

# Miniplates for osteosynthesis of middle facial fractures



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## INTRODUCTION

Numerous biomechanical studies illustrate the stability of the rigid fixation for mandibular fractures <sup>4-6</sup>. However, little research has focused on the maxilla, despite the fact that Le Fort fractures and osteotomies are common clinical presentations. For the treatment of Le Fort maxillary fractures, the primary aims include the restoration of correct midfacial vertical height and anterior projection and restoration of occlusion. Nonetheless, the removal rate of the miniplates and screws were approximately 50% in orthognathic surgery (Le Fort I osteotomy), due predominantly to infection or wound dehiscence <sup>7</sup>. The other problem is that patients sometimes complain of weak clenching after the operation, therefore questions regarding minimum number of plates and stability following fixation have risen in recent times.

Miniplate osteosynthesis, developed by Champy in 1975 <sup>1</sup>, is today's standard for the treatment of facial fracture. More recently resorbable plates <sup>2</sup> and screws and 3-dimensional miniplating system <sup>3</sup>, have been introduced for fixation of facial fractures. Many studies have proved the efficacy of three dimensional plating systems in mandible fractures but very little research have been carried out on midface fractures. We studied the efficacy of three dimensional plates in midface fractures and found them efficacious enough to stabilize the bone fragments during osteosynthesis.

Three dimensional miniplating system was introduced by Farmand (1992) <sup>3</sup>. The basic concept of three-dimensional fixation is that a geometrically closed quadrangular plate secured with bone screws creates stability in three dimensions. The three dimensional plates are positioned perpendicular to the <https://assignbuster.com/miniplates-for-osteosynthesis-of-middle-facial-fractures/>

fracture line. The screws adapt each part of the plate separately without any tension to the bone. The cross linking provides the stability to the system. Three dimensional miniplates are easy to adjust, requires minimal tissue dissection thus least disturbing the blood supply and because of its design fixation points remain in the vicinity of fracture line. Its low profile design and space between plate holes permits excellent revascularization.

The biomechanical and technical advantages of three dimensional miniplate systems over two dimensional miniplate system promoted the current study to evaluate the efficacy of the 3-D titanium miniplates as a viable treatment modality in the osteosynthesis of middle third facial fractures.

#### MATERIAL AND METHOD

Subjects for the present study were selected amongst the patients, attending the outpatients department and emergency services of Department of Oral & Maxillofacial Surgery, Kothiwal dental college and research centre, Moradabad.

Study comprised of thirty patients, with isolated lefort I fracture, 20 patients had bilateral fracture and 10 patients had unilateral lefort I fracture . All patients were taken up randomly irrespective of age, sex caste and creed.

Patients were diagnosed on the basis of clinical examination and radiographic interpretation. Preoperative evaluation included careful examination of the soft tissues and underlying skeleton. A thorough physical examination was carried out to exclude any other injuries.

All selected patients were informed about the experimental nature of the study and the possible complications were explained. Their co-operation was solicited and informed consent was obtained. The patient received prophylactic antibiotic coverage and analgesics at the time of initial presentation.

## INVESTIGATIONS

Radiographs: The following radiographs were used to confirm clinical diagnosis and to assess the exact location of fracture and degree of displacement

- Occipitomental view and submentovertex view for midface
- PA - Mandible view
- OPG view (Orthopantomogram)
- CT scan as needed

## Other investigations

- Routine Blood investigation Urine analysis
- Urine analysis

## TREATMENT PLANNING

All patients were admitted to the hospital prior surgery. Erich's arch bar were placed on upper and lower standing teeth to stabilize the fracture segment and to achieve occlusion before plating.

## ARMAMENTRIUM

1. Basic instrument set for maxillofacial surgery

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2. Instrument used for intermaxillary fixation

### 3-DIMENSIONAL TITANIUM MINIPLATE - 1.7 MM SYSTEM

## **PLATES**

**DESIGN: 4 different designs of three-dimensional titanium miniplates were included.**

1. 2Ñ...2 holed - square plate
2. 2 x 2 holed - rectangular plates
3. 3 x 2 holed - continuous rectangle or double rectangle
4. 4x2 holed -continuous rectangle plate

All the plates had 1.7 mm diameter holes.

## **PROFILE HEIGHT**

0.6 mm (low profile plates)

## **SCREWS**

Non compression, self-tapping, monocortical screws with round head.

Diameter : 1.7 mm

Length : 5mm, 7mm and 9 mm

***DRILL BIT : Diameter: 1.2 mm***

### CONVENTIOANAL TITANIUM MINIPLATE - 1.7 MM SYSTEM

1Ñ...2 holed - straight plate

## **PROFILE HEIGHT**

1.0mm

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## **SCREWS**

Non compression, self-tapping, monocortical screws with round head.

Diameter : 1. 7 mm

Length : 5mm, 7mm and 9 mm

## ***DRILL BIT : Diameter: 1. 2 mm***

## **ACCESSORIES**

1. Screwdrivers
2. Bone plate holding forceps
3. Bone plate bending forceps
4. Plate cutting pliers

## **OPERATIVE TECHNIQUE FOR THREE DIMENSIONAL MINIPLATES**

Patients were operated either under general anesthesia (Naso-tracheal intubations) or local anesthesia. Strict asepsis was followed.

