PROJECTION GEOMETRY

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Deals with guidelines to achieve images on the image receptors with

- improved clarity
- minimum distortion
- lesser magnification
- better diagnostic details

Rules of Projection Geometry

1)The size of the focal spot should be as small as possible

2)The focal spot – object distance should be as long as possible

3)The object– film distance should be as small as possible

4)The long axis of the object and the film should be parallel.

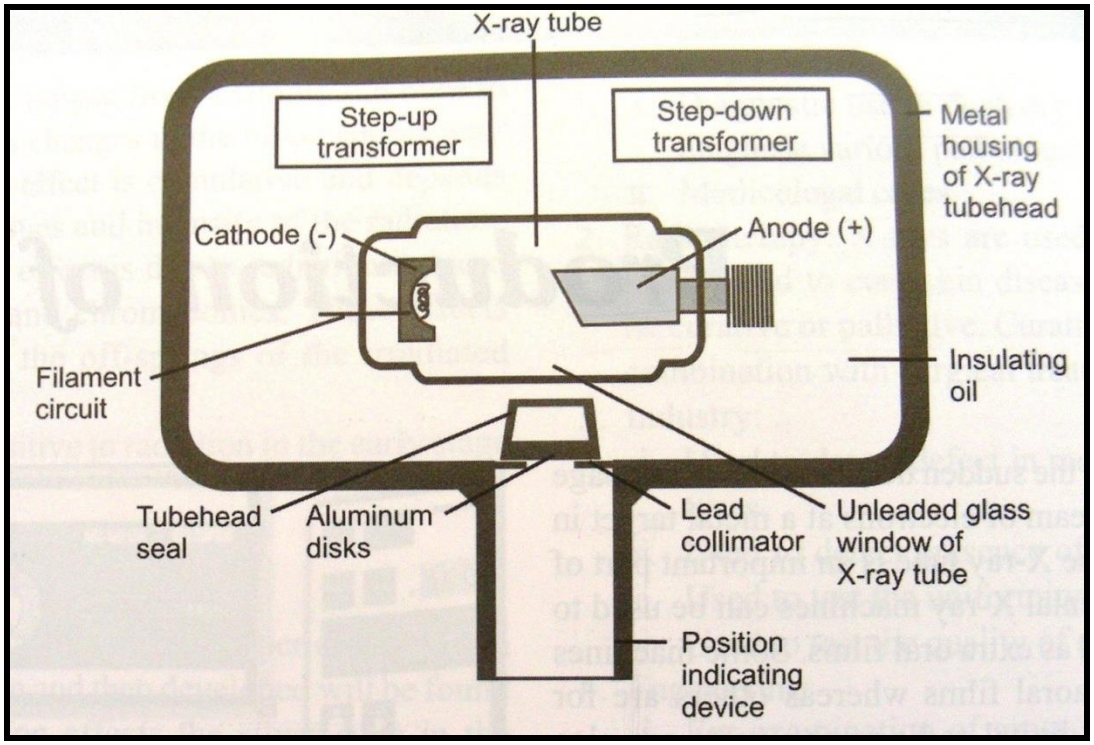
5)The x- ray beam should strike the object and the film at right angles

6)There should be no movement of the tube, film or the patient during an exposure

Rule no1

- The size of the focal spot should be as small as possible
  - governs geometric unsharpness

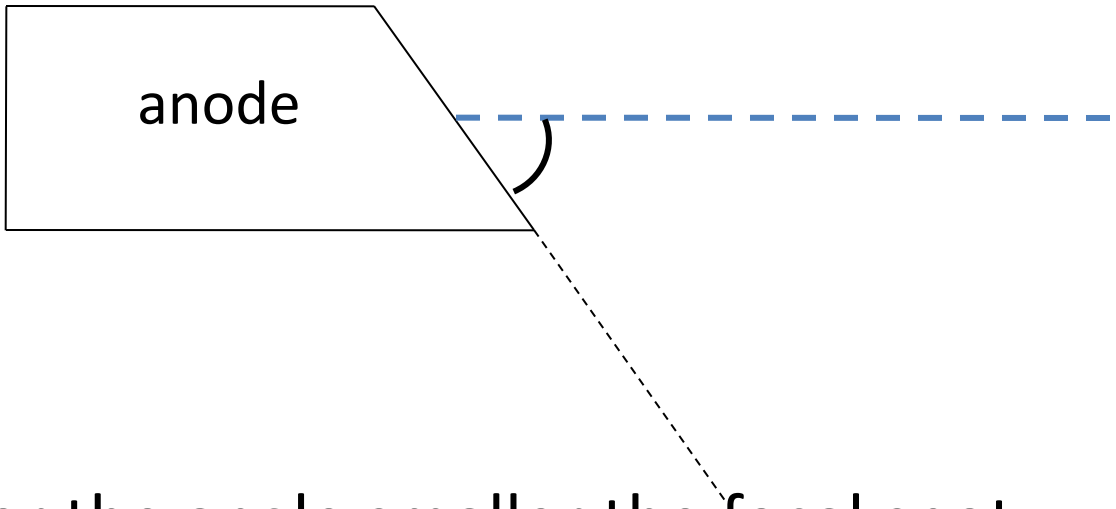
Rule no1



Focal spot is an area on the anode where electrons with high speed strike the cathode.

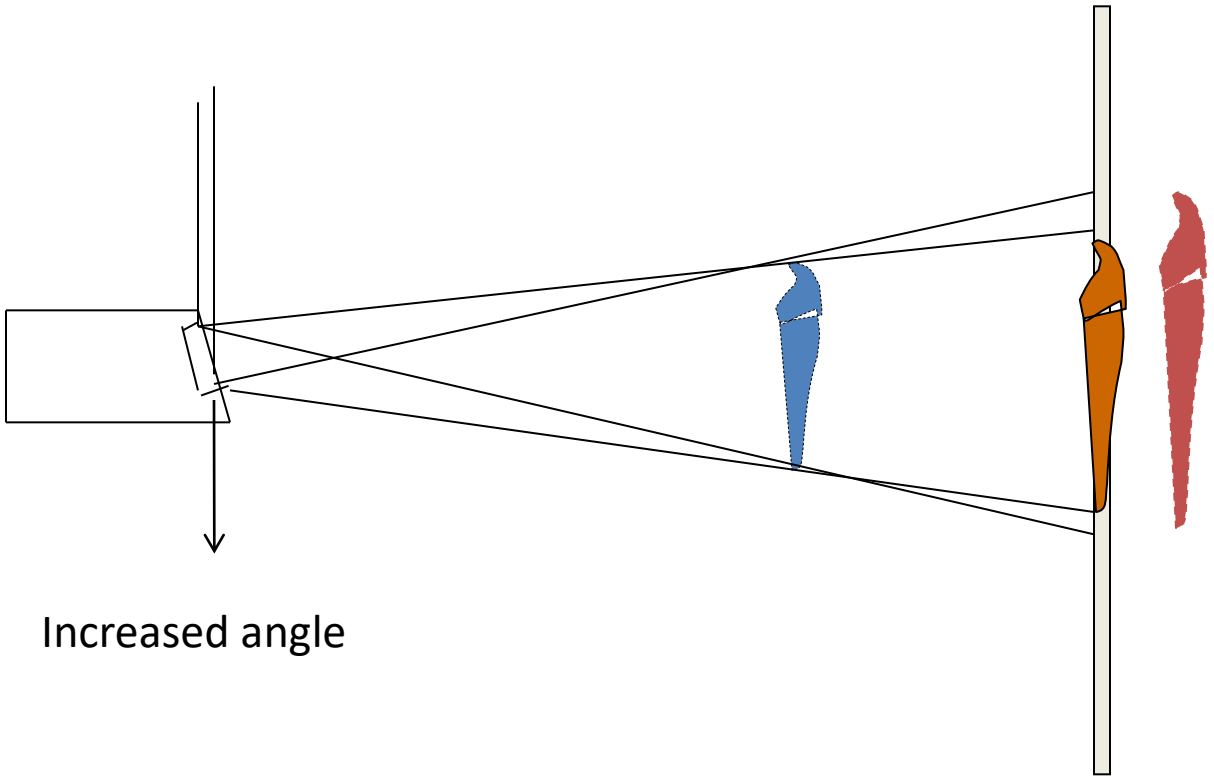
Rule no1

- Size of focal spot is a function of the angle of the target with respect to the long axis of the electron beam



