

Radiology

Lec. 5

Ideal radiographic projection

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The term image quality describes the subjective judgment by the clinician of the overall appearance of a radiograph. It depends on density, contrast, latitude, sharpness, resolution, and other factors. Ideal radiograph demonstrates certain image qualities include:

A – Radiographic image that is sharp.

B – Radiographic image that is shaped like the object.

C – Radiographic image that is the same size as the object.

- ❖ **Sharpness:** is the ability of a radiograph to define an edge precisely (e.g. the dentino-enamel junction, a thin trabecular plate), or measures how well a boundary between two areas of different radio density is revealed.
- ❖ **Resolution:** is the ability of a radiograph to record separate structures that are close together. Or measure how well a radiograph is able to reveal small objects that are close together. (two type spatial resolution and contrast resolution).
- ❖ **Image Size Distortion (magnification)** is the increase in size of the image on the radiograph compared with the actual size of the object.
- ❖ **Image shape distortion** is the result of unequal magnification of different parts of the same object (Is the change in the shape of image as compared to the object due to improper alignment of the tube, film or the object).
- ❖ **Penumbra:** Is the amount of unsharpness of the image so penumbra is the area of partial shadow.
- ❖ **Umbral:** Is the area of total shadow and it exists only when the object absorbs all of X-rays.

Penumbra is created by the size of focal spot (source of radiation), the larger the spot size the greater is the penumbra (the amount of unsharpness). Penumbra is not only affected by focal spot size but also affected by tube – object distance and object – film distance so the closer tube – object distance the greater is the penumbra while the closer object – film distance the lesser is the size of penumbra.

Identification dot: It's a round raising dot present in the corner of each film, allows rapid and proper film orientation and placement. The manufacturer orients the film in the packet so that the convex side of the dot is toward the front of the packet and faces the source of radiation. During film exposure, the film is oriented to place the dot 2-3 mm away from the incisal or occlusal surface.

