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.

One examines a radiograph and NOT an X-ray. Bear in mind that an X-ray cannot be seen. An X-ray is a photon / beam of energy.

**Dental caries**
Moderately advanced caries on any tooth surface can be demonstrated on a properly angulated, exposed & processed intra-oral film.

**Factors affecting the interpretation of dental caries:**
1. Cervical burnout: Radiolucent band around the neck of the teeth (area not cover by enamel or alveolar bone) happened due to less x-ray absorption than areas below and above. It can be reduced by reducing kVp.
2. Peripheral burnout: It could be reduced by decreasing exposure time or kVp.
3. Ratio of enamel to caries which X-ray photon must penetrate.
4. Errors in vertical angulations: Increased & decreased.
5. Errors in horizontal angulations: which cause interproximal overlapping.

**Interproximal caries**

The intra oral radiographic film, notably the bitewing or periapical film made with the paralleling technique is extremely useful in detecting interproximal carious lesions.

The first evidence of the interproximal carious lesion consists of an extremely small notching in the enamel surface below the interproximal contact point.
As the carious lesion in the enamel increase in size, it continues to demonstrate a more or less triangular pattern with its base toward the outer surface of the tooth and with somewhat flattened apex toward DEJ. The carious process proceeds toward the pulp, roughly along the dentinal tubules, and form another triangular radiolucency this is happen due to paths of the dentinal tubules. When the under mind enamel fracture the entire carious lesion appear as V_shape.

**An incipient interproximal lesion** extends less than halfway through the thickness of enamel. The term incipient means beginning to exist or appear. An incipient lesion is seen in enamel only.

**A moderate interproximal lesion** extends greater than halfway through the thickness of enamel, but does not involve the DEJ. A moderate lesion is seen in enamel only.

**An advanced interproximal lesion** extends to the DEJ or through the DEJ and into the dentin, but does not extend through the dentin greater than half the distance toward the pulp. An advanced lesion affects both enamel and dentin.

**A severe interproximal lesion** extends through enamel, through the dentin and greater than half the distance towards the pulp. A severe lesion involves both the enamel and dentin and may clinically appear as a cavitation (or hole) in the tooth.

- **Occlusal caries:**
The first radiographic sign is a thin dark line between enamel and dentin. Occasionally occlusal caries is confused with buccal or lingual caries and differentiated clinically.

Occlusal caries follows the enamel rods, as in interproximal caries the shape of the caries in the fissures is triangular but occlusal caries differs from interproximal caries is that in enamel caries the base is toward the DEJ and the apex of the triangle is toward the occlusal surface of the tooth.
Incipient occlusal caries cannot be seen on a dental radiograph and must be detected clinically.

Moderate occlusal caries extends into dentin and is seen as a very thin radiolucent line. The radiolucency is located under the enamel of the occlusal surface of the tooth. Little if any radiographic change is noted in the enamel.

Severe occlusal caries extends into dentin and is seen as a large radiolucency. The radiolucency extends under the enamel of the occlusal surface of the tooth. Severe occlusal caries is apparent radiographically and clinically, appears as a cavitation (or hole) in a tooth.

- **Buccal and lingual caries**: It occurs in the pits and grooves in the region of the free gingival margin. The enamel caries tends to follow the lines of the enamel rods, it is elliptical and/or semi lunar. It is difficult to differentiate between buccal and lingual caries, also it may be confused with pulp exposure even if the lesion may be relatively superficial.

- **Cemental caries**: On a dental radiograph, root surface caries appears as a cupped-out or crater-shaped of varying depth radiolucency just below the cemento-enamel junction (CEJ). Early lesions may be difficult to detect on a dental radiograph.
  It does not occur in areas covered by a well attached gingival, it may be confused with cervical burnout.

Secondary or recurrent caries occurs adjacent to a pre-existing restoration. Caries occurs in this region because of inadequate cavity preparation, poor restoration, defective margins or incomplete removal of caries prior to the placement of the restoration. High caries incidence and poor oral hygiene also play a part.

On dental radiograph, recurrent caries appears as a radiolucent area just beneath a restoration. Recurrent caries is most often seen beneath the interproximal margins of a restoration.
**Pulp exposure**
Radiographic evidence suggesting pulp exposure should not be used as the only definitive criteria for either tooth removal or endodontic therapy. It is possible through angulations changes to create on appearance radiographically that simulate pulpal exposure.

