Anatomy and Function

The temporomandibular joint (TMJ) is a condylar joint. The condyloid process articulates in the mandibular fossa of the temporal bone. This fossa generally conforms to the articular surface of the process. A complete meniscus is between the articular surfaces. The meniscus attaches laterally to the condyle and medially to the temporal bone by ligamentous extensions. Capsular attachments to the meniscus are found circumferentially. The lateral aspect of the capsule is strengthened by the lateral temporomandibular ligament. This ligament originates from the posterior ventral aspect of the zygomatic arch and inserts on the lateral aspect of the condyloid process and retroarticular process.

Each mandible rotates about a common transverse axis that passes through the center of each condylar process. The medial aspect of the process is firmly seated in the fossa throughout the range of motion. The lateral aspect of the process moves in a rostral and ventral arc during mouth opening and is displaced from the fossa. Therefore, the movement of the TMJ is more complex than a simple hinge type of movement. The masseter, temporalis and pterygoid muscles hold the condyle tight in the fossa. A small amount of lateral movement occurs during mastication and is limited by normal occlusion.

Abnormalities of the TMJ result in the inability to completely open or close the mouth and, usually, a lateral shift and/or caudal displacement of the mandible.

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The surgical procedures that are used in the treatment of TMJ conditions include: 1) condylectomy for displaced condyle fractures, recurrent TMJ luxations, TMJ degenerative joint disease (DJD), and TMJ ankylosis; 2) condylectomy combined with caudal mandibulectomy (with or without segmental zygomatic arch excision) for periarticular neoplasia or ankylosis; and 3) zygomatic arch partial excision or partial arch excision combined with height reduction of the coronoid process for intermittent open-mouth jaw locking or oral pain due to abnormal bone contact (arch and coronoid process).

Intermittent Open Mouth Jaw Locking

This condition has been associated with TMJ joint dysplasia that results in joint subluxation and contralateral shifting of the mandible. The contralateral coronoid process of the mandible (vertical ramus) contacts the ventral aspect of the adjacent zygomatic arch or is
displaced lateral to the arch. For example, subluxation of the right TMJ causes the mandible to shift to the left, resulting in contact between the left zygomatic arch and left coronoid process.

This mechanical interference with coronoid process motion prevents the mouth from closing. Locking usually is of short duration and is corrected spontaneously when the mouth is opened wider, thereby allowing the coronoid process to disengage the arch. This abnormal contact may also result in intermittent oral sensitivity without open mouth locking.

This condition occurs in both dogs and cats. There is no apparent breed, sex or age predilection. Cranial trauma is usually not reported. Locking episodes occur randomly and usually increase in frequency over time. Duration of locking is variable ranging from a few seconds to 30-60 minutes. Occasionally, the animal cannot spontaneously reduce the lock and manual manipulation, under anesthesia, is needed to restore normal mandible range of motion.

Physical examination after spontaneous reduction finds no abnormalities. Examination of a patient with open mouth locking finds an open mouth with the jaw shifted to one side. A protuberance is visible along the ventral or lateral aspect of one zygomatic arch. This protuberance occurs on the same side of the face as the direction of the jaw shift and is caused by the proximal end on the laterally shifted coronoid process.

Ideally, a CT scan should be obtained. A TMJ radiographic series can be obtained. Lateral-oblique projections may reveal unilateral signs of joint dysplasia or radiographically normal joints. Usually normal joints are found on most imaging studies. During a locking episode, a CT or an open-mouth radiographic projection will reveal the abnormal relationship of the coronoid process and zygomatic arch.

In a patient with a history of locking and spontaneous correction, manual manipulation of the jaw may reproduce the lock. Open-mouth locking can usually be reproduced by manipulation of the lower jaw. After induction of general anesthesia and endotracheal intubation, the patient is placed in left lateral recumbency. The mouth is widely opened to see whether the lower jaw tends to shift toward one side. Laterally directed digital pressure is placed on the medial aspect of the right coronoid process and the jaw rotated counter-clockwise to lower the right coronoid process ventral to the right zygomatic arch as the mouth is widely opened. The manipulation is repeated on the left side with the patient in right lateral recumbency and clockwise rotation of the mandible. Clinical experience suggests that successful displacement of the coronoid process to engage the ventral or lateral aspect of the adjacent zygomatic arch and create the lock on one side indicates laxity of the contralateral and/or ipsilateral side TMJ. Locking cannot be recreated if joints are normal. Locking may not be recreated in every patient with a history of open-mouth locking episodes. It is important to manipulate the right and left sides even if a unilateral lock was observed in the awake patient as bilateral TMJ dysplasia may be present that could result in alternating right and left locking episodes. Crepitus secondary to degenerative TMJ disease may be noted during manipulation. Manual reduction of open mouth locking is accomplished by opening the mouth further, pressing the laterally displaced coronoid in a medial direction then closing the mouth. It is possible that diagnostic manipulation of the mandible may not cause locking. However, the TMJ laxity is often apparent on manipulation and the coronoid process(s) may be displaced laterally to contact the ventral aspect of the arch then slip medially when manipulation is stopped. Neither of these findings are present in normal animals.

The patient is then placed in dorsal recumbency to assess for contact between the rostro-dorsal aspect of the coronoid process and zygomatic and maxilla bone junction. Opening the mouth with counter-clockwise rotation of the mandible will cause the left coronoid process to contact the zygomatic and maxillary bone junction. Opening with clockwise rotation will test the
right side. During this manipulation, intraoral digital palpation of the caudal maxilla immediately
caudal to the second molar may reveal crepitus, contact between the bone structures, or the
vibration of contact and disengagement; all of which suggest TMJ dysplasia and, possibly an
abnormally tall coronoid process. The normal patient should exhibit no bone contact.

