Special Considerations when Dealing with Juvenile Jaw Fractures

Christopher Snyder, DVM, DAVDC
University of Wisconsin
Madison, WI

Facial fractures represent less than 10% of all fractured bones in dogs. Most fractures in canine patients are associated with- blunt force trauma (hit by car), falls from heights or pathologic fracture related to periodontal disease. Dogs and humans demonstrate similar trends with regard to location and age demographics of those affected. Fractures associated with younger patients (human or canine) create challenges with fixation and the impact on growth and development.

Epidemiological reviews of large number of jaw fracture cases in canine and human populations demonstrate similarities between the age and sex of those affected. A study by Lopes revealed a bimodal distribution of the age of the animals injured. Male dogs under the age of 2, and over the age of 8 were overrepresented. A similar study by Ellis evaluating the records of over 2000 cases of maxillofacial injury in people revealed predominately young males (in their 20's and 30's) were the most prevalent. Physical assault was the most frequent cause of injury in these patients. In the human studies there does not seem to be an additional peak incidence in an older (mature) population like there was dogs. It is hypothesized that the bimodal distribution in dogs is associated with younger dogs becoming sexually mature and responding to a hormonal urge to find a mate and breed. Similarly with younger males, many of the assaults were associated with bars and frequently the fight may have been about a woman. The increase in incidence in older dogs was not seen in the human population and it can be hypothesized that the focus on human oral health minimizes periodontal disease and periodontal disease-related pathologic fractures are not as common. Periodontal disease associated with the mandibular first molar, especially in smaller dogs causes profound weakening of the mandible and predilection for fracture.

A similar correlation exists between dogs and people in these studies when looking at fracture location in the mandible. In dogs and people the body of the mandible, and in particular the mandibular first molar region in dogs, demonstrates increased prevelance of fractures. The human study reveals many more fractures involving the condylar and coronoid processes which were not seen in the Lopes article. While computed tomography, skull radiographs and panorex dental radiographs remain standard of care for the management of maxillofacial injury, the data generated from the Lopes article states nothing about the extent of the diagnostics used. Since the underlying degree of diagnostic investigation may be different between these two studies, there also maybe an anatomical explanation as well. The ramus of the mandible in the dog is protected by stronger and thicker muscles of mastication, this may begin to answer why there are fewer injuries in veterinary patients. Beyond that, the fibrocartilagenous symphysis in dogs and cats may act as mechanism for kinetic force distribution. In humans, assaults are commonly associated with a sideways force contacting the jaw. By having a fused right and left mandible, the force has nowhere to go but to be transferred to the condylar process. While the mandibular first molar, held in place by the soft tissues of the periodontal ligament may be a natural area of weakness predisposing the jaw to fracture, unerupted third molars (wisdom teeth) in people may play a similar role. In addition there is a sharp right angle between the mandibular body and ramus seen in humans that is not equal with dogs. In fact, the smaller the dogs, the closer the root-to-bone height ratio becomes. This equates to the apices of M1 in small dogs nearing the ventral cortex. Those smaller dogs, compounded with their dental crowding, longer life spans and worsening periodontal disease all predispose these patients to potential fracture.

When we think about how maxillofacial injuries could impact subsequent growth and development of younger patients, an understanding of how the maxillae and mandibles grow is important. The flat bones of the face and skull grow by appositional bone growth. Since no true growth plates exist in the maxilla and only the coronoid and condylar process have growth plates, the effects of maxillofacial trauma may have greater impact on facial symmetry related to soft tissue injury and scarring. The cephalocaudal gradient of growth if the phenomenon that states that the further a bone is away from the brain, the greater and later growth will occur to reach skeletal maturity. Because of this, injuries in juvenile pets that involve the mandible stand to have a greater impact on jaw growth; because of the increased potential for growth exists. Because we said that the condylar process has a growth plate that is responsible for ramus height, computed tomography should be recommended in younger patients to screen for injuries in this area.

