

Use of a single 2.0-mm locking AO reconstruction titanium plate in linear, non-comminuted, mandible fractures

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ABSTRACT

Purpose: The aim of the following study is to prospectively evaluate the use of a single Arbeitsgemeinschaft für Osteosynthesefragen (AO) 2.0-mm locking reconstruction plate for linear non-comminuted mandibular fractures without the use of a second plate. **Materials and Methods:** This study consisted of a sample of 10 patients who reported to the department with fractures of the mandible and were treated over a period of 24 months from November 2010 to November 2012. Out of these, there were 8 male patients and 2 female patients. There were four cases of isolated parasymphysis fractures, 1 of the case had a parasymphysis fracture associated with subcondylar fracture, 4 had a body fracture and 2 had a symphysis fracture. **Results:** All patients had satisfactory fracture reduction and a successful treatment outcome without major complications. Only one patient (10%) developed minor complications. **Conclusion:** The study has demonstrated that treating linear non-comminuted mandibular fractures with a single AO 2.0-mm locking reconstruction plate provides excellent stability at the fracture site which in turn leads to sound bone healing and early functional rehabilitation.

Keywords: Linear, mandible fractures, non-comminuted, single 2.0-mm locking Arbeitsgemeinschaft für Osteosynthesefragen reconstruction titanium plate

INTRODUCTION

Over the years the methods to treat mandibular fractures have undergone many refinements. The open reduction techniques of rigid internal fixation with compression plates and semi rigid fixation with miniplates, have replaced the use of wire osteosynthesis and prolonged maxillomandibular fixation (MMF). The advantages of plate fixation with minimum periods of MMF include early mobilization and restoration of jaw function, airway control, nutritional status, improved speech, better oral hygiene, patient comfort and an earlier return to work.

There are several disadvantages to compression plating which is usually performed transcutaneously, including bulky nature of plates,

the procedure itself which is technique sensitive, increased operating room time, risk of the facial nerve paresis and a reported high infection rate, ranging from 6% to 32%, associated with this technique.^[1,2]

Due to the smaller size, miniplates are not as rigid as the standard mandibular fracture plates and this decreased rigidity may lead to torsional movements of the fracture segments under functional loading, resulting in infection or non-union or both.^[3] Due to the reduced stability of miniplate fixation, reduced function is recommended after fracture fixation. Some surgeons even advocate 1-2 weeks of MMF.^[3]

According to Arbeitsgemeinschaft für Osteosynthesefragen (AO)/ Association for the Study of Internal Fixation principles, the

main objective of open reduction and internal fixation in the management of mandibular fractures is to achieve undisturbed healing and immediate restoration of form and function without the adjunctive use of MMF.^[4-7]

To overcome the drawbacks associated with the use of compression plates or miniplates,^[8] reported their clinical experience with the use of a single 2.0-mm locking reconstruction plate at the inferior border of the mandible to treat linear non-comminuted mandibular fractures since the 2003, launch in Switzerland of a new internal AO low profile 2.0-mm locking system.

This prompted this study which was conducted in the Department of Oral and Maxillofacial Surgery, Government Dental College and Hospital, Ahmedabad from November 2010 to November 2012 to evaluate the use of a single 2.0-mm locking reconstruction titanium plate (AO) in linear, non-comminuted, mandible fractures [Figures 1 and 2].

MATERIALS AND METHODS

Materials

The plate/screw system used in our study was the AO 2.0-mm locking reconstruction plate/screw system manufactured by Synthes-Maxillofacial Paoli, PA [Figure 3].

Plates

1. Type: Commercially pure titanium with 99.42% of titanium by weight and the rest made of iron, carbon, nitrogen and hydrogen
2. Shape: Straight, notches between holes
3. Number of holes: Six hole plates
4. Thickness (profile height): 2.0 mm
5. Length of plate: 4.7 cm
6. Width of plate: 7 mm
7. Hole diameter: 2.0 mm
8. Bevel at hole: 30°

Screws

1. Type: Locking, self-tapping screws
2. Length: 10 mm
3. Diameter of head: 3.5 mm
4. Screw diameter: 2 mm
Distance between threads: 1 mm.

Methods

All patients were treated under general anesthesia. Intraoral approach was used in all cases. The fracture site was first palpated. Intraoral degloving incision in mandibular vestibule was done and muscles such as depressor anguli oris, depressor labii inferiors and mentalis were exposed through sharp dissection and detached up to the lower border of mandible. Periosteum overlying the bone was cut and detached to expose the bone and the fracture line.

This whole surgery was completed taking care of the mental nerve. Skeletonization of the mental nerve was done whenever it was encountered.

Plate osteosynthesis was performed using a single 2.0 mm locking reconstruction titanium plate with 2.0 mm, 10 mm self-tapping locking screws applied at the inferior border of mandible [Figures 4 and 5]. As the locking design did not mandate precise adaptation of the plate to the bone surface, contouring of the plate was done such that offset of 1.0-1.5 mm was allowed to allow for periosteal growth beneath the plate.

RESULTS

The study was conducted in 10 patients having linear mandibular fractures. All the patients were treated with a single AO 2.0 mm 6 hole locking reconstruction plate and 6, 2.0 mm, 10 mm locking screws.

