



Three Dimensional Plates in the Fixation of Mid Face Fractures: A Case Series

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Three dimensional plates (3D plates), mid face fractures, semi rigid fixation.

ABSTRACT:

Maxillofacial trauma refers to any injury to the face and jaw. These injuries are common in motor vehicle accidents, assaults, fall and sports injuries. Improperly treated maxillofacial trauma can lead to functional, aesthetic and psychological complications. These may arise due to incomplete healing, mal-alignment or inadequate reduction and fixation of facial structures. The method of fixation can range from a simple closed reduction to open reduction requiring the use of non or semi rigid and rigid fixations. Three dimensional plates are commonly used for the fixation of mandibular fractures, but their application in management midface fractures remains relatively under explored. This case series presents three reports highlighting the applications of three-dimensional plates in fixation of midface bone fractures.

1. Introduction

Maxillofacial trauma refers to any injury to the bones and soft tissues of the face or jaw. Maxillofacial region is a complex anatomical region which houses vital structures such as brain, eyes, nose, airway and oral cavity thus, trauma to these structures may lead to various functional, aesthetic and psychological consequences.

Trauma of the midface region involves the soft tissue, dentoalveolar, and bony components of the skull including the maxilla, the zygomatic bone, the naso-orbital and naso-ethmoid (NOE) complex as well as supraorbital structures^[3]. Adequate knowledge in terms of anatomy, pattern of fractures and various techniques of osteosynthesis are required for a successful treatment of these fractures. The correction of occlusion, bony prominences and buttresses that act as supporting pillars is imperative for a successful treatment and is regardless of the severity and the fracture type. The aim of any definitive surgical therapy is to restore the architecture of the skeletal structures in terms of width, height, and sagittal projection^[3].

Improper reduction and fixation often lead to posterior and inferior translational movement of the mid face segment causing post operative deformities like the “dish face” deformity, especially seen in cases of Lefort II or III type. Zygoma fracture displacements are analyzed in

terms of their rotation in vertical axis-yaw or longitudinal axis-roll, to predict stability following closed reduction and relation to a spatial coordinate system to predict the ideal hardware application for reconstruction of load paths^[5].

The three-dimensional miniplate system was pioneered by Farmand to enhance stability in maxillofacial fracture management. The plates are positioned perpendicular to the fracture line. With screws adapting plate without dissipating any tension to the underlying bone. This cross-linking aids in stability. However, other added advantages over conventional 2-dimensional plates are easier to adapt, requires minimal tissue dissection. The biomechanical and technical advantages of 3D miniplate systems over 2D miniplate system popularizes its use in recent times. ^[2]In this paper we have highlighted three cases in which open reduction and internal fixation of the mid face fractures were done using 3 dimensional plates.

2. Case report

Case 1:

A Case of unilateral Lefort I fracture. Fracture site was exposed using vestibular incision and reduced and fixed. A three-dimensional plate was used in the zygomaticomaxillary buttress region.



Fig 1 : fracture site after exposure



Fig 2: reduction and fixation of the fracture



Fig 3: post operative clinical pictures of the patient and OPG showing satisfactory results

Case 2:

A case of Lefort II fracture for which open reduction and internal fixation was done, where a 8-hole Three dimensional plate was used to stabilize the zygomaticomaxillary buttress region.

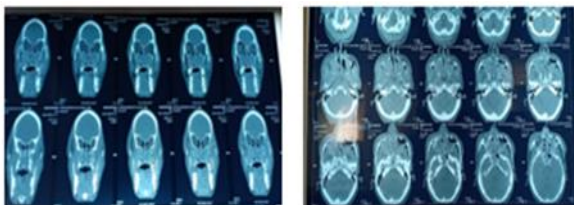


Fig 4: Preoperative CT scans showing Lefort II and left ZMC fractures

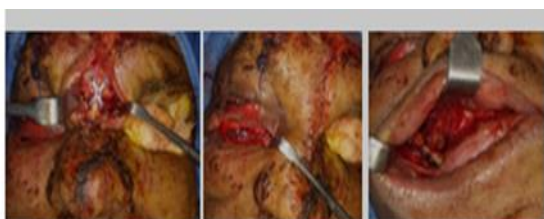


Fig 5: Fracture site exposed, reduced and fixed using mini plate system.



Fig 6: Left zygomatic buttress region exposed using vestibular incision, fractured segments were reduced and fixed using 3-dimensional plate.

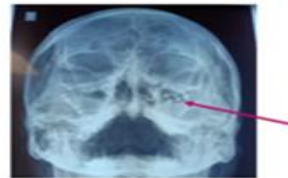


Fig 7: Post operative radiograph

Case 3:

A case of left ZMC and mandibular fracture. Three - dimensional plate was used to stabilize the body of the zygoma.



Fig 8: Fracture site exposed using infraorbital incision.



Fig 9: fracture reduced and fixed using 3-dimensional plate



Fig 10 : Post operative Orthopantomogram



Discussion:

Midface consists of nasal, ethmoidal, palatal, sphenoid, zygomatic, and maxillary bones, and associated paranasal sinuses. These bones combine in such a pattern as to give rise to a light weighted construction with reinforced trajectories.^[3]

The buttresses are regions of increased bone thickness that reinforce the structural integrity of the face. They support essential functional units, offering a protective framework for delicate soft organs like the eyes, brain, airway, and masticatory apparatus. By shaping the contours of the face, they influence the projection of overlying soft tissues, ultimately defining facial height and width.^[11]

The aim of fracture reduction is the restoration of original form and function, this is only possible when the fracture fragments are fixed adequately so as to ensure their immobilization. Failure to achieve these conditions of healing results in infection, malocclusion, nonunion or malunion. Complications such as loss of facial width/projection, trismus, malocclusion, ocular entrapment, and significant enophthalmos requires management through open repair.

The limitations of conventional mini plate and other treatment modalities led to the development of the three-dimensional plating system for fracture management, introduced by Farmand in 1992. The geometric configuration of these strut plates provides enhanced three-dimensional stability and improved resistance to torsional forces. Ideally a three-dimensional plate is positioned along the structurally weaker lines, avoiding the primary lines of compression and tension. In a recent study it was found that the stability is gained over a defined surface area of contact created by the quadrangular configuration of the plate irrespective of plate thickness or its length.

In a recent literature review, it was found that three dimensional plates are relatively superior when compared to conventional plating system having properties like reduced intraoperative time, enhanced stabilization and resistance, improved biocompatibility, and fewer postoperative complications.^[12]

Similar results were obtained in our experience too, out of the three cases discussed here in 2 cases 3D plates were placed along the ZM buttress and in one case on the

Zygomatic body. Occlusion was satisfactory in 2 cases; another was a case of ZMC fracture. There were no neurosensory disturbances, infection, wound dehiscence in any of cases.

Conclusion:

Thus, from the clinical experience, it can be inferred that the use of 3D plates in the management of midface fractures gives good results in term of function, esthetics and acceptability.

However, Randomized controlled trials comparing 3D with the semi-rigid fixation with long term follow up are recommended.

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