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Combination of Open and Closed Reduction Methods in the Treatment of Multiple Mandible Fractures

Endang Sjamsudin[1], Seto Adiantoro[2], George Abraham Saragih[3], Yasinnurrasyad Azmabasyar Rausyanfikr[4], Reiner Avelino Simarmata[5], Timotius Andi Kadrianto[6]

[1,2] Staff of Oral and Maxillofacial Surgery Department, Faculty of Dentistry , RSUP Dr.Hasan Sadikin, Universitas Padjadjaran, Bandung, Indonesia

[3,4,5 ,6] Resident of Oral and Maxillofacial Surgery Department, Faculty of Dentistry Universitas Padjadjaran, RSUP Dr.Hasan Sadikin, Bandung, Indonesia

Abstract: ***Introduction: Mandible fracture is defined as a loss of continuity of the mandible bone. Loss of continuity of the mandible bone can have fatal consequences if not treated properly. Classification of mandibular fractures based on anatomic location can occur in the condyle, coronoid, ramus, mandibular angle, mandibular corpus, symphysis, parasymphysis, and dentoalveolar. This case report aims to explain the management of multiple mandibular fractures with closed and open reduction approaches. The desired outcome for these patients is to restore the patient's maxillary and mandibular (occlusion) relation, who have experienced an occlusion shift due to mandible fracture. Case report: Three cases of multiple mandible fractures. In a panoramic examination obtained a picture of several fracture lines in the mandible with two or more fracture lines. Treatment is carried out using open reduction and closed reduction techniques. As an initial treatment, interdental wiring was installed and followed by ORIF using a mini screw and plate. Then intermaxillary fixation (IMF) is done using elastic bands in the anterior and posterior regions. Conclusion: This case concludes that the reconstruction of mandibular mutilated fractures using open reduction and close reduction techniques can be carried out continuously in multiple mandibular fractures.***

Keywords: multiple fracture, mandible, closed reduction, open reduction

1. Introduction

Mandibular fracture is the discontinuation of mandibular bone, which can be caused by direct or indirect trauma and in certain conditions resulting from pathological abnormalities such as degenerative bone/osteoporosis. Trauma is the most frequent cause of the fracture. The causes of mandibular fractures were 30.8% due to road traffic accidents, 22.3% falling, 18.8% violence, 2.8% work accidents, 3.7% sports accidents, and 1.6% other accidents. The mandibular bone fracture can cause various complications such as malocclusion, infection, osteomyelitis, nonunion, malunion, wound dehiscence and can even be fatal. Complications that occur depend on the fracture's level, the number of fracture locations and ways of handling that are not right. [1]

The location of the fracture line can occur in several parts of the mandibular anatomy. Classification of mandibular fractures based on anatomic location can occur in the condyle process coronoid process, ramus, angulus, corpus, alveolus, symphysis of the mandibular parasymphysis.[2] Fragile areas in the mandible are in the condyle-sub condyle, angular and symphysis areas of the Parasymphysis mandible. The incidence of mandible fractures seen from its location, namely angulus (30%), condyle (23%), symphysis (22%), corpus (18%), ramus (2%) and coronoid process (1%).[3]

The management of multiple mandibular fractures is a challenge for maxillofacial surgeons. Taking into account the severity of the trauma, often accompanied by fractures in other maxillofacial bone and fractures at the base of the cranium and often leads to infection. The goal of treating multiple mandibular fractures is to restore the anatomy and function of the mandible (occlusion) and also the patient's aesthetic appearance. The treatment of Multiple mandible fractures with several methods such as closed reduction and open reduction with internal fixation.[4] The purpose of this case report is to explain the management of multiple mandibular fractures using closed reduction and open reduction.

