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Three-Dimension Grid Plate Effecting in Mandibular Fracture Fixation

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Case Report

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ABSTRACT

Introduction: The mandibular angle fractures in the region of the body represent the highest incidence of fractures in mandibles and therefore deserve special attention and care. The use of three-dimensional plates has shown good results in this type of treatment and use has increased every day.

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Case Report: The authors describe two cases of mandibular fractures treated with grid miniplate. In case 1, was carried out extra-oral access for fracture reduction in angle. In case 2 was also carried out extra-oral access for fracture reduction in mandibular body. The monitoring showed the surgical success and the absence of postoperative complications. The grid miniplate has shown a great treatment option in cases of fractures of the mandibular body and angle for ease of use and lower rates of postoperative complications.
Conclusion: The use of a three-dimensional grid plate has proven to be a viable alternative for the osteosynthesis of mandibular fractures. The results have significant clinical implications and encourage its use.

Keywords: Mandibular fractures; fracture fixation; bone plates; surgical Fixation devices; oral surgical procedures.

1. INTRODUCTION

Fractures of the mandibular angle and branch account for 41% of mandibular fractures [1,2]. However, the frequency, etiology and location of mandibular fractures can be altered according to geographical location. The angle is the first most frequent region for fractures caused by sports activities, the second most frequent region for fractures caused by violence, and the third most fractured region in cases of traffic accidents involving automobiles [3].

Although there is widespread agreement regarding the need for surgical reduction and fixation of a mandibular angle fracture (MAF), various treatment modalities have been described. Compared with other methods, the grid miniplate or three-dimensional plate provides greater stability and ease of installation, in addition to a lower rate of postoperative complications [4,5].

The most common postoperative complications of MAFs include occlusal disturbances, wound dehiscence, nerve injury, postoperative infection, pseudarthrosis, and insufficient stable osteosynthesis miniplate fracture [1,2,4]. Therefore, several treatment options have emerged to minimize these postoperative complications. A comparison between the various methods is difficult considering that the reported complication rates vary greatly between different studies and when the same method is used [4,6].

In this work, we describe two cases of successful clinical treatment of mandibular angle and body fractures treated with a grid miniplate. The long-term monitoring of patients confirms the success of the treatment.

2. CASE PRESENTRATION

Case 1: A 32-year-old male subject was referred to the Hospital Geral de Vila Penteado in the city of São Paulo, Brazil, complaining of a volume augmentation at the right mandible that had gradually increased in size and pain after a trauma to the face. Facial examination revealed right mandibular swelling with pain on palpation, and the patient reported occlusal alteration and trismus. Radiographic examination revealed a right mandibular angle fracture associated with an impacted third molar (Fig. 1).

The patient received systemic antibiotics before surgery. The mandibular angle fracture was scheduled electively, and after day 1, a surgical procedure was performed. Intermaxillary fixation (IMF) was performed before the surgical procedure was started with an Erich arch bar (Fig. 2).

Under general anesthesia, the fracture was exposed via an extraoral incision with Risdon access (Fig. 3).

Tissue detachment was applied to visualize, reduce, and stabilize the fracture line. The right mobile mandibular third molar exposed in the fracture line was removed. The fracture was then reduced, and an eight-hole rectangular grid miniplate was adapted to the outer side of the mandibular right angle. Monocortical perforation and fixation were performed with 8-mm screws (Fig. 4).

After plate placement, the IMF wires were removed, and occlusion was checked. The incision was closed with a nylon 5–0 suture. Postsurgical IMF was not necessary.

Antibiotic therapy was maintained throughout the perioperative period for seven days after surgery, and a chlorhexidine mouthwash was also prescribed. The patient was followed up for six months without infection and with occlusal stability. The use of the Erich arch bar did not compromise the periodontal health status, and

the scar from the extraoral access, which is a disadvantage of this access option, did not present any aesthetic compromise (Fig. 5).

