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Diagnostic Imaging in Veterinary Dental Practice

In collaboration with the American Veterinary Dental College

History and Physical Examination Findings

A 16-month-old 35.0-kg castrated male mixed-breed dog was referred for progressive right maxillary swelling. The dog had been adopted 12 months earlier and had a history of maxillofacial trauma and resolved distemper virus infection. The owner reported that the dog was otherwise healthy.

The general physical examination did not reveal any clinically important abnormalities. Oral examination revealed numerous visibly missing teeth, including all canine teeth. There was marked right maxillary swelling associated with the visibly absent right maxillary canine and first premolar teeth. There was relative maxillary brachygnathism, which did not result in soft tissue trauma. Most of the remaining teeth appeared small compared to the dog's size. In addition, they were abnormally shaped and had evidence of severe, shallow, brown enamel defects consistent with a clinical diagnosis of enamel hypoplasia. Lastly, generalized severe plaque and calculus accumulation associated with moderate gingivitis and halitosis were noted.

Preoperative hematologic results were within reference limits. The dog underwent general anesthesia for cone-beam CT (CBCT; 5G CT imaging system; NewTom) of the skull with a field of view of 18 X 16 cm, scan time of 24 seconds, and slice thickness of 250 µm **(Figure 1)**.

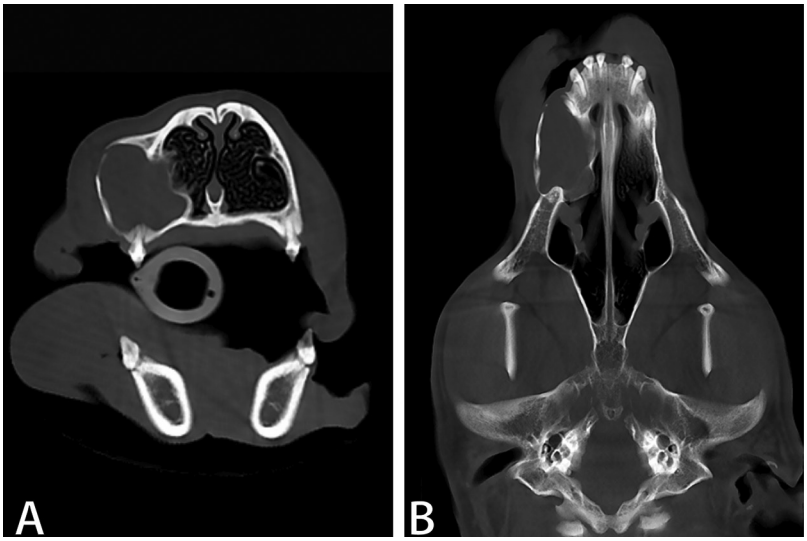

Figure 1—Transverse (A) and dorsal (B) plane reconstructed cone-beam CT (CBCT) images of the skull of a 16-month-old 35.0-kg castrated male mixed-breed dog with progressive right maxillary swelling. The dog's right side is toward the left in both images.

Formulate differential diagnoses, then continue reading.

Diagnostic Imaging Findings and Interpretation

On CBCT, the right maxillary canine and first premolar teeth were associated with a large soft tissue expansion of the right maxilla from the level of the canine tooth to the third premolar tooth **(Figure 2)**. This structure was noted to thin the cortices of the maxilla, extending medially into the nasal cavity and focally deviating the right-sided nasal turbinates. Due to the lack of eruption and presence of vestigial teeth within this soft tissue expansion, a preliminary radiologic diagnosis of dentigerous cyst (DC) was made. In addition, generalized enamel and dentin defects with abnormally small roots consistent with generalized enamel, dentin, and root hypoplasia were noted. Collectively, these dental changes are referred to as odontodysplasia. All canine teeth and the mandibular first premolar teeth were odontodysplastic and embedded **(Figure 3)**. The maxillary canine teeth were mesioverted. The mandibular first molar teeth had severe root hypoplasia, and the roots of the remaining multirooted premolar and molar teeth were convergent, concrescent, or fused **(Figure 4)**.