2. Case Report

First case

A 37-year-old male patient presented with bleeding from his mouth and open bite due to a traffic accident about 3 hours ago. History of loss of consciousness (-), nausea and vomiting (-), bleeding from the mouth (+), bleeding from the nose (-), bleeding from the ear (-). On general examination, the patient was fully aware of the Glasgow Coma Scale (GCS) of 15, and vital signs were within normal limits. On extraoral examination, there was facial asymmetry and laceration in the chin and lower lip area. On intraoral examination, there was loose and avulsion of the anterior maxillary teeth, as well as gingival injury (Figure 1). On radiographic examination, it showed fracture lines on both the condyle and left the Parasymphysis mandible (Figure 2.) The diagnosis of this case was bilateral condyle fractures and Parasymphysis mandible fractures. The treatment was an open reduction of the parasymphysis fracture, followed by a closed reduction of the condyle fractures.

Open reduction and Internal Fixation (ORIF) surgery were performed intraorally. The incision was made from the right canine region to the left region of the mandible. Internal Fixation was done using mini plates and screws in the left Parasymphysis region (Figure 3).

Figure 1: Extraoral and intraoral clinical features

Figure 2: Radiographic examination, Head x-ray (a.) and panoramic (b.) showed fracture lines on the bilateral condyle and the left Parasymphysis mandible

Figure 3: Intraoperation, fixation using mini plates and screws

Treatment of condyle fractures with close reduction and fixation using intermaxillary fixation (IMF) was carried out using an elastic band, and continued with wire after occlusion was retained for 3 weeks (Figure 4). After 3 weeks the IMF wire is replaced again with an elastic band until 4 weeks after surgery. Patients are advised to undergo a soft and liquid diet. At the one month control examination, no asymmetry was found on the face, occlusion returned to normal and no deviation was found when opening the mouth.

Figure 4: Installation of IMF elastic bands and wires

Second Case

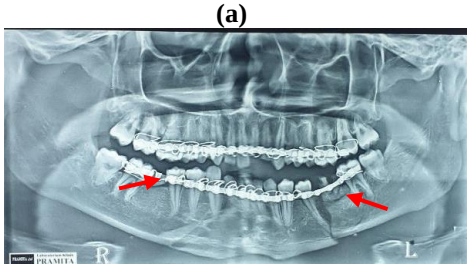
A 21-year-old male patient presented with bleeding from the mouth due to an accident while riding a motorcycle 12 hours ago. History of loss of consciousness (-), nausea and vomiting (-), bleeding from the mouth (+), bleeding from the nose (-), bleeding from the ear (-). On general examination, the patient was fully aware of GCS 15 and vital signs within normal limits. On extraoral examination, there were facial asymmetry, stitches on the upper lip and chin after treatment from the previous hospital. On intraoral examination, there were swelling and sutures on the upper lip (Figure 5.). Radiographic examination showed fracture lines on the right Parasymphysis area and the left mandibular corpus (Figure 6.) The patient was diagnosed with a fracture of the right Parasymphisis and the left corpus of the mandible. The treatment was an open reduction with internal fixation.

Figure 5: Extra and intraoral clinical features

ORIF surgery was done through an extraoral approach. Incisions were made in the left submandibular and right submental region (Figure 7.). Then dissection was done until

the fracture line is visible. Internal fixation of the Parasymphisis or corpus fracture was performed using two mini plates with four screws each.

(a)



(b)

Figure 6: Radiographic examination, head x-ray (a) And panoramic (b) Showing fractal lines in the right Parasymphysis and left mandibular corpus

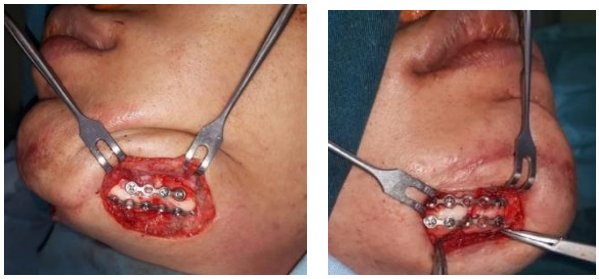


Figure 7: Intra operation, internal fixation using mini plates and screws

Then interdental wiring (IDW) was performed on the upper jaw, and lower jaw and an intermaxillary fixation were placed for two weeks (Figure 8.). The patient was advised to undergo a soft diet.

