Emergency Veterinary Dentistry and Oral Surgery

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Maxillofacial trauma is common in dogs and cats. Mandibular fractures are more common and more evident compared to maxillary fractures. However, computed tomography (CT) increases the veterinarian's ability to accurately identify, assess, and treat severe maxillofacial trauma and maxillary fractures. Significant force is required to fracture the maxillofacial skeletal (e.g., vehicular trauma, high falls, sports equipment, animal bites, and iatrogenic). Maxillofacial fractures often involve multiple sites in the maxillofacial skeleton. The mandibular molar region and maxillary bone are the most common site for fractures in the dog. Symphyseal separation is the most common injury in the cat. Intraoral radiographs are required for accurate assessment and treatment planning. Multimodal pain control, appropriate antibiotic coverage, and nutritional support are necessary for each case.

The teeth are often involved with the skeletal trauma. Appropriate treatment and planning includes the teeth for potential endodontic and periodontal disease treatment.

Emergency *vs.* urgency

Emergency is defined as an accident, urgent or pressing need. There may be situations where urgent care and attention is needed but rarely does dental and oral treatment need to be started immediately at presentation. Treatment is often best delayed until the patient is stable for general anesthesia. True dental emergencies requiring immediate attention would include an avulsed tooth, uncontrollable oral hemorrhage (rare), or severely comminuted maxillofacial trauma. Oral trauma is often the result of vehicular accidents, baseball bats, golf clubs, dog fights, horse kicks, gun shots, and falling from heights.

Soft tissue injury and soft tissue avulsions

A patient may present for uncontrolled hemorrhage from the oral cavity. This is often the result from injury to the palatine artery, located palatal to the upper 4th premolars, or injury to the sublingual and/or lingual arteries. These injuries may be associated with other maxillofacial trauma and fractures or can occur from stick or projectile foreign bodies. Hemorrhage from the maxillary artery, situated in the sphenopalatine fossa, may lead to exophthalmus of the ipsilateral eye and swelling of the ipsilateral pharyngeal area. The tongue can be lacerated from a variety objects (e.g., lawn mowers, knives, machetes, paper shredder). If necessary, a non-crushing forceps, temporary mattress sutures, or temporary occlusion of the carotid arteries can be done in order to slow hemorrhage and identify the lingual arteries deep in the musculature of the tongue. Partial glossectomy may be necessary if tissue is devitalized. Depending on the cause and extent of trauma, there is some collateral circulation to the tongue. The client should be advised a second surgery could be necessary if devitalized tissue appears several days following the initial injury and emergency ligation. Ligation of the major palatine artery is more problematic if is retracted into, or near, the major palatine foramen. If the artery cannot be located, then ligation of the carotid artery in the neck may be necessary.

The avulsion of soft tissue from the rostral mandible or maxilla can occur. The neurovascular structures exiting from the mental foramina are often avulsed. However, there is usually minimal continued hemorrhage by the time the patient arrives at the hospital. The bone is exposed and may or may not have suffered fractures. The patient is stabilized and the exposed bone is kept moist with 0.12% chlorhexidine gluconate oral rinse and sterile water based lubricant until definitive repair can be performed. Intraoral radiographs are obtained to evaluate the dentition and bone in the traumatized region. The gingiva must be returned to surround each tooth for periodontal health. Fortunately, the avulsion often occurs at the mucogingival junction so many teeth will still have gingiva surrounding them. Second, the musculature and mandibular lip attachment in the region of the labial frenula will be a source of tension on the suture line. Meticulous suturing between the mucosa and gingiva with 5-0 or 4-0 polyglecaprone-25 with a simple interrupted pattern and supportive sutures with 3-0 or 4-0 polyglecaprone-25 simple interrupted in the interproximal spaces has worked well. In addition, deep tacking sutures to the tissue of the mandibular symphysis and ventral periosteum are used prior to closure of mucosa. Prior to closure, the exposed bone is carefully, gently, and meticulously debrided and lavaged to remove debris and devitalized tissue.

Fractured teeth

Fractured teeth require intraoral dental radiographs. All fractured teeth with pulp exposure require endodontic treatment or extraction. "Wait and see" is a negligent and an inappropriate option. Even if there is no pulp exposure the tooth may have irreversible pulpitis due to the concussive trauma or the exposure of the porous dentin tubules. The tooth may become infected and require treatment. Even if there is a large radiographic periapical lucency associated with a chronically fractured tooth, the tooth is still treatable with endodontic therapy.

