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Diagnosis and Treatment of Dental Disease in Pet Rodents

Vittorio Capello, DVM

Abstract

Acquired dental disease is relatively common in pet rodents and is seen in many different presentations depending on species and type of teeth affected. The degree of disease severity will vary between individuals of the same and different species. A thorough understanding of the anatomy and physiology of rodent teeth and a complete workup are needed for proper diagnosis and prognosis. Treatment is aimed at restoration of the normal shape and function of the dental arcades. This article will highlight the differences between diagnosis, prognosis, and treatment of dental disease in rabbits and pet rodent species. Copyright 2008 Elsevier Inc. All rights reserved.

Key words: **dentistry; guinea pig; rodent; elodont; anelodont**

Dental disease is relatively common in pet rodents, and results in a complex of clinical signs and symptoms both primarily related to dental function and secondarily related to other organs and systems. For this reason, dental disease is best defined as a syndrome.[1] Congenital dental disease in rodents seems to be much less frequent than in pet rabbits; therefore, dental disease in rodents can be further defined as an acquired dental disease syndrome. Clinical signs and, therefore, the overall disease process, will vary in regards to associated pathology between individual animals. Despite some anatomic and physiologic similarities with the rabbit, dental disease in rodent species presents distinct peculiarities at any stage of the medical trial: diagnostic, prognostic, or therapeutic. The common belief that most pet rodents are just "smaller rabbits" regarding dental disease is misleading and potentially harmful.

Normal Dental Anatomy and Physiology

Proper diagnosis and treatment of dental disease in pet rodents require a thorough understanding of normal dental anatomy and physiology.[1-4] All rodent species have 1 pair of well-developed maxillary and mandibular incisor teeth, representing the best-known anatomical peculiarity of this order. Although incisor teeth vary slightly in shape, color, and thickness, they are continually growing and open rooted (elodont) in all rodent species. As in rabbits, all rodents lack canine teeth and have a diastema between the incisor and the first premolar (or molar) tooth. Premolar and molar teeth vary among rodent species. They are anatomically indistinguishable and are simply called "molariforms" or "cheek teeth." The hundreds of species belonging to the order Rodentia are grouped into 3 suborders.[1] From the taxonomic standpoint, the different groups are based on anatomical and functional differences of the masseter muscle. These 3 suborders are the *Caviomorpha* or *Hystricomorpha* ("guinea pig-like" or "porcupine-like"), the *Myomorpha* ("mouse-like" or "rat-like"), and the *Sciuromorpha* ("squirrel-like"). Among the rodent species

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Table 1. Dental formulas of the suborders of rodent species and the rabbit

	Incisor Teeth	Premolars	Cheek Teeth Molars	Total of Cheek Teeth	Total
Rabbits	2/1	3/2	3/3	6/5 = 22	28
Porcupine-like rodents	1/1	1/1	3/3	4/4 = 16	20
Rat-like rodents	1/1	0/0	3/3	3/3 = 12	16
Squirrel-like rodents	1/1	1-2/1	3/3	4-5/4 = 16-18	20-22

kept as pets, the porcupine-like group includes the guinea pig (*Cavia porcellus*), chinchilla (*Chinchilla laniger*), and degu (*Octodon degus*). The rat-like group includes the rat (*Rattus spp*), mouse (*Mus musculus*), golden hamster (*Mesocricetus auratus*), Russian hamster (*Phodopus sungorus, P. campbelli, P. roborowskii*), Chinese hamster (*Cricetulus griseus*), gerbil (*Meriones unguiculatus*), and duprasi (or "fat-tailed" gerbil—*Pachyuromys duprasi*). The squirrel-like group includes many species that can be kept as pets in different countries. Among the most important are the prairie dog (*Cynomy ludovicianus*), chipmunk (*Tamias striatus*), and European citellus (*Citellus citellus*). The suborders have different dental formulas, but from the standpoint of the dental anatomy and physiology, they can be simply reduced to two groups. The porcupine-like rodent species have both elodont incisor and cheek teeth, whereas the rat-like and squirrel-like rodent species have elodont incisor teeth but anelodont (rooted, not growing throughout life) cheek teeth. This distinction between species with elodont cheek teeth and species with anelodont cheek teeth is clinically important. Despite differing dental formulas, from the physiologic standpoint, guinea pigs, chinchillas, and degus have dentition similar to rabbits. A minor distinction between rat-like and squirrel-like species is that the first group lacks premolar teeth; however, this is not a clinically significant anatomical difference. Dental formulas for pet rodent species are reported in Table 1.

Incisor teeth of rodents are covered by enamel only over the labial surface. The enamel can be white (e.g., guinea pigs) or orange-pigmented (e.g., chinchillas, golden hamsters, prairie dogs). The length of the clinical crown differs from species to species. In the guinea pig, the length of the mandibular incisors is normally 3-fold the maxillary incisor teeth. In all rodent species, both maxillary and mandibular incisors present a "chisel-shaped" occlusal surface, as in rabbits. There is normally some degree of movement between the mandibular incisor teeth of rat-like rodents because of the presence of a relatively elastic symphysis.