The goals of repair should be: a quick return to function, a comfortable occlusion (the patient will have to live with this lifelong) and stabilization of fracture fragments. When making decisions about methods of fixation for mandibular fractures, location-location-location becomes crucial. Whether or not the fracture is favorable or unfavorable will be important in determining if the method of fixation should be load-sharing or load-bearing. Favorable fractures are mandible fractures that course cranially and ventrally. When acted on by: gravity, the presence of a bolus of food in the mouth, upwards pulling of the masseter and temporalis muscles and downward and caudal pull of the digastricus- all these vector forces aid in reducing and compressing the fracture. Oblique fractures coursing caudolingually are also considered favorable since the inward pull of the pterygoid muscles will serve to generate compression on those fracture lines. Sometimes these fractures can be fixated with a single form of load sharing fixation. Unfavorable fractures frequently require the stabilization of the alveolar crestal bone and the ventral cortex because all of the above stated forces serve to distract the fracture fragments. The alveolar crestal bone (oral side) is considered the tension surface while the ventral cortex is considered the compression surface. In favorable fractures, stabilization of the tension surface may be all that is required for bony

healing. Ultimately if the animal's pain can be treated and the animal can be supported nutritionally, no animal needs to be euthanized due to a jaw fracture. Intractable bleeding or fractures involving temporomandibular joint luxation are situations where immediate treatment is necessary.

Maxillomandibular fixation (MMF) is the simplest way of fixation for simple fractures. By realigning the patient's bite or occlusion, the bone fragments should also become anatomically approximated. Putting a patient into MMF can be done for stabilization until the patient can be surgically repaired, or it can serve as a sole means of fixation. Whether a loose fitting muzzle (loose enough for them to get their tongue out and lap food) or acrylic bonding of the canine teeth in a semi-open position, this method of fixation can permit healing. One downside of this technique is that the TMJ shouldn't be immobilized for more then 3 weeks at a time (especially in young animals). At 3 weeks, the acrylic should be removed and/or the muzzle needs to be loosened to encourage increased range of motion. This method of fixation has the highest likelihood for post-operative malocclusion but should be an alternative to euthanasia for clients who cannot afford much more.

Interdental wiring and acrylic splint fabrication have become the most widely used methods of fixation by veterinary dentists. The philosophy is that if occlusion can be restored the bone fragments will be realigned and will heal. In addition, this noninvasive fracture repair techniques eliminates the need for surgically opening the fracture site, disturbing the fracture hematoma and stripping away the periosteum necessary for a great deal of the bone's vasculature. The combination of the interdental wiring and acrylic splint, rather than each alone, offers greater strength in the construction. Wiring and splint fabrication can be performed with reasonable training and materials much cheaper than traditional orthopedic hardware. These methods are applied to the tension surface of the fracture and can make a favorable fracture quite stable. Beware of your patient feeling so good that they bite down and crack the splint on something hard- the acrylic is brittle! This repair can be easy (add more acrylic) but does require another general anesthesia- these patients should go home on strict restrictions of soft food and soft toys only- if any! Splints and wiring should only be needed for 6-10 weeks. There are limitations with the placement of splints and wires if the patient has mixed dentition. Understanding and anticipating deciduous tooth exfoliation can be helpful in determining if the 6-10 weeks is reasonable. In situations where the practitioner fears deciduous teeth anchoring the splint and being exfoliated, mandibular cerclage wires can be place through simple stab incisions in the ventral mandible. This orthopedic cerclage wire can be tightened down in the mouth after a first layer of acrylic and covered with a subsequent layer of acrylic. Patients that are this young usually will be sufficiently healed in 6-8 weeks or sooner.

Forms of internal fixation can be tricky and difficult to place in juvenile patients due to overwhelming presence of developing tooth buds. Interfragmentary wiring, external skeletal fixation and plates/screws all have advantages and disadvantages. Depending on the state of the patient's dentition, interfragmentary wiring may offer the best flexibility for implant placement. Avoiding the mandibular canal and associated neurovascular bundle, developing permanent teeth and deciduous tooth roots are all important criteria to minimize long-term complications.

What to do with unerupted teeth in the fracture line is controversial in human jaw fracture repair. On one hand, those hard tissue structures aid in the reduction of the fracture. Removal of additional bone to remove the unerupted tooth may serve to destabilize the fracture reduction. One paper in people demonstrates that approximately 50% of unerupted teeth in the fracture line will erupt with an abnormality. Enamel defects (hypocalcification, hypomineralization), the absence of either a crown or root, tooth nonvitality and endodontic disease or impaction are all possible sequella of the injury. Owners and the pet's primary veterinarian should be carefully counseled on what to watch for in these cases.

In conclusion, the goals of jaw fracture management should be centered on a quick return to function, a comfortable occlusion and providing a stable means of fixation. Juvenile patients often complicate fracture management because of their deciduous or mixed dentition. Conversely, they tend to heal quickly. Client communication is key since the full extent of the effects on growth and development of teeth or the facial bones won't be known until almost 1 year of age (in most breeds). Efforts should be made to recommend diagnostic imaging that will provide the most information. The more prepared you are with information, the more accurate your long-term prognosis may be.

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