CASE 10.4

Dental Disease and Sinusitis

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Clinical case

History

A 12-year-old Arabian-Thoroughbred cross gelding presented with unilateral, right-sided mucopurulent nasal discharge of 2 months' duration. The gelding had been evaluated 1 month before and was prescribed 2 weeks of oral trimethoprim sulfamethoxazole for a possible respiratory infection. The discharge resolved while the horse was on antimicrobials, but recurred within 48 h once the medication was discontinued. The gelding had no history of other major medical or surgical illness. He was vaccinated twice a year against Eastern and Western encephalitis, West Nile, tetanus, herpes, and influenza, and once yearly against rabies. There were no other sick horses on the farm, and the gelding was used for trail riding on the owner's property.

Physical examination findings

At presentation, the gelding was alert and responsive with a heart rate of 36 bpm. His mucous membranes were pale pink, with a capillary refill time of less than 2 s. His respiratory rate was 24 brpm, and his heart, lungs, and gastrointestinal system on auscultation were normal. Rectal temperature was 99.9 °F (37.7 °C).

Examination of his head and cervical region identified unilateral right-sided copious, malodorous mucopurulent nasal discharge (Fig. 10.4-1). Airflow from the right, affected nostril was normal and equal to the unaffected left side. External bony structures of the head were symmetrical. Mild atrophy of the right temporalis muscle was appreciated. Percussion of the right maxillary paranasal sinus yielded a relatively dull sound when compared to percussion over the left maxillary paranasal sinus (Fig. 10.4-2). The right mandibular lymph nodes were moderately enlarged, firm, and nonpainful to palpation. Palpation of the throat latch (caudal intermandibular region) and larynx was unremarkable and did not elicit a cough. Palpation of the cervical trachea was also unremarkable.

Differential diagnoses

Dental disease with secondary sinusitis, paranasal sinus cyst, neoplasia, primary bacterial sinusitis, guttural pouch empyema, retropharyngeal lymph node abscessation (e.g., secondary to *Streptococcus equi equi* ("strangles") infection)

Diagnostics

The gelding was sedated with a combination of detomidine and butorphanol to facilitate placement of a full mouth speculum and thorough oral examination. The Triadan 109 and 209 teeth (maxillary right and left first molar teeth) had occlusal defects (infundibular caries) packed with feed material. Evaluation of the 109 tooth following removal of the impacted feed material revealed the carious (L. *cariosus* rottenness) lesion to involve most of the occlusal surface of the tooth, with a depth of approximately 1.5 cm (0.6 in.) (Fig. 10.4-3). Secondary fractures of

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FIGURE 10.4-1 Copious unilateral, mucopurulent nasal discharge at the right nares.

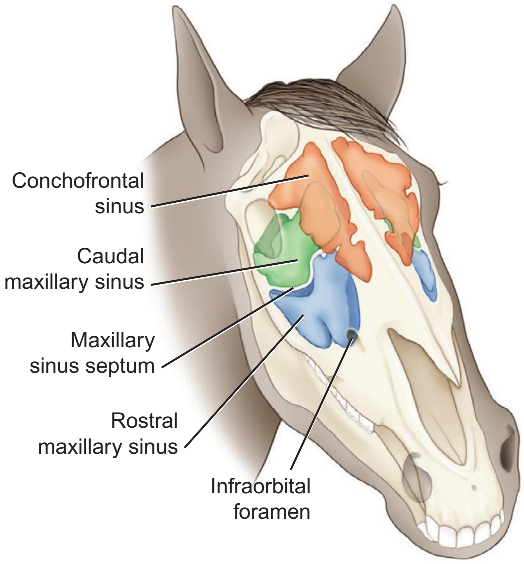

FIGURE 10.4-2 The region of the conchofrontal and caudal and rostral maxillary sinuses, which may be percussed to detect any changes in sound.

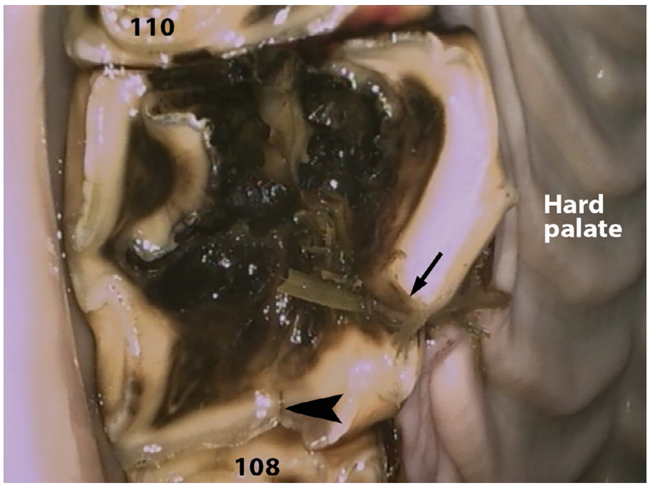

FIGURE 10.4-3 Endoscopic intraoral examination of tooth 109 occlusal surface revealed a severe central carious lesion, seen here, with secondary palatal *(black arrow)* and mesial *(arrow head)* fractures. Grass fragments are lodged in the palatal fracture plane.

the palatal and mesial edge of the tooth were noted, with a blade of grass lodged between 2 of the fragments. The occlusal defect of the 209 tooth was shallower, and the tooth was not fractured. The opposing 409 tooth was slightly overgrown (Fig. 10.4-4C).

