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Functional and Aesthetic Outcomes in Facial Reconstructions with Multiple Composite Axial Flaps – Case Report

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ABSTRACT

The article presents a case of facial reconstruction with several facial axial flaps for a posttraumatic defect of the left upper lip, medial cheek region and left nasal wing.

The case refers to a 58-year-old patient who is hospitalized for a facial trauma which involves only the soft tissues, resulting from a car accident.

The immediate reconstruction of all the affected aesthetic units using multiple reconstructive techniques allowed the favorable resolution of the case in the shortest possible time. We used advancement and rotation orbicularis oris innervated musculocutaneous flaps for reconstruction of the left upper lip, cervicofacial cutaneous flap for the medial cheek defect and composite forehead flap for the reconstruction of the left nasal wing.

The simultaneous use of different types of flaps made possible the total healing after 4 weeks after the accident and the social and professional integration of the patient.

Complex facial trauma often involves both skeletal and soft tissue damage, presenting significant challenges in both initial management and long-term reconstruction. These injuries can result from various etiologies including motor vehicle accidents, assaults, sports injuries, and falls. Effective treatment requires a multidisciplinary approach to address the intricate anatomy and functional importance of facial structures.

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INTRODUCTION

Facial trauma encompasses a wide spectrum of injuries, from minor lacerations to severe fractures involving multiple bones and soft tissue structures. Complex facial trauma, characterized by both extensive skeletal damage and soft tissue loss, poses significant challenges in achieving optimal aesthetic and functional outcomes. The face's role in identity, expression, and vital functions such as breathing and eating underscores the importance of meticulous management of these injuries.1,2

Complex facial trauma can be classified based on the regions involved and the extent of injury: skeletal injuries (midface, mandibular and nasal fractures) and soft tissue injuries (lacerations, avulsions, burns or chemical injuries).

Accurate diagnosis is crucial for effective treatment planning and includes:

a. Clinical examination:

-Inspection: assessing for asymmetry, swelling, bruising, and open wounds.

-Palpation: identifying bone step-offs, tenderness, and crepitus.

-Functional Tests**:** evaluating eye movement, occlusion, and facial nerve function.

b. Imaging studies:

-CT Scans: Essential for detailed assessment of bony structures.

-MRI: Useful for evaluating soft tissue and neural injuries.

-3D Reconstruction**:** Assists in preoperative planning and understanding complex fractures.

Interdisciplinary consultations in facial trauma management are essential for providing comprehensive care, addressing complex injuries that often involve multiple anatomical and functional aspects of the face. This collaborative approach typically involves specialists from various fields, including but not limited to:

1. Oral and Maxillofacial Surgery: These surgeons are key players in the management of facial trauma, handling injuries related to the bones of the face, such as fractures of the jaw, cheekbones, and eye sockets. They perform reconstructive surgeries and are adept at managing both hard and soft tissue injuries.2
2. Plastic and Reconstructive Surgery: These surgeons focus on restoring both function and aesthetics. They handle complex lacerations, soft tissue reconstruction, and ensure that scarring and cosmetic outcomes are optimized.
3. Ophthalmology: When facial trauma involves the eyes or the orbital bones, ophthalmologists are brought in to manage injuries such as orbital fractures, globe ruptures, and damage to the ocular muscles or nerves. Their role is crucial in preserving vision and ocular function.
4. Neurosurgery: In cases where facial trauma is associated with head injuries or involves the cranial base, neurosurgeons are consulted. They manage concussions, skull fractures, and potential brain injuries.
5. Dentistry and Orthodontics: Dental specialists are essential when trauma affects the teeth, gums, or jaw alignment. They manage dental fractures, avulsed teeth, and occlusal disturbances.
6. Radiology: Radiologists play a vital role in diagnosing the extent of injuries through imaging techniques such as X-rays, CT scans, and MRIs. Accurate imaging is crucial for planning surgical interventions.
7. Emergency physicians are often the first to assess and stabilize patients with facial trauma. They provide initial care, manage airway compromise, control bleeding, and coordinate further specialist consultations.

