RESEARCH

Fixation of Mandibular Fractures- A Comparative Study Between 2.0 mm Locking Plates snd Screws and 2.5 mm Conventional Miniplates and Screws.

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Abstract

Introduction; Fixation stability and occlusion are of atmost importance in the management of mandibular fractures. Locking plates (2mm) were introduced as internal fixators for achieving stability by locking the screw to the plate. The advantage of using locking plates was decreased amount of inflammatory response and decrease in the infection rate. Our aim was to compare the efficacy of 2mm locking plate and screw with 2.5mm conventional mini plates and screws in the treatment of mandibular fractures in the inter foraminal region and also to evaluate the fixation stability provided by these plates.
Methods; 20 patients with mandible fractures were selected who required open reduction and internal fixation under general anesthesia were included in the study. 2mm locking plates and screws were used for fixation of linear fractions in the interforaminal region in 10 patients and 2.5mm mini plates and screws in 10 patients. The various parameters that were compared were fixation stability which included gap alignment after reduction and fixation. Occlusion was checked on the second day and at six weeks post operatively. Patients had a follow up of six weeks and complications if any were recorded
Results; In our study it was found that the gap between the fractured fragments after fixation was reduced in the 2mm locking plate and screw system with better fixation stability when compared to mini plate group.
Conclusion; So we safely conclude that locking plates and screw showed better results in comparison to miniplate in relation to their fixation stability and complication.

KEYWORDS: Interforaminal fractures, Locking plates and screw, Mini plates and screws, Fixation stability.

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. Participation in the management and rehabilitation of the patient with facial trauma involves a thorough understanding of evaluation for and surgical treatment of facial injuries[1]. 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[2].

To handle post surgical immobilization different systems for internal fixation of facial trauma was developed resulting in patients to resume function earlier[3]. The systems have become smaller, more simple and to avoid extraoral procedures. Meanwhile the miniplate fixation of mandibular fracture has become a standard treatment[4]. 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 relationship[5]. 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 tightening [6].

Our study is designed to compare the effectiveness of 2.0 mm locking plate and screw with standard 2.5 mm miniplate and screws in the fixation of linear mandibular fractures in the interforaminal region with respect to fixation stability and complication rate.

OBJECTIVES

- To provide stable fixation of mandible fractures using smaller plates and screws.
- To reduce the incidence of post operative complications
- To avoid the use of post surgical maxillomandibular fixation.

MATERIALS AND METHODS

In this study, 2mm stainless steel locking plate and screws were used and compared with 2.5 mm stainless steel miniplates and screws.

SOURCE OF DATA

A total number of 20 patients with fractured mandible who reported to Department of Oral and Maxillofacial Surgery, M.S.Ramaiah Dental College and Hospital requiring open reduction and internal fixation of the fracture were selected from December 2003 to January 2006. Conventional miniplates (2.5 mm) and screws were used in 10 patients and 2.0 mm locking plates and screws were used in 10 patients for fixation of fractures in interforaminal region.

INCLUSION CRITERIA

Simple /linear fractures of the mandible in the interforaminal region.
Fractures treated via the transoral approach.
Two plates used for the fixation of all fractures.
Follow up period of 6 weeks post operatively.

EXCLUSION CRITERIA:

Comminuted fractures.
Infected fractures.
Completely edentulous patients.

SURGICAL TECHNIQUE

All cases were treated under general anesthesia. Face was painted with povidone-iodine. The oral cavity was prepared with diluted povidone-iodine. Towels and drapes were applied to the head to expose the surgical area. Upper and lower surgical arch bars were placed. Lidocaine (2%) with 1:200000 adrenaline was used as a local anaesthetic solution. 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. Great care was taken not to damage the mental nerve.

Open reduction of the fracture was done. Occlusion was established with maxillomandibular fixation and gap between the fractured fragments was measured with stainless steel wire of different diameters/different scales. In the interforaminal region, one four hole stainless steel plate and one two hole plate were used for the fixation of fracture. 2mm locking plate and screws were used on 10 patients and 2.5mm miniplate and screws were placed in 10 patients according to Champy's line of osteosynthesis.

A gap of 4-5 mm and parallelism were maintained between the two plates. The lower plate was adapted first and then the upper plate. Care was taken not to injure the mental nerve. 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 7^{th} postoperative day. The occlusion was checked on the 2^{nd} and 6^{th} week post operatively and complications recorded if any.

RESULTS AND DISCUSSION

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 fracture[7].

