# Prevalence of odontoclastic resorption lesions and periapical radiographic lucencies in cats: 265 cases (1995–1998)

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**Objective**—To determine whether odontoclastic resorption lesions were associated with radiographic evidence of periapical lucencies in cats.

**Design**—Retrospective study.

**Animals**—265 feline dental patients.

**Procedure**—Full-mouth radiographs were examined for evidence of odontoclastic resorption lesions, periapical lucencies, periodontitis, and fractured teeth.

**Results**—Odontoclastic resorption lesions affecting 567 teeth were identified in 161 (60.8%) cats. Periapical lucencies were identified in 53 teeth in 35 cats. Periapical lucencies were most commonly associated with fractured teeth (25 teeth with periapical lucencies) and severe periodontitis (21 teeth). None of the periapical lucencies appeared to be specifically associated with resorption lesions. Prevalence of periapical lucencies in cats with resorption lesions was not significantly different from prevalence in cats without.

**Conclusions and Clinical Relevance**—Results suggest that although odontoclastic resorption lesions are common in cats, pulpal involvement associated with these lesions does not appear to be associated with development of radiographically detectable periapical lucencies. Crown amputation with intentional root retention may, therefore, be a suitable alternative to extraction in selected cats with odontoclastic resorption lesions. (*J Am Vet Med Assoc* 2000;217:1866–1869)

Odontoclastic resorption lesions, also known as dental resorptive lesions, neck lesions, and cervical line lesions, may be present in up to 67% of cats examined in veterinary practices.[1] These lesions are characterized by odontoclastic resorption of enamel, dentin, and cementum, and on dental radiographs, they appear as radiolucent areas in the affected teeth.[2] Odontoclastic resorption lesions are graded on the basis of clinical and radiologic findings. Stage-1 lesions are shallow cementum or enamel defects that do not affect the dentin; stage-2 lesions extend into the dentin; stage-3 lesions extend into the pulp cavity and may involve loss of tooth structure; stage-4 lesions are chronic resorption lesions with loss of tooth structure, ankylosis of roots, or complete root destruction.[3]

Because the pulp is exposed with stage-3 and -4 odontoclastic resorption lesions, it may be expected that such lesions would result in pulp necrosis and periapical inflammation. Inflammation of the periapical tissues associated with pulp necrosis is evidenced by changes in the integrity of the periapical lamina dura and surrounding periapical bone. The ensuing periapical lesions may vary from acute or chronic periapical abscesses to periapical granuloma, condensing osteitis, osteomyelitis, and periapical cyst formation. The most common lesion at the apex of a nonvital tooth is a periapical granuloma.[4] It may develop from an acute or chronic periapical abscess or may result directly from pulpal necrosis without abscess formation. Radiographically, periapical granulomas appear as well-circumscribed round radiolucent areas with loss of the lamina dura.[4] However, radiologic differentiation of periapical lesions is not always possible, and most periapical lesions appear as periapical lucencies on radiographs.

One study[5] did find a high incidence of osteomyelitis in association with retained tooth roots and external root resorption in a small series of cats with nonmalignant mandibular swellings. This has not been the authors' clinical experience, however, and in a study including 301 feral cats,[6] Verstraete et al did not find any association between mandibular thickening and odontoclastic resorption lesions. The purpose of the study reported here was to determine whether odontoclastic resorption lesions were associated with radiographic evidence of periapical lucencies in cats.

## Criteria for Selection of Cases

Medical records of all cats that underwent dental treatment by the Dentistry and Oral Surgery Service of the University of California, Davis, Veterinary Medical Teaching Hospital between April 1995 and June 1998 were reviewed. Cats for which full-mouth radiographs had been obtained were included in the study. Cats included in the study did not necessarily represent only cats with severe dental disease, as full-mouth radiographs were routinely obtained for all new adult cats undergoing dental treatment during this period.[7]

## Procedures

Full-mouth radiographs were evaluated for evidence of odontoclastic resorption lesions and periapical lucencies. Resorption lesions were staged, as described[3]; clinical findings were reviewed as necessary to distinguish between stage-2 and -3 lesions. Diameters of the pulp cavities and root canals of all corresponding teeth were compared. Integrity of the periapical lamina dura and surrounding periapical bone was assessed, and appearance and size of any periapical lucencies and integrity of the apices were recorded. Other radiographic findings, including den-

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tal fractures and bone loss associated with periodontal disease, were also recorded. In cats in which periapical lucencies did not have any radiographically evident cause, the dental charts were reviewed to determine possible causes of the lesions.

