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Management of Mandibular Fractures: Report of Three Cases

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Abstract

The mandibular bone is an important component of the facial bone, which has a unique role in digestive system, speech, and facial esthetics. For these important functions of mandibular bone, it is vital that surgeons should not only treat function but also consider the esthetics together. Mandibular fractures are among the most common traumatic injuries of the maxillofacial, and it is in facial region, the second most frequently fractured adult facial bone is the mandible due to its vulnerable position and projected onto the face. The objective of this study is to show in detail all the specific aspects, the management and the efficacy of the use of treatments by means of closed reduction and open reduction+stable internal fixation in patients with mandibular fractures. Special emphasis was placed on the potential impact of socioeconomic standards on the mechanism and pattern of jaw fractures.

Keywords: Fracture jaw, Closed reduction, Open reduction, Internal fixation

Abbreviations: IMF-Intermaxillary Fixation, MMF-Maxillomandibular Fixation

Introduction

Trauma at the facial level gives rise to soft tissue and hard tissue injuries, including dental organs, as well as the bony components that make up the face: mandible, maxilla, zygomatic bone, Nasoorbital-Ethmoidal Complex (NOE) and the supraorbital structures. The jaw is the second facial bone with the highest incidence of fractures in relation to the other facial bones; second only to the nasal bones, this is due to their unique shape, mobility, and prominence in the facial skeleton [1].

In a 10-year retrospective case study carried out in Saudi Arabia to analyze the incidence and etiology of maxillofacial fractures, 270 patients were registered with a total of 476 facial fractures, of which 260 fractures (54.5%) had mandibular involvement, among which the condyles turned out to be the most affected (11.8%). The main etiology of maxillofacial fractures are car accidents (63.3%) followed by falls (15.9%) assaults (6.7%) sports trauma (8.1%) work accidents (8.3%) gunshot wounds (8.7%) and attacks received by animals (2.2%) [2].

The goal of treatment in patients with mandibular fractures is to anatomically reduce the fractured segments or to place each fragment in the appropriate relationship with respect to the others [1]. To successfully reduce fractures of tooth bearing bones, the most

important thing is to place the teeth in the previously existing occlusive relationship. To achieve these objectives, closed reduction by means of Arches of Erich or open reduction and internal fixation by means of titanium plates and screws can be used [3-6].

Evaluation of Patients with Facial Trauma

The primary assessment encompasses the ABCDE of trauma care and identifies life-threatening conditions by adhering to this sequence: [7]

- A. Maintenance of the airway and control of the cervical spine.
- B. Breathing and ventilation.
- C. Circulation and hemorrhage control.
- D. Neurological deficit.
- E. Exposure /environmental control: Completely undress the patient, but prevent hypothermia

Once the patient is stabilized, a clinical history should be obtained as complete as possible, detailing precisely all aspects related to the trauma. The five questions to consider are:

- How did the accident happen?
- When did it happen?
- What are the specific aspects of the injury?
- Was there loss of consciousness?
- What symptoms does the patient currently have? [3]

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After a meticulous clinical assessment of the entire maxillofacial complex and when mandibular fractures are suspected, radiographs should be taken to provide additional information for their correct diagnosis. Among the most used projections we have: [3,8]

- **Orthopantomography:** in this type of X-ray we can detect any type of mandibular fracture.
- **Towne's projection:** Projection indicated to assess the mandibular condyles.
- **Anteroposterior and posteroanterior projection of the face:** projection indicated in the event of suspected fractures at the mandibular angles or condyles.
- **Oblique lateral projection of the mandible:** type of radiography indicated to assess the mandibular angles.
- **CT of the facial massif:** preferred radiological technique to study any type of maxillofacial fracture [8].

Classification

Trauma at the facial level can vary depending on the location, direction and intensity of the trauma received, which can cause mandibular fractures in its different locations. One of the classifications is based on the anatomical location in which the fracture occurred, within which we have: condylar, subcondylar, coronoid process, ascending mandibular ramus, mandibular angle, parasymphysal, symphyseal and dentoalveolar. Another classification of fractures is based on the state of the bone fragments and their possible communication with the external environment, among which we have: greenstick fractures that are the type of incomplete bone fractures, simple fractures that have no communication with the external environment, comminuted fractures characteristic of those fractures in which multiple bone fragments are present, such as those produced with gunshot wounds and Compound fractures that are characterized by having communication with the external environment [3].

