How to Repair Rostral Mandibular and Maxillary Fractures

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1. Introduction
Fractures of the rostral mandible, premaxilla, and incisive bones can be repaired with wire or acrylic. Only fractures that can be readily repaired with stainless steel wires are discussed.

Causes
Causes include kicks from other animals, becoming entangled in or running into a fence, and pulling back on stationary objects.\(^1\)

Clinical Signs
Clinical signs include anorexia, difficulty prehending feed, quidding, ptyalism, halitosis, swelling, heat, pain, and incisor malalignment. Oral pain is manifested by difficulty or unwillingness to eat.\(^1-3\)

Evaluation
Oral examination should be performed and is often the only evaluation necessary. Radiographs may provide additional information. Lateral, dorsoventral, and oblique views should be included. Rostral fractures may be more clearly imaged by intraoral placement of the radiographic cassettes.

Goals
The goals of treatment are early return to normal mastication, resolution of infection, and adequate cosmesis

2. Equipment
Equipment includes stainless steel wire (16- or 18-gauge), needle holders or pliers, wire cutters, acrylic, and a drill. A spool speculum or section of PVC tubing placed between the cheek teeth improves access to the oral cavity. If the procedure is performed under general anesthesia, it is recommended that a nasotracheal tube is also placed to facilitate breathing.

3. Positioning and Preparation
Simple fractures involving one to five incisors can be repaired in the standing, sedated horse with local anesthesia. Mental and infraorbital nerve blocks provide effective regional anesthesia in these cases. The mental nerve may be blocked at the mental foramen, or the mandibular alveolar nerve may be blocked at the mandibular alveolar foramen. The infraorbital nerve may be blocked as it exits the infraorbital foramen. Alternatively, direct infiltration anesthesia can be used but is not recommended. Fractures involving the...
interdental space are more commonly repaired under general anesthesia in either lateral or dorsal recumbency, depending on fracture configuration, as the repair methods discussed in this report are not sufficiently stable for this type of fracture. Antibiotics and nonsteroidal anti-inflammatory agents are administered before surgery. Ideally, a nasotracheal tube is placed to protect the airway. The mouth is rinsed with water to remove accumulated feed material, and the area surrounding the fracture site is scrubbed with povidone-iodine soap and rinsed again. If a wire will be passed around the premolars, stab incision sites are clipped and prepared aseptically.

Anatomy
The primary structures potentially involved in the repair of these fractures are the premaxilla (incisive bone); incisive part of the mandible; incisors; canine teeth; mental, inferior alveolar, and infraorbital nerves; intermandibular synchondrosis; and permanent tooth roots. The permanent incisors, canines, and premolars are formed from separate enamel organs that are derived from lingual (medial) extensions of the dental laminae of the deciduous teeth. The permanent incisors erupt on the lingual aspect of the deciduous incisors.

The mental nerve emerges from the mental foramen on the rostrolateral aspect of the horizontal ramus, approximately midway between the second premolar and the third incisor. The inferior alveolar nerve continues rostral to the mental foramen in a smaller canal along with the vasculature of the lower incisors.

Procedure
The first step of the surgery is thorough debridement of the fracture site. Remaining food material, clotted blood, and bone fragments are removed to facilitate reduction. A bone curette may be used to freshen the edges of exposed bone, being careful to not manipulate or damage exposed, unerupted permanent teeth. Completely detached or broken teeth should be removed. Fractures involving alveoli can result in infectious periodontitis and pulpitis, necessitating eventual removal of the tooth. However, deciduous teeth are maintained if at all possible until the fracture heals or the infectious process is confirmed. These teeth often survive better than expected and provide stability, structure, and positioning for future permanent tooth eruption.

Most fractures that involve five or fewer incisors can be repaired with cerclage wire fixation techniques. As a rule of thumb, wires should engage a minimum of two teeth because the teeth immediately adjacent to the fracture may not be very stable. A minimum of two loops should be used to secure a fracture fragment. Ideally, there should be overlap of the wire loops to improve stabilization. A 14-gauge hypodermic needle with or without a 2-mm drill hole can be used to guide the stainless steel wire.
wire (16- to 18-gauge [1- to 1.2-mm diameter]) through the interalveolar spaces. In young horses, the 14-gauge needle may be used without prior drilling. The 14-gauge needle may also be used as a cannula after drilling to facilitate wire passage between the incisors. The wires should be applied tightly by hand and twisted one or two turns followed by additional twisting using fencing pliers, needle drivers, or the equivalent, being careful not to overtighten and break the wires. Additional stabilization can be achieved by securing the corner incisor(s) to the exposed canine, if erupted, or the second premolar (Figs. 1 and 2). Incorporation of the second premolar or canine is recommended for adequate stabilization of fractures that involve a corner incisor (03).

Incorporating the second premolar into the fixation involves placing a tension band wire from the incisors to the second premolar (Figs. 3 and 4; also see Figs. 5 through 9). A stab incision is made through the cheek directly over the space between the second and third premolars. Hemorrhage is minimized by incising through the skin and using blunt dissection to separate underlying soft tissues. The buccal mucosa is penetrated, and the drill bit with a protective drill guide is positioned between the second and third premolars just ventral (or dorsal in the maxillary arcade) to the gingival margin. The drill guide is left in place after drilling between the teeth is completed to help thread the wire through the drilled hole. The wire is then pulled through the cheek and directed rostral, to be laced through the holes previously made between the incisors. The wires, spanning the interdental space, are twisted together to increase compression at the fracture line. After tightening, the ends of the wires are bent flat and may be covered with a small amount of acrylic. In young, rapidly growing horses, both sides of the mandible should be included in the fixation to the premolars to minimize the risk of developing disparate mandibular growth or placing undue stress on the symphysis.

4. Postoperative Care

Medications

Because these fractures are often open, with significant contamination, broad-spectrum antibiotic therapy should be considered, but it is generally not necessary beyond the first 3 to 5 postoperative days. Nonsteroidal anti-inflammatory drugs are typically administered for 1 to 3 days. Tetanus prophylaxis should be current.

Other

Horses generally return to a normal diet immediately after surgery, but in some cases a pelleted feed or gruel may be of benefit. The mouth may be rinsed out at least twice daily for the first week. Additionally, the horse should not be allowed to graze for 2 to 4 weeks, and hay should be pulled apart to minimize prehension. The wires should be checked for breakage daily.

5. Expected Outcome

Rostral fractures usually heal without complication in 4 to 6 weeks, provided there is adequate stabilization and permanent tooth buds are not involved. Fractures involving the interdental space may re-
quire a longer healing period, typically 8 weeks. In most cases, the wires can be removed in the standing horse with minimal sedation.

6. Complications

Purulent drainage, bone sequestration, septic osteitis/osteomyelitis, difficult mastication, unusual incisor eruption, malocclusion, wire loosening, and
fixation failure are potential complications. Brachygnathism has also been reported in three foals after repair of bilateral fractures of the mandible. In one study, 27% of horses had short-term complications. Fortunately, the long-term prognosis for functional and cosmetic outcome is favorable, although short-term complications may be common.

7. Comments
Young, curious horses typically incur these fractures when they try to free themselves after getting their head or teeth caught. Delay or failure to repair these fractures may result in malocclusion, tooth loss, osteomyelitis, loss of function, and less than optimal cosmesis. Because the oral side of the mandible and maxilla is the tension surface, intraoral wire fixation provides strong, effective fixation in many fracture configurations.

References