

PRINCIPLES OF RADIOGRAPHIC INTERPRETATION.

Sept. 2000.

W&P. Ch.14. Oral and Maxillofacial Imaging. Farman and Nortje

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Only a licensed dentist is permitted to prescribe radiographs. Radiographs are taken for a patient only **after** a thorough **clinical examination** has been completed and a clinical decision has been made that radiographs are indicated; that is, that the *probable* benefits to the patient at that stage outweigh the *possible* potential hazards. A clinical evaluation is essential even for asymptomatic patients undergoing routine dental examinations. A clinical assessment also determines the **most appropriate view(s)** that should be taken as well as the **frequency**. Radiographs are **never taken "routinely"**. It is ethically unsound to do so.

It is important to bear in mind that when one views a radiograph, one is looking at the image (shadow) of the object, and a radiograph is a two dimensional image of a three dimensional **object**. Thus, there must be sufficient density on a radiograph to be able to examine the radiograph(s). Areas that permit more rays to pass through, appear dark and are known as **radiolucent** areas. Areas that absorb more ionizing radiation are known as **radiopaque** areas and appear white or clear. Areas that have both radiopaque and radiolucent areas are known as **mixed** lesions.

It is very seldom that an area is made up completely of one shade. A combination of the black, mainly gray and white areas constitute the image. There are many shades of gray and the human eye is capable of detecting very subtle differences. There should be minimal or no distortion of the images as this can result in incorrect interpretation.

A radiograph is only one part of the diagnostic process. Usually one does NOT make a diagnosis solely from a radiograph. A diagnosis is made by the clinician once all the diagnostic information has been collected and analyzed collectively. An interpretation or a *differential diagnosis* is made from the radiograph. The interpretation of a radiograph is accomplished in three steps, visualization, perception and integration of information received from the radiograph with that from other sources.

Also one never makes use of a radiograph in cases where one can make use of other diagnostic tools; e.g. one never takes a radiograph to check the vitality or mobility of a tooth. The vitality of a tooth is checked with a pulp tester.

It is important always to use the correct terminology when discussing radiographs.

1. One examines a **radiograph** and NOT an X-ray. Bear in mind that an X-ray can not be seen. An X-ray is a photon / beam of energy.
2. One does not see infection at the apex of a tooth. What one does see is the well / poorly demarcated **radiolucency/opacity**, x mm by y mms in size at the apex of tooth number X.
3. For the same reason one does not speak about a PAP in radiology.
4. Periodontal bone loss is not periodontitis per se.

5. Stay away from brand names. We do not have a panorex machine here. Use the word **PANORAMIC** radiograph or PAN.
6. In radiologic terminology, a PA is a postero-anterior view.

For **optimal interpretive yield** from a radiograph, it is important to observe the following guidelines.

1. Examine radiographs in a **logical**, systematic manner. Develop a **routine** of examining every radiograph from corner to corner.
 - 1.1 Observe the difference between perception and visualization. Perceptual inaccuracies include misinterpretation of size, content, or length [e.g. short gutta percha endo fill]
 - 1.2 You only observe what you know or look for. It is important to know [radiographic] anatomy and pathology to be able to read a radiograph
 - 1.3. You must learn to think in terms of the third dimension.
2. Examine radiographs in a distraction-free environment.
3. Use uniform illumination of greater than **200 foot candles**.
 - 3.1 Reduce room illumination. [back ground]
 - 3.2 and cover unused portions of the viewing box to be able to see subtle changes in gray.
4. Use a magnifying glass and a millimeter ruler to maximize the perception of image detail.
5. When an abnormality is found do not neglect to examine the rest of the radiograph. Never fall into the trap of seeing one problem and not carefully examining the rest of the radiograph.
6. Radiographs must be mounted in an opaque mount to mask out extraneous light.
7. **Eye movement**. Subtle differences in densities will not be observed by staring at one spot.
8. **Viewing distance**. Each person sees best at a certain distance.
9. All relevant findings must be **recorded**.