As true herbivores, the occlusal surface of cheek teeth of guinea pigs and chinchillas is rough and uneven because of enamel crests and dentinal grooves. Unlike rabbits, the occlusal surfaces of rodent check teeth are flat and do not present a "zig-zag" pattern. A very important anatomical peculiarity of cheek teeth of guinea pigs is that they are curved; the mandibular with a buccal (lateral) convexity and the maxillary with a palatal (medial) convexity. This results in a 30° oblique occlusal plane that slants from dorsal to ventral, lateral to medial. The clinical crowns are much shorter than reserve crowns when compared with those of rabbits (Figs 1 and 2).

Cheek teeth of prairie dogs have multiple roots. Although they are herbivorous ground squirrels, their structure is similar to that of primates, with

Figure 1. Close-up of the rostral view of the cheek teeth in a guinea pig, incisors removed. The oblique occlusal plane is clearly visible. Guinea pigs are anisognathus, with the mandible much wider than the maxilla. The mandibular teeth are curved with a pronounced buccal convexity, and the maxillary teeth with a prominent palatal convexity. This results in a 30° oblique occlusal plane that slopes from buccal to lingual, dorsal to ventral. Reprinted from: Capello V: Dental diseases and surgical treatment in pet rodents. Zoological Education Network (2003), with permission.

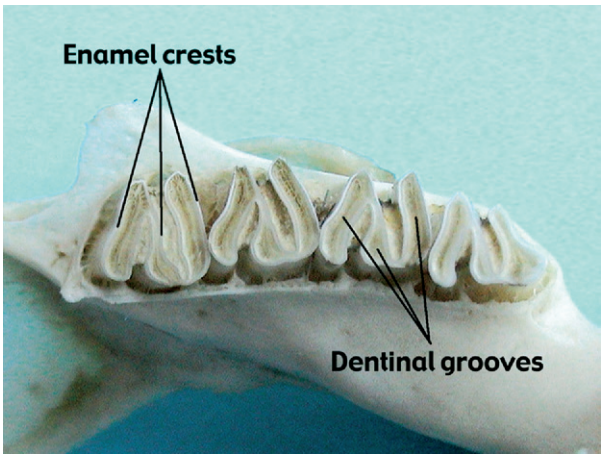

Figure 2. Occlusal plane of the left mandibular cheek teeth arcade. Normal abrasion of the occlusal surface leads to the development of a rough surface characterized by higher-enamel crests and deeper dentinal grooves. Reprinted from Capello V, Gracis M, Lennox A (eds): Rabbit and Rodent Dentistry Handbook. Zoological Education Network (2005), Blackwell Publishing (2007), with permission.

cusps and ridges that create a rough occlusal surface (Fig 3).

The temporomandibular joint and masticatory muscles of rodent species (especially those with anelodont cheek teeth) allow much greater rostrocaudal movements than in rabbits. Similar to rabbits, elodont cheek teeth of porcupine-like rodents are worn during normal chewing activity.

Pathophysiology of Dental Disease

Congenital malocclusion is rare because prognathism of the mandible (or brachygnathism of the maxilla) is not recognized in rodent species, with the exception of anecdotal reports in the hamster.[1-3] True dwarfism, as recognized in pet rabbits, has not been documented in rodents because these species have not been selectively bred for extreme size variation.

The primary cause of dental disease in porcupine-like rodent species (e.g., guinea pig) is insufficient or improper wearing of cheek teeth due to eating an inappropriate diet (e.g., lack of fiber). This disease process does not occur in rodent species with anelodont cheek teeth (e.g., rats, hamsters). However, these patients can develop dental problems of the cheek teeth because of excessive wearing.

Metabolic bone disease as an underlying cause of dental disease has not been investigated or reported in rodent species.

Primary congenital deviation and malocclusion of the incisors in growing rats, hamsters, and squirrels have been described. Primary congenital deviation may be difficult to distinguish from malocclusion due to incisor fractures in adult animals, because many owners do not recognize the initial injury.

Acquired malocclusion and severe deviation of incisor teeth occur most often after repeated trauma and fractures. In prairie dogs, repeated trauma is the most important cause of dysplastic dental pathology (pseudo-odontoma). Trauma can be the result of constant chewing of cage bars, fractures, or improper trimming of malocclusion incisor teeth, all of which can interfere with normal tooth eruption. Apical tooth growth continues, causing primary deformation of the apex and the reserve crown, and contributes to secondary abnormalities of the surrounding structures (e.g., incisive bone). When the apical deformity is severe, it can act as a space-occupying mass leading to progressive obstruction of the nasal opening.[1]