- Lesser the angle smaller the focal spot

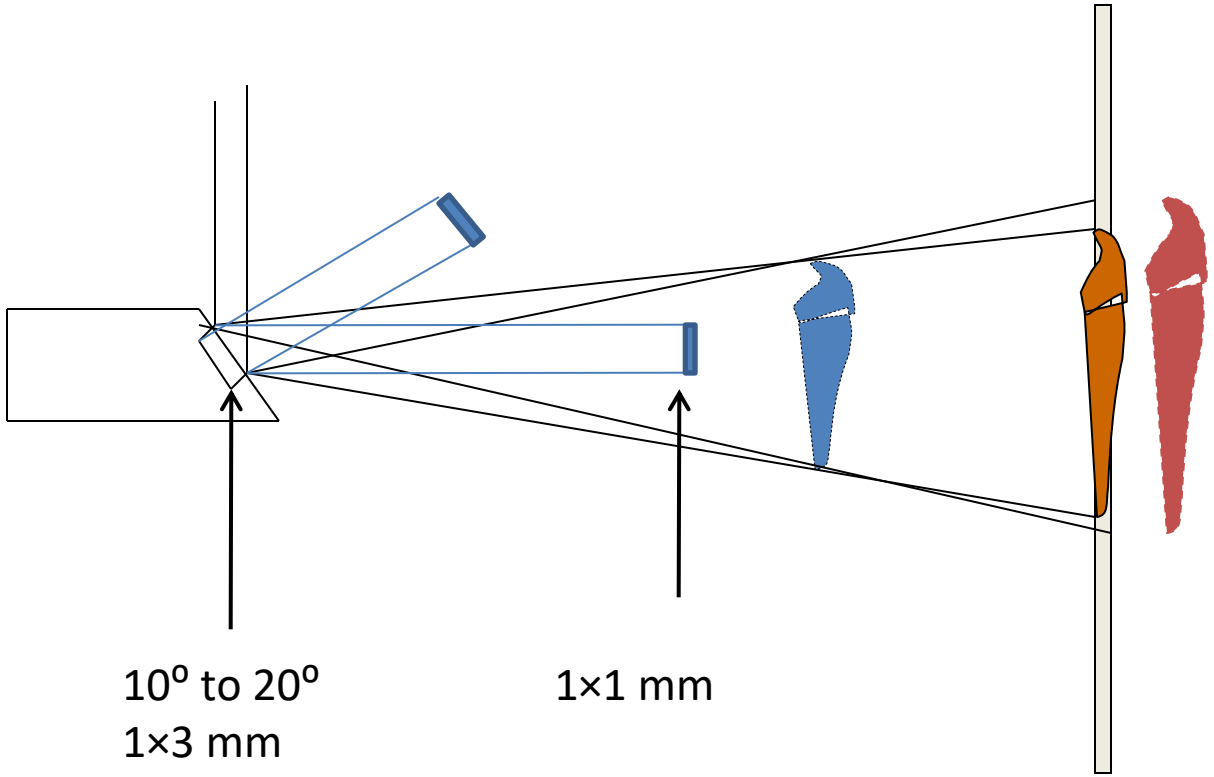
Rule no1:



Increased angle

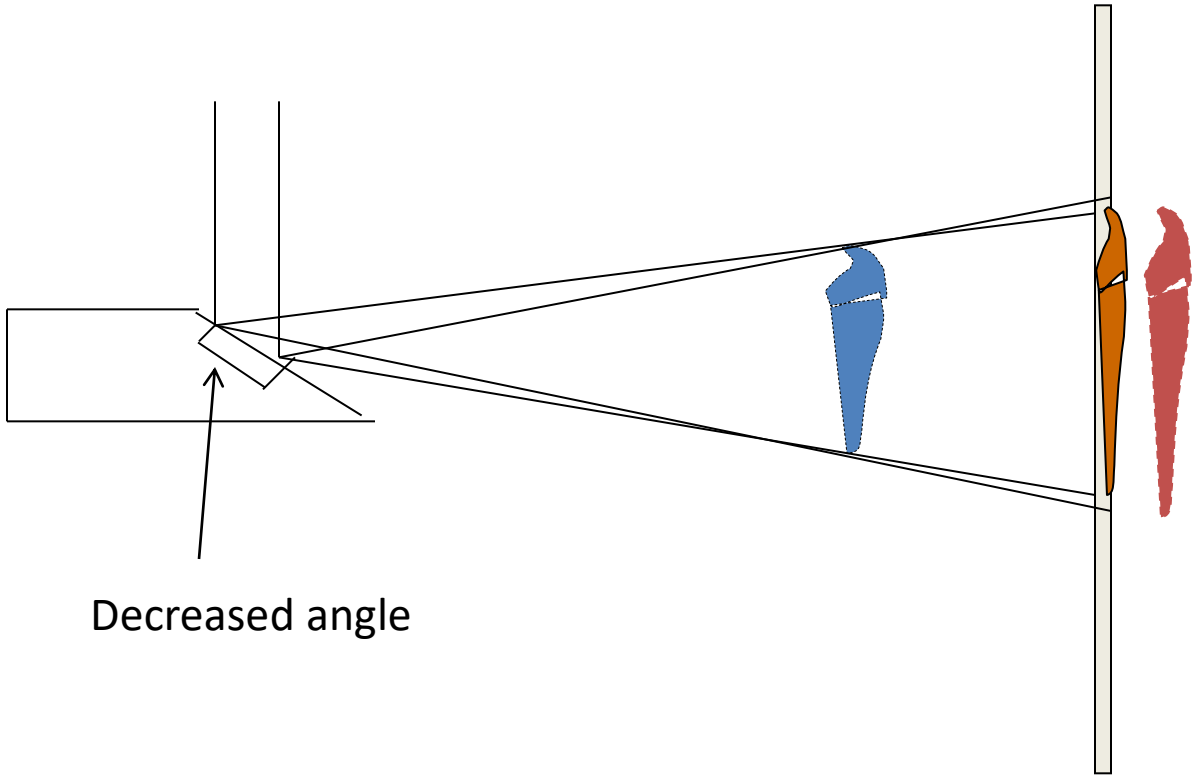
If the size of the focal spot increases, unsharpness increases, because rays diverging at the angle of the object create a wider penumbra and a greater unsharp image is produced
Increasing the angle of anode to central beam increases unsharpness

