SURGICAL MANAGEMENT OF MANDIBULAR ANGLE FRACTURE IN AN ADOLESCENT PATIENT: A CASE REPORT

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ABSTRACT

Introduction: Mandibular fractures in pediatric and adolescent patients pose unique challenges due to active facial growth and differing biomechanical properties of bone. Treatment planning in adolescents must carefully balance surgical stability and preservation of growth potential. The mandibular angle is a common site of fracture, often resulting from high-impact trauma. Aim of this case report is to describes the surgical management of a right mandibular angle fracture in adolescent using open reduction and internal fixation (ORIF) combined with intermaxillary fixation. **Case report:** A 16-year-old male presented with right jaw pain persisting for one week following a motor vehicle accident. Extraoral examination revealed facial asymmetry, edema, and hematoma in the right chin region. Intraoral findings included trismus, edema and erythema in the gingiva of region 48, posterior open bite, and malocclusion. Panoramic radiography revealed a step deformity at the right mandibular angle. The diagnosis was a right mandibular angle fracture and treated with ORIF followed by intermaxillary fixation using arch bars. Three week postoperative follow-up, the fracture was well stabilized, occlusion had returned to normal, and minimal postoperative complications were noted. **Discussion:** ORIF and temporary intermaxillary fixation provided adequate stabilization without interfering with developing structures. Prompt intervention and careful surgical planning resulted in proper fracture healing and restoration of function. **Conclusion:** ORIF combined with intermaxillary fixation is a reliable treatment option for mandibular angle fractures in adolescents. Early recognition, proper surgical planning, and appropriate follow-up are essential to achieve favorable functional and esthetic outcomes without compromising facial growth.

Keywords: Adolescent, Intermaxillary fixation, Mandibular angle fracture, ORIF

INTRODUCTION

The mandible is a distinctive bone that plays an essential role in both facial appearance and functional occlusion. Because of its anterior prominence, it is the facial bone most often affected by fractures.[1] A frequent fracture site is the mandibular angle.[2,3] Although the incidence is relatively low at around 3.5%, angle fractures are usually encountered in patients with permanent dentition. Due to the concentration of muscular forces in this high-stress region, displacement is not always apparent; however, when present, it may result in occlusal abnormalities and mandibular deviation.[1]

Facial fractures in children under five years are relatively uncommon, but the prevalence rises with increasing age, particularly during adolescence.[4] Adolescents, defined as individuals aged 10–19 years, are more vulnerable because of behavioral tendencies and environmental exposures.[5] In contrast, preschoolers (<5 years) are closely monitored by caregivers, limiting their risk of traumatic injuries. Children of school age (6–12 years) frequently sustain injuries from sports activities, while adolescents often ride bicycles, skateboards, or scooters without adult supervision, exposing them to road traffic accidents related to impulsivity, inexperience, and risk-taking behavior. Consequently, adolescents account for the highest proportion of mandibular fractures among pediatric patients.[2,4,5]

The most common mandibular fracture sites are the angle (31.3%) and body (24.8%), although other studies have reported varying distributions: 33% in the body, 29% in the condyle, 23% in the angle, and 8% in the symphysis.[2,6] Nevertheless, the condyle and angle are consistently identified as the regions most frequently involved.[3,7] Etiological factors also vary, with motor vehicle accidents reported as the leading cause (33.8%), followed by falls (20.7%) and sports-related trauma (8.1%).[4,6] Younger children (0–6 years) are more prone to falls, while older children and adolescents sustain fractures predominantly from traffic accidents and sports injuries.[4,8] Other less frequent causes include interpersonal violence, occupational trauma, and even animal attacks.[4,6,9] Male patients are disproportionately affected compared to females.[1,2,4,10]

Clinically, mandibular angle fractures often present with pain during mandibular movement, trismus, swelling leading to facial asymmetry, step deformity distal to the last molar, and altered occlusion, frequently with the presence of numbness sensation.[2,3,6,11] Additional features may include paresthesia or anesthesia of the lower lip on the affected side, tenderness on palpation near the fracture site, as well as palpable mobility or crepitus.[3,6]

