Intra-oral radiographs are an essential part of a comprehensive oral examination and have become a key element in the diagnosis and formulation of a pet’s dental treatment plan. Yes teeth can be cleaned and polished without radiographic images, but a complete periodontal assessment and treatment cannot be performed without intraoral radiography.

Facts:
- It is simply not possible to provide good quality dental care without dental radiographs.
- Current practice standards dictate a higher level of care than a technician removing visible tartar and the extraction of the “loose tooth”. In fact, AAHA standards recommend dental radiographs for all patients, combined with probing and visual inspection of the teeth and oral tissues.
- Pathology noted on oral examination (gingival recession, furcation exposure, tooth fractures) or the loss of attachment noted upon probing (pockets >3mm in dogs, >1mm in the cats) must receive radiographic evaluation.
- In one published report intraoral radiographs revealed clinically important pathology in 27.8% of canine patients and 41.7% of feline patients when no abnormal findings were noted on the initial examination.
- In another study, in patients with abnormal exam findings, additional pathology was revealed via radiography in 50% of dogs and 54% of cats.

Intra-Oral Radiograph Uses
1. Treatment planning and follow-up care in pets with periodontal disease. When the gingival sulcus depth, measured with a periodontal probe, is greater than normal (>3mm in dogs, >1mm in cats).
2. With advanced periodontal disease. For proper extraction decision making and the prevention of mandibular fractures.
3. Pre- and post-extraction cases to evaluate root morphology, root fracture, root ankylosis, or root abscess, as well as assisting in the removal of fractured root tips.
4. Periodontal and endodontic evaluation of teeth with attrition or abrasive wear, discoloration, and fractures teeth with pulp exposure.
5. Evaluating of persistent primary dentition when found with adult counterpart. Always radiograph before removal.
7. Treatment planning in the feline stomatitis patient.
8. Evaluating oral masses and facial swellings.
9. Oronasal fistula diagnosis and treatment planning.
10. Diagnostics in the painful mouth patient, the chronic rhinitis patient, and the oral malodor patient.
11. Evaluating the presence or absence of unerupted or impacted teeth.
Materials Needed for Intra-oral Radiography

1. Dental x-ray unit (select one)
   a. Wall
   b. Floor mounted dental radiograph generator
   c. Handheld unit

2. Digital based system
   - Direct digital sensor or Phosphor plate
   - Desktop or laptop computer

*Dental x-ray units* are usually mounted on a wall overlooking the dental suite. They can also be free standing or mobile and a handheld unit is now available. A dental x-ray unit permits accurate positioning of the film and X-ray beam with minimal adjustments to the patient’s position. The majority of dental machines used in the veterinary field have a technique chart designed for our canine and feline patients making it easy to change the settings for the size patient or selected tooth. The wall mounted or mobile (rolling) units are safer for the operators and positioning training is easier to learn.

*Digital radiography* provides excellent image quality and have veterinary specific software. Digital systems use either a wired sensor (*direct system*) or a phosphor plate (*indirect system*) instead of film. The wired sensor models have a #2 size sensor, connected to a computer by a USB cord and it will provide an image to be viewed within 5-8 seconds on a computer screen. Pre-loaded X-ray templates make this system very efficient as the next image can be acquired as soon as the sensor and tube head is repositioned. Also, this system requires significantly less radiation than CR or film based systems. These shorter exposure times greatly decrease the amount of radiation needed which increases the safety to the patient and staff. The phosphor screen is similar to dental film in size (#0, #2, #4), these are flexible like film, are fed through a scanner, and the image is viewed in approximately 30 seconds. This system reduces radiation used compared to film based systems.

Image quality depends a great deal on the software used to process the image. Software allows for the changes in contrast and enhancement of the image. Images are projected onto a computer screen which allows for improved evaluation of an image, images can be easily shared with the client on a laptop computer, exported to a printer and shared at dismissal. Also images can easily be emailed to a specialist for interpretation or consultation.

There are many systems to choose from. There are differences in image quality, software capabilities and software user friendliness. I would recommend you assess your practices needs, compare systems with an experienced vendor, consult with a Diplomate of the American Veterinary Dental College in your region ([www.avdc.org](http://www.avdc.org)).

