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MMF Screws - A Modern, Minimally Invasive Mode Of Fixation Of Gunning Splint: A Case Report

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Abstract
Management of edentulous mandibular fractures in elderly patients poses a unique clinical challenge due to their compromised systemic health, poor bone quality, and absence of teeth for maxillomandibular fixation. These limitations often preclude the use of conventional open reduction and internal fixation techniques, increasing the risk of complications such as infection, delayed healing, and malunion. In such cases, conservative approaches utilizing intraoral splints offer a viable alternative. The Gunning splint, originally devised for edentulous jaw fractures, remains a reliable method for achieving closed reduction and stabilization by re-establishing occlusal guidance in the absence of teeth. This case report highlights the collaborative role of the oral surgeon and prosthodontist in the fabrication and application of a Gunning splint for conservative management of an edentulous mandibular fracture in an elderly patient. The surgeon's assessment of fracture extent and alignment, combined with the prosthodontist's expertise in splint design and denture simulation, enables accurate anatomic reduction and immobilization. This multidisciplinary approach not only minimizes surgical risk but also improves functional outcomes and patient comfort during recovery. We describe here an innovative technique combining the time tested method of the "gunning splint" and the advanced minimally invasive MMF screws for obtaining closed reduction in edentulous jaw fractures. The case underlines the

clinical efficacy and relevance of Gunning splints in modern maxillofacial trauma management, especially in medically compromised, elderly edentulous patients where surgical interventions may be contraindicated.

Keywords: *Gunning splint, Edentulous mandible, Mandibular fracture, Closed reduction Maxillomandibular fixation (MMF)*

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I. Introduction

Fracture management in edentulous patients, especially the elderly, presents unique clinical challenges due to anatomical, physiological, and systemic factors. Following tooth loss, the jaws undergo significant morphological changes, including progressive resorption of the alveolar process, reduced bone density, and atrophy of the ridges.[1]These changes result in decreased resistance to fracture and complicate the process of fracture reduction and fixation. Moreover, elderly patients often present with compromised medical conditions, reduced healing potential, and diminished vascularity, making open reduction and internal fixation (ORIF)less favourable orcontraindicated.[2]Maxillomandibular fixation (MMF), a cornerstone in the management of mandibular fractures, becomes particularly difficult in edentulous cases due to the absence of teeth that normally guide and stabilize the fracture segments. To overcome these limitations, the use of intraoral splints, specifically the Gunning splint, has been advocated. Originally described by Thomas Brain Gunning in the 19th century, this device was initially used in dentate individuals and later adapted for edentulous jaws by incorporating bite blocks in place of molars and a central feeding space.[3]TheGunning splint facilitates closed reduction that holds fractured mandibular segments in alignment and immobilizes the jaws. In the absence of teeth, retention is achieved through wiring techniques such as per-alveolar wiring, circumzygomatic wiring, or circummandibular wiring. Despite its long-standing history, newer techniques involving MMF screws and cortical screws have also been explored, although their application remains limited.[4]This clinical report outlines a step-by-step protocol for the fabrication and intraoral stabilization of a Gunning splint in an edentulous patient using MMF screws, highlighting its continued relevance in maxillofacial trauma management.

II. Case Report:

A 50-year-old male patient reported to Department of Oral and Maxillofacial Surgery with chief complaint of injury to the lower face due to a fall from standing height two days prior to presentation. On initial examination at the time of trauma, the patient had bleeding from the left ear, which subsided by the second day.On clinical evaluation, the patient exhibited pain, swelling, and reduced mouth opening (figure 1 and 2). There was no relevant medical history, and the patient's general health was stable at the time of evaluation. Orthopantomographic examination revealed a left-sided parasymphysis fracture of the mandible and bilateral subcondylar fractures (figure 3). The parasymphysis fracture line extended in a vertically favorable direction toward the inferior border of the mandible.Due to the patient's edentulous status,the absence of teeth, systemic health and age, open reduction and internal fixation of the fracture and traditional methods of maxillomandibular fixation (MMF) were deemed unsuitable. Hence the decision for closed reduction and stabilization using a customized Gunning-type splint was made in collaboration between the prosthodontic (Dept of Maxillofacial Prosthodontics) and surgical teams to ensure proper alignment and immobilization of the fractured mandibular segments.

