A Novel Technique for Attaining Maxillomandibular Fixation in the Edentulous Mandible Fracture

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Abstract

Keywords

- MMF
- maxillomandibular fixation
- mandible
- fracture
- edentulous
- spanning

Edentulous mandible fractures present a unique and challenging surgical problem, particularly because of lack of occlusive dental surfaces to capitalize upon maxillomandibular fixation (MMF). We present a novel technique to achieve MMF using rigid plates spanning the oral cavity to fixate the maxilla to the mandible. The process is rapid and allows stability using the established principles of rigidity, external fixation, and osteosynthesis. This technique allows for a faster MMF than with a Gunning splint and allows for easier oral hygiene. An illustrative case and pre- and postoperative imaging are provided.

The edentulous mandible fracture presents a challenging and controversial clinical scenario for a multitude of reasons, the most obvious of which is the lack of occlusive dental surfaces to capitalize upon for manual fracture reduction and maxillomandibular fixation (MMF). Further complicating the situation is an often severely atrophic mandible with poor vascularity. The rate of fracture nonunion is inversely proportional to the thickness of the atrophic segment.¹ Rigid fixation of these difficult fractures can result in palpable plates and sometimes painful fitting of dentures down the road. All of these problems are encountered in the setting of a frequently aged patient, with multiple comorbid conditions and higher anesthetic risks.

Historically, these fractures were treated conservatively, but success with open reduction and internal fixation of mandible fractures in general has led to a more aggressive approach with the edentulous mandible.^{2,3} Various open treatment strategies have been described, with no consensus regarding the best therapy.⁴ This is confounded by certain treatment modalities, namely external fixation, having an increased rate of complications, though these modalities are often reserved for more severe injuries.⁵ Treatment of edentulous mandible fractures with plates beneath the periosteum, above the periosteum, and even atop the mucosal

surfaces have all been described.^{1,6} The treatment plan must be individualized depending on bone stock available, degree of comminution, availability of dentures, medical comorbidities including smoking, and patient preferences.⁷

Although the use of MMF is often cited in the literature, it is also controversial.^{8,9} Many novel ways of achieving fixation have been described, including the traditional methods of arch bars or circumdental wires, Gunning splints, bone anchors, embrasure wires, orthodontic dental brackets, and cortical bone screws, among others.^{10–13}

We present a novel way of achieving MMF using rigid plates, fixed to both the mandible and maxilla with screws, thus spanning the oral cavity.

Case Report

A 55-year-old woman presented to the trauma bay by helicopter from the scene of a single-vehicle rollover crash. Facial computed tomography scans showed a bilateral Lefort 2 fracture, a left mandibular body fracture measuring 17.5 mm in height, and a right subcondylar fracture (►Fig. 1). The patient's dentures were irreparably damaged in the accident, with most of the pieces missing entirely. She presented with a low albumin, multiple extremity orthopedic

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Figure 1 Preoperative 3-D reconstruction of facial bones. Note the left angle fracture and loss of height in right ramus.

injuries, vertebral fractures, spleen injury, mediastinal hematoma, pulmonary contusions, sternal fracture, pelvic fractures, scapula fracture, multiple rib fractures, severe posttraumatic bruising, and edema of the oral gingiva and had a history of smoking. Given her polytrauma status, prolonged respiratory failure, dysphagia, and continued protein-wasting malnutrition, a tracheostomy and percutaneous endoscopic gastric tube were placed prior to fracture repair. Planned MMF did factor in to the decision for feeding tube and tracheostomy placement, though the decision was made in the global setting of preexisting malnutrition, prolonged respiratory failure, dysphagia, and the need for multiple surgical procedures.

During fracture repair, each of the patient's facial fractures was exposed followed by manual reduction. The left mandible body fracture was plated first with a miniplate placed subperiosteally, trying to capture as many of the comminuted segments as possible but realizing total rigid fixation would not be achievable given the multiple bony fragments and the desire to minimize periosteal dissection. This plate was fashioned along Champy's line of osteosynthesis.