Rule no1



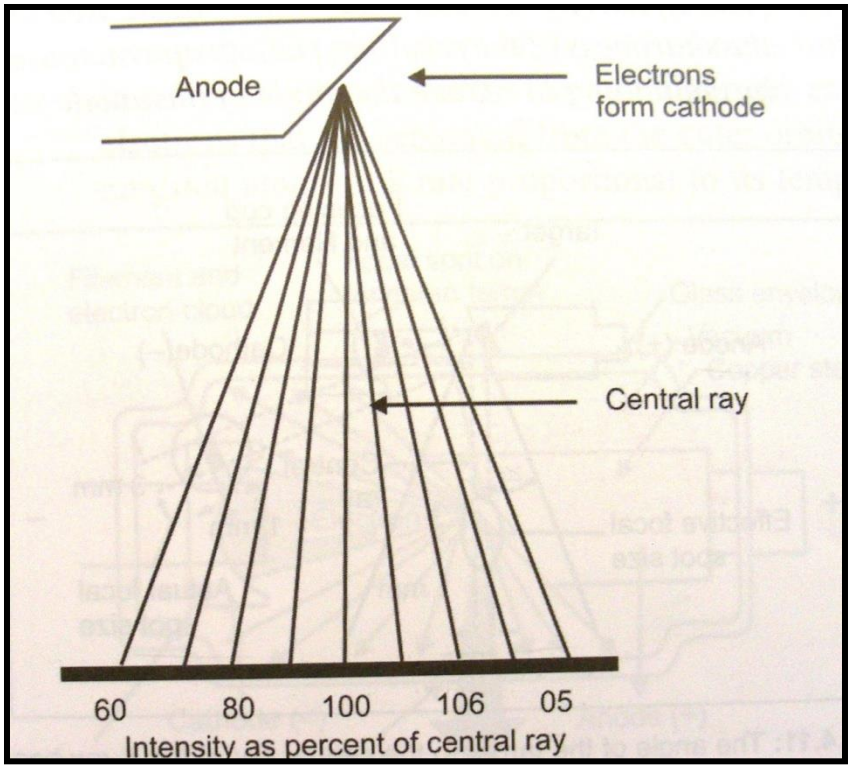
The anode is angulated at 10 to 20 degrees to the central beam. This gives an focal spot of 1 × 3 mm. which effectively becomes 1× 1 mm.

Rule no1



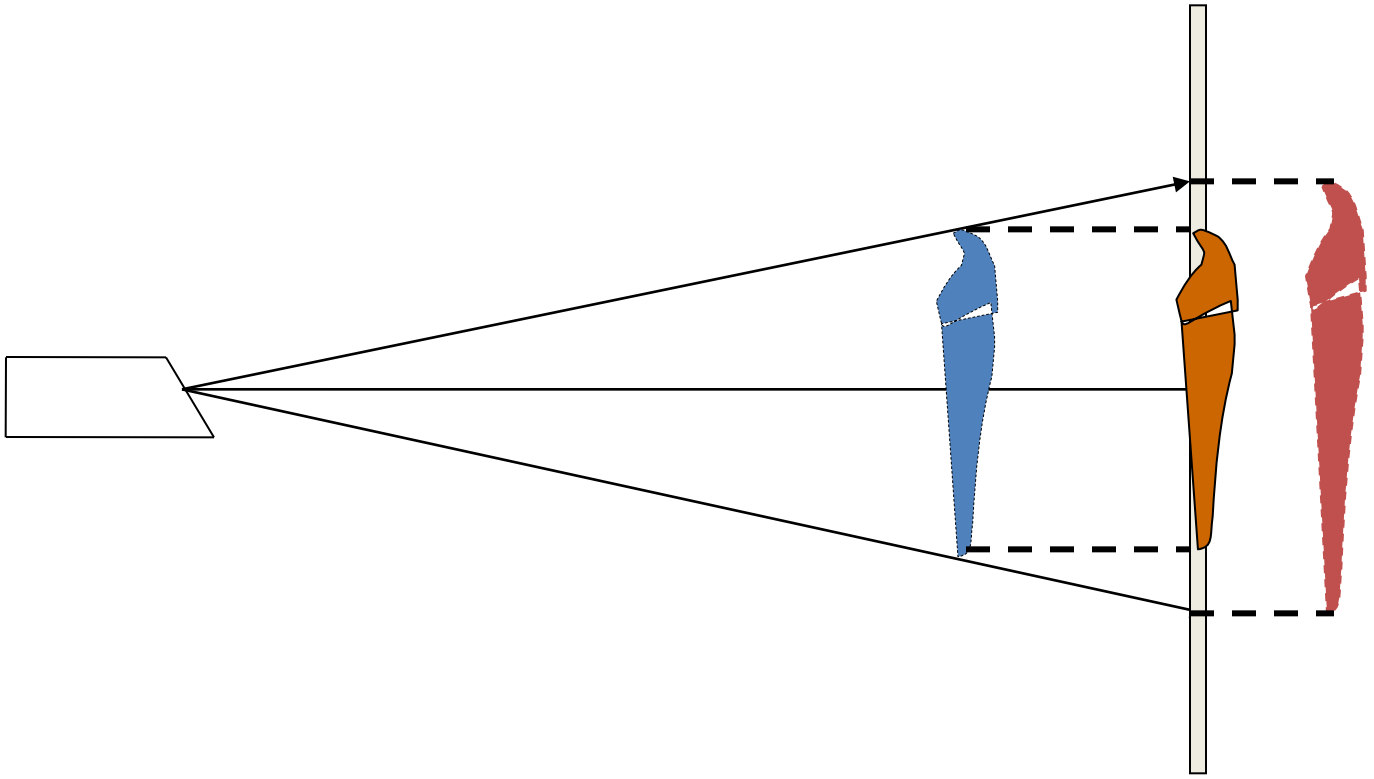
If the angle is reduced further, then the area of unsharpness decreases. But, the angulation cannot be further reduced because of the Heel effect. Since as the angulation is reduced more, the distortion at the anode side is different than at the cathode side.

Rule no1



Heel Effect:

Rule no1



If the focal spot is a point area, there are no chances of distortion as no penumbra is created.

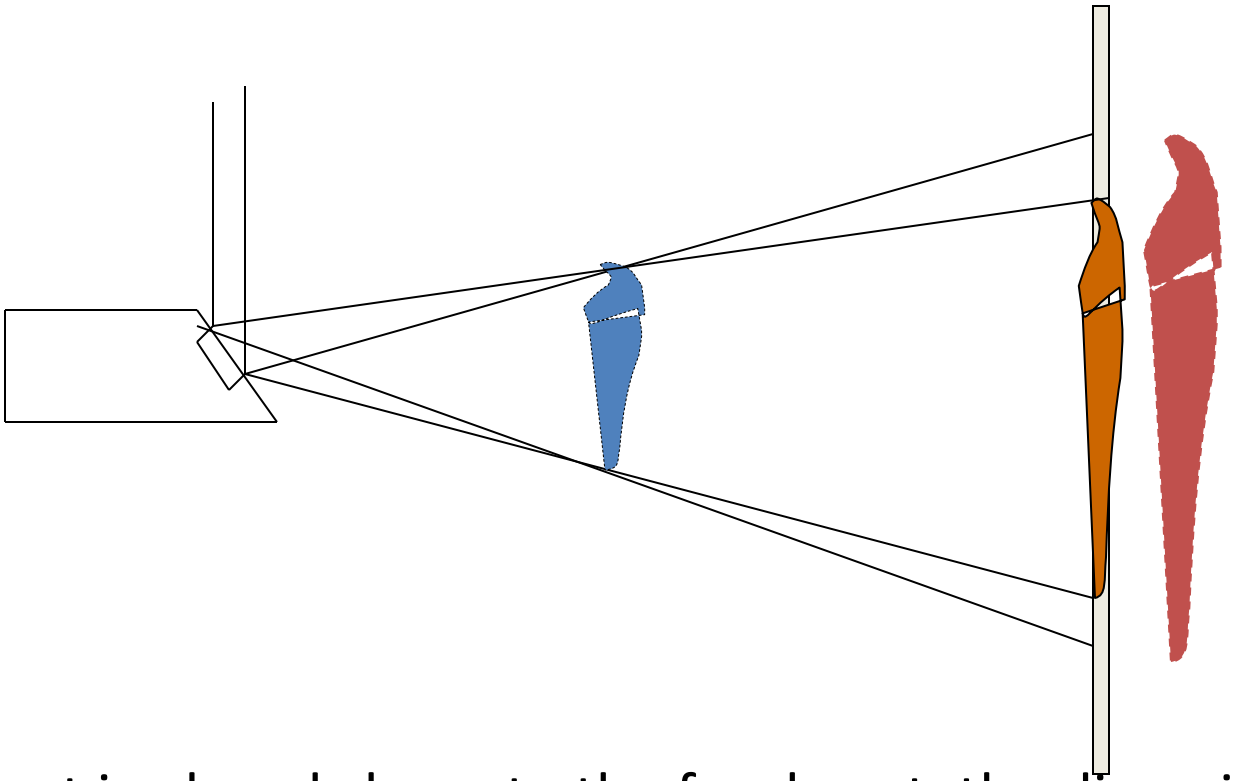
Rule no1

- A large angle distrubutes the electron beam over a large surface and decreases the heat generated per unit of target area, thus prolonging the tube life
- Paralleling angle technique and Bisecting angle technique follow this rule