In this study, the fracture sites were exposed through standard intraoral vestibular incision.(Fig. 1),

Following reduction of the fragments and temporary maxillomandibular fixation, a suitable 3D plate was selected and bent with a plate bending pliers to conform the proper adaptation of plates to bone surface.

The three dimensional titanium miniplates were then positioned in such a way that the horizontal cross-bars were perpendicular to the fracture line and the vertical ones were parallel to it (Fig. 2). Holding the plate perpendicular to the reduced fracture, drilling was performed through the <https://assignbuster.com/miniplates-for-osteosynthesis-of-middle-facial-fractures/>

hole in the plate strictly perpendicular to the bone surface. The drilling was performed at slow-speed along with copious saline irrigation to prevent damage to the bone by heat. To avoid injury to the dental roots the superior holes were drilled strictly monocortically, and directed into the space between the roots.

Later screws of suitable length were selected for fixation of the plate. In each case the upper screws were tightened first, followed by the lower ones. For screw tightening the rotations were executed using the screw-holding screw driver.

Maxillomandibular fixation was released and occlusion was checked by moving the lower jaw. The site was closed using 3-0 silk suture material. No maxillomandibular fixation was required in any of the patient.

#### OPERATIVE TECHNIQUE FOR THREE DIMENSIONAL MINIPLATES

Operative technique for conventional plate was similar to the one used for three dimensional miniplate. Intraoral vestibular incision was used in all the patients and after fracture reduction either conventional 2 dimensional L shaped plate was fixed at zygomaticomaxillary buttress region and 2 hole with gap miniplate was placed over nasomaxillary buttress region.

#### POSTOPERATIVE MANAGEMENT

Postoperative course of medication consisted of injection ceftriaxone 1gm 12 hourly (i. v.), injection metrogyl 100ml 8 hourly (i. v.) and analgesic and multivitamin preparation continued till 5<sup>th</sup> postoperative day. All patients

were put on liquid diet for first 2 weeks. All patients were encouraged to maintained good oral hygiene. Sutures were removed on the 7<sup>th</sup> postoperative day. All patients were followed up at regular interval that is at 1st week, 3<sup>rd</sup> week, 6<sup>th</sup> week and 3 month postoperatively regarding restoration of function, stability of system used and any complication.

*Assessment of the patients was done under following parameters:*

1. *Pain* - Visual Analogue Scale (VAS) (0-10)
2. *Swelling* -present/absent.
3. *Occlusion* - intact/deranged
4. *Mobility of fracture segment* -present/Absent
5. *Infection/wound dehiscence* -present/Absent
6. Hardware failure - present/Absent

## STATISTICAL ANALYSIS

The following statistical tools were employed for the present study:

Mean, Standard Deviation, Student't' test, Paired' t' test and Chi-square test

## RESULTS

We obtained following results in our study

1. Patients in the 31-40 years of age were the predominant age group presenting with midface fractures (50%).
2. Males were most commonly affected with Lefort I fracture (92. 84%).
3. The most common cause of midface fracture was found to be road traffic accident (92. 8%).



4. There is significant decrease in pain at 3 WK, 6 WK and 3<sup>rd</sup> Months from the Baseline (1WK) for both the groups
5. Swelling was present in 15 patients (50%). It decreased significantly at 3W, 6WK, 3 MONTHS, from baseline (1WK)(fig. 3)
6. There is significant improvement (75%) in post traumatic Parasthesia of infraorbital nerve following fixation with 3-D plating system.(Fig. 4)
7. Occlusion was achieved in all the patients after surgery
8. No sign of infection and hardware failure was present in any patient.

## DISCUSSION

Le Fort I maxillary fractures are among the injuries encountered most frequently in patients who suffer facial trauma and it is common in orthognathic surgery. Fixation of maxillary Le Fort I fractures(/osteotomy) by RIF of the facial skeleton has become an accepted, and even expected, form of treatment. When the teeth of the maxilla and mandible are clenched, anatomic support for the midface is provided through a series of buttresses or struts that distribute masticatory forces from the teeth to skull base. 19-21 The vertical struts of the midface are clinically

the most important in management of Le Fort I maxillary fractures. The 3 principal vertical buttresses of the maxilla are the nasomaxillary (medial) buttress, zygomaticomaxillary (lateral) buttress, and the pterygomaxillary (posterior) buttress. 4 The internal fixation of Le Fort I fractures should use miniplates and screws and be fixed at anterior and lateral buttresses for the ideal internal fixation, whereas the posterior buttress should be without fixation due to the surgical difficulty of the operative approach. 4 Surgical

treatment of Le Fort I fracture according to the “ ideal internal fixation” produces satisfactory results, but patients sometimes complain of weak clenching after the operation. Very few comparisons of the different maxilla fixation modalities and their behavior have been reported currently. In clinical Le Fort I fracture treatment, restoration of the correct midfacial vertical height and anterior projection and restoration of occlusion are critical.

