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Diagnostic Imaging in Veterinary Dental Practice

In collaboration with the American Veterinary Dental College

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History and Physical Examination Findings

A 9-year-old 43.1-kg castrated male mixed-breed dog was presented for evaluation of an irregular maxillary premolar tooth that the owner had noticed 2 months earlier. The dog's appetite was unchanged, and no signs consistent with oral pain had been observed. The dog's referring veterinarian reported a history of generalized mild gingivitis and calculus, although the dog had not received any previous dental treatments.

Abnormalities on general physical examination included a body condition score of 7/9 and 3 subcutaneous masses all previously diagnosed as lipomas. Results of the extraoral examination were unremarkable. The intraoral examination revealed halitosis, generalized gingivitis and calculus, a fracture of the left maxillary fourth premolar tooth, marked gingival recession of the right maxillary third premolar tooth, and abrasions to multiple crowns. Further evaluation and treatment under general anesthesia were recommended.

Results of a preanesthetic CBC and serum biochemical profile were unremarkable, with the exceptions of high aspartate aminotransferase activity (54 U/L; reference range, 14 to 51 U/L), high cholesterol concentration (381 mg/dL; reference range, 138 to 332 mg/dL), and high creatine kinase activity (785 U/L; reference range, 48 to 261 U/L). The patient was anesthetized, a complete oral examination was performed, and full-mouth radiographs were obtained with size 4 films and the use of bisecting angle and parallel techniques. The following abnormalities were noted on clinical and radiographic findings: an uncomplicated crown-root fracture of the left maxillary fourth premolar tooth, stage 3 furcation and stage 3 mobility of the right maxillary third premolar tooth with gingival recession and > 50% horizontal bone loss, mild abrasions to multiple crowns, and a sulcular probing depth of 4 mm at the mesial aspect of the left mandibular first molar tooth. An image of the left mandibular first molar tooth is provided **(Figure 1)**.

Formulate differential diagnoses, then continue reading.

Figure 1—Intraoral radiographic view of the left mandibular first molar tooth of a 9-year-old 43.1-kg castrated male mixed-breed dog. The image was obtained with the parallel technique.

Diagnostic Imaging Findings and Interpretation

Dental radiography revealed a unilocular, scalloped, 5 X 6-mm radiolucency at the apex of the mesial root of the left mandibular first molar tooth **(Figure 2)**. The margins were well-defined, the interior opacity was uniform, and no displacement of surrounding structures was observed. Loss of the periodontal ligament space was noted around the apex of the mesial root. Vertical bone loss of 4 mm was observed along the mesial aspect of the tooth's mesial root. Abrasions to the occlusal surfaces of the middle and mesial cusps were also appreciated. To further investigate this radiolucency, a second radiograph was taken with the cone set approximately 30° caudal to the original parallel projection.

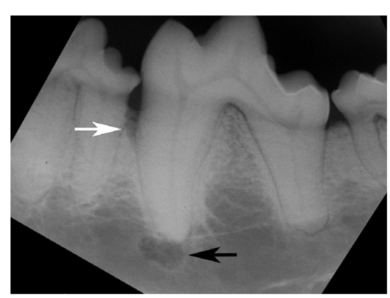

Figure 2—Same radiographic view as Figure 1. A lucency is visible at the apex of the mesial root (black arrow). Vertical bone loss is associated with the mesial aspect of the mesial root (white arrow).

The second intraoral radiograph revealed a unilocular, spherical, 4 X 4-mm radiolucency rostral to the tooth's mesial root **(Figure 3)**. The periodontal ligament appeared intact, but bone loss along the mesial root was now obscured by superimposition

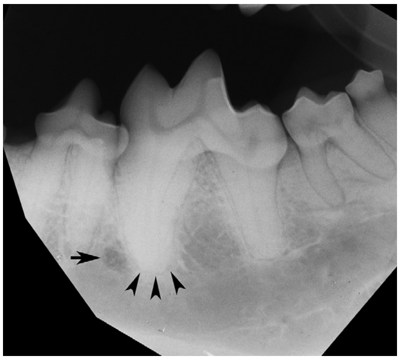

Figure 3—Radiographic view of the left mandibular first molar tooth obtained with an oblique angle technique. The lucency in Figures 1 and 2 can be seen located dorsorostral to the mesial root apex (arrow), and the root's periodontal ligament is clearly intact (arrowheads).

with the distal aspect of the right maxillary fourth premolar tooth. Abrasions to the occlusal surfaces of the middle and mesial cusps were also less evident.

The radiolucency evident on the first radiograph was suggestive of apical periodontitis. However, there were no other clinical or radiographic signs indicative of pulp inflammation or necrosis. The disparity between the initial radiographic and clinical findings necessitated further investigation; therefore, the second image was obtained with an oblique cone angle to determine whether the lesion was truly associated with the root apex or the 2 structures were merely superimposed. In the second image, the radiolucency was observed adjacent to the tooth root, and the previously obscured periodontal ligament was clearly intact. As a result, the radiographic findings indicated that the lesion was not consistent with apical periodontitis. Differential diagnoses that were considered included another type of odontogenic cyst, a nonodontogenic cyst, neoplasia, and an anatomic anomaly.

