Anatomy of the Dental Radiograph

Interpretation of the radiographic image is as important as creating a high-quality image. It is recommended that you take full-mouth radiographs for comparison from one dental procedure to the next. Solid knowledge of anatomical structures and their location is beneficial in determining normal from abnormal. While not all anatomical features can be seen on every radiograph, being familiar with them allows accurate identification and interpretation when seen. Keep in mind that there is a wide variation that can still be considered normal, and it sometimes depends on the angle when taking the film or age, breed, and species of the animal.

Radiolucent objects will appear black and radiodense objects are white. Starting with the crown of the tooth, the enamel is difficult to differentiate on the crown of the tooth. Dentin is seen as medium density and encompasses most of the tooth, both crown and root, of the typical adult tooth. The pulp cavity is the center radiolucent space of the tooth. It occurs in both the crown and the root. If the animal is younger, the pulp cavity will be quite wide, with the dentin being a narrower line between the enamel and the pulp cavity. As the animal ages, the pulp cavity goes from very wide with a narrow line of dentin, to a narrow pulp cavity and a wide area of dentin. The cementum on the root of the tooth is ill-defined in radiographs and will be outlined by a radiolucent (black) line, the periodontal ligament. The lamina dura is the thin, very radiodense line in the alveolar bone that forms the tooth socket.1-5 Beyond that is the cortical bone that forms the jaw and alveolar crest (Fig. 6.20). Be aware that the various foramina in the jaw can appear as lesions. Knowing where these are located is very beneficial to interpretation.

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There are several techniques that can be used to help orient the films for viewing. Keep in mind that they are viewed the same as other X-rays. It is a mirror image. The right side of the patient is on your left and the left side is on the right. Maxillary teeth should always be viewed as they naturally occur with the roots pointing upward and mandibular teeth with the roots pointing downward. It is easy to tell the maxillary from mandibular teeth as maxillary teeth will have the sinuses visible and a thin radiodense line that runs along the apices of the roots of the premolars. Refer to Figure 6.20 to see the maxillary sinus/nasal passages with the thin white line of the palatine process. The mandibular teeth will have the darker mandibular canal visible below the root.2

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The raised dot on film is the root of much contention, namely, “Where to place the dot?” Some people always place the raised film dot on the right and some to the front of the mouth. Others prefer to always place the dot on the labial/buccal side of the teeth, regardless of whether this places the dot rostral or caudal in the mouth. Pick one and be consistent in using it.

I prefer that the dot be placed coronal to the teeth to be radiographed for this reason: The dot will never be in the roots of the teeth, potentially obscuring an important portion of the film as the dot can distort the picture. See Figure 6.11 for a view of the dot coronal to the teeth when taking a film. Figure 6.20 shows where the film clip was in the lower right corner of the film on the left.

I recommend using this succession to view radiographs: First place the film so the raised dot is toward you, and then identify the teeth as maxillary or mandibular. The mirror image comes into effect. The molars of the right arcade will be on your left and the molars of the left arcade will be on the right.

Digital images are a bit simpler to view. There usually is no dot; the image simply comes up just as you took it. After that, it is the same as with film. Remember, do not flip the image or you will make it difficult to determine left or right. Rotating the image is alright, flipping is not.

Learning what is normal is a large part of identifying what is abnormal. Once your picture is correctly oriented, assess the entire film for quality of exposure and developing. Does the tooth in question, both crown and root, appear in your film? The film should have a clear image without blurring, splotching, or fogging. All roots should be visible, with a minimum of 2 mm visible beyond the apices of the teeth. This allows you to view the full periodontal ligament, lamina dura, and some of the alveolar bone.

Next look at all the structures in the view. It is easy to get sidetracked or make quick assessments if there is an obvious defect; however, you do not want to miss the less obvious issues either. Check out the bony tissue present—does it appear normal and consistent? Do you have an adequate amount of structure to assess it? Your radiograph should extend well beyond the roots of the teeth in question. Remember the minimum 2 mm rule.

Then start on the left and move to the right; look at each tooth—does the dentin and pulp cavity match its neighbors, is the periodontal ligament visible all the way around the root, is the alveolar bone at the proper height (any signs of vertical or horizontal bone...
loss), any resorption or periapical lucency? Perform these steps with each tooth as you move to the right.

Common radiographic pathology to learn to identify includes missing or unerupted teeth, horizontal and vertical bone loss, endodontic lesions, abnormal root structure, retained tooth roots, tooth resorption, and fractures to the roots or bone below the gum line. This is by no means a complete list of the pathology that may be seen but it is a good start at identifying problems seen with radiographs.

Missing and unerupted teeth are fairly obvious. A missing tooth is one that is not visible in the mouth and on radiograph is also not present within the bone. An unerupted tooth is not visible in the mouth but can be seen on the radiograph below the gingiva and possibly impacted. Be sure you have a radiograph that goes to the ventral border of the mandible or to the maxillary sinuses and at least one tooth beyond the normal area for the missing tooth. Remember that the tooth may be in an abnormal position.

There are several problems to look for when analyzing radiographs for periodontal disease. Bone recession and alveolar bone loss can be seen as either horizontal or vertical. Normal bone should reach 1–2 mm apical to the cementoenamel junction (CEJ) and fill the furcation of a tooth. Horizontal bone loss is seen as bone receding from the CEJ and/or furcation of the tooth apically in a horizontal line. Vertical bone loss is seen as bone loss that follows one or more roots apically.

Root abnormalities vary, from root tips that curve in unusual directions to extra roots. This is very important information when planning extractions as the procedure may need to be adjusted to accommodate an extra root or a tip that is curved in an unusual fashion. Fractures of the roots will appear as a solid dark gray line across the root. If the fracture involves bone, the gray line will appear in the bone too. Retained roots will appear as white densities in the bone subgingival to where a tooth crown is missing.

Tooth resorption can vary. Teeth with tooth resorption will have an abnormal gray area of the tooth crown and/or root. The crown may appear to have a large piece missing from it or have a moth-eaten appearance. The roots can have a normal periodontal ligament with only the crown affected or the periodontal ligament can be almost nonexistent with the root and surrounding bone hard to differentiate. These teeth are in the process of becoming ankylosed and can be difficult to extract.

Endodontic disease may not be obvious until you take a radiograph. It is exhibited in several ways on radiographs. It may be seen as a pulp canal that is wider in the affected tooth than other similar teeth in the same mouth. Compare the tooth in question with the neighboring teeth and the contralateral tooth. Is the canal similar in size? If not, the tooth will warrant further evaluation. You may see periapical lucency as a darker gray, radiolucent bubble or line around the apex of one or more roots. This bubble can vary in size or shape and a foramen can mimic periapical lucency, so be cautious and know your anatomy. Sometimes these changes can be very subtle, showing a slight widening of the periodontal ligament space or a disruption of the lamina dura.

Learning radiographic anatomy and recognizing pathology can be a challenging part of taking dental radiographs. With a bit of practice this skill will expedite the diagnosis of several treatable diseases of the oral cavity.