Skull radiographs revealed fluid within the right rostral and ventral conchal maxillary sinuses, consistent with sinusitis of those spaces (Figs. 10.4-4A–D). Discrete fluid lines were seen on the lateral projection, and an opacity consistent with soft tissue or fluid was noted within the right rostral maxillary sinus on the dorsoventral (DV) projection. The fracture of tooth 109 was visible on the right maxillary oblique projection, along with moderate periapical sclerosis. Overgrowth of tooth 409 was also visible, most easily seen on the right maxillary oblique projection. On the DV projection, the infundibulum of the 209 tooth was widened with a central gas opacity, consistent with an infundibular caries.

Diagnosis

Dental (infundibular) caries of tooth 109 with secondary paranasal sinusitis

Treatment

Standing extraction of tooth 109 and trephination of the rostral maxillary sinus were elected (see side box entitled "Additional surgical approaches to extracting cheek teeth"). Heavy sedation of the horse and a right maxillary nerve block (see Case 10.3) provided restraint and analgesia. The 109 tooth was extracted orally. However, the diseased tooth root was fractured during the extraction and could not be removed via oral manipulation in its entirety. Consequently, the right rostral maxillary sinus was trephined, and the remaining 109 root fragments were repulsed into the oral cavity. The rostral maxillary sinus and ventral conchal sinus (see Case 10.3) were filled with purulent

CLINICAL REASONING FOR THIS CASE PRESENTATION

Dental disease with secondary sinusitis was considered most likely due to the nature of the discharge (malodorous, mucopurulent, and unilateral) together with right mandibular lymphadenopathy, atrophy of the right temporalis muscle, and dull percussion sounds over the right paranasal sinuses. A horse with a paranasal sinus cyst might present similarly, but is less likely to exhibit malodorous nasal discharge and unilateral temporalis muscle atrophy and may be more likely to have asymmetry of the frontal or maxillary bones overlying the sinus cyst. Neoplasia, too, might have a similar presentation, but is less common in horses of this age and might also exhibit deformity of the bony structures of the head. Primary bacterial sinusitis is more common in younger horses and often has a nonodorous discharge. A horse with guttural pouch empyema or lymph node abscessation due to strangles frequently has an elevated body temperature, nonodorous bilateral nasal discharge, and would be less likely to have atrophy of the right temporalis muscle.

COMPLICATIONS OF CHEEK TOOTH EXTRACTION—SURGICAL-RELATED TRAUMA

Soft tissue trauma—Trauma to the infraorbital nerve can occur when a maxillary cheek tooth is being repulsed, as it passes through the infraorbital canal above the palatal roots of the cheek teeth, and it is very closely related to the apices of those teeth in young horses. With external approaches to the maxillary cheek teeth (06–08s especially), trauma to the dorsal buccal branches of the facial nerve can occur. Significant intra-operative bleeding can result from injury to the major palatine artery during extraction of a maxillary cheek tooth. Trauma to the ventral buccal branches of the facial nerve and/or parotid duct is a possible complication during mandibular cheek tooth extraction. Short-term neuropraxis or long-term nerve damage can result from intra-operative nerve trauma. Parotid duct trauma results in leakage of saliva from the surgical incision, which may resolve with time or need additional surgical treatment.

Bony or dental trauma—Trauma to adjacent teeth or surrounding supporting bone can result from misplacement of surgical extraction instruments during an oral extraction. Adjacent teeth or supporting bone can also be injured during repulsion of cheek teeth if the dental punch is not properly aligned with the apex of the diseased tooth. Mandibular fracture can occur during or after tooth extraction in cases with significant dental disease and related weakened mandibular bone.

