Rabbit Dentistry

Dental disease is one of the most common reasons pet rabbits present to veterinary clinics. It can produce a wide variety of clinical signs and varies in severity. Although the underlying cause of dental disease can be congenital or traumatic, husbandry is a major influence in the prevention, onset, and treatment of dental disease. When rabbits are fed an inappropriate diet, their teeth can overgrow, resulting in malocclusions and other abnormalities. The goals of treatment are to return teeth to their normal anatomy and to control inflammation and infection, thereby returning the teeth to normal function. Veterinary technicians play a vital role in educating rabbit owners about prevention and early detection, as well as assisting veterinarians with diagnosing and treating dental disease.

ANATOMY AND PHYSIOLOGY
A thorough understanding of normal oral anatomy and physiology is necessary for prevention and treatment of dental disease in rabbits. Rabbits are unique in that they have 4 maxillary incisors (101, 102, 201, and 202) and 2 mandibular incisors (301 and 401) (FIGURE 1).1–5 Two of the maxillary incisors (102 and 202) are significantly smaller and are called the peg teeth.1–5 The peg teeth are located directly behind the larger set of 2 incisors (101 and 201).1–5 The maxillary incisors are typically shorter than the mandibular incisors and have a longitudinal groove on the labial surface that runs the length of each incisor tooth.1–5

CLIENT EDUCATION
Veterinary technicians play a vital role in educating rabbit owners about prevention and early detection of dental disease. Rabbit owners should be instructed to feed unlimited high-fiber foods.
When the jaw is at rest, the mandibular incisors are situated behind the first larger set of maxillary incisors in occlusion with the peg teeth, and the cheek teeth do not touch (FIGURE 2).1-5 Lack of contact between the molars is due to anisognathism, meaning the mandible is narrower than the maxilla.1,5 Rabbits do not have canine teeth.1-4 Instead, there is a space between the incisors and premolars called the diastema (FIGURE 1).1-5 The premolars and molars are anatomically identical, making differentiation of each tooth challenging.2 Thus, the premolars and molars are simply called the cheek teeth.7 The dental formula for a rabbit is I2/1, C0/0, P3/2, and M3/3, for a total of 28 teeth.1-5 Rabbit teeth are cylindrical and have a natural curve as they grow.1,5 The occlusal surface of the maxillary cheek teeth curves buccally, and the occlusal surface of the mandibular cheek teeth curves lingually.1 They are aradicular; that is, both the incisors and the cheek teeth have open apices, never forming true tooth roots.1 Rabbit teeth are also elodont, meaning that they continually grow throughout the life of the rabbit.1 Germinall tissue, located at the apices of the teeth, continuously forms enamel to cover each tooth as the teeth constantly grow.3 Because of this, there is no anatomic difference in the tooth above or below the gum line.2 The enamel is free of pigment, resulting in white teeth.1

Rabbits have a blind spot directly in front of their mouth, so they rely on sensitive vibrissae on their lips to find food.4 Food items are grasped with prehensile lips, bitten off or chopped with the incisors, and moved to the cheek teeth by the tongue.4,5 Occlusal surfaces of the cheek teeth are irregular, providing a rough surface for grinding coarse, fibrous material. Normal side-to-side grinding movements of the jaw during mastication keep the teeth worn down to a proper length.1,5 Teeth wear down approximately 2 to 2.4 mm per week, depending on the rate of tooth growth and attrition.1,5

**CAUSES OF DENTAL DISEASE**
Dental disease results from any anatomic or physiologic abnormality that interferes with eruption or wear of incisors, cheek teeth, or both. Causes of dental disease are categorized as congenital or acquired. Congenital causes are conditions present at birth. Acquired dental disease is not inherited but rather the result of external factors.2

Congenital causes include prognathism, brachygnathism, and other jaw malformations.2 For example, a malformation of the incisors may cause improper wear of the cheek teeth, eventually leading to the development of sharp points and overgrowth of the cheek teeth. Alternatively, a malformation of a cheek tooth may cause improper occlusion of other cheek teeth or the incisors, causing improper tooth wear and overgrowth.