Patient 2: A 43-year-old male subject was referred to the Hospital Geral de Vila Penteado in the city of São Paulo, Brazil, complaining of a volume augmentation at the left mandible that had gradually increased in size for a period after trauma. The patient did not experience systemic changes or contraindications to surgery. A head and neck examination revealed left facial swelling with pain on palpation, and the patient reported occlusal alterations. Radiographic examination revealed a left mandibular corpus fracture.

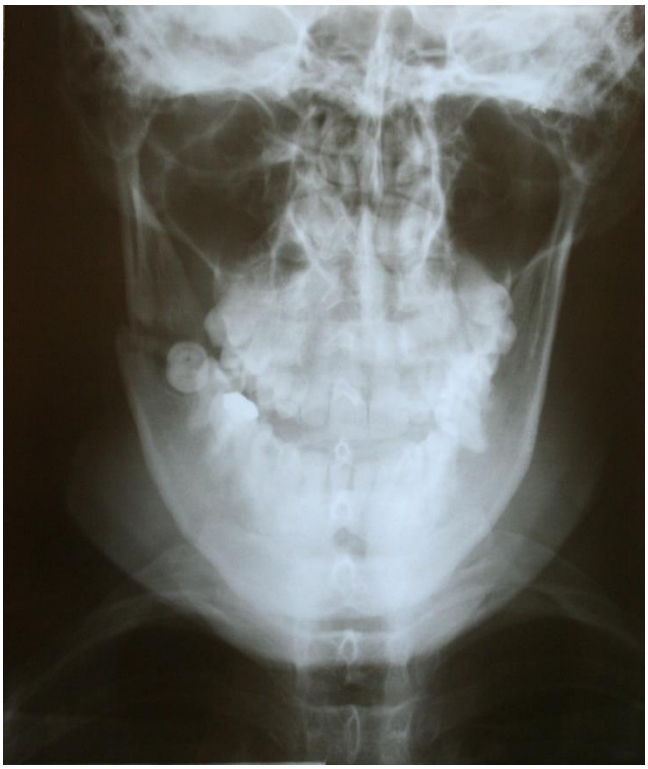

Fig. 1. Radiographic examination revealed a right mandibular angle fracture associated with an impacted third molar

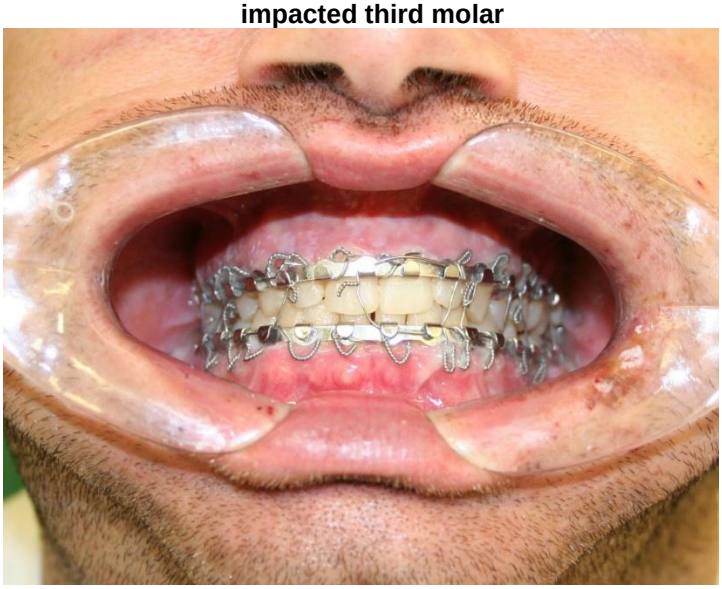

Fig. 2. IMF was performed before the surgical procedure was started with an Erich arch bar

