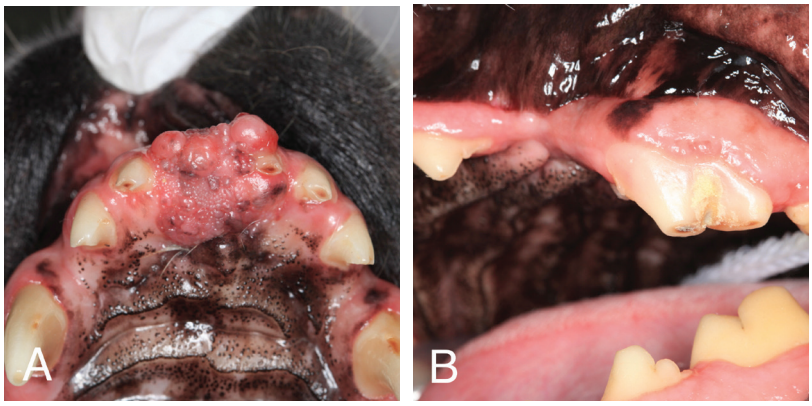

Figure 1—Clinical photographs of the maxillary incisive region (A) and left maxillary fourth premolar tooth and edentulous left maxillary third premolar tooth region (B) in a 12-year-old Labrador Retriever evaluated because of an oral mass. In panel A, an exophytic gingival mass extending from the right maxillary second incisor tooth to the left maxillary second incisor tooth and palatally from this region to the incisive papilla is visible grossly; the right maxillary first incisor tooth is not clinically apparent, and multiple teeth have evidence of wear with tertiary dentin formation. In panel B, intrinsic pink discoloration of the left maxillary fourth premolar tooth is evident in addition to tooth wear of the middle cusp and tertiary dentin formation.

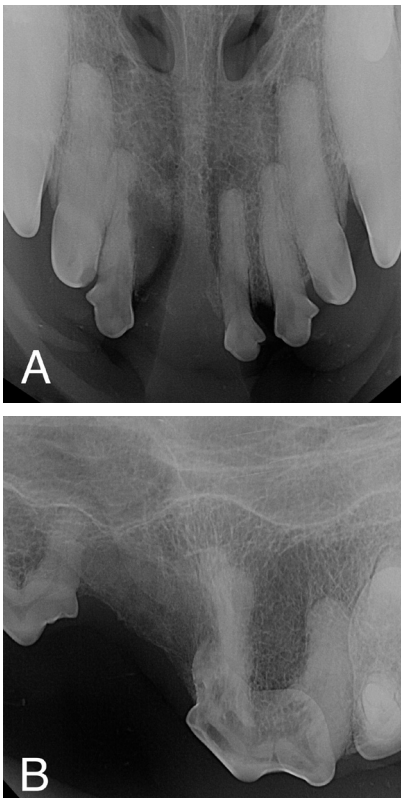

Figure 2—Occlusal (A) and bisecting angle (B) radiographic images of the oral cavity of the same dog as in Figure 1.

History and Physical Examination Findings

A 12-year-old castrated male Labrador Retriever was referred for evaluation of a recurrent gingival mass of 1-month's duration in the maxillary incisive region. A mass was marginally excised from the same site by the referring veterinarian 2 years prior to this examination, but histologic evaluation was not performed. A general physical examination did not reveal any clinically important abnormalities, and results of routine hematologic and serum biochemical analyses were unremarkable. A complete oral examination, including periodontal probing and charting, was performed. An irregular, exophytic, 16 X 15 X 10-mm gingival mass extended from the right maxillary second incisor tooth to the left maxillary second incisor tooth **(Figure 1)**. The right maxillary first incisor tooth was missing. In addition, the crown of the left maxillary fourth premolar tooth had intrinsic pink discoloration, and the left maxillary third premolar tooth was absent.

The patient was premedicated by IV administration of methadone hydrochloride (0.2 mg/kg [0.09 mg/lb]) and acepromazine maleate (0.01 mg/kg [0.0045 mg/lb]). General anesthesia was induced with alfaxalone (1.3 mg/kg [0.59 mg/lb], IV) and maintained with isoflurane delivered at a variable rate in oxygen. Once the patient was anesthetized, full-mouth intraoral radiographs were obtained. An occlusal radiograph of the maxillary incisive region and a bisecting angle radiograph of the caudal aspect of the left maxilla were obtained **(Figure 2)**.