Next, fracture reduction was performed from superior to inferior by plating inferior orbital rims and midface buttresses with miniplates. Once the midface was stabilized, gentle traction was used to reduce the subcondylar fracture and estimate centric occlusion. The appropriate distance between maxilla and mandible was verified by measuring the occlusal relationship of the remains of denture fragments. The mandible and maxilla were fixed together using 2.0 locking plates placed above the mucosa. These spanning plates were placed in a superoanterior vector to compensate for lack of rigid occlusion behind the left angle fracture (►Fig. 2).

Routine oral care including chlorhexidine and oral swabs was continued every 6 hours postoperatively. The

Figure 2 Postoperative 3-D reconstruction of facial bones. Note the spanning plates and correction of facial height. The left angle has also been repaired.

patient remained an inpatient and on continuous oxygen saturation monitoring with a screwdriver at the bedside while she was in MMF. The MMF plates were removed at the bedside after 3 weeks, and range of motion exercises began. Three months after surgery, the patient is healed with nontender fracture sites and no temporomandibular joint dysfunction and she is ready to be fitted for dentures (►Fig. 3).

Discussion

Rigid MMF can be achieved using plates and screws to allow for subcondylar healing and remodeling at appropriate bony height. Given the plates will leave the posterior occlusion unfixed behind the angle fracture, certain measures must be taken to prevent torque on the fracture line by the masseter. These measures include placing the plates in a superoanterior vector and also plating the angle fracture along the line of osteosynthesis. This Luhr class III fracture was fixed with a miniplate rather than with compression given the degree of comminution and our plan to also use MMF as an adjunct.¹ We elected to use locking plates to allow the screw to engage the plate without crushing the fixed gingiva beneath. This was done with the aid of a Freer elevator placed between the plate and gingiva.

Given the degree of angulation alone, consideration was given to open reduction of the subcondylar fracture.¹⁴ However, this fracture was comminuted with intra-articular extension, and this finding, coupled with degree of brittleness found on dissection and reduction of the other facial fractures, led us to the decision to treat the fracture closed with reestablishment of vertical height using MMF.¹⁵ The trend toward expanding the indications for open treatment of subcondylar fractures is acknowledged, though repeat randomized and prospective studies have shown comparable

Figure 3 Postoperative panoramic view after removal of spanning plates. Note evidence of bony union at left angle.

clinical results in both open and closed management of subcondylar fractures.^{14,16} The issue remains controversial and each patient must be approached individually. Our management strategy achieved an acceptable result with imaging-proven establishment of vertical height and no limitation of function.

This technique is not suggested to be an absolute alternative to Gunning splints for closed management of subcondylar fractures, though it does have several advantages. The fixation takes 5 to 10 minutes and is certainly quicker than open reduction of a subcondylar fracture, diminishing anesthetic time and operating time costs while also avoiding facial scarring. Hardware costs are higher with spanning MMF plates as two 4-hole plates and eight screws runs on the order of \$950 and four rapid MMF screws would cost around \$225 at our institution. Arch bars and wires would be even less expensive but take longer to apply. Given reduced operating time, we still believe spanning fixation to be less expensive than open reduction. Oral care is simplified and visualization improved compared with burdensome splints or even arch bars. The preoperative preparation time of making impressions and splints is also avoided, though the potential role of a dental specialist should not be understated. In this case, the dentures were largely unrecoverable and the remains were sparse and in fragments. This coupled with contused and swollen gingiva did not allow repair of dentures and use as Gunning splints. However, consideration should be given to early involvement of dental specialists, especially in the setting of a partially edentulous patient, to allow precise placement of implants for functional long-term occlusion.¹⁷

There is a narrow subset of patients who will benefit from this novel approach, typically patients with another means of controlled airway who are edentulous and require rapid, short-term MMF, where Gunning splints are not an option. Although this approach is not used often given the narrow indications, it is certainly a useful tool to have in the armamentarium of a craniofacial surgeon. The spanning plates essentially function as an intraoral external fixator and allow for absolute rigidity in the setting where dentures are not available and as an alternative to Gunning splints.

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