

RADIOLOGY OF DENTAL CARIES.

July 2003
Neill Serman.

Radiographs are often essential for the **early detection** of interproximal caries. The carious process results in demineralization, which is radiolucent, because the carious lesion attenuates the beam less than healthy tooth structure, resulting in more of the remnant beam reaching the film to produce more interaction in the emulsion layer, thus producing more black metallic silver. **One only sees what one already knows** so learn to recognize caries as this is often the dentist's bread and butter. Caries can reach a large size before it presents clinical problems and a good diagnostician must find and treat the caries before that stage is reached.

I. RADIOGRAPHIC TECHNIQUES

- A. Posterior bitewing views.
Premolar and molar view with a kVp of 75 - 85 kVp.
The **most important** view for caries.
Remember anterior B.W. views can be used for Perio.
- B. Periapical views.
Remember in Radiology a PA is a Postero-Anterior view. The parallel technique must be used to see caries best.
- C. Pan view. Often not sufficient detail to see incipient caries but is often the best view to see occlusal caries.
- D. Lateral Oblique. Not often used.
- E. Any radiograph that shows the teeth.

II. FACTORS INFLUENCING DIAGNOSIS.

1. kVp 75 - 85 is the ideal. - affects contrast - gray scale.
2. Excessive filtration - same effect as kVp.
3. mAs or exposure time. Results in excessive / reduced density.
4. Processing. The cause of most problems, whether the film is too light, too dark or too yellow.

III. FREQUENCY OF RADIOGRAPHIC PROCEDURES.

The frequency that radiographs are required can be determined **only** clinically and by taking a history. Such factors as oral hygiene, fluoride exposure, diet, history of caries and age are important. Radiographs for caries should be taken at 1 - 3 year intervals in adults depending on the above factors. In young children one can consider taking radiographs every 6 - 12 months on caries-prone children. When a new patient is seen it is important to find out when the last radiographs were taken. If recent, one should attempt to obtain them before attempting retakes. Radiographs of inferior quality should be ignored and retaken - yours or others.

IV. RADIOGRAPHIC CLASSIFICATION OF CARIES.

(HAUGEJORDEN & SLACK 1975)

C-1. Enamel caries less than halfway through the enamel. Also known as incipient caries.

C-2. Enamel caries penetrating at least halfway through the enamel.

C-3. Caries at the D-E junction. (moderate lesion).

C-4. Dentin caries halfway to the pulp. (severe lesion).

V. RADIOGRAPHIC APPEARANCE OF CARIES.

A. INTERPROXIMAL CARIES.

- (1) Commences **apical** to contact point.
- (2) Starts off as a radiolucent **notch**. C-1.
- (3) Later **cone-shaped** with the **base toward the periphery**. C-1 to C-2.
- (4) Sometimes - Hourglass shape contacting the dentin.
- (5) At the D - E junction the caries spreads out forming a *second cone* with the *base toward the apex of the first cone*.
- (6) The second cone mushrooms and then is diffuse shaped.
- (7) The outline of the caries is poorly demarcated.

B. OCCLUSAL CARIES. (often seen on pan before B.W.)

- (1) Commences in pits and fissures. May occur at the base of a pit or fissure **with no clinical signs**.
- (2) Not seen radiographically until the D - E junction reached. Stage - C3.
- (3) First seen as radiolucent dot at depth of fissure.
- (4) Spreads out as thin radiolucent line at D - E junction. (In the Nat Board Part II exam they claim that this is the first radiographic sign of occlusal caries)
- (5) Later becomes conical with rounded apex *toward the pulp* and the base toward the periphery. Caries usually cannot be seen radiographically in the enamel.
- (6) The caries first penetrates the dentin in a cone-shape with the base toward the periphery.
- (7) The radiolucent outline is **poorly demarcated**.
- (8) Outline later becomes diffuse.

C. BUCCAL / LINGUAL CARIES (CERVICAL).

- (1) Radiolucency with clearly demarcated borders, because the enamel rods are parallel to each other and to the X-rays.
- (2) Radiolucent outline will be more clearly defined if on the lingual side. (smaller film-object distance.)
- (3) Projection effect may make caries appear enlarged.
- (4) Can be mistaken for interproximal caries. Check clinically.