Figure 8: Installation of interdental wiring (IDW) on the upper jaw and lower jaw

At the time one-month examination, there was no asymmetry on the face, occlusion returned to normal, and no deviation was found when opening the mouth.

Third case

A 37-year-old male patient presented with bleeding from the mouth due to an accident while riding a motorcycle about 20 hours ago. History of loss of consciousness (-), nausea and vomiting (-), bleeding from the mouth (+), bleeding from the nose (-), bleeding from the ear (-). On general examination, the patient was fully aware of the GCS of 15 and vital signs within normal limits. Extraoral examination, there was facial asymmetry accompanied by edema and hematoma in the eye area and right cheek. On intraoral examination, there was a laceration on the upper lip area and anterior open bite (Figure 9.). On radiographic examination, bilateral fracture lines were seen in the condyle and Parasymphysis (Figure. 10.). The diagnosis of this case was bilateral condyle fracture and mandibular Parasymphysis fracture. The patient was treated with ORIF on the Parasymphysis fracture and closed reduction on condyle fractures.

Figure 9: Extra and intraoral clinical features

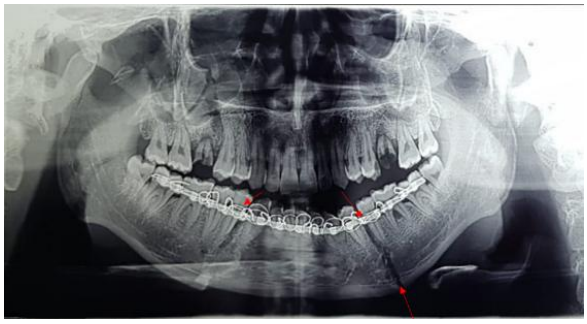


Figure 10: Radiographic examination, the panoramic photo showing fracture lines in bilateral condyle and Parasymphysis

ORIF surgery was performed via an intraoral approach (Figure 11.). Incisions were made in the left and right canine regions of the lower jaw. Internal fixation of mandibular Parasymphic fractures was performed using a mini plate and screw and interosseus wiring. On the first day after surgery, intermaxillary fixation (IMF) was done using elastic bands to look for occlusion and reduce condyle fractures (Figure. 12). On the second day after surgery, intermaxillary fixation

(IMF) was replaced by wire for two weeks and replaced again with an elastic band for one week.

Figure 11: Intra operation, fixation using mini and screw plates and intraosseus wiring

Figure 12: Installation of the elastic band one day postoperatively

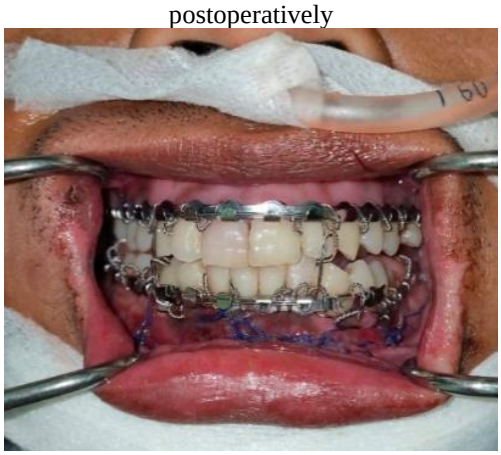


Figure 13: Installation of intermaxillary wire fixation on the second postoperative day

