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INNOVATIVE USE OF AUTOLOGOUS PLATELET BIOMASS IN THE TREATMENT OF ZYGOMATIC BONE FRACTURES.

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Abstract. The purpose of this research was to optimize the healing of zygomatic bone fractures by applying local injections of platelet-rich autologous platelet concentrate (autothrombocytic mass) as a regenerative aid. The study involved **162 patients** who were treated at the Bukhara Regional Multidisciplinary Medical Center (BRMMC), including 153 men and 9 women. All participants received five localized injections of platelet-rich autologous platelet concentrate administered directly into the fracture area. Clinical observations indicated that this therapeutic approach offered several positive outcomes, including a decrease in pain intensity and soft tissue swelling, acceleration of bone tissue regeneration, and a reduction in post-traumatic inflammatory complications. The results suggest that the use of platelet-rich autologous platelet concentrate in the management of zygomatic bone fractures can significantly improve bone healing, regulate inflammatory responses, and minimize the likelihood of secondary infections.

Keywords: zygomatic bone fracture, autologous platelet concentrate, bone healing, regeneration, autothrombocytic mass.

Introduction: Fractures of the zygomatic bone represent one of the most frequently encountered injuries of the midfacial skeleton due to the prominent anatomical position and structural role of the zygomatic complex. These injuries commonly result from high-energy trauma such as road traffic accidents, sports-related impacts, falls, and interpersonal violence. The zygomatic bone forms an essential component of the zygomaticomaxillary complex (ZMC) and contributes significantly to facial symmetry, orbital stability, and masticatory biomechanics. Consequently, disruption of this structure may lead to functional impairments including trismus, infraorbital nerve paresthesia, diplopia, and malocclusion, as well as noticeable aesthetic deformities of the facial contour.

The standard management of zygomatic bone fractures includes both conservative and surgical approaches depending on the degree of displacement and associated orbital or maxillary involvement. Open reduction and internal fixation (ORIF) using titanium miniplates and screws remains the gold standard for restoring anatomical alignment and structural stability of the fractured segments. However, despite advances in maxillofacial surgical techniques and fixation systems, postoperative complications such as delayed osteogenesis, inflammatory edema, infection, hematoma formation, and prolonged soft tissue recovery may still occur. These challenges emphasize the importance of adjunctive therapeutic strategies capable of enhancing tissue regeneration and improving clinical outcomes.

In recent decades, regenerative medicine has emerged as a rapidly developing field within oral and maxillofacial surgery. Autologous biological materials obtained from peripheral blood have gained particular attention due to their high biocompatibility and regenerative potential. Platelet-derived biomaterials are widely investigated because they contain numerous bioactive mediators that play a critical role in wound healing, angiogenesis, and osteogenesis. These preparations are increasingly utilized in reconstructive surgery, implantology, and bone regeneration procedures.

Autologous platelet concentrates are characterized by an increased concentration of thrombocytes capable of releasing multiple growth factors and cytokines. Among the most important are platelet-derived growth factor (PDGF), transforming growth factor-β (TGF-β), vascular endothelial growth factor (VEGF), and insulin-like growth factor (IGF). These molecular mediators actively participate in the regulation of cellular proliferation, differentiation of osteoprogenitor cells, extracellular matrix formation, and neovascularization. Through these biological mechanisms, platelet-based biomaterials may significantly accelerate reparative osteogenesis and improve the quality of newly formed bone tissue.

The application of autothrombocytic mass as a local regenerative agent in the treatment of facial bone fractures has demonstrated promising therapeutic potential. Targeted administration of platelet-rich biological material directly into the fracture zone may enhance microcirculatory dynamics, reduce inflammatory response, and stimulate osteoblastic activity. Additionally, the autologous origin of this biomaterial minimizes the risk of immunogenic reactions, allergic responses, and transmission of infectious agents, making it a safe adjunct in surgical practice.

