

A Comparison Between Locking Plates and Miniplates In Fixation of Mandibular Fractures

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ABSTRACT

The use of locking plates in mandibular fracture is efficacious. This study compared the efficiency of locking plate and screw with standard miniplate and screws in the fixation of mandibular fractures with respect to fixation stability and complication rate. Locking plate/screw systems offer certain advantages over other plates, it bear the masticatory forces with greater stability, do not require intimate contact with bone, making them easier to adapt and less technique sensitive, minimizes disruption of the cortical bone blood supply. Screws are unlikely to loosen from the plate due to the threading mechanism associated with locking screw/plate systems. A final advantage of locking screw/plate systems is that the patient has early use of the jaws reducing the need for maxillo-mandibular fixation.

Key words: Mandible fracture, locking plate, mini plate.

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 experience of oral and maxillofacial surgeons with dental anatomy, head and neck physiology, and occlusion provides us with unparalleled skills for the management of mandibular fractures. 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}. Fractures of the mandible have been reported to account for 36-70% of all maxillofacial fractures. All reports apparently show a higher frequency in males aged 21-30 years. In addition to this, the patient's age, the presence of teeth, and the physical properties of the causing agent also

have a direct effect on the characteristics of the resulting injury. Other contributing factors such as socioeconomic status, environment and alcohol use show greater variability³.

To handle post surgical immobilization different systems for internal fixation of facial trauma was developed resulting in patients to resume function earlier⁴. 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^{5,6}. Champy advocated transoral placement of small, thin malleable miniplates with monocortical screws along an ideal osteosynthesis line of the mandible^{7,8,9}. The guidelines of AO rigid internal fixation and the

Champy method of monocortical miniplates revolutionized the treatment approach to mandibular fractures.

A 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 relationship¹⁰. To overcome this, locking bone plates were introduced. It is claimed that less screw loosening and greater stability across the fracture site are the advantages of this system. Also, 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 tightening¹¹. In conventional miniplate system the stability is achieved when the head of the screw compresses the fixation plate to the bone as the screw is tightened. In locking plates the screw locks not only to the bone but to the bone plate also. This is accomplished by having a screw with a double thread. One thread will engage the bone; another will engage a threaded area of the bone plate which results in providing mini-internal fixator¹².

This study compared to efficiency of 2mm locking plate and screw with standard 2mm miniplate and screws in the fixation of mandibular fractures with respect to fixation stability and complication rate.

MATERIALS AND METHODS

A total number of 20 patients with 26 various fracture sites in mandible who reported to Department of Oral and Maxillofacial Surgery, Sree Balaji Dental College and Hospital, Chennai requiring open reduction and internal fixation of the fracture were selected. Locking plates and screws were used in 10 random patients and Conventional miniplates and screws were used in other 10 patients for fixation of fractures.

Inclusion criteria

- Simple/linear fractures of the mandible in
- Fractures treated via the transoral approach.
- Follow up period of 6 weeks post operatively.

Exclusion criteria

- Comminuted fractures.
- Immunocompromised patients
- Infected fractures.
- Completely edentulous patients

Operative procedure

Procedure was explained and Informed consent was taken for every patient included in the study. All the patients were operated under general anesthesia (nasotracheal intubation) along with 2% lignocaine hydrochloride with 1:2,00,000 concentration of epinephrine for local infiltration at surgical site to achieve blood less field. A lower vestibular incision was made in the labio-buccal sulcus and a mucoperiosteal flap raised to expose the fracture site till the lower border of the mandible.

Open reduction of the fracture was done. Occlusion was established with maxillomandibular fixation. Locking plate and screws were used on 10 patients and miniplate and screws were placed in 10 patients according to Champy's line of osteosynthesis.(Fig 1, 2)

The occlusion was checked and screws were tightened finally. Following fixation the gap between the fractured fragments was reassessed. The site was closed with 3-0 vicryl and 3-0 mersilk. An extra oral pressure bandage was applied.

All patients were kept under antibiotic cover for one week. Patients were advised to take liquid diet for 2 days and thereafter a soft diet for 2 weeks and they were 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.