   Facial reconstruction is a critical component of plastic surgery, aiming to restore both functionality and aesthetics after trauma, tumor resection, or congenital defects. Among the various techniques, the use of multiple axial facial flaps has shown significant promise. These flaps, based on specific vascular territories, provide reliable blood supply essential for the survival of transferred tissue.1,2

CASE PRESENTATION

The case presentation refers to a 58-year-old male patient who is hospitalized for facial trauma secondary to a road accident. Upon admission to the emergency department, the therapeutic protocol for polytrauma patients is applied. After the clinical and paraclinical evaluation, an interdisciplinary neurosurgery, general surgery, maxillofacial and ENT surgery consultation is required. The CT scan of the skull, thorax and abdomen and the consultations performed do not reveal injuries to the bones of the skull, brain or internal thoracoabdominal organs.

Emergency surgical intervention under general anesthesia is decided after the stabilization of the patient's general condition. The intraoperative evaluation found facial avulsion wounds with soft tissue defects at the level of the left upper lip, the medial part of the left cheek and the left nasal wing with penetration into the left nasal fossa and partial damage to the nasal columella.

During surgery we practiced debridement, lavage with antiseptic solutions and hemostasis. At the same time we decide to practice double plasty with innervated musculocutaneous lip flaps to reconstruct the upper lip. We combined this technique with a cervicofacial rotation skin flap plasty for the reconstruction of the left midcheek area and a composite auricular cartilaginous graft with frontal flap for the reconstruction of the left nasal wing. After 21 days, we sectioned the pedicle of the forehead flap and finalized its integration at the frontal area. 28 days after the trauma, the patient was completely cured.

The innervated musculocutaneous flaps used for upper lip reconstruction involved orbicularis oris advancement and rotation flaps. Vascularization is provided by the facial artery and the upper and lower labial branches. The sensory innervation is provided by branches of the trigeminal nerve, the infraorbital nerve and the mental nerve.

The motor innervation is provided by the buccal and mandibular branches of the facial nerve.

By advancing and rotating the two innervated musculocutaneous flaps of the orbicularis oris muscle, we achieved the reconstruction of the soft tissue defect of the left upper lip and the left oral commissure.

The reconstruction of the skin defect in the medial part of the cheek was performed by rotating a cervicofacial skin flap with the vascular support provided by branches from the external carotid artery. This procedure allowed the reconstruction of the entire aesthetic unit of the left midface region.

For the reconstruction of the left nasal wing, we performed a composite midline forehead flap plasty with auricular cartilaginous graft. The midline forehead flap has a pedicle between 1-1.5 cm focused on the medial portion of the eyebrow and the vascular support is provided by the supratrochlear artery and veins. The skin paddle can be positioned in the central part of the forehead in the majority of cases and must fit the size of the alar defect. The midline forehead flap is a 2 stage flap and is our preferred reconstructive method in the case of the nasal lobe and alar wings reconstructions. The frontal donor site was closed

primarily and the sectioning of the pedicle was performed 21 days after the trauma.

RESULTS

1.Functional Outcomes

Functional restoration is a primary goal in facial reconstructions, aiming to preserve or restore essential activities such as breathing, eating, and speaking. The choice of flap impacts these outcomes significantly:

- **Breathing**: Nasal reconstructions using the forehead flap maintain nasal patency and structure.
- **Eating and Speaking**: Reconstructions involving the lips using innervated musculocutaneous flap ensure adequate mobility and sensation.

2.Aesthetic Outcomes

Aesthetics in facial reconstruction encompass symmetry, contour, color match, and minimization of donor site morbidity:

- **Symmetry and Contour**: Axial flaps provide sufficient tissue bulk and can be contoured to match the defect area. The forehead flap, for instance, offers excellent tissue for nasal reconstruction, achieving near-natural contours.
- **Color Match**: The innervated musculocutaneous flap, harvested from adjacent facial region, offers superior color and texture match for perioral defects. Also, the cervicofacial flap offers the same colour and texture for the entire cheek area.
- **Minimization of Donor Site Morbidity**: Axial flaps, minimize visible scarring and functional loss at the donor site.3,4

FIG 1. A 58-year-old patient with facial trauma after a road accident. Preoperative, intraoperative and postoperative appearance at 21 days

DISCUSSIONS

The simultaneous use of loco-regional composite flaps in post-traumatic face reconstructions is the best option in the case of extensive defects of soft parts of the face. We agree that this reconstructive option ensure healing in optimal time and very good aesthetic results.

Upper lip reconstruction with innervated musculocutaneous flaps offers multiple advantages, including restored sensation and muscle function, superior aesthetic outcomes, reduced donor site morbidity, psychological benefits, and enhanced long-term results. These benefits highlight the importance of

this technique in achieving comprehensive and successful upper lip reconstruction.

