Diagnostic Imaging in Veterinary Dental Practice

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Figure 1—Photograph of a cylindrical maxillary mass located between the right maxillary second and third premolar teeth in a 6-year-old neutered male Labrador Retriever. The mucogingival mass was firm and smooth.

Figure 2—Lateral radiographic view (bisecting-angle technique) of the right maxillary second to fourth premolar teeth and mass in the dog in Figure 1.

History and Physical Examination Findings

A 6-year-old neutered male Labrador Retriever was evaluated because of a right maxillary oral tumor. The mass had been present for 3 years and had been slowly growing during this time. Initially, the mass did not seem to bother the dog; however, the dog's owners noticed that the mass had recently become sensitive to the touch. Additionally, they reported that the dog no longer played with or chewed on toys as it normally would. The owners described the dog as a typically avid chewer but said that this behavior had changed substantially over the past several months. They also reported that when the dog ate, it preferred the left side of its mouth and shifted food away from the oral mass.

Results of physical examination of the dog were largely unremarkable, with the exception that during an oral examination, a smooth, firm, fixed, cylindrical mass protruding from the right maxillary gingiva interdentally between the second and third premolar teeth and extending ventrally was found (**Figure 1**). The mass was approximately 10 × 5 × 3 mm. The patient had mild distal enamel abrasion on all 4 canine teeth and a calculus and gingival index of 2. Results of preanesthetic blood testing were largely within reference limits, and the patient was anesthetized for radiography of the mass and excisional biopsy. An intraoral radiograph of the mass is shown (**Figure 2**).

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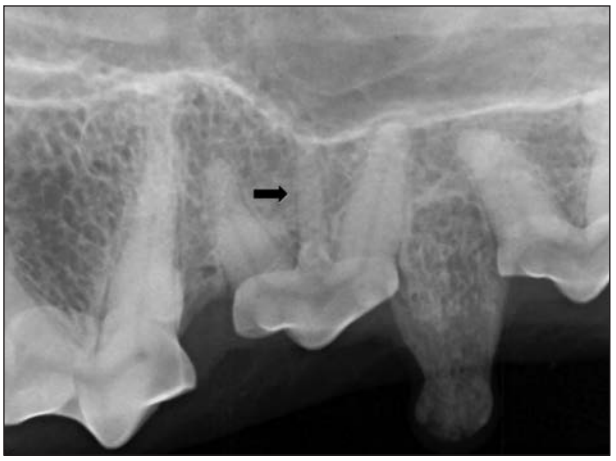

Figure 3—Same lateral radiographic view as in Figure 2. The mass is of uniform bone opacity and does not cause displacement of or affect the adjacent premolar teeth. The third premolar tooth is noted to have a supernumerary root (arrow).

Figure 4—Lateral radiographic view (bisecting-angle technique), obtained for comparison purposes, of the left maxillary second to fourth premolar teeth of the dog in Figure 1. Notice that the appearance of the interdental space and maxillary second and third premolar teeth is similar to that seen on the right side.

Diagnostic Imaging Findings and Interpretation

On the intraoral radiograph, the right maxillary mass had a uniform radiopacity and was located in the interdental space between the second and third premolar teeth. There was no radiographic evidence of bone lysis, and the osseous proliferation was focal and regular. The mass did not originate from either of the adjacent teeth but was continuous with the alveolar bone and had a radiographic appearance consistent with bone. Neither the second or third premolar tooth was displaced by the mass, and the mass did not extend medially along the palatal surface. The zone of transition between the mass and the maxillary bone was ill-defined. As an incidental finding, the right maxillary third premolar tooth was noted to have a supernumerary root (**Figure 3**). For comparison purposes, an intraoral radiographic view of the left maxillary second through fourth premolar teeth was obtained (**Figure 4**).

The radiograph illustrated a monostotic mass of suspected bone origin. Owing to the relatively slow growth of the mass, the lack of lysis of the adjacent bone, and the absence of displacement or lesions of the adjacent dentition, a benign neoplasm was suspected. Differential diagnoses for the clinical and radiographic appearance of the mass included chondroma, odontoma, osteoma, osteochondroma, exostosis of the jaw, and acanthomatous ameloblastoma.

Treatment and Outcome

Excisional biopsy of the mass together with the second and third premolar teeth and adjacent alveolar bone was performed. Postoperative radiographs were supportive of complete removal of the mass, although histologic evaluation was needed to confirm complete excision.

The mass was characterized histologically as mature trabecular and cortical bone with no remarkable cellular infiltrates. The lesion had normal fat and well-developed vasculature. It was confirmed to be completely excised and consistent with osteoma, a benign bone tumor. The patient recovered from surgery without complications. Oral examination 2 weeks after surgery revealed that the surgical site was healing well and the patient was eating soft food with no signs of discomfort.

Comments

Primary bone tumors in dogs are usually malignant; benign tumors are rare.[1,2] An osteoma is a mass composed of abnormally dense but otherwise histologically normal mature compact or cancellous bone.[2–4] Osteoma can be found in many species but is most commonly seen in horses and cattle.[5] Osteoma tends to grow slowly and can cause clinical signs if the mass interferes with function of adjacent structures. In dogs, osteoma typically involves the skull and maxillofacial bones.[4] The breed, age, and sex distributions for dogs with osteoma are unknown.

Osteoma generally does not cause bone destruction, and to our knowledge, there are no published reports of an osteoma undergoing malignant transformation.[5,6] Osteoma does not have metastatic potential but can recur locally if not completely excised.[6] The prognosis following complete surgical excision is good.