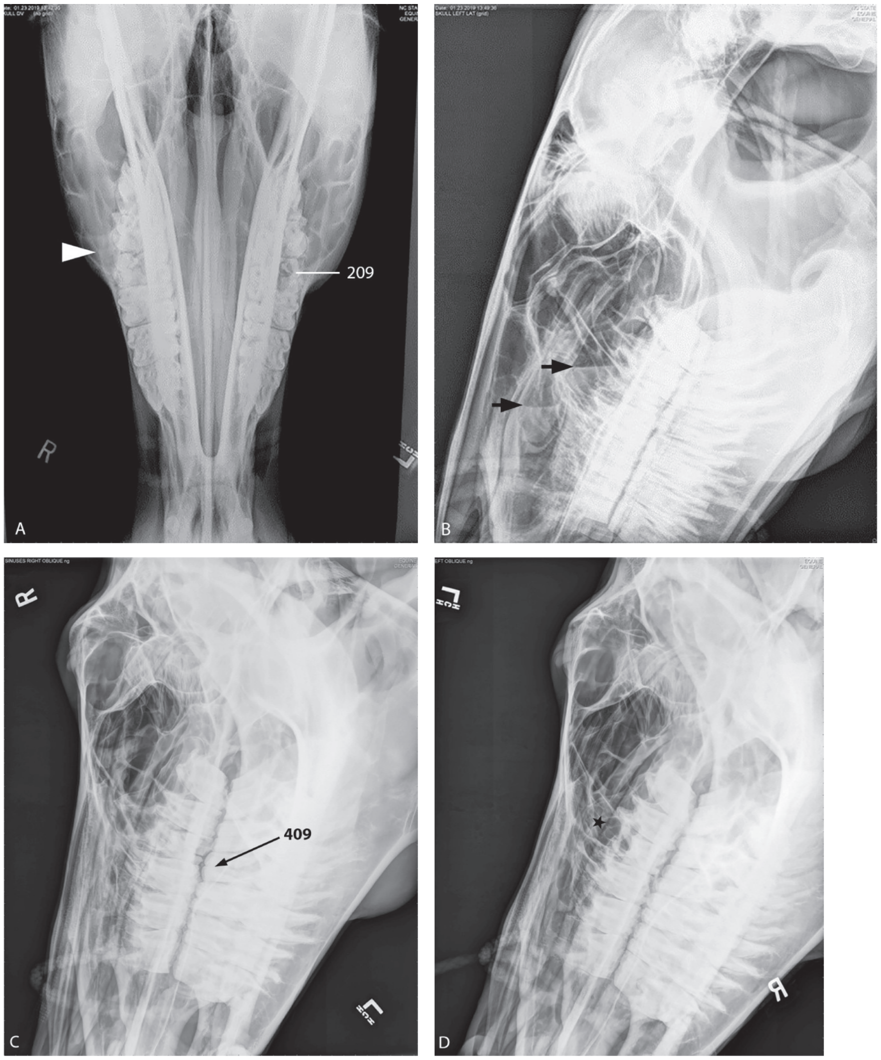

FIGURE 10.4-4 (A) The dorsoventral projection reveals a fluid or soft tissue opacity superimposed over the right maxillary sinus compartment *(arrowhead)*. The infundibulum of the 209 tooth was wide with a central gas opacity, consistent with infundibular caries. (B) The lateral projection reveals horizontal fluid lines *(arrows)* within the rostral maxillary sinus and ventral conchal sinus. The “fluid line” is the interface between gas *(black)* and fluid *(light gray)* opacities on the radiograph. (C) The right maxillary oblique projection reveals moderate sclerosis surrounding the 109 tooth roots, with a fissure evident extending to the occlusal surface of the 109 tooth. The right rostral maxillary sinus appears generally opaquer than the left rostral maxillary sinus (see D). Tooth 409 is mildly overgrown compared to the rest of the mandibular arcade. (D) The left maxillary oblique projection reveals gas opacity (more normal in appearance) within the left rostral maxillary sinus *(black star)*.

material, and a sample was obtained for culture and sensitivity. The sinus was lavaged with sterile saline and the tooth socket was sealed on its oral side with a plug made of dental impression material to prevent food entering the socket and contaminating the sinus. A Foley catheter was passed via the trephination portal and secured within the sinus to allow for daily sinus lavage, and the trephination portal skin flap was sutured closed. The horse was discharged into the owner’s care the following day. The horse was administered antimicrobials orally for 2 weeks and nonsteroidal anti-inflammatory medication for 4 days for pain management. The owners were instructed to lavage the sinus via the Foley catheter with 1 L of saline once daily for 2 weeks. The sutures and Foley catheter were removed at the 2-week recheck. The dental plug within the socket was removed to evaluate healing and the plug was then replaced. At the 4-week recheck, granulation tissue had formed within the socket and sealed the communication between the sinus and oral cavity, so the dental plug was permanently removed. An oral examination was recommended every 6 months for routine dental care and reduction of overgrowth of the opposing mandibular 409 tooth to prevent possible malocclusion.

Anatomical features in equids

Introduction

Equine dental disease and paranasal sinusitis secondary to dental disease are common in horses. Familiarity with normal dental anatomy and the spatial relationships of the teeth with surrounding structures is important for careful evaluation and comprehensive treatment of horses with dental disease and secondary complications. This section will cover equine dentition, dental anatomy, sinuses as they relate to dental anatomy, and the periodontium. Sinus anatomy is covered in Case 10.3.

Function

Equine teeth have cutting, crushing, and grinding functions, serving to aid in ingestion and mastication of feed materials before swallowing. Incisor teeth provide a cutting action, while premolar and molar teeth serve crushing and grinding functions. Canine teeth have little evident function and are typically not in occlusal contact with their opposite number. The first premolar, when present, is usually vestigial and not in occlusal contact with any other tooth.

Dentition formulas, eruption times, and Triadan tooth terminology (Fig. 10.4-5)

The **deciduous** (temporary) dental formula for the horse is represented by the following formula: [I 3/3; C 0/0; PM 3/3; M 0/0] × 2 = 24 teeth. There are no deciduous canines, first premolars, or molars.

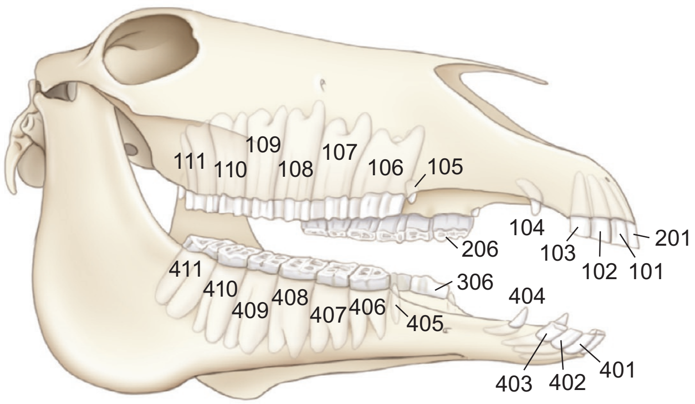

FIGURE 10.4-5 The modified Triadan numbering of teeth.