The use of innervated musculocutaneous flaps can reduce donor site morbidity. By carefully selecting and harvesting the flap, surgeons can minimize the impact on the donor area. Additionally, the improved functionality and aesthetics of the reconstructed lip can reduce the need for secondary corrective surgeries, thus decreasing overall patient morbidity and healthcare costs. Musculocutaneous flaps that are innervated also offer the advantage of better muscle function. The upper lip is not only involved in sensory perception but also in motor activities such as lip movement and facial expressions. Reconstructing the lip with flaps that include muscle and nerve components helps restore dynamic function. Patients are more likely to regain voluntary movement of the lip, which is essential for articulation, mastication, and non-verbal communication.

One of the primary advantages of using innervated musculocutaneous flaps is the restoration of sensation. The upper lip plays a crucial role in sensory perception, which is important for various functions such as speaking, eating, and expressing emotions. By utilizing flaps that include nerve innervation, surgeons can significantly enhance sensory recovery in the reconstructed lip. This improvement in sensation contributes to a more natural and functional outcome.5,6

As surgical methods and understanding of tissue integration continue to advance, the use of innervated musculocutaneous flaps is likely to become an increasingly standard practice in the field of reconstructive surgery.

Even if the operating time is longer due to the complex approach together with other specialties or the simultaneous use of several plasties with axial composite flaps, the aesthetic and functional results are better compared to other staged facial reconstructions.

Long-term outcomes of upper lip reconstruction are significantly improved with the use of innervated musculocutaneous flaps. These flaps tend to integrate better with the surrounding tissues, providing durable and lasting results. The reestablishment of nerve and muscle function ensures that the reconstructed lip maintains its dynamic capabilities over time, reducing the likelihood of complications such as atrophy or fibrosis.

The use of the forehead flap in nasal alar wing reconstruction offers numerous advantages, making it a valuable technique in reconstructive surgery. Its excellent vascularity, aesthetic compatibility, versatility, structural support, low donor site morbidity, reliability, and potential for single-stage reconstruction make it a superior choice for achieving optimal functional and cosmetic outcomes. As a result, the forehead flap remains a cornerstone in the armamentarium of reconstructive surgeons aiming to restore both form and function to patients with nasal alar defects.

The forehead flap offers great versatility in design, allowing surgeons to tailor the flap to the specific requirements of the defect. The length, width, and orientation of the flap can be customized to ensure precise coverage of the nasal alar defect. This adaptability is crucial for addressing the unique contours and dimensions of the nasal alar region, providing optimal functional and cosmetic outcomes.7,8

CONCLUSIONS

The use of multiple flap techniques in facial reconstruction represents a significant advancement in reconstructive surgery. By employing a variety of flaps tailored to the specific needs of the defect, surgeons can achieve superior results, enhancing both the cosmetic appearance and functional capacity of the patient. Continuous innovation and collaboration among surgical teams are essential to further improve outcomes and expand the possibilities of facial reconstruction.

Loco-regional flaps are a versatile and effective option for the reconstruction of extensive post-traumatic facial defects. Through meticulous planning and execution, these flaps can restore both form and function, significantly improving the quality of life for patients affected by facial trauma. As techniques continue to evolve, the outcomes of facial reconstruction using local and regional flaps will undoubtedly become even more refined and successful.

Facial reconstruction is a complex surgical endeavor aimed at restoring the form and function of the face following trauma, tumor resection, or congenital defects. One of the most effective methods employed in this field is the use of multiple flap techniques, which involve the transplantation of tissue flaps from various parts of the body to the affected facial areas.

Facial trauma can result in extensive defects that pose significant challenges for reconstruction. The goals of facial reconstruction are not only to restore the structural integrity and aesthetics but also to recover the functional aspects such as speech, mastication, and expression. Loco-regional axial flaps have become a cornerstone in the armamentarium of reconstructive surgeons due to their reliability, versatility, and ability to provide well-vascularized tissue that matches the texture and color of the facial region.

The simultaneous reconstruction of the upper lip, cheek and left nasal wing using axial composite flaps ensures the best aesthetic and functional result, quick healing and socio-professional integration of the patient.

Facial reconstruction with multiple axial flaps is a sophisticated approach requiring careful planning and execution to ensure successful outcomes in extensive facial defects. The technique's success hinges on understanding the vascular anatomy, precise surgical skills, and diligent postoperative care.

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