EXOTIC COMPANION MAMMAL DENTAL DISEASE: STANDARDS OF CARE

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TERMINOLOGY

- **Herbivorous rodent:** Refers primarily to the guinea pig and chinchilla in these notes
- **Elodont:** Continuously growing teeth that do not develop anatomic roots (also called aradicular as in the incisor and cheek teeth of the rabbit, guinea pig, and chinchilla)
- **Hypsodont:** Long-crowned teeth
- **Anelodont:** Teeth with a limited period of growth
- **Brachydont:** Short-crowned teeth
- **Peg teeth:** A much smaller second pair of maxillary incisors that lie directly behind the visible maxillary incisors.
- **Cheek teeth:** Includes all the premolars and molar teeth, which are visually indistinguishable.
- **Clinical crown:** Exposed portion of the tooth above the gingival margin
- **Reserve crown:** In a hypsodont tooth, the part of the crown below the gingival margin
- **Root:** For the rabbit the embedded reserve crown of aradicular hypsodont teeth is often referred to (improperly) as the "root"

RABBIT DENTAL DISEASE

Dental formula: 2I 0C 3P 3M = 28
1I 0C 2P 3M

Numerous writings on rabbit dental disease have been published in the past decade, with entire texts [*Rabbit and Rodent Dentistry* 2005] and journals [*Journal of Exotic Pet Medicine* 2008; 17(2)] being devoted to the subject. Rabbits and strictly herbivorous rodents (ie, guinea pigs, chinchillas, degus) have continuously growing incisor and cheek teeth making them susceptible to dental developmental problems or acquired dental disease (ADD) throughout their lives. ADD is most commonly associated with dental arcade malocclusion resulting from trauma, inappropriate diet, or metabolic bone disease. Trauma, commonly resulting from falls or drops, may cause fractures to the teeth or jaw bones that result in arcade displacement that may lead to future abnormal tooth growth and wear. The most common cause of ADD is dietary related. Elodont teeth are worn during normal chewing activity, effectively reducing the length of the clinical crown and allowing the reserve crown to replace the worn portion.[1] This feature allows the rabbit to continuously replace the occlusal surface of the teeth when fed free-choice grass hay, which stimulates this prolonged chewing. Alternatively feeding a diet of pellets and grains alone fails to stimulate the full chewing action and jaw movement necessary to prevent acquired dental disease. Metabolic bone disease associated with a poor diet and inadequate calcium, vitamin D and natural sunlight has also been incriminated as a cause of ADD leading to malocclusion.[3] Feeding diets with inappropriately high phosphorus content or insufficient calcium content (< 2:1 Ca:P), such as grain-based diets, will lead to ADD. Feeding a diet consisting predominately of hay, commercial pellets and fresh leafy greens (not for chinchillas), will results in an overall appropriate calcium to phosphorus ratio (~2:1). Acquired dental disease most commonly manifests as uneven tooth growth and wear (step mouth) or painful molar spurs or points. Either of these conditions will result in oral pain, increased salivation, decreased food intake or dysphagia and general loss of condition. Overgrowth and elongation of the clinical crown may be accompanied by elongation of the reserve crown and extension of the tooth apices into the periapical tissues (apical elongation). This can lead to palpable swellings on the ventral surface of the mandible. Epiphora and conjunctivitis develop when the nasolacrimal duct becomes compressed secondary to apical elongation of the maxillary cheek teeth or incisor teeth.