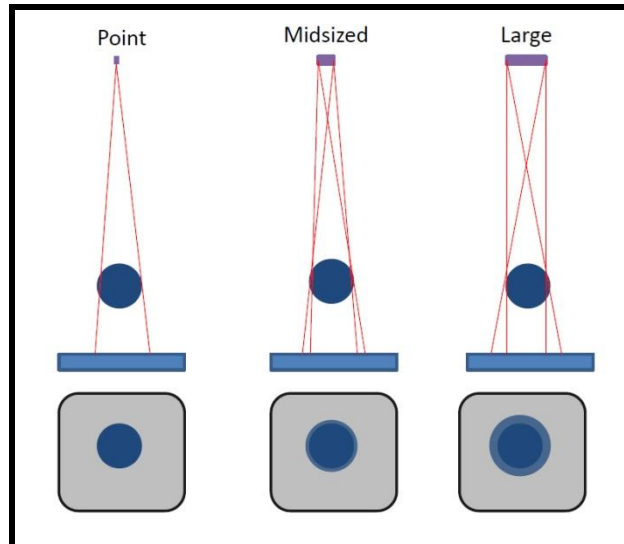


Fig. 1: effect of focal spot size on penumbra and umbra

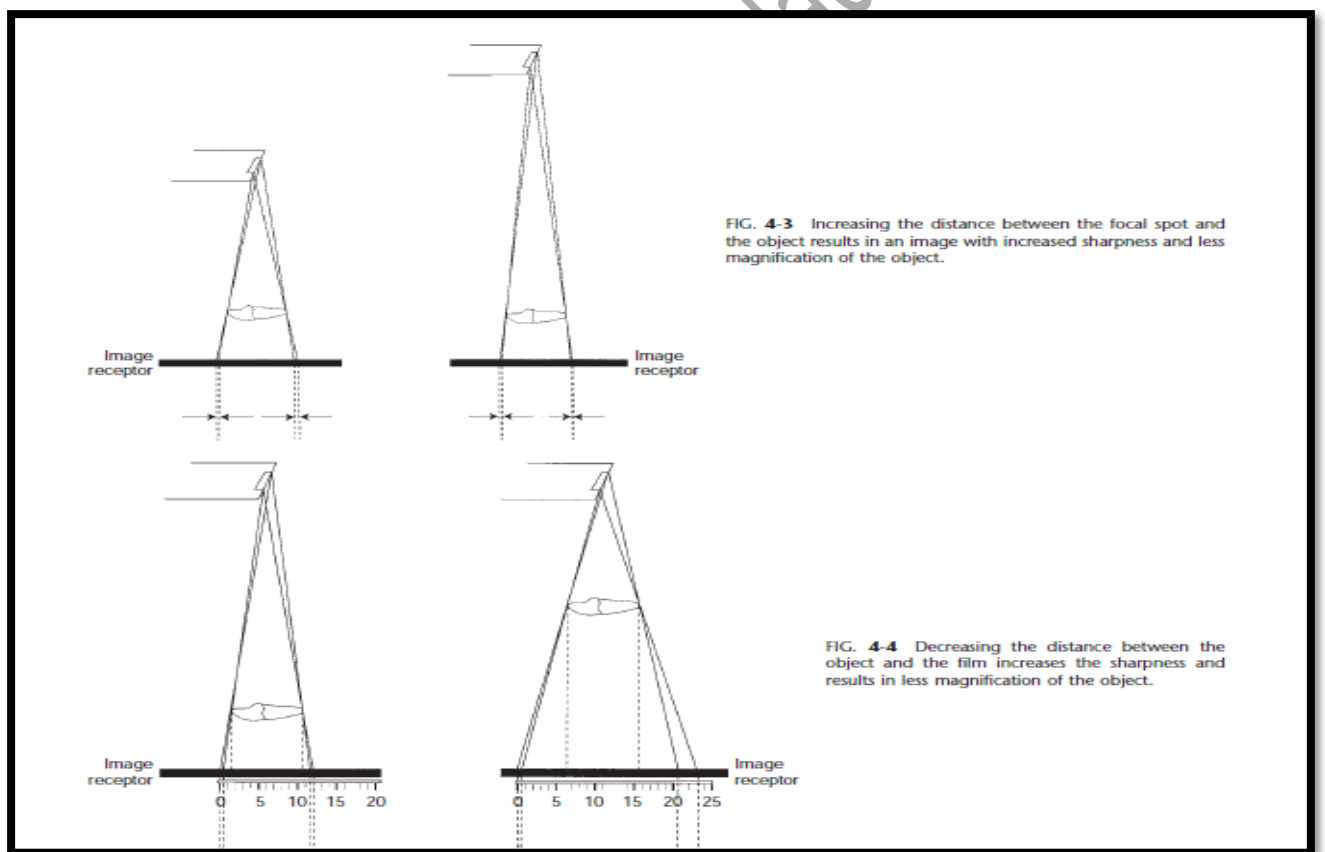


Fig. 2: effect of tube-object distance and object –film distance on umbra and penumbra.

principles of shadow casting

1. Source of radiation should as small as possible.
2. Tube – object distance should be as great as possible.
3. Object – film distance should be as small as possible.
4. Film should be parallel to an easily identifiable plane of the object.
5. Central ray of the beam should be perpendicular to the film.

The first 3 principles deal with the image sharpness while the last 2 principles required during exposure as a technique.

Every radiographic examination should produce radiographs of optimal diagnostic quality, incorporating the following features:

The radiographs should record the complete areas of interest on the image. In the case of intraoral periapical radiographs, the full length of the roots and at least 2 mm of the periapical bone must be visible. If evidence of a pathologic condition is present, the area of the entire lesion plus some surrounding normal bone should show on one radiograph. Sometimes, however, this is difficult to achieve on a periapical radiograph; in such an instance an occlusal projection may be required as well as an extraoral projection. Bitewing examinations should demonstrate each proximal surface at least once. The radiographs should have the least possible amount of distortion. Most distortion is caused by improper angulations of the x-ray beam rather than by curvature of the structures being examined or inappropriate positioning of the film. Close attention to proper positioning of the film and x-ray tube results in diagnostically useful images. The radiographs should have optimal density and contrast, which are essential for interpretation. Faulty processing can adversely affect the quality of a properly exposed radiograph

Factors affecting the radiographic quality of a diagnostic film

Image factors	clarity	Image size	Shape distortion	density	Contrast
kVp				☺	☺
mAs	☺			☺	☺
Collimation		☺		☺	☺
Filtration				☺	☺
Focal spot size	☺	☺			
Object-film distance	☺	☺			
Source-film distance	☺	☺		☺	
Motion	☺	☺			
Alignment			☺		
Subject density	☺			☺	☺
Subject shape	☺			☺	☺
Film speed	☺			☺	☺
Developing time				☺	☺
Technique	☺	☺	☺		
Screen speed	☺	☺		☺	☺

Radiographic errors and Artifacts:

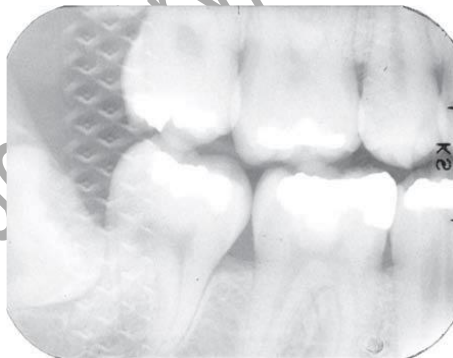
Classified into three category:

- A. Technique and projection errors**
- B. Exposure errors**
- C. Processing errors**

1. Cone cut: is clear unexposed area result from positioning fault when the X- ray beam not completely cover the film during exposure.



