Focus On: Mandibular Fractures

Fracture of the mandibles is a common injury in dogs and cats and can arise from a variety of situations. How to manage these fractures will be the subject of this article. I will use examples drawn from my own case files to show you both the wrong ways and the right ways. In showing failed cases managed by others, it is not my intent to embarrass anyone. I just want all of my readers to have the benefit of learning from the experience (positive and negative) of others. We are supposed to learn from our mistakes, but life is too short for you to make all the mistakes you could learn from. It will be faster if you can also learn from other people's ~~mistakes~~ experiences.

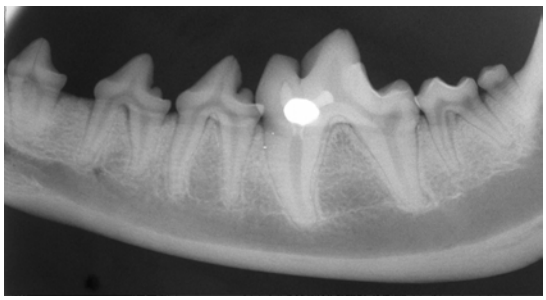
This is going to be a very brief discussion, as a detailed one would take hundreds of pages. There is an excellent chapter on this in the Vet Clinics issue mentioned on page 1 and watch for a new textbook on Oral and Maxillofacial Surgery editied by Frank Verstaete coming soon (I hope – I submitted my chapter almost two years ago!).

When managing a mandibular fracture, the first step is to get good, intra-oral dental radiographs. I know I sound like a broken-record on this subject, but I have never seen a skull radiograph on standard film that gave as good information as can be obtained with intra-oral film. We need to find all of the fractures (bone and dental) and assess their significance in both the short term and the long term.

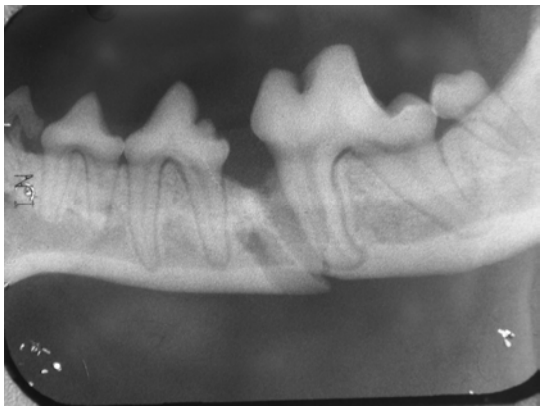
Priorities in managing mandibular fractures include excellent anatomical reduction of the fracture to ensure proper occlusal and TMJ relationships, rigid stabilization of the fracture site to allow bone healing, minimizing iatrogenic damage to dental and oral tissues and a rapid return to function of the oral cavity to allow the animal to eat and drink immediately after surgery.

Sometimes the fracture is such that use of the oral cavity post-op will not be a

This was a maxillary fracture that was poorly managed. The occlusal relationships were ignored and so after healing, the dog could not close its mouth. Several teeth required extraction to allow comfortable function.



Radiograph of the left mandible of a dog (ignore the restorations in the molar. I had been practicing on this skeleton years ago). Note the large lucent canal ventral to the tooth roots. This space is occupied by the mandibular vein, artery and nerve. The only substantial area of dense cortical bone is ventral to the canal – not much to work with. Dorsal to the canal is the cancellous alveolar bone and a lot of tooth roots.



Radiograph of the fractured left mandible in a Shih Tzu. The fracture involves the periodontal ligament space of the mesial root of the first molar. Note how in this small dog, the roots of the first molar extend beside the mandibular canal and into the ventral cortex. These large holes (alveoli) running through the majority of the mandible leave it rather weak, predisposing these small dogs to mandibular fractures. Notice also how much more of the total height of the mandible the mandibular canal takes up and so how little solid bone there is to work with.

feasible goal and in these cases, placement of an esophagostomy feeding tube will allow enteral nutrition and hydration, but the other objectives must be met.

Now let's look at some of the anatomical features and physics of the mandible as they pertain to repair options.

The mandible is full of tooth roots. If the patient enjoys good periodontal health, the roots are surrounded by a thin layer of bone on the lingual and buccal sides and then there is cancellous bone between the roots. Between each root and the surrounding bone is the periodontal ligament.

