

A Technique for Reduction of Edentulous Fractures Using Dentures and SMARTLock Hybrid Fixation System

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Summary: Establishing anatomic reduction of an edentulous mandible fracture is a frequently acknowledged challenge in craniomaxillofacial trauma surgery. In this study, we report a novel method for the reduction of the edentulous mandible fracture, via fabrication of modified Gunning splints using existing dentures and SMARTLock hybrid arch bars. This technique dramatically simplifies the application of an arch bar to dentures, obviates the need for the fabrication of impressions and custom splints, and eliminates the lag time associated with the creation of splints. Furthermore, this method may be used with or without adjunctive rigid internal fixation. The technique described herein of creating Gunning splints with SMARTLock hybrid arch bars provides surgeons with a simple, rapid, single-stage solution for reduction of mandibular fractures in the edentulous patient. (*Plast Reconstr Surg Glob Open* 2017;5:e1473; doi: 10.1097/GOX.0000000000001473; Published online 13 September 2017.)

INTRODUCTION

Maxillomandibular fixation (MMF) is a well-established tool that is used to establish occlusion and immobilize the mandible after facial trauma. Dr. Gunning described the use of Gunning splints for the reduction of mandibular fractures in 1864, and methods of externally stabilizing the mandible have continued to evolve.^{1,2} Commonly used methods for stabilization of the edentulous mandible fracture utilize preexisting dentures or fabricated Gunning splints in combination with arch bars or MMF screws. When available, preexisting dentures can be fitted with arch bars and then secured to the maxilla and mandible using screws or circummandibular wiring to achieve MMF.³⁻⁶ If dentures are unavailable, Gunning splints can be manufactured and used in a similar manner. Disadvantages inherent to the latter technique include the need for the fabrication of impressions and the time lag associated with creating the splint. In this report, we describe a novel method for

the fabrication of Gunning splints using dentures and SMARTLock (Stryker Corporation, Kalamazoo, Mich.) hybrid arch bars. This technique simplifies the application of arch bars to dentures, obviates the need for the fabrication of impressions and splints, and eliminates the lag time associated with the creation of splints.

MATERIALS AND METHODS

Case Presentation

A 67-year-old male presented to the emergency department after a motor vehicle collision. After stabilization by the trauma surgery team, computerized tomography scans were obtained and revealed a displaced left frontal bone fracture, bilateral frontal sinus fractures with anterior and posterior table involvement, a left Markowitz II naso-orbito-ethmoid fracture, a displaced left zygomaticomaxillary complex fracture, and a right mandibular body fracture. The mandibular fracture was held in reduction by the patient's lower denture (in place at the time of the accident; Fig. 1). No additional traumatic injuries were noted. The patient was then taken to the operating room for irrigation and debridement of the open left frontal bone fracture by the neurosurgery team. Concurrently, the craniomaxillofacial trauma team performed a bilateral frontal sinus cranialization and frontal bone reconstruction.

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Fig. 1. Three-dimensional reconstruction obtained from the pre-operative CT scan. Imaging revealed a displaced left frontal bone fracture, bilateral frontal sinus fractures with anterior and posterior table involvement, a left Markowitz II naso-orbito-ethmoid fracture, a displaced left zygomaticomaxillary complex fracture, and a right mandibular body fracture. The mandibular fracture was held in anatomic position by a denture that is not visible on CT.

Creation of Custom Splints and Establishing MMF

Approximately 1 week after presentation, the patient was deemed stable for open reduction and internal fixation of his left naso-orbito-ethmoid, left zygomaticomaxillary complex, and right mandibular body fractures. For reduction of the right mandibular body fracture, a novel modified Gunning splint technique was employed using the patient's preexisting dentures and SMARTLock hybrid MMF.

Intraoperatively, the patient's dentures were brought to the operating field, and SMARTLock arch bars were adapted to fit the patient's dentures. The arch bars were then fixated to the dentures using four 4-mm screws on the mandibular denture and three 4-mm screws on the maxillary denture, thus creating modified Gunning splints (Fig. 2). Fabrication of these splints required less than 10 minutes of operative time. The splints were then fixated to the patient's maxilla and mandible using 10-mm screws placed through the denture flange. After fixation, the splints were wired into occlusion with 25-gauge stainless steel surgical wires. The right mandibular body fracture was then exposed to confirm anatomic reduction, and a mandibular reconstruction bar was used to rigidly fixate the fracture. Finally, the gingival incision was closed, the MMF wires were released from the arch bars, and the patient was maintained in MMF using guiding elastics (Fig. 3).



Fig. 2. A modified maxillary Gunning splint that was fashioned intraoperatively using the patient's preexisting dentures and the SMARTLock hybrid arch bars.



Fig. 3. Splints in situ with the patient in elastic MMF.