**Developmental pits**
Developmental pits particularly isolated hypoplastic areas, can simulate caries radiographically. In the case of a hypoplastic pit the enamel surface tends to curve inward into the defect.

**Periapical radioluencies**
1. Common pathologic conditions granuloma, cyst, abscess, 1st stage of cementoblastoma you must remembered that anatomic entities such as the mental and incisive foramina my superimposed on the tooth apex which may simulate apical pathology.
2. Less common pathologic conditions fibro - osseous lesions, neoplastic changes, and various infections.

Radiographic signs: the apical lesion will show an interrupted lamina dura. The periphery blend into surrounding bone; definite demarcation may exist between the lesion and bone or the lesion may exhibit a distinct bone lamina encircling the radiolucency shape is basically spherical with irregular or smooth outline periphery.

It must be kept in mind that you must think firstly about normal anatomical landmarks superimposed above the periapical area like mental foramen & maxillary sinus.

**Interpretation of periapical radiolucency:**
1. Superimposition of radiolucent normal anatomical structure like mental foramen & maxillary sinus, & inferior dental canal.
2. Incomplete root formation (with children)
3. Periapical cyst, granuloma, or abscess.
4. First stage of cementoblastoma

**Periodontal space thickening**
1. Pathologic: as in tooth extrusion, root resorption, resorption of lamina dura or initial symptoms of osteomyelitis or with trauma.
2. Non pathologic: as in terminal stage of root formation.
**Root end changes**
1. Hypercementosis: clubbing of root (radiopacity related to the root surface)
2. Root resorption
   a. Smooth root resorption (smooth root periphery)
   b. Rough root resorption (roughened root periphery).

**Bone changes associated with apical alteration**
1. Condensing osteitis: bone sclerosis as a result of stress, trauma or infection. It characterized by reduction of trabecular spaces size.

**Periodontal disease**
1. Incipient periodontal disease
   a. Triangulation: widening of periodontal space at the crest of interproximal bone
   b. Crestal irregularities: slightly more opaque alveolar crest with itched appearance (irregular)
   c. Alveolar bone changes, bone sclerosis between the lamina dura of two adjacent teeth.
2. Advanced periodontal disease
   It includes all stages that follow incipient periodontal changes in addition to periodontal pocket exists between soft tissue and tooth structure.

**Location of bone loss**
Periodontal bone loss may be localized (restricted to one or a few areas) or Generalized periodontitis (when periodontal bone loss is evenly distributed throughout the mouth).

**Amount of bone loss**
Under normal circumstances the alveolar bone level is located 1 to 1.5mm from CEJ so a measurement made from the crest of remaining bone to the CEJ minus approximately 1mm gives an indication of bone loss.

**Direction of bone loss**
Intercerstal bone should be parallel with a line drawn from the CEJ of one tooth to that of the contacting tooth.
1. Horizontal bone loss: - when loss occur on a plane that is parallel with a line drown.
2. Vertical bone loss: - when there is greater bone loss in one tooth than on the adjacent tooth, so the bone level is not parallel with a line joining the cementoenamel junctions.

**Detection of local irritating factors**

These include calculus deposits, over hanging restorations, faulty restorative margins and carious lesions.

**Tooth resorption**

1. Physiologic root resorption: - resorption of the deciduous teeth normally precedes their exfoliation.
2. Idiopathic tooth resorption: - resorption of tooth surfaces, either internal or external can occur from unknown cause
3. Pathologic tooth resorption: - it usually caused by pressure, infection neoplasm or trauma.

**Pulp calcifications**

It include pulp stones, secondary dentin, dentinal bridges and pulpal obliteration

1. Pulp stone: - round or oval opacities within the pulp
2. Secondary dentin: - reduces the size of the chamber. It appears to be a normal aging phenomenon as well as a defense mechanism.
3. Dentinal bridges: - develop between Normal pulp tissue and large carious lesion
4. Pulpal obliteration: - is associated with aging and degenerative pulp changes.

**Tooth fractures**

Fracture-line and discontinuity in the outline of the tooth are the most usually observed signs of fracture. It must be remembered that the radiogram can have an appearance that simulates a fracture and fractured segments can be superimposed in a manner that hides the fracture multiple views of the questionable area ordinarily resolve such difficulties.

**Erosion, abrasion, and attrition**

Loss of tooth structure can be observed radiographically.