The management of mandibular fractures in pediatric and adolescent patients differs from adults because of their unique anatomical and physiological characteristics.[10] Treatment planning must consider age, associated injuries, comorbidities, mechanism of trauma, and fracture location.[4] Reduction may be achieved through either closed or open techniques, with fixation aiming to restore anatomical alignment and provide stability.[3,6]

Open reduction is a surgical approach that allows direct access to the fracture line, enabling accurate visualization, reduction, and stabilization of bone fragments, usually with stainless steel wires or titanium plates and screws.[2,3] This technique, known as open reduction and internal fixation (ORIF), is widely accepted as the standard for maxillofacial fracture management.[1] While nondisplaced fractures can often be managed conservatively, complex fractures typically require ORIF.[12] In the mandibular angle specifically, muscular forces from the masseter and medial pterygoid can displace the proximal fragment, making ORIF particularly advantageous.[7]

Conservative management using intermaxillary fixation (IMF) remains a common approach in children and adolescents.[2,3] This method immobilizes the maxilla and mandible with wires, arch bars, or splints to maintain occlusion.[2] The duration of fixation depends on age, fracture type, and systemic health, with pediatric patients generally healing faster.[2,3] Both elastic and wire-based IMF techniques are employed, each with specific benefits and limitations.[2]

In the present case, a 16-year-7-month-old male with a mandibular angle fracture and an impacted right third molar was treated using open reduction and internal fixation (ORIF) combined with arch bars and elastic intermaxillary fixation (IMF).

CASE REPORT

A 16-year-7-month-old male was referred to Pringsewu General Hospital with a chief complaint of persistent pain in the right jaw for one week following a motorcycle accident. At the local hospital emergency department, his wounds were initially cleaned, after which he was referred to the Oral Surgery Department of Pringsewu General Hospital for further management. The patient weighed 51 kg and was 160 cm tall. On primary examination, his blood pressure was 121/82 mmHg with a pulse rate of 82 beats per minute. The pupils were equal, round, and isochoric with a diameter of 3 mm, showing no disturbance of the light reflex. No signs of paresis were observed. The conjunctiva was not anemic, and the sclera was not icteric.

On admission, the patient was in good general condition and fully conscious, with a pain score of 5 on the Visual Analog Scale (VAS). Laboratory examination revealed hemoglobin 14.4 g/dL, hematocrit 41.8%, erythrocytes 5.02 $\times 10^6/\mu L$, leukocytes 7.98 $\times 10^3/\mu L$, and platelets 331 $\times 10^3/\mu L$. Coagulation tests showed a clotting time of 4 minutes and a bleeding time of 1 minute 30 seconds. Random blood glucose was 93 mg/dL. HBsAg and HIV screening were both non-reactive.

Extraoral examination revealed facial asymmetry, edema in the right chin region, and trismus with a maximum mouth opening of approximately 2 cm. Intraoral examination demonstrated a unilateral posterior open bite in the mandible, accompanied by edema and erythema of the gingiva around the right mandibular third molar (FDI 48), and no clinical intraoral picture documenting the occlusion was recorded. Panoramic radiography showed a step deformity at the right mandibular angle associated with the right mandibular third molar (Figure 1). Posteroanterior chest radiography revealed no abnormalities. Based on the history, clinical examination, and radiographic findings, the patient was diagnosed with a right mandibular angle fracture accompanied by posterior open bite malocclusion. Definitive management included intermaxillary fixation and open reduction internal fixation (ORIF).

Figure 1. Panoramic radiograph showing step deformity at the right mandibular angle.

On January 20th, 2025, the patient received premedication consisting of a prophylactic antibiotic (Amoxicillin 500 mg every 8 hours) and an anti-inflammatory agent (Mefenamic acid 500 mg every 8 hours) for three days. Surgical management was carried out under general anesthesia on January 23rd, 2025. Preoperative clinical photographs were obtained (Figure 2). Following aseptic preparation, interdental wiring (IDW) with arch bars was applied to both the maxilla (Figure 3) and mandible (Figure 4), followed by intermaxillary wiring (IMW) between the arches (Figure 5).

Figure 2. Preoperative clinical photograph showed oedema in the right angle of mandible.