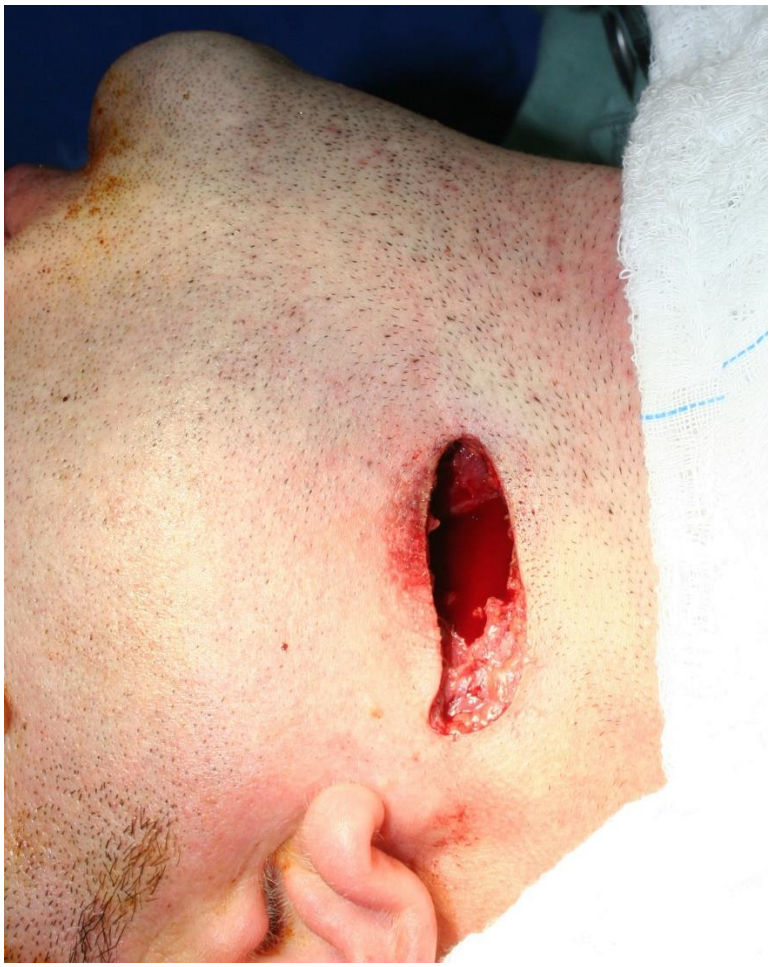

Fig. 3. Under general anesthesia, the fracture was exposed via an extraoral incision with Risdon access

