Dental Disease in Rabbits and Rodents

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This lecture will review dental anatomy, physiology, and pathology of rabbits and guinea pigs. Assessment and treatment of common dental disease will be covered along with a brief overview of dental equipment useful to treat these species.

Key words: rabbit, dental, abscess, teeth, guinea pig, mandibular prognathism

RABBIT ORAL ANATOMY AND PHYSIOLOGY

The domestic rabbit (*Oryctolagus cuniculus*) is classified under the order Lagomorpha. Although rabbits were once classified in the Rodentia order, they were reclassified because of anatomical differences. While rodents have a single row of incisor teeth in the upper jaw, rabbits have 2 rows of upper incisors. Two large upper incisors fit just in front of the lower incisors with the 2 small rudimentary incisors, or "peg teeth", located just behind the large upper incisors. Another difference between rabbits and rodents is that a rabbit's lower jaw (mandible) is narrower than its upper jaw (maxilla). Also, rabbits have a side-to-side chewing motion while rodents have a more front-to-back motion. It is also thought that rabbits have 2 sets of teeth, the first set being shed while in the uterus of the mother or shortly after birth.⁵ The dental formula for the rabbit is: I 2/1; C 0/0; P 3/2; M 3/3 = 28.

Rabbits have continuously growing, open-rooted incisor and cheek (premolar and molar) teeth – sometimes referred to as aradicular hypsodont, or elodont teeth. Incisor tooth growth occurs at a rate of 2.0 mm per week for the first maxillary incisors and 2.4 mm per week for the mandibular incisors.⁵ In their natural environment, rabbits feed on grasses and other plants by cropping them with the incisor teeth and grinding the plant material with their cheek teeth. Rabbits have no canine teeth. There is a large toothless gap between the last incisor and first cheek tooth called the diastema.^{3,4}

The incisors of rabbits and rodents come together to form a chisel-like cutting surface. The incisors should always have a sharp point; this is thought to occur because enamel is deposited more thickly on the front surface of the tooth and the back surface has a softer surface of dentin. Because of this, the front of the incisors wears more slowly than the back and forms a point.⁴ Rabbits and guinea pigs have a prominent infolding of skin on each side of the face near the diastema that can make oral examination difficult.^{2,4}

The upper and lower premolars and molars meet at a slight angle in normal rabbits, so separation of the cheek teeth is necessary to allow for normal incisor movement. In the normal rabbit at rest, the incisors are held in occlusion with the lower incisors fitting between the first and second upper incisors while the cheek teeth do not come in contact. When chewing, the mandible slides backward, and the cheek teeth come together, and the incisors separate. The caudal cheek teeth have deep enamel folds that allows for increased surface area for grinding food. The cheek teeth are arranged in parallel rows with wider space between the maxillary teeth than the mandibular teeth. The rabbit has a limited capacity to open the jaw.¹⁻³

GUINEA PIG ORAL ANATOMY AND PHYSIOLOGY

The guinea pig (*Cavia porcellus*) is related to the semidomestic Caviae (*Cavia aperea*) that is found in the wild in South America. Guinea pigs are classified in the order Rodentia, which contains over 1700 species. Rodents have a single row of upper and lower incisors that are usually covered with yellow enamel, although this is not the case in the guinea pig. All rodents have continuously growing incisors. Although guinea pigs and chinchillas have open-rooted continuously growing premolars and molars, other rodents have check teeth with anatomical roots that stop growing once they are fully erupted.^{1,4,6} The dental formula for the guinea pig/chinchilla is: I 1/1; C 0/0; P 1/1; M 3/3 = 20.

Like the rabbit, the guinea pig and chinchilla have a limited capacity to open the jaw. The premolars and molars have a folded surface to increase the grinding surface area. Unlike in the rabbit, the mandible is wider than the maxilla, and the occlusal surface of the cheek teeth in guinea pigs is heavily angled. The temperomandibular joint allows for limited side-to-side motion but a large degree of front-to-back motion.^{1,5,6}

