Soft Tissue Trauma in the Temporomandibular Joint Region Associated with Condylar Fractures

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KEYWORDS

• Soft tissue injury • Temporomandibular joint injury • Condyle fractures • Intracapsular injury • Articular injury

KEY POINTS

- The role of soft tissue injury within the temporomandibular joint (TMJ) in mandibular fractures in general and condyle fractures in particular has been often overlooked.
- With improved MRI and the cumulative information gathered from clinical observation, arthroscopic studies and MRI have given us a new insight into the severity and the natural history of soft tissue damage to the TMJ in trauma.
- There is emerging evidence suggesting concomitant repair of soft tissue injury may lead to improved long-term functional outcome.

Introduction

Advances in MRI have shed new light to the curious clinician's intrigue of what goes on around and within the temporomandibular joint (TMJ) that is involved in condyle fractures. Although for decades clinicians have argued over the various modalities of management of condyle fractures, only recently have we started investigating changes within the joint in such injuries and the influence the different modalities of management elicit on the joint. The more we understand intra-articular changes, the more we are inclined to consider a paradigm shift in the management of condylar injuries. Perhaps re-aligning the bony fragments is only one aspect of the management of these injuries and soft tissue repair warrants some attention to achieve complete functional rehabilitation of the injured mandible.

Internal injuries to the temporomandibular joint

Historically, there has been a tendency to treat most fractures of the condyle closed. Not only has this proven to be effective and economical, and often indicated in patients who may not be fit for open surgery, but there is a school of thought that suggests that intracapsular fractures must be managed with closed treatment.

Large meta-analyses of management of fractures of the condyle has shown no significant difference was found between closed and open treatments with respect to range of motion and lateral excursions and that in some high-quality studies, the difference of all outcomes measured over time is essentially marginal between the 2 groups.

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Interestingly, earlier studies have looked at functional and radiological results of open and closed treatment of intracapsular fractures of the mandible. However, the soft tissues of the joint were not studied or reported in detail in studies that focused primarily on the postoperative radiographic appearance of the condyles using orthopantomograms, reversed Towne view, Submentovertex view, and axiograms and those that did show that open treatment had better results in TMJ function.

In fact, our current literature is not exactly overwhelmed by studies showing intra-articular or soft tissue injuries to the joint in mandibular trauma. In contrast, orthopedic literature is abounding with reports that correlate fractures close to or within a joint that lead to future arthritis and degenerative joint disease.

One must assume that considering the significant force that it takes to fracture condyles, the soft tissues in those regions must be sustaining significant injuries in that impact. Despite this assumption, posttraumatic TMJ symptoms are relatively uncommon. This of course is barring the incidence of TMJ ankylosis following intracapsular trauma, especially in younger patients.

The role of meniscal injury in the causation of ankylosis of the TMJ has been debated over time. Goss and Bosanquet conducted a unique study in 1990 in which they were able to arthroscopically examine the joints of 20 patients with mandibular trauma. Each patient had an arthroscopic examination of the superior surface of the disc and temporal fossa, and the internal aspects of the posterior and medial capsule were examined for damage before repair of the mandible fractures. Most patients in the study had condylar injuries. Most of the joints exhibited hemarthrosis, with structural damage to both the disc and temporal surface. The apparent extent of damage correlated with the time elapsed since injury with more hyperemia and hemarthrosis exhibited in more recent injuries. Cumulative summary of findings from this study

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suggested a natural history of intra-articular and soft tissue damage to the joint from mandibular trauma; bruising and bleeding into the superior joint space (inferior joint space was not examined) and tearing and shredding of the disc and temporal surface of the joint happened first and resolved rather quickly. Disc displacement did not appear to occur from the trauma. Long-term follow-up was not available. Jones and Van Sickels did a similar study and found similar results.

Such studies may not pass the stringent regulations of human research in this day and age. However, soft tissue injuries of the TMJ have been studied extensively using MRI. Early studies by Sullivan and colleagues identified joint effusions (hemarthroses?) and disc displacements but could not quantify the degree of such a displacement.

More recent studies with higher-resolution and cinematic MRIs have been able to prospectively identify the following general patterns of soft tissue. These MRIs were accurate in identifying more damage to the soft tissue that correlates with severity of damage of the condylar complex.

