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MANAGEMENT OF POST-TRAUMATIC DEFORMITIES USING VIRTUAL 3D IMAGING

Dentistry

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ABSTRACT

Over the past 20 years, there has been a growing interest in a systematic restoration strategy for post-traumatic facial form and functions. Two popular management sequences for panfacial fractures are "bottom up and inside out" and "top down and outside in." However, organizing and sequencing the repair of these fractures can be challenging. This is a case of a 20-year-old male with complicated orbital and skull malformations who was assessed and treated using advanced computer technology, including 3D imaging. The patient had crippling diplopia in every area of vision, and the normal orbit was mirrored to accurately direct the globe's repositioning, orbital reconstruction, and cranioplasty.

KEYWORDS

Pan facial Fracture, Orbital Floor Defect, Midface Fracture, 3D Imaging

INTRODUCTION

Pan facial fracture includes the multiple fracture of facial bone in which the maxilla, zygomatic complex, and naso-ethmoid-orbital region are the most typical bone that fractures with mandible. [1-3] An experienced surgeon would find it difficult to operate due to multiple fragments and loss of reference points, which otherwise guide the facial reconstruction. This multiple bony injury is often associated with soft tissue injury, destruction of facial bony framework, and malocclusion. The facial deformities referred to as “dish” face deformity have a loss of facial height or projection with increased face width and enophthalmos. There are varying techniques for the management of these types of fractures. [4,5]

Frontal and palatoalveolar fractures are defined by Markowitz & Manson [6] as prolonged injuries of pan facial fractures. Reconstruction should be handled like a puzzle when there are several facial fractures affecting the top and lower face. In recent years, surgical techniques for Pan facial fractures have evolved. The introduction of cavarial or iliac crest bone grafts for repair, high-resolution computed tomography, rigid fixation systems, [7] and extensive exposure of fracture sites have all improved the situation. The face's breadth, anteroposterior projection, and vertical height are all reconstructed in three dimensions. Persistent deformity is frequently caused by unstable fixations and an inability to visualize all fractures directly. Nevertheless, despite aggressive treatment, some residual post-traumatic deformity may persist, which may warrant a second correction surgery.

Epidemiology Of Pan Facial Bone Fracture

Since the face framework is made up of many bones, the more quickly trauma occurs, the more bone is destroyed and fragmented; as a result, high-energy injuries such as those from gunshots or traffic accidents—are the most prevalent cause of pan facial injuries. For all face fractures, this type of damage occurs 4–19% of the time.

History Of The Management Of Panfacial Fractures

The ideas for managing pan face injuries were developed by craniofacial surgeons in the early 1980s and 1990s. These principles included extensive exposure and direct visualization for the purpose of aligning and reducing the craniofacial bones. The order of restoration and rehabilitation is affected by the use of these principles. [6] The restoration of the facial skeleton is emphasized by the concepts of facial buttresses and pillars, and the reduction of frontal bone is followed by the alignment of mid-facial bones in the reconstruction of pan facial injuries. [6]

The lower face is built from top to bottom using the maxillary framework as a template. Because of the benefits of rigorous internal fixation, the surgeon starts the reduction process from the condyle, proving the posterior face height. This height restoration enables the mandible, the strongest bone in the facial skeleton, to be employed as a template. [6,8] As a result, the top sequence is currently most frequently utilized in treating craniofacial surgery.

Case Report

A year ago, a 20-year-old male reported to the Adithri oral and maxillofacial centre, with frontal bone fractures, zygomatic fractures, and a complicated left orbital rim fracture after a motorbike accident. The patient was reliant on one eye for all tasks and had crippling diplopia and frequent nausea while using both eyes. Left enophthalmos, left lateral canthal displacement, ectropion of the lower eyelids, vertical orbital dystopia, and a laterally and inferiorly displaced, comminuted zygoma with many bone abnormalities were all seen during the preoperative assessment.

He had periorbital scarring and a drooping look in the left upper and midface. Although correcting diplopia was the patient's main therapy objective, he also wanted his face to look better. Le-forte II facial fractures involving the left maxillary bone with palatal split, left nasal orbital ethamoidal (NOE) bone, and left symphysis bone with avulsed tooth were discovered by clinical examination and radiographic analysis irt 41,31,32,33. For preoperative planning and diagnostic evaluation, cutting-edge 3D computer technology was used (Fig 1,2). Written informed consent was acquired once the patient was made aware of the necessity of surgical intervention. Every standard blood test that is necessary for surgery to be performed under general anesthesia was completed.

Figure 1

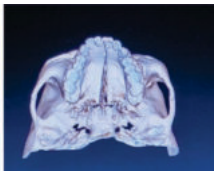

Figure 2

Figure 3

IMF was done before starting the surgery. Local infiltrations were given of local anesthesia containing lignocaine HCL in 1:80,000 dilutions of adrenaline. Patient underwent open reduction and internal fixation of the panfacial fractures using lower degloving incision for left symphysis, and fracture was stabilized using sterilized AO titanium plates and screws at every fracture site for fiaxation of bone. The fractures were reduced under general anaesthesia, the patient underwent tracheostomy to secure his airway before starting the operative procedures. (Fig 3) Following this the patient underwent bicoronal and lower eyelid incisions to provide sufficient exposure of the fractured site and easy fixation.