The $\chi^2$ test was used to determine whether detection of odontoclastic resorption lesions in cats was associated with detection of periapical lucencies. A value of $P < 0.05$ was considered significant.

## Results

A total of 265 cats met the criteria for inclusion in the study. Of these, 161 (60.8%) had radiographic evidence of odontoclastic resorption lesions; 567 teeth were affected (mean, 3.5 teeth/affected cat). Resorption lesions were staged on the basis of radiographic appearance; 197 were classified as stage 2, 169 were classified as stage 3, and 201 were classified as stage 4 (**Fig 1–3**). Because stage-1 lesions are not detectable radiographically, none of the 567 lesions were classified as stage 1. When necessary, the dental chart was reviewed for indications of pulpal involvement to differentiate between stage-2 and -3 lesions.

Periapical lucencies were identified in 53 teeth in 35 cats. Twenty-five of these periapical lucencies were found in association with a fracture of the affected tooth, and 21 were found in association with severe bone loss around the affected tooth (**Fig 4** and **5**). The remaining 7 teeth with periapical lucencies were mandibular canine teeth that did not have any radiographic evidence of fractures, periodontitis, or resorption lesions. Review of these cats' medical records also failed to reveal any cause for these lesions.

None of the periapical lucencies appeared to be specifically associated with resorption lesions, and we did not detect a significant association between detection of odontoclastic resorption lesions and detection

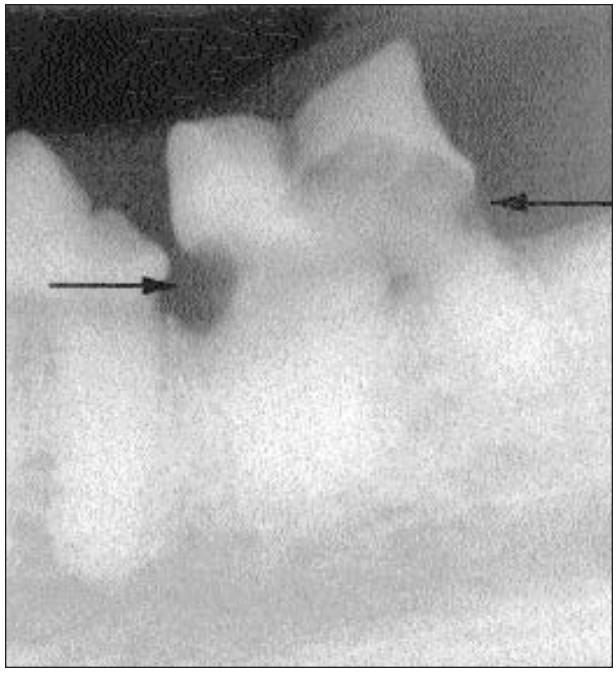

Figure 2—Radiographic appearance of stage-3 odontoclastic resorption lesions on the mesial aspect and on the distal cusp of the left mandibular first molar tooth (arrows) of a cat.

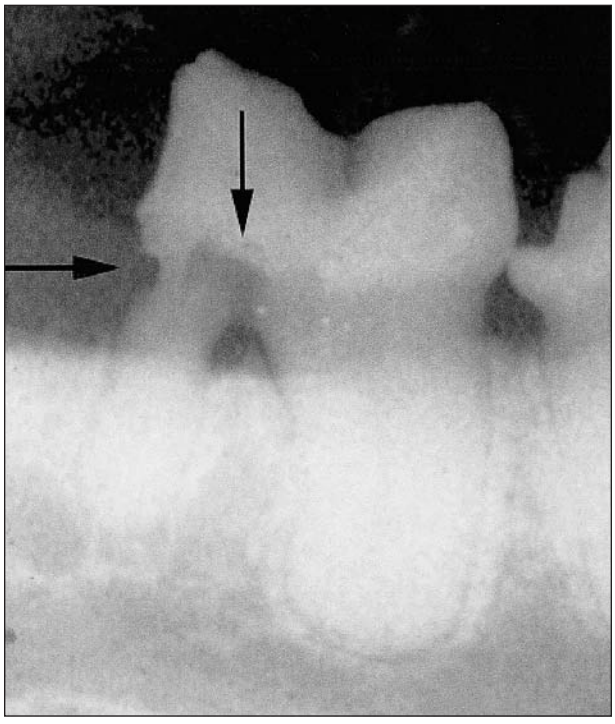

Figure 1—Radiographic appearance of stage-2 odontoclastic resorption lesions on the distal aspect of the distal root (horizontal arrow) and in the furcation area (vertical arrow) of the right mandibular first molar tooth of a cat.

