

Surgical Management of Non-Union Edentulous Mandibular Fracture: A Case Report

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Abstract

Introduction: Management of the atrophic mandibular fracture is a common challenge among maxillofacial surgeons. This is related to anatomic and physiologic changes in the elderly patients. As a member of trauma team, a maxillofacial surgeon should have a good knowledge in management of maxillofacial trauma in this group of patients. The treatment options are not unique, but open reduction is more common than closed reduction in the last decade. The purpose of this study is to describe a complication of surgical treatment of an edentulous mandibular fracture and management of this situation.

Case report: A patient with a previous bilateral mandibular body fracture that treated surgically with open reduction and rigid internal fixation with the use of mini-plates and titanium mesh presented with a fistula and mesh exposure after 5 months. The nonunion was occurred at the site of fracture in right side of the mandible. This condition was managed surgically with removal of fixation devices and debridement of all fibrous and necrotic tissues and placement of a reconstruction plate to maintain the anatomical position of the segments. Layered closure of soft tissues with development of a platysmal flap and buccal fat pad flap over the reconstruction plate was done. With a 39 months period of follow up the soft tissue healing and jaw relationship was satisfactory.

Conclusion: With regard to this paper, a good anatomical reduction and rigid fixation of the edentulous mandibular fracture can provide successful results. For this purpose we can use the reconstruction plate to get the better stability and reduce the possible movements between segments that can lead to nonunion and infection at the site of fracture.

Keywords: Atrophy; Edentulous jaw; Mandibular fracture; Surgical procedure

Introduction

The elderly population continues to grow and the incidence of trauma among this group has also increased. As a member of trauma team, a maxillofacial surgeon should have a good knowledge in management of maxillofacial trauma in this group. One of the most challenging fractures to manage is the bilateral body fracture in a severely atrophic mandible [1]. The treatment options are not unique, but open reduction is more common than closed reduction in the last decade. Some advantages of open reduction consist of direct visualization and excellent reduction and immobilization [2-4]. Fractures of the atrophic edentulous mandibular represent one of the most challenging injuries to manage successfully. Decreased vascular supply and osteogenesis capability coupled with decreased bone volume, can cause the healing of fractures in this region very difficult [1]. By the 1970s, Bradley demonstrated that the primary blood supply of the edentulous atrophic mandible is from periosteal region and periosteal stripping can compromise blood supply. This led to minimizing periosteal stripping and the use of closed reduction of fracture or the use of mini-plate fixation with minimal periosteal elevation. On the other hand some surgeons advocated of primary bone grafting in management of these fractures [1]. In recent decades techniques with more rigid internal fixation have gained popularity. These are based on minimal movement between segments and lower rate of non-union and infection [5-12]. But it is still controversial because of blood supply compromised in the fractured site after open surgical operation [13,14]. In cases of established non-union, the treatment of choice is the rigid internal fixation with or without bone grafting. And the presence of active osteomyelitis is not a contraindication to this treatment. In cases of large defect between segments application of a reconstruction plate is mandatory [15]. In a study reported that application of a reconstruction plate is superior to the mini-plate fixation in cases of atrophic mandibular fractures. And better rigid fixation can achieve by this method [16].

We report a case with a non-union of the previously treated edentulous mandibular body fracture. We treated this case by open reduction and rigid internal fixation with a reconstruction

plate based on the principles of Association for Osteosynthesis [17].

Case Presentation

The patient was a 38 years old male that came to our hospital with the chief complaint of pain and fistula at the right side of the mandible. In the review of systems and physical examination there is not any positive point. He was edentulous from 8 years ago due to extraction of his teeth as the result of dental caries and periodontal disease. And after that time he used a removable complete denture. He was suffered a car accident 7 months before, and bilateral fracture in body of the mandible was occurred (**Figure 1A**). Fractures were unfavorable and notable displacement was seen at the site of fractures. The quality and quantity of bone was favorable. The fractures were treated surgically with open reduction and rigid internal fixation in another hospital, with mini-plates and titanium mesh. In the left side there are two 4-hole mini-plates with 2 screws at each side of fracture line, and in the right side there is a 10-hole mini-plate that fixates the segments with 3 screws at each side of the fracture line and a titanium mesh with 2 screws in place. The mesh was formed to cover the buccal, inferior and lingual aspect of the mandible. After 5 months the bony union was occurred on the left side but in the right side there is not any bone continuity at the fracture site (**Figure 1B**). A fistula with pus secretion was developed at the right side of the mandibular body and the titanium mesh was exposed to the skin (**Figure 1C**). We take a CT scan with reconstruction of 3 dimensional views to evaluate the mandible and position of the segments for the purpose of removal of fixation devices and reconstruction of the mandible at the ideal anatomical position of segments (**Figure 1D**). An informed consent was taken from the patient.