CLINICAL SIGNS OF DENTAL DISEASE IN RABBITS AND GUINEA PIGS

The signs of dental disease in rabbits and rodents may be non-specific and weight loss may be the only obvious clinical sign. Excess salivation is common in rabbits and guinea pigs with dental disease ('slobbers') and is especially common in chinchillas. Prolonged contact of saliva with the skin on the chin, neck, and front legs of rabbits and guinea pigs may result in a secondary dermatitis. The client may note poor coat quality and decreased food consumption. 'Diarrhea' has been reported in rabbits with dental disease, but this may be a result of the inability of the rabbit to ingest cecotrophs ('night feces') that subsequently soil the fur of the animal. The animal may have obvious difficulty eating and might be seen dropping food. Ocular or nasal discharge may be noted, especially in rabbits with dental disease. Visible signs of incisor malocclusion may be noted, and masses may be visible on the face. The masses can be dental abscesses or bony changes in the skull. Swellings can often be felt on the lower mandible and upper maxilla where tooth root elongation is causing skeletal changes. The animal may not be able to completely close the mouth or may be uncomfortable when the jaw is manipulated. Protrusion of the eye can be seen if there is an abscess or bony changes behind the eye pushing it outward. In severely affected animals, systemic signs of disease may be evident, with death seen in severe cases.^{3,5-7}

DIAGNOSTIC MODALITIES FOR ASSESSING DENTAL DISEASE

Oral examination

A good oral examination is critical in assessing dental disease. Although the oral cavity can be examined without anesthetizing the patient, the best examination may be made under light sedation or general anesthesia. Otoscopic cones can be used to examine the mouth of an unanesthetized patient, but this technique can result in missed lesions in 50% of the cases.⁸ A dental speculum set specifically designed for rabbits and rodents is available, however, 25% of the visible lesions seen after death are still missed in live patients with the use of mouth gags and cheek pouch dilators.⁸ When using a dental speculum set, one speculum is placed over the incisors to hold the mouth open and then a cheek pouch dilator is placed to allow visualization of the premolars and molars. The use of dental cameras or endoscopy can further aid in visualization of the oral cavity.^{9,10} Good lighting, suction, and magnification can also help with the examination.⁵

Fasting the guinea pig for a short period of time (around 6 hours) may be helpful in reducing the amount of food particles in the mouth and improve visualization of the teeth, tongue, and gingival surfaces. At the time of oral examination, a complete physical examination should also be performed. Additional diagnostics including bloodwork and radiographs may be helpful in assessing the general health status of the patient.

Radiography

Because it is possible to miss dental lesions even with a thorough oral examination, radiography is an essential part of comprehensive oral examination. Plain skull films and magnified skull films are useful in assessing patients with malocclusion, and tooth root or bone pathology. High-resolution mammography film or dental film may have advantages over conventional radiography film. Skull radiographs should include several views, including lateral, dorsoventral, oblique, and potentially rostro-caudal positions.

Magnified films using a small focal spot creates an 'enlarged' skull film. The resulting image may be 4 times larger than plain skull films and small lesions are more easily visualized.

CT/MRI

Advanced imaging techniques such as computed tomography (CT) and magetic resonance imaging (MRI) may be more useful than radiographs in assessing dental disease of rabbits and guinea pigs.^{5,7} We have used CT imaging frequently in rabbits with dental disease and feel that this imaging modality has been more diagnostic than radiographs at characterizing the extent of dental lesions. In one report, computed tomography (CT) was found to be more useful in diagnosing dental problems in chinchillas than was conventional radiography. In a recent similar study in rabbits, neither radiography nor CT was clearly superior, but the two modalities provided complementary diagnostic information.⁵ While CT is helpful in

characterizing lesions of the bone, MRI is most useful in describing soft tissue lesions. Surgical planning for abscess removal involving the face can be difficult without knowing the full extent of soft tissue lesions. CT and MRI have helped us plan surgical approaches when removing masses from the face and in obtaining the most diagnostic sample when performing biopsies.

DENTAL DISORDERS

Incisor malocclusion

Incisor malocclusion and overgrowth may occur by itself or in conjunction with premolar-molar malocclusion and overgrowth. Mandibular prognathism (abnormally long mandible in relation to maxilla) and resulting incisor malocclusion is the most common dental problem and the most common genetic problem reported in rabbits.¹¹ However, in most cases, especially in small rabbit

breeds, the maxilla is too short, whereas the mandible is a normal length; therefore, the term maxillary brachygnathia is preferred.⁵ Incisor malocclusion resulting from hereditary mandibular prognathism usually appears after the third week of life.¹¹ The first evidence of a problem may be that the incisors meet evenly rather than the mandibular incisors resting between the first and second maxillary incisors; as the disease progresses, the mandibular incisors rest in front of the first maxillary incisors resulting in incisor overgrowth. Mandibular prognathism is reported to be an autosomal recessive trait and affected animals have a reduced length measurement for the skull and maxillary diastema, without abnormal length of the mandibles.^{2,11} The upper incisors usually curl into the oral cavity and the lower incisors grow in a dorsofacial direction.⁵ Because cheek teeth malocclusion often accompanies, or can be the cause of, incisor malocclusion, a

complete oral examination is necessary for any rabbit suspected of having mandibular prognathism.⁵

Treatment of incisor malocclusion and overgrowth can involve frequent trimming (every 3-6 weeks or as needed), appropriate dietary changes, or incisor extraction. Because mandibular prognathism is a genetic disorder, affected rabbits should not be bred.