Figure 3. Interdental wiring (IDW) with arch bar in the maxilla.

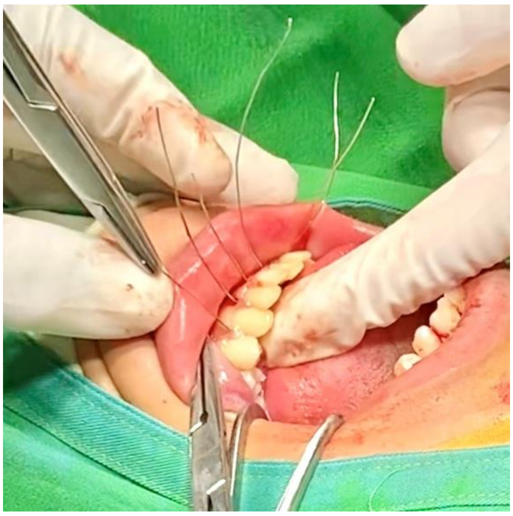

Figure 4. Interdental wiring (IDW) with arch bar in the mandible.

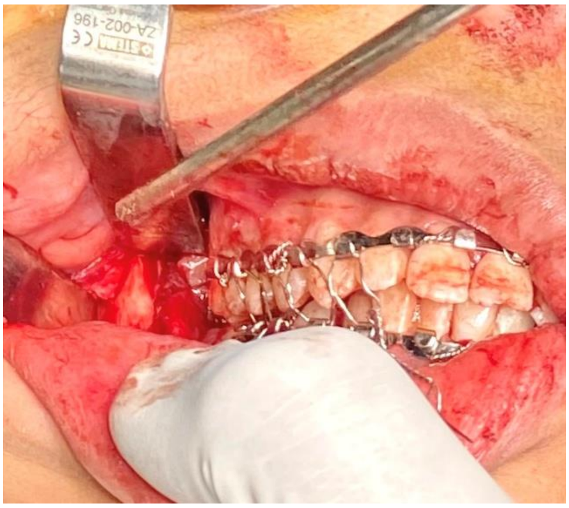

Figure 5. Intermaxillary wiring (IMW) applied to both arches.

A mucosal incision was made, and a full-thickness flap was elevated (Figure 6). The fracture line was exposed using a raspatorium. Open reduction and internal fixation (ORIF) was subsequently undertaken using a 2-hole miniplate positioned along the right mandibular superior border. Fixation was achieved with two screws placed on the buccal cortex which the posterior screw was inserted at the mandibular angle, approximately 5–7 mm anterior to the fracture line and 2–4 mm inferior to the alveolar crest, whereas the anterior screw was placed in the distal root region of the second molar (tooth #47), maintaining a similar safety margin from the fracture interface. This construct provided stable fixation while maintaining a safe distance from the inferior alveolar nerve (Figure 7).

The lower right third molar was preserved, as it was located adjacent to the fracture line and served as a guide for fracture reduction. The surgical site was irrigated, and closure of the wound was accomplished using non-absorbable silk 3/0 sutures (Figure 8).

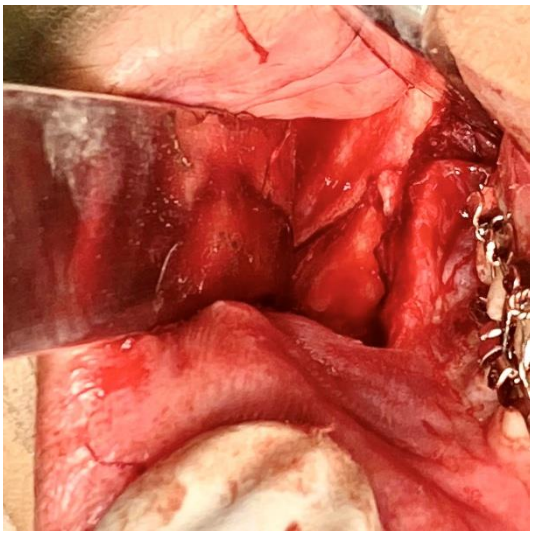

Figure 6. Mucosal incision and flap elevation.