Clinical Signs and Symptoms of Dental Disease in Guinea Pigs

Guinea pigs often present with clinical signs consistent with dental disease (e.g., dysphagia, reduced food intake, anorexia).[1-3] In multi-pig households, owners may be unaware of a decreased appetite by one individual with the only presenting sign being

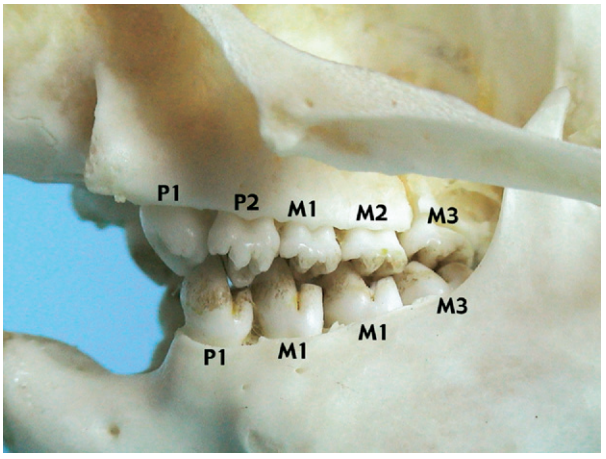

Figure 3. Lateral view of the left cheek teeth of a prairie dog. Because maxillary and mandibular cheek teeth differ in number, each mandibular tooth occludes with 2 maxillary teeth. Prairie dogs are herbivorous ground squirrels; however, the structure of the premolar and molar teeth is similar to that of primates, with bunodont cusps and ridges that create a rough occlusal surface. Because of these anatomic features, plus the fact that these teeth do not continuously grow, cheek teeth of prairie dogs should never be burred. Reprinted from Capello V, Gracis M, Lennox A (eds): Rabbit and Rodent Dentistry Handbook. Zoological Education Network (2005), Blackwell Publishing (2007), with permission.

Figure 4. The elodont incisors of guinea pigs are an excellent indicator of abnormal chewing patterns, which reflect malocclusion and acquired dental disease of the cheek teeth.

weight loss. In contrast, clinical signs in rabbits are, in general, less specific and often reflect various secondary disease processes. Although both are prey species, rabbits are more capable of masking or hiding the effects of disease, and often tolerate significant dental abnormalities for longer periods of time. With guinea pigs, a slight alteration of the sloped occlusal plane of cheek teeth is painful enough to discourage chewing, and a slight overgrowth of clinical crowns will interfere with movements of the tongue and swallowing. Therefore, guinea pigs are much more susceptible to the onset of anorexia due to dental disease than rabbits. The history of guinea pigs with dental disease often includes improper feeding, more specifically the lack of fiber (hay) in the diet.

Malocclusion of incisor teeth often presents as excessive elongation or lateral deviation of the clinical crown of mandibular incisors. Because primary incisor malocclusion is rare, the cheek teeth should be examined for evidence of dental disease (Fig 4).

Clinical Signs of Dental Disease in Chinchillas

The most common clinical signs linked to dental disease in chinchillas are reduced activity, food intake, and production of stools. Other presenting signs observed with chinchillas with dental disease are wet fur over the mouth, chin, and forelimbs because pain associated with the diseased teeth often leads to ptyalism and pawing of the mouth (Fig 5).[1,3,5,6,7] Weight loss and emaciation are a common sequela of dental disease, and it is often present but frequently not recognized by the owner because of the heavy fur typical of this species. Malocclusion of the incisors is also a rare presenting complaint because owners are usually unaware of the problem. As with guinea pigs and rabbits, incisor malocclusion is seldom the only cause of dental disease, and, apart from a few exceptions, it is associated with acquired dental disease of the cheek teeth.

Chinchillas often demonstrate clinical signs only in cases of advanced dental disease, and the reasons for this type of presentation are unknown. Two clinical signs that may help the clinician detect early dental disease are often missed during physical examination: 1) epiphora and 2) cortical bone deformities of the ventral mandible. Both of the clinical signs mentioned above are related to elongation of the reserve crowns and apex deformation of the maxillary and mandibular cheek teeth, respectively. From the pathophysiologic standpoint, the abnormalities represent more advanced dental disease, because these changes are permanent and cannot be corrected. Therefore, the only realistic preventive diagnosis of dental disease in chinchillas can be performed with a thorough dental examination starting from 2 years of age, before the onset of clinical signs.

Clinical Signs of Dental Disease in Prairie Dogs

The most common presenting signs in prairie dogs with dental disease are depression, anorexia, scant feces, and abnormal respiration.[1,3,5,8,9,10] True dyspnea is common, but milder respiratory signs in-

Figure 5. Severe malocclusion of incisor teeth in a chinchilla. The lateral view demonstrates severe elongation of the maxillary incisors. The mandibular incisors were fractured and are not visible. Ptyalism is also evident.

clude sneezing, or a unique snoring sound sometimes referred to as "reverse sneezing." Respiratory symptoms are related to dystrophic changes and apical deformations of maxillary incisor teeth (pseudoodontoma), leading to reduced nasal air passage.[1,5,8,9,10] Weight loss or emaciation is often present at this stage as well.