Elimination of locking episodes is accomplished by removal of a portion of the involved
zygomatic arch(es). This involves excision of the rostral one-half and ventral two-thirds of the
arch. Once this bone is excised, the anesthetist opens and closes the mouth to confirm
unimpaired motion of the coronoid process. Additional bone may need to be excised. Bilateral
surgery may be needed if locking can be produced on both sides by manual manipulation.

Locking episodes or oral pain associated with the rostral aspect of the coronoid process
contacting the caudal maxilla is largely a problem in brachycephalic breeds. Treatment is
surgical reduction of the height of the coronoid process on one or both sides. Access to the
coronoid is allowed by partial zygomatic arch resection as described above.

Surgical decision making is summarized in Figure 1.

**Temporomandibular Joint Ankylosis**

Ankylosis is an abnormal immobility and consolidation of a joint as a result of fibrosis or
bony union secondary to disease, injury, or surgery. The clinical result of TMJ ankylosis is
moderate to severe reduction in the patient’s ability to open the mouth. Extra-articular pathology
is the usual cause. Examples include caudal mandibular and/or zygomatic arch fractures and
fibrosis from associated soft tissue trauma; and fibrous or calcified adhesions between the arch
and coronoid process secondary to trauma, infection, or tumors of the caudal mandible or
zygomatic arch.

Craniofacial trauma or ear infection may be noted in the history. Weight loss may be the
presenting complaint. The patient is unable to completely open the mouth and the extent of this
limitation depends on the extent of tissue fusion and sensitivity that may be present. Visual or
palpable asymmetry in the regions of the TMJ(s) may be noted due to a neoplasia or fibrous
tissue mass. Other findings may include dehydration, atrophy of masticatory muscles, and
craniofacial asymmetry. Resulting facial deformities in the immature animal may include
mandibular brachygnathia (bilateral ankylosis) or unilateral jaw shift (unilateral ankylosis).
Ankylosis interferes with TMJ enchondral ossification and limits the influence of growing facial
soft tissues on mandibular growth.

Physical exam, skull radiographs or CT imaging are needed to diagnose TMJ ankylosis.
CT with contrast is very beneficial for indicating the extent of the ankylosis. Imaging findings
may include TMJ exostosis, joint deformity, irregular bone contours of the caudal mandible
and/or zygomatic arch, and soft tissue or bony mass lesions. A suspected tumor mass should be
investigated via aspiration cytology or biopsy and complete clinical staging before attempted
surgical resection.

Surgical excision of all involved bone and soft tissue is performed with the goal of
restoring a more normal range of motion and preventing recurrence of the ankylosis. Ankylosis
in the immature animal should be corrected as soon as possible to minimize resultant facial
deformity. Dehydration is corrected before surgery. Endotracheal intubation is often
accomplished via temporary tracheostomy. As needed, en bloc excisions are performed and may
include the entire caudal mandible and zygomatic arch in addition to associated fibrous tissue or
tumor mass. Excised tissue samples are obtained for culture and sensitivity testing and
histopathologic evaluation. Complications may include transient exophthalmos due to tissue
swelling, facial nerve injury, malocclusion, and recurrence of ankylosis. The long-term
functional prognosis for release of a TMJ ankylosis by complete excision of all involved tissue, and in the absence or malignancy, is fair to good. The prognosis is reduced if additional surgery is needed to release an ankylosis recurrence.

*Mandibular Condyle Fractures*

These fractures may be associated with ipsilateral TMJ subluxation or luxation; other mandibular fractures; fractures of the retroarticular process or fossa of the temporal bone; or a contralateral TMJ subluxation or luxation. Fractures usually occur though the condyle base or neck; however, the condyle itself may be fractured.

Common findings include lateral shifting of the jaw (usually toward the affected side) and inability to completely close the mouth. Drooling may be present. Blood-tinged saliva suggests an open intraoral fracture. A CT scan is best in determining the extent of condyle and fossa fractures. Often, other facial/cranial bone injuries are present.

Many condylar fractures that are minimally displaced are managed conservatively with repair of any concurrent mandibular fractures. If normal occlusion is maintained, the patient is fed gruel consistency food for two weeks and no TMJ stabilization is needed. If occlusion can not be maintained, then immobilization with a tape muzzle, inter arcade wiring or dental bonding is required. Conservative management protects local blood supply to the fracture fragments. Severely displaced condyle fractures may be primarily repaired, but this is very difficult due to the small size of fracture fragments. If needed, condylectomy results in adequate mandibular function.

Potential complications include malunion, nonunion, degenerative joint disease, and TMJ ankylosis secondary to fibrosis. Condylectomy will preserve mandibular function. Condylectomy with partial mandibulectomy may be needed for treatment of resulting ankylosis.

*Selected References*


Figure 1: Surgical Decision Making for Open Mouth Jaw Locking

Clinical observation of locking & manual recreation of locking

Unilateral lock

Unilateral zygomatic arch resection

History of locking & manual recreation of locking

Bilateral lock

Bilateral zygomatic arch resection

History suggesting oral sensitivity

Radiographic evidence of DJD

History of locking with recreation of locking & no palpable or radiographic evidence of coronoid process/zygomatic arch contact

Unilateral or bilateral partial coronoidectomy

No palpable coronoid process & zygomatic arch/maxilla junction contact

Unilateral or bilateral condylectomy

History suggesting oral sensitivity & inability to manually recreate locking

History of locking & inability to manually recreate locking

Palpable coronoid process & zygomatic arch/maxilla junction contact

Unilateral or bilateral zygomatic arch resection

History of locking with recreation of locking & no palpable or radiographic evidence of coronoid process/zygomatic arch contact

Unilateral or bilateral condylectomy

Unilateral or bilateral partial coronoidectomy