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Case Report

Mandibular Parasymphysis Fracture Management Using 3d Plates: A Case Report

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ABSTRACT

The management of maxillofacial trauma has undergone evolution over a period of years comprising of supportive bandages, splints, circum-mandibular wiring, extra oral pins, and semi-rigid fixation with trans-osseous wiring to rigid fixation using compression plates and more recently, semi-rigid fixation with mini plates.

Newer plating systems like 3-Dimensional Titanium systems have been developed to provide semi rigid fixation with lesser known complications. The 3D miniplate system provides a good result because of a stable geometrical configuration. Various researchers have shown that the 3D plating systems provides more acceptable outcome in terms of attaining stability and strain resistance in different anatomical areas of the mandible.

KEYWORDS: Mandibular Fracture, 3-D Plates, Maxillofacial Trauma.

INTRODUCTION

The definition of "**Trauma",** in general, is "A physical force that results in injury." Trauma to the maxillofacial region is comprehensive as it affects both the functional and the aesthetic aspects. There is commonly a psychological component involved with the injury arising out of the patients' concerns regarding permanent unacceptable scar formation and disfigurement of the face. Mandibular fractures are the most commonly occurring bone injuries because of the prominence anatomically and exposed position in the maxillofacial skeleton, comprising about 23% - 97% of all facial fractures. The causes involved include road traffic accidents, interpersonal violence, and sports injuries.

The concept of miniplate osteosynthesis was first introduced by Michelet et al. in 1973, and later modified by Champy and Lodde in 1975. The Champy's method of semi-rigid fixation incorporates the use of easily bendable plates along ideal osteosynthesis lines. During the last five decades, there has been a significant improvement in the final treatment outcome of maxillofacial surgeries in terms of significant reduction in the number of associated morbidities. This has mainly become possible because of the advances in biomaterials, specially designed instruments, newer radiographic techniques, the perfection of anaesthetics and introduction of antibiotics, etc.[1]

The management of maxillofacial trauma has evolved greatly over the centuries from supportive bandages, splints, circum-mandibular wiring, extra-oral pins, and semi-rigid fixation with trans-osseous wiring to rigid fixation with compression plates and more lately back to semi-rigid fixation with mini plates. In recent years, techniques involving rigid internal fixation (RIF) has questioned the traditional methods devised for the treatment for maxillofacial trauma; RIF of mandibular fractures minimizes the need for intermaxillary fixation (IMF) and enhances stable anatomic reduction thus allowing immediate return to function. Techniques for open reduction of

mandibular fractures have changed and diversified enormously in recent decades and attained new heights. Transorally placed mini plates have gained wide acceptance for the treatment of mandibular fractures as described by Champy et al. Non-comminuted symphyseal and parasymphyseal fractures, as well as condylar fractures, can be treated with two 2.0-mm mini plates.[1]

Farmand and Dupoirieux introduced the concept of 3-D plates with quadrangular shape and geometry that were formed by joining two mini-plates with interconnecting vertical struts. Because of the quadrangular configuration of these plates, they provided enhanced stability and increased resistance to torsional forces. Easier use, better resistance against torsion, and compact orientation of the plates were some of the primary advantages. The basic concept of 3D plate fixation lies in their quadrangular shape that provides a geometrically stable configuration for support. The 3D miniplate system provides better stability in majority of the cases and shortens the operating time because of simultaneous stabilization at both superior and inferior borders. The 3D plating system provides certain advantages over conventional mini plates as it uses lesser implant material compared to conventional mini plates. As regards to conventional mini plates, 2 plates are recommended in symphyseal and parasymphyseal regions, whereas the application of only one 3D plate has been advocated. Thus it uses lesser foreign material, reduces the operation time and overall cost of the treatment.[1]

The term "*3D PLATES"* itself is a misnomer as the plates themselves are not there dimensional but have the ability to hold the fractured segments rigidly by resisting the forces in three dimensions, which are shearing, bending, and torsion acting on the fractured site.

In the case of a 3D plating system, the two horizontally aligned mini-plates are further connected using vertical bars that act as struts and aid in reducing bending forces. Since the entire plate acts as a single unit, the vertical displacement and shearing of the bone are reduced to a minimum, thus holding the fractured bony fragments in three dimensions and thereby, the name.[2]