Rule no 2

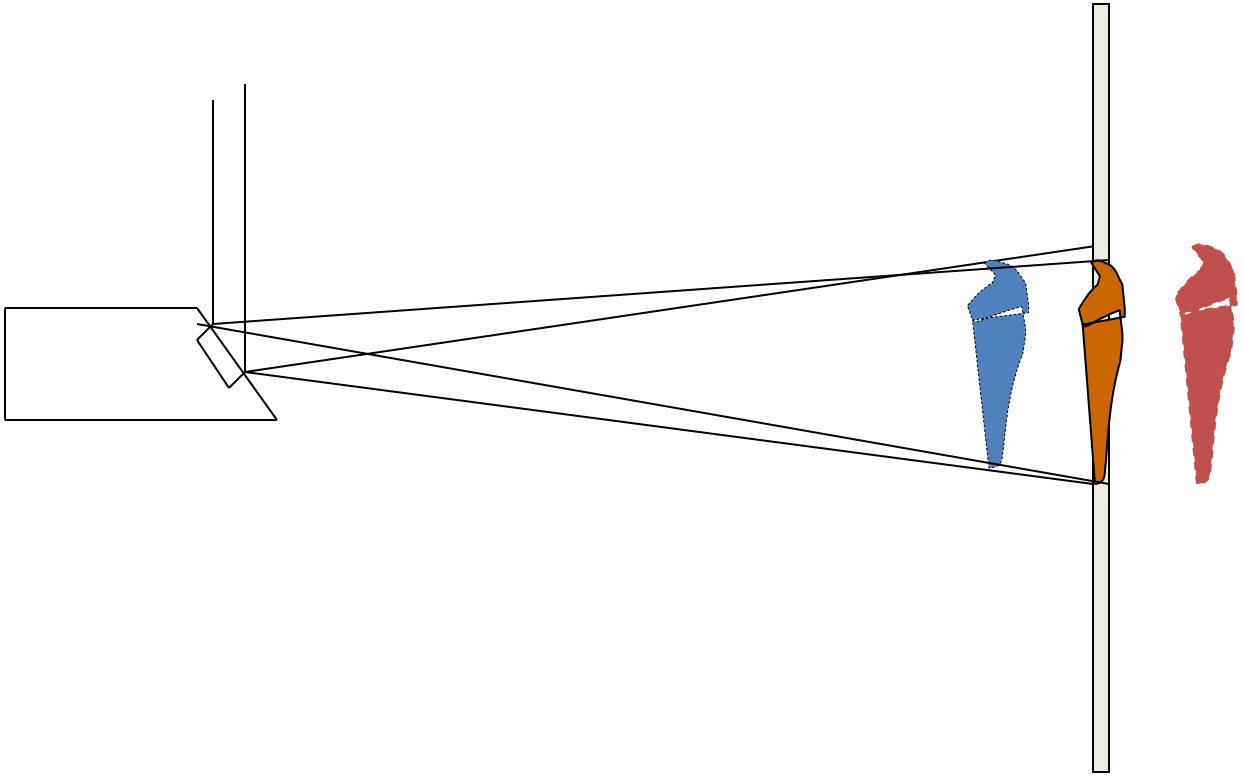
- The focal spot – object distance should be as long as possible.
  - governs geometric unsharpness, and magnification

Rule no 2



If the object is placed closer to the focal spot, the diverging rays create a large area of unsharpness on the image receptor by an increase in the area of penumbra area. Thus magnification results.