Fracture and malocclusion of incisor teeth are common but often missed by the owners. There are anecdotal reports of owners who mistakenly consider frequent incisor fracture and regrowth as normal "shedding" of these teeth.

Another less common presentation, especially in animals older than 5 years of age, is reduced food intake and emaciation without respiratory signs. This presentation is often associated with a number of other underlying medical conditions, but the primary cause is end-stage dental disease of cheek teeth with flattened crowns due to excessive wearing and advanced cavitation.[1]

Clinical Signs of Dental Disease in Rat-like Rodents

Rats, hamsters, and other rat-like rodent species are frequently presented for evident malocclusion of the incisor teeth[1] (Fig 6). However, with most cases, dental disease of the incisor teeth is missed by the owner, and patients present for reduced activity, reduced food intake, emaciation, and, in some cases, ptyalism.[1-3]

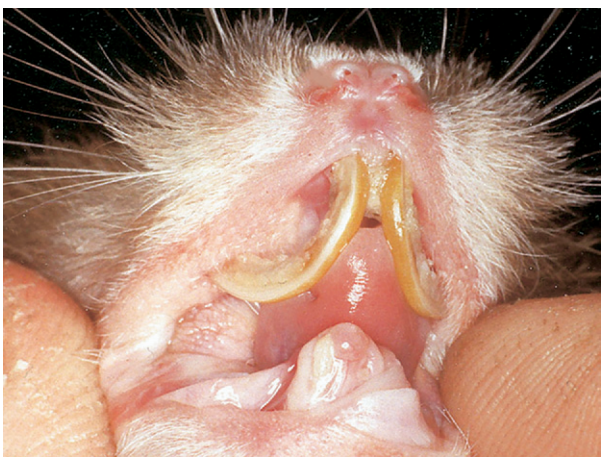

Figure 6. Severe malocclusion of the maxillary incisor teeth and fracture of the mandibular incisors in a golden hamster. The most common presentation is curved elongation of the maxillary incisor teeth, often with secondary lesions of the lips, tongue, and hard palate. Reprinted from: Capello V: Dental diseases and surgical treatment in pet rodents. Zoological Education Network (2003), with permission.

Figure 7. Positioning of a guinea pig on the tabletop mouth gag and restrainer, which can be used for larger rodent species as well. This guinea pig is under general anesthesia with injectable agents, and oxygen is delivered nasally through a 1.5-mm endotracheal tube. Reprinted from Capello V, Gracis M, Lennox A (eds): Rabbit and Rodent Dentistry Handbook. Zoological Education Network (2005), Blackwell Publishing (2007), with permission.

Rat-like rodents generally do not display signs related to diseases of the cheek teeth. More commonly they present facial swellings related to periapical infection and abscessation, which occasionally affect the ocular and periocular structures.

Diagnosis of Dental Disease

The small size and natural behavior of rodents make safe restraint and effective oral examination much more difficult in nonanesthetized rodent species than in rabbits. Complete oral inspection of rat-like and squirrel-like rodent species is not feasible without sedation. Complete inspection and proper diagnosis of dental disease in rodent species should be performed while the patient is under general anesthesia (Fig 7).[1,3]

Diagnosis of dental disease in rodent species requires 2 modalities: 1) radiology and 2) oral endoscopy. A complete radiologic study must include 4 basic projections to diagnose dental disease: 1) lateral; 2) oblique in 2 directions; 3) ventrodorsal; 4) rostrocaudal and definition cassettes and films (e.g., mammography) because standard radiographic cassettes and films will not produce adequate detail in these small patients (Fig 8).[1]

A thorough inspection of the oral cavity is greatly enhanced by oral endoscopy (Figs 9 and 10).[1,12,13] Although this is considered very useful in rabbits, in the author's opinion, it is mandatory for a rodent's oral cavity. Other magnification devices are helpful

Figure 8. Acquired dental disease in a chinchilla, advanced stage. Maloccluded maxillary cheek teeth demonstrate uneven occlusal plane and marked curvature of the crowns with widened interproximal spaces. The apex of a maxillary cheek tooth 1 appears oriented horizontally as opposed to vertically because of marked curvature of the reserve crown. Reabsorption of mandibular cheek tooth 3 and cheek tooth 4, deformation of the ventral mandibular cortical bone, and secondary malocclusion of incisor teeth are also visible. Reprinted from Capello V, Gracis M, Lennox A (eds): Rabbit and Rodent Dentistry Handbook. Zoological Education Network (2005), Blackwell Publishing (2007), with permission.

but not always sufficient, and many lesions can be overlooked without the help of stomatoscopy. Documentation of lesions for comparison or client education is another added benefit.