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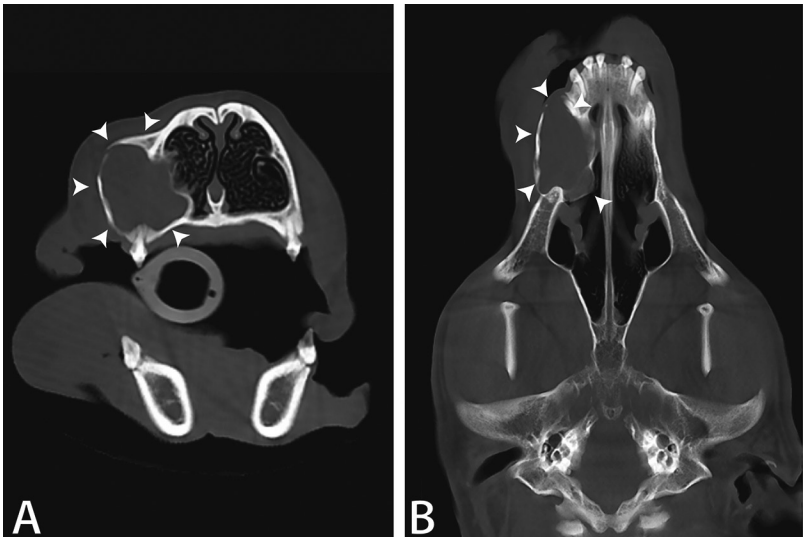

Figure 2—Same images as in Figure 1. There is a large soft tissue expansion (arrowheads) of the right maxilla from the level of the canine tooth to the third premolar tooth, consistent with a cystic structure.

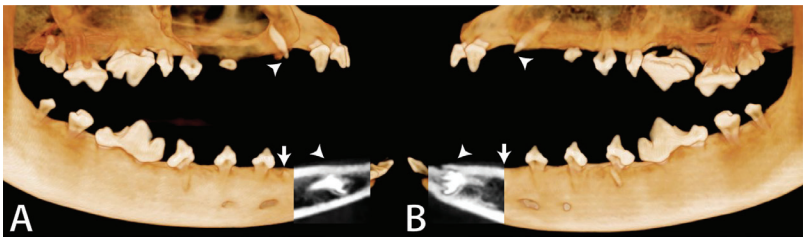

Figure 3—Right (A) and left (B) lateral perspective 3-D rendered CBCT images displayed in teeth mode with overlaying reconstructed sagittal plane CT image of a rostral section of each mandible of the dog described in Figure 1. All canine teeth (arrowheads) and the mandibular first premolar teeth (arrows) are odontodysplastic and embedded.

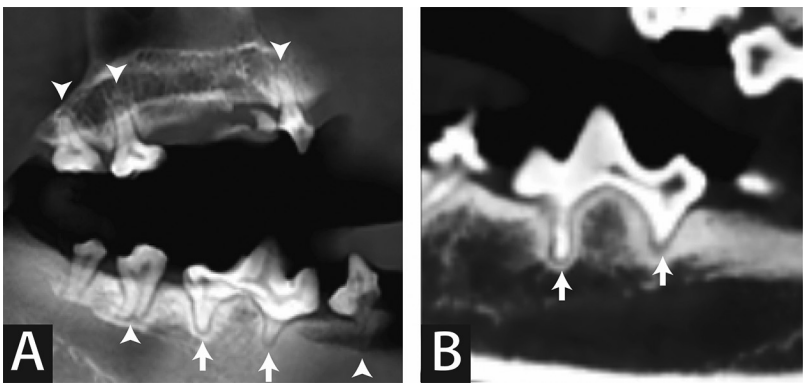

Figure 4—Sagittal plane CBCT images of right (A) and left (B) mandibular and maxillary teeth. The mandibular first molar teeth have severe root hypoplasia (arrows), and the roots of the remaining multirooted premolar and molar teeth shown here are convergent, concrescent, or fused (arrowheads).

