REPAIR OF INCISOR AVULSION FRACTURES
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Key points
- Rostral jaw fractures are common and often involve both osseous and dental structures.
- Simple wire repair of incisive bone fracture carries a favorable prognosis but negative dental complications are common.
- Following good surgical principles for care of dental structures involved in incisive fractures gives teeth the best chance for long-term survival.

Rostral mandibular and maxillary fractures are the most common type of fractures sustained to the head of the horse. They are most often seen in younger animals with deciduous or mixed deciduous and permanent dentition. These injuries are frequently seen to arise from falls or kicks, biting behavior with tie-up chains, or involvement with window bars or mangers. Rare cases are iatrogenic from dental procedures or secondary to pathological conditions such as tumors, osteomyelitis, or equine odontoclastic tooth resorption with hypercementosis (EOTRH).

Clinical signs can vary from some horses being asymptomatic to those showing excessive salivation, dental misalignment, crepitation or swelling of the head region, bleeding from the mouth and malodor. Careful evaluation via a general physical examination and intraoral examination followed by radiographs will usually lead to a diagnosis. Dental structural integrity and temporomandibular joint function should be evaluated. Since a large number of these injuries occur in young horses it is important to take intraoral radiographs and evaluate the impression of the injury to the support structures of the tooth, the state of reserve crown maturity, and root development or fracture and the relation of the deciduous tooth to its permanent successors.

Techniques of reducing and stabilizing rostral incisive fractures with various configurations of wire and acrylic splints have been well described in the literature. Stabilization of rostral mandibular fractures with tension band wires in the mouth supported by an intraoral acrylic splint, provides a high level of stability in an invitro equine model. The literature gives these injuries a favorable prognosis for healing but the long-term health and viability of the hypsodont teeth have only recently been considered in the veterinary literature.

Always attempt to salvage the teeth and associated bone. Consider the health and vitality of the teeth for survival. True success is a long-term favorable result for the bone fracture to heal and the tooth to survive with continued functionality. In humans, avulsed teeth have a favorable prognosis for implantation if the tooth is kept moist and reimplanted within 30 minutes. Most equine cases are not seen in that time frame. Root or pulp exposure and subsequent avascular necrosis of the avulsed teeth can lead to periapical (the area around the tooth root) abscessation that will necessitate future endodontic therapy or exodontia (extraction). The owner should be informed of short-term and long-term sequelae of injury and repair.

Fractures to the incisive area need to be dealt with as a surgical emergency if the teeth are to be preserved. First aid care by the primary practitioner in the field should consist of gentle cleansing of the areas to remove food and gross debris. A muzzle or moving the horse to a stall with no bedding and restricted access to food, will limit further contamination. The horse should be placed on broad-spectrum antibiotics and non-steroidal anti-inflammatory drugs prior to referral for further diagnostics and/or surgical repair. Once referred for specialty care, these
cases need to be attended to immediately to determine if teeth have been compromised. If such is the case, treatment should not be delayed even a day, for repair.

The horse has vertically successional incisor teeth that are radicular hypsodont in nature. The young horse erupts new deciduous incisors until 6-9 months of age. These teeth continue to erupt to compensate for occlusal attrition until they are exfoliated and replaced by permanent teeth between 2.5 and 5 years of age. The permanent incisors continue to erupt as they are worn, until the hypsodont crowns expire between 20 and 30 years of age. This eruption schedule of incisor teeth is basic knowledge for the equine practitioner and aids in developing a treatment plan and long-term prognosis for a horse that suffers from an injury of the incisor teeth.

The bony dental alveolus is the cup-like support structure of the tooth. The tooth is attached through a “gomphosis” with Sharpey’s fibers from the dental cementum through the fibroelastic periodontal ligament attaching via Sharpey’s fibers to the alveolar bone. Fractures can be avulsion or compression types and this will affect the fracture configuration and degree of associated tissue trauma. Some involve individual teeth while others may involve several teeth and a large section of associated bone. Most rostral fractures do not lead to jaw instability but associated bones and soft tissue should be evaluated (nasal bone, nasal septum, caudal areas of the mandible or temporomandibular joint). Radiographs are needed to evaluate the extent of injury and the submucosal integrity of the teeth crowns and roots as many of these fractures also involve fractured teeth.

Fractures to the rostral facial area can be classified as to location: 1) incisive area, 2) interdental space, and 3) cheek teeth area. These fractures should also be classified by structures involved:

1) Tooth crown and/or root fracture
2) Fracture to the tooth crown and alveolar process
3) Fracture to alveolar socket wall
4) Fracture to alveolar process
5) Concussion fracture to the alveolus
6) Subluxation—loose but undischplaced tooth
7) Extrusive luxation—partial displacement
8) Lateral luxation—with fracture of the alveolar socket
9) Intrusive luxation—tooth pushed down into bone
10) Avulsion (exarticulation)—tooth out of the socket

Surgical management of incisive injuries depends on the type of fracture and age of the animal. Primary or deciduous teeth that are loose in the socket and have minimal bone damage should be extracted to help preserve the permanent tooth. There is no need to stabilize a bone fracture in these cases. If a large bone fragment is attached to the tooth it can be replaced and stabilized with wire and acrylic. Deciduous teeth avulsed from the socket should not be replanted due to risk of damaging the permanent tooth from forcing contaminated coagulum from the socket into the dental follicle of the developing permanent tooth. Many of these cases appear to heal with the deciduous tooth in place but later in life no permanent tooth develops or it erupts in an abnormal form or position.