COMPLICATIONS OF CHEEK TOOTH EXTRACTION—HEALING AND INFECTION

Delayed healing or nonhealing alveolus—A delay in, or complete lack of, the healing of the alveolus can occur when a portion of the tooth, usually the root, remains after extraction. Post-extraction radiographs are important for confirmation that the entire tooth has been extracted or repulsed. Presence of a sequestrum, or a dead fragment of alveolar or other supporting bony structure, can also result in delayed healing. This is more commonly seen after repulsions. A loose or missing alveolar dental plug can result in an infection, and delayed healing, of the alveolus.

Oro-sinus or oronasal fistula—In some cases, a communication between the oral cavity and sinus, or between the oral cavity and nasal passage, persists after the remainder of the alveolus has healed. This communication can result in food material entering and accumulating in the sinus or nasal passage, and secondary bacterial infection.

Persistent sinusitis in the absence of fistulization, alveolar sequestration, or retained dental fragments—Sinusitis that persists despite a lack of unhealthy tissue or communication with the oral cavity is often due to inspissated material within one or more paranasal sinus compartments. Advanced three-dimensional imaging, such as a CT scan, may be necessary to identify the persistently infected compartment. Treatment frequently requires additional trephination and exposure of the infected compartment and debridement and lavage to resolve.

The **permanent** dentition of the mature horse is represented by the following formula: [I 3/3; C (1)/(1); PM 3(4)/3(4); M 3/3] × 2 = 36–44 teeth. Therefore, in a normal horse, up to 11 teeth may be present in each dental arcade. Uncommonly, supernumerary teeth may be present. Canines are typically absent, unerupted, or vestigial in female horses, and the first premolar teeth (referred to as the **wolf** teeth in the horse) are commonly absent. When present, the first premolar teeth are usually found in the maxilla and rarely in the mandible. **Cheek teeth** is a collective term for the 6 closely approximated premolars 2–4 and molars 1–3 in each arcade.

Approximate eruption times for deciduous and permanent teeth provide the most reliable aging cues in the horse (Table 10.4-1). The normal horse has permanent dental arcades by 5 years of age. Up to this age, there is considerable dental and periodontal activity present as the deciduous teeth develop, erupt, wear, and are shed, and permanent teeth develop, erupt, and come into wear. There are slight breed variations in eruption times.

For ease of medical record-keeping and communicating accurate identification, a number has been ascribed to each tooth, based on a modification of the **Triadan tooth numbering system**. From the viewpoint of standing in front of the horse and looking at it, the head is divided into quadrants, with a dental arcade in each quadrant. The 100 quadrant is the horse's maxillary right, the 200 quadrant the maxillary left, the 300 quadrant the mandibular left, and the 400 quadrant the horse's mandibular right. Teeth are numbered sequentially from the first incisor (number 01) to the third molar (number 11) within each arcade, and then the tooth number is preceded by its quadrant identifier. This 3-digit number allows specific labeling of each tooth present in the normal horse (Fig. 10.4-5). For example, the 109 tooth is the first molar of the right maxillary dental arcade. Absent teeth still retain their number. For deciduous teeth, the individual tooth number remains the same, and the quadrants are numbered 500, 600, 700, and 800 in the same clockwise sequence (as looking at the horse), starting in the horse's maxillary right quadrant. Therefore, for example, the 703 tooth is the third deciduous incisor of the left mandibular arcade.

Dental anatomy and physiology

Structurally, teeth consist of dentin, enamel, cement, and pulp (Fig. 10.4-6D). **Dentin** is a cream to pale yellow calcified tissue, consisting of 70% mineral and 30% organic compounds and water. Dentin makes up the bulk of the tooth and is divided into primary, secondary, and tertiary types. Secondary dentin is laid down over the dental (pulp) cavity subocclusally to protect the pulp horns and vital tissues of the cavity from being exposed secondary to tooth wear. **Enamel** is the most dense and brittle substance in the body, with a crystalline mineral matrix. Peripheral enamel wraps around the dentin in a simple layer (on the incisors, canines, first premolar) or forms deep folds in a tortuous path around the dentin of the premolars 2–4 and molars. In addition, during development enamel forms an invagination on the occlusal surface of incisors and 2 invaginations on the occlusal surface of maxillary cheek

TABLE 10.4-1 Average eruption schedule for equine teeth.

Tooth (Triadan #)[a]	***Deciduous***	***Permanent***
1st incisor (01)	Birth or first week	2½ years
2nd incisor (02)	4–6 weeks	3½ years
3rd incisor (03)	6–9 months	4½ years
Canine (04)	N/A	4–5 years
1st premolar (05)	N/A	5–6 months
2nd premolar (06)	Birth or first 2 weeks	2½ years
3rd premolar (07)	Birth or first 2 weeks	3 years
4th premolar (08)	Birth or first 2 weeks	4 years
1st molar (09)	N/A	9–12 months
2nd molar (10)	N/A	2 years
3rd molar (11)	N/A	3½–4 years

[a]Juvenile or deciduous teeth are identified by replacing the first digit with 5, 6, 7, or 8; e.g., 203 for the permanent tooth (left upper 3rd incisor) would be identified by the number 603 for the deciduous tooth.
Adapted and modified from the American Association of Equine Practitioners, Guide for Determining the Age of the Horse, 2007.