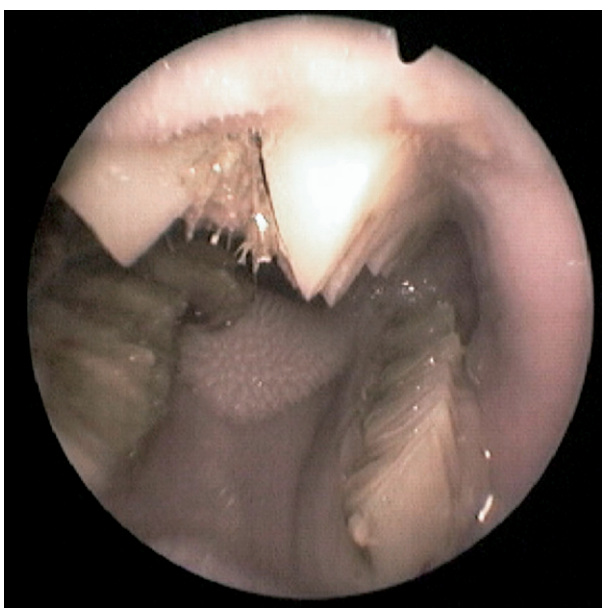

Figure 9. Endoscopic view of acquired dental disease of cheek teeth in a guinea pig. Elongation of clinical crowns leads to a severe abnormality of the occlusal plane, in this case deviation of the normal 30° angle to more than 45°. Even when structural abnormalities of the teeth and secondary soft tissue lesions are not present, these patients have tremendous difficulty chewing and eating.

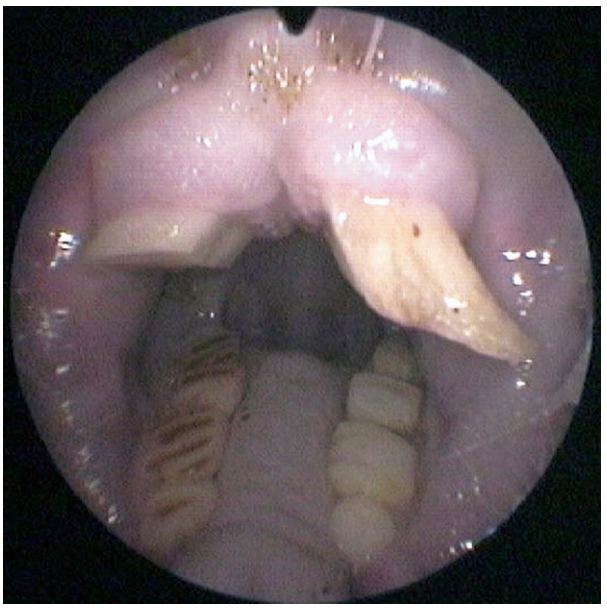

Figure 10. Endoscopic view of severe bilateral elongation of maxillary cheek teeth clinical crowns. Elongation of maxillary cheek teeth in chinchillas is frequently accompanied by an increase in height of both the alveolar crest and the gingival margin. This makes coronal reduction to normal height almost impossible to achieve.

Modern spiral computed tomography units are capable of providing excellent detailed scans of small species, including guinea pigs and chinchillas.[14] In particular, 3-dimensional volume and surface renderings of the skull can provide tremendous information for diagnosis of dental disease in these species (Fig 11).

Common Patterns of Dental Disease

Rodent Species With Elodont Cheek Teeth

The most frequent cause of malocclusion of incisor teeth in the guinea pig appears to be crown elongation and malocclusion of cheek teeth.[1,3] This may be because of their physiologic ability to compensate for any moderate primary incisor abnormalities through rostrocaudal movements of the jaw, which permit normal wearing of incisors. The two most common patterns of malocclusion in guinea pigs are excessive coronal elongation of the mandibular incisors and lateral deviation with an oblique occlusal plane of about 45°. Typical incisor malocclusion of rabbits, where mandibular incisors commonly elongate toward the labial surface, is rarely observed in rodent species. In guinea pigs, maxillary incisors do not curve toward the dorsal palate, with the dorsal