A variety of special instruments have been designed to enhance visualization of the oral cavity and aid in treatment of dental disease in rabbits and rodents. The rabbit and herbivorous rodent oral anatomy including the fleshy tongue, buccal skin folds, a long and narrow oral cavity and caudally placed cheek teeth make a complete intraoral examination of the non-anesthetized patient impossible. When history and physical examination findings suggest dental disease, general anesthesia for thorough oral examination is indicated. General loss of condition, decreased appetite, digestive disturbances and ocular discharge may all be associated with dental disease in these species. The authors find the following invaluable in assessing and treating dental disease in the rabbit, guinea pig and chinchilla:

- Skull radiographs, preferably 6 views that evaluate lateral, ventrodorsal, dorsoventral, rostrocaudal, and right and left lateral oblique projections, in order to more critically assess the teeth and jaw bones.
- If available, a CT scan of the head is preferred to skull radiographs because CT allows for detailed evaluation of the teeth and surrounding bone without the summation effects seen on skull radiographs. In addition, a complete evaluation of the retrobulbar space, middle ears, and nasal cavities is possible and provides valuable information.
- To aid in the visualization of the teeth use specialized dental tools such as the mouth gag, inserted between the incisor teeth in order to open the mouth from top to bottom, and cheek dilators that have spatulated wings that open the mouth from side to side with a spring action.
- The use of a rigid endoscope of video-otoscope is highly recommended for intraoral examination. Endoscopy (stomatoscopy) provides focal illumination, magnification, and allows for documentation of normal and abnormal findings, which will aid in client education and medical record keeping. Using an endoscope for intraoral exams will reduce the risk of missing intraoral disease, in particular in chinchillas periodontal disease

and buccal spurs of the last two maxillary cheek teeth can be easily missed if no endoscopy-guided intraoral examination is performed.

- Many veterinarians prefer to use a specially designed dental platform, the rodent dental table (table-top mouth gag), which allows hands-free elevation of the head and opening of the mouth.
- A stainless-steel spatula or a split wooden tongue depressor, used to move oral soft tissues, allows for visual assessment of the premolars and molars and protects the oral mucosa and tongue
- A high-speed dental drill is the preferred method of trimming or filing of overgrown incisors, in order to properly shape and contour teeth with minimal damage to the reserve crown located below the gum line. Alternatively a low-speed handpiece with a diamond disk cutter can be used.
- A low speed hand-piece straight nose cone (1:1) attachment is available and serves as a great tool for the atraumatic adjustment of overgrown cheek teeth, if combined with a diamond bur tip and a soft-tissue protector.
- For oral surgery and advanced dental procedures rabbit intubation is preferred in order to prevent aspiration of oral fluids associated with these procedures.
- In rabbit oral surgery where endotracheal intubation may interfere with visualization and access some practitioners will consider nasal intubation or TIVA (total intravenous anesthesia) with alfaxalone (0.5-1 mg/kg slow IV to effect) **after** premedicating with midazolam (0.5mg.kg), an opioid, low dose ketamine (7 mg/kg) +/- dexmedetomidine (2 µg/kg).[4,5]
- Use of local anesthetic dental blocks with approaches extrapolated from those used in dogs and cats and a knowledge of rabbit skull anatomy. One of the authors (PF) use faster-onset 2% lidocaine mixed with slow-onset, longer duration of action 0.5% bupivicaine at a rate of 1 mg/kg body weight for each drug and dilutes with saline to a final volume of 1 mL.
- Elongation of the incisors has 3 main causes: decreased gnawing due to poor diet or lack of suitable chewing substrate (this applies more to the herbivorous rodents than to rabbits), trauma that results in misalignment, or faulty genetics that results in dolicognathia or brachygnathia.[6] Husbandry and dietary changes along with trimmings at regular intervals may control all three causes. Extraction of the incisor teeth is recommended for long-term resolution of persistent incisor malocclusion in rabbits and herbivorous rodents.
- Periapical infection with abscessation and osteomyelitis requires aggressive and prolonged therapy. The authors have found the following to be the key to long term resolution; extract all diseased teeth associated with the abscess, thoroughly debride necrotic and infected jaw or skull bone tissue, when possible; marsupialize abscess to facial skin and treat as an open wound. Pack marsupial site gauze strips impregnated with antibiotics,[7] preferably based on bacterial culture and antibiotic sensitivity and the proclivity of anaerobic bacteria.[8] Change packing and flush daily or every other day until healing and wound granulation and contracture occur. If marsupial site healing is delayed use medicinal grade honey to pack marsupial site and discourage local infection.[9,10]
- Periapical abscesses involving the maxillary cheek teeth (PM3-M3) may result in osteomyelitis and penetration of the alveolar bulla an anatomical space between the orbit and the thin cortical bone of the maxilla. Retrobulbar abscessation may occur and presents a therapeutic challenge. Retrobulbar abscesses in rabbits can be successfully treated without the need of enucleation, by removal of the involved maxillary cheek teeth to allow for drainage followed by systemic antibiotic therapy.
- Facial dermatitis as a result of chronic epiphora secondary to dacryocystitis is not uncommon in the rabbit. Many times this is in association with an elongated incisor or 3rd or 4th upper cheek tooth reserve crown or incisor teeth and blockage of the nasolacrimal system. In rabbits a topical ophthalmic anesthetic can be applied and in the sedated patient a 23-gauge (0.64 mm) lacrimal canula, or 22- to 24-gauge intravenous catheters can be used to cannulate the punctum lacrimale, located in the ventral lid margin several millimeters from the medial canthus, for gentle flushing with saline. This will help remove purulent debris and possibly relieve any blockage. This same cannulation technique can be used to infuse iodine-based contrast media in order to perform a contrast study to confirm severity of the blockage and aid in prognosis and long-term management.