2. Back side exposure: when the film placed in wrong position making the non exposure side facing the beam, the result is the image with the pattern of the lead foil is evident.



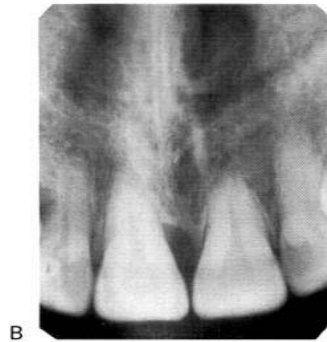
3. Double exposure: the same X- ray film used and exposed twice to X- ray this result in excessive dense and blurred image.



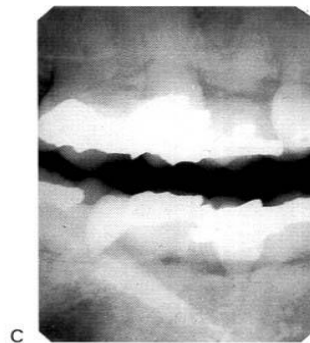
4. Elongated image: vertical angulations of X- ray tube was too shallow.



5. Shortened image: vertical angulations was too steep.



6. Over lapping of adjacent structures: when horizontal angulations was incorrect.



Horizontal and vertical angulations

1. **Horizontal angulation:** refers to X-ray beams direction in a horizontal plane.
2. **Vertical angulation:** refers to X-ray beam direction in a vertical plane.

Plus vertical angulation: when the beam is tipped down ward

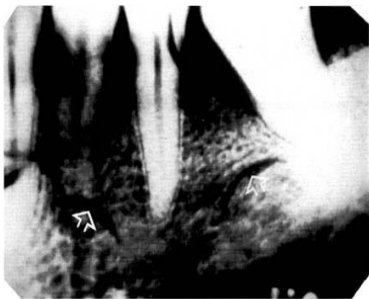
Minus vertical angulation: when the beam is tipped upward.

7. Blurred film: due to excessive bending of the film during placement for exposure.



B

8. Fingernail marks: resulting black lines when pressure by fingernail as an example put on the film or sometime we have (finger print impression) in the emulsion.



B

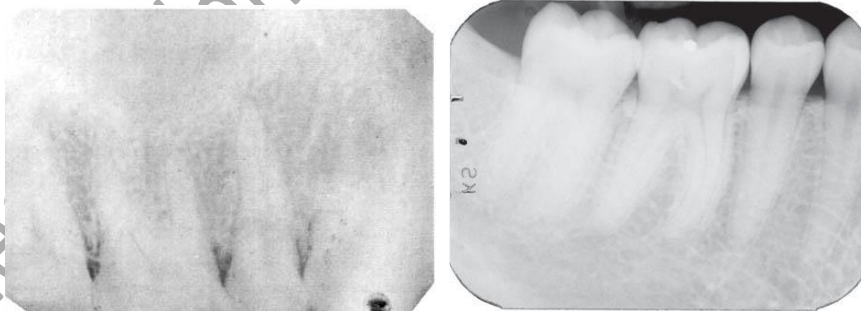
Finger nail mark



A

Finger print error

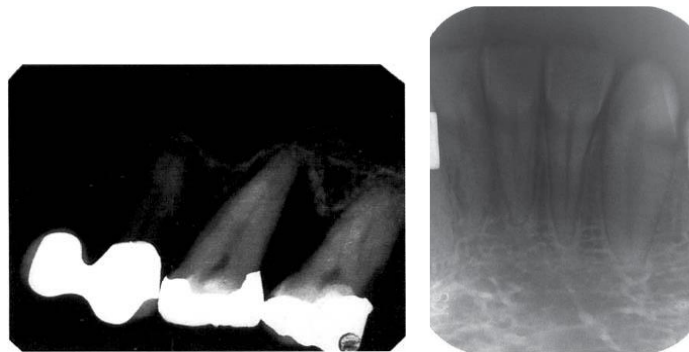
9. Pale X-ray film: this due to either under exposure, or under developing.



10. Blank image: when the film didn't receive radiation, so the film appear totally clear.

11. Completely clear film: when put the film in fixer before developer.

12. Dark X- ray film: this is due to either over exposure or over development.



13. Reticulation: it mean crack of emulsion when subjected to great change in temperature between different processing solution. Note: temperature must go from warm to cold.