Depending on the direction of the fracture line and the muscle action proximal or distal to the fracture that these exert, mandibular fractures can be favorable or unfavorable [3]. Favorable fractures are those in which the fracture line is perpendicular to the muscle action, which causes the fragments to resist their separation, whereas unfavorable fractures have a line parallel to the muscular action causing the displacement of the segments.

Treatment

For the treatment of mandibular fractures, different techniques have been proposed, known as Closed Reduction (conservative) in which only Intermaxillary Fixation (IMF) and Open Reduction (surgical) are used, which include opening, exposure and manipulation of the fractured segments [3]. The first and most important aspect of surgical correction of mandibular fractures is to reduce the fracture properly. In the tooth-bearing bones, it is of outermost importance to place the teeth in a pre-injury, occlusal relationship. Merely aligning the bone fragments at the fracture site without first establishing a proper occlusal relationship rarely results in satisfactory postoperative functional occlusion. With interdental fractures, fracture models are important: impressions poured in Snow-White plaster and sectioned at the fracture site allow the assessment of pre-trauma occlusion.

Missing teeth, pre-existing class II or III, and deep bite deformities may otherwise misguide the surgeon. To establish a proper occlusal relationship, several techniques have been described, generally referred to as IMF. The most common technique includes the use of a prefabricated arch bar that is adapted and circumferentially wired to the teeth or acid-etch bonded to each arch; the maxillary arch bar is wired to the mandibular arch bar, thereby placing the teeth in their proper

relationship. Other wiring techniques, such as Ivy loops or Obwegeser continuous loop wiring, have also been used for the same purpose [9].

The main objective of the treatment is to achieve a correct dental occlusion that existed prior to the fracture, so that only achieving a correct alignment of the bone fragments without having a satisfactory functional occlusion is not enough to achieve the desired objectives [3]. The correct dental occlusion established with the help of wires or elastic traction is known as intermaxillary fixation, within these several techniques have been established. The most important and most used are the Erich arches, which consist of prefabricated arches placed in both dental arches and, with the help of ligating wires or elastic traction, establish the maxillomandibular fixation [3,6]. Other techniques used that support the same objective are Ivy's loop wire ligations, transalveolar screws, Risdon's ligation, Ernst's ligation, and Essig's ligation. [3,6,10].

The use of elastic traction is important, even more so when the fracture segments are displaced, since they exert a constant force that gradually causes a satisfactory reduction of the fracture, and in cases of condylar fractures since immobilization by long-term can cause ankylosis of the Temporomandibular Joint (TMJ) (Figure 1 and 2) [5].



Figure 1: Prefabricated archwires (Erich's archwires) and elastic traction to restore ideal occlusion.



Figure 2: Ivy handle placed between premolars of the quadrants for IMF.

Titanium plates and screws are used in open reduction plus internal fixation. Pioneers such as Michelet and Champy had the greatest impact on the evolution of osteosynthesis in maxillofacial trauma. Their concept states that when a physiological load is applied to the mandibular teeth, a negative tension is created on the upper edge and a positive pressure will appear on the lower edge (Figure 3) [11].

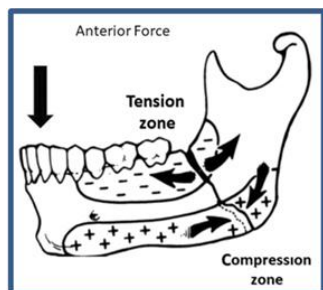


Figure 3: Biomechanics of mandibular angle fractures.

