Shades of Gray:
Interpretation of Feline Dental Radiographs
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As with any new piece of equipment in veterinary hospitals, there is a learning curve associated with dental radiography – both in obtaining diagnostic dental radiographs and interpretation of dental pathology.

With digital images, the image appears on the computer screen. When obtaining intraoral radiographs the following tips will help you orient the image in the same way each time for evaluation. Some veterinary software programs will label the images with the tooth number or tooth as you expose them. First, if the tooth being imaged is a maxillary tooth the tooth crowns should point down and if the tooth being imaged is a mandibular tooth the tooth crowns should point up. Remember that all three rooted teeth are located in the maxilla. The presence of the palatine fissures, nasal passages and sinuses indicate the tooth is in the maxilla. Visualization of the mandibular canal or ventral cortex of the mandible confirms that the tooth is a mandibular tooth. After determining if the tooth is in the maxilla or mandible then determine if you are viewing the right or left side. When viewing the right side of the mouth the anterior teeth are on the right side of the image and when viewing the left side of the mouth the anterior teeth are on the left side of the image. Depending on the imaging software the images may appear on the computer screen in the correct orientation.

When mounting full mouth radiographs, the patient’s right maxilla and right mandible are on the viewer’s left side and the patient’s left maxilla and left mandible are on the viewer’s right side. (Remember that the viewer is standing on the outside of the patient’s mouth looking at the patient.)

Knowledge of normal anatomy of the tooth, mandible and maxilla is essential for the proper evaluation of dental radiographs. The components of the tooth and its supporting structures are usually well defined on dental radiographs. These structures include the following:

- **Enamel:** the outermost layer of the crown of the tooth
- **Cementum:** the outermost layer of the root of the tooth
- **Cementoenamel junction:** area where the cementum and enamel meet
- **Dentin:** radiopaque layer between the outermost surfaces of the crown and root and the radiodense pulp cavity
- **Pulp cavity:** radiodense area within the tooth and roots including the pulp chamber, pulp horns and root canal.
- **Periodontal ligament space:** thin radiolucent area between the root of the tooth and the lamina dura
- **Lamina dura:** the cribiform plate and dense alveolar bone surrounding the root which appears as a radioopaque line adjacent to the periodontal ligament space
- **Alveolar bone:** encases and supports the tooth structure
- **Alveolar margin:** most coronal portion of the alveolar bone, located between teeth, composed of dense cortical bone
- **Furcation:** the anatomic area of a multi-rooted tooth where the roots diverge
The mandibular canal is visible as a radiolucency of uniform width in the mandible parallel to the ventral border of the mandible. The caudal, middle and rostral mental foramen may be mistaken for periapical pathology in the area of the mandibular premolars. The middle mental foramen is located distal to the apex of the canine tooth in the cat. (To distinguish the foramen versus a periapical lucency, change the horizontal angle of the tubehead. If the lucency remains associated with the apex of the tooth it is indeed a periapical lucency. The foramen will move relative to the root as the horizontal angle of the tubehead is changed.) The mandibular symphysis appears as a linear radiolucent line between the central incisors.

In the maxilla the symmetrical radiolucent structures which appear distal to the maxillary incisors are the palatine fissures. The junction of the vertical body of the maxilla and its palatine process is visualized as a radiopaque line that crosses the midroot section of the maxillary canine tooth.

Radiographs should include the entire crown and root of the tooth being imaged and 3 mm of alveolar bone around the tooth apex. The following generalizations can be made about dental radiograph interpretation.

Radiographic signs of feline tooth resorption include defects present at the cementoenamel junction and/or roots with evidence of root replacement. Clinically, there are two types of tooth resorption in cats. Tooth resorption type I lesions have normal root density and a well-defined periodontal ligament space around the tooth root. Often these teeth have associated horizontal or vertical bone loss. Tooth resorption type II lesions have root replacement resorption with no discernible periodontal ligament space and the roots appear to blend in with the surrounding bone. Both types of tooth resorption can be found in the same cat and even in the same tooth.