RESULTS AND DISCUSSION

A total of 20 patients (18 male and 2 female) were selected for the study based on the inclusion criteria. Average age of the patients was 26 years with a range of 12 to 43 years (Table I). 14 fracture sites (angle, parasymphysis and body) in

10 patients were treated with 2mm 4 hole locking plates and 12 fracture sites in 10 patients were treated with 2mm miniplate fixation. Anatomic distribution of fracture sites was 13 angle, 11 parasymphysis and 2 body (Table II). Minor complications occurred in both groups though no significant difference in success rate was seen between groups treated with 2mm locking plate and screw and standard 2mm miniplate and screws (Table III).

Management of mandibular fractures should be guided by several dental and orthopedic principles such as reduction of the fracture site to its correct anatomical position, restoration of pre morbid occlusion and rigid immobilization of the fractures, this is to facilitate healing, optimal and early restoration of function, prevention of infection, malunion or nonunion of fracture¹³. Locking plate/screw systems have been available for greater than 3 decades, but a recently rejuvenated interest in these systems has occurred. When used for bridging fractures, they allow for secondary bone healing with load-bearing capabilities.

Traditional *arbeitsgemeinschaft fu'r osteosynthesefragen* (AO) fracture fixation

technique requires exposure of the fracture site, anatomic reduction, and internal fixation with the goal of absolute stability and primary bone healing¹⁴.

Secondary bone healing begins with a hematoma, followed by inflammation, fibrous tissue growth, cartilage formation, and eventually a bony callus. As healing occurs, strain across the fracture gap decreases, stabilizing the fracture. Locking plates when used to bridge the fracture site can facilitate secondary rather than primary bone healing¹⁵.

In 2003, Gutwald *et al* performed the first biomechanical comparison of locking plates applied to the mandible. They concluded that a higher stability was achieved with the locking plates¹⁶. Haug *et al* performed a similar study with intentional maladaptation of the plates. They concluded that the degree of adaptation affected the mechanical behaviour of nonlocking systems, but it did not affect the locking systems¹⁷. Ellis and Graham recently reported encouraging results with the 2.0-mm locking plate and screw system applied to a consecutive series of patients¹⁰.

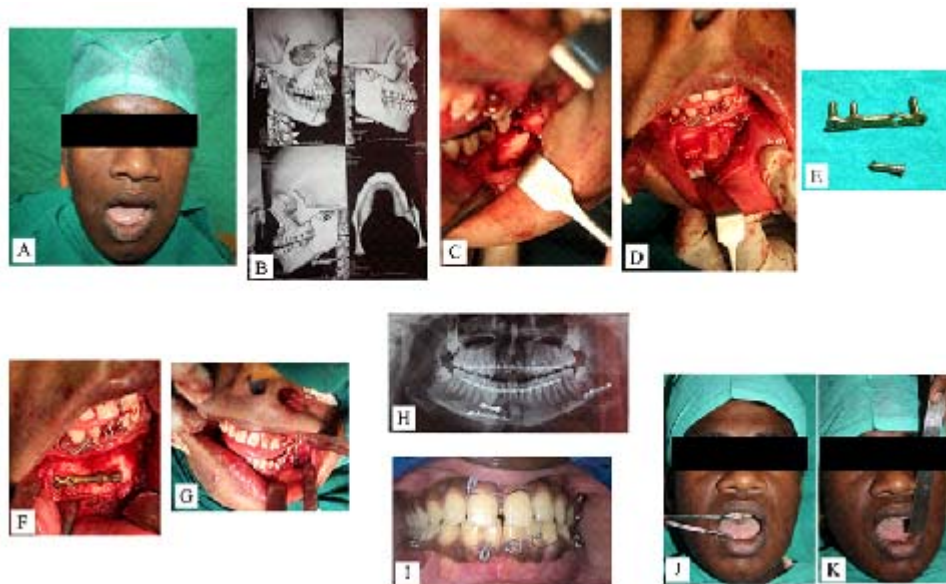


Fig. 1: A. Pre operative photograph; B. Pre operative CT scan; C & D. Fracture site is exposed in angle region & parasymphysis region, E. 2mm Locking miniplates and screws; F&G. Plating done with 2mm locking plate & screws; H. Post operative OPG; I. Post operative Occlusion, J & K. Post operative mouth opening

The locking plates have many advantages over rigid fixation systems like miniplates. They do not require intimate contact with bone, making them easier to adapt and less technique sensitive^{18,19}. 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 cortices^{20,21}. 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 hardware²². 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 maxillomandibular fixation (MMF)^{11,23}. Eliminating or reducing the time spent in postoperative MMF allows the patient to speak, masticate, and improve his or her state of nutrition.