The Frontal Bone Fractured Segments Were Fixed Using:
1- double y mini plate
1- L shaped mini plate and multiple titanium miniplates with screws. (Fig 4)

Figure 4

The orbital rim fracture was fixed using a subciliary–lower eyelid incision. (Fig 5)

Intra oral vestibular incisions were given at the left maxilla just above the left central incisors extending up to the molar region, the flap was raised, and the zygomaticomaxillary complex fractured was reduced and fixed. (Fig 6) After the fixation of the fracture with titanium AO miniplates was done, the site was closed with 3-0 vicryl and 4-0 ethilon. The palatal split was managed by traction wiring with closure of the ora-antrum fistula with 3-0 vicryl followed by a palatal plate. Oral hygiene was maintained using chlorhexidine irrigation.

The patient was recalled after 8 days, and his pressure dressings were removed. (Fig 7) He was followed up to 3 months, and he was satisfied with his appearance and had no complaints. Postoperative medications were advised, including antibiotics and analgesics.

Extra oral sutures were removed after a week. The patient recovered with uneventful healing. The patient was advised to have a soft diet for one month. Postoperative stability and functions were satisfactory, with an imperceptible scar. (Fig 7)

A second stage surgery was done under general anaesthesia for retrieval of titanium miniplates after 4 months of surgery on complete uneventful healing of bones followed by Dio dental implant (in second stage surgery) in the region of lower left incisors and canine.

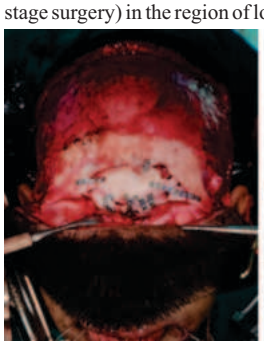

Figure 5

Figure 6

Figure 7

The pan facial fracture is simultaneous, including the cranium (lower, mid and upper third of face) and mandible. [9,10] The reduction and fixation of these fractures are aimed at the rehabilitation of patients' functional, anatomical structures and three-dimensional contours of the face. [7,11,12] The Patient's history tells the cause and mode of injury, which gives an idea about the level of force delivered to the bone and the extent of injury. Since pan facial trauma involves multiple bones of the face hence it is associated with several vital senses and organs, so often involving other speciality references too. [13]

Markowitz claims that the frontal and palato-alveolar bone fractures cause the pan facial trauma to be more severe. The face's structure is formed by the horizontal and vertical buttresses, which also aid in transferring masticatory power to the base of the skull. The pressures are absorbed by the face buttresses, which stop them from reaching the brain. Since the face's buttresses resemble pillars, they must be appropriately reduced and stabilized to fully restore the structure and profile of the face. The middle part of the face has anatomical and functional stability when the facial skeleton is properly aligned. With all these bony structures, complete attention is also required for nasal projection in NOE fracture as it can alter the facial profile, left uncorrected may led to saddle nose deformity, epiphoria, telecanthus etc. [7,14,15]

It has frequently been noted that facial injuries in RTA cases are typically bilateral. In these situations, the intubation route may switch from oral to any other because it may make it more difficult to manage the injury. For this reason, submental intubation is the most recommended method and is simple to perform without the need for highly specialized equipment. According to Robert Marciani, patients with pan-facial trauma should be treated as per Advanced Trauma Life Support (ATLS) recommendations.

In this case report, we followed the same procedure after the clinical assessment, imaging modalities to confirm the diagnosis, and surgery. Surgical intervention must be performed early to prevent post-operative deformities and unsatisfactory aesthetics. Following four days of trauma, the patient had surgery after receiving full clearance from the medical, neurosurgical, and other specialist departments. [13,14] In this instance, local incisions were done upon intubation rather than a coronal incision, which might have resulted in issues such as scar alopecia and sensory difficulties. By fixing the maxillomandibular joint, occlusion was accomplished, and the maxilla was brought into alignment. Michelet observed that mini plates were successful in stabilizing and fixing the Naso orbito-ethmoidal complex. [13,16,17]

CONCLUSION

Pan facial trauma requires extensive anatomical knowledge and experience for maxillofacial surgeons. Miniplate osteosynthesis is a minimally invasive procedure for treating panfacial fractures. Early intervention and corrective procedures may be necessary for complicated facial injuries. The main goals are to restore orbital, oral, and nasal cavities and achieve proper facial frame connections. Contemporary 3D technology can accurately design surgical repairs for complicated periorbital abnormalities and manufacture personalized bone implants. Further research is needed to improve severe periorbital traumatic repair results.

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