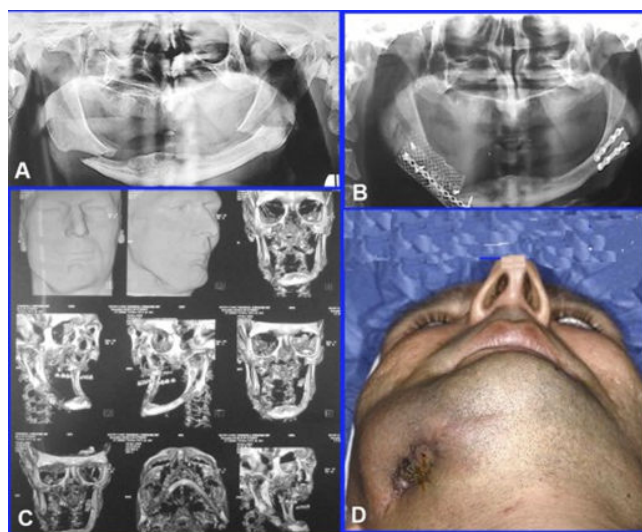


Figure 1 (A) Panoramic view of bilateral mandibular body fracture (B) Panoramic view after 5 months of open reduction and rigid internal fixation. Nonunion at the right side is present (C) 3 Dimensional views (D) Extra oral fistula.

The operation was done under general anesthesia with a nasal intubation. During surgery the epithelium of the fistula and the all of granulation and necrotic tissues were removed. Before removal of the fixation device to maintain the optimum position of proximal segment and condylar position in the glenoid fossa we use a mini-plate to fixate the proximal segment to the body of the zygoma at the right side only for maintaining proximal segment position during surgery. We removed it at the end of the surgery and before soft tissue closure. After removal of titanium mesh and mini-plate and all fibrous connective tissues, the dehiscency of the oral mucosa was sutured.

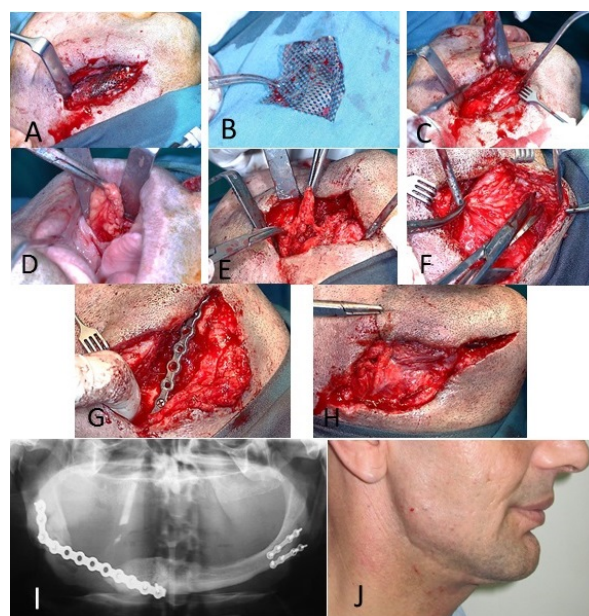


Figure 2 Intra operation photographs. (A) Submandibular incision and dissection (B) Removal of titanium mesh (C) Removal of fibrous connective tissue (D, E) Transposition of buccal fat pad over the mandible (F) Platysmal flap (G) Placement of reconstruction plate (H) Layering closure of the wound (I) Panoramic view (J) Photography at 39 months after surgery.