Treatment and Outcome

The right maxillary third premolar tooth was removed with extraction forceps, following creation of an envelope flap. Given the degree of alveolar bone loss and mobility, no elevation or luxation was necessary. Alveolectomy was performed with a round diamond-tip bur, and the gingiva was apposed with 5-0 poliglecaprone 25 suture in a simple interrupted pattern. Gingivectomy was performed on the left maxillary fourth premolar tooth with a No. 15 scalpel blade to expose the ventral extent of the fracture. Gingivoplasty was then performed over the incised gingiva with a round diamond-tip bur.

Because findings on the second radiograph were not consistent with endodontic abnormalities, there was < 50% attachment loss and no mobility, and no furcation exposure was present, the left mandibular first molar tooth received no specific treatment. All teeth were ultrasonically scaled and polished supra- and subgingivally. A recheck appointment was recommended after 2 to 4 weeks to examine the extraction and gingivectomy sites. A follow-up examination at 6 to 12 months was recommended to reassess the mandibular radiolucency.

The patient was readmitted 18 days later for a recheck of the right maxillary third premolar tooth surgical extraction site. Intraoral examination revealed a healed gingival flap with a small amount of suture material still present and resolution of the dog's gingivitis. The owner was informed that the dog could return to its normal diet and activities. No appointment to recheck the mandibular radiolucency was made at that time, and the patient was lost to follow-up.

Comments

The present report emphasizes the value of obtaining additional dental radiographic views when the findings of standard dental radiographic views are not clear. In particular, this report illustrates that when clinical findings disagree with findings of standard radiographic imaging, supplemental images obtained at nontraditional angles may provide valuable additional information. A solid foundation of intraoral imaging techniques and equipment allows practitioners to bend the rules when standard approaches leave questions unanswered. In this case, a combination of parallel and oblique tube angles ruled out the suspected diagnosis of apical periodontitis in a mandible with a lucent defect.

Anomalous mandibular radiolucencies have been described in humans and animals and are primarily cystic or neoplastic in nature.[1] Oral cysts are further divided into odontogenic and nonodontogenic categories, and their etiologies may be developmental, inflammatory, traumatic, or neoplastic.[1] However, nonodontogenic cysts have not yet been described in the veterinary literature. Odontogenic cysts arise from islands of odontogenic epithelium in the bone and periodontal ligament and were first described in dogs in 1992.[1,2] In a retrospective study of canine odontogenic cysts by Verstraete et al,[3] the most common bone cysts observed were dentigerous cysts and canine odontogenic parakeratinized cysts (71% and 22%, respectively, of all cysts), followed by radicular cysts and lateral periodontal cysts. Since that study was published, 2 new odontogenic cysts—canine furcation cysts and keratinized odontogenic cysts—have been described in dogs.[4,5]

Dentigerous cysts are developmental and occur when fluid collects between the crown of an unerupted tooth and the enamel epithelium, resulting in dilation of the tooth follicle.[2,6] Canine odontogenic parakeratinized cysts arise around the roots of normally erupted, vital maxillary teeth, leading to variable amounts of expansion and tooth displacement; their pathoetiology is unknown.[3] Radicular cysts are inflammatory and occur at the apex or lateral root of a nonvital tooth when pulpal inflammation and necrosis lead to a periapical granuloma, which osmotic pressure then converts into a cyst.[2,6] Canine furcation cysts are also inflammatory, have only been described in the furcation region of the maxillary fourth premolar teeth, and have all been associated with a visible swelling of the buccal alveolar mucosa.[4] Considering the specific characteristics of the preceding cysts, they were ruled out as differential diagnoses in our patient.

Lateral periodontal cysts are developmental and arise from the epithelial rests of the dental lamina.[3,6] These cysts are typically located between the roots of vital teeth, appearing as unilocular, well-corticated lesions.[3,6] Keratinized odontogenic cysts are lined with heavily ortho- or parakeratinized stratified squamous cell epithelium, whereas all other cysts have nonkeratinized epithelial linings.[5] These cysts can be unilocular or multilocular and well or poorly circumscribed, and have variable degrees of luminal radiolucency. Furthermore, they may be associated with unerupted teeth or the roots of nonvital teeth, or with sites of previous tooth extractions.[5] Given their heterogeneity, it is unclear whether keratinized odontogenic cysts are a distinct condition or simply a keratinized variant of other odontogenic cysts.[5] Lateral periodontal cyst, keratinized odontogenic cyst, and neoplasia (or neoplasm) were the primary differential diagnoses for our patient.

Odontogenic cysts and tumors both have the potential to undergo metastatic transformation,[1] and many odontogenic tumors have a cystic appearance.[3] As a result, it is not always possible to differentiate between these 2 conditions on the basis of clinical examination and imaging findings, particularly in the early stages when intervention is most beneficial. According to Verstraete et al,[3] 45% of the lesions observed were incidental findings, further underscoring the importance of radiography as part of a routine intraoral examination. Any suspicious mandibular cystic lesion should be monitored closely for growth; however, because so many cystic lesions are incidental findings, it is possible that some may never cause any clinical signs. Regardless, when dental radiographic findings appear to be benign or are identified as incidental findings, they should be closely monitored to ensure the appropriate, timely treatment of dental patients.

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