Permanent teeth in younger horses often suffer from incisor luxation fractures. These are often heavily contaminated and many times presented for treatment days after they occur. The horse may even be presented for a fever of unknown origin. The fracture line is exposed to the plethora of bacteria in the normal equine mouth in addition to the anaerobes and spirochetes that
proliferate in the presence of inflammation. Broad-spectrum antibiotic and NSAID therapy is mandatory and should be initiated immediately on presentation. Bacteremia may lead to “anachoretic pulpitis” (exposure to bacteria through a hematogenous route) of involved and/or adjacent teeth or seeding of infection in areas of increased metabolic activity.

Radiographs are essential to diagnostic workup and no further manipulation of the fracture should take place before a diagnostic intraoral film is obtained. Intraoral radiographs help identify tooth root or crown fractures, bone fragments, and degree of displacement of the teeth from their normal anatomic position. Lateral extraoral films are also indicated and are easily produced with standard radiographic equipment.

Extraction of loose teeth with no bone attachment, or those with deep root or crown fractures, should be performed immediately. These teeth will not add to the stability of the fracture fragment and extraction will prevent infection from progressing to a periapical abscess. Root tip fragments attached to the parent bone can be left in place but often abscess or sequester and have to be dealt with after the bone fracture has healed.

When the horse is adequately sedated, anesthetized, and administered anti-inflammatories, antibiotics, and tetanus prophylaxis, examination and diagnostics can commence. The entire oral cavity should be rinsed clean before manipulation of the fracture. A solution of <0.12% chlorhexidine digluconate (CHX) is the antiseptic of choice for rinsing the oral cavity. CHX adheres to the cells of the pellicle and salivary glycoproteins that coat the entire oral cavity for approximately 72 hours. Concentrations >0.2% should not be used, especially in the case of bone exposure, because CHX at higher concentrations may inhibit healing. The wound should be gently debrided without traction on the teeth, and the fracture line should be carefully cleaned of all debris and non-vital tissue. No curettage of the alveolus or tooth roots is required due to possible damage or removal of periodontal ligament (PDL) cells, which would prevent their reestablishment and reattachment to the tooth. The fracture line should be gently but copiously lavaged after careful debridement with warm sterile saline with or without dilute doxycycline in solution. Doxycycline and minocycline microspheres (Arestin, OraPharma, IN, Warminster, PA, USA) have many useful actions but specifically in this instance, they have been shown to inhibit collagenase and enhance reattachment of the PDL.

The fracture is reduced using the least amount of traction on the fracture fragment, thus minimizing further trauma to the apical blood supply. This procedure is best carried out without an oral endotracheal tube so incisor tooth alignment can be adjusted with the mouth closed. In most jaw fracture repairs, tooth alignment is more important for a long-term successful outcome than bone alignment. Fixation can be accomplished by wiring the crowns of the teeth to other teeth as anchors. Several authors have previously described the intraoral wiring technique. Most of the techniques use holes created using a Steinmann pin or a drill bit in the bone of the mandible or maxilla to achieve stabilization of the fracture site. Review of small animal mandibular and maxillary fracture repair techniques clearly show the use of intraosseous fixation devices are contraindicated in many cases and may cause further irreversible damage to the very structures one is desirous of saving. Denervation by traumatization of the mental or infraorbital nerve may lead to denervation necrosis of teeth because odontocyte processes only extend into the dentinal tubules in the presence of nerves. Therefore, wiring should be limited to the crowns of the teeth for stabilization if at all possible. Small notches in the enamel of the corner incisions can provide a seat for the wire. If further stabilization is required, the use of intraoral splints built from dental acrylic is recommended.
Acute pulp exposure of any tooth should be treated immediately with a direct pulp capping procedure. If the exposure is greater than 48 hours, vital pulpotomy or root canal therapy is indicated for permanent incisors. Endodontic therapy may be performed at a later date when the larger fracture is fully healed. During the healing phase, teeth involved in the fracture fragment should be taken out of occlusion after wire stabilization to avoid normal occlusal forces placing stress on the fracture line. The fixation device should be left in place for 6-8 weeks and then removed.

Six months after the initial fracture, a thorough extra- and intra-oral recheck examination should be performed. At this time, any swollen lymph nodes, asymmetries, or draining tracts in the skin should be identified. A complete intra-oral examination should be performed with an excellent light source and periodontal probe. A diagnostic intraoral radiograph of the involved teeth should be taken to assess periodontic and endodontic status. Endodontic or periradicular pathology is rarely outwardly obvious, but sinus tracts from periradicular abscesses may be evident. They appear as small blister-like areas on the attached gingiva on either the labial or palatal/lingual surfaces of the incisive areas that has been fractured. These may be seen several months later and should be traced radiographically with a long gutta-percha point or a small probe to identify the tooth that is the source of infection.

In juvenile horses, the follow-up radiograph is imperative to assess the condition of or lack of developing permanent teeth or persistence of developmental tissue that may present as a cystic structure. In small animals, it is known that internal staining of the involved teeth is a poor prognostic indicator because it signified previous pulp hemorrhage and probable pulp necrosis, necessitating endodontic therapy. Despite the outward appearance of successful fracture repair, the need for exodontia or additional surgeries may still exist to provide for an optimum outcome. Should exodontia be indicated, the owner should be advised that frequent equilibration of the mouth will be necessary to maintain balance and prevent dental overgrowth problems. In foals as the primary dentition involved in the fracture exfoliates, the permanent dentition may erupt with developmental problems, be malformed or impacted, or simply have excess cementum on the crown.