Therefore, questions have arisen regarding the stability and number of plates required of adequate fixation of lefort fractures.

The fixation of 2 miniplates on each side as suggested by AO/ASIF, provides adequate stability and conventionally it has been the standard treatment for lefort fractures ,

Farmand <sup>8</sup> in 1992 developed new titanium miniplate system that takes advantage of biogeometry to provide stable fixation and he called it as three dimensional plating system. A geometrically closed quadrangular plates secured with bone screws creates stability in three dimensions. . These plates have low profile design, excellent biocompatibility, and minimal rebound after bending.

The present study was carried on patient’s age group 10- 50 years with the mean being 33. 14 years. The maximum number of patients were in a age group between 31- 50 years (nearly 50%). This is in accordance with the study of Khateeb T, Abdulla FM(2007) <sup>9</sup> .

There was predominance of males in this study, male is to female ratio being 13: 1, and percentage of male patients being 92%. . Motamedi MH(2003) <sup>10</sup> observed in a retrospective study on 237 patients, percentage of male patients being 89% and that of female patients being 11%, our study is in accordance with this study.

In this study road traffic accident (92%) were found to be the major etiological factor for the fracture of the middle third of the facial skeleton . These findings coincides with the findings of, Iida S, Kogo M11 who reported road traffic accident to be the most common cause of injury in a retrospective analysis of 1502 patients with facial fractures.

In the present study it was observed that among the maxillary fractures, Lefort II fractures( approx78%) were most common, this finding is in accordance with the study Motagemi MH (2003) <sup>10</sup> which reported the incidence of Lefort II fractures to be 54. 6% among all maxillary fractures in a five year retrospective study on 237 patients .

In the present study, post traumatic parasthesia of the infraorbital nerve was present was present in 4 cases (57. 14%) (out of the 7 patients with zygomatic complex fractures) which was clinically inferred as compression of nerve by fracture fragments . Anesthesia was relieved in 3(75%) out of 4 patients in a three month follow up period which found to be due to infra orbital nerve relieved from compression by means of reduction of fractured segments in to its correct position. c. Demen et al (1988) <sup>12</sup> reported the presence of sensory disturbances of infraorbital nerve in 219 cases (80. 2%) out of 273 patients

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The influence of treatment approach on the recovery of the injured infraorbital nerve is controversial in the literature . Several authors reported that frequency of persistent sensory disturbance is independent of the method of reduction and fixation of fracture. Deman and box(1993) <sup>12</sup> state that reduction and fixation are important factors in recovery from sensory disturbances of infraorbital nerve. Taicher (1993) <sup>13</sup> , observed that there is higher recovery rate of infraorbital nerve with miniplate osteosynthesis than with other method of treatment . We report a (75%) recovery rate of in our study, Our results support these findings . This significantly high recovery rate with 3 D plate can be explained by the fact that fixation with 3 D plate provides better stability to the complex in all the three dimensions of movement? However there is no study in the literature on the recovery of infraorbital nerve after fixation with 3-D plates.

In the present study occlusion was achieved in all the patients after surgery. Conventional treatment with maxillomandibular fixation is associated with its well known limitations and disadvantages. Klotch DW(1987) <sup>14</sup> studied internal fixation versus conventional therapy in midface fractures and found that a more stable occlusion is achieved with internal fixation . S Anand, Thangavelu (2004) <sup>15</sup> studied the use of three dimensional plate fixation of fractures and osteotomies and stated that satisfactory occlusion was achieved in all the patients after internal fixation with 3- plates and no patient required any maxillomandibular fixation. Claude Guimond(2005) <sup>16</sup> studied the use of 3-D plate for fixation of mandibular factures and reported similar findings in their study. As three dimensional plates provide stability in

three dimensions of movement the need for maxillomandibular fixation is greatly diminished or moreover eliminated. Our study is in accordance with these studies.

No patient reported for any type of postoperative infection, wound dehiscence during the period of three month follow up. Lia G (1997) <sup>17</sup> reported the similar results in his study . He found no post operative complications in 30 treated cases of 3 D titanium bone plating. S Anand, Thangavelu (2004) <sup>15</sup> studied the role of 3-dimensional plating system and did not reported any infection in their study . Claude Guimond(2005) <sup>16</sup> studied the use of 3-D plating in mandibular fractures and reported a significantly low rate of infection as compared with other systems.

Farmand(1995) <sup>3</sup> studied the use of 3-D plates in fixation of fracture and osteotomies and reported an significantly low rate of post operative infection with 3-D plates. No infection in our cases could be attributed to the preoperative antibiotic therapy in all patients, and proper sterilization technique.

In none of the patients plates need to be removed exhibiting there excellent biocompatibility in this short period of study. Farmand(1992) <sup>18</sup> , in their respective studies on the use of three dimensional plates in oral and maxillofacial region did not report any hardware failure with the use of these plates , our study is in accordance with these studies.

Thus as a result of clinical experience it can be inferred that the use of 3 D plates and screw system in the management of midfacial fractures give good

results in term of function , esthetic and acceptability. However, owing to fewer numbers of cases, no definitive conclusions can be drawn, for this; studies with larger sample size and long term follow up are recommended.