WHEN DESCRIBING A LESION, it is essential to discuss the

1. **LOCATION** / SITE. e.g. left mandibular third molar region
2. **LESION** itself [e.g. radiolucent/opaque/mixed: unilocular/multilocular],
3. **SHAPE** round, oval, linear, saucer-shaped is a lesion that starts at the periphery of the bone.
4. **BORDERS**, poorly / well defined with regular/irregular borders.
5. **SIZE** in inches or mms Measure do not estimate.
6. **SYMMETRY** usually indicates a variant of normal or an inherited condition.
7. **Relationship** to OTHER ANATOMY [pushing into sinus/ destroying the mandibular canal, causing root resorption, etc.].

Radiographically, examine bone, teeth and soft tissue separately.

BONE.

If bone is abnormal, the radiograph can reveal 4 types of changes - increased radiolucency, [less trabeculations] increased radiopacity, a mixed lesion or a change in the alveolar trabecular pattern or outline of the bone.

TEETH.

Always **count** the teeth [and roots] to observe missing or additional teeth or roots. Check for abnormal location of teeth, shape of teeth.

Then check the **individual** teeth, checking the enamel, [amelogenesis imperfecta, mulberry molar, etc.] the dentin, [dens invaginatus or evaginatus, denticles etc.] the pulp chamber [dentinogenesis imperfecta, odontogenesis imperfecta, odontodysplasia, taurodontism, individual obliteration of nerve canals, etc.] and nerve canal, [dentinogenesis imperfecta, individual obliteration of nerve canal etc.] the apical area of the tooth, [root resorption, lucencies or opacities] the periodontal ligament space [widened in early osteosarcoma (localized), scleroderma (generalized) [absent in hyperparathyroidism] and the amount of bone support.

In young people, check that the eruption pattern is normal and on schedule. Check periodontal ligament space.

SOFT TISSUE.

The examination of the radiographic appearance of soft tissue is all too often overlooked. This is particularly true on panoramic radiographs. If the clinical examination determines that soft tissue requires radiographic examination, request that the kVp be reduced when the patient is exposed. Soft tissue structures in the maxillofacial region are often seen; some examples are the tongue, soft palate, tip and ala of the nose, earlobe, etc.

EXISTING DIAGNOSTIC RADIOGRAPHS.

An effective way to reduce unnecessary radiation to the patient is to avoid retaking [recent] radiographs that already exist. It is the clinician's responsibility to obtain these records from earlier health providers where possible.

ATTACHING SIGNIFICANCE TO OBSERVATIONS.

One only sees on a radiograph what one already knows and **has seen** on a radiograph previously. It is basic that one can recognize "normal" radiographic anatomy, otherwise one will not be able to recognize the pathology (abnormal). Certain features are highly suggestive or pathopneumonic of certain disease processes. As already stated, the interpretation of the changed radiographic pattern(s) require(s) a thorough background knowledge of both Anatomy and Pathology.

The diagnostic process is far from infallible. In any diagnostic procedure there are four possible outcomes:-

1. **True positive.** The disease is present and correctly identified.
2. **False positive.** The disease was absent but something on the radiograph convinced the clinician that it was present.
3. **True negative.** No disease present and correctly determined.
4. **False negative.** Disease is present but not detected. Occurs much too often

RADIOGRAPHIC RECORDS.

The value of radiographs as a part of the integral records of a patient cannot be overstated. The information contained in a good radiograph is difficult to match with written records and the radiograph is usually more indisputable than a written statement in a court of law provided the name of the patient is indicated as well as the date. However, this is not a call to expose the patient to ionizing radiation merely for the sake of documentation. One may not retake radiographs for the sake of improving one's grades. Radiographs legally must be kept for at least 5 years; some authorities state 7 years.

DOCUMENTATION.

There is a clear medico-legal requirement for documentation of interpretation. For this reason a signed and dated radiographic report must be written and included in the patient's record. It is also clinically useful in treatment planning and case presentation.

RADIOGRAPHIC PRESCRIPTION.

Only a licensed dentist may prescribe radiographs and then only after an examination has been performed to determine which are the most appropriate radiographic views that will give the maximum amount of information, while exposing the patient to the minimum amount of ionizing radiation.