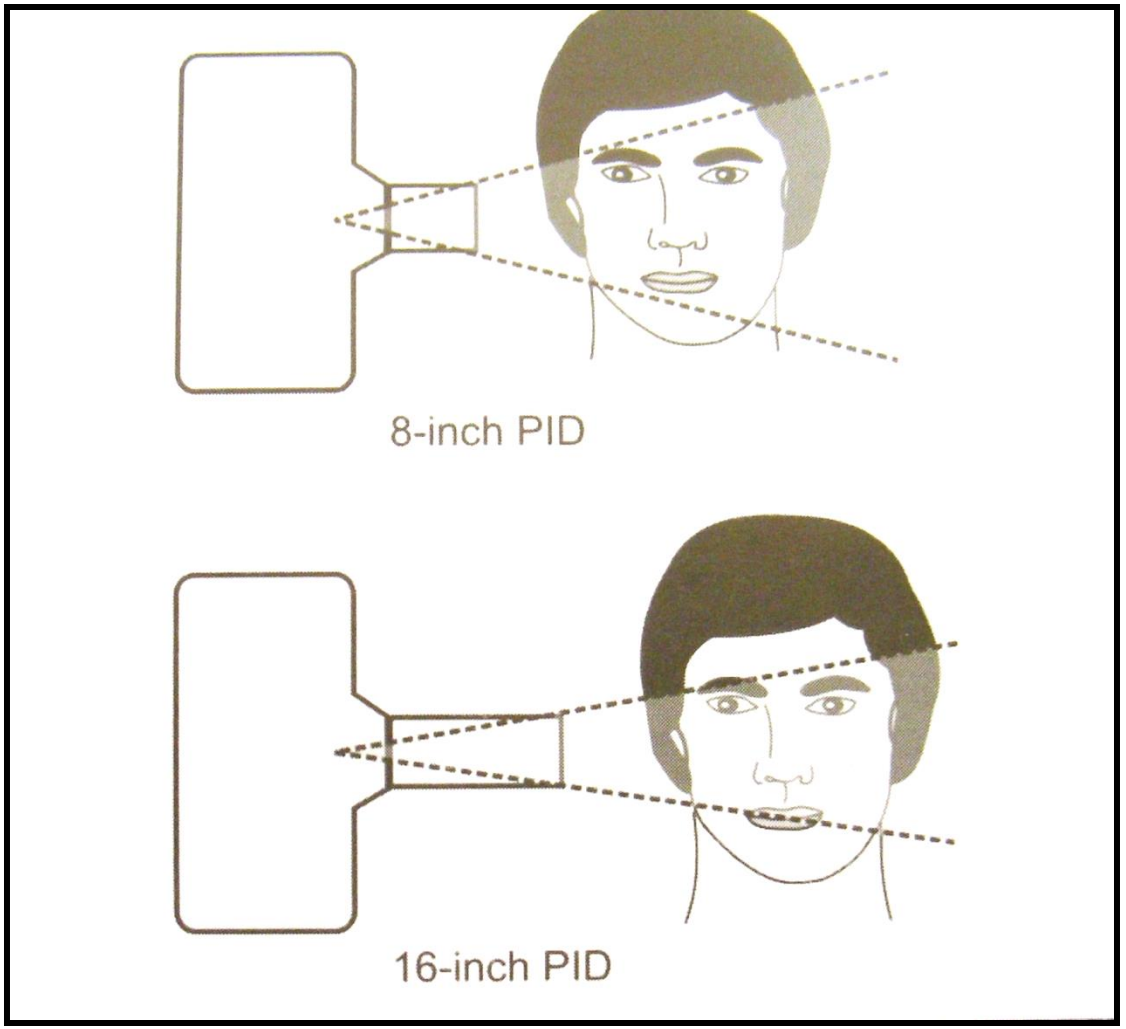
Rule no:2



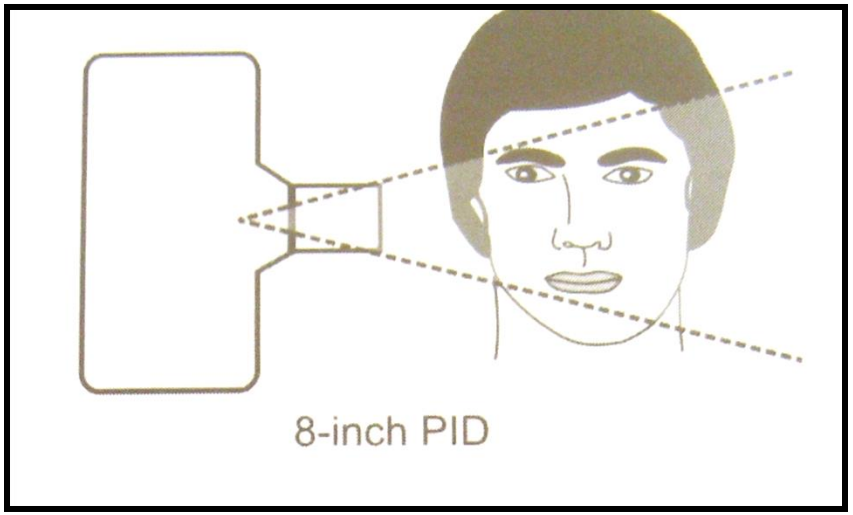
Increasing the distance between the focal spot and the object results in an image with increased sharpness and less magnification of the object.

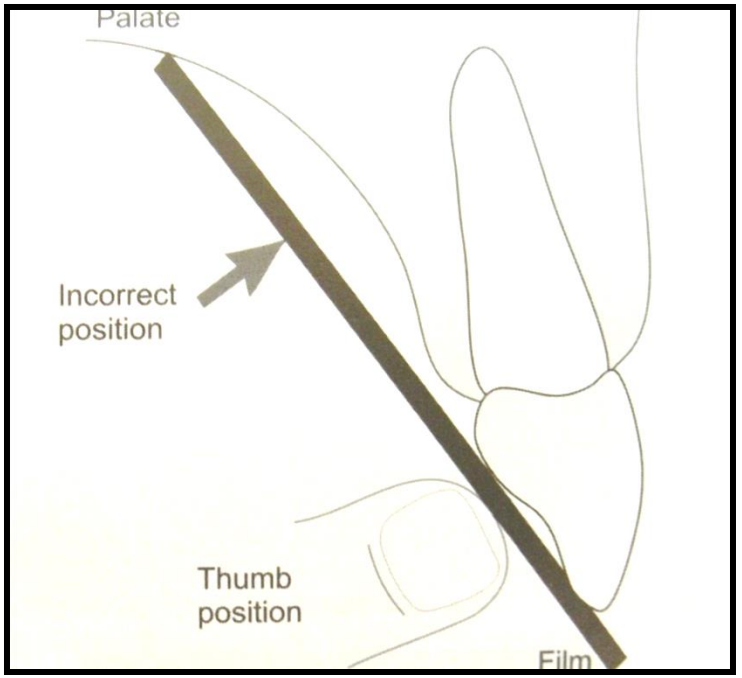
Rule no 2

Longer Position indicating device (PID) can provide this distance



Rule no 2

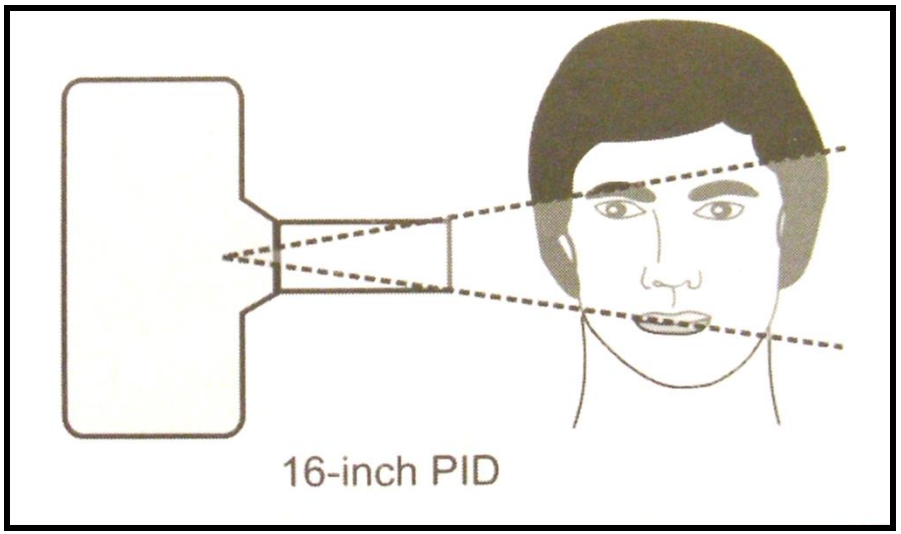




In the Bisecting Angle technique, the focal spot- object distance is less approx- 6 to 8 in.

This is compensated by placing the film closer to the object

Rule no 2

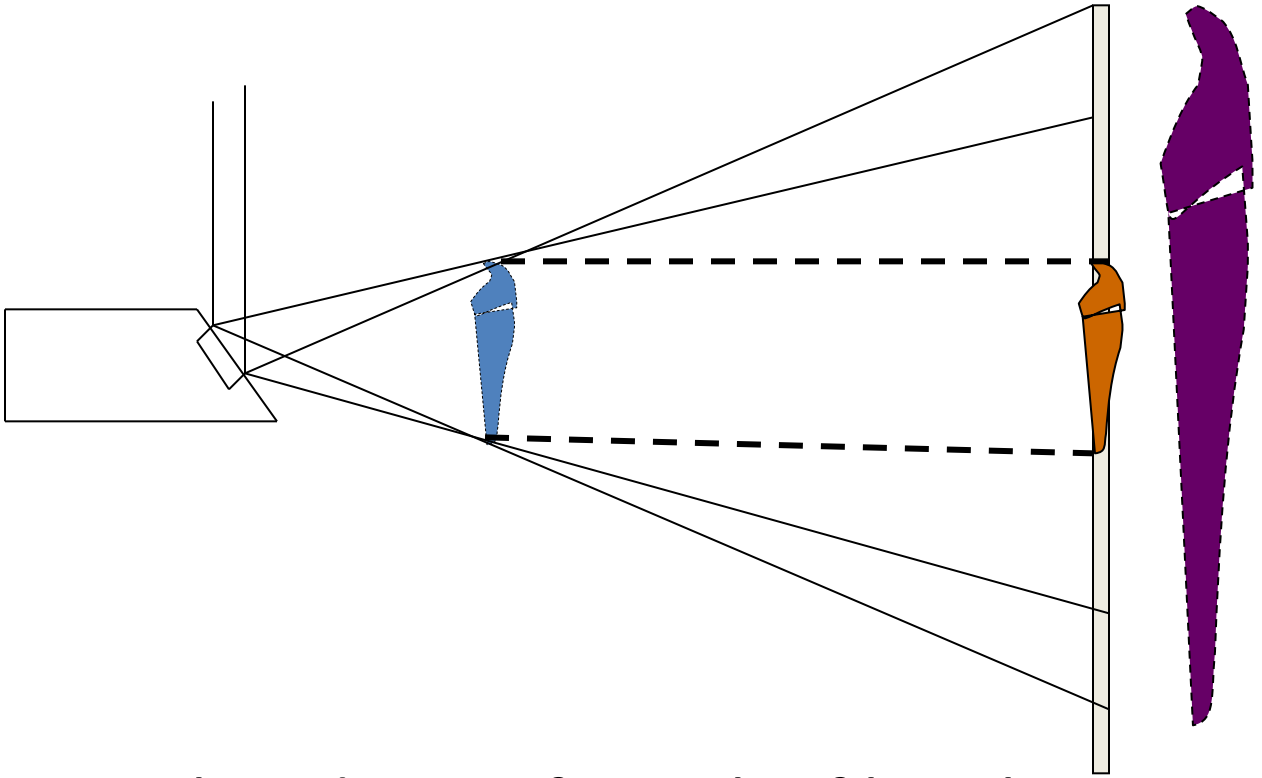


In the paralleling angle technique, the object is placed away from the film using a long cone