All patients were treated under general anesthesia. No postoperative intermaxillary ligation/fixation was done except in the patient with associated subcondylar fracture.^[9]

The 2.0 mm titanium locking reconstruction plate employs the benefits of an excellent combination of a reliable osteosynthesis protocol, a stable locking technique, a low profile reconstruction plate and an ideal implant biomaterial. The technique is simple and amenable to the use of intraoral approach. Moreover, the AO 2.0-mm locking reconstruction plate placed at the inferior border of the mandible seems capable of neutralizing compression and tensile forces, thus making unnecessary use of a second plate.

Follow-up was carried out at intervals of 1st, 3rd and 6th month [Figure 6]. All patients came regularly for the follow-up. One patient reported a complication of paresthesia in the distribution of mental nerve, which was successfully managed conservatively with medication. There was no other complication [Table 1].

DISCUSSION

This study had been done to evaluate the use of a single 2.0-mm locking reconstruction titanium plate (AO) in linear, non-comminuted, non-infected mandible fractures.

The patients were evaluated for the location, type and number of fractures, presence of teeth in fracture area, pre- and post-surgical occlusal relationship, adequacy of reduction on the postoperative radiograph, immediate postoperative stability and any post-surgical complications.

In all cases, teeth were retained in fracture area.

Table 1: Complications

Complications	Fractures involved	Percentage
Infection	0	0
Dehiscence	0	0
Malocclusion	0	0
Delayed union	0	0
Anesthesia/paresthesia	1	10
Screw loosening/plate fracture	0	0
Total	1	10



Figure 1: Preoperative photograph with malocclusion



Figure 2: Preoperative orthopantomogram showing right parasymphysis fracture



Figure 3: 2.0 mm locking reconstruction plate with screws

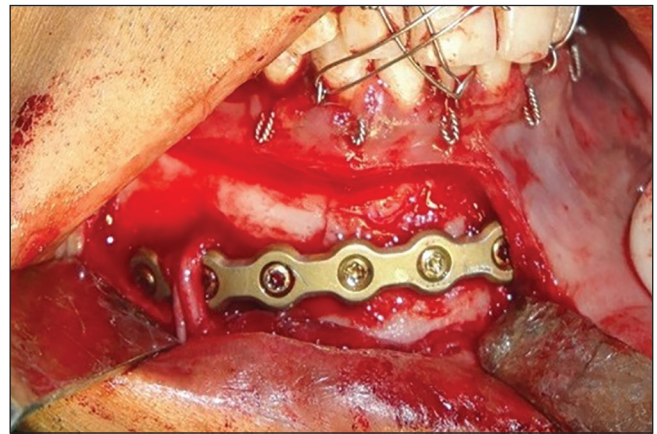


Figure 4: 2.0 mm locking reconstruction plate fixed to the fracture segments with three screws on either side of fracture line after reduction of the fracture



Figure 5: Postoperative orthopantomogram showing accurate reduction of the fractured segments

In our study, all patients were treated by intraoral approach. This is supported by the study of Kruger and Schilli,^[10] Nishioka and Van Sickels^[11] which states that intraoral approach is preferable for open reduction of mandibular fractures. Its advantages are adequate access for inspecting the occlusion at all times, lesser chances of the facial nerve damage and better esthetics due to avoidance of extraoral scar.

A single 2.0 mm locking reconstruction plate was fixed to each stable fragment with three screws near the lower border of the mandible. There were no intraoperative complications. There was good immediate postoperative stability in all patients. No intermaxillary fixation was given to any of the patients. One patient with an associated subcondylar fracture required postoperative intermaxillary ligation with traction elastics for 3 weeks postoperatively. There was no case of non-union, malunion or plate fracture.



Figure 6: Occlusion and intraoral healing at 6 month follow-up

There was only one complication in our study. One patient reported paresthesia in the area of distribution of the mental nerve. It was managed conservatively by administration of tablet methylcobalamine once daily for 1 month.^[12]

A number of research studies^[13-17] have shown that asymptomatic plates and screws may be retained indefinitely without any adverse effects. In the present series, removal of any asymptomatic

plates was unintended and none of the plates had to be removed up till the present follow-up period.

Apart from the advantages of the locking mechanism, the AO 2.0-mm locking reconstruction plates offer the advantages resulting from buttress plates, which can support a full functional load by acting as load bearing devices and can counter and convert shear forces to compressive axial forces at the fracture site. This improves the stability of the construct, which decreases the gap strain and the mechanical susceptibility to infection that occurs when adequate stabilization is no longer guaranteed.^[8]

Moreover, the AO 2.0-mm locking reconstruction plate placed at the inferior border of the mandible seems capable of neutralizing compression and tensile forces, thus making unnecessary the use of a second plate.^[8] It provides optimal stability which allows direct bone healing to occur.

Ellis^[8] studied outcomes for two bone plating techniques used in the treatment of mandibular symphysis/body fractures and concluded that the application of a second bone plate in cases of parasymphysis and symphysis fractures in accordance with the Michelet-Champy technique increased the incidence of wound dehiscence, plate exposure and need for plate removal. It might be prudent to choose one stronger bone plate applied at the inferior border instead in such cases.

CONCLUSION

The study has demonstrated that treating linear non-comminuted mandibular fractures with a single AO 2.0-mm locking reconstruction plate provides excellent stability at the fracture site which in turn leads to sound bone healing and early functional rehabilitation.

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