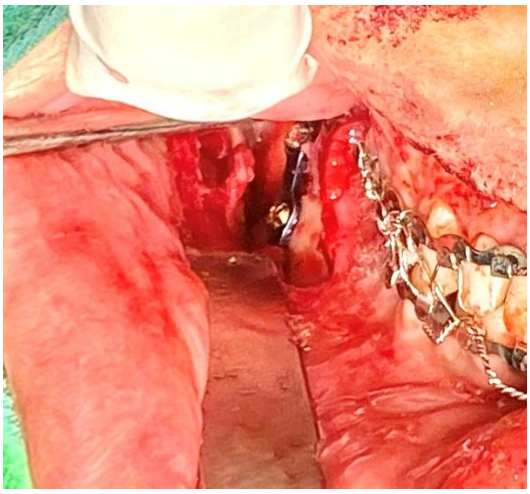

Figure 7. Open reduction and internal fixation (ORIF) with plate and screws extending from the right mandibular angle to mandibular secondary right molar.

Figure 8. Suturing with non-absorbable sutures.

On the first postoperative day (January 24th, 2025), the patient was evaluated, and elastic traction was applied to the arch bars. At the 20-day follow-up (February 12, 2025), both the elastic traction and sutures were removed simultaneously. Clinical evaluation demonstrated stable occlusion, secure fracture fixation, no signs of infection, and restoration of normal mandibular function (Figure 9).

Figure 9. Clinical photograph at 20-day follow-up after removal of elastic traction and sutures,
(A) right view, (B) front view, (c) left view.

During hospitalization, the patient received ceftriaxone injection (1 g twice daily), paracetamol 500 mg orally (three times daily), ondansetron injection (1 ampoule as needed), tranexamic acid injection 250 mg, dexamethasone injection (twice daily), ketorolac injection 30 mg/mL (twice daily), and ranitidine injection (twice daily). Upon discharge, the prescribed medications included cefixime 200 mg every 12 hours for 15 doses, mefenamic acid 500 mg every 12 hours for 15 doses, and vitamin B complex once daily for 10 doses. Postoperative instructions were to maintain a liquid diet during recovery, crush oral medications before ingestion, and cut the elastic in case of choking, coughing, or vomiting.

At subsequent follow-up, the patient was in good general condition, with no significant complications. Fracture healing was stable, occlusion was corrected, and the overall prognosis was favorable. The management of mandibular fractures in adolescents and adults demonstrates notable differences, particularly in relation to ongoing craniofacial growth. In patients younger than 16 years, fixation plates are typically removed approximately six months postoperatively to minimize the risk of disrupting mandibular development. In the present case, plate removal was not indicated because the patient was already 16 years old, at which point mandibular growth is considered largely complete, and the fixation material used is biocompatible

DISCUSSION

A mandibular fracture is defined as a disruption in the continuity of the mandibular bone.[12,13] Hagan and Huelke described fracture patterns based on the site of impact, reporting the angle as the second most common location.[14] The mandibular angle is a triangular region outlined by the anterior border of the masseter muscle, with its posterosuperior attachment usually distal to the third molar.[13] Angle fractures are considered the most complex due to high complication rates and difficult surgical access.[12] Biomechanically, the lingual surface near the second and third molars undergoes maximum tensile strain under anterolateral force, while the abrupt curvature at the angle further predisposes this site to fracture.[14,15] The management of mandibular angle fractures remains controversial, as the region is influenced by thin cross-sectional bone, abrupt curvature changes, masticatory muscle forces, and the presence of third molars.[16]

In children, facial skeletal growth contributes to greater fracture susceptibility, with increasing incidence linked to sports and recreational activities and reduced parental supervision.[17] Adolescents, especially those aged 16–19 years, present the highest prevalence of mandibular angle fractures.[18] Compared with adults, the pediatric mandible shows thinner cortical bone, more cartilaginous tissue, and greater protection by subcutaneous tissues, making it elastic yet prone to injury.[19 20]