Determine whether additional studies are required, or make your diagnosis, then turn the page →

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Diagnostic Imaging Findings and Interpretation

Examination of the occlusal radiograph of the maxillary incisive region revealed a soft tissue mass lesion spanning from the right maxillary second incisor tooth to the left maxillary first incisor tooth **(Figure 3)**. The right maxillary first incisor tooth was confirmed missing. A poorly defined area of alveolar bone lysis was present apical to the mass. The lamina dura at the right maxillary second incisor tooth adjacent to the mass was absent, and there was a loss of tooth structure. These findings were consistent with an aggressive mass lesion characterized by bone lysis and external inflammatory resorption. The differential diagnoses included nonodontogenic tumors such as malignant melanoma, squamous cell carcinoma, fibrosarcoma, and osteosarcoma or a locally invasive odontogenic tumor such as acanthomatous ameloblastoma. The periodontal ligament spaces of the right maxillary third incisor tooth and left maxillary first, second, and third incisor teeth were not visible in several areas, and there was replacement of root structure with trabecular bone, consistent with external replacement resorption.

The bisecting angle radiograph of the caudal portion of the left maxilla revealed a decrease in radiopacity of the left maxillary fourth premolar tooth crown, with replacement of the coronal tooth structure by tissue resembling trabecular bone as well as a lack of a periodontal ligament space in the furcation **(Figure 4)**. These findings were consistent with internal and external tooth resorption. In the region of the missing left maxillary third premolar tooth, a poorly defined area of decreased radiopacity with loss of trabecular detail was observed. Adjacent to this area, the lamina dura of the distal root of the left maxillary second premolar tooth and the mesiobuccal and palatal roots of the left maxillary fourth premolar tooth was absent, and there was loss of root structure of the mesiobuccal and palatal roots of the left maxillary fourth premolar tooth. Despite the normal appearance on gross examination, these radiographic findings were consistent with an aggressive bone lesion characterized by bone lysis and secondary tooth resorption and were considered most consistent with a neoplastic process.

Treatment and Outcome

The oral cavity was rinsed with 0.12% chlorhexidine gluconate solution, and all teeth were ultrasonically scaled and polished with dental prophylaxis paste. Left and right infraorbital regional nerve blocks were performed with 0.5 mL of bupivacaine (5 mg/mL).

An incisional wedge biopsy of the gingival mass in the incisive region was performed. A No. 15 scalpel blade was used to perform 2 converging incisions in the center of the mass. The edges of the biopsy site were sutured in apposition with 4-0

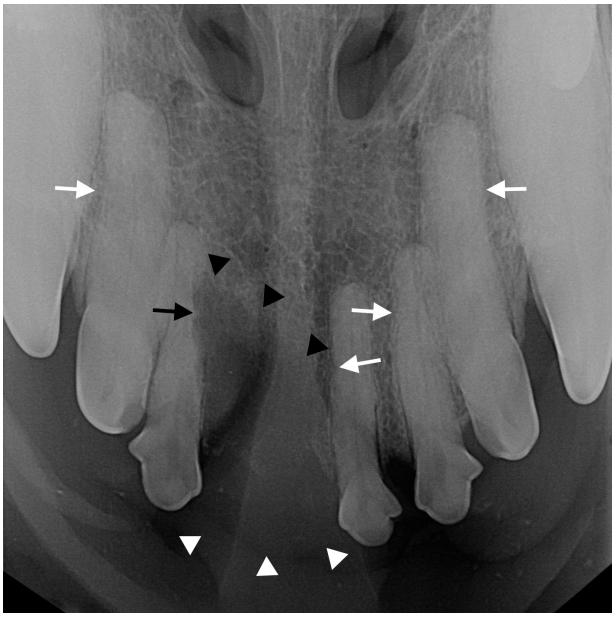

Figure 3—Same occlusal radiographic image as in Figure 2. A soft tissue mass is present between the right maxillary second incisor and left maxillary first incisor teeth (white arrowheads). A poorly defined area of bone lysis (black arrowheads) and external inflammatory resorption of the adjacent right maxillary second incisor tooth (black arrow) are associated with the mass. The right maxillary first incisor tooth is absent. Areas of external replacement resorption are present at the roots of multiple incisor teeth (white arrows).