D. ROOT / CEMENTAL CARIES.

- (1) Occurs with advanced gingival recession on exposed dentin
- (2) Also with *food packing, open contacts and over eruption*.
- (3) Seen as interproximal saucer shaped or notched radiolucency apical to the cemento-enamel junction but **coronal** to the bone height.

- (4) Often mistaken for cervical burnout. Differentiate clinically and also because of situation.
- (5) With prolonged retention of teeth, this type of caries is increasing

E. RECURRENT / SECONDARY CARIES.

- (1) Seen as a radiolucent adjacent to / under existing restoration.
- (2) Radiopacity of restoration may often hide much of the caries.
- (3) May be confused with lining.

F. ARRESTED CARIES.

- (1) Seen on proximal surface of tooth as a vague radiolucent notch where adjacent tooth is lost.
i.e. no contact.
- (2) Arrested caries in pits or fissures rarely seen.
- (3) Can be mistaken for cervical burnout.

G. RAMPANT CARIES.

Usually occurs in children on high carbohydrate diet, poor oral hygiene and no fluorides. Seen radiographically as caries described above. Interproximal and smooth surfaces affected. Nursing / baby bottle syndrome is a type of rampant caries. Becoming rare.

H. RADIATION / DRUG RELATED CARIES.

Due to xerostomia and not only the teeth in the beam affected. A type of rampant caries that usually is seen as a radiolucent shadow commencing at the necks (cervical caries) of teeth and spreads mesially and distally in patients with poor oral hygiene not using topical fluoride. Several adjacent teeth often affected causing crowns to be lost with root fragments remaining. Many patients are taking drugs that produce xerostomia and that can result in a similar appearance.

VI. FACTORS INFLUENCING CARIES INTERPRETATION.

A. UNDERESTIMATION OF SIZE OF CARIES.

- I. Early caries results in minimal calcium loss and cannot be visualized. Thus caries is further advanced than the radiograph indicates.
- II. Where the carious lesion is smaller in relation to healthy tissue it tends to obscure the demineralized lesion in proportion to its depth.
- III. Ratio of normal tooth structure to caries. Small caries in a broad molar tooth will not be seen as well as the same size caries in a narrow bicuspid tooth.

IV. **Peripheral burnout.**

With overexposed (kVp too high) or low kVp and then over-processed films, adjacent teeth may appear not to contact each other and the caries in the area is not as visible or will give the appearance of being smaller than it is.

V. Incorrect vertical or horizontal angulation - may cause the image of the caries to be smaller or be obliterated due to increased amount of healthy tissue traversed. Adjacent restoration may hide radiolucency of caries.

B. **OVERESTIMATION OF CARIES SIZE.**

I. **Projection effect.** Radiographically one radiolucency overlapping another radiolucency produces enlargement of the radiolucencies that are overlapping, as seen where cervical caries overlaps the pulp chamber.

II. When caries is large, the remaining healthy tissue may **not** be seen making the image of the caries appear enlarged.

C. **IMAGINED CARIES - MISINTERPRETATION.**

I. **Cervical burnout.** A sharply defined radiolucent **wedge** at the alveolar bone height may resemble interproximal or cemental caries.

II. **Mach Band Effect.**

An optical illusion which produces fictitious radiolucent areas in dentinal peaks bounded by occlusal and proximal enamel, seen especially in premolar but also in molar teeth.

III. **Radiolucent restorations** and linings may be mistaken for caries but these usually have clearly demarcated outlines and can be confirmed clinically.

IV. Developmental defects in enamel. Hypoplasia. May appear as radiolucent dots.

CRITERIA FOR A GOOD BITEWING VIEW.

1. The film should be exposed and processed such that there is good density and detail between enamel and dentin.
2. Adjacent or opposing teeth should not overlap.
3. The premolar view must include distal surfaces of both cuspids.
4. The molar projection (view) must include the distal surfaces of the second premolar teeth (or that area). The distal surface of the third molar tooth will then be seen.
5. The image of the occlusal plane must be horizontal.
6. There must be no cone-cutting, scratches or bending of the film.

The above can be achieved by having:-

- a. The central ray perpendicular to the film.
- b. The film and the teeth (object) as close as possible to each other. The buccal and lingual cusps will then be overlapping. This also results in better detail.
- c. The film placed correctly in the appropriate position. **The aligning instruments automatically do the above.**