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CASE REPORT
Reconstructive

Prosthetic Facial Reconstruction in a Blast Injury Case

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Summary: The management of blast and burn injuries to the facial soft tissue and craniomaxillofacial skeleton has been a challenge since the inception of reconstructive plastic surgery. These injuries continue to present complex reconstructive challenges today. While there have been advancements in free tissue transfer and vascularized composite allotransplantation, prosthetics have been used successfully since antiquity until the present day. Prosthetics may achieve acceptable coverage without complex surgery or as an adjunct to reconstructive surgery. Here, we report a case of devastating blast injury to the face that has been managed successfully with orbital prosthetics anchored with osseointegrated implants. *(Plast Reconstr Surg Glob Open 2020;00:e3255; doi: 10.1097/GOX.0000000000003255; Published online 23 November 2020.)*

High energy craniomaxillofacial trauma from conflict zones continues to be a challenging problem. Technological advancements in conventional and chemical weaponry has increased the incidence of complex traumatic injuries. Advancements in personal protective equipment have been made as well, but much of this research has been devoted to body armor, leading to a disproportionate rate of head and neck injuries.[1] The Joint Facial and Invasive Neck Trauma (J-FAINT) Project revealed not only that orbital fractures were the most common facial fracture, but that incidents of orbital fractures have significantly increased from previous data.[2] These findings highlight the need for the continued development of techniques to safely and efficiently reconstruct the orbit and periorbital tissues.

Orbital repair options vary upon etiology and extent of injury. Reconstruction is dependent on not only the tissue defect but on patient compliance and ability to tolerate postoperative care as well. This case report details orbital reconstruction utilizing a prosthetic in a low-compliance young adult male who suffered a devastating traumatic blast injury.

CASE REPORT

A 29-year-old African male refugee presented to us for facial reconstructive surgery. He suffered a blast injury as a bystander in an explosion that resulted in facial disfiguration, vision loss, and chronic orbital wounds. He was triaged and 6 months later underwent partial reconstruction in Egypt before being transferred to the United States.

Physical examination revealed significant scarring of the forehead and midface. The frontal area had evidence of a residual large bony defect and was covered by intact but depigmented skin grafts (Fig. 1A). Ophthalmologic examination revealed residual draining conjunctival tissue. A CT scan was performed, which delineated the frontal bony defect and confirmed the presence of residual globe structures bilaterally.

A multidisciplinary team was assembled to discuss the available options and assess the patient's reconstructive goals. The patient's main concerns were restoration of vision, which obviously was not possible, and the establishment of normal social interactions, which, due to his appearance, were extremely limited. After discussing all possible reconstructive options for achieving a normal appearance, with the patient and considering all the risks and benefits associated with them, we opted to forgo a more complex reconstruction and proceed with using an osseointergated facial prosthetic.

SURGICAL PROCEDURE

The procedure was performed in 2 stages. First, the orbits were debrided and full exenteration (including the lacrimal glands) was performed. A thin but well-vascularized soft tissue bed was retained. Solid bone stock at the orbital rim was used for placement of osseointegrated implants. Two implants were placed on each rim. Shaped full-thickness skin grafts were then used to resurface each orbit. Bolsters were placed over the grafts. At 1 week, the bolsters were removed and successful resurfacing was appreciated (Fig. 1B).

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Fig. 1. Pre- and postoperative photographs of a 29-year-old male patient who had survived a blast injury. Pre-reconstructive appearance of the patient (A). Patient appearance after the first operative stage bilateral orbital exenteration, placement of orbital rim osseointegrated implants, and shaped full thickness skin grafting for superficial orbital resurfacing (B).

Fig. 2. Patient appearance after the second operative stage, consisting of partial orbital flaps' re-elevation, and debulking and placement of transcutaneous screw fixture (A). Patient fitted with his final prosthetic firmly attached to the osseointegrated implants, with normalization of the facial appearance (B).

Four months later, the patient was taken to the operating room for the second stage. Orbital skin flaps were partially re-elevated to access the previously placed osseointegrated implants. The protective caps covering the posts were removed and permanent transcutaneous screw fixtures were placed. The skin flaps were debulked to allow the implants to protrude farther and to ease the attachment of the prosthetic. Bolsters were applied over the area of dissection to prevent fluid accumulation and allow skin flap re-attachment (Fig. 2A).

Once healing occurred, molds were taken by the anaplastologist and fabrication of the prosthetic was undertaken. The prosthetic covered both orbital areas, the nasal radix, and the forehead (**See figure, Supplemental Digital Content 1,** which displays the custom prosthetic covering both orbital areas, the nasal radix, and the forehead. http://links.lww.com/PRSGO/B509). The patient was subsequently fitted with his final prosthetic that firmly attached to the osseointegrated implants. Normalization of the facial appearance was achieved (Fig. 2B).

DISCUSSION

Herein we describe the reconstruction of a young man who suffered significant facial injury and blindness as a result of a blast injury. Reconstructive surgery has been rooted in armed conflicts since its inception. In World War I, Sir Harold Gillies pioneered the field of the reconstruction of post traumatic facial injuries. He used skin grafts, local flaps, and tubed pedicle flaps to establish soft tissue coverage of traumatic defects.[3,4]

The goals of reconstructing orbital exenteration defects are to achieve stable soft tissue coverage and often separate the central nervous system from the aerodigestive tract, preventing osteomyelitis and central nervous system infection. In the case of oncologic reconstruction, this is often achieved with free tissue transfer. This is beneficial, as reconstruction is possible in the setting of radical resection that removes any orbital vascularized bed with ability to accept grafts.[5,6] In addition, the patients have a high likelihood of undergoing radiation therapy better tolerated by the newly transferred tissue. Nonetheless, normalization of the appearance when free tissue transfer is used is usually not achieved. In the case presented here, the limitations encountered in oncologic cases were not present. Skin grafting for orbital resurfacing was possible due to the presence of a vascularized wound bed at the time of the reconstruction. The fabricated custom prosthetic provided an excellent skin color match and simulated a normal appearance. By utilizing the prosthetic, the patient's goal of re-establishment of normal social interactions was achieved, as after the reconstruction, the patient was comfortable enough to venture into public places without the fear of embarrassment.

Prosthetics have been used in head and neck reconstruction since antiquity.[7] There are several options for prosthesis retention, including eyeglass, adhesive, magnetic and osseointegrated implants. There are many benefits to the use of osseointegrated pins, including eliminating the need for adhesive, less dermal irritation, less malposition with sweating and temperature change, and less degradation of prosthesis with daily reapplication.[8,9] Orbital implant survival rates vary from 59% to 73%; they are the highest risk of craniofacial osseointegrated implants.[8] Mean survival time for orbital implants is 13.4 months.[10] Classically constructed prosthetics can cost upward of $4000; however, 3-dimensional printing has been reported to decrease this cost.[11] Ongoing costs associated with maintenance of the prosthetic should be expected, as paint reapplication is recommended every 2 years to maintain the original color.

While prosthetics are often lower in the plastic surgeons' reconstructive algorithms, they have continued and will continue to play a role in select patients.

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PATIENT CONSENT

The patient provided written consent for the use of their images.

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