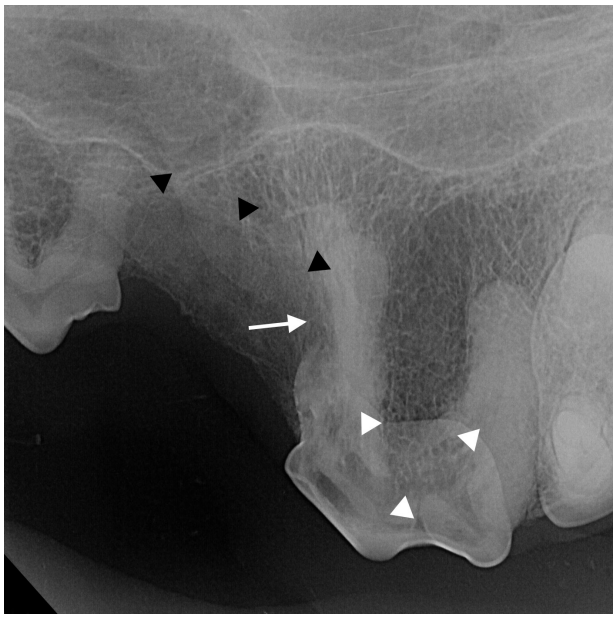

Figure 4—Same bisecting angle radiographic image as in Figure 2. An aggressive, lytic bone lesion characterized by poorly defined loss of trabecular detail (black arrowheads) and secondary external root resorption (arrow) extends from the left maxillary second premolar tooth to the left maxillary fourth premolar tooth. External and internal replacement resorption of the left maxillary fourth premolar tooth crown is also present (white arrowheads).

poliglecaprone-25 suture material in a simple interrupted pattern. A new set of instruments was then used to surgically extract the left maxillary fourth premolar tooth. During extraction, friability of the alveolar bone mesial to this tooth was noted, and a sample of this tissue was collected and submitted for histologic analysis.

The patient was discharged from the hospital with tramadol (2.6 mg/kg [1.2 mg/lb], PO, q 12 h) and carprofen (2 mg/kg [0.9 mg/lb], PO, q 12 h) for analgesia for 5 days. The owners were instructed to gently apply 0.12% chlorhexidine gluconate antiseptic rinse solution to the oral cavity twice daily for 2 weeks and to feed the patient soft food for the same duration.

Histologic examination of the abnormal bone from the region of the missing left maxillary third premolar tooth revealed features consistent with osteosarcoma. Thoracic imaging and fine-needle aspirates of the mandibular lymph nodes were recommended for tumor staging, as was CT examination of the head for tridimensional evaluation of the masses, surgical planning, and regional lymph node evaluation. Histologic findings for the maxillary incisive mass were consistent with a peripheral odontogenic fibroma (POF). However, the histologic diagnosis was inconsistent with the aggressive radiographic appearance of this lesion, and en bloc resection of both masses with histologic examination for margin evaluation and confirmation of diagnosis was recommended pending the results of tumor staging. The client declined further diagnostic procedures and treatment. Twelve months after the initial examination, the referring veterinarian reported that the POF had increased in size and that a new mass lesion which measured approximately 25 mm in diameter was present at the site of the previously diagnosed osteosarcoma. The patient was subsequently euthanized.