Intraoral dental radiography was essential in the assessment and treatment of the oral osteoma in the present case. The radiographic appearance of oral masses can vary greatly and is nonspecific. However, biologic aggressiveness can be cautiously inferred on the basis of the radiographic appearance of the mass.[7,8] With aggressive neoplasms, the bone response is typically active and continuous, whereas with benign neoplasms, changes are typically chronic, indolent, and quiet.[7] Criteria involved in differentiating aggressive from benign lesions include the following: the presence of disruption of bone or, in the case of oral neoplasms, the disruption and displacement of teeth; the presence and pattern of bone lysis; the type of periosteal reaction; and the characteristics of the zone of transition.[7–9] A study[10] reviewing 50 cases of canine maxillary and incisive neoplasia found that there was dental disruption associated

with 60% of the tumors. Additionally, 87% of the malignant neoplasms had radiographic evidence of bone involvement, with aggressive or irregular bone lysis as the most common appearance.[10] The absence of radiographic bone involvement does not completely rule out a malignancy, but a malignant neoplasm can potentially be placed lower on the differential diagnosis list if these changes are not seen.[10,11] Encapsulated, slow-growing benign lesions may displace teeth over time; however, these are usually well-defined lesions, whereas malignant neoplasms are ill-defined and can cause displacement or resorption of the adjacent teeth and structures.[12] A widened periodontal ligament space in the absence of clinical or radiographic findings of endodontic or periodontal disease is also considered indicative of malignancy.[9] In this case, there was no radiographic evidence of bone lysis or disruption of teeth, no increase in the width of the periodontal ligament spaces of the second or third premolar teeth, and quiet bone proliferation, all supportive of a benign neoplasm. The transition zone was ill-defined, which was the only criterion that indicated a potentially more aggressive oral tumor, given that benign lesions usually have a clear demarcation between normal and abnormal bone. Ultimately, history and clinical examination findings combined with radiographic findings were used during the planning of the surgical procedure.

Computed tomography or MRI in combination with intraoral radiography can also assist in surgical planning for dogs with oral neoplasms.[13] Advanced imaging should be considered when planning excisional biopsy of large, invasive, caudal, or palatal oral masses. Computed tomography can provide an understanding of the extent of the tumor in relation to the sinuses and intranasal, periorbital, and temporomandibular joint structures.[14] Advanced imaging was not necessary in this case, owing to the size and favorable location of the mass; however, CT could have provided greater morphological detail and a more accurate understanding of preoperative tumor margins.[8] As with all neoplasms, a definitive diagnosis could be made only on the basis of histopathologic findings. Follow-up examinations with radiographic recheck were recommended for 6 to 12 months after surgery in this case.

References

1. Dobson J, Morris J. Skeletal system. In: Dobson J, Morris J, eds. *Small animal oncology*. Ames, Iowa: Iowa State University Press, 2001;78–93.
2. Misdorp W, Van Der Heul RO. Tumors of bones and joints. *Bull World Health Organ* 1976;53:265–282.
3. Fiani N, Arzi B, Johnson EG, et al. Osteoma of the oral and maxillofacial regions in cats: 7 cases (1999–2009). *J Am Vet Med Assoc* 2001;239:1470–1475.
4. Goldschmidt MH, Thrall DE. Benign bone tumors in the dog. In: Newton CD, Nunamaker DM, eds. *Textbook of small animal orthopaedics*. JB Lippincott Co, 1985;899–907.
5. Baba AI, Câtoi C. Bone and joint tumors. In: Baba AI, Câtoi C, eds. *Comparative oncology*. Bucharest, Romania: The Publishing House of the Romanian Academy, 2007;6.1–6.14.
6. Gassel AD, Huber ML. What is your diagnosis? *J Am Vet Med Assoc* 2002;220:1151–1152.
7. Berry CR, Ferrell EA, Thrall DE. Interpretation paradigms for the appendicular skeleton. In: Thrall DE, ed. *Textbook of veterinary diagnostic radiology*. 5th ed. St Louis: Saunders Elsevier, 2007;222–239.
8. Ehara S, Khurana JS. Systematic approach to tumors and focal lesions of bone. In: Bonakdarpour A, Reinus WR, Khurana JS, eds. *Diagnostic imaging of musculoskeletal diseases: a systematic approach*. New York: Springer Science+Business Media, 2010;241–312.
9. Langlais RP. Assessment/interpretation of pathology of the jaws. In: *Exercises in oral radiology and interpretation*. 4th ed. St Louis: Saunders Elsevier, 2004.
10. Dobson JM, Frew DG. Radiological assessment of 50 cases of incisive or maxillary neoplasia in the dog. *J Small Anim Pract* 1992;33:11–18.
11. Anderson JG, Revenaugh AF. Canine oral neoplasia. In: Colmery BH, DeForge DH, eds. *An atlas of veterinary dental radiology*. Ames, Iowa: Iowa State University Press, 2000;87–104.
12. MacDonald D. Basics of radiological diagnosis. In: MacDonald D, ed. *Oral and maxillofacial radiology: a diagnostic approach*. Hoboken, NJ: Wiley-Blackwell, 2011;5–36.
13. Forrest LJ. Cranial and nasal cavities: canine and feline. In: Thrall DE, ed. *Textbook of veterinary diagnostic radiology*. 5th ed. St Louis: Saunders Elsevier, 2007;119–141.
14. Arzi B, Verstraete FJM. Clinical staging and biopsy of maxillofacial tumors. In: Lommer MJ, Verstraete FJM, eds. *Oral and maxillofacial surgery in dogs and cats*. St Louis: Saunders Elsevier, 2012;373–380.