Acquired causes of dental disease include trauma, systemic disease, neoplasia, and improper nutrition.2 Jaw fractures and broken teeth are common traumas.2 If not healed properly, changes in the jaw and occlusion of the teeth may result, leading to improper attrition of teeth and subsequent dental disease. Systemic disease that causes any change in

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**FIGURE 1.** (A) Cheek teeth. (B) Diastema. (C) Four maxillary incisors, including the 2 smaller peg teeth situated directly behind the larger set of incisors, and 2 mandibular incisors. Note the chisel-like appearance of the incisors and the occlusion of the mandibular incisors to the peg teeth.

**FIGURE 2.** Craniocaudal view of rabbit skull. When the jaw is at rest, the cheek teeth do not touch. This is due to anisognathism (mandible is narrower than the maxilla).
a rabbit’s normal diet and eating patterns may lead to dental disease.1–4 A systemic disease characterized by altered calcium levels may result in changes in jawbones and altered tooth placement.3,5

Improper nutrition is the most common cause of dental disease in pet rabbits.1 Improper food items prevent normal tooth wear, eventually leading to dental disease.3,5

CLINICAL SIGNS
Rabbits are a prey species, so they tend to hide clinical signs of illness until they are remarkably debilitated.2 Clinical signs of dental disease are directly related to the severity of the disease.2 If the dental disease is mild, the rabbit may not show any signs. However, once one tooth is affected, over time, the dental disease will affect all the other teeth. The following clinical signs may be associated with dental disease in rabbits:

→ Changes in eating ability or pattern, including anorexia, decreased food intake, selectiveness of food items, and difficulty holding food in mouth. Oral pain can cause anorexia and difficulty eating.1–3,5,6 Malocclusions may make eating certain food consistencies difficult, causing the rabbit to choose smaller, softer food items over fibrous hay.3 Malocclusions of the mandibular cheek teeth may cause the tongue to become trapped, making it difficult or impossible for the rabbit to move food toward the cheek teeth.1

→ Changes in fecal output, size, and appearance. Changes in eating patterns result in changes in fecal output.1,2

→ Excessive drooling or area of wetness or hair loss under the chin. Pain can cause excessive salivation, resulting in drooling.2,3 Malocclusions may limit the rabbit’s ability to completely close its mouth, which also results in drooling.2,3

→ Nasal discharge. Elongation of roots of maxillary teeth, especially the maxillary incisors, may irritate sinuses, resulting in nasal discharge.3

→ Matting of hair on forelimbs. Rabbits are fastidious groomers. Matting of the hair on the forelimbs indicates that the rabbit is grooming discharge from the eyes, nose, or mouth.1,6

→ Epiphora or exophthalmos. The roots of the maxillary incisors are close to the tear ducts (FIGURE 3).3 If elongated, the roots will partially or completely occlude the nasolacrimal duct, resulting in excess tearing and wetness around the medial canthus of the eye.3,6

→ Facial masses or swellings. Facial masses and swellings can be caused by abscesses forming around the affected teeth.1 Masses or swellings palpated along the ventral mandible could indicate elongated roots of the mandibular cheek teeth.1

→ Bruxism. Bruxism (ie, tooth grinding) is an indication of pain.1,3

→ Uneven occlusal surfaces of the cheek teeth. Although a thorough oral examination can be performed only with the rabbit under sedation, uneven occlusal surfaces may be observed during an oral examination by using a bivalve nasal speculum or an otoscope cone (FIGURE 4).1,2,6

DIAGNOSIS
Dental disease is diagnosed by obtaining a thorough patient history and by performing a physical examination and endoscopic oral examination with the patient under sedation, blood analysis, and radiography.1

Patient History
A thorough history should be obtained for every patient. Information on a patient’s eating habits may reveal early dental disease.1 Rabbits without sufficient roughage in their diet may not be grinding their teeth properly, predisposing them to overgrown teeth and dental disease.1
Physical Examination
Every rabbit that presents to the veterinary hospital should undergo a physical examination that includes an oral examination. Early detection of dental disease increases the probability of successful treatment. The success of performing an oral examination on an unsedated rabbit varies depending on the stress level and cooperation of the rabbit. If dental disease is suspected, a more thorough oral examination should be performed with the patient under anesthesia. Rabbits with advanced dental disease commonly present with anorexia, pain, gastrointestinal stasis, or other secondary illness. These patients require anesthesia to perform a thorough, stress-free oral examination.