In our study, 18 patients were male and two patients were female. The age ranged between 20-40 years and cause of injury was road traffic accidents. The above mentioned surgical technique was performed with a degloving incision and a minimum amount of periosteal stripping was done and the fracture was exposed. It has been suggested that miniplate osteosynthesis is indicated in all jaw fractures in the mandibular body. Correct fracture fixation with miniplates is ensured in completely in dentulous jaws.

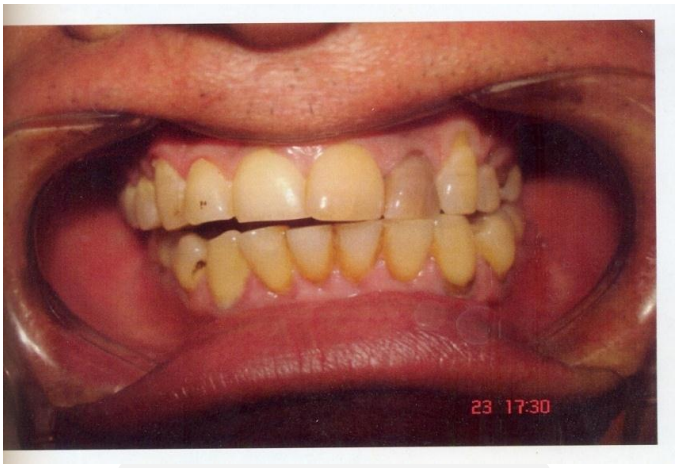

Fig-1 Deranged occlusion

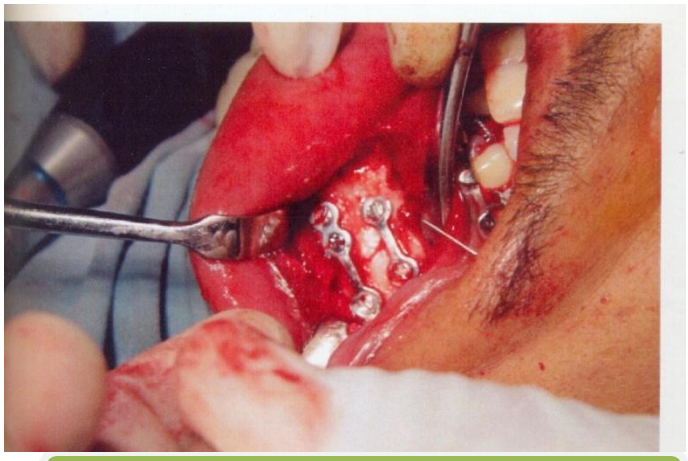

Fig-4 Gap between fracture fragments after fixation

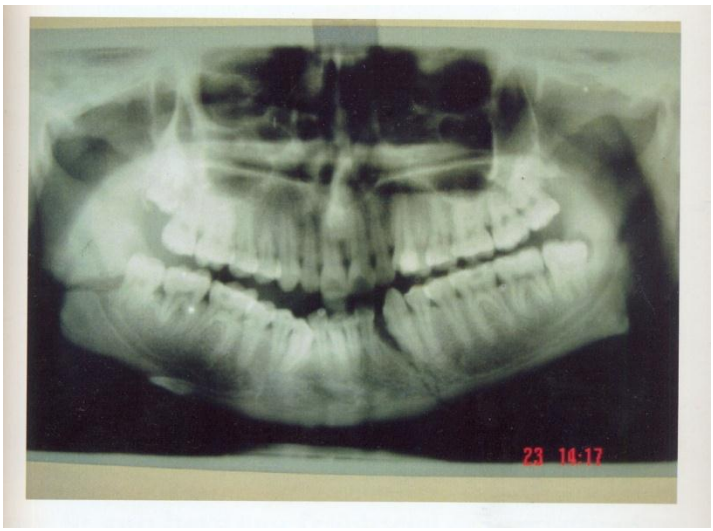

Fig-2 Radiograph showing left mandibular parasymphsis fracture with right angle and zygomatic butress fracture