Site	No. of cases	Percentage
Angle	13	50%
Parasymphysis	11	42.30%
Body	2	7.70%

Age range (In years)	No. of patients	Percentage
10 - 20	2	10%
20 - 30	13	65%
30 - 40	4	20%
40 - 50	1	5%

	Occlusal Instability	Complications	%
Locking plates (14)	None	1	7.14%
Miniplates (12)	None	1	8.33%

In our study, 20 cases of mandibular fractures (26 fracture sites) were used, of which locking plates and screws were used in 10 random cases and miniplate fixation was done in the other 10 cases. Post-operatively after 6 weeks no significant difference in complications were seen in the cases with locking plate fixation with miniplate fixation. Good bone healing and occlusal stability was seen in all the cases.

The limitations to this study include a short follow-up period, small sample size and the intermaxillary fixation variable added to each case. This is an acceptable follow-up period for studying mandible fractures when compared with the literature; however, long-term follow-up is

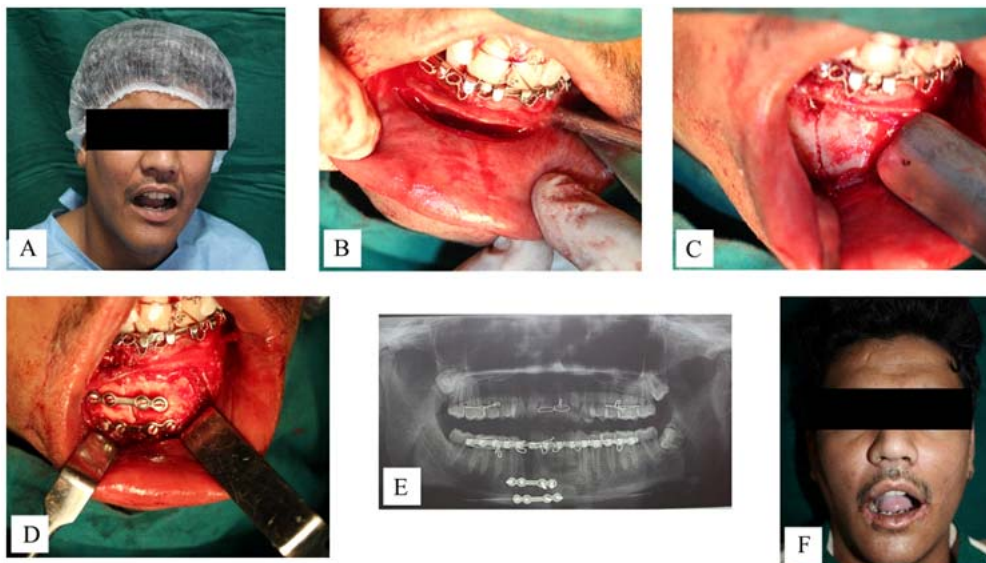


Fig. 2: A. Pre Operative photograph; B. Vestibular Incision placed; C. Fracture site exposed. D. 2mm miniplates and screws fixation done; E. post operative OPG; F. Post operative photograph.

desirable. Also larger sample size would allow to further investigate the efficiency of the locking plate system.

CONCLUSION

The art of surgery demands that we evaluate the risk and benefits of each treatment modality and apply it appropriately for each patient. From time to time, internal fixators are being modified to overcome existing shortcomings.

Locking screw and plates system are one among the latest advancement. In this study we tried to evaluate the efficacy of locking plate and screw system with traditional miniplate system in the management of mandibular fractures. In the study, locking plates and screw system fulfilled the treatment goals of adequate immobilization, fixation and stabilization of mandibular fractures. However more detailed study using larger samples with long term follow up will help evaluate this system in future.

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