RESULTS

No complications were noted in the postoperative period. Postoperative computerized tomography scans revealed excellent mandibular reduction with appropriate positioning of the surgical hardware (Fig. 4). Elastic MMF was maintained for a total of 6 weeks, after which the splints were removed (Figs. 5, 6). This technique maintained the structural integrity of the denture. Repair of the surgical screw holes was easily accomplished with placement of a liquid self-curing pink-colored acrylic resin (Lang Dental Jet Denture Repair; Wheeling, Ill.), preventing the need for costly replacement, or remanufacture, of the maxillary denture (Fig. 7).

DISCUSSION

The management of mandibular fractures in the edentulous patient is challenging due to the presence of atrophic, poorly vascularized bone, diminished capacity for bone regeneration, and the lack of dental surfaces to guide anatomic fracture reduction.^{3,7,8}



Fig. 4. Postoperative 3-dimensional CT scan that was obtained after mandible and midfacial fracture fixation. Postoperative CT scans revealed excellent mandibular reduction with appropriate positioning of the hardware.



Fig. 6. Minimal surgical screw damage to the existing dentures, which can easily be treated with self-curing acrylic resin negating the need, and associated costs, for remanufacture of the denture.

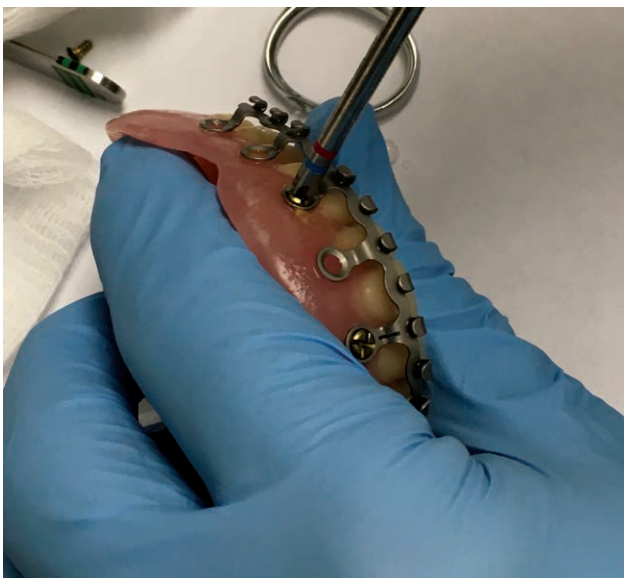


Fig. 5. Removal of the SMARTLock hybrid arch bars in the clinic setting after discontinuation of MMF.

Multiple techniques to achieve MMF have been described for the management of fractures in the edentulous patient including the application of conventional arch bars to preexisting dentures or Gunning splints.⁸⁻¹⁰



Fig. 7. Repair of the surgical screw holes to the complete denture was accomplished with the application of self-curing dental acrylic resin, negating the need and costs associated with fabrication of a new denture. This repair can be easily accomplished at the clinical setting immediately upon removal of the SMARTLock hybrid arch bar screws, or referred to the patient's general dentistry provider.

Although these techniques allow surgeons to achieve MMF, they may be invasive and/or time intensive. In our experience, the use of the SMARTLock hybrid MMF system in conjunction with preexisting dentures offers multiple advantages over conventional techniques for accomplishing MMF in the edentulous patient. This technique allows for the rapid creation of splints (< 10 minutes) that can be assembled in the operating room and precludes the need for the formation of impressions or splint assembly by a prosthodontist. In addition, the minimally invasive application may be more appropriate for the edentulous patient in whom decreased vascularity and blood flow to the atrophic mandible may make an open reduction and internal fixation a less suitable option.^{11,12}

Bone anchored arch bars combine 2 methods for reducing mandibular fractures: conventional arch bars and MMF screws. The advent of MMF screws has circumvented many challenges inherent to the use of arch bars. MMF screws have significantly reduced the risk of penetrating injury to the surgeon, surgical time, and trauma to the gingiva.¹³ However, MMF screws are unsuitable in many situations; specifically, this technique should not be used in severely comminuted, displaced, and/or unstable fractures, areas of atrophic mandibles where placement of screws may iatrogenically injure the inferior alveolar nerve, or in patients with multiple mobile teeth. Furthermore, MMF screws do not exert a tension band effect or provide stability to the dental arch and thus are less suitable for patients who require long-term MMF.^{14,15} The technique proposed in this report details a method of fixation adapted for use in edentulous patients that provides the benefits of both MMF screws and arch bars.¹⁵⁻¹⁷ If properly performed, the application of the SMARTLock surgical screws within the acrylic resin of the denture should not predispose the denture to fracture. The patient would still need to be cautioned as to this possibility and the potential for replacement of the denture at their expense. The consensus of the authors would be to recommend the use of the smallest length screw included within the SMARTLock system (6 mm) and to consider using the prep drill to exactly position the screw path within an adequate bulk of acrylic resin to minimize potential iatrogenic injury to the denture.

CONCLUSIONS

We have proposed a modified Gunning splint technique for the reduction of an edentulous mandibular fracture using dentures and SMARTLock hybrid arch bars. This technique offers a simple, rapid method for the reduction of a mandibular fracture, obviates the need for the fabrication of impressions and splints, and eliminates the lag time associated with the creation of traditional Gunning splints.

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