Comments

With few exceptions, sole reliance on the radiographic appearance of osseous lesions is insufficient for definitive diagnosis, and histologic examination is essential. However, osseous lesions can be categorized as aggressive or nonaggressive on the basis of their radiographic appearance.[1] In conjunction with clinical and histologic findings, this plays an important role in determination of prognosis and treatment planning. The radiographic categorization of osseous lesions is determined by evaluating the appearance of the lesion border, characteristics of any periosteal reaction present, and effects of the lesion on surrounding structures. Nonaggressive bone lesions are typically well-defined and are associated with a periosteal reaction with smooth margins; this type of lesion can cause displacement of bony cortices and teeth.[2] Aggressive bone lesions typically have poorly defined boundaries and are associated with a periosteal reaction characterized by irregular margins and spiculated or columnar patterns; this type of lesion causes destruction of the lamina dura or cortex.[1,3] Aggressive bone lesions may also be more likely to cause external inflammatory resorption in dogs.[4] The radiographic pattern of bone lysis may also be used to differentiate aggressive and nonaggressive lesions. Geographic lysis, characterized by a singular, large, well-defined area of lysis, is indicative of a nonaggressive lesion. In contrast, moth-eaten lysis, characterized by multiple punctate radiolucencies or permeative lysis (typically comprising poorly-defined, coalescing lytic areas) is indicative of an aggressive lesion.[1] Bone lesions may also be described as productive, lytic, or mixed, depending on whether bone production, lysis, or both are present.[1] Cysts and benign tumors typically have a nonaggressive radiographic appearance, whereas malignant tumors and bone infections typically appear aggressive.[1] In the dog of the present report, both lesions were best described as focal lytic lesions with poorly defined peripheral borders, features that indicated aggressiveness.

The odontogenic tumor in the maxillary incisive region was characterized radiographically as a lytic aggressive bone lesion, with external inflammatory resorption of the adjacent right maxillary second incisor tooth. Although the histologic findings for the incisional biopsy sample were consistent with a POF, they were inconsistent with the radiographic features, indicating a lack of clinicopathologic correlation. A more biologically aggressive odontogenic neoplasm, such as acanthomatous ameloblastoma, could not be definitively ruled out, and en bloc excision of this mass with submission of excised tissue for a second evaluation was recommended. Peripheral odontogenic fibromas are considered benign, slow-growing odontogenic tumors of mesenchymal origin. Radiographically, they typically appear nonaggressive and are productive rather than lytic lesions, and the appearance varies depending on the amount of mineralized tissue present.[5-7] Early lesions may not have a mineralized component, but as the lesion progresses, soft tissue mineralization and displacement of adjacent teeth can become apparent.[5] Conversely, acanthomatous ameloblastoma in dogs is a locally aggressive epithelial tumor believed to arise from odontogenic epithelial remnants located in the gingiva, periodontal ligament, or both, and is usually characterized radiographically by aggressive bone lysis with or without tooth displacement.[6,8] Neither tumor type has been reported to metastasize, and en bloc surgical excision is considered curative.[6]

Similarly, the osteosarcoma in the edentulous left maxillary third premolar region was characterized radiographically as an aggressive, lytic bone lesion. Despite the innocuous gross appearance of the area, surgical exploration revealed abnormal bone quality. Osteosarcoma is a tumor of mesenchymal origin char-

acterized by osteoid production from malignant osteoblasts. It is reportedly the fourth most common nonodontogenic neoplasm of the oral cavity and the most common oral bone malignancy in dogs.[9] Although the radiographic appearance of osteosarcoma can vary, with lytic, productive, or a combination of these patterns possible, it is typically aggressive.[10] Early lesions can be seen as subtle changes to the trabecular pattern, such as that observed in the dog of this report. A recent review[9] of the literature found that the reported metastatic rate of axial osteosarcoma in dogs ranges from 11% to 13%, and tumor staging, including regional lymph node evaluation and thoracic imaging, is essential for treatment planning. When no metastatic disease is evident, the recommended treatment for maxillofacial osteosarcoma is en bloc excision with margins ≥ 10 mm in all directions.[9] However, clinical data validating current recommendations for margin allowances when excising oral tumors in companion animals are sparse. The outcomes for dogs following chemotherapy or radiation therapy alone or in combination with surgery are reported to be variable.[9]

The concurrent presence of multiple oral tumors of different types in 1 dog has been previously reported.[11] A lack of clinicopathologic correlation was observed between the radiographic appearance and the histologic or gross features of both lesions in the dog of the present report, emphasizing the importance of taking into account all available clinical, radiographic, and histologic information during treatment planning for oral neoplasms.

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