CASE REPORT

A case, 22-year-old male, reported to the Department of Oral and Maxillofacial Surgery, Pacific Dental College and Hospital, Udaipur with a chief complaint of pain in the lower front region of the jaw for the last 3 days. The patient also complained of an inability to chew food properly for the last 3 days. The case allegedly reports trauma due to a RTA. The patient does not report any loss of consciousness or ENT bleed. No history of pre or post-traumatic amnesia was present. The patient reports bleeding through the oral cavity at the time of injury. Informed consent was taken after describing the full procedure, benefits, potential risks and complications related to the procedure and General anaesthesia a day before surgery. The patient was taken to the operating room with the record files and all the investigations (Figure 1, 2). The patient was given 100% oxygen mask ventilation for induction. Naso-endotracheal intubation was done through the right nostril, depending on the fracture site using lidocaine 5% topical gel. The endotracheal tube cuff was then inflated, and the tube was secured, followed by the placement of throat pack. The patient was then scrubbed and painted with 7.5% povidone-iodine and then draped in a conventional manner. The agents administered at the time of induction were Fentanyl, Succinylcholine, Atropine, and Propofol. For induction, halothane was given 2-3% % in concentration, and for maintenance, it was reduced to 0.5-1 % along with N2O-O2 mixture (75-25 %). A mucosal incision was given in the lower anterior vestibule, depending upon the amount of exposure needed (Figure 3-10). This incision was followed by a tangential (trans-mentalis incision) down to the level of the bone. A mucoperiosteal flap was elevated till the inferior border of the mandible and the fracture site was exposed. After manually reducing the fracture fragments, Intermaxillary fixation was done. One 3-D 6 hole, 2mm rectangular plate with the gap was adapted. One hole was drilled using a drill bit of size 1.5 mm in one corner hole of the plate. A 2x8 mm screw was fixed in the hole. Another screw was fixed in the same way in the hole furthest from the fracture site .6, 2x8 mm screws were used to fix the plate. IMF was released, and occlusion was checked. A two-layered closure was done using vicryl 3-0 sutures. The throat pack was removed. The patient was extubated and shifted to the recovery room. The entire surgical procedure remained uneventful.

Figure 1: Pre OP Front, Right and Left Profile View

Figure 2: Pre OP Panoramic View (OPG)