GUINEA PIG AND CHINCHILLA

Dentition: Elodont, hypsodont
Dental formula: 1I 0C 1P 3M = 20
1I 0C 1P 3M

Like the rabbit, the guinea pig and chinchilla are also true herbivores and benefit from a diet rich in abrasive foods (such as grass hays) which stimulate the prolonged chewing that keep the cheek teeth in wear. The length of the clinical crown is worn through this normal chewing action. Malocclusion and elongation of cheek teeth may also result from an abnormal incisor relationship or anisognathia[6] (variation in width between maxillary and mandibular dental arcade). In the guinea pig the cheek teeth occlusal planes are at an angle of about 30 degrees to the horizontal plane, whereas this occlusal surface is nearly horizontal in the chinchilla. Cheek tooth clinical crown elongation as described above in the rabbit is also commonly seen in the guinea pig and chinchilla as the result of insufficient tooth wear. Sharp enamel points or spurs on the buccal and lingual surfaces of the maxillary and mandibular cheek teeth respectively, can cause mucosal irritation, ptyalism, and oral pain.[2] In addition, guinea pigs may suffer from marked overgrowth of the cheek teeth which often lead to inability to fully close the mouth, rostral displacement of the lower jaw, and weight loss. The mandibular premolar teeth often grow across and trap the tongue in guinea pigs.

Apical elongation of the reserve crown tends to be less severe in the guinea pig, but is not uncommon in the chinchilla. In the mandible the apical elongation causes the tooth to impinge on the ventral cortex, which

induces bone remodeling resulting in palpable swellings in the ventral mandible. The swellings may be painful. Maxillary apical elongations may extend into the nasal cavity or orbital bones and may cause pain, nasal and/or ocular discharge and epiphora. Periodontal disease, tooth resorption, and caries are very common in middle-aged or older chinchillas and can be easily missed. Diagnostic imaging of the skull (radiographs or CT) will help detect resorptive tooth lesions of the reserve crowns. Stomatoscopy (endoscopy) for intraoral examination and dental treatments is highly recommended in order to detect and effectively treat periodontal disease in chinchillas.