Treatment and Outcome

Periodontal treatment was performed, followed by bilateral inferior alveolar and infraorbital nerve blocks with 0.5% bupivacaine solution followed by routine extractions of the right maxillary canine and first premolar teeth. The cystic cavity was drained and enucleated, and the distended bone was shaped and reduced to a relatively normal anatomic contour. Several other teeth were extracted due to either being embedded or having stage 3 mobility. Postoperative intraoral radiography confirmed that the alveoli of the extracted teeth were completely vacated. Ampicillin (20 mg/kg, IV) was administered perioperatively, and carprofen (2.2 mg/kg, IV) was administered once after surgery. Multimodal analgesic treatment was provided after surgery with tramadol hydrochloride (4.2 mg/kg, PO, q 8 to 12 hours for 5 days), gabapentin (8.6 mg/kg, PO, q 8 to 12 hours for 10 days), and carprofen (2.1 mg/kg, PO, q 12 h for 7 days). Histopathologic examination of the cyst sample confirmed a stratified squamous epithelial-lined cyst, consistent with a DC. Oral examination revealed healing of the extraction sites after 2 weeks. Three months later, the dog was reevaluated with CBCT, which revealed no evidence of recurrence of the DC and progressive bone remodeling. The owner was instructed to have the dog reassessed in 1 year.

Comments

In the present report, the use of CBCT combined with clinical evaluation led to the diagnosis of enamel hypoplasia, root hypoplasia, embedded dentition, and a DC. Enamel hypoplasia refers to a disturbance in the formation of a tooth leading to macroscopically visible defects in the enamel. Dentinal defects, or dentinal dysplasia, are characterized by abnormal dentin formation following the initial deposition of mantle dentin. This results in abnormally short or absent roots and a narrow pulp chamber (shell teeth).[1] Root hypoplasia has rarely been reported in dogs with severe enamel hypoplasia.[2–4]

Clinical and CBCT findings for the dog described in the present report were consistent with descriptions of odontodysplasia in humans. It is considered an abnormal development of enamel and dentin and is a sequela of genetic, infectious, and nutritional disturbances.[4] Distemper virus infection is reported as the most common cause of generalized enamel and dentin hypoplasia in dogs.[5] Other etiologies have also been suggested, including nonspecific bacterial and viral infection, nutritional factors, toxicoses, and trauma.[5] The reported history of distemper viral infection was consistent with clinical findings.

Odontogenic cysts are epithelium-lined structures that occur in the tooth-bearing areas of both jaws and are considered uncommon in domestic animals.[6] Odontogenic cysts reported in dogs and cats include DCs, periapical (or radicular) cysts, lateral periodontal cysts, odontogenic keratocysts, and canine odontogenic parakeratinized cysts.[7] Dentigerous cysts are the most prevalent odontogenic cyst in dogs.[6–7] Dentigerous cysts arise from proliferation of tissue remnants of the enamel organ or reduced enamel epithelium. The tissue remnants of the enamel organ or reduced enamel epithelium are shed during normal tooth eruption. Therefore, DCs are associated with unerupted normal or malformed teeth.[8–9]

An embedded tooth, by definition, is a tooth that is unerupted, usually because of a lack of eruptive force. A tooth is impacted if there is a physical barrier that prevents the tooth from eruption.[10] Treatment options for unerupted teeth include extraction, intervention to encourage normal eruption, or orthodontic movement of the teeth.[11] Teeth extraction was elected due to the severely dysplastic nature of the teeth, precluding them from being appropriate candidates for operculectomy or orthodontic treatment.

Conventional CT may have been a viable option to assess the extent of the expansile cystic lesion. Due to the pronounced dental anomalies noted during oral examination, a CBCT was preferred, as it is considered superior to conventional CT in assessing and characterizing tooth morphology and pathology. The latter can also be analyzed, to some extent, using intraoral dental radiographs. This would, however, not be sufficient to investigate the cystic lesion.

In conclusion, the use of CBCT for the diagnosis of enamel hypoplasia, root hypoplasia, embedded dentition, and a DC, as demonstrated in this case, guided clinical decision-making and assisted appropriate surgical approach for teeth extractions and cyst enucleation. Findings for the dog of the present report emphasized the importance of advanced imaging in diagnosing of dentoalveolar disorders and supporting treatment planning.

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