Incisor-premolar-molar malocclusion

The most common dental problem in small herbivores, such as the guinea pig, is cheek teeth overgrowth.⁷ This often results in incisor malocclusion. Cheek teeth overgrowth may be the result of lack of adequate wear due to malocclusion or an inadequately abrasive diet.⁷ It may also be the result of genetic, periodontal, or metabolic disease.⁷ Vitamin C deficiency and excessive selenium intake may predispose guinea pigs to dental disease. Some sources implicate lack of dietary calcium or low vitamin D levels as a cause for dental disease.^{8,12}

It has recently been shown that affected animals have elevated parathyroid hormone levels and lower calcium levels.

Incisor-premolar-molar malocclusion may involve the following syndromes: incisor overgrowth and malocclusion as described above; abnormal premolar-molar occlusal plane resulting in sharp points or 'spike' formation, most commonly on the tongue side of the lower teeth and the cheek side of the upper teeth; tongue entrapment by overgrown mandibular premolar teeth (especially in the guinea pig); periodontal disease with increased mobility of the teeth; apical changes with elongation of the tooth and possible perforation of the cortical bone of the upper maxilla and lower mandible; soft tissue lesions inside the mouth associated with sharp tooth points; and abscess formation associated with the maxilla, mandible, or behind the eye.^{5,8} Ocular discharge is seen commonly in the rabbit as a result of increased tear production or if the lacrimal duct is

obstructed by apical intrusion of the upper incisor teeth.⁷ With severe root elongation, the eye may bulge outward from increased pressure behind the eye. As the maxillary and mandibular teeth elongate, swellings can be felt along the upper and lower jaw.⁷

Treatment of incisor-premolar-molar malocclusion may involve trimming of the affected teeth, tooth extraction, and abscess removal and treatment. The most effective treatment for cheek tooth overgrowth is drastic reduction of the height of all affected teeth and their counterparts, thus taking them out of occlusion.¹³ Once the teeth are out of occlusion, pressure is removed from the teeth and the tissue around the teeth has a chance to repair. This treatment is most successful if severe root involvement is not evident; otherwise it is mostly a palliative treatment.⁸ Dietary changes may be helpful. Euthanasia may be considered in very severe cases.⁵

Dental abscesses

Abscesses on the face, especially in the rabbit, are most often caused by dental disease. Abscesses can also result from external trauma such as penetrating wounds and subsequent infection. Dental abscesses can result from root abscessation of the teeth or perforation of the mucosa of the cheeks or tongue by dental spikes.^{5,13} Treatment of dental abscesses usually involves surgical removal of the abscess, but the underlying dental disease must be addressed.

TREATMENT FOR DENTAL DISEASE

Teeth trimming

Most dental disorders involve trimming affected teeth, especially in the case of malocclusion. Traditional tooth trimming in unanesthetized rabbits has been performed with nail trimmers or wire cutters. This method is no longer recommended for several reasons: excessive force is applied to the tooth, which can damage the tooth and affect growth; the procedure is

painful; the normal chisel shape of the teeth is not maintained; longitudinal splits often occur which can extend under the gumline and expose the pulp.^{2,5,13}

A high-speed dental drill provides the most atraumatic and accurate method for trimming teeth.¹³ The pulp cavity usually extends just beyond the gingival level and pulp exposure is unlikely if teeth are trimmed back to a level that is just below normal.¹³ The chisel edge of the incisors and normal occlusal plane angulation of the premolars and molars should be maintained when trimming teeth.^{5,13} The most effective treatment for cheek tooth overgrowth is drastic reduction of the height of all affected teeth and their counterparts, thus taking them out of occlusion.¹³

When trimming the incisors, a tongue depressor can be placed behind the incisors to protect the surrounding tissues from damage. Small spatulas can be used to protect the tongue and cheeks when performing premolar-molar trimming. A diamond bur may be useful for trimming the incisors, while a flat or round bur is more appropriate to use on the premolars and molars.⁵ If tooth-height reduction is correctly performed, pulp exposure should not occur; however, if it does, partial pulpectomy and direct pulp capping are indicated. An intermediate restorative material should be used for filling the pulp cavity opening; harder materials such as composites are not indicated because they may interfere with normal attrition.⁵