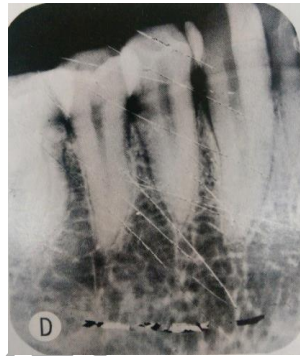
14. Wet and leaking packets: when we have black borders due to light entering a poorly sealed film wrapper.



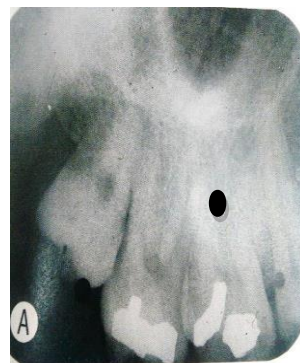
15. Undeveloped area: this appear as clear area caused by incomplete immersion of the film in developer (sometimes called developer cut-off) or sticking the film in the developer to the side of the tank.



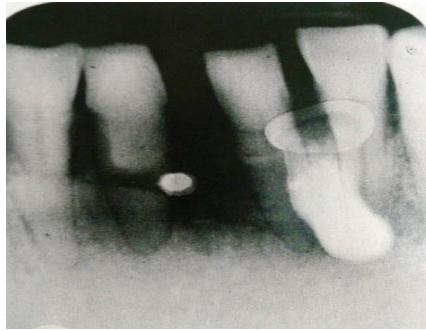
16. Scratched film: when the film is processed in manual processor, the soft emulsion is easily scratched due to rough handling of the film , ex. scratched by holder, tank or nails.



17. Developer spot: black dots or dark spots on the film caused by drops of developer solution that was accidentally spilled on the film before it was developed.



18. Fixer drop: white dots or light spots on the film caused by drops of fixer solution that was accidentally spilled on the film before it was developed.

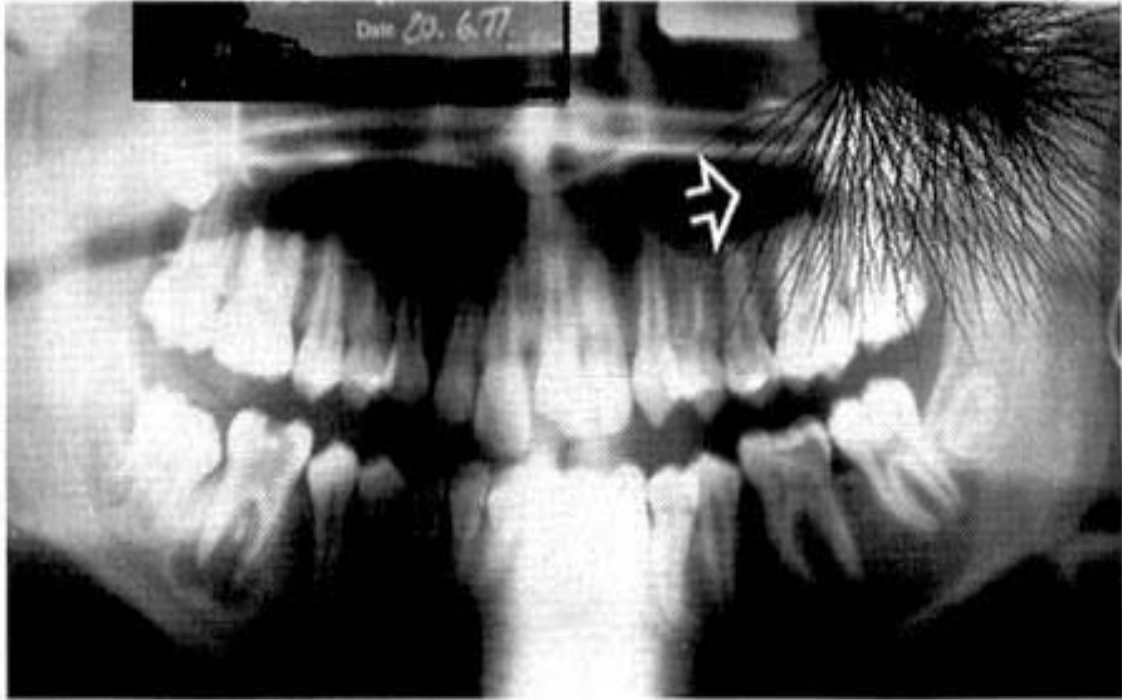


19. Yellow or brown stain: stain or discoloration of film due to contaminated solution or insufficient rinsing.



20. Discharge of static electricity: lightning bolts or multiple black linear streaks produced when two surfaces are rubbed together against each other vigorously, or when film flexed to make it less stiff. occur in extraoral film when cassette film removed too quickly from film pack, especially in low humidity.





D

Discharge of static electricity seen in panoramic radiograph (OPG)

college of dentistry/bag.