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Comparison of Locking Plates with Miniplates for Management of Mandibular Fracture.

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ABSTRACT

Locking plate/screw systems offer certain advantages over other plates. The use of locking plates in mandibular fracture is efficacious, to bear the masticatory forces, with greater stability, less alteration in periosteal blood supply.

Keywords-mandible, fracture, bone, locking plate, mini plate.

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INTRODUCTION

Trauma to the facial skeleton commonly results in injuries to the soft tissues, teeth and major skeleton component of the face including the mandible, maxilla, zygoma, naso orbitoethmoid complex and supra orbital structures. The prominence, position and anatomic configuration of the mandible is such that it is one of the most frequent facial bones like the nose and zygoma to be fractured [1,2]. The treatment of mandibular fractures has been studied for the past 40 years. To handle post-surgical immobilization different systems for internal fixation of facial trauma was developed resulting in patients to resume function earlier. The systems have become smaller, more simple and to avoid extraoral procedures.

Rigid internal fixation is a gold standard for the treatment of fractures. This technique was developed and popularized by Arbeitsgemeinschaft fur Osteosynthesefragen/Association for the Study of Internal Fixation (AO/ASIF) in Europe in 1970s [3]. Champy[4] advocated transoral placement of small, thin malleable miniplates with monocortical screws along an ideal osteosynthesis line of the mandible. The guidelines of AO rigid internal fixation and the Champy method of monocortical miniplates revolutionized the treatment approach to mandibular fractures.

The main disadvantage of traditional rigid miniplate fixation is that the plates must be perfectly adapted to underlying bone to prevent alteration in alignment of segments and changes in occlusal relationship¹⁵. To overcome this, locking bone plates were introduced. It has also been claimed that less screw loosening and greater stability across the fracture site are the advantages of this system[5]. Additionally, less precision is required in plate adaptation because the screws are locked to the plates and there is less alteration in osseous or occlusal relationship upon screw tightening [5].

To evaluate the efficacy, a clinical study was done to compare effectiveness of 2.0 mm locking miniplates and screws with 2.0 mm standard miniplates and screws in treating mandible fractures.

MATERIALS AND METHODS

Unicortical locking screws provide stability and load transfer only at the near cortex due to the threaded connection between the plate and the screw,(fig 1, 2). Screw stability and load transfer are accomplished at two points along the screw: the screwhead and near cortex. Because the screw is locked to the plate, fixation does not rely solely on the pullout strength of the screw or on maintaining friction between the plate and the bone.



Figure 1: 2mm locking plates and screws

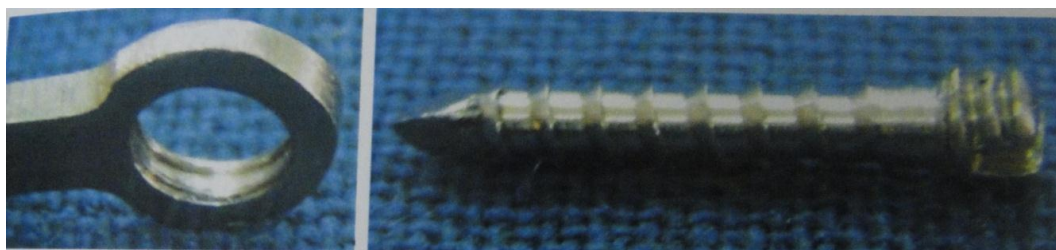


Figure 2: Locking plate and screw system

Screws lock to the plate, forming a fixed- angle constructs and bone healing is achieved indirectly by callus formation when using locking screws exclusively. Once the locking screws engage the plate, no further tightening is possible. Therefore the bone fragments are locked in their relative positions by the implants, regardless of degree of reduction. Precontouring the plate minimizes the gap between the plate and the bone, but an exact fit is not necessary.

Locking the screw to the plate does not generate additional compression. Therefore, the periosteum will be protected and blood supply to bone preserved.

The cases were treated under general anaesthesia. Lidocaine (2%) with 1:200000 adrenaline was used as a local anaesthetic solution. Pre-operative photographs and OPG are evaluated, (fig 3, 4). A lower vestibular incision was made in the vestibular sulcus and a mucoperiosteal flap raised to expose the fracture site till the lower border of the mandible,(Fig.5). Great care was taken not to damage the mental nerve.

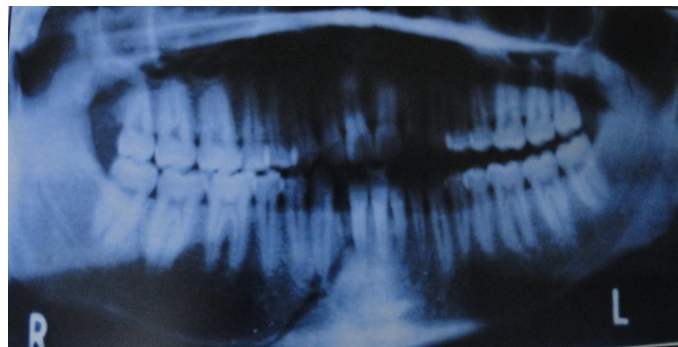


Figure 3: Pre operative OPG



Figure 4: pre-operative photograph



Figure 5 vestibular incision



Figure 6 locking plates fixation

Open reduction of the fracture was done. Maxillomandibular fixation was used to establish occlusion. One four hole 2mm titanium plate with 8mm locking screws each was used in all the fracture sites in the mandible,(fig.6). The plates were placed according to Champy's line of Osteosynthesis.