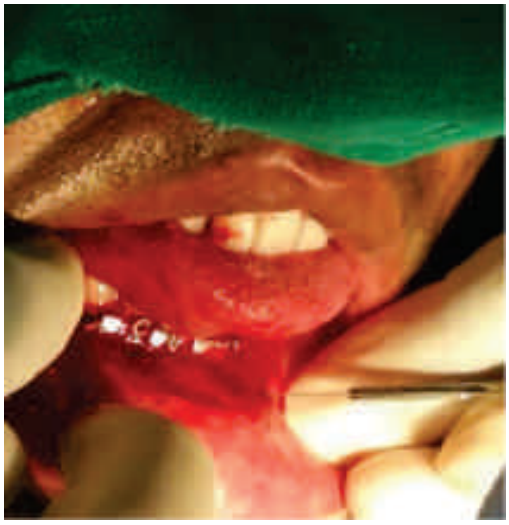

Figure 3: Mucosal Incision

Figure 4: Trans Mentalis Incision

Figure 5: Exposure of Fracture Site

Figure 6: 3D Plate Adaptation

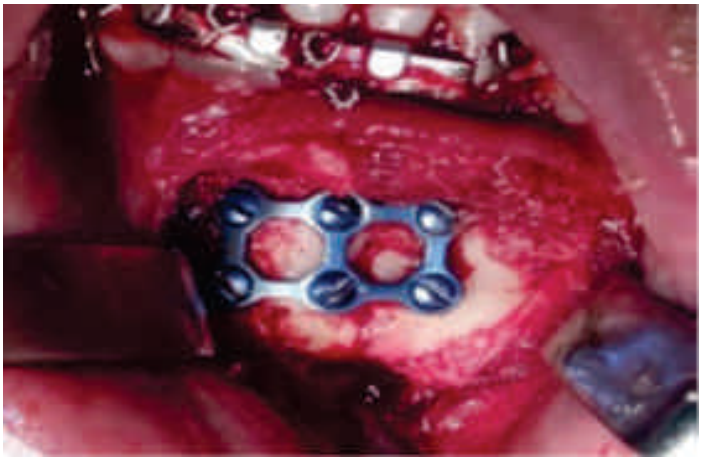

Figure 7: 3D Plate Fixed

Figure 8: Final Wound Closure

Figure 9: Status of Occlusion at 3rd Post Operative Month

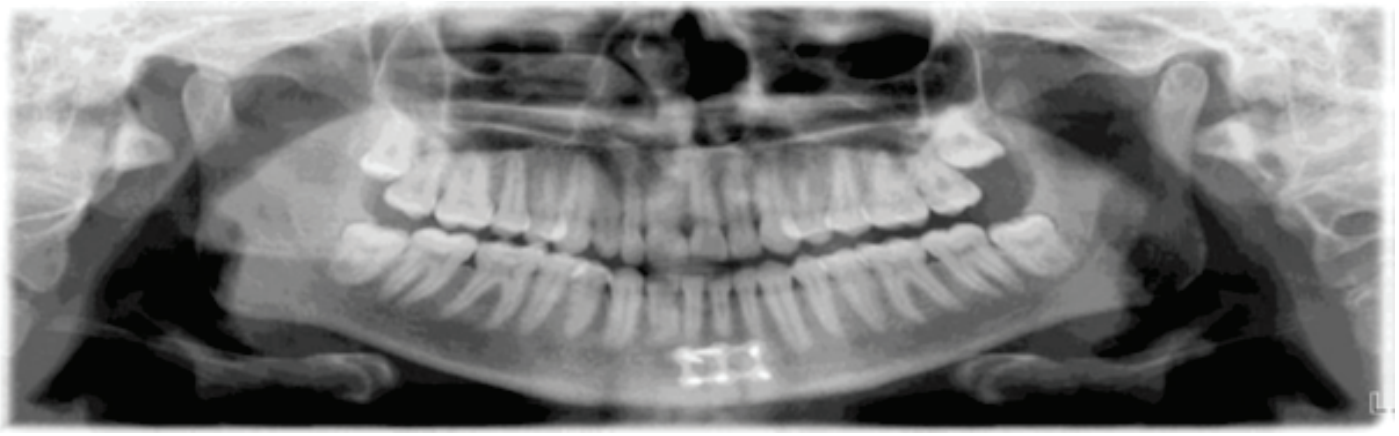

Figure 10: OPG at 3rd Post Operative Month

DISCUSSION

T.F.Renton[3] stated that the most significant region for the fracture fixation of the segments was in the area with the greatest muscular tensile forces. Under the influence that is induced physiologically, tensional forces develop along the superior border (dentoalveolar border) and compression forces develop along the lower border of the mandible. Champy et al. (1976, 1978) studied the movements of the mandible using mathematical analytical models and were able to describe the ideal lines of osteosynthesis, which would aid in neutralizing the displacing forces acting on the mandible. Champy et al. [4] described the management of fracture mandible using a different concept. He considered the mandible having the shape of a parabola with the outer cortex being thick and a comparatively thinner inner cortex that comprised of central spongiosa. His concept stated that the thick outer cortex provided good anchorage to the osteosynthesis screws, particularly in the area of mentum and in the retromolar area. He also stated that smaller plates placed in the ideal lines of osteosynthesis with monocortical screws were sufficient enough to achieve healing in the presence of functional loads.

Michelet et al. also put forward a method of monocortical,

small - plate osteosynthesis using malleable plates that are inserted using an intra oral approach- by fixing the plates at the most favourable site, considering the biomechanics, to help in neutralizing tension forces that cause fracture distraction. In order to compensate this, the plate thickness can be minimized, with the advantage of increased malleability.[5]

Therefore the technical advantages of miniplate osteosynthesis are: Small and easily adapted Mono -cortical application[6], application via an intra-oral approach is feasible, functional stability uses lesser implant material. These miniplates produce enhanced stability, thereby eliminating the need for Intermaxillary fixation. R.A.Loukota et al.[7] in a study on bio-mechanical analysis of miniplates found that the mean ultimate load seen to varied from 300N to 1200N. Farmand[8] in 1992 described the concept of 3D miniplates. Their shape is based on the quadrangle principle and is helpful in attaining a geometrically stable configuration for support.

The 3D miniplate itself is a misnomer, as the plates are not 3-dimensional, but stabilize the fracture segments firmly by resisting forces in three dimensions - shearing, bending and torsional forces acting on the fracture fragments. The application of 3D miniplates, however, in the fixation of mandibular fractures, so far has not become established. In a recently published survey by GEAR et al.[9], among 104 AO/ASIF surgeons, only 6% use this type of plate.

Alper Alkan et al.[10] conducted a study to evaluate the biomechanical behaviour of various rigid fixation systems along with the concept of miniplate osteosynthesis.

J.M.Wittenberg et al.[11] used 3 dimensional plates in mandibular fracture fixation and stated that the 3-D plates are easier to use intra-orally. As a consequence of the quadrangular geometry and easier ability to contour, shape, and adapt to the bone fragments, it provides enhanced stabilization in three dimensions resulting in low morbidity and infection. The only probable disadvantage may be excessive implant material especially in area where the fracture line passes through the mental foramina.

CONCLUSION

The quadrangular shape and orientation of the 3D plates provides enhanced stability of the fracture fragments and reduces the post-operative mobility of the segments. The geometry provides good resistance against torsion, compression, and strain, thereby eliminating the need of post –operative intermaxillary fixation. The reduced mobility of the fracture fragments helps in eliminating post-operative infection. The easy application, malleability, low incidence of infection, reduced mobility, a considerable reduction in buccolingual splay are some of the certain advantages of 3D plates over the conventional plates.

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