The incisors are examined by pulling the lower lip down with the thumb and forefinger of one hand while using the thumb and forefinger of the other hand to pull the upper lip up and aside in similar fashion (FIGURE 5). The length, color, shape, quality of enamel, and occlusal edge can be assessed. Healthy incisors will be white and cylindrical, with a horizontal, chisel-shaped edge. When the jaw is at rest, the mandibular incisors should meet the peg teeth directly behind the maxillary incisors.

The oral cavity of rabbits is small, making it impossible to examine the cheek teeth without instrumentation and sedation. A cursory examination of the cheek teeth may be performed without sedation by using a bivalve nasal speculum or an otoscope cone. By inserting the speculum or cone through the diastema into the oral cavity, the occlusal surface of the cheek teeth may be briefly examined, although the viewing window is limited. The lateral and dorsal surfaces of the cheek teeth are difficult or impossible to evaluate in this fashion, and small dental lesions are easily missed.

An endoscope may also be used to view the cheek teeth. As with an otoscope cone or bivalve nasal speculum, the endoscope does not allow a thorough evaluation of the cheek teeth in an awake patient. Endoscopes may also be easily damaged if the rabbit chews on the delicate equipment. However, the endoscope permits substantial magnification, making small lesions easily detectable. Another advantage of the endoscope is the ability to take pictures, allowing owners and other members of the veterinary team to see the oral cavity.
Blood Analysis
Blood analysis is indicated if systemic disease is suspected or anesthesia is required for a dental procedure.\textsuperscript{5}

Radiographic Examination
Radiography is an essential diagnostic tool that should be performed for all patients with suspected dental disease.\textsuperscript{1} The bulk of the teeth and the supporting structures is below the gumline, hidden from view during gross oral examination. The tooth roots, jawbone, periodontium, nasolacrimal canal, and intra-alveolar portion of the teeth can only be examined radiographically. Changes to these structures account for 80% of dental disease.\textsuperscript{1} Radiographs also provide the veterinarian with information on treatment options and long-term prognosis.

Proper positioning of the patient is vital for correct interpretation of radiographic images.\textsuperscript{1,2,7} It may be necessary to sedate or anesthetize the patient to reduce patient stress and to obtain correctly positioned, symmetric radiographic images of the skull.\textsuperscript{1,2,7} The standard projections needed for thorough evaluation of the oral cavity of the rabbit are a laterolateral skull view, dorsoventral or ventrodorsal skull view, and right and left 40° oblique skull views.\textsuperscript{1,2,7} BOX 1 provides positioning guidelines.

The laterolateral view often yields the most valuable information regarding dental disease.\textsuperscript{1,7} The incisor teeth, cheek teeth, and supporting structures are easily evaluated for malocclusions.\textsuperscript{1,7} The appearance of the bone surrounding the teeth may also be assessed.\textsuperscript{1,6} The dorsoventral view is particularly helpful for evaluating the palatal and buccal margins of the cheek teeth and the zygomatic bone.\textsuperscript{1,7} Oblique projections of the skull are useful for separating individual cheek teeth of the mandible and maxilla, which are directly superimposed in laterolateral views.\textsuperscript{1} In 2009, Boehmer and Crossley introduced the use of anatomic reference lines when evaluating dental radiographs (BOX 2).\textsuperscript{1,7}