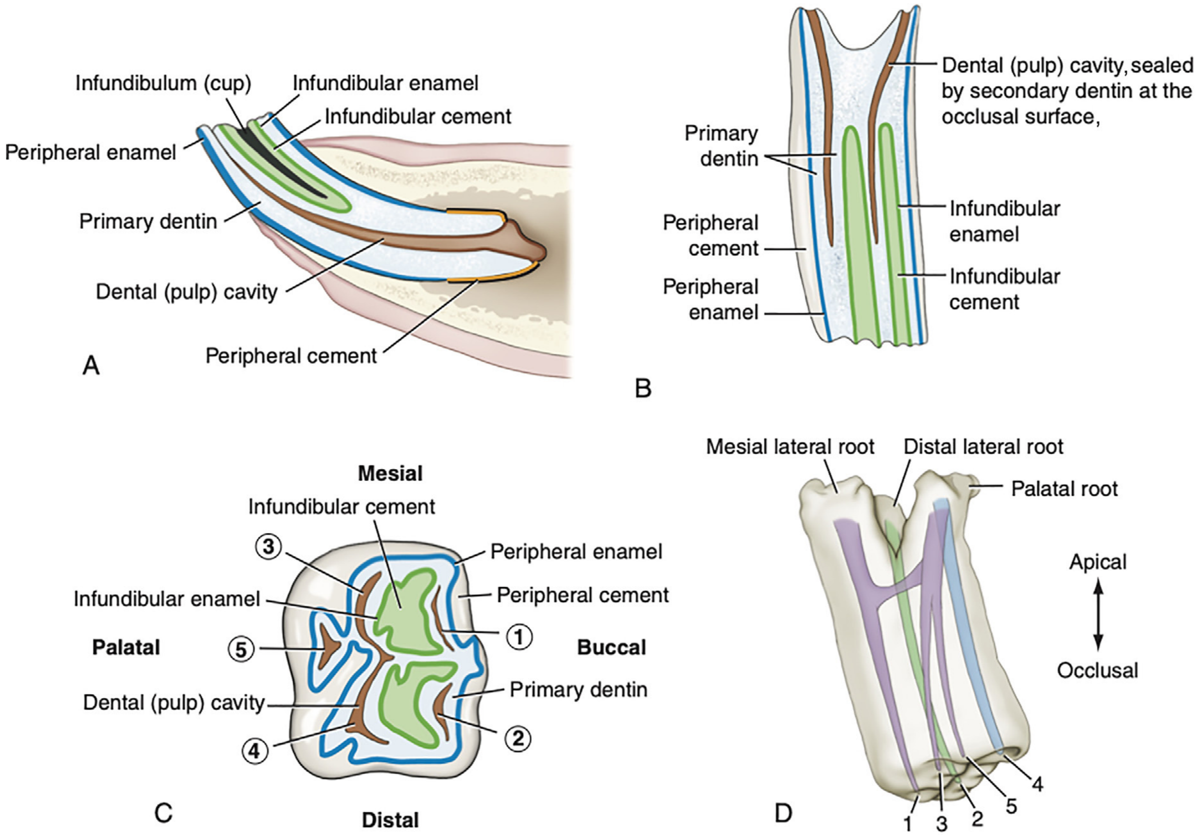

FIGURE 10.4-6 (A) Anatomy of a sectioned incisor. (B) Anatomy of a molariform tooth longitudinally sectioned and (C) of its occlusal surface. (D) A representative configuration of pulp horns of an equine cheek tooth, with the pulp horn number matching the numbers in image C.

teeth. These enamel invaginations are referred to as **infundibula** and appear as separate rings of infundibular enamel contained within the peripheral enamel boundary.

Cement, with a matrix similar to bone, covers the root and body of teeth (**peripheral cement**) and partially fills the infundibula of incisor teeth and maxillary cheek teeth (**infundibular cement**). Infundibular caries is the destruction and dissolution of the cement found in this location. The **pulp** is the vital supply of the tooth—that is, connective tissues, vessels, nerves, and lymphatics. It is contained in the **dental (pulp) cavity** of the tooth. The pulp structures enter and exit the tooth at its apical extent (and subsequently the developed tooth root(s)). Equine incisors have 1 or 2 pulp horns (2 is more common), canine and wolf teeth have a single pulp horn, and the cheek teeth have 5–8, depending on the tooth (Fig. 10.4-6C–D).

Teeth are defined as having 5 surfaces (Fig. 10.4-7B and C). The **occlusal** (masticatory, grinding, cutting) surface faces the ipsilateral upper or lower arcade. The inner surface facing the oral cavity is the **palatal** (maxillary teeth) or **lingual** (mandibular teeth) surface. The external surface facing the vestibule of the oral cavity (and lips and cheeks) is the **vestibular** (or **buccal** for cheek teeth and **labial** for incisors and canines) surface. The **rostral or mesial** surface faces rostrally and—in the case of incisors—is the surface toward midline. The **caudal or distal** surface faces caudally, or away from midline in the case of incisors. In lieu of mesial and distal, the term **contact surface** is used for the closely abutting surface of cheek teeth in the horse. Use of surface terminology allows for the specific description of where on a tooth a lesion is present.

For example, in this Fig. 10.4-3 the occlusal surface of tooth 109 has a non-displaced fissure fracture in its mesial margin, running mesial to distal, 5 mm (0.2 in.) from the mesiopalatal corner.