In mid to large size dogs, the ends of the tooth roots (apices) are dorsal to the mandibular canal, a hollow chamber that begins on the lingual aspect of the mandible behind the last molar and ends at the mental foramina in the region of the chin. In small dogs, the roots of the teeth are proportionally longer so that the apices may be beside the mandibular canal and may even extend down into the ventral cortex.

The blood supply to the mandibular bone and all of the mandibular teeth comes from the mandibular artery which travels through the mandibular canal. There is no significant vascular cross-over at the symphysis and so no collateral circulation to the mandible. Therefore, preserving the integrity of the mandibular artery is crucial to ensuring adequate blood supply to the bone to support healing. In some seriously displaced fractures, the artery is severed, but if the fracture is reduced and stabilized shortly after injury, the artery can re-anastomose on its own (give the body half a chance and it will try to heal).

Wire Alone = Bad

There are a few specific inter-dental wiring patterns, which if well executed with proper case selection, can provide quite good fracture reduction (Ivy Loop, Stout's Multiple Loop, Essig's and Risdon's patterns). In general, however, wire on its own is a poor choice. Wire tends to develop small kinks during handling. The wires may seem tight and the fracture stable at discharge, but in a few days, the wire stretches, the kinks straighten and the wire becomes loose. Now the fracture is free to fall out of alignment and the wire is just an annoying foreign body. **Wire alone is bad news.**

Plates = Bad

The ventral cortex is the compression side of the fracture and the dorsal

(alveolar) ridge is the tension side. Therefore, a plate or wire placed in the solid bone ventrally will have a hard time holding the dorsal edges together – it is in the wrong place mechanically. Ventral appliances tend to become hinge points.

Putting a plate on a mandible further dorsally runs an extreme risk of seriously damaging the mandibular artery, thus compromising the blood supply rostral to the screws. Going dorsal to the mandibular canal runs a very real risk of drilling through tooth roots, causing lots of iatrogenic damage necessitating extraction of the teeth. Plates are flat and rigid and so cause the mandible to adapt to the shape of the plate, making preservation of proper occlusion next to impossible. **Plates are bad news.**

Pins = Bad

Another idea that has been tried is to run an IM pin up the mandibular canal to stabilize the fracture. This will destroy the mandibular vein, artery and nerve, killing the pulp in each of the teeth and likely devascularizing the fracture site. Again, pins are straight and the mandible is not, so an IM pin pulls the jaws out of proper occlusion. Pins also offer no rotational stability. **Pins are bad news.**

Intra-Oral Splints = Good

Whenever possible, the first choice for mandibular fracture repair is the use of an intra-oral splint. Typically these will have a wire base and then be reinforced with dental composite or acrylic to hold them rigid in 3-dimensions. If there are enough teeth on either side of the fracture, then the splint is anchored (bonded) to the tooth crowns. If there is insufficient coronal surface-area to support the splint on one side of the fracture or the other, then the splint may have to be wired to the mandible in some fashion.

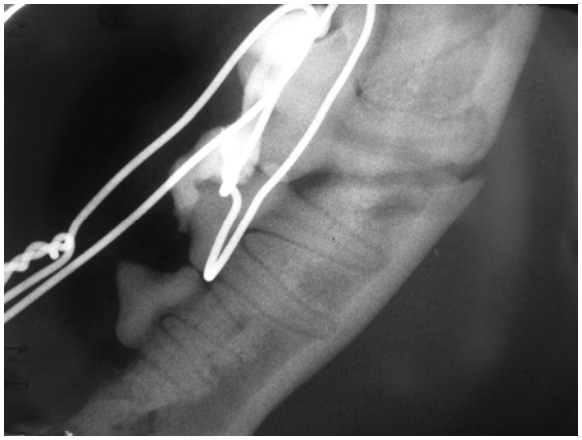
Intra-oral splints can often be fashioned to avoid iatrogenic damage to teeth and bones, they give good stability in all dimensions and allow immediate return to ailementation. They put the stability along the tension side of the fracture, which is where you want it and they are custom made to re-establish and maintain proper anatomic alignment.

Now let's look at some examples.