Computed tomography (CT) is becoming a widely accepted alternative to dental radiography in specialty and academic facilities.\textsuperscript{1,2} CT allows 3-dimensional reconstruction of the skull, viewing of finer detail than can be seen on radiographs, and isolation of areas or teeth of interest.\textsuperscript{1} CT is especially advantageous

| BOX 1 Positioning Guidelines for Dental Radiography in Rabbits\textsuperscript{7,8} |
|-----------------------------|--------------------------------------------------|
| **RADIOGRAPHIC VIEW**       | **POSITIONING GUIDELINES**                       |
| Laterolateral               | ➔ Place the patient in lateral recumbency. If applicable, position the affected side nearest to the cassette. |
|                            | ➔ Pull front limbs caudally and extend the head. Use foam pads, rolled hand towels, or tape to assist with positioning the rabbit’s skull perfectly horizontal to the table. |
|                            | ➔ Vertically position ventral margins of the mandible and both eyes. In some patients, it may be useful to open the mouth slightly with a small cotton prop to separate the occlusal surfaces of the maxillary and mandible teeth. |
| Dorsoventral                | ➔ Place the patient in sternal recumbency. The front limbs can remain in natural position; ensure they are out of the x-ray beam. |
|                            | ➔ Use sandbags to apply gentle pressure to the back of the patient’s neck to ensure the head is not tilted ventrally. Use tape or foam wedges on either side of the head to prevent rotation if necessary. |
|                            | ➔ If positioned correctly, both of the patient’s eyes will be horizontal to the table. |
| Ventrodorsal                | ➔ Place the patient in dorsal recumbency. Use V-trays and foam wedges to prevent rotation of the patient. |
|                            | ➔ Pull the front legs caudally. Use foam or rolled hand towels to support the neck of the patient and tilt the patient’s nose toward the table top, achieving a ventrodorsal position. |
|                            | ➔ The ventral lower jaw should be horizontal to the table top. |
| Right and left 40° oblique  | ➔ Place the patient in lateral position. |
|                            | ➔ Pull the front legs caudally and extend the head. |
|                            | ➔ Rotate the patient’s head 40° away from the table. |
|                            | ➔ Repeat with the patient in lateral position on the opposite side. |
for evaluating intranasal structures, surrounding soft tissue structures, abscesses, and neoplasia.¹

**TREATMENT**

Treatment of dental disease consists of returning teeth to their normal length, restoring normal occlusion, extracting diseased teeth, and treating associated abscesses.

**Crown Height Reduction**

Crown height reduction can often be curative in the beginning stages of dental disease when accompanied by diet correction and other preventive measures.¹⁻³ However, in cases of moderate to severe dental disease, crown height reduction procedures will need to be performed repeatedly.¹⁻³ Overgrown incisors or cheek teeth should be trimmed using a dental bur or trimming forceps (FIGURE 6A) designed specifically for crown reduction.¹⁻³ Nail trimmers, rongeurs, and other manual cutting tools should never be used to perform crown height reduction.²⁻³ Root damage, tooth fractures or splinters, and abnormal regrowth are likely to occur when using improper equipment.²⁻³ Crown reduction performed without sedation or anesthesia is difficult and often done blindly, resulting in missed sharp points or spurs and injury to the gums, cheeks, or tongue.¹⁻³ Rabbits with moderate to severe dental disease should be anesthetized, allowing crown reduction and reshaping to be performed with a low-speed dental bur while protecting soft tissues with bur guards and dental spatulas.¹⁻³ (FIGURE 6B)

**Tooth Extractions**

Tooth extraction with the patient under general anesthesia is indicated for any tooth that is loose, infected/abscessed, fractured, or severely maloccluded.² Extractions can be performed intraorally or extraorally, depending on the difficulty of the extraction based on the accessibility of the diseased tooth and the size of the patient.² Tabletop mouth-gag positioners, oral speculums, cheek dilators, spatulas, a low- to high-speed dental handpiece with a cheek guard, dental burs, and

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**BOX 2 Boehmer and Crossley Radiographic Anatomic Reference Lines¹,⁷**

**Lateral view, normal anatomy**
A black line (A) extends from the tip of the nasal bone to the occipital protuberance. The roots of anatomically normal maxillary cheek teeth will not extend past this line. The white line extends the height of the tympanic bulla. A second black line (B) runs parallel to the first, extending from the rostral end of the hard palate to one-third of the height of the tympanic bulla. The occlusal surface of the cheek teeth will appear to match this line in healthy rabbits. A yellow line (C) highlights the mandibular cortical bone. The roots of anatomically normal mandibular cheek teeth will not extend past this line.