3. Discussion

Mandibular fractures are described according to the anatomic location of the fracture line or their involvement. It can be in the form of a greenstick fracture, separate, and comminuted fracture. Other classifications are described as favorable fractures and unfavorable fractures. Mandible Condylar fractures can be divided into parts that affect the intracapsular (condyle head) and extracapsular (condyle neck and subcondyle) depending on fracture location. [1,3]
Multiple fractures of the mandible require comprehensive treatment, and the anatomic location of the fracture is an essential factor in determining treatment plans. The goal of treating the fracture is to restore mechanical strength to the fracture site to restore normal mastication function. The first stage in fracture treatment is carried out by returning the fractured part to its original anatomical position (reduction). During the second stage, fixation is performed in the anatomical position, and the third stage is immobilization to facilitate adequate bone healing.[1,5]

Treatment of multiple fractures in the mandible can be done through a closed reduction approach using intermaxillary fixation (IMF) and open reduction by surgery using internal fixation (ORIF). In cases of mandibular corpus fractures that do not have or with only minimal displacement and have a sufficient number of teeth in the area of the fracture, the ideal treatment is closed reduction using the IMF. Treatment with ORIF is recommended for older patients to prevent discomfort and long-term obstruction caused by IMF use. In the case of symphysis or Parasymphysis fractures, the most commonly used treatment technique is ORIF with an intraoral approach.[6] While based on consensus, on the case of condyle fractures, the goal is to restore the movement or opening function of the mouth as soon as possible to restore TMJ activity, because the patient generally experiences pain around the ear, malocclusion and chin deviation during movement of the mandible. The expected outcome of treatment of mandibular fractures is proper occlusion without malocclusion due to nonunion, malunion, or delayed union.[7]

In this case report, the above patients received combined treatment for multiple mandibular fractures. Open reduction is performed on Parasymphysis and symphysis fractures using internal mini-plate and screw fixation. In combination with interosseous wiring, this method provides an advantage in fracture treatment by shifting bone fragments to the ideal anatomical location with a direct approach to the fracture site. Furthermore, it can prevent complications such as respiratory distress, pronunciation disorders, and severe nutritional imbalances by shortening the IMF period through rigid fixation.[8] The downside of open reduction is the invasive approach, which can cause nerve or blood vessel injury during surgery and post-surgical complications, including infection. Besides, scars can be permanent even though the incision is performed with consideration of aesthetics.[3,9,10] Also, although the interosseus wiring technique is rarely used as a definitive fixation at present, this technique is useful for bringing the fracture segment closer before fixation using a mini plate.[11]

While the closed reduction method in the above cases was done on all condyle fractures. Judging from the anatomy of the condyle fracture, the minimal displacement of the condyle and the position of the fragment that was still in the glenoidal fossa, closed reduction combined with a bite riser if needed is the best choice. The combination of these techniques aims to restore occlusion and function.[12,13] The advantage of closed reduction with functional therapy is a relatively safe treatment. No nerve and blood vessel injuries occurred during treatment, and there were no postoperative complications such as infection or scars. Specifically, complications such as broken bones, loss and delayed eruption of tooth growth can be avoided in pediatric patients because there are no injuries to permanent tooth gears. [13,14]

Long-term IMF has disadvantage from periodontal and buccal mucosal tissue injury, poor oral hygiene, pronunciation disorders, imbalanced nutrition, mouth opening disorders and respiratory disorders. Conservative treatment with closed reduction in condyle fractures that are too long can cause complications in the form of TMJ ankylosis and impaired growth of the mandible if it is still in the growth phase.[15] Treatment with the combination of open and closed reduction in multiple mandibular fractures in all of the aforementioned cases showed good result in which occlusion and function of mandibular movement were achieved.

4. Conclusion

The management of multiple mandibular fracture treatments with open and closed reduction methods has its advantages and disadvantages. Based on appropriate indications, the combination of both can restore anatomy, occlusion, and the function of the mandible (movement), and also the aesthetic appearance of the patient. Excellent treatment results in these cases can be achieved with consideration of the condition and anatomical location to determine the appropriate treatment method.

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