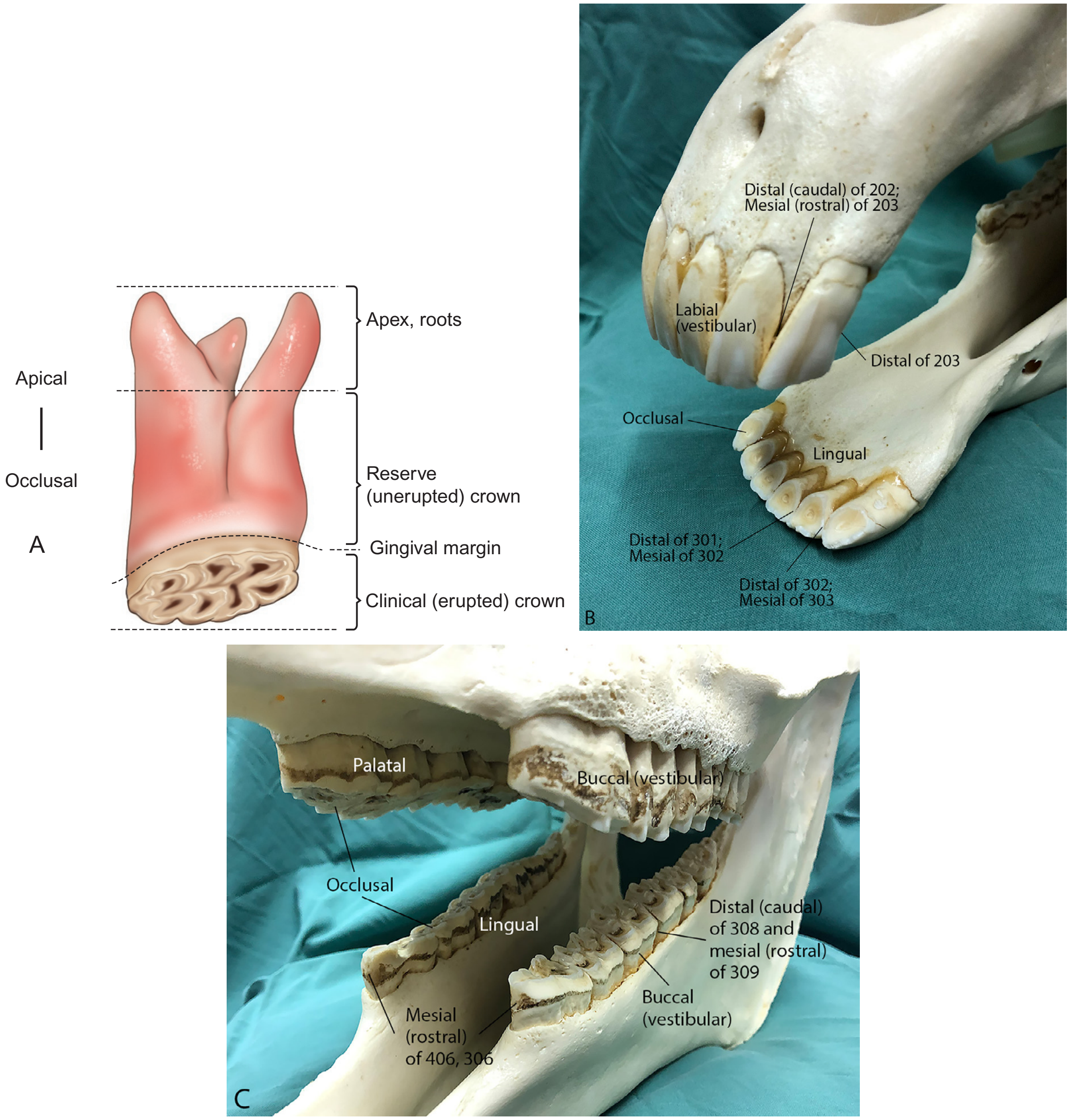

FIGURE 10.4-7 (A) Parts and directional terms for a hypsodont maxillary cheek tooth. (B) Anatomical surfaces of incisor teeth. (C) Anatomical surfaces of cheek teeth.

Before extracting a diseased tooth, it is important to know the number and location of roots in the tooth.

Equine teeth have a **crown** and **apex** (Fig. 10.4-7A). The apex (**apical** aspect) of a tooth is the site of root development, and **occlusal** refers to the masticatory end of the tooth. The crown is subdivided into 2 parts: **clinical** (that portion of the tooth visualized on oral exam) and **reserve** (the portion of the crown below the gingival margin). Equine cheek teeth develop characteristic root structures as the tooth matures and erupts. Incisors, canines, and wolf teeth are single-rooted teeth, mandibular cheek teeth develop 2 roots in a mesial-distal alignment, and maxillary cheek teeth develop 3 roots, 2 located laterally in mesial and distal positions, and 1 larger root located medially (palatal) (Fig. 10.4-6D).

Equine incisors and cheek teeth are classified as hypsodont—that is, having long crowns. Hypsodont teeth develop and grow to a certain length and slowly erupt throughout much of the life of the horse. Eruption rates are about 2–3 mm (0.07–0.11 in.)/year, which is similar to the rate of dietary abrasive wear at the occlusal surface. The wearing of the occlusal surface of hypsodont teeth leads to architectural changes in progressively exposed dental tissues (enamel, dentin, and cement). Canines have long crowns (mostly reserve), but do not continuously erupt like the cheek teeth. The first premolar is brachydont, with a short crown, an intervening neck, and a root of variable length.

