Fractures of the Mandibular Condyle

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Abstract

There exists no consensus "gold standard" treatment for condylar fractures, and there is continued debate on whether condylar fractures should undergo surgical or conservative management. Herein, we review various techniques of conservative, closed, and open surgical treatments of condylar fractures. Also, we review complications associated with each treatment modality and compare and contrast closed and open management. Standardization of fracture classification schemes and treatment modalities is needed to elucidate the best course of action for each patient and each fracture.

Keywords
- mandible fracture
- subcondylar fractures
- condylar head fractures
- surgical approaches

The condylar region of the mandible is frequently injured and is affected in an estimated 25 to 40% of all cases of mandibular fractures.[1–3] Often, condylar fractures result from indirect blunt trauma with transmitted forces, resulting in bone breaking.[4] Despite the frequency with which it is encountered, there exists no consensus "gold standard" treatment of condylar fractures, and there is continued debate on whether condylar fractures should undergo surgical or conservative management.

Poorly managed condylar fractures can result in numerous chronic problems for patients. Malocclusion and deviation of the jaw on opening can occur. Ankylosis and pain in the temporomandibular joint (TMJ) can develop, and a diminished mouth opening, as measured by the interincisal distance, can persist. Muscle spasm, osteonecrosis, and facial asymmetry have also been observed.[4–6] In some cases, complications such as arthritis do not develop for several decades after initial injury.[7]

Classically, Zide and Kent have posited criteria for when condylar fractures should be approached surgically,[8] such as when there is severe bony displacement outside the TMJ capsule or into adjacent structures, when there is a foreign body in the joint, when there are bilateral condylar fractures, and when the mandible is edentulous or, for other reasons, cannot be treated with closed maxillomandibular fixation (MMF). Newer criteria advocate for closed management of condylar fractures with less than 2 mm shortening of the height of the ramus and less than 10 degrees of deviation.[3,9] Open or endoscopic reduction and internal fixation (ORIF), however, is necessary when the height of the ramus is shortened by more than 15 mm or there is more than 45 degrees of deviation. Moderate fractures that fall between these extremes have been treated with both closed and open techniques. In general, ORIF has been employed with greater frequency over the past decade, and the indications for open surgical management have expanded.[10]

Closed Fracture Management

Conservative Management

Some condylar fractures can be appropriately managed without fixation, either open or closed. In general, nondisplaced fractures in which natural occlusion is maintained can be successfully treated with a soft diet for several weeks to allow bony healing.[3] In other cases, some authors still advocate for conservative management without fixation to allow an earlier return to mobility.[11] Many authors strongly recommend a period of MMF, however, and the indications for management without fixation remain variable and poorly defined. Bony healing typically takes 6 weeks to complete; therefore, a soft diet may be necessary for 1 to 2 months in the absence of other fixation methods to prevent jaw displacement while the fracture is healing. Jaw exercises, or physiotherapy, are useful in maintaining or improving jaw movement as well, and a period of soft diet and physiotherapy are often employed following closed or open fracture reduction.

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Closed Fixation

Closed MMF immobilizes fracture segments after manual reduction to achieve premorbid occlusion. Fractures are immobilized for a variable period of time, after which physiotherapy is employed to improve jaw movement.[3] Immobilization is often accomplished with arch bars and elastic bands, though interdental wiring for more rigid fixation can also be used. Screws can also be placed instead of arch bars, and some studies suggest that screws are associated with improved patient quality of life during treatment,[12] which may subsequently lead to improved patient compliance with therapy. Less commonly, Ernst ligatures, head chin caps, dental splints, and bite blocks have been used.[13] In some cases, elastics are employed to guide the teeth into normal occlusion, whereas in other studies, they are used to achieve rigid fixation.[13] Duration of fixation has been reported to last between 5 and 49 days, with many studies employing closed fixation for 3 weeks.[13,14] Many believe that MMF should be maintained until a fibrous union of the fractured bones has developed.[13,15] After the release of fixation, many regimens still recommend a soft diet for 2 to 3 weeks, until bony healing is complete.[13] Compliance with recommended therapy regimens can be poor, however.[16]

Complications

Prolonged MMF risks TMJ ankyloses and poor movement of the jaw.[17] An evaluation of jaw immobility in a sheep model found that fixation longer than 3 weeks resulted in significant hypomobility.[18] Inadequate fracture reduction can also lead to an open-bite deformity, malocclusion, and facial asymmetry.[4,19] Dijkstra et al found in their review of 116 patients with condylar fractures treated with closed fixation that age older than 25 years and gross displacement of the condylar were significant predictors of mandibular dysfunction after closed fracture treatment, whereas female gender and intracapsular fractures were predictive of chronic pain.[20] An estimated 89% of all patients will experience a return to normal occlusion after closed fixation, with rates in individual studies ranging from 76 to 98%.[13] Similarly, patients are reported to achieve adequate mouth opening, with an estimated 65 to 100% of the time, with definitions of "adequate" including mouth opening greater than 30, 35, and 40 mm in different studies.[13] Similarly, chronic pain at rest is reported at rates of 0 to 16% in individual studies and 8% overall.[13]