**Positioning Techniques**

Dental radiographic positioning is somewhat challenging due to anatomical and spatial limitations of the oral cavity. The ideal evaluation would include two radiographic views taken at a 90 degree angle (as in standard radiography) to provide a 2D image of 3D structures. However the oral anatomy of dogs and cats (palate and mandibular symphysis) does not allow this. Therefore, we use the bisecting angle, parallel, and oblique techniques in dental radiography.
Once these techniques are learned, accurate images can be generated to ensure the correct diagnosis and treatment is provided for each dental patient.

**Parallel vs. Bisecting Angle Technique**
Below are diagrams of the two main techniques that are used in dental radiography.

For the **parallel technique** the sensor is placed behind the tooth in question and the x-ray beam is aimed at right angles to the tooth and film. Due to the anatomy of the oral cavity, this technique is only possible in the caudal mandibular premolar and molar regions.

The **bisecting angle technique** is used when the sensor cannot be placed parallel to the long axis of the tooth. The sensor is positioned at an angle behind the tooth in question. An imaginary line bisects the angle formed by the long axis of the tooth and the film. The x-ray beam is aimed at a right angle to that imaginary line. This creates an image that is neither elongated or foreshortened. This technique will be used when taking radiographs of the maxillary teeth, mandibular 1<sup>st</sup> and 2<sup>nd</sup> premolars incisors and canines.
Standard Views
1. Dental radiographs are best obtained with the patient is under general anesthesia. When learning the positioning techniques it is easiest to place the dog or cat in:
   a. Sternal recumbency for all maxillary images.
   b. Dorsal recumbency for the rostral mandible, the mandibular premolars and molars
   c. As one masters positioning, rostral maxillary and mandibular views may be accomplished with the patient in lateral recumbency. The patients head maybe propped up on a towel to prevent interference of the tube head with the treatment table.

Special Views
*Lateral or oblique views of the canines:* Intra-oral bisecting angle oblique views for the evaluation of the maxillary canine teeth are indicated. The periapical region of these teeth overlap the premolars on the standard occlusal view. Therefore each canine tooth should have a slightly oblique bisecting angle view taken.
Extra-oral near parallel view of the maxilla in the cat:
Image overlap of the zygomatic arch and maxillary premolars commonly occurs in the cat. In order to avoid this problem an extra-oral technique may be used. With the animal in lateral recumbency, the dental sensor is positioned under the head (under the side you wish to radiograph) with the mouth propped open. Align the sensor edge at the level of the crown to allow the image to be projected on to the sensor.

Separating superimposed roots of multi-rooted teeth: The standard view of the maxillary fourth premolar results in an image with mesial roots superimposed. In order to separate the mesiobuccal and palatal roots, an additional slightly oblique view is indicated. In this view the x-ray beam is directed at a slight angle from the caudal/distal or rostral/mesial direction, while still maintaining the proper vertical angle (bisecting angle) with the sensor.

Sensor Orientation
The intraoral/dental sensor is placed in a protective sleeve. The sensor has a wire attached to the back. The sensor is placed in oral cavity between the tongue and mandible in the parallel technique or against the palate or on the tongue in the bisecting technique. One must have the understanding that our goal is to obtain the entire subgingival root and 2-3 mm of peri-apical bone to properly evaluate the patient for pathology. Thus, one can “cut” off the crown of a tooth on the image as we can visualize the crown. Remember the X-ray beam will project the image (shadow) of the root structure on to the sensor, so the sensor many times is placed more towards the patients midline of the oral cavity.

The digital software will orient the image as you are be observing the pet’s dentition from the outside (looking at the pet face to face). With a working knowledge of the pet’s dental formula, looking for single, double, and triple rooted teeth plus a few other landmarks you will be able to distinguish the maxilla from mandible and left from right.

Technique Problems
Images that are too dark may be over exposed (time setting too high). Films too light may have been under exposed (time setting too low).

Common Positioning Problems
Elongation and foreshortening of images occur relatively frequently when first learning the bisecting angle technique. This occurs when the angle of the x-ray beam is too shallow or too steep. Cone cutting may also occur. This error causes the image to be incomplete or portion “cut off”. To prevent this start by lining up the tube head from behind. Position the cone over the teeth in question. Then look from the side to adjust the bisecting angle. Remember, you are more concerned on obtaining an image of the tooth root and at least 2-3 mm of bone than all of the crown.
Resources