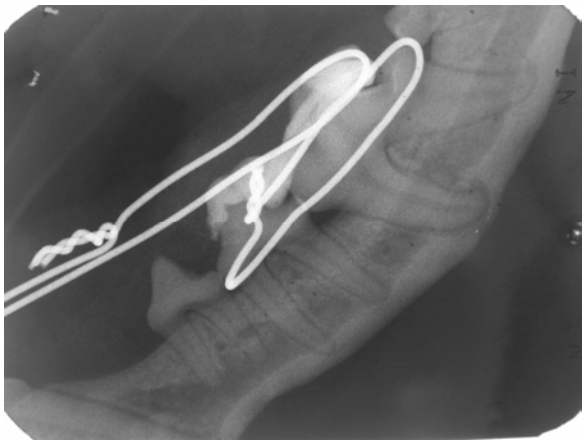
The Shih tzu whose film appears on page 3 had a fracture through the alveolus of the mesial root of the first molar. This gave us lots of crown and root surface area on both sides of the fracture to hold a splint.

Treatment began with careful lavaging of the fracture site with saline. I did not curette the wound, as I wanted to preserve the periodontal ligament fibers on the root surface to get periodontal healing rather than ankylosis of the root to the bone. I then sutured the soft tissues with absorbable material. A wire/composite splint was constructed in the mouth to hold the fracture stable as shown in the radiograph at the top of this page.

The dog was sent home with instructions to feed only very soft food and to avoid all rough play and activities. An antiseptic solution was dispensed for rinsing around the appliance to reduce irritation to the soft tissues.



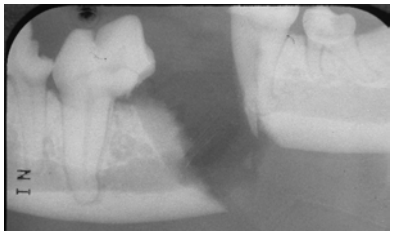
Due to geography, it was 2.5 months before we saw the dog again at which point, the mandible looked like this:



We removed the splint at this point.

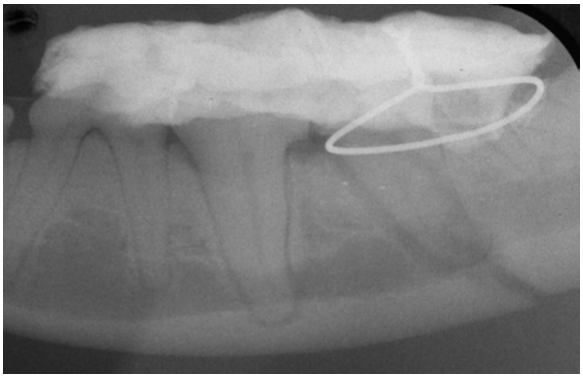
Since the fracture had come very close to the apex of the mesial root of the mandibular first molar, this tooth's endodontic future is not certain and root canal treatment may be needed at further follow-up.

The next case is a Lhasa Apso with a fracture through the first molar which obviously exposed the pulp of this tooth. This molar had no long-term future, but its presence as anchor points for a splint made it a real asset at this stage.

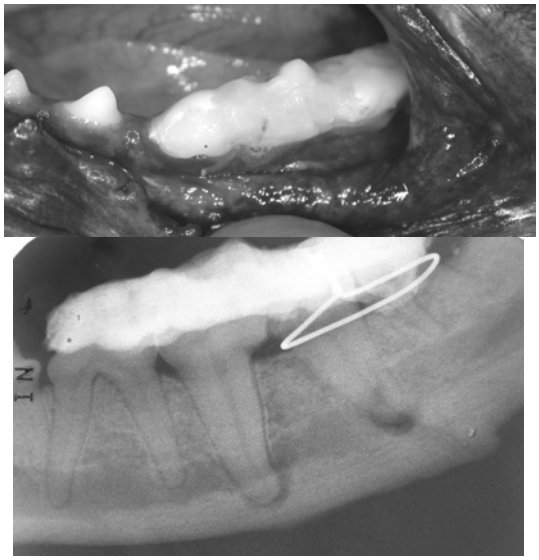


Treatment again involved flushing the wound, closing of the soft tissue and creation of an intra-oral splint. The distal portion of the first molar had good coronal surface area but the root was about to fall into the fracture gap. The second molar had good root stability, but not much coronal surface area to bond to. So, I wired the distal root of the first molar to the second molar to create one functional unit. This gave both lots of coronal surface area and stable root surface area.

Here is the immediate post-op film showing the wire/acrylic splint in place and the fracture well reduced. The bulk of this splint meant that the upper teeth were going to hit it. Therefore I also built a bite block on the right mandibular molars to keep the mouth open enough to prevent damage to the splint.