**Dorsoventral view, normal anatomy**
A black line (A) extends from the lateral margin of the mandibular incisors to the medial margin of the mandibular ramus on the same side. Another black line (B) extends from the lateral margin of the mandibular incisors to the lateral wall of the tympanic bulla on the opposite side. Cheek teeth should not extend outside of these reference lines. Two yellow lines (C) highlight the medial cortex of the mandible, which should appear straight, smooth, and symmetric.

**Lateral view, abnormal anatomy:**
Note the overgrowth of the cheek teeth that extend past all 3 reference lines. The occlusal surface of the teeth does not match the reference line. The mandibular cortical bone is not straight and smooth in appearance. Also note the overgrowth of the mandibular incisors.
Crossley incisor and molar luxators are specialized equipment used to assist in positioning and tooth extraction (FIGURE 6). Analgesia and nutritional support must be provided after surgery to any patient undergoing a tooth extraction procedure.

TREATMENT OF ABSCESS
Abscesses on a rabbit’s head or jaw are often associated with the periapical area of an infected incisor or cheek tooth. In rabbits, mandibular abscesses are more common than maxillary abscesses. Often, abscesses present as palpable masses. Occasionally, an abscess is detectable only on radiography or CT. Treating a rabbit with an abscess can be difficult because the pus has a remarkably thick-to-solid consistency. Primary treatment of an abscess is to remove the cause, which is 1 or more infected teeth. Further treatment of the abscess varies by veterinarian preference but may include repeated lancing and flushing of the abscess, systemic antibiotics, complete surgical excision of the abscess, and antibiotic bead impregnation. Analgesia and nutritional support may be indicated in patients that have an abscess.

PREVENTION
Proper nutrition and husbandry are essential for the prevention of dental disease. Rabbit owners should be instructed to feed unlimited high-fiber foods. Grass, a good-quality timothy hay, and fibrous, green, leafy vegetables are favorable foods that are high in fiber and encourage the grinding motions of the jaw that benefit attrition of the teeth. Rabbits require a diet that provides enough calcium for sufficient mineralization of their continually growing teeth and surrounding bone structures, but not so much calcium that urinary tract disease is a risk. The ideal amount of dietary calcium for a rabbit is 0.5% to 1.0%.

Barn-dried hay may not contain as much vitamin D as sun-dried hays. Alfalfa hay is very high in calcium. It is a good choice for rapidly growing young rabbits but should not be fed as a sole source of hay for adult rabbits. If possible, rabbits should be allowed to graze outside on a variety of grasses and weeds while basking in the sun, which helps prevent a vitamin D deficiency. Pellets are not a necessary part of a rabbit’s diet. If pellets are fed, they should be timothy hay based, not alfalfa based. Pellets require a less desirable chewing motion of the jaw, not the grinding motion required.
for fibrous grasses and hays. Mixed-cereal foods are also not recommended because it is impossible to prevent rabbits from selectively feeding.

In addition to proper nutrition practices, owners can be educated about acquiring their pet rabbits from breeding stock without a history of dental disease in their lineage. Growing rabbits are especially susceptible to congenital malocclusions and metabolic bone disease if fed inappropriate, low-calcium food items early in life.

CONCLUSION
Dental disease is profoundly common in pet rabbits. Although it cannot be prevented in all pet rabbits, feeding a high-fiber diet and providing objects to encourage chewing are positive preventive practices.

### Pain Assessment in Small Mammals

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Recognizing and assessing pain in small mammals can be challenging. As prey species, small mammals mask signs of illness and injury, especially when in an unfamiliar environment. The International Association for the Study of Pain (IASP) describes pain as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage.”

Lichtenberger and Ko indicate any animal should be assumed to be experiencing pain in any condition expected to produce pain in human beings. Therefore, when working with a patient, it is reasonable to ask yourself, “Would this illness or procedure cause me to feel pain?” If your answer is yes, then it is likely the illness or procedure will also cause the animal pain.

