social discomfort are also common consequences. Prevention begins with early primary surgical treatment and adequate debridement. Strict aseptic technique reduces microbial contamination. Timely antibiotic therapy prevents spread of infection. Proper layered suturing minimizes scar formation. Physiotherapy helps prevent contractures. Regular follow-up examinations allow early detection of complications. Therefore comprehensive prevention strategies are essential for successful recovery.

Rehabilitation is an integral part of the management of maxillofacial injuries and starts shortly after acute treatment. The primary goal is restoration of functional activity and aesthetic appearance. Physiotherapy methods such as UHF therapy and laser therapy improve microcirculation and accelerate healing. Therapeutic massage softens scar tissue and prevents adhesions. Mimetic muscle exercises restore facial expression and symmetry. Gradual mouth opening exercises help recover temporomandibular joint mobility. Chewing training improves mastication efficiency and muscle strength. Speech therapy is necessary when articulation is disturbed. Psychological counseling supports emotional adaptation after facial trauma. Proper oral hygiene prevents secondary infection during healing. Nutritional guidance ensures adequate protein and vitamin intake for regeneration. Orthopedic appliances may be used to correct occlusion disturbances. Continuous monitoring evaluates progress of functional recovery. Scar correction procedures may be performed if necessary. Social reintegration is an important rehabilitation objective. Early rehabilitation shortens disability period and improves quality of life. Patient motivation plays a significant role in successful recovery. Multidisciplinary cooperation between surgeons, dentists, physiotherapists, and psychologists provides optimal results. Comprehensive rehabilitation therefore completes the treatment cycle and ensures full restoration of patient function and appearance.

Discussion and Results

Analysis of open wounds of the maxillofacial region demonstrates that treatment outcomes primarily depend on timely first medical care and properly performed primary surgical management. Early and adequate surgical debridement protects the wound from infection, preserves tissue viability, and significantly reduces the risk of complications. In contrast, delayed or insufficient treatment is frequently associated with cellulitis, abscess formation, osteomyelitis, salivary fistula, and scar deformities.

The anatomical and physiological characteristics of the maxillofacial region - rich vascular supply, presence of oral microflora, and dense arrangement of nerves and muscles - require a comprehensive treatment approach. Management should not be limited to simple wound closure; instead, accurate anatomical reconstruction of all tissue layers is essential. Preservation and repair of nerve structures allow recovery of sensation and facial expression, while proper reconstruction of salivary ducts prevents chronic fistula formation. Antibacterial therapy and local antiseptics play an important role in infection prevention, but they cannot replace adequate surgical treatment. Early application of reconstructive and plastic techniques reduces cosmetic defects and helps maintain facial symmetry. The use of physiotherapy, facial muscle exercises, and speech rehabilitation accelerates functional recovery. As a result, patients treated with a

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staged комплекс management approach showed a lower incidence of infectious complications, less pronounced scarring, and better restoration of mastication and speech functions. Therefore, early diagnosis combined with high-quality primary surgical treatment and structured rehabilitation represents the most effective strategy for managing open maxillofacial injuries.

Conclusion

Management of open wounds of the maxillofacial region is a complex clinical task that requires a staged and comprehensive approach. Treatment effectiveness primarily depends on early diagnosis and timely, properly performed primary surgical management. Accurate debridement of wound edges, anatomical reconstruction of tissue layers, and adequate infection prevention play a decisive role in avoiding postoperative complications.

Comprehensive medical therapy, including antibacterial and anti-inflammatory treatment, accelerates tissue repair and limits inflammatory processes. When necessary, reconstructive and plastic surgical methods significantly improve both functional and aesthetic outcomes. Rehabilitation measures such as physiotherapy, facial muscle exercises, and speech training contribute to restoration of quality of life and social adaptation of the patient. Thus, an integrated approach that combines early primary surgical treatment, rational медикаментоз therapy, and full rehabilitation represents the key condition for achieving optimal functional and cosmetic results in patients with open maxillofacial injuries.

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