Rule no 3

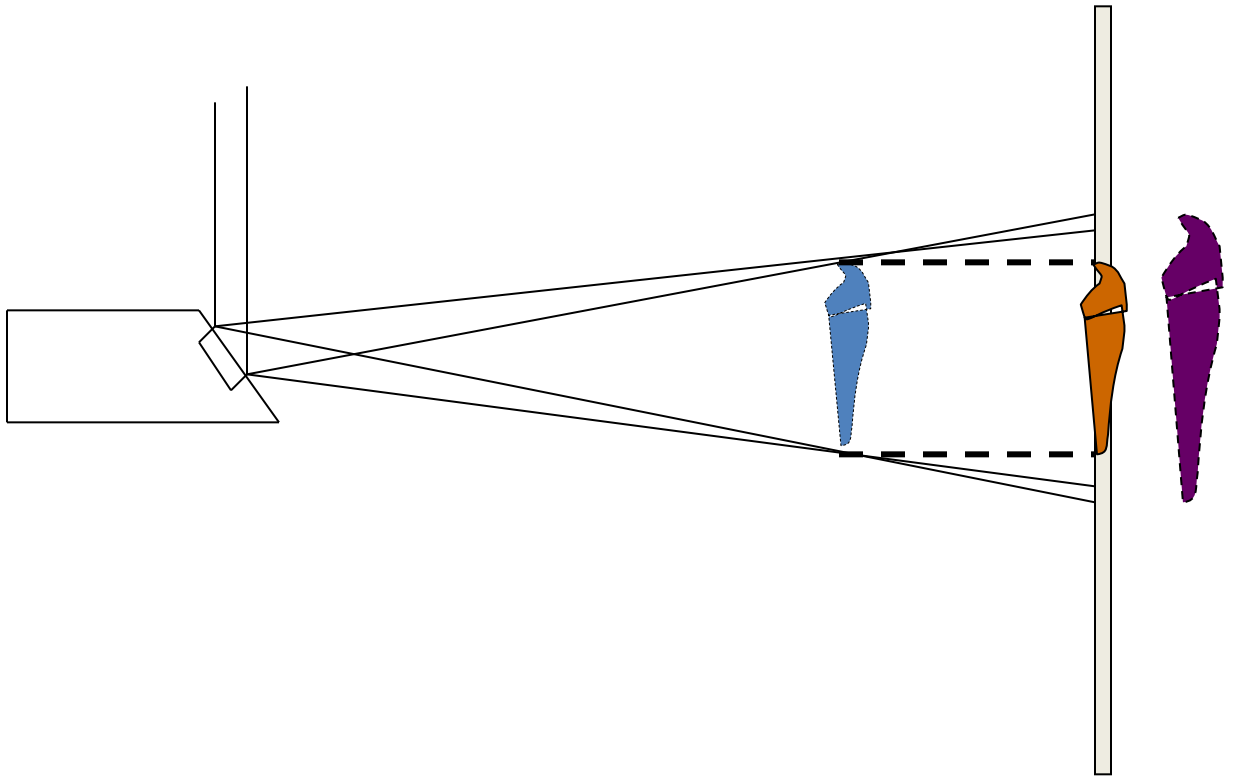
- The object – film distance should be as small as possible.
  - governs geometric unsharpness, and magnification

Rule no 3



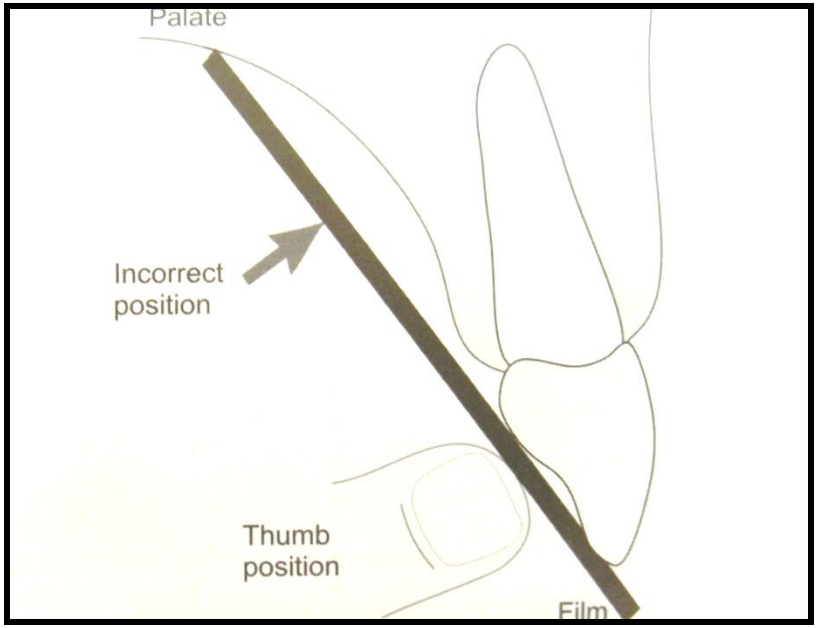
If the object is placed away from the film, then magnification may result and reduces sharpness because more diverging rays from the object reach the film

Rule no 3



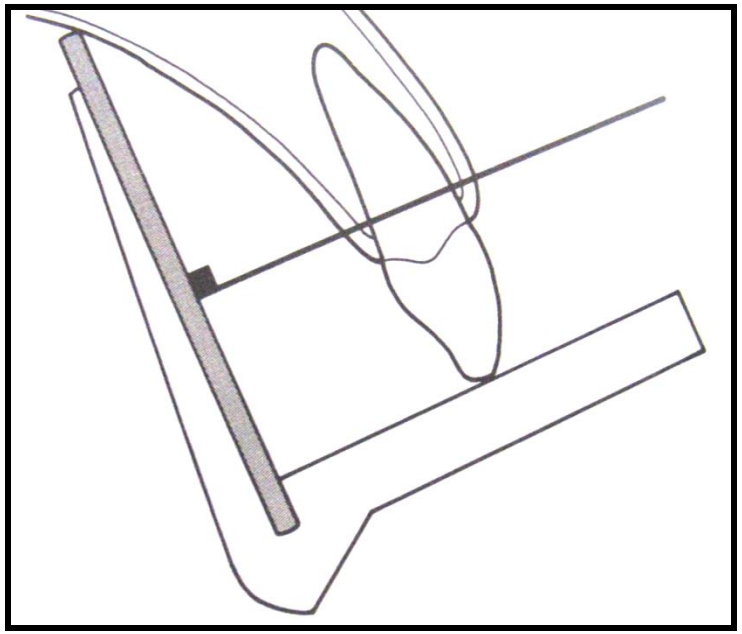
Object should be placed as closer to the film as possible. This reduces the area of unsharpness resulting in less magnification and distortion.