Open and Endoscopic Surgical Fracture Management

Approaches

Preauricular

The preauricular approach allows excellent lateral and anterior exposure of the entire condyle.[21] An incision hidden in natural skin creases and the junction of facial subunits extends from the temporal hair-bearing scalp inferiorly to the lobule. Dissection is carried deeply through the superficial temporoparietal fascia (TPF), temporalis fascia, and deep temporal fascia to the lateral aspect of the zygomatic arch. The TMJ capsule is then revealed with a vertical incision at the root of the zygomatic arch. This approach has the most obvious incision placement of all open approaches. Also, it risks injury to the facial nerve and bleeding from violation of the superficial temporal vessels.[21]

A retroauricular variant to the preauricular incision has also been described. It allows better aesthetic placement of the incision posterior to the ear, in a location similar to that used for tympanoplasty or mastoid surgery. In this approach, dissection proceeds anteriorly and involves transection of the ear canal to reach the anterior TPF. Dissection and subsequent exposure are similar to that of a preauricular approach. A retroauricular approach carries the same risks as a preauricular approach but with the additional risks of stenosis of the ear canal and infection involving cartilage of the ear.[21]

Submandibular

In a submandibular approach, an incision is made in the neck 2 to 3 fingerbreadths inferior to the mandible, just anterior to or directly inferior to the angle of the mandible. Dissection then proceeds deep to the lateral surface of the mandible. A subperiosteal flap can then be developed to expose the ramus and subcondylar regions. This approach typically does not allow clear access to the entire condylar head. In the initial dissection, care must be taken to avoid injury to the facial artery, facial vein, and facial nerve, specifically the marginal mandibular branch.[21]

Retromandibular

In a retromandibular approach, a 4-cm incision is created 5 to 10 mm inferior to the lobule, paralleling the posterior border of the mandible. Dissection then proceeds to the mandible itself either directly through the parotid gland or inferiorly to the sternocleidomastoid muscle and then anteriorly to the posterior mandibular border. In some cases, the root of the facial nerve and its branches are dissected and preserved. In other cases, blunt spreads through the body of the parotid gland in the direction of nerve branches are made to reach the mandible without clear dissection or manipulation of the nerve.[21] Retromandibular approaches allow exposure of the subcondylar and condylar neck regions and can even be extended to reach the condylar head. They risk injury to the facial nerve and sialocele formation due to the violation of the parotid parenchyma.[21]

Endoscopic Transoral

The development of endoscopic surgery and angled, rigid scopes has allowed for the transoral repair of condylar and subcondylar fractures. In a series by Ducic, 97% of patients were successfully treated with an endoscopic technique.[22] Typically, an incision is made in the gingivobuccal sulcus and retromolar trigone near the ramus of the mandible on the affected side, and a subperiosteal plane is developed on the lateral surface of the mandible. Elevation is carried posteriorly and superiorly to fully expose the fracture. The 30- and 70-degree endoscopes allow high-definition visualization of condylar and subcondylar fractures that otherwise could not be seen with an intraoral incision. After adequate exposure is achieved, fractured segments can be manually reduced and fixated with miniplates (►**Fig. 1**). Often, a transcutaneous

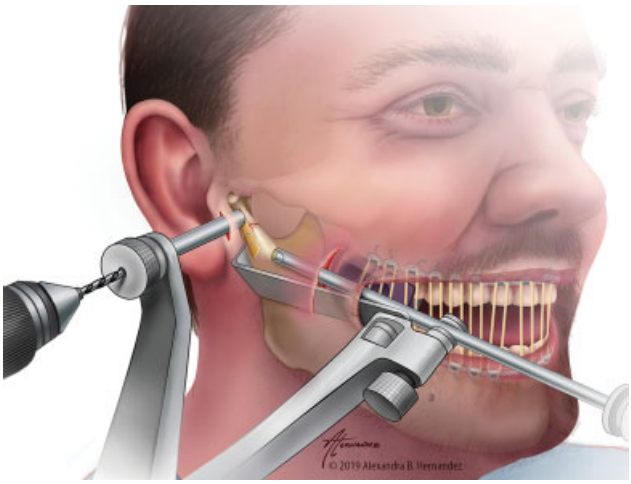

Fig. 1 Illustration of the endoscopic technique for open reduction and internal fixation of subcondylar fractures. A transoral incision is made with subperiosteal elevation around the fracture. A rigid endoscope provides excellent transoral visualization of the fracture and facilitates plating. A transcutaneous stab incision is often needed for screw placement.