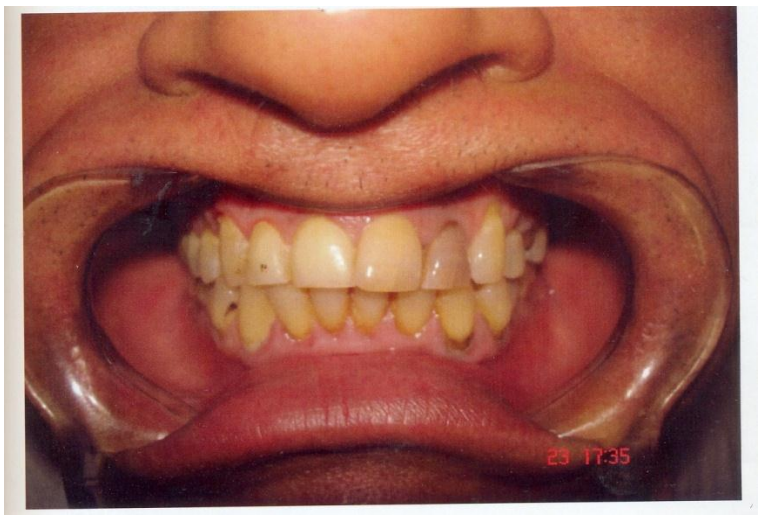

Fig-5 Post operative occlusion

Fig-3 Gap between fracture fragments after reduction

Fig-6 Post operative radiograph

(Table-1)2.0 locking plates and screw- data:

Sl. No	Age/Sex	Fracture in the interforaminal region	Associated fractures	Gap between fractured fragments after reduction	Gap between fractured fragments after fixation	0cclusion		Complication
						2nd week	6th weeks	
1	20/ m	Left parasymphysis	Rt zmc	1.5	0.9	Mild derangement	Satisfactory	None
2	39/m	Mid symphysis	Bilateral sub condylar	1.5	0	Mild derangement	Satisfactory	None
3	26/m	Left parasymphysis	Rt angle	2	0	Satisfactory	Satisfactory	None
4	24/m	Rt parasymphysis	Left body	1.5	1	Satisfactory	Satisfactory	None
5	24/m	Mid symphysis	Bilateral sub condylar	1.5	0.9	Satisfactory	Satisfactory	None
6	24/m	Left parasymphysis	Bilateral sub condylar	2	1	Deranged	Satisfactory	Pain
7	27/m	Left parasymphysis		0.8	0	Deranged	Satisfactory	None
8	32/m	Left parasymphysis	Left sub condylar	1.5	1	Mild derangement	Satisfactory	Swelling
9	19/m	Mid symphysis		1.5	0.8	Satisfactory	Satisfactory	None
10	30/f	Rtarasymphysis	Left sub condylar	1.5	0.8	Satisfactory	Satisfactory	None

(Table-2) 2.5mm miniplates and screws- data:

Sl.	Age/ Sex	Fracture in the interforaminal region	Associated fractures	Gap between fractured fragments after reduction	Gap between fractured fragments after fixation	0cclusion		Complication
						2nd week	6th weeks	
1	38/m	Lt parasymphysis		2	1	Mild derangement	Satisfactory	None
2	20/m	Rt parasymphysis	Lt subcondylar	1.5	0.8	Deranged	Satisfactory	None
3	25/m	Rtparasymphysis		2	1	Deranged	Satisfactory	None
4	27/m	Lt parasymphysis	Rt subcondylar	1.5	0.8	Mild derangement	Satisfactory	None
5	39/m	Lt parasymphysis	Rt angle	2	1	Deranged	Satisfactory	None
6	40/m	Lt parasymphysis	Rt angle, rtzmc	1.5	0.9	Mild derangement	Satisfactory	None
7	25/m	Rt parasymphysis	Rt angle, rtzmc	2	0.9	Satisfactory	Satisfactory	None
8	19/m	Lt parasymphysis		2	0.9	Satisfactory	Satisfactory	None
9	20/m	Rt parasymphysis		2	0	Satisfactory	Satisfactory	None
10	25/m	Rt parasymphysis	Left angle	1	0.8	Mild derangement	Satisfactory	None

Its been compared that the advantages of miniplates system with 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[8].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 fixation[9] 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.

Plate fixation with locking screws can avoid this secondary dislocation, as they secure locking of the screw in the plate[5]. The locking plate and screw system was introduced which demonstrated higher stability across the fracture / osteotomy gap and decreased the chance of screw stripping with associated inflammation. The optimal reduction of dislocation between the fragments and adequate immobilization promotes rapid bony union[10]. The atraumatic management of bone tissue during insertion of the screw is of utmost importance to a rigid fixation.

It has been stated[11] that the use of inter maxillary fixation with or without intraosseous wiring declined in favor of compression plates. It is required to apply the plates properly as rigid nature of material may predispose it to rebound after bending. Restoration of occlusion with accuracy is required and plate must be adapted meticulously to the contours of the bone. Errors in fixation will result in permanent malocclusion.

In a study of 52 patients[12], with 32 patients treated with Maxillomandibular fixation (MMF) and 20 patients with rigid internal fixation (DCP), found that use of rigid internal fixation results in rapid bone mineralization than use of MMF. The disadvantage of Rigid Internal fixation must not be overlooked. Technique and instrument handling require training and bone fragments must be scrupulously reduced before osteosynthesis plates are placed. Also failure to properly adapt leads to malocclusion.