Penetrating soft tissue temporomandibular joint trauma

Penetrating injuries to the soft tissues of the TMJ are not uncommon. Foreign objects, such as shrapnel, can become dislodged in the TMJ and affect mandibular function, can cause discomfort, and may be challenging to retrieve. Such penetrating injuries and their surgical removal can potentially cause more scarring and may require more rigorous postoperative functional rehabilitation. Sometimes severe injuries may require reconstruction of hard and soft tissues by using one of many reconstructive strategies (Fig. 1).

Hemarthrosis of the joint

The closed off joint spaces, superior and inferior spaces in the TMJ, serve as reservoirs that collect blood following trauma. Several investigators have proven that a hemarthrosis can be created experimentally by inducing trauma directly and indirectly to the TMJ area in animal studies. Further, as pointed out earlier, hemarthrosis is the first response elicited on arthroscopy as well as MRI studies of the traumatized mandible. Significant malocclusion noted in most patients with displaced mandible fractures overshadow the clinician's suspicion of something as subtle as clinical symptoms of hemarthrosis. In nondisplaced and green stick fractures or sometimes in the absence of fractures, patients with history of trauma may present with pain and swelling in the TMJ area and a mild open bite on the affected side, suggestive of a disturbance in the position of the TMJ as altered by the hemarthrosis. This usually tends to resolve rather quickly, usually within the first couple of days. There is some evidence suggesting a permanent fibrosis occurs following any hemarthrosis in all joints (Fig. 2).

Damage to the joint surfaces, disc, and disc displacement

Most studies have found a gradient in injury patterns within the joint when mandibular trauma occurs. Although most joints have some bruising and bleeding, severe trauma causes damage to the joint surfaces. More severe injuries lead to more scarring and limitation of joint function. There is strong clinical evidence that suggests that injuries that lead to damage to joint surfaces and the disc cause fibrous ankylosis and possibly bony ankylosis. Ruptures of the periosteal sheath and joint capsule cause extravasation of blood eventually leading to heterotopic bone formation. When the barrier formed by the disc is eliminated, if the disc is either torn or displaced severely, bony surfaces of the condyle and the fossa that never contacted can come to contact and lead to ankylosis. Severe trauma can cause capsular penetration as well as significant disc displacement (Fig. 3).

Damage to the glenoid fossa

A series of studies by Honda and colleagues have looked into the thickness of the thinnest part of the glenoid fossa. Cadaveric studies suggest that an average thickness of the roof of the glenoid fossa is 0.9 mm. Subsequent MRI and cone-beam computed tomography measurement studies corroborated the same.

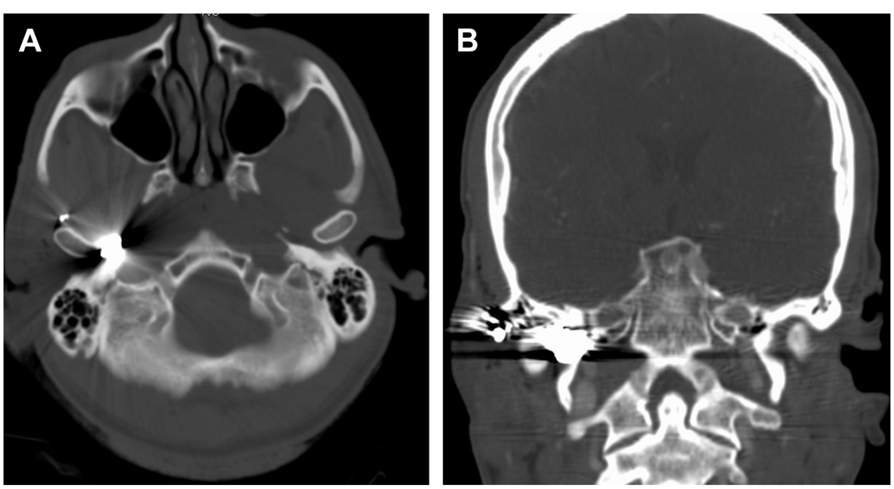

Fig. 1 Surgical management of a projectile within the temporomandibular joint. (*A*) Axial view of shrapnel in the TMJ. (*B*) Coronal view of the same shrapnel in the TMJ: the bullet traversed the capsule, destroyed the disc, and fractured the condylar head before being dislodged in the medial aspect of the joint.