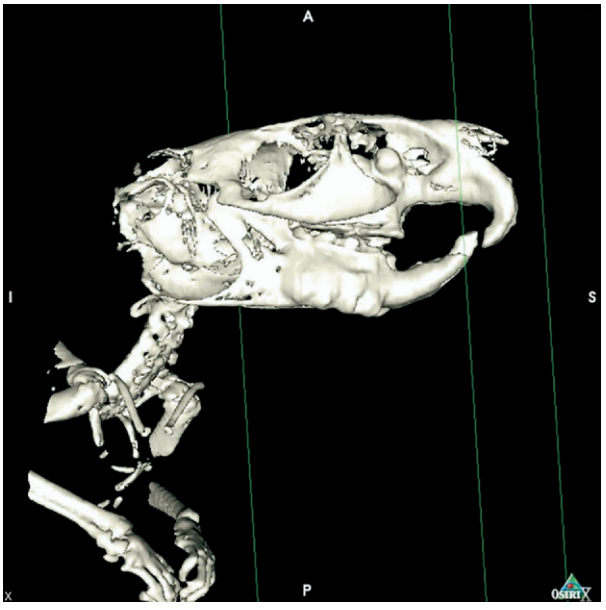

Figure 11. Computed tomography 3-dimensional surface reconstruction of the skull of a chinchilla with acquired dental disease of the cheek teeth. Apical deformities of the cheek teeth, typical of acquired dental disease in chinchillas, are visible. Severe apical elongation and deformity of right maxillary cheek tooth 1 and cheek tooth 2 are highlighted with this imaging technique. This can permit earlier diagnosis of acquired dental disease that may be contributing to vague clinical signs such as epiphora. Fracture of the right mandibular incisor is also present. Reprinted with permission from Capello V, Lennox A: Clinical Radiology of Exotic Companion Mammals, Blackwell Publishing, 2008.

palate pattern being more common in chinchillas. Various fractures of incisor teeth are diagnosed in both guinea pigs and chinchillas.

As with rabbit patients, excessive crown elongation and malocclusion of the cheek teeth arcades are very common in guinea pigs but have different presentations.[1,3,5] Because of the peculiar orientation of the cheek teeth, mandibular cheek teeth crowns always elongate lingually, and maxillary crowns always laterally.

Overgrowth of clinical crown is not so evident as it is in rabbits, and spike or spur formation is much less frequent. Mandibular cheek teeth tend to bend lingually over the tongue-hampering movements. A typical "bridge-like" malocclusion occurs when the first mandibular premolars occlude or even cross each other.[1] The sharp border of the entire maxillary arcade can create severe discomfort to the buccal mucosa. An important fact to remember is that even very early malocclusion and subsequent alteration of the sloped occlusal planes are enough to elicit reduced food intake, anorexia, and resultant cachexia in this species.

Elongation of clinical crowns of mandibular cheek teeth is not so evident in chinchillas. Like rabbits, abnormalities of the occlusal planes can occur in a rostrocaudal direction, with the production of "step mouth" and "wave mouth" patterns. Excessive elongation of the reserve crowns leads to both maxillary and mandibular apical deformities of the cheek teeth, presenting as a typical firm swelling that can be palpated on the ventrolateral aspect of the mandible. These are even more pronounced and develop in a more lateral position than in rabbits. Apical deformities can also result in perforation of the cortical bone, with resulting exposure of the apexes. Despite this pathologic feature, chinchillas appear much less prone to development of periapical abscesses and osteomyelitis than rabbits. The typical intraoral clinical expression of this marked, abnormal curvature is widened interproximal spaces on the mandibular arcades, and buccal sharp edges on the maxillary arcades. Also, clinical crown elongation of maxillary cheek teeth is frequently accompanied by an increase in height of both the alveolar crest and the gingival margin.[1]

Rodent Species With Anelodont Cheek Teeth

Every pattern of incisor malocclusion, from mild to severe, can be encountered in rat-like rodents.[1,3] The most common pattern of maloccluded incisor teeth is slightly elongated or fractured mandibular and maxillary incisors curved toward the palate. Secondary lesions of the lips, tongue, and palate can be present, even with perforation of the hard palate and subsequent oral-nasal fistulas.

Squirrel-like rodents (e.g., prairie dog, citellus) often present with different patterns of fractures of incisor teeth. The fracture can occur somewhere along the clinical crown, resulting in a visibly shortened tooth or teeth, or along the reserve crown, under the gum line. In this case the affected tooth appears loose. A common disease in captive prairie dogs is pseudo-odontoma, a dysplastic disease that affects the apexes and the reserve crowns of incisor teeth, particularly the maxillary incisors (Figs 12 and 13).[5,8,9,10] The pathophysiology has been described above, and, as eruption is arrested, the apposition of new dentine results in a space-occupying mass leading to nasal obstruction. A typical firm swelling of the hard palate is visible intraorally because of deformation of the apex(es). Because this is not a true neoplastic disease, the former term "odontoma" is incorrect.[1,5] Fractures and dental caries of the cheek teeth are frequently reported in older patients.

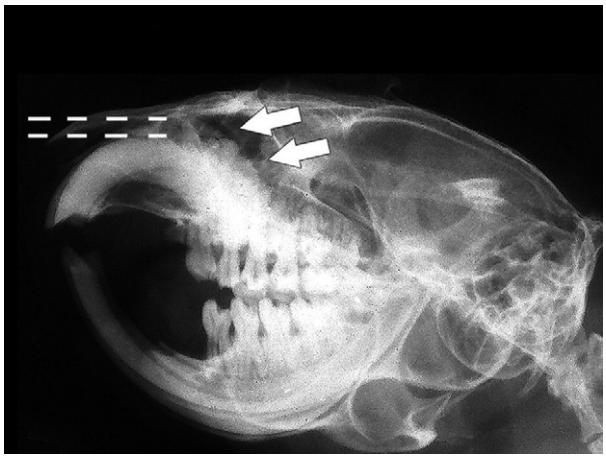

Figure 12. Radiograph demonstrating pseudo-odontoma of maxillary incisors in a prairie dog. The apex appears irregular and hyperplastic (*arrows*). The opening of the nasal cavities is reduced (*dotted lines*) and air flow is limited, resulting in dyspnea and sneezing. Reprinted from: Capello V: Incisor extraction to resolve clinical signs of odontoma in a prairie dog. Zoological Education Network (2002), with permission.