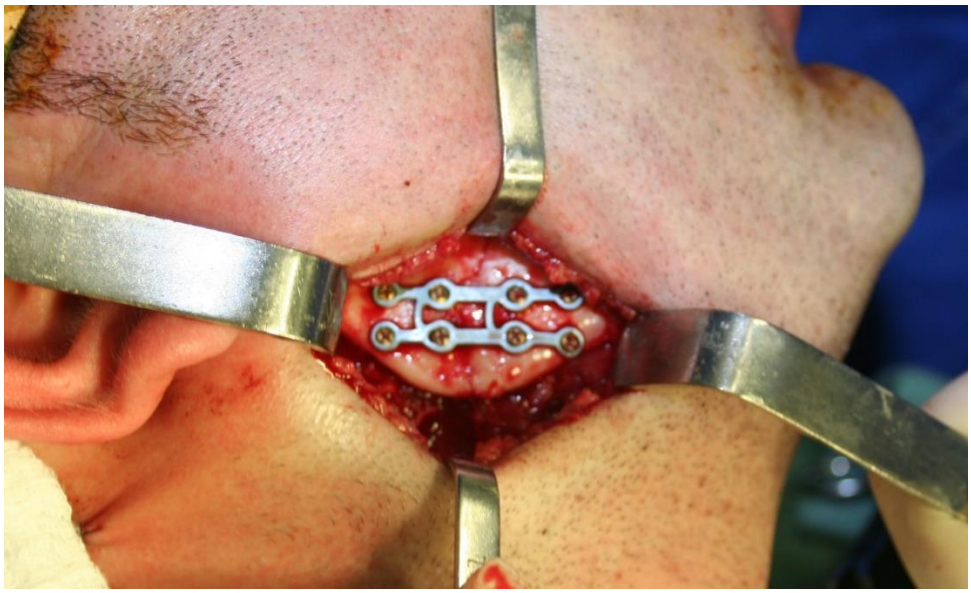

Fig. 4. Monocortical perforation and fixation were performed with 8-mm screws

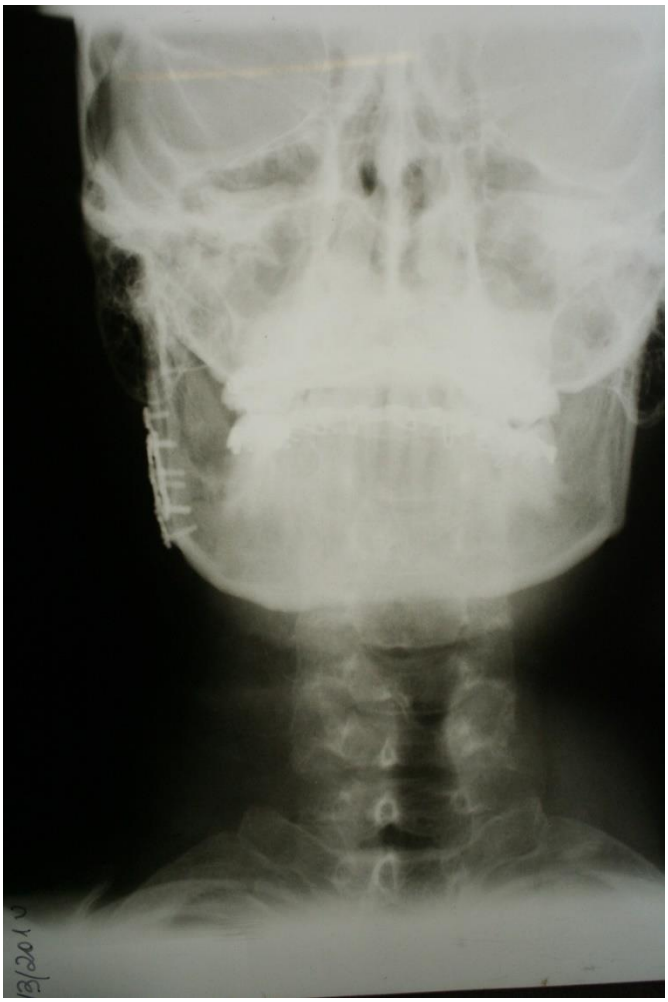

Fig. 5. The patient was followed up for 6 months, without infection and with occlusal stability

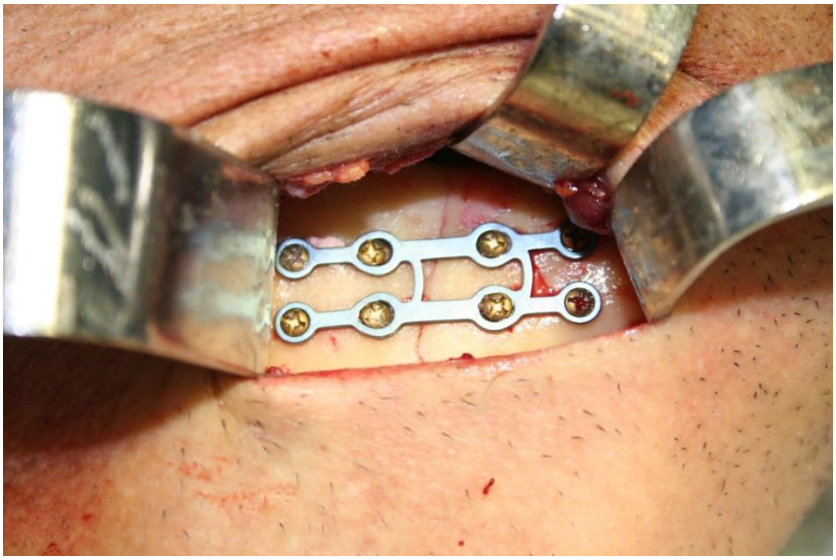

Fig. 6. The fracture was exposed via an extraoral incision and reduced with an 8-hole rectangular grid miniplate. Monocortical perforation and fixation were performed with 8-mm screws