Figure 3—Radiographic appearance of a stage-4 odontoclastic resorption lesion with resorption of the roots of the left mandibular fourth premolar tooth in a cat.



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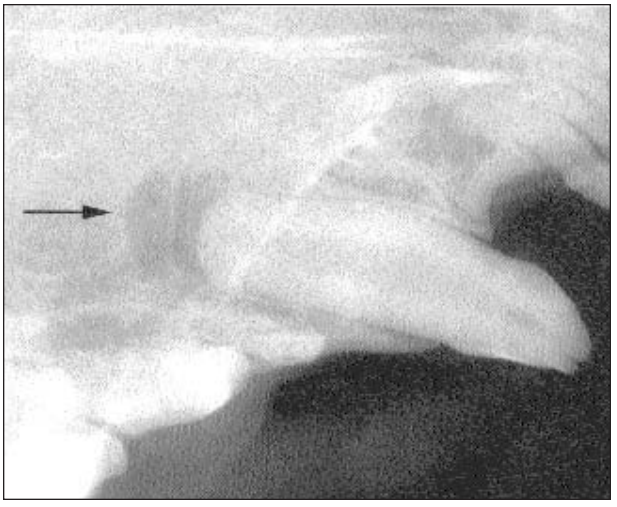

Figure 4—Radiographic appearance of a periapical lucency (arrow) found in association with a complicated fracture of the crown of the right maxillary canine tooth in a cat.

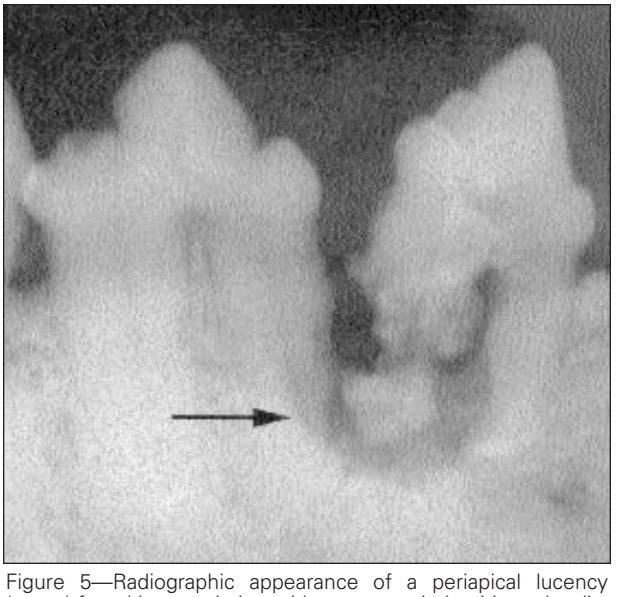

Figure 5—Radiographic appearance of a periapical lucency (arrow) found in association with severe periodontitis at the distal root of the right mandibular third premolar tooth in a cat.

Table 1—Cross-classification of results of evaluation of full-mouth radiographs for odontoclastic resorption lesions and for periapical lucencies in 265 cats

| Odontoclastic resorption lesions | Periapical lucencies | | |
|---|---|---|---|
| | Present | Absent | Total |
| Present | 22 | 139 | 161 |
| Absent | 13 | 91 | 104 |
| **Total** | **35** | **230** | **265** |

of periapical lucencies (**Table 1**). Prevalence of periapical lucencies in cats with resorption lesions (13.7%) was not significantly different from prevalence in cats without (12.5%).

## Discussion

Results of the present study suggest that pulpal involvement associated with odontoclastic resorption lesions in cats is not associated with development of radiographically detectable periapical lucencies. In particular, we found that the prevalence of periapical radiographic lucencies in cats with odontoclastic resorption lesions was not significantly different from the prevalence in cats without odontoclastic resorption lesions.

