

Reconstruction of Anterior Maxillary Defect Following Gunshot Injury: A Case Report

İhtişam Zafer Cengiz¹, Ensari Yavuz², Rana Kapukaya³, Önder Tan²

¹ Department of Plastic Reconstructive and Aesthetic Surgery Atlas University Hospital, İstanbul, Türkiye

² Plastic Reconstructive and Aesthetic Surgery Private Clinic, İstanbul, Türkiye

³ Department of Plastic Reconstructive and Aesthetic Surgery Health Sciences University, Adana School of Medicine, City Hospital, Adana, Türkiye

Abstract

Aim: To present a case of complex anterior maxillary defect caused by a gunshot injury and discuss the surgical approach using an autologous bone graft and a mini free flap for reconstruction.

Methods: A 15-year-old male presented with maxillofacial trauma, including mandibular and anterior maxillary fractures, following a gunshot injury. Initial management involved mandibular fixation, nasal base stabilization, and primary mucosal repair. Subsequent imaging revealed a 4x2 cm anterior maxillary defect and upper lip contracture. Reconstruction was performed using a 4x2 cm autologous iliac crest bone graft and a 5x4 cm mini free flap harvested from the lower extremity. Microvascular anastomosis was conducted with the facial artery and vein.

Results: Postoperative recovery was uneventful, and at the one-year follow-up, the patient exhibited significant improvements in aesthetic and functional outcomes. The bone graft demonstrated successful integration, and the free flap-maintained viability without complications.

Conclusion: Combining autologous bone grafts with free flaps provides effective functional and aesthetic restoration for gunshot-induced maxillofacial defects. This case underscores the importance of a multidisciplinary approach and highlights strategies for optimizing outcomes in complex maxillofacial reconstructions.

Keywords: Maxillofacial reconstruction; autologous bone graft; free flap; anterior maxillary defect; anterolateral thigh flap

1. Introduction

Gunshot injuries are among the most severe traumatic injuries in modern medicine and often require complex, multidisciplinary approaches. These injuries can lead to extensive soft tissue damage as well as hard tissue defects. Facial gunshot injuries, in particular, leave profound aesthetic and functional impacts on patients, affecting essential life functions such as chewing, speaking, swallowing, and breathing. Consequently, surgeons must develop patient-specific and effective treatment strategies to manage these injuries effectively.

Anterior maxillary defects significantly affect both structural stability and overall facial appearance, making reconstructive surgery critically important. Repairing defects in this region often requires complex surgical techniques involving both bone and mucosal tissues. Autologous bone grafts are commonly employed for reconstructing bony defects.¹ Grafts harvested from sites such as the iliac crest, ribs, or cranial bone are preferred due to their high biocompatibility and integration potential.² However, the long-term success of these grafts depends on adequate vascularization and tissue integration.³

Free flaps harvested from the lower extremity are valuable op-

tions for repairing extensive defects. The vascularized nature of these flaps provides an effective solution for covering soft tissue and mucosal defects.⁴ These flaps also enhance aesthetic and functional outcomes during the reconstruction process⁵. In maxillofacial trauma, such combined approaches play a critical role in optimizing patient outcomes.

This case report presents the treatment of a patient with a 4x2 cm anterior maxillary defect involving both bone and mucosa caused by a gunshot injury. Reconstruction was achieved using an autologous bone graft for structural stability and a free flap from the lower extremity for soft tissue repair. The case demonstrates the efficacy of a multidisciplinary approach in treating such complex traumas and provides a model for similar clinical scenarios.

2. Case

A 15-year-old male patient presented to the emergency department after sustaining a gunshot injury. Initial evaluation revealed a mandibular fracture accompanied by comminuted fractures in the anterior wall and alveolar segments of the maxilla.

The patient's general condition was stable, although extensive hematoma and swelling were noted in the facial region. The injury caused mucosal damage, negatively impacting nasal base stability and upper lip aesthetics. Laboratory investigations showed hemoglobin levels of 11.5 g/dL, leukocyte count of 14,000/ μ L, and CRP levels of 5.2 mg/L. Coagulation parameters and platelet counts were within normal limits. Radiological imaging revealed an open mandibular fracture, comminuted fractures throughout the anterior maxillary segment and alveolar regions, as well as instability of the nasal base.

Emergency surgery included fixation of the mandibular fracture. However, due to the instability of the fractured maxillary bone fragments, fixation was not feasible for the anterior maxilla. Nasal base stabilization and primary repair of the mucosal defect were performed during the procedure. Postoperatively, the patient was closely monitored. Follow-up CT imaging revealed a 4x2 cm bone defect in the anterior maxilla. Additionally, mucosal contracture caused significant aesthetic deformities of the upper lip, adversely affecting facial aesthetics and oral functions, necessitating a multidisciplinary reconstructive approach (Figure 1,2).