puncture and trochar are necessary to allow drilling of holes and screw placement, but there is otherwise no external scar or incision. Alternatively, transcutaneous pins can be placed to aid in reduction followed by external fixation.[23]

Mueller et al found that endoscopic fixation of condylar fractures restored normal condylar anatomy in nearly 95% of patients.[24]

Complications

There are risks associated with ORIF that are not present in closed management of condylar fractures. First, cutaneous incisions can lead to unsightly scarring or hypertrophy. Many studies subjectively describe scar outcomes, and most scars are reported to be acceptable to patients, but more objective classifications are rarely reported.[25] Next, Stenson's duct and the facial nerve are at a risk of injury with subsequent sialocele, salivary fistula, parotitis, or facial palsy. In a study by Van Hevele and Nout, 7.5% of patients who underwent ORIF of condylar fractures using a retromandibular approach developed salivary fistula.[26] Temporary injury to the facial nerve is estimated to occur in 0 to 21% of cases,[2,19,27–29] though the incidence of permanent nerve injury is less than 1%.[29] Commonly, it is believed that tissue retraction causes a stretch injury to the nerve branches or the nerve trunk, which recovers over several months. Rarely, the nerve can be transected. Next, there is a risk of damage to the internal maxillary artery, with significant blood loss.[4,30] Finally, there are the risks of hardware placement; plates and screws can loosen over time, extrude, or cause infection.[27] Infection rates after ORIF of condylar fractures vary from 0 to 10%, with the overall rate from all studies being 3.3%.[4]

Open Versus Closed Management

Numerous studies have advocated the use of ORIF recently. Proponents note that ORIF decreases the overall treatment time by facilitating primary bony healing.[4] Also, ORIF can improve respiratory care, nutritional maintenance, and oral hygiene by minimizing duration of or eliminating the need for MMF.[4] A recent meta-analysis of 23 studies comparing closed and open management of condylar fractures in more than 1,300 patients found that open treatment resulted in significantly better maximum interincisal opening, laterotrusive excursions, and protrusive movements.[27] Furthermore, ORIF was found to result in significantly fewer cases of malocclusion.[27] There was no significant difference in TMJ pain, symptomatic clicking, tenderness, or other noise between the groups.[27] A separate meta-analysis from the same year evaluating 36 studies comparing closed and open treatment of condylar fractures also found that open management results in better jaw mobility, less chin deviation, and less malocclusion.[4] Multiple studies have demonstrated similar pain measures between patients managed with MMF and those managed with surgery; MMF can cause painful muscle spasm, whereas surgery causes pain from incision and dissection.[4]

ORIF is associated with higher treatment costs, however, due to longer time in the operating room, longer general anesthetic, and use of expensive equipment and hardware.[27] In general, ORIF of condylar fractures is not technically straightforward, and there may exist a significant selection bias among the literature that supports open management; typically only very experienced, high-volume surgeons will consider open treatment.[27] The true incidence of complications unique to ORIF, such as infection or injury to vessels, ducts, and nerves, may not be appropriately represented in published studies. Also, while reported infection rates after ORIF are low, they have been shown to be significantly higher than those for closed treatment, in which the risk of infection is close to 0%.[4]

There are numerous published studies examining treatment methods of condylar fractures, including multiple systematic reviews, randomized controlled trials, and at least five meta-analyses.[2,27,29,31,32] Continued debate on the optimal management methods may stem from a heterogeneity of published studies, however.[29] First, studies often have variable follow-up schedules, and many do not report on patient compliance with the recommended follow-up or physiotherapy. Next, some studies subclassify patients based on a specific fracture location (condylar head, condylar neck, or subcondylar), whereas others group all these patients together. Also, there is not one standard classification system for condylar fractures; therefore, even when fractures are divided into subgroups, they still cannot easily be compared across studies using different schemes.[29] Next, treatment methods even within the broader categories of "closed" and "open" are variable in terms of treatment duration and materials used. Many studies do not describe if their patient population had other facial fractures and how the management of those fractures influenced the decision for an open or closed treatment of the condylar injury.[29] All of these factors contribute to uncertainty in evaluating the best available data and drawing a conclusion as to the "best" treatment methods.

Conclusion

In summary, while the management of condylar fractures has been extensively studied and reported, there remains no consensus on what the best treatment regimen should include. In general, minimally displaced fractures are likely amenable to conservative treatment without fixation as long as the patient is willing and able to adhere to a soft diet for 3 to 6 weeks. Closed fixation is advantageous for patients who are poor surgical candidates or who have minimally displaced fractures, who can tolerate MMF, and who are willing to participate in postfixation physiotherapy. ORIF is likely best for significantly displaced fractures, for patients who cannot tolerate MMF, and for those who want a faster return to movement of the jaw. Standardization of fracture classification schemes and treatment modalities in the future will help elucidate the best course of action for each patient and each fracture.

Conflict of Interest
None declared.

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