The occlusion was checked and screws were tightened finally. The site was closed with 3-0 vicryl and 3-0 mersilk.

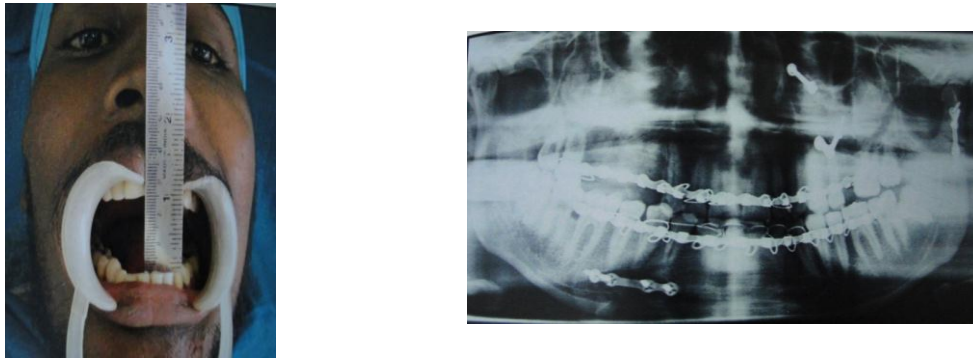


Figure 7: Post-operative mouth opening & post-operative OPG

The patient was kept under antibiotic cover for one week. He was advised to take liquid diet for 2 days and thereafter a soft diet for 2 weeks and was instructed to use chlorhexidine mouth rinse frequently to keep up the oral hygiene. Sutures were removed on the 7th postoperative day. The occlusion was checked on the 2nd and 6th week post operatively and complications recorded if any,(Fig 7).

DISCUSSION

Studies have shown the advantages of the miniplates system over conventional intermaxillary fixation suggesting that miniplates were easy to use, allowed precise anatomical reduction and in most cases intermaxillary fixation was not required to facilitate early recovery [6]. Miniplates are superior in terms of bone healing because less periosteal stripping is required for their placement so that the blood supply to the mandible is preserved through undisturbed periosteum. Miniplates provide stable fixation⁷ unlike rigid fixation that prevent micromotion of the bony fragments under friction. Functionally stable fixation applies to internal fixation that allows bone alignment and permit healing during function.

Locking plates and screw systems has been present for more than the past 30 years but recently rejuvenated interest in these systems has been seen. The locking plates have many advantages over rigid fixation systems like miniplates.

Conventional bone plate/screw systems require precise adaptation of the plate to the underlying bone. Without this intimate contact, tightening of the screws will draw the bone segments towards the plate, resulting in alterations in the position of the osseous segments and the occlusal relationship[8]. Locking plate/screw systems offer certain advantages over other plates in this regard; the most significant advantage may be that it becomes unnecessary for the plate to have intimate contact with the underlying bone in all areas. As the screws are tightened, they “lock” to the plate, thus stabilizing the segments without the need to compress the bone to the plate. This obviates the risk that screw insertion will alter reduction [8,9].

Also, as the locking plates do not require intimate contact with bone, it makes them easier to adapt and less technique sensitive [9,10]. The screws lock to the plate; thus the fracture segments are stabilized without the need to compress the bone. This minimizes disruption of the cortical bone blood supply and decreases the chance of resorption of the buccal and lingual corticesP [11,12].

Screws are unlikely to loosen from the plate due to the threading mechanism associated with locking screw/plate systems. This in turn leads to a decreased incidence of inflammation due to loosening of the hardware[13]. A final advantage of locking screw/plate systems is that the patient has early use of the jaws by eliminating or reducing the need for postoperative MaxilloMandibularFixation(MMF)[5,14]. Eliminating or reducing the time spent in postoperative MMF allows the patient to speak, masticate, and improve his or her state of nutrition.

There are some drawbacks to locking plates. Locking plates are more difficult to remove than standard compression plates. Cold-welding may occur, in which the locking screw heads become affixed to the screw hole and cannot be removed from the plate without great difficulty [16]. There is limited tactile feedback with the quality of purchase the screw has in the bone and thus quality of fixation [17]. Bending of the plate may result in distortion of the threaded screw holes and dysfunction of the locking mechanism. Plates must be precontoured and bent only with caution [17]. Finally specialized locking implants are more expensive than standard plates, and a larger inventory is required incurring additional cost.

CONCLUSION

The use of locking plates in mandibular fracture is efficacious enough to bear masticatory loads during the osteosynthesis of fracture. It has greater stability, less precision required in plate adaptation because of the "internal/external fixator", less alteration in periosteal blood supply and reducing the need and duration of IMF.

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