Procedure for Fabrication and Fixation of Gunning Splint with MMF Screws

After thorough clinical and radiographic examination, preliminary impressions of the edentulous maxillary and mandibular arches were obtained using Type I impression compound (figure 4) and a wash impression with irreversible hydrocolloid impression material (figure 5). These impressions were immediately poured in dental stone to create diagnostic casts. Diagnostic casts were obtained,sectioned at fracture site and realigned according to proper mandibular arch anatomy. Record bases were fabricated, followed by construction of occlusal rims (figure 6).An approximate jaw relation was established using clinical judgment and the casts were mounted on an articulator (figure 7). The wax rims were then modified: an anterior opening was created to facilitate feeding (figure 8), and a posterior interlocking mechanism was incorporated—3 mm triangular projections on the mandibular rim and a corresponding triangular trough in the maxillary rim, to prevent any movement between the splints (figure 9). The rims were processed as separate units, using heat-cure acrylic resin.To facilitate intermaxillary fixation, arch bars were incorporated on the buccal aspect of each splint using self-cured acrylic resin (figure 10). These arch bars could accommodate traction forces additional tie wires when required (figure 11).For fixation, MMF (Maxillomandibular Fixation) screws were used due to their minimally invasive application through the buccal cortex. These screws, measuring 2.5 mm in diameter and 10 mm in length, provide cortical engagement. MMF screws are best suited for regions with adequate bone height

(at least 10 mm) and are contraindicated in cases with severely atrophic jaws.Ideal anatomical sites for screw placement included the midline of the maxilla or mandible—areas of high bone density and minimal vital structuresas well as the canine and the premolar-molar regions. The splints were first predrilled at planned fixation points. During the clinical procedure,the splints were checked in patient's mouth for extension and frenum relief. Then finishing and polishing of splints was carried out and they were disinfected in glutaraldehyde solution.The splints were seated over the edentulous ridges and the predrilled holes served as guides to place the MMF screwssecuring them with interdental wiring and ensuring the firm seating of splint and proper immobilization of the fractured mandibular segments (figure 12). This was kept for 6 weeks after which patient was rehabilitated with a complete denture (figure 13-16). AnOPG was repeated which showed complete reduction of fractured segments (figure 17).

Fig. 1: maxillary arch pre op photograph

Fig. 2: mandibular arch pre op photograph

Fig. 3: pre op OPG

Fig. 4: Preliminary impression

Fig. 5: Alginate wash impression

Fig. 6: wax occlusal rims

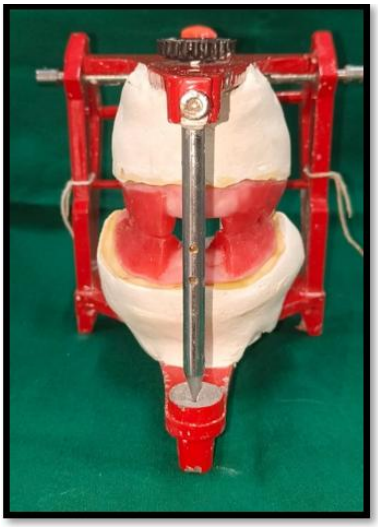


Fig. 7: mounted wax rims with anterior opening

Fig. 8: mounted wax rims with slots present laterally

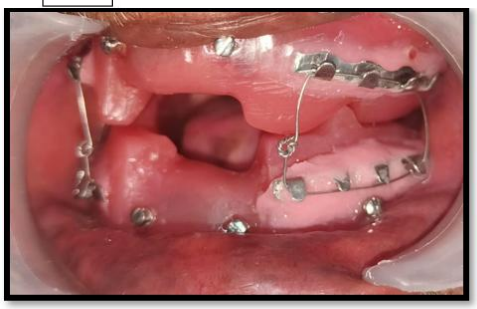
Fig. 9: occlusal view of wax rims

Fig. 10: gunning splint with arch bar (anterior view)

Fig. 11: gunning splint with arch bar (lateral view)

(a)

(b)



(c)

Fig. 12: Securing gunning splint with IMF screws and interdental wiring(a):frontal view; (b):right lateral view; (c): left lateral view (d) MMF

Fig. 13: Complete denture prosthesis

Fig. 14: complete denture (intra oral view)

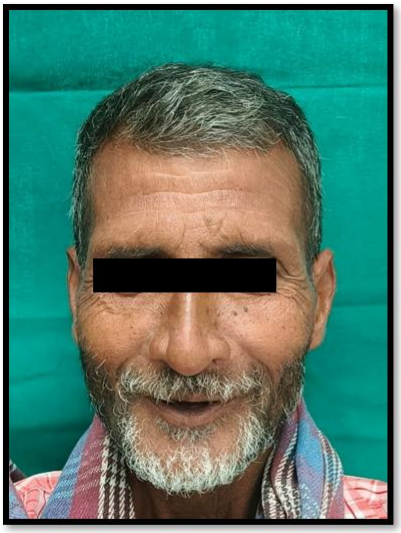


Fig. 15: Pre op photograph (extra oral)