Figure 1



Figure 2



Figure 3



Figure 4

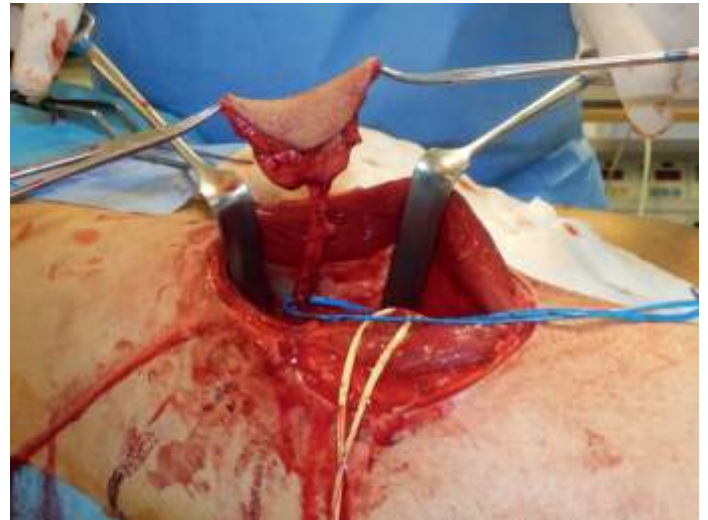


Figure 5



The reconstruction plan included the harvest of a 4x2 cm autologous bone graft from the iliac crest to repair the maxillary defect (Figure 3). To address the mucosal contracture and restore aesthetic deficiencies, a 5x4 cm mini free flap was harvested from the lower extremity and transferred to the defect area (Figure 4). Microvascular anastomosis was performed between the free flap and the right facial artery and vein. The iliac crest graft was shaped to fit the defect site and secured. The free flap was successfully transferred to the target area without complications during intraoperative circulation monitoring (Figure 5). Post-surgery, the patient was observed in the intensive care unit for one day before being transferred to the general ward.

The patient's postoperative course was uneventful. At the one-year follow-up, significant improvement in lip aesthetics, viability of the alveolar graft, and structural stability of the maxillary segment were observed (Figure 6). The free flap exhibited no circulatory issues. Additionally, the patient demonstrated marked improvements in oral and functional capacities (Figure 7,8). This case highlights the successful use of autologous bone grafts and free flaps in treating maxillofacial defects caused by gunshot injuries, underscoring the importance of a multidisciplinary approach in managing complex traumas.

Figure 6



Figure 7



Figure 8



3. Discussion

Maxillofacial defects resulting from gunshot injuries have profound functional and aesthetic consequences. Comminuted fractures and bone loss in the anterior maxilla not only compromise facial aesthetics but also impair critical functions such as mastication, speech, and respiration. Thus, treatment strategies must adopt a multidisciplinary approach tailored to the patient's specific needs⁶.

In this case, the combined use of an autologous bone graft and a free flap proved effective in addressing the 4x2 cm anterior maxillary defect. Autologous iliac crest bone grafts are considered the gold standard in maxillofacial reconstruction due to their high osteogenic potential and biocompatibility². However, the viability of these grafts in large defects depends on adequate vascularization⁷. The use of a mini free flap in this case not only corrected the mucosal contracture but also enhanced graft integration by providing vascular support. Free flaps, particularly when combined with microvascular anastomosis, effectively address both soft tissue and vascular needs, leading to successful outcomes⁸.

At the one-year follow-up, satisfactory aesthetic and functional results were achieved. Improvement in lip aesthetics indicated successful correction of mucosal contracture, while graft viability confirmed proper vascularization and structural stability. This highlights the combined utility of autologous bone grafts and free flaps as an effective option for managing complex maxillofacial defects.

This case underscores the importance of a multidisciplinary approach in the treatment of gunshot-related maxillofacial injuries. The selection of appropriate surgical techniques and materials is critical to achieving both short- and long-term success.

4. Conclusion

This report demonstrates the successful reconstruction of a complex maxillofacial defect caused by a gunshot injury using a combination of autologous bone grafting and a mini free flap. The applied surgical procedures effectively addressed both aesthetic and functional deficits. The positive outcomes observed during follow-up emphasize the importance of a multidisciplinary approach and meticulous surgical execution. This case provides a valuable model for managing similar injuries, highlighting the potential of combining autologous bone grafts and free flaps in maxillofacial re-

construction. Further research involving larger patient cohorts is warranted to validate these findings and expand their applicability.

Statement of ethics

As this study is a case report, approval from an ethics committee was not required. Written informed consent was obtained from the patient. The authors certify that they have obtained written informed consent from the patient. In the consent form, the patient agreed to the publication of her clinical information and relevant medical images in the journal. The patient understands that personal identifiers such as name or initials will not be published and efforts will be made to conceal her identity, but anonymity cannot be guaranteed.

genAI

No artificial intelligence-based tools or generative AI technologies were used in this study. The entire content of the manuscript was originally prepared, reviewed, and approved by both authors.

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Conflict of interest statement

Both authors have read and approved the final version of the manuscript and take full responsibility for the accuracy and integrity of the data presented. The authors declare no conflicts of interest.

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