Classification of tooth fractures can be found at www.avdc.org. Enamel infraction (an incomplete fracture of the enamel without loss of tooth substance), enamel fracture (a fracture with loss of crown substance confined to the enamel), uncomplicated crown fracture (a fracture of the crown that does not expose the pulp), complicated crown fracture (a fracture of the crown that does expose

the pulp), uncomplicated crown-root fracture (a fracture of the crown and root that does not expose the pulp), complicated crown root-fracture (a fracture of the crown and root that does expose the pulp), and a root fracture (a fracture involving the root).

Crown-root and root fractures may require periodontal surgery in order to save the tooth. Additionally, these teeth may die, become discolored, and infected from the same trauma (concussive pulpitis) that fractured the tooth even if the pulp is not exposed. Intraoral radiographs, monitoring, and/or treatment are necessary. Discolored teeth need intraoral dental radiographs followed by endodontic treatment or extraction.

Luxated teeth

Avulsed teeth have been completely knocked out of the mouth, with or without concurrent maxillofacial fractures. Luxated teeth are clinically displaced but still in the oral cavity and supportive tissues. Subluxated teeth have been moved but return to a correct anatomical position. Regardless, the blood supply is disrupted and all these teeth require endodontic treatment.

Luxated teeth are replaced into correct occlusion and splinted. Subluxated teeth are splinted. These teeth are endodontically treated and monitored radiographically for root resorption. Prognosis is good if done in a timely fashion and correctly.

Oral fracture presentation

When the patient is presented it may be obvious that there are significant facial fractures. However, first focus on basic emergency support such as fluids, hemorrhage, blood pressure, analgesia, respiratory and other injuries. Survey radiographs of the skull may be taken while the patient is sedated with analgesic medications. They may provide some initial assessment of fractures but more detailed intraoral radiographs or CT is needed to fully plan a skillful and functional repair. The patient's facial fractures may be stabilized with a tape muzzle to decrease mobility of fragments and nutritional planning should start. Maxillofacial fracture repair is rarely and emergent issue. Rather, stabilization of the cardiopulmonary system for 24-48 hours is the first priority.

Mandibular fractures are the most common and evident. Mandibular fractures commonly cause deviation of the mandible towards the side of the fracture where as with TMJ luxations, the deviation tends to be away from the side of the luxated TMJ joint. Asymmetry of the face, epistaxis (nasal or turbinate fractures) may be indicators of maxillofacial fractures indicating a full radiographic evaluation of these regions. Finally, fractured teeth may or may not be evident. Planning for a root canal treatment and/or a vital pulpotomy may be necessary. It is important to know fracture line locations for teeth and the associated recommendations.

Preparations for one anesthetic episode (if possible) are made once the patient is stable. Planning for intraoral radiography/CT, diagnosis, fracture repair and nutritional feeding tubes are made. Appropriate antibiotic selection in the stabilization period is important. The exposed and traumatized bone is susceptible to attack by the oral bacteria. Consideration for anaerobic bacteria flora and selection of antibiotics such as amoxicillin/clavulanic acid or clindamycin is recommended.

Maxillofacial fracture repair

Fractures of the mandible and maxilla are approached differently compared to fractures of the long bones. Teeth and tooth roots as well as the curvature of the mandible, preclude the use of straight, bulky, bone plates and screws. It is difficult, or near impossible, to place them without damaging tooth roots or neurovascular structures in the mandibular canal. An exception would be mini-plates. However, the cost of the equipment and inventory and the training required precludes the use by most general veterinary practitioners. External fixators are bulky and fraught with problems. Placing the teeth in occlusion and the use of non-invasive intraoral fracture techniques using interdental wire and composite material is far superior, faster, and less costly. The healing of the oral cavity is rapid due to its blood supply. Skillful intervention and repair allows a more rapid return to function and reduced risk of malocclusion. Pharyngotomy endotracheal tubes allow continued evaluation of proper occlusion during fracture repair and should be considered in major maxillofacial fracture repair reconstruction.