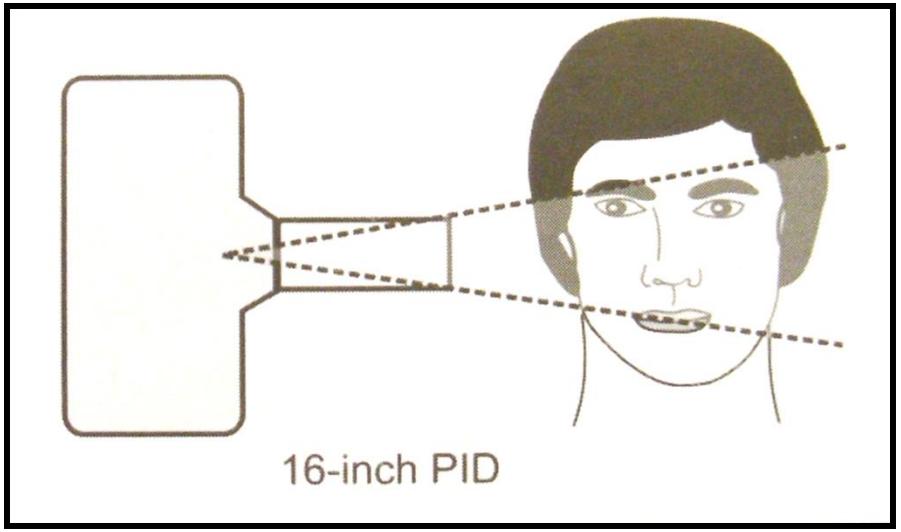
Rule no 3



In the Bisecting angle technique, the object film distance is minimal. So there is minimal distortion

Rule no 3



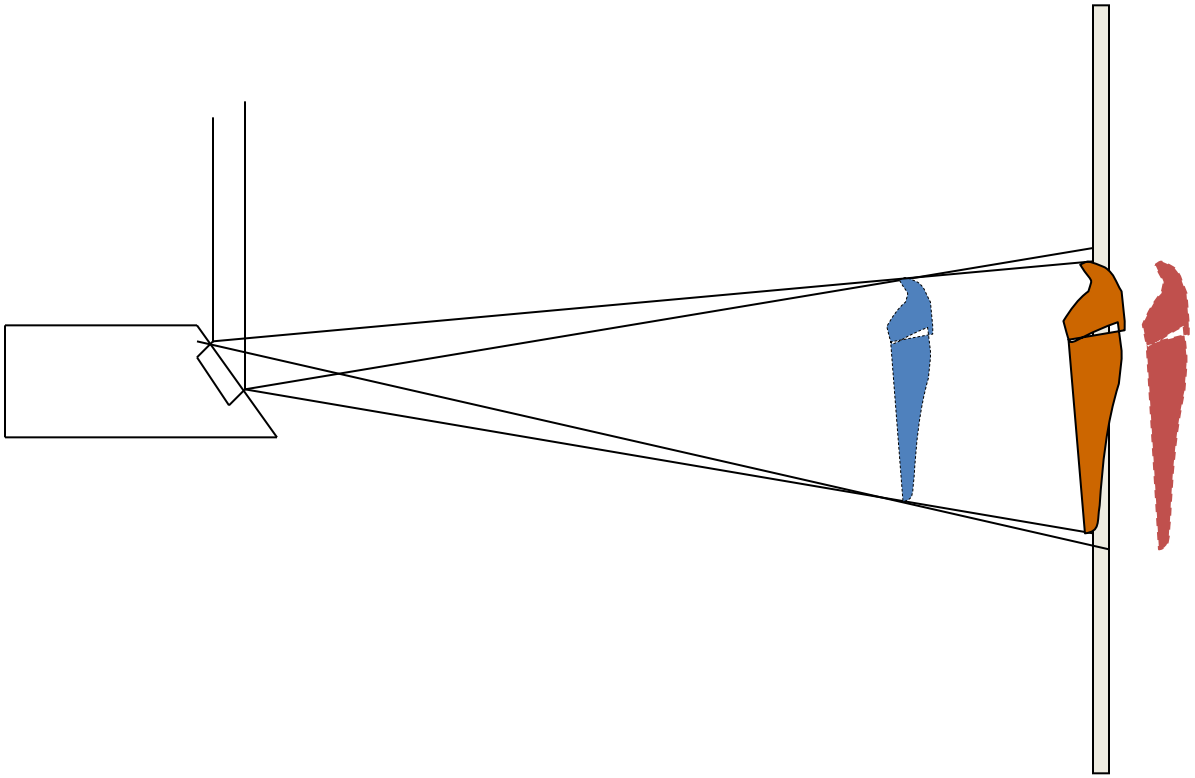


In the paralleling angle technique, the object is placed away from the film resulting in magnification which can be avoided by using a long cone

Rule no 4

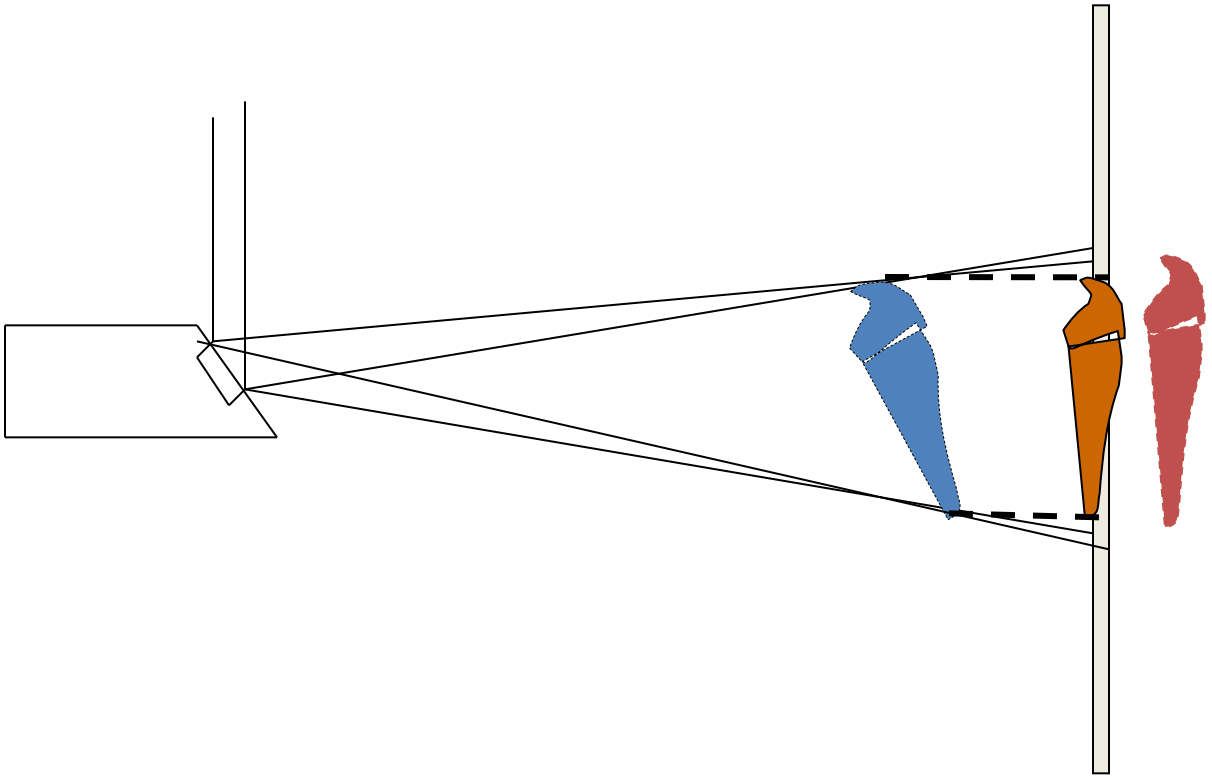
- The long axis of the object and the film should be parallel.
  - governs magnification