The patient received systemic antibiotics from the time of presentation, and surgery was performed 1 day later under general anesthesia. IMF was performed before the surgical procedure was started with an Erich arch bar. The fracture was exposed via an extraoral incision and reduced with an 8-hole rectangular grid miniplate. Monocortical perforation and fixation were performed with 8-mm screws (Fig. 6). After plate placement, the IMF wires were removed, and occlusion was checked. The incision was closed with a nylon 5–0 suture. Postsurgical IMF was not used. Antibiotic therapy was continued throughout the perioperative period and for 7 days after surgery, and a chlorhexidine mouth rinse was also prescribed. The patient was followed up for 12 months, with regular periodontal probing and clinical examinations. No signs of infection were observed, and occlusal stability was maintained as evidenced by the absence of changes in occlusal contacts. Notably, the scar from the extraoral access healed with a minimal aesthetic impact.

3. DISCUSSION

A variety of different treatment modalities for treating mandibular angle and body fractures have been described. All successful treatments depend on undisturbed healing in the correct anatomical position under stable conditions. Failure to achieve this leads to infection, malocclusion, or nonunion.

Arch bars, two miniplates, tension band plates, locking screw plates and lag screw plates are among the main alternatives [1,2,4–13], but the Champy technique is likely the most commonly used method. The stability of single miniplate fixation for MAFs has been challenging in several biomechanical studies. The use of one standard miniplate leads to the opening of the fracture line at the lower border, lateral displacement of the fragments at the inferior border, and aposterior open bite on the fracture side. This fracture movement is thought to contribute to subsequent complications [14].

Although the strut plate is relatively new in the management of MAFs, it has demonstrated good clinical results in the literature. In addition to presenting the advantage of being easy and prompt intra- or extraoral manipulation, grid miniplates have simple adaptations over the bone, without distortion or displacement of the fracture, as well as simultaneous stabilization of the tension and compression zones [5,8,11]. Through its simple rectangular uniting two places through two bars, the twisting motion in the fracture region is virtually eliminated, unlike what happens when isolated plates are placed [8,11,12,15].

Kalfarentzos et al. (2009) simulated fractures in synthetic mandibles from SYNBONE® and compared the biomechanical behavior of the following systems of rigid internal fixation: 3D miniplate square, 2 mm; 3D miniplate curved, 2 mm; two miniplates straight, 2 mm and 1.6 mm; and one single miniplate straight, 2 mm. The 3D miniplate square system is the most favorable system [11]. Other recent experimental comparative studies corroborate these results and demonstrate better biomechanical results for grid miniplates [9,12,15].

Al-Moraissi et al. (2014) performed a systematic review and meta-analysis and reported statistically higher complication rates when standard plates were used. Compared with standard miniplates, MAF fixation with 3D miniplates decreases the risk of postoperative complications by 58% [16]. Some clinical trials have shown lower infection rates with the use of three-dimensional mini-plates than with conventional plates [5,8,10,13]. The statistically significant difference in the incidence of complications may be related to interfragmentary stability.

Furthermore, in a recent study using finite element analysis, *Subramanian et al. (2024)* evaluated the stress, deformation and strain in three different groups with bite force loads: a fixation system with a single miniplate, a system with two miniplates and a system with a matrix miniplate. The latter is the system that presented the best results in terms of its ability to support the loads distributed in the jaw by the masticatory muscles [15].

4. CONCLUSION

All these observations have important clinical implications and are likely associated with the recent increase in the use of 3-D miniplate systems; however, many clinical trials are still needed to validate these findings.

Therefore, we describe two successful treatments for mandibular fractures with internal fixation via a rectangular grid mini-plate. The method of treatment was shown to be efficient

since it promoted sufficient interfragmentary bone contact and allowed primary stability of the fracture, which implied quality in terms of bone healing and the absence of infection, with a consequent good postoperative clinical outcome [5,8].

ETHICAL APPROVAL

As per international standards or university standards written ethical approval has been collected and preserved by the author(s).

PATIENT CONSENT

Written consent was obtained from the patient.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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