Given these regenerative properties, the integration of autologous platelet-based biomaterials into the management of zygomatic bone fractures may represent an effective strategy for improving bone repair and postoperative recovery. Therefore, the present study was designed to evaluate the clinical effectiveness of local injections of autologous platelet concentrate in stimulating reparative osteogenesis, reducing inflammatory complications, and optimizing the overall healing process in patients with zygomatic bone fractures.

Purpose of the study: to assess the effectiveness of local injections of autologous platelet concentrate (autothrombocytic mass) in accelerating bone regeneration, reducing inflammation, and improving clinical outcomes in patients with zygomatic bone fractures.

Material and method: This prospective clinical study was carried out at the Bukhara Regional Multidisciplinary Medical Center between 2021 and 2024 and included **162 patients** (153 males and 9 females), aged 18–60 years, who were diagnosed with unilateral or bilateral fractures of the zygomatic bone involving the zygomatic arch, lateral orbital rim, and zygomaticomaxillary buttress.

All participants received standard treatment for zygomatic fractures, including open reduction and internal fixation (ORIF) using titanium miniplates under strict aseptic technique, along with systemic antibiotic therapy, anti-inflammatory medications, and physiotherapeutic rehabilitation. In the experimental group, patients additionally underwent targeted local injections of autologous platelet-rich plasma (PRP) along the fracture line to enhance osteogenesis and promote soft tissue repair.

PRP was prepared from 10 ml of venous blood employing a double-spin centrifugation method, with acid citrate dextrose (ACD-A) as an anticoagulant. The initial centrifugation at 1,600 rpm for 10 minutes separated the plasma, followed by a second centrifugation at 3,500 rpm for 10 minutes to concentrate platelets. The PRP fraction, containing approximately four to six times the baseline platelet count, was activated with 10% calcium chloride. Activated PRP (2–3 ml per session) was administered locally along the fracture line under sterile conditions at intervals of 2–3 days, for a total of five sessions.

Clinical assessment included evaluation of pain intensity using the Visual Analogue Scale (VAS, 0–10), measurement of soft tissue edema, radiological monitoring of bone callus formation via digital panoramic radiographs and cone-beam computed tomography (CBCT), determination of the time required for bone consolidation, and observation for post-traumatic inflammatory or infectious complications.

Statistical analysis was conducted using SPSS version 26.0, with continuous variables presented as mean ± standard deviation (SD). Intergroup comparisons were performed using Student's t-test and χ^2-test, with p-values less than 0.05 considered statistically significant.

Results: Patients treated with autologous platelet-rich plasma (PRP) for zygomatic bone fractures exhibited accelerated recovery and a lower rate of complications compared with those who received standard therapy alone. Over 90% of patients reported marked pain relief within 48–72 hours following the initial PRP injection. Significant reduction of soft tissue edema was observed after the second to third treatment session, which improved local microcirculation and promoted more rapid tissue repair. Radiological assessment demonstrated the appearance of initial bone callus in the PRP group between days 21 and 24, whereas in the control group callus formation occurred between days 30 and 35, effectively shortening the overall healing period by 10–14 days. The incidence of post-traumatic inflammatory or infectious complications decreased from 12% in the control group to 3% in the PRP group, with no reported adverse immunological or allergic reactions.

The observed therapeutic effects of PRP are attributed to its high concentration of platelet-derived growth factors, including PDGF, TGF-β, VEGF, and IGF-1, which stimulate osteoblast proliferation, collagen deposition, angiogenesis, and enhancement of microvascular perfusion. The fibrin matrix within PRP provides a scaffold that facilitates stem cell migration and osteoconduction, while the modulation of pro-inflammatory cytokines contributes to reduced edema and pain. Additionally, PRP-derived exosomes may further support tissue regeneration and bone remodeling.

Conclusion: The incorporation of autologous PRP into the treatment protocol for zygomatic bone fractures accelerates reparative osteogenesis, decreases postoperative edema and inflammation, reduces the frequency of complications, and improves overall clinical outcomes. PRP represents a safe, biologically active, and effective regenerative adjunct in the management of maxillofacial trauma.

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