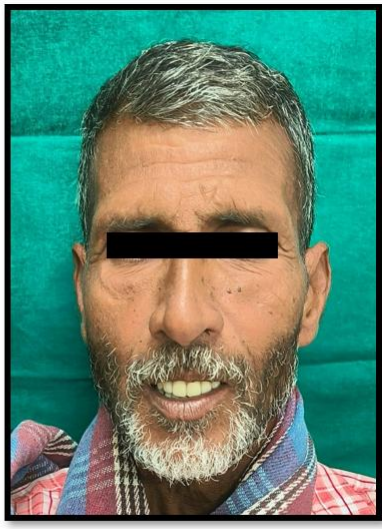


Fig. 16: Post op photograph

Fig. 17: Post op OPG

III. Discussion

Managing mandibular fractures in edentulous and atrophic jaws presents significant challenges due to reduced bone height, poor vascularity, and diminished healing capacity.[3] Aging leads to a decline in endosteal blood supply from the inferior alveolar artery, making the mandible reliant on the periosteal circulation. In such cases, open reduction disrupts the periosteum and increases the risk of delayed or complicated healing.[5] Furthermore, the reduced bone volume limits the application of plates and screws, increasing the risk of fragment displacement.Gunning splints offer a conservative, minimally invasive alternative by enabling closed reduction while preserving periosteal blood supply. They provide adequate immobilization and are particularly useful in edentulous patients where occlusal guidance is absent.[6] These splints can be stabilized using per-alveolar wiring, circummandibular wiring, or MMF screws, however, in the given case due to patient refusal for invasive wiring techniques, lesser invasive method of immobilisation by using IMF screws, were utilised.Dental splints are classified as fixed or removable. Fixed splints, such as sectional acrylic splints or vacuum-formed splints, are designed for immobilization. Gunning splints act as monoblock appliances with posterior bite blocks and anterior feeding windows, offering reliable fixation without surgical exposure.[7]Despite their advantages, Gunning splints have limitations. Improperly placed wires may lead to inadequate stabilization, and they are not ideal for unfavorably displaced fractures. Poor hygiene can also lead to foul odour and mucosal issues. However in our case due to regular follow up of the patient and strict compliance of the post operative instructions, there was no nidus for secondary infection. Nevertheless, for elderly or medically compromised patients, Gunning splints remain a valuable tool for effective fracture management.[8]The management of mandibular fractures in edentulous, elderly patients requires a careful balance between effective stabilization and minimally invasive intervention. Gunning splints offer a reliable and conservative method for closed reduction, particularly in cases where open surgery is contraindicated due to systemic health concerns or anatomical limitations such as atrophic ridges.[9] By preserving the periosteal blood supply and providing stable immobilization, Gunning splints contribute significantly to improved healing outcomes. Their ease of fabrication, adaptability to edentulous arches, and minimal surgical morbidity make them an essential tool in the multidisciplinary management of edentulous mandibular fractures.[10]

IV. Conclusion

Despite advances in maxillofacial trauma care, closed reduction using gunning splints or patient's existing dentures remains the primary modality for managing fractures in the edentulous mandible. This approach is particularly favoured when open reduction and internal fixation (ORIF) is contraindicated due to factors such as advanced age, systemic comorbidities, poor bone quality, or patient preference. The gunning splint continues to be the workhorse in such scenarios, offering reliable stabilization while preserving the patient's ability to maintain nutrition—an essential aspect of fracture healing.

Traditionally, gunning splints have been secured using circummandibular and circumzygomatic wiring, a time-tested but invasive technique that often results in patient discomfort and psychological distress. These methods, while effective, involve transcutaneous wire placement and can be particularly challenging in elderly or medically compromised individuals. In contrast, Mandibulo-Maxillary Fixation (MMF) screws offer a minimally invasive and atraumatic alternative, allowing for secure splint fixation without the need for invasive and extensive wiring. Their use not only simplifies the procedure but also contributes to improved patient comfort and psychological well-being, making them a valuable tool in the modern management of edentulous mandibular fractures.

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Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest
There are no conflicts of interest.