> Changes in appearance of the occlusal surface of the mandibular incisors provide many cues to assist in aging a horse.

Periodontium

The tissues surrounding the tooth include the **gingiva**, the **periodontal ligament**, and the **alveolus**. In some texts, the cement is also considered part of the **periodontium**. The tightly attached gingiva transitions to more loosely attached oral mucosa at the **gingivomucosal junction**.

Teeth and anatomical relationships

Erupting and recently erupted permanent mandibular premolars 2–4 and the first molar have apices very closely related to the ventral mandibular cortex. Due to the natural curve of the caudal body of the mandible as it transitions to the **ramus** (known as the **Curve of Spee**), the apices of molars 2 and 3 are relatively distant from the ventral cortex. The apical portion of developing and erupting teeth is highly metabolically active and forms an **eruption cyst**. The eruption cyst at the apex of a permanent, erupting premolar may manifest as a focal swelling of the ventral mandible due to its proximity to the cortex.

> These swellings are known as "eruption bumps" and are typically self-limiting. Eruption bumps are anticipated to be present in both mandibles at the age when permanent premolars are replacing temporary premolars (2–5 years of age) and then regress within 1–2 years. These normal swellings should not be misdiagnosed as apical dental abscesses or trauma to the mandible, although eruption cysts can rarely become infected. Determining the horse's age and obtaining radiographs allows accurate assessment if questions arise.

The apices of the maxillary molars and premolar 4 are directly related to the **maxillary sinus**. The Triadan 11 teeth project into the **caudal maxillary sinus**, the 10 teeth are associated with the caudal and **rostral maxillary sinus** and dividing **maxillary sinus septum**, and the 09 and 08 teeth are associated with the rostral maxillary sinus. The infraorbital canal passes in direct contact with the dorsomedial margin of the maxillary alveoli in young horses. With increasing age, the infraorbital canal increases its distance from the apical region of the alveoli, supported by a vertical bony plate that forms the lateral wall of the **ventral conchal sinus**. The amount of space in the maxillary sinus becomes larger with age, primarily due to tooth eruption and a decrease of the apices of the 08–11 maxillary teeth. The dental arcades migrate rostrally in relation to the sinuses over the life of the teeth; however, the 08 tooth usually remains associated with the rostral maxillary sinus.

> The relationship of the infraorbital canal to the apices of the teeth must be considered during dental and sinus procedures and when apical infections are present (see side box entitled "Complications of cheek tooth extraction—surgical-related trauma").

> In young equids, trephination of the rostral maxillary sinus is difficult at best and should be avoided if possible (unless specifically being done for a primary dental procedure). The risk of trauma to the underlying apices of the cheek teeth is high due to minimal sinus space (see side box entitled "Trephination").

Innervation and nerve blocks

Blocking/anesthesia of the infraorbital nerve as it leaves the infraorbital canal is only effective for soft tissue anesthesia of the rostral face. Local anesthetic must pass caudally in the canal to reach the alveolar branches that supply incisors, canines, and the rostral cheek teeth. The infraorbital/maxillary nerve may also be blocked before it enters the maxillary foramen using a lateral approach, ventral to the zygomatic arch (see Case 10.3).

The inferior alveolar nerve is routinely blocked at this location via an external or intraoral approach to affect analgesia of the entire ipsilateral arcade. The lingual nerve, also a branch of the mandibular nerve, may be inadvertently blocked if needle position is inaccurate or a large volume of local anesthetic is used, and it diffuses to reach the lingual nerve. Blocking the lingual nerve desensitizes the tongue on the affected side, and this may result in self-mutilation of the tongue due to loss of sensation.

Blocking/anesthesia of the mental nerve does not desensitize the teeth. Injecting local anesthetic via the mental foramen into the mandibular canal may reach rostral alveolar branches supplying incisors, canines, and rostral cheek teeth.

The maxillary dental arcade is innervated by **superior alveolar branches** (**caudal, middle, and rostral**) of the **infraorbital nerve**, which continues the **maxillary branch** of the **trigeminal nerve** (CN V). The caudal superior alveolar nerve exits the infraorbital nerve immediately before it enters the **maxillary foramen** and infraorbital canal, and the middle and rostral superior alveolar nerves branch off before the infraorbital nerve exits rostrally at the **infraorbital foramen**.

The mandibular dental arcade is innervated by **alveolar branches** of the **inferior alveolar nerve**, a branch of the **mandibular nerve** (which is from CN V). The inferior alveolar nerve enters the **mandibular canal** at the **mandibular foramen** on the medial ramus of the mandible.

Rostrally, the inferior alveolar nerve exits the mandibular canal at the **mental foramen** on the lateral surface of the body of the mandible. At this point, the inferior alveolar nerve becomes the **mental nerve**, providing sensory innervation to soft tissues of the lower rostral face.

TREPHINATION

Minimally invasive approaches to dental repulsion use imaging (radiographs), external facial landmarks, and oral triangulation to identify the appropriate location for creating a small hole to pass a Steinmann pin or similar-style dental punch. This instrument is seated directly onto the apex of the diseased tooth (confirmed by radiographs), and then bone mallet is used to repel the tooth normograde into the oral cavity. Routine trephination of the maxillary or conchofrontal sinus is frequently indicated to obtain a sample of purulent material for culture and sensitivity testing and to aid in lavage of an infected sinus. Knowledge of sinus anatomy and communication between compartments is critical in selection of the specific sinus cavity for culture and lavage and to minimize complications. The locations described for standard trephination sites are shown in Fig. 10.4-8.