In our study, it was found that patients who had associated fractures (subcondylar /angle fracture) intermaxillary fixation/elastics were used for a duration of 2 weeks guiding the teeth into occlusion. At about 6 weeks, post operatively occlusion attained was satisfactory (fig-5). The locking mini plates system has demonstated higer stablitiy across a fracture / osteotomy gap compared with conventional non locking 2mm miniplates which was seen on post operative radiograph (fig-6). On the 2nd day and also 6 weeks post operatively in those patients who did not have associated fractures, satisfactory occlusion was found. If patients with associated fractures had been excluded from the study then better assessment of occlusion would have been possible. (Table-1, 2)

Miniplates in infected mandibular fracture are well tolerated [13] if main principles viz, proper curettage of the infection, rigid osteosynthesis and specific antibiotic therapy are followed and all teeth in the fracture line are carefully evaluated.

It has been described[14] that infection at a fracture site can cause serious sequelae. It can initiate delayed union, non union and mal union as well as bone and tooth loss.

A larger sample size, with exclusion of patients with associated fractures of mandible, will allow a more complete evaluation of fixation stability of the 2 mm locking plate and screw system. It will also help to investigate whether the locking plate system can be used in favor of miniplates considering its advantages.

Conclusion

The art of surgery demands that we evaluate the risk and benefits of each treatment modality and apply it appropriately for each patients. 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 our study we have made an attempt to evaluate the efficacy of 2mm locking plates and 2.5mm miniplates and screw used for fixation of fractures in the inter foraminal region. The results we obtained suggest that 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.

References

1. larry J Peterson, James R Hupp. Contemporary Oral and Maxillofacial Surgery, 2nd Edition. Mossy by.
2. Mc Carthy. Plastic Surgery, Volume II, W.B. Sauders Company.
3. Jose C Moreno, Antonio Fernandis, Jose A Ortiz. Complication rates associated with different treatment for mandibular fractures. Journal Of Oral and Maxillofacial surgery 2000: 58: 273-280
4. Ralf Gutwald, Brian Alpert, Rainer Schmelzeisen. Principal and Stability of Locking Plate. Keijo J Med Mach 2003: 52(1): 21-24.
5. Edward Ellis III, John Graham. Use of locking plates/ screw system for mandibular fracture. Surgery 60; 642-645.
6. Chad P, Collins, Gaila Piranjan, Andrew Tolas. A prospective randomided clinical trail comparing 2.0 mm locking plates to 2.0 mm standardized plates in treatment of mandibular fractures.

Journal of Oral and Maxillofacial Surgery 2004; 62:1392-5
7. Harold Kai Tu, David Tenhulza: Compression Osteosynthesis of Mandibular Fractures; A Retrospective study. Journal of Oral and Maxillofacial Surgery 1985; 43: 585-589.
8. Mohammed Hosein, Kalantar M Motamedi. An assessment of maxillofacial fractures; A 5 year study of 237 patients . Journal of Oral and Maxillofacial Surgery 2003: 61;61-64
9. Ayman Chritah, Stevert K Lazaro, Julius R, Berger. Transoral 2.0mm locking miniplate plate fixation of mandibular fractures plus 1 week of maxillomandibular fixation; A prospective study, Journal of Oral and Maxillofacial Surgery 2005:63;1737-41.
10. Kahnberg, A. Ridell : Bone plate fixation of Mandibular Fractures. International Journal of Oral Surgery 1980: 9; 267-273.
11. N.Zachariades, M.,G.R.Rallis. An audit of mandibular fractures treated by intermaxillary fixation, Intraosseous wiring and Compression plating. British Journal of Oral and Maxillofacial Surgery 1996: 34; 293-297.
12. Pedro M Villarreal, Louis M Janqera; Study of mandibular fracture repair using quantitative radiodensitometry. A comparison between maxillomandibular and rigid internal fixation, Journal of Oral and Maxillofacial Surgery 2000: 58; 776-781.
13. Bjon Johnston, leonard kmenov. Miniplate Osteosynthesis in infected mandibular fracture. Journal of Craniomaxfacial Surgery; 1998: 16; 22-27.
14. M.A. Kuria Kose, M .Fardy , et al; A comparitive review of 266 mandibular fracture with internal fixation using rigid (AO/ASIF) plates or miniplates. British Journal of Oral and Maxillofacial Surgery 1996:34; 315-321.