Unlike adults, whose fractures are typically managed with reduction, fixation, and immobilization, pediatric and adolescence cases require a cautious approach to avoid damage to developing teeth and to preserve growth.[19] Challenges include growth disturbances, tooth injury, delayed eruption, and impaired stomatognathic function.[20]

Diagnosis relies on both clinical and radiographic examinations. Palpation of the maxillofacial region is followed by imaging, with panoramic radiography serving as the primary diagnostic tool.[12,19] Evaluation should include occlusal relationships, dentition, mental nerve function, and the presence of trismus.[12] In children, mandibular growth is characterized by progressive reduction in craniofacial ratio, chin prominence development, and eruption of primary and permanent dentition.[19]

The primary approach in managing mandibular fractures is emergency care, which involves securing the airway, ensuring adequate breathing and circulation, addressing shock, treating soft tissue injuries, applying temporary immobilization, and assessing potential brain trauma. Definitive management is achieved through either closed or open reduction of the fractured segments.[12] Treatment options depend on the patient’s age and may include observation, intermaxillary fixation (IMF), or open reduction and internal fixation (ORIF).[18] Compared to conservative methods, ORIF offers stronger stabilization, quicker restoration of function, and greater patient comfort, though in children it may lead to complications such as growth disturbances from periosteal damage, injury to developing teeth, or plate displacement.[15] Open reduction is indicated for unfavorable fractures of the symphysis, body, or angle, as well as delayed or malunited fractures, and in complex maxillofacial trauma where stabilization of mandibular segments is required.[3] Angle fractures are particularly prone to displacement due to the traction of the masseter and medial pterygoid muscles, often necessitating rigid fixation.[21]

Antibiotic prophylaxis prior to surgery is essential to reduce the risk of infection. In this case, the patient underwent ORIF under general anesthesia, was administered 500 mg of amoxicillin for prophylaxis, and received interdental arch bar wiring for temporary stabilization.[12]

Management of teeth in the fracture line remains a challenge in mandibular fracture treatment, particularly concerning whether to extract or retain third molars.[23] Some studies suggest that preserving impacted teeth in the fracture line may help stabilize fracture segments and promote bone healing, whereas others recommend extraction to prevent sepsis.[12,22] The main concern is infection, which represents the most significant complication. In this case, ORIF was performed at the mandibular angle without extracting the impacted right third molar, as retention facilitated stabilization.

Intermaxillary fixation (IMF) is a rigid construct that immobilizes the maxillary and mandibular dentition in occlusion. Arch bars, introduced in the 1940s, remain the standard technique.[23] The main principles include achieving anatomic reduction, immobilization of bone fragments in functional occlusion, maintenance of the occlusal plane, and infection prevention.[22] Technique selection should ensure adequate stabilization according to fracture pattern, location, and baseline occlusion, as well as facilitate postoperative physiotherapy.[23]

The duration of intermaxillary fixation (IMF) depends on patient age, health status, fracture location, and timing of treatment. With wire osteosynthesis, immobilization for 4–6 weeks is generally required.[22] Young adults with early-treated angle fractures and tooth extraction in the fracture line typically need 3 weeks, while children and adolescents require about one week less; conversely, retained teeth may prolong fixation by an additional week.[22] Erich arch bars with wire IMF are usually maintained for 2–3 weeks.[24] In growing mandibles, splints provide stable fixation while preserving maxillary arch integrity, allowing soft-liquid diet and good oral hygiene. These splints are considered more reliable and cost-effective than open reduction or conventional IMF, minimizing patient discomfort.[7,9,19]

Major complications of mandibular fractures include ankylosis, malunion, malocclusion, and growth disturbances.[24] Optimal management requires careful selection of techniques to minimize short and long term complications. Early mobilization is crucial to prevent ankylosis and restore normal jaw function in pediatric patients.[20] Regular follow-up is necessary to monitor healing and detect potential problems.[19]

CONCLUSION

Surgical management of mandibular angle fracture in adolescents requires careful consideration of anatomical and developmental factors. Appropriate treatment planning with intermaxillary fixation (IMF) and ORIF can provide stable fracture healing, restore functional occlusion, and enable early recovery. Regular follow-up is important to monitor healing, prevent complications, and preserve mandibular growth potential.

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