We used the pedicled buccal fat pad flap from the upper side of the wound and advancement of a platysmal flap from the opposite side for the purpose of layering closure over the reconstruction plate and body of the mandible. Our treatment option was rigid fixation with a reconstruction plate. Because of loss of hard tissue in that region the reconstruction plate could maintain the gap between the segments and provide enough stability. We used a 2.7 mm reconstruction plate with 4 screws on each side of the segments to stabilize the proximal and distal segments. To achievement the best anatomical and functional position of segments, we used the removable complete denture of the patient as a gunning splint. We fixed the mandular denture by circummandibular wiring and also the maxillary denture by the screws to the palatal bone. Then we achieved intermaxillary fixation by wiring between arch bars on the buccal side of the dentures. After adaptation of the reconstruction plate over the mandible, it was fixed with 4 screws at each segment. Care was taken to preserve the remaining bone and

avoidance of shattering the remaining bone. After complete fixation, we released the intermaxillary fixation and the mini plate between proximal segment and zygoma was removed. Mandibular range of motion was checked and layered closure of soft tissue was done.

We did not have any complication in this surgery. The function of the marginal mandibular branch of the facial nerve was preserved. The mandible was symmetric. Mandibular function was good and there is not any deviation during mandibular opening. After 39 months follow up period, the healing of the soft tissues was acceptable and the relationship of the jaws was good. We do not have any problem in soft tissue healing and we did not have recurrence in fistula formation (**Figure 2**).

Discussion

In elderly patients some deficits in visual acuity, musculoskeletal and nervous system function could lead to increased incidence of trauma in this population and one of the most complicated traumas is head and neck trauma which could lead to high mortality, especially in females [18]. One of the most commonly fractured facial bone in geriatric patients is the mandible, with the female to male ratio of 2:1 [19,20]. Treatment modalities of these fractures is a common challenge between surgeons because in this population we encountered with decreased quality, quantity and healing potential such as angiogenesis and calcification at the fracture site [20,21]. Methods of treatment in these patients include: maxillomandibular wiring with the adjunctive splinting provided by the patient's dentures or a fabricated Gunning splint, external pin fixation and open reduction with rigid internal fixation [22]. One important factor for decision making in treatment of these cases is be the degree of atrophy. More rigid fixation may be necessary in mandibles with less than 15 mm bone height. And in cases with advanced bone resorption we need to reconstruct the mandible with simultaneous bone grafting and rigid fixation of the fractured segments [23].

Another important factor in achievement of a successful result in treatment of fractures is the stable and rigid fixation of segments without any movement at the fracture site. That it can be achieved with open reduction and rigid internal fixation [24,25]. In this case the fixation of fragments at the right side was insufficient because only one plate with 3 screws were used for fixation of fracture where only one screw were placed in the distal segment. With the use of mini-plate fixation we must use at least two screws in each side of the fractured segments. The presence of titanium mesh itself can interfere with blood supply from the soft tissues to the bone and can delay the healing process. On the other hand in atrophic mandibles there is decreased blood supply and some author advocate of not stripping the periosteum with regard to maintaining of blood supply to the bone. This concept can lead to treatment approaches with closed reduction and fixation such as intermaxillary fixation with the use of gunning splints. But the possible movements between segments may interfere with healing process of the fractured segments.

The use of larger plates such as reconstruction plates, and bicortical screws applied to an atrophic mandibular body fracture can result in good rigid fixation and successful healing of fractures. But this technique increase the risk of injury to the inferior alveolar nerve [16,26,27]. In cases with infected non-union mandibular fractures, the procedure of concomitant incision and drainage, debridement, fracture reduction, and stabilization with rigid internal fixation can be effectively used for successful treatment [28].

In our case we used a reconstruction plate for rigid internal fixation after debridement of the necrotic and fibrous connective tissues. We used an extraoral approach to have a good access for debridement and reconstruction of the mandible. That precise reduction and fixation of fractured segments under direct visualization in open approach can lead to better results and successful treatment. For good coverage of the bone and reconstruction plate we used the local flaps such as platysmal flap and buccal fat pad flap. With a good rigid fixation without any movement and good anatomic relationship between segments and layering closure of the soft tissue wound, the incidence of complications after surgery was low and we can achieve successful results.

Conclusion

We with respect to this paper, with the use of a rigid internal fixation and good soft tissue management the result of surgical management of the non-union edentulous mandibular fracture was good with no complication. The use of rigid internal fixation without any movement between segments in treatment of edentulous mandibular fractures can lead to better results and decrease the incidence of complications such as non-union and infection at the fracture site.

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