While incisor trims may be performed with the animal awake, premolar and molar trimming should be performed under general anesthesia. Injectable anesthetics can be used alone with supplemental oxygen when needed or in combination with inhalant anesthesia. For long or extensive procedures, such as extractions, rabbits and guinea pigs should be intubated and maintained on inhalant gas. Intubation is challenging in rabbits because the larynx is located deep within the oropharanyx; in guinea pigs the soft palate is continuous with the base of the

tongue and intubation is possible only through a small palatal ostium.⁴ Nasal intubation may be preferable to oral intubation because workspace is less restricted. In the case of brief oral examinations and trimming, a small mask can be placed over the nose to provide inhalant anesthesia while still allowing access to the oral cavity. Careful anesthetic monitoring and support, including intravenous fluids, are vital for a positive outcome.

Depending on the rate of tooth growth and the degree of malocclusion, trimming may need to be performed as often as every 3-6 weeks. The client should be advised of this as soon as dental disease is diagnosed because long-term commitments of time and money may be required. Following an extensive occlusal adjustment with height reduction, it may take several days for the masticatory muscles to adapt before they can contract sufficiently to bring the teeth into occlusal contact. Nutritional support and pain management may be required during this period.⁵

Dental extractions

Dental extractions can be useful in the rare case of serious incisor problems uncomplicated by cheek tooth changes. If congenital incisor malocclusion is present, early extraction of the incisors may minimize or prevent secondary cheek tooth changes.¹³ Extractions may also be necessary in the case of premolar or molar teeth with root abscesses. If a tooth is removed in one arcade, the teeth in occlusion with the extracted tooth will overgrow if not removed.⁸

Incisor extraction is difficult because of the long length of the incisors. Careful luxation of the tooth is usually the best way to perform incisor extraction. There are specially designed incisor luxators for rabbits and rodents; also flattened and bent hypodermic needles can be used.^{14,15} In short, the periodontal ligament is severed, and extraction forceps can be used to

gently extract the teeth. Iatrogenic tooth fracture can occur if too much or incorrect force is applied to the tooth. Curettage of periapical tissues has been advised to minimize the chance of tooth regrowth. However, incisor regrowth has occurred even when this has been performed, so the client should be warned of this possibility.¹⁴⁻¹⁶

Extraction of the premolars and molars is more difficult than incisor extraction because of the amount of embedded tooth, limited access to the teeth and close proximity of the teeth.^{14,15} Damage to the bone of the nasal cavity and around the eye is possible. Several techniques have been described including: extra-oral surgical approach; buccotomy approach; and intra-oral non-surgical technique.^{14,15}

Dental extraction can be traumatic and painful for the patient. Careful consideration should be made prior to performing dental extractions and extensive supportive care and pain control should be provided if extractions are performed.^{14,15} Nutritional support may be necessary and nasogastic or esophageal feeding tubes may be useful in some cases. Antibiotics must be chosen carefully because of the sensitivity of the gastrointestinal tract in rabbit and guinea pig patients and should be based on culture and sensitivity results when possible.

Abscess management

Abscess management involves addressing the underlying disease, such as treatment of dental disease, in combination with specific abscess therapy. Abscesses in rabbits are usually thick-walled and contain a caseous purulent discharge. Surgical excision is recommended rather than simply opening and 'draining' the abscess.⁴ Culture of the abscess wall is useful in determining which bacterial organisms are involved. Bacterial sensitivities can be used to determine the most appropriate antibiotic choice. In one study, 100% of facial abscess pathogens identified were susceptible to chloramphenicol, 96% to penicillin,

86% to tetracycline, 54% to metronidazole and ciprofloxacin, and only 7% to trimethoprim-

sulfamethoxazole.²⁰ Antibiotics must usually be given long-term when treating abscesses.

Abscesses are often left open to heal by secondary intention rather than performing surgical

closure to reduce the chance of regrowth. Other options such as packing the area with antibiotic

ointment or substances such as calcium hydroxide have been described.^{5,13,17-19} Antibiotic-

impregnated beads or gauze may provide a long-term release of antibiotics locally and have been

used in treating dental abscesses.¹⁷ We have had success with using a laser to remove abscesses

in rabbits.

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