Among the advantages of internal fixation with respect to closed reduction is the greater comfort for the patient since the IMF is eliminated or reduced depending on the location and type of fracture, better feeding and postoperative hygiene, better results in the presence of unfavorable fractures, less inconvenient in patients with seizures [3]. In the treatment with closed reduction or open reduction plus osteosynthesis of mandibular fractures, multiple complications can occur, and this due to the little experience of the operator or poor planning of the case to be treated. Among the most frequent complications are facial asymmetries, dental problems, nerve injuries, infections, pseudoarthrosis, osteonecrosis, limitation of mouth opening, malocclusions, and wound dehiscence (**Figure 4**) [12-15].



Figure 4: A, poorly positioned and contoured osteosynthesis material. B and C, Retained 4.3 dental organ which was perforated by titanium screws which caused an abscess with a drainage path in the submental region.

Case 1

A systemically stable 20-year-old male patient who attends the CBMF-HEU service, who reports having been physically assaulted, receiving a blunt blow to the face with a baseball bat at the time he was about to board his motorcycle, denies loss of awareness. On physical examination, he presented facial asymmetry and swelling in the right parotid region, painful on palpation and when opening the mouth (**Figure 5**).

In the intraoral clinical examination, a mandibular bone fracture was observed, compromising dental organs 3.1 and 3.2, with mobility of the segments, poor dental occlusion, and a wearer of a removable partial denture of a "Wipla" type unit that replaces the organ dental 1,2 absent. A panoramic radiograph is indicated in which a solution of continuity is seen in the right mandibular angle and the left parasymphysis (**Figure 6 and 7**).

Diagnosis: Compound fractures of the right mandibular angle and left parasymphyseal, which was reduced by means of the conservative method with the Erich arch technique. It began by placing the prefabricated bar in the upper jaw secured with ligating wires, and the reduction of the lower jaw fractures continued in the same way. Lastly, the IMF was performed with the help of elastic traction by means of orthodontic bands of 3.2 mm and 6½ ozs. A control appointment is indicated every two weeks for the change of leagues until reaching 8 weeks with the Maxillomandibular Fixation (MMF).



Figure 5: Frontal view showing facial asymmetry and lacerations in the left parasymphyseal region.



Figure 6: Intraoral photographs showing malocclusion and dental displacement of 3.1 and 3.2.



Figure 7: Panoramic radiograph in which a fracture of the right mandibular angle and left parasymphyseal is observed.

In the evolutions after the therapy implemented in the patient, a satisfactory anatomic reduction of the fractures was achieved, an optimal dental occlusion that is confirmed with the postoperative panoramic radiograph and clinical improvement of the initial symptoms, the discharge is decided by the oral and maxillofacial surgery unit (**Figure 8 and 9**).

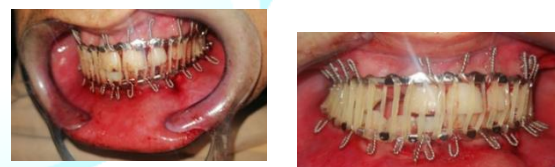


Figure 8: Intermaxillary fixation by means of elastic traction achieving satisfactory dental occlusion.



Figure 9: Postoperative control at 2 months in which facial symmetry, dental occlusion and an anatomical reduction of optimal fractures are reestablished.

Case 2

A 21-year-old male patient without systemic compromise is received, who attends the oral and maxillofacial surgery service of the Hospital Escuela Universitario referred from the plastic surgery service of the same healthcare center, with a history of cranioencephalic trauma secondary to a motor vehicle collision-type road accident, self, not wearing a helmet, with trauma to the frontal and mandibular region, with subsequent loss of consciousness and expression of an encephalic mass. On the extraoral clinical examination, he presented multiple wounds in the upper third and middle facial region, surgical suture in the frontal region, ocular dystopia without visual disturbances, and labial incompetence (Figure 10).



Figure 10: Frontal view showing multiple facial injuries, ocular dystopia, and labial incompetence.

The intraoral clinical examination revealed a displacement of the mandible to the right side with loss of continuity of the occlusal line in the area of dental organs 4.7 and 4.6, occlusal incompetence and abundant deposit of bacterial plaque and lingual coating. In the Computerized Axial Tomography of the facial massif with three-dimensional reconstruction, a solution of continuity is observed in the frontal bone of the left side and left mandibular angle and right mandibular body. In the medical-surgical history, the neurosurgery department intervened surgically in which he underwent frontal craniotomy and drainage of the epidural hematoma (Figure 11 and 12).