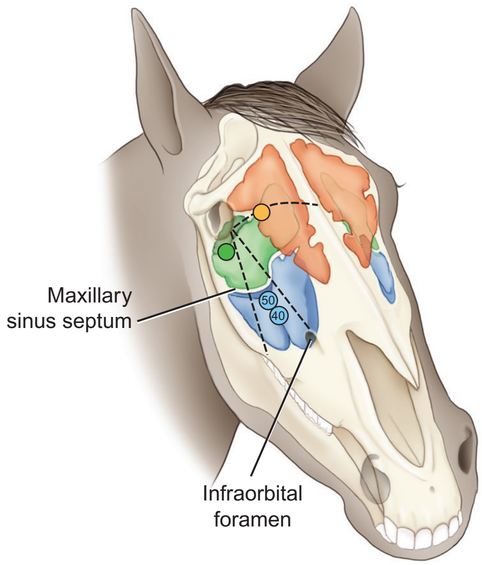

FIGURE 10.4-8 Diagram depicting locations for trephination of the conchofrontal sinus *(orange)*, the caudal maxillary sinus *(green)*, and the rostral maxillary sinus *(blue)*. To minimize injury to the underlying dental apices, the caudal entry (50) into the rostral maxillary sinus is recommended in horses <6 years of age and the rostral site (40) can be used in horses ≥ 6 years of age. 50 and 40 refer to the percent distance from the rostral end of the facial crest to the medial canthus of the eye.

Blood supply and lymphatics of the teeth

Maxillary dental arcades receive their blood supply from branches of the **infraorbital artery**, a continuation of the **maxillary artery** as it enters the infraorbital canal. Mandibular teeth are supplied by dental branches from the **inferior alveolar artery**, also a primary branch of the maxillary artery. Dental lymphatic drainage is to the **mandibular** and **retropharyngeal lymph node centers**.

ADDITIONAL SURGICAL APPROACHES TO EXTRACTING CHEEK TEETH

Standing oral extraction is generally the preferred method for extraction of teeth because it is associated with fewer complications. However, when the clinical crown is fractured or missing, oral extraction may not be successful. These cases require a second attempt with an alternative extraction method. Repulsion of the tooth into the oral cavity, through a sinusotomy or via resection of bone and alveolus, is a traditional alternative method. In this approach, a dental punch is positioned directly over the apex of the tooth, and a bone mallet is used to tap the tooth out of the alveolus and into the oral cavity for removal. Another option is a surgical approach to the lateral aspect of the tooth—for sectioning or for loosening for oral extraction—via a buccotomy or via a lateral alveolar resection. A newer alternative method is the minimally invasive transbuccal approach with intradental screw placement. The tooth is first loosened orally, if possible. Then, a buccal stab incision is made for introduction of a cannula and screw. With radiographic guidance, the screw is inserted into the diseased tooth, and a slotted mallet is used to tap the tooth out into the oral cavity.

Any approach through the cheek has important anatomic considerations (Fig. 10.4-9). The dorsal and ventral buccal branches of the facial nerve traverse the lateral aspect of the masseter muscle in a dorsocaudal to rostroventral direction, and they frequently lie in the path of the proposed incision. The nerve branches are externally palpable and often visible and can be avoided through adjustment in incision location and careful retraction if encountered in the surgical approach. The facial artery and vein, along with the parotid duct, cross the ventral border of the mandible at the rostral margin of the masseter muscle and extend rostrodorsally on the lateral face, continuing along the margin of the masseter muscle. Vascular branches pass rostrally from the vessels. The parotid duct turns rostrally at the level of the maxillary cheek teeth and opens into the vestibule of the oral cavity in line with the 07 or 08 maxillary tooth. Pre-operative identification of the facial nerves, vessels, and parotid duct through visualization and palpation, together with careful intra-operative dissection, is critical to avoiding iatrogenic trauma during extraction procedures. Retrograde catheterization of the parotid duct to aid its identification may be performed.

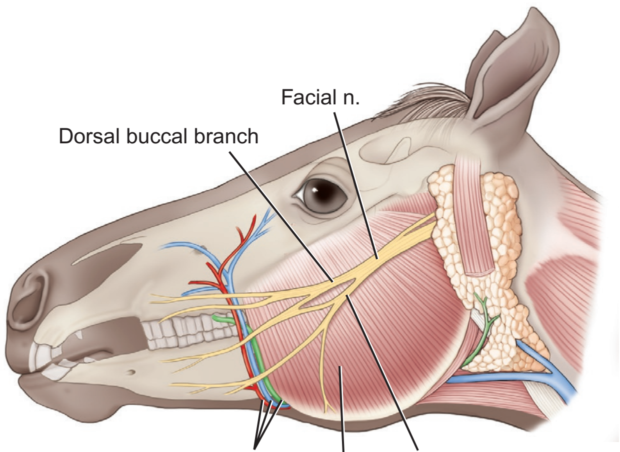

FIGURE 10.4-9 Superficial structures relevant to the lateral buccotomy approach for accessing and removing cheek teeth.

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