Principles of maxillofacial and mandibular fracture repair

1. Restore normal occlusion – aligning the teeth aligns the bone
2. Restore normal function
3. Maintain soft tissue (minimal invasiveness) and suture close open soft tissue
4. Use appropriate antibiotics
5. Make appropriate decisions on involved teeth
6. Treat periodontal disease
7. Know when skillful surgical intervention (referral) is needed
8. Home care instructions and plan

The repair needs to be stable. However, the concept of rigid fixation, as for orthopedic repair of long bones, is not an absolute requirement. The facial bones and mandible are non-weight bearing. When repairing multiple fractures, repair mandibular fractures first, then put the teeth in proper occlusion and repair the maxillofacial fractures.

TMJ range of motion abnormalities

Patients will often present with the inability to open or close the mouth or pain during opening and closing. Start with an examination of the head and mouth. Identify if there is pain at the TMJ, a click during range of motion, pain or resistance on retropulsion of the eyes (retrobulbar abscess/cellulitis or masticatory myositis), pathology on otoscopic exam, and normal occlusion. Diagnosis can often be made with a good oral and TMJ exam as well as computed tomography (CT). CT is the best diagnostic modality as diagnostic skull films require general anesthesia and perfectly positioned patients. If performed correctly and charged for appropriately, a better value is to obtain a CT.

The inability and/or pain when opening and closing the mouth

Unable to close mouth: 1) TMJ Luxation (with or without fracture) 2) TMJ Dysplasia with Coronoid Displacement (open mouth jaw locking) 3) Zygomatic Arch Fracture/Healing 4) Zygomatic or Dorsal Coronoid Neoplasia 5) Idiopathic Trigeminal Neuritis 6) Masticatory Muscle Neurogenic Atrophy.

Unable to open mouth: 1) Retrobulbar/Maxillofacial Abscess/Cellulitis 2) Masticatory Myositis 3) Zygomatic mucocele 4) Neoplasia 5) Craniomandibular Osteopathy 6) TMJ Ankylosis (previous trauma) 7) Zygomatic Arch Fracture/Healing 8) Tetanus (Clostridium tetani) and 8) Osteoarthritis of TMJ (rare).

Diagnostic tests

1. CBC/Chemistry/UA
2. Sedated and/or anesthetized exam to evaluate ROM
3. Type 2M Muscle Fiber Antibody
4. Masticatory Muscle biopsy
5. Culture and Sensitivity? (Anaerobes Difficult)
6. TMJ Radiography? (anesthesia and perfect positioning necessary)
7. Computed tomography
8. Magnetic Resonance Imaging

Clinical note: Do not place a patient on immunosuppressive corticosteroids for a presumptive diagnosis of masticatory myositis until retrobulbar/maxillofacial abscess/cellulitis is ruled out. Immunosuppression of an infection has lead to severe regional and systemic infection and death in many patients due to a misdiagnosis or inappropriate presumptive diagnosis. Remember many patients with retrobulbar cellulitis/abscess will resist opening the mouth during a conscious examination due to pain. Therefore, placing an intravenous catheter and administering multimodal analgesia and/or anesthesia will allow you to assess the range of motion of the TMJ as well as evaluate the pterygopalatine fossa for evidence of trauma and swelling – the mouth can be opened; in these cases treat with antibiotics, anti-inflammatory NSAIDS, if not contraindicated, and other analgesics. In an acute masticatory myositis case, the mouth cannot, or rarely, be opened, in the anesthetized patient, due to the extreme inflammation of the muscles. In these cases, draw blood for a Type 2M antibody titer and obtain a muscle biopsy. Then administer immunosuppressive medications.

Maxillofacial gunshot wounds

Gunshot wounds (GSW) are not uncommon. Shootings occur due to mistaken canine and feline identity as well as malicious behavior. Obtaining digital photographs throughout the disposition of the case is recommended since these cases often are associated with legal investigations. Understanding these wounds involves understanding principles of ballistics, type of ammunition, cavitation principles, wadding, etc… that lead to laceration, crushing, shock wave, and contaminated injuries. Patient stabilization comes first. Clients must be advised that multiple surgeries may be necessary because it may take several days for the dead tissue to delineate itself, wound care may be necessary prior to closure, and fracture stabilization, dental treatment, and cosmetic repair often cannot be completed under one anesthesia. As the zone of necrosis expands after the initial injury, wounds often increase in size. Vital and questionable vital tissue should be maintained until the full extent of tissue death delineates. The metallic projectiles are often left in place unless they are in a threatening or in a vital position. Dehiscence is common and repeat surgeries may be necessary.

References available upon request