Differentiation between type I and type II tooth resorption in feline patients is important to determine the appropriate treatment for these teeth. Type I tooth resorption is treated by extraction of the entire tooth and root. Type II tooth resorption is treated by crown amputation with intentional root retention.

Radiographic signs of periodontal disease may include: widening of the periodontal space; resorption of the alveolar crest; decreased alveolar bone density and horizontal, vertical, angular or furcation bone loss. Remember that 30-60% of the bone must be lost before it is visible radiographically. Horizontal bone loss involves the buccal, lingual and interdental portions of bone and appears as decreased alveolar marginal bone around the tooth. Vertical bone loss usually appears as an area of decreased bone density surrounding the root tooth and may appear to as a ‘V’ shape adjacent to the tooth root. It is important to recognize that clinical examination in combination with dental radiographs is necessary to properly diagnose periodontal disease. Mild bone loss, stage 1 furcation exposure, vertical bone loss on the palatal side of the maxillary canine teeth may not be visible radiographically, only clinically. In addition, proper exposure is necessary to evaluate the alveolar bone margin. Overexposure of the dental radiograph may result in ‘burnout’ of the alveolar bone margin and interdental bone.

Radiographic signs of endodontic disease include changes associated with the bone surrounding the tip of the root (periapical area) and changes within the pulp cavity or tooth itself. Radiographs to evaluate a tooth for endodontic disease should include the entire root tip and the surrounding bone. The characteristic radiographic lesion of endodontic origin (LEO) involves changes in the periapical radiodensity (often appearing as a radiolucency) or detail that results from apical periodontitis. Lesions of endodontic origin can also develop along the lateral aspect of the root at the site of a lateral canal. Remember that lack of radiographic lesions does not rule out endodontic disease.

Radiographic signs of endodontic disease that are associated with the tissues around the tooth may include: increased width of the periodontal ligament space, loss of the radiopaque lamina dura, diffuse periapical lucency, well defined periapical lucency, or a diffuse area of radiopacity.

Radiographic changes within the tooth are often associated with endodontic disease. When a permanent tooth first erupts, the apex is open, the pulp canal is very wide and the primary dentin layer is thin. Next, the apex closes and then as the tooth continues to mature, the odontoblasts within the pulp canal continue to lay down dentin (secondary dentin). As the tooth continues to mature, the secondary dentin becomes thicker as the pulp canal decreases in width. Radiographically, a tooth that became non-vital during the maturation process will have a pulp canal larger than the contralateral tooth indicating arrested tooth maturation. A seemingly narrow pulp cavity can result from pulpsitis that is generalized over a section of the root canal.

Internal root or crown resorption, caused by inflammation in the pulp, appears as an irregularly shaped root canal system. Internal root resorption results from removal of dentin from the wall of the pulp cavity. An internal resorption lesion does not move with change in horizontal angle of the beam of the radiograph (it stays associated with the root canal system).

External resorption resulting from inflammation in the periodontal ligament appears as an irregular defect in the external surface of the tooth root. An external root resorption that is overlying the root canal system will move relative to the root canal system with a change in horizontal angulation of the beam of the radiograph.

Radiographic signs of aggressive jaw lesions include:

- Lytic areas of variable size or uniformly pinpointed
- Indistinct margins
• Lysis of the cortex
• Layers of varied opacity or sunburst effect
• Teeth in position, floating in space
• Bone is moth eaten in appearance
• Root structure is irregular
• Increased tooth mobility

• Radiographic signs of non-aggressive jaw lesions include:
  • Well defined areas of lysis
  • Distinct regular, smooth or sclerotic margins
  • Expanding or thinning of cortex
  • Uniform opacity or lamellar onion skin pattern
  • Displaced teeth
  • Tooth mobility may be affected

Dental radiography is an essential part of the evaluation of oral and maxillofacial diseases. In combination with a complete extraoral and intraoral examination, including the use of a dental probe and explorer, intraoral radiography makes dentistry a science based on fact and provides veterinarians with the tools to properly evaluate and treat oral disease.