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.

To view the dental radiographs, first orient the x-ray film on the viewbox so that the raised dot is projecting toward you (outward). The resultant image is being viewed as if you are looking at the patient’s mouth from the outside. This step is completed automatically with digital images. Second, determine if the tooth being imaged is in the mandible or maxilla. Rotate the film so that the maxillary crowns point downward and the mandibular crowns point upward. Remember that all three rooted teeth are located in the maxilla. The palatine fissures, nasal passages and sinuses are also located in the maxilla. The mandible contains the radiolucent mandibular canal and the radiopaque ventral cortex. Finally, determine exactly which tooth you are viewing. Determine which edge of the radiograph is toward the nose of the patient and which edge of the radiograph is toward the tail of the patient. Once the radiograph is in proper position, you are standing on the outside of the patient, looking at the patient’s mouth. You are looking at the right maxilla or right mandible if the nose of the patient is on your right. You are looking at the left maxilla or left mandible if the nose of the patient is on your left. The exception to these orientation rules is the extraoral view of the feline maxillary premolars and molar. These films should be labeled on the film clip when obtained.

With digital images the image appears on the computer screen. Always rotate the image so that the mandibular crowns point up and the maxillary crowns point down. Then flip or rotate the image so that you are standing on the outside of the patient looking at the teeth.

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:** radioopaque 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 dense white 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
- **Periapical:** the area around the tooth apex

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 ventral to the mesial root of the second premolar in the dog and distal to the apex of the canine tooth in the cat. The caudal mental foramen is located ventral to the mesial root of the mandibular third premolar. (To distinguish the foramen vs 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 radioopaque line that crosses the midroot section of the maxillary canine tooth. The **maxillary chonchal crest** is visualized as a radioopaque line apical to the canine tooth root apex.

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 discernable periodontal ligament space. 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: increased periodontal space; resorption of the alveolar crest; and horizontal, vertical, angular or furcation bone loss. Remember that 30-60% of the bone must be loss 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 tooth root and may appear to as a ‘V’ shape.

Radiographic signs of endodontic disease include changes associated with the bone surrounding the tip of the root (periradicular area) and changes within the pulp cavity or tooth itself. Changes in the bone include a periradicular radiolucent defect, widening of the periodontal ligament space and/or a discontinuous lamina dura. Some periradicular radiolucent defects are not true pathology, but are actually artifacts. Changing the horizontal angle of the tubehead will assist in determining if the defect is indeed real.

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 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. 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.

Internal resorption begins in the pulp and appears as an irregularly shaped root canal system. 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 root resorption appears as an irregular defect in the external surface of the tooth root and is commonly accompanied by loss of bone in the area. External root resorption occurs most commonly at the apex in dogs and cats. 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 assess and treat oral disease.

(After review of radiographic signs of common diseases, attendees of this lecture will participate in the interpretation of intraoral radiographs.)