Diagnosis: frontal bone fracture and compound fracture of the left mandibular angle and the right mandibular body. A closed reduction of the mandibular fractures was carried out using the Erich arch technique. Prefabricated bars were placed in both jaws, secured with ligating wires; the IMF was performed with the help of elastic traction using 3.2 mm and 6½ ozs orthodontic bands. A control appointment is indicated every two weeks for the change of leagues until reaching 8 weeks with the MMF (Figure 13 and 14).



Figure 11: Intraoral photographs showing mandibular displacement with occlusal incompetence.



Figure 12: CT scan of facial mass showing fracture of the frontal and bilateral mandible bone.



Figure 13: Erich arches placed in the upper and lower jaw.



Figure 14: IMF with optimal dental occlusion.

In the evolutions after the therapy implemented in the patient, a satisfactory anatomical reduction of the fractures was achieved, an optimal dental occlusion that is confirmed with the postoperative panoramic radiograph and clinical improvement of the initial symptoms, the discharge is decided by the oral and maxillofacial surgery unit (Figure 15).



Figure 15: Postoperative control at 2 months prior to the removal of Erich's arches in which facial symmetry is reestablished, cessation of lip incompetence and satisfactory dental occlusion and anatomical reduction of fractures).

Case 3

A 19-year-old male patient who attends the oral and maxillofacial surgery service of the University School Hospital referred from the plastic surgery service of the same healthcare center, with a 10-day history of motorcycle rollover-type facial trauma, non-carrier helmet without loss of consciousness. On the extraoral physical examination, he presented wounds in the frontal, nasal and nasolabial areas without facial asymmetry. In the intraoral examination, he presented a total superior unimaxillary prosthesis with absence of dental organ [2,3]. A panoramic X-ray is indicated in which a solution of continuity is seen in the left parasymphiseal region (Figure 16 and 17).



Figure 16: Frontal view showing multiple facial wounds.



Figure 17: Panoramic radiograph showing the left mandibular parasymphyseal fracture.

Diagnosis: Compound fracture of left mandibular parasymphysis. Open reduction of the mandibular fracture was carried out for the placement of titanium plates and screws due to the total edentulism of the maxilla. Dieresis and tissue dissection were performed through an intraoral approach used with an electrosurgical device until the fracture lines were exposed, then a 6-hole titanium plate with 2.0 profile and 6 screws was placed, achieving a reduction ideal anatomical pattern of the fracture confirmed with the control panoramic radiograph (Figure 18-20).



Figure 18: Exposed fracture traces.



Figure 19: Profile 2.0 titanium plate and screws achieving adequate stabilization of the fracture segments.



Figure 20: Panoramic control radiograph showing satisfactorily resolved mandibular fracture. Look at the reconstruction plate on the orthopantomography.

Discussion

In facial trauma, the mandibular fracture is one of the most common. According to what has been seen, the most common cause is the motorcycle accident, followed by violent accidents (stab wounds, or gunshot wounds), among others. Among the patients attended, there is a higher percentage in male patients. The treatment of mandibular fractures varies, with the objective of preserving the occlusion and maxillomandibular function. It is debated whether between conservative management with mandibular fixation; According to Daniel Briones et al, in his comparative study between surgical treatment vs. non-surgical treatment, less complex fractures resolve in accordance with non-surgical treatment, while more complex mandibular fractures resolve better with surgical treatment.

Conclusions

Open reduction plus internal fixation or closed reduction as conservative treatment are the alternatives in patients with mandibular fractures accompanied or not by other facial fractures, the choice of treatment will depend on various factors such as: the condition of the fractured bone segments, anatomical location of the fracture, surgeon's management preferences, and even the socioeconomic status of the patient. This study provides useful information for the diagnosis and steps to follow for the management of these patients. The majority of patients treated were men, where most of the cases were motorcycle accidents [8,9,12,16].

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