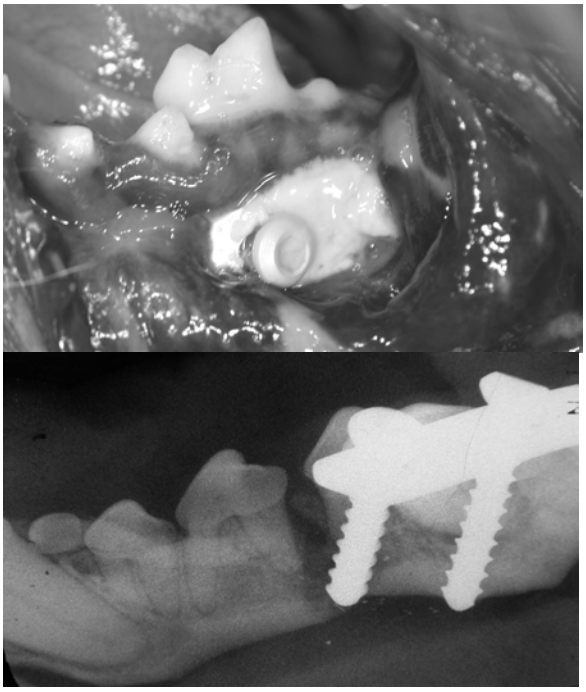
Here she is six weeks later.



The pulp in the fractured molar has obviously died and there is periapical bone loss due to endodontic disease but the fracture has healed so well, I can hardly see where it was. I removed the splint, the bite block and the fractured molar. Here is the post-op film.

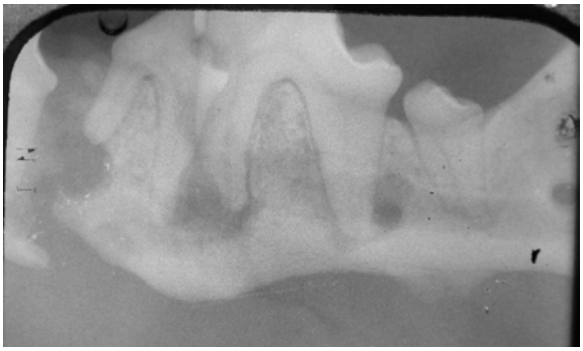
Now a not-so-wonderful case. A Shih Tzu suffered a left mandibular fracture somewhere around the first molar (I did not see the dog 'til much later and never saw pre-op films to know exactly where the fracture was). The initial attempt to stabilize with wire alone failed.

Some days later, a bone plate was placed. I saw the dog five months later and found this.



The soft tissues over the middle of the plate had sloughed, exposing the plate and screws and opening pathways for infection to enter the bone around the screws. Worse, the mandible had fractured pathologically at the rostral end of the plate. Why would the bone break there?

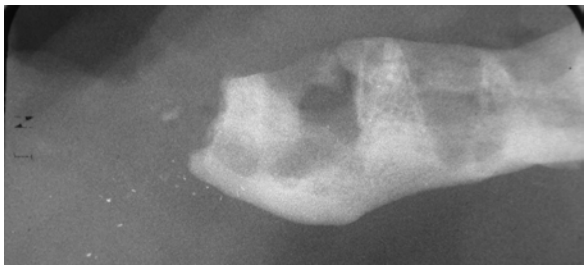
Here is a film with the plate removed.



Note the screw holes right through the mandibular canal (and artery). I suspect that placement of the screws destroyed the blood supply to the mandible rostral to the fracture site. While the initial fracture healed, avascular necrosis of the bone led to weakening and fracture at the fulcrum point. Some of the screw

holes also damaged the tooth roots in the area.

My treatment for this case was to remove all teeth distal to the new fracture and then to remove the mandible from the new fracture to the symphysis.



So the take home message is: ***When presented with a mandibular fracture, refer it ASAP to a veterinary dentist (or a surgeon who knows the mouth). Do not attempt to wire, pin or plate these fractures.*** Only in the most extreme cases are these approaches used as a last resort. They should never be the first choice.

There are a number of other tricks that I have employed over the years. Mandibular fractures can have a wide variety of presentations and so having the ability to utilize a number of different treatment modalities (or combinations thereof) and the ability to make-it-up-as-you-go are crucial.