Prognosis of Dental Disease

The goal of dental disease treatment is restoration of the patient's dental health and anatomy, returning it to normal if possible. In many cases, complete restoration is not feasible, and owners must be aware that a reasonable goal can be palliative only or simply management of dental disease. For more severe clinical cases, euthanasia is a humane, reasonable option.

As a general consideration, prognosis for dental disease in rodent species is more guarded than in rabbits. Nevertheless, because there are so many species with so many different pathologic patterns, prognosis must be formulated for every single case or species.

Unless the patient is presented in very poor general condition, prognosis for the treatment of dental malocclusion of cheek teeth in guinea pigs is fair to good. Malocclusion of incisor teeth is usually addressed as a consequence, and extraction is rarely needed. Herbivorous rodent species can adapt well to extraction of incisor teeth, although not as readily as rabbits, because rodents tend to use the incisors for chewing to a larger degree than rabbits. Unlike rabbits, though, guinea pigs may not improve immediately after a dental treatment because of stretching of the masticatory muscles and associated pain and inflammation. Patients that do not immediately return to eating may not wear teeth down to the degree required to prevent repeated overgrowth. These patients may require additional dental treatment until the soft tissues heal and the patient is able to eat enough high-fiber food to allow normal wearing.

The key for prognosis in chinchillas is related to the stage of dental disease when a diagnosis is made. As mentioned above, severe to end-stage dental disease is frequently diagnosed at first presentation. In most cases, repeated dental treatments provide only palliation because effective restoration of dental anatomy to normal is not possible. Gingival proliferation appears to be associated with increased discomfort and a more guarded prognosis. Conversely, as in rabbits but unlike guinea pigs, chinchillas tolerate advanced dental disease remarkably well. Extraction of incisor teeth in chinchillas can be performed, but the indication is much less frequent than in rabbits.

Prognosis for pseudo-odontomas in prairie dogs is guarded to poor and related to many factors, including the stage of disease at the time of diagnosis, whether disease is monolateral or bilateral, the impact of the disease on the respiratory tract, and overall patient condition. Prognosis for end-stage dental disease of cheek teeth is always poor.

Dental disease of smaller rat-like or squirrel-like rodents carries a fair prognosis that presents with cases of uncomplicated malocclusion of incisor teeth. Prognosis for diseases related to cheek teeth is guarded to poor because of patient size and the difficulties associated with the surgical approach needed to treat the problem.

Specialized Equipment for Diagnosis and Treatment of Dental Disease

Oral inspection and treatment of dental disease in rodents require specialized equipment.[1,3] Most den-

Figure 13. Deformation of the apexes of maxillary incisors can produce visible swellings of the hard palate. Note the asymmetrical hard palate associated with a pseudo-odontoma of the left maxillary incisor tooth in this prairie dog.

tal instruments described elsewhere for rabbits are useful for rodents. The "table top mouth gag and restrainer" is useful for guinea pigs, chinchillas, prairie dogs, rats, and degus, and is much easier to use than traditional mouth gags, which are difficult to keep in place because of the smaller patient size. Smaller, modified "open blade" cheek dilators are available and are much more effective than those used in rabbits because they provide an effective hold on cheek margins and inner mucosa. This is especially true for guinea pigs, where the well-developed buccal folds complicate the positioning of the traditional "flat wing" cheek dilator.

Appropriately contoured needles are used for extraction of incisor teeth and are shaped to match the size and curvature of the tooth. A rotating dental unit with a straight hand piece as described for rabbits is used in rodents as well, with the addition of smaller metal or silicon burrs. The rigid endoscope is very useful to confirm adequate burring of smaller teeth and for a complete examination of the oral cavity.[1]

Treatment of Dental Disease

Medical therapy is an important adjunct to dental correction or even surgical treatment of dental disease. The three key points for success with medical treatment are the use of antibiotics to control local infection and reduce the risk of systemic complications, the administration of analgesic drugs, and general supportive therapy for debilitated patients both before and after dental treatments. Established or potential toxicity of common antibiotics in rodent species should be considered and owners informed of the medical concerns related to antibiotic therapy being administered to their animal.

Treatment of Dental Disease in Porcupine-like Rodents

Coronal reduction of incisor teeth is usually performed in conjunction with dental treatment of cheek teeth.[1,3,5] Shortening of clinical crowns should never be performed without complete inspection and evaluation of the cheek teeth. Reduction of the length of the crowns of incisors is performed with high-speed dental equipment, because cutting instruments pose an unacceptably high risk of iatrogenic damage, in particular fractures of the clinical or reserve crowns.