HAMSTER AND RAT

Dentition: Elodont, hypsodont incisors; anelodont brachydont molars
Dental formula: 1I 0C 0P 3M = 16
1I 0C 0P 3M

The most common dental problem seen by the authors in these species is malocclusion and subsequent overgrowth of the incisor teeth. This overgrowth is usually related to primary congenital deviation or acquired as the result of trauma that may result from the constant chewing of cage bars and tooth fractures which can interfere with normal tooth eruption.[1] Overgrown incisors can be intermittently trimmed and filed with a high speed dental drill. As this is a chronic recurring problem some clinicians choose to extract the incisors for long-term resolution. In older animals disorders of the brachydont cheek teeth can, and include periodontal disease, tooth resorption and tooth fractures.

FERRET

Eruption of permanent teeth is normally completed between 42-77 days after birth.[11]

Adult dental formula: 3I 1C 3P 1M = 34
3I 1C 3P 2M

Domestic ferrets are commonly used as animal models for research of human oral conditions. One study[12] evaluated the prevalence of oral pathology in rescued ferrets with oral examination being performed on 63 ferrets, of which 49 underwent general anesthesia for further examination. The most common clinical findings included malocclusion of mandibular second incisor teeth (95.2%); extrusion[1] of canine teeth (93.7%); and abrasion and attrition of teeth (76.2%). Tooth fractures were exclusively associated with canine teeth and found in 31.7% of ferrets. Pulp exposure was confirmed in 60.0% of fractured teeth. The normal gingival sulcus depth measured less than 0.5 mm in 87.8% of anesthetized ferrets. Clinical evidence of periodontal disease was present in 65.3% of anesthetized ferrets (gingivitis or probing depths >0.5 mm), although advanced periodontal disease (ie, periodontal pockets > 2 mm or stage 3 furcation exposure) was not found upon clinical examination. There was no evidence of tooth resorption, dental caries, stomatitis, or oral tumors in the examined group of ferrets.

The authors' experience with ferret dental disease agrees with the findings in this study. Lingual displacement of the mandibular second incisor teeth is a common "malocclusion" in the ferret is not associated with clinical discomfort and may be a normal anatomic variation. The high incidence of canine tooth fractures in the ferret may be the result of abnormal chewing behavior exacerbated by cage confinement and the resulting chewing on wire mesh. Environmental enrichment may reduce the incidence of this self-trauma behavior. Oral tumors are uncommon in the ferret, but oral squamous cell carcinoma and odontoma have both been diagnosed in the author's practice. As well, the author has occasionally diagnosed resorptive neck lesions involving both the maxillary and mandibular premolars.

In the ferret, professional dental cleaning, including supra- and subgingival ultrasonic scaling and polishing of teeth, extractions, and dental radiographs are all performed in a similar fashion as the dog and cat. Also similar to dogs and cats, complicated tooth fractures in ferrets can lead to pulpitis and pulp necrosis with possible periapical infection. Worn and fractured teeth without pulp exposure may also be at risk of endodontic disease[12] with affected ferrets showing signs of discomfort. The treatment of choice for complicated crown fractures is endodontic treatment or extraction. Open extraction procedures are similar to the dog and cat (ie, mucoperiosteal flap creation, partial aveolectomy, elevation of the tooth, and closure of the extraction site), keeping in mind that the oral mucosa of the ferret is extremely thin necessitating gentle handling of flap tissue.

AFRICAN PYGMY HEDGEHOGS

Adult dental formula: 3I 1C 3P 3M = 36
2I 1C 2P 3M

African pygmy hedgehogs have anelondont and brachydont teeth and are omnivorous. Middle-aged and older hegehogs are frequently diagnosed with periodontal disease and dental disease. A complete intraoral examination requires general anesthesia or sedation. Calculus, periodontal disease, gingival recession, and tooth fractures are common. Treatment follows standard techniques like in other brachydont species.

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[1]Tooth extrusion was defined as supragingival positioning of the suspected cementoenamel junction (junction of the conical and cylindric portions of the tooth) with exposure of up to 3 mm of the cylindric portion of the tooth in the absence of gingival recession. This may be explained either by idiopathic tooth extrusion similar to that seen in domestic cats, or may represent a normal anatomic variation in the ferret.

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