History and husbandry information about the patient should be obtained from the owner using open-ended questioning techniques upon arrival at the veterinary clinic. Since the patient will most likely be masking any signs of illness or discomfort, information obtained from the owner about how the animal has been acting in its normal environment will be helpful. The interview process also allows time for the animal to become accustomed to the veterinary clinic setting. Observation of the patient during the interview or in a quiet room before handling may reveal signs of pain or discomfort. If a small mammal is unable to mask clinical signs of pain and discomfort, it should be considered severely debilitated.

Assessing pain in small mammals can be a difficult task, but it is not impossible. There is no one objective way to tell if a small mammal is feeling pain, as individual animals display different clinical signs. These signs may include anorexia, lethargy, lameness, reduced grooming, abnormal vocalizations, aggression when usually docile, or any deviation from normal behavior. Many small mammals in pain hide under bedding or substrate. They also segregate themselves from their cage mates, positioning themselves on opposite ends of their enclosure. An increase in the frequency and depth of respirations or rapid, shallow breathing is also a sign of distress. Bruxism, a loud tooth grinding, is a common clinical sign of pain in small mammals. The animal may be less active or even completely immobile. It may display a hunched posture, arch its back, or press its abdomen to the floor.

Various species and individuals have different pain responses and pain tolerance. Rats have a hardener gland that secretes red, porphyrin tears when they are ill or stressed, giving the appearance of bleeding eyes. Guinea pigs and rodents may display piloerection. Guinea pigs, which normally give high-pitched squeals when handled, also tend to be quiet during handling while painful. Ferrets are reluctant to curl up while resting and commonly squat their eyes. Other animals, frequently rodents, spend more time than normal curled up and may have bulging eyes. Overgrooming, chewing at the location of pain, and self-mutilation are observed in small mammals, most commonly in rodents and sugar gliders.

Appropriate multimodal analgesia techniques can and should be used in small mammals. The veterinary technician oath states, “I solemnly dedicate myself to aiding animals and society by providing excellent care and services for animals, by alleviating animal suffering, and promoting public health.” Veterinary technicians play an integral role in recognizing pain in patients and act as patient advocates to alleviate pain and suffering in all animals.

### References


Annual physical examinations of pet rabbits assist in early detection of dental disease. Veterinary technicians play a critical role in educating rabbit owners about early clinical signs of dental disease, as well as diagnostic modalities and treatment options for a pet rabbit with suspected dental disease.

References

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1. The space between the incisors and premolars is called the/a
   a. diastema.
   b. buccal space.
   c. lingual space.
   d. malocclusion.

2. The dental formula for a rabbit is:
   a. I1/1, C0/0, P2/3, M3/3
   b. I2/1, C0/0, P3/2, M3/3
   c. I1/1, C1/1, P3/2, M3/3
   d. I2/1, C0/0, P2/3, M3/3

3. The term ______ means the teeth have open apices, never forming true tooth roots.
   a. aradicular
   b. hypsodont
   c. bruxism
   d. anisognathism

4. The term ______ means the teeth continually grow throughout the life of an animal.
   a. aradicular
   b. hypsodont
   c. elodont
   d. attrition

5. In a normal, healthy rabbit, the teeth wear down ______ mm per week.
   a. 0–0.4
   b. 1–1.4
   c. 2–2.4
   d. 3–3.4

6. Which of the following is a congenital cause of dental disease in rabbits?
   a. Jaw fracture
   b. Neoplasia
   c. Improper nutrition
   d. Prognathism

7. Masses or swellings palpated along the ventral mandible could be an indication of
   a. elongated mandibular incisors.
   b. elongated mandibular cheek teeth.
   c. uneven occlusal surface of cheek teeth.
   d. labial points on occlusal surface of cheek teeth.

8. _______ skull radiographic views often yield the most valuable information regarding dental disease in rabbits.
   a. Laterolateral
   b. Dorsoventral
   c. Right oblique
   d. Left oblique

9. _______ is not high in fiber and does not encourage the grinding motions of the jaw that benefit tooth attrition in rabbits.
   a. Timothy hay
   b. Apples
   c. Green leafy vegetables
   d. Grass

10. Rabbits that eat a diet high in calcium are at risk for
    a. decreased mineralization of teeth.
    b. decreased mineralization of bones.
    c. congenital malocclusions.
    d. urinary tract disease.