ANALYSIS OF THE SURGICAL MANAGEMENT OF THE CURRENT EPIDEMIOLOGICAL PATTERN OF BONE DEFECTS IN THE MAXILLOFACIAL REGION

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Abstract Acquired defects of the maxillofacial region represent the loss of bone tissue resulting from trauma (e.g., motor vehicle accidents, gunshot wounds), oncological diseases, or surgical interventions. These defects may lead to facial asymmetry, impaired chewing, swallowing, and speech, and can also affect aesthetics and mental well-being. Treatment options include bone grafting or prosthetic reconstruction. Conditions following oncological treatment, acute maxillofacial trauma, and post-traumatic deformities of the facial skeleton with bone defects are among the most common challenges faced by maxillofacial surgeons.
Keywords: maxillofacial defects, bone grafts, revascularized bone, osteogenesis

With the increasing mobility of the population, widespread availability of firearms, and rise in military conflicts, the number and severity of post-traumatic deformities with bone defects are rapidly growing. Surgical reconstruction requires a more meticulous and highly qualified approach.

According to various authors, maxillofacial trauma accounts for 11–25% of injuries, and in some domestic and international studies this figure reaches 30–38%. The incidence of post-traumatic complications ranges from 7% to 36%. Early specialized care is not always feasible within the first 24 hours, leading to repeated surgeries and the formation of defects with disrupted continuity and beyond.

Modern reconstructive maxillofacial surgery widely uses materials of non-biological origin (titanium, Teflon, polyethylene, calcium- or cement-based powders, etc.) as well as multicomponent osteomyocutaneous autografts transplanted using microsurgical techniques. Each method has advantages and limitations, and their application is not always possible to the full extent, which inevitably results in trauma to both donor and recipient sites.

The past three decades have seen substantial progress in reconstructive microsurgery of the maxillofacial region. Today, the restoration of extensive composite defects of the face and neck is inconceivable without microvascular autotransplantation. Even for smaller bone defects of the facial skeleton, optimal outcomes require revascularized bone grafts that maintain their own blood supply independent of the recipient site. These grafts, however, should be more anatomically delicate, ideally matching the form and size of the defect without excessive soft-tissue bulk.

Using established revascularized bone grafts for limited bone defects is often impractical. While revascularized bone remains the optimal material for reconstructing facial skeleton defects, the choice of donor sites for small defects is

limited, necessitating the exploration of new donor areas to ensure reliable rehabilitation.

One of the pressing medical and social challenges in modern dentistry and maxillofacial surgery is the treatment and rehabilitation of patients with maxillofacial defects. The significance of this issue has increased in recent years due to rising rates of oncological diseases in the maxillofacial region and growing incidence of trauma and combat-related injuries (Reshetov I.V., 2019; Schwarz S., 2018). Such defects and deformities often involve severe functional and aesthetic impairments, limiting patients' daily activities and causing social maladaptation and profound psychosocial difficulties (Zoumalan R.A., 2020).

Human technological progress—development of mechanisms, increased speed—has simultaneously contributed to more severe injuries involving facial bone defects. In the early 19th century, these defects were left to heal by secondary intention; one-third of patients died, and those who survived were invariably disfigured, making normal social integration impossible.

Defects of the facial skeleton and adjacent soft tissues caused loss of facial symmetry, impaired mandibular movement, speech, occlusion, breathing, chewing, and swallowing.

The functional and aesthetic impairments associated with mandibular defects have long driven surgeons to develop methods to minimize or eliminate disfiguring consequences of trauma.

Throughout the evolution of reconstructive maxillofacial surgery, autogenous bone grafting has proven to be the most reliable method for long-term and definitive reconstruction of facial bones.

Bone grafts are categorized into vascularized and non-vascularized (autogenous, homologous, xenogenic). Autogenous bone grafts are considered the most suitable for reconstructing maxillofacial bone defects due to their low rejection rates and are regarded as the gold standard for managing limited defects of the facial skeleton.

Common donor sites for autogenous bone harvesting include: calvarium, scapula, humerus, radius, rib, iliac crest, tibia, fibula, and metatarsal bones. Each of these grafts represents a primary type of bone transplant widely used in fragmentary form.

Advances in microsurgery allow transplantation of complex bone autografts with vascular pedicles, including large bone segments often combined with surrounding soft tissues. This method plays a central role in facial reconstruction but is not without limitations. Yang et al. (2018) and Song et al. (2018) demonstrated that vascularized autografts resist infection, maintain osteogenic potential, and integrate with the defect.

Recently, there has been a growing body of literature on bioengineered constructs for reconstructing facial bone defects. Despite the wide range of techniques and materials available, new methods continue to emerge, each with strengths and weaknesses. Various bioengineered solutions are used to enhance osteogenesis in combination with organic and inorganic materials. Preference is given

to methods that closely replicate natural tissue regeneration. However, achieving stable outcomes through combining inorganic matrices with biologically active components is challenging. To date, successful vascularization and “revitalization” of a bioengineered construct remain elusive.

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