Resorption of permanent teeth in humans and other species is uncommon. In humans, root resorption is typically a result of periodontal trauma, orthodontic pressure on the periodontal ligament, or inflammation secondary to endodontic or periodontal infection.[8] The histologic characteristics of odontoclastic resorption lesions in cats distinguish them from other destructive dental lesions, including root resorption and caries. In particular, although bacterial plaque may play an important role in stimulation of odontoclasts and subsequent development of odontoclastic resorption lesions,[9] the destructive process associated with these lesions does not appear to result from acid produced by saccharolytic bacteria, as is the case with true caries lesions.[10] Microradiographic[10] and histologic[2,11] evaluation of odontoclastic resorption lesions in cats has demonstrated the presence of numerous multinucleated odontoclasts aligned along a resorption boundary at the edge of Howship's lacunae in the dentin. Dentinal tubule distribution remains unchanged, and there are no areas of enamel or dentin demineralization such as are seen with caries.[10] Odontoclasts may be surrounded by an infiltrate consisting of macrophages and plasma cells, with some neutrophils, lymphocytes, and fibroblasts.[2] Immature granulation tissue infiltrated predominantly by lymphocytes and plasma cells has also been found in association with resorption lesions.[11] Clinically, lesions may be covered with granulomatous tissue or proliferated epithelial tissue, and during the terminal stages, bone-like or cementum-like tissue may replace dental structures, including the pulp.[2,9] Odontoclastic destruction may be external or internal (ie, within the pulp cavity), and the pulp may become exposed to the oral environment indirectly (through dentinal tubules) or directly (following destruction of substantial amounts of enamel and dentin).

Stage-2 odontoclastic resorption lesions lead to dentin exposure, and stage-3 and -4 lesions involve direct pulp exposure, so an inflammatory pulpal and periapical response would be expected in teeth with radiographically detectable odontoclastic resorption lesions. However, Okuda and Harvey[9] found that resorption lesions invading the dentin were associated histologically with only a mild or no inflammatory response; odontoblasts appeared to remain vital, with edema, fibrosis, and increased vascularity observed in the pulp. In the present study, although most of the affected teeth (370/567) had resorption lesions that apparently involved direct pulp exposure, radiographic evidence of periapical inflammation associated with these teeth was notably absent. On the other hand, periapical inflammation is a bacterial disease,[12] and although bacterial plaque may play a role in development of odontoclastic resorption lesions,[2,9,10] it has not been demonstrated that bacterial invasion of the pulp



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occurs during the resorptive process associated with odontoblastic resorption lesions. In addition, periodontitis was not found to be associated with odontoclastic resorption lesions in 2 previous studies.[13,14] Findings of these previous studies, in conjunction with results of the present study, would, therefore, seem to suggest that bacterial infection is not an important factor in progression of odontoclastic resorption lesions, as evidence of endodontic disease would have been expected if it were. However, further investigation into the pathogenesis of odontoclastic resorption lesions in cats is required to determine what role, if any, bacterial infection plays.

Because the cause of odontoclastic resorption lesions remains unknown, treatment of affected teeth has been symptomatic. Stage-1 and -2 lesions can be restored with amalgam, glass ionomer, or composite restorative materials; however, 2 studies reported poor long-term results, with only 10 to 20% of restorations intact without additional resorption 24 months after treatment.[3,15] Currently, extraction is the recommended treatment, as the lesions appear to be painful and almost invariably progressive. However, with advanced lesions in which the roots of the affected teeth have been partially or completely replaced with bone-like or cementum-like tissue, fracture of the roots during extraction is common. Removal of root fragments is technically difficult and time consuming and may result in prolonged anesthetic periods. Therefore, on the basis of clinical, radiographic, and histologic findings of continued root resorption and absence of associated inflammation in teeth without endodontic or periodontal abnormalities, intentional root retention has been proposed as an alternative to whole-tooth extraction.[16] For instance, in a previous study,[16] surgical amputation of the crown with intentional root retention was performed on 52 teeth (102 roots) with stage-2 or higher odontoclastic resorption lesions. Radiographic follow-up of 51 roots 5 to 36 months later revealed continued uneventful resorption of the root structure without any evidence of periosteal reaction. Results of the present study in which periapical lucencies were not associated with odontoclastic resorption lesions would seem to support these findings and suggest that intentional root retention would be an acceptable alternative to complete extraction of teeth with odontoclastic resorption lesions. However, this would only be appropriate for teeth that did not have any radiographic evidence of endodontic disease or periodontitis. Teeth with endodontic disease (ie, periapical inflammation) or periodontitis and teeth in cats with gingivostomatitis or severe gingivitis should be removed completely.

Periapical lesions in companion animals most commonly result from dental fractures or severe periodontitis (class-II periodontal-endodontal lesions), and in the present study, 25 of 53 periapical lucencies were found in association with a fracture of the affected tooth, and 21 were associated with severe periodontitis. However, 7 teeth in the present study had periapical lucencies without any radiographic evidence of fractures, periodontitis, or resorption lesions. All 7 of these teeth were mandibular canine teeth, and a review of the medical records for these cats did not reveal any potential causes of the periapical lucencies. It is possible, therefore, that the periapical lucencies in these teeth may not be pathologic, and further investigation is warranted.

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