Extraction of incisor teeth is rarely indicated in guinea pigs but is slightly more frequent in chinchillas. The technique is similar to that described in rabbits, and 21 gauge-contoured needles are used as dental elevators.[1,17] Hemostatic clamps or small needle holders can be used as extraction forceps.

Occlusal adjustment of cheek teeth in guinea pigs should be performed with the tip of a delicate, slightly abrasive bur. The goals for occlusal adjustment are to shorten the elongated clinical crowns and restore the proper oblique occlusal plane, which is a critical aspect of treatment in this species. Coronal reduction of the maxillary cheek teeth of chinchillas to normal length may be difficult to impossible because of concurrent elongation of the gingival margin. Adjustment can be performed to the level of the gingival margin, but additional reduction may require gingivectomy.[1]

Because of the normal curvature of cheek teeth in guinea pigs, extraction is virtually impossible, unless the tooth is loose secondary to periodontal infection. Unfortunately, diseased teeth fracture easily, making complete extraction extremely difficult, and the same holds true for mandibular cheek teeth of chinchillas, despite the fact they are less curved than those of the guinea pig. Successful extraction of maxillary cheek teeth is more likely than that of mandibular cheek teeth. The extraoral approach for extraction of cheek teeth as described for rabbits is possible but much more difficult because of decreased patient size.

Treatment of Dental Disease in Prairie Dogs

Different surgical techniques have been reported for the treatment of pseudo-odontoma in prairie dogs.[1,5,8,9,10]

Anesthesia for this dental procedure is challenging, because the disease itself hampers normal respiration. Endotracheal intubation may be difficult even with the endoscopic over-the-top technique,[16] and proper location of the tube can interfere with the dental procedure itself. For this reason, temporary tracheostomy for intubation is a viable alternative.

The goal of primary treatment is extraction of the affected maxillary incisor tooth or teeth, which is extremely challenging in this species. Mandibular incisors can be extracted during the same surgery, or a second procedure can be delayed to shorten anesthesia. The goal of palliative treatment is restoration of sufficient air passage without extraction of the diseased teeth. Extraction of incisor teeth through an extraoral approach is similar to that described for rabbits. Diseased teeth are elevated carefully from surrounding alveolar bone and carefully extracted to prevent the most common complication, fracture of the tooth, which represents treatment failure. In these cases, an

intraoral, transpalatal approach to the apexes should be considered. The palatal mucosa is incised, dissected from the surrounding bone, and saved for the final suture. The palatine bone is cut or burred to access the ventral portion of the incisive bone. Bleeding is a concern and can be controlled with cotton tips or with a radiosurgery unit. When the apical fragments are removed, the palatal mucosa is sutured. The development of an oral-nasal fistula is a possible postoperative complication when suture of the palatal mucosa is not feasible, or in case of dehiscence. An alternative to the transpalatal exposure is the dorsal rhinotomy approach to the apical mass.[9] Depending on the case, the apical mass can be removed entirely or simply debulked. A bilateral, lateral approach has been also described to treat pseudo-odontoma in prairie dogs.

Palliative treatment by dorsal rhinostomy and positioning of a tubular stent can be considered when radiographs or computed tomography evaluation reveals the maxillary incisor teeth are fractured, or when the preoperative plan is to minimize risks related to anesthesia and surgical treatment.[9] It should be considered that this surgical option does not stop the dysplastic process. Depending on the clinical case, the rhinostomy site can be slightly more caudal if the goal is simply to enter the rhinal cavity immediately dorsal to the apical mass or more rostral if the goal is to angle the stent and make it pass beyond the pseudo-odontoma. The skin is incised with a linear incision or with a biopsy punch, because the rhinostomy site and the stent opening will be round. Rhinostomy of the nasal bones is performed with a 2.5-mm or 3-mm intramedullary pin, and the nasal cavity is exposed. A plastic catheter is cut to proper length and inserted into the nasal cavity, just dorsal to the mass if the goal is to keep the rhinostomy site open, or beyond the pseudo-odontoma to maintain a larger airway passage. A few weeks postoperatively, the stent can be removed or exchanged for a smaller one to keep the skin from closing over the bony rhinostomy opening. Postoperative management of the rhinostomy site includes removal of mucus and debris. Complications and long-term follow-up have not been reported for this procedure.

Treatment of Dental Disease in Rat-like Rodents

Extraction of incisor teeth is performed with careful dissection of the periodontal ligament with small (25 gauge) contoured needles.[1,3] The most common complications are fracture of the maxillary incisor teeth or diastasis of the mandibular symphysis. Inadvertent symphyseal fracture has been anecdotally treated successfully in the hamster by simply suturing the rostral hemimandibles together with 4-0 or 5-0 absorbable sutures.

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