Rule no 4



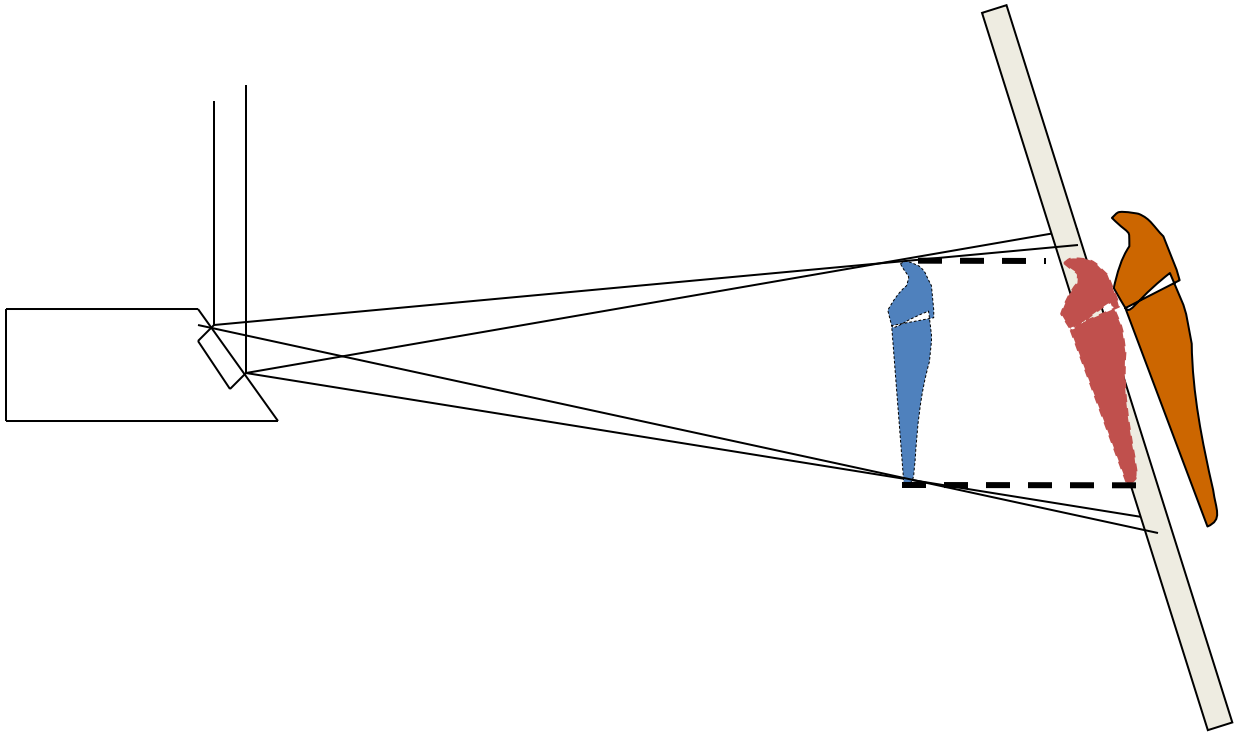
If the tooth and the film are not parallel, all the parts of the object are not at the same distance from the film. An angular relationship is formed resulting in unequal magnification of different parts of the same object

Rule no 4



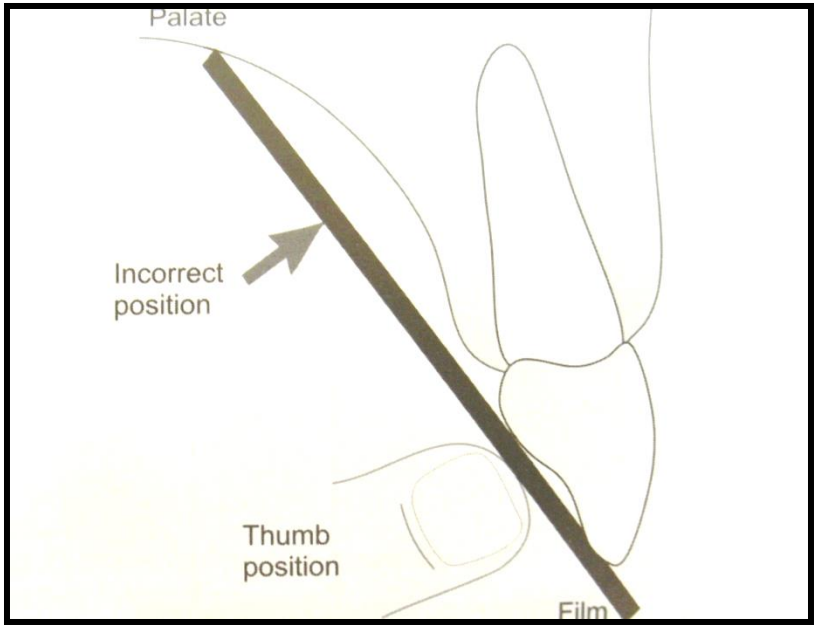
If the object is not parallel to the film and a perpendicular ray falls on the film, resulting in foreshortening of the image.

Rule no 4



If the film is not parallel to the object, and a parallel ray falls on the object, but not on the film, then elongation occurs

Rule no 4



In Bisecting angle technique, film is placed touching the tooth surface at the crown level and slightly apart at the root level. So there are chances of some degree of elongation at the root area.

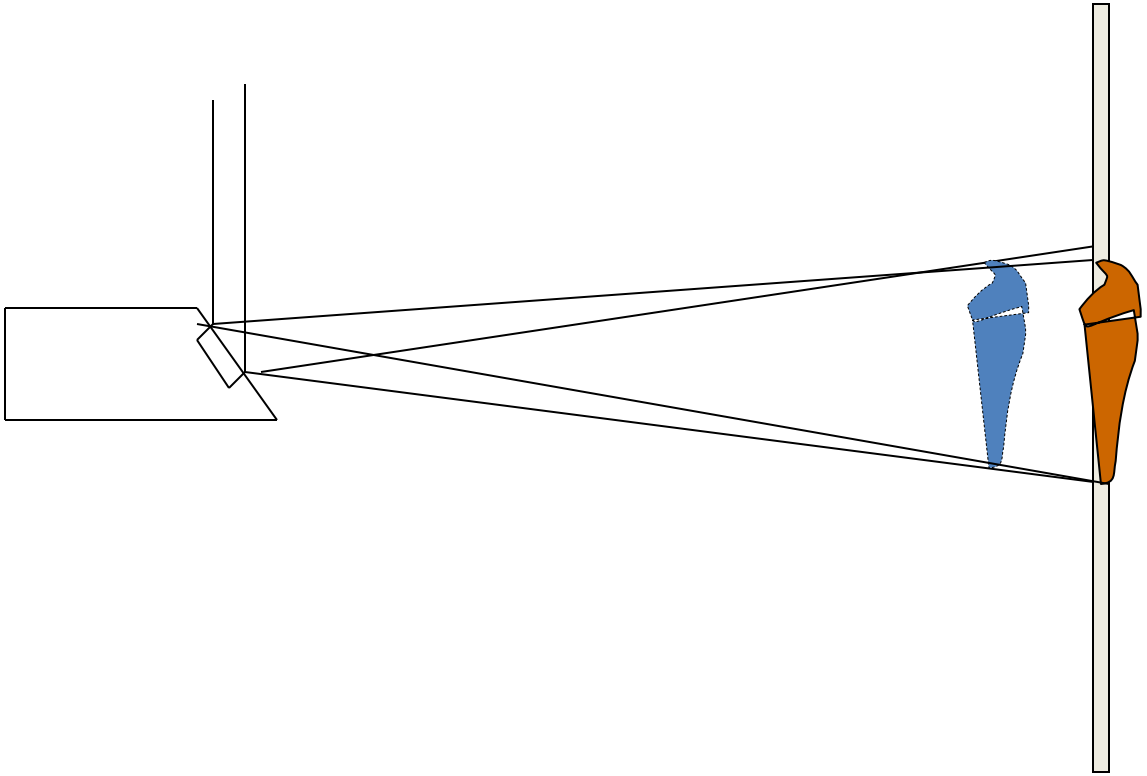
Rule no 4

In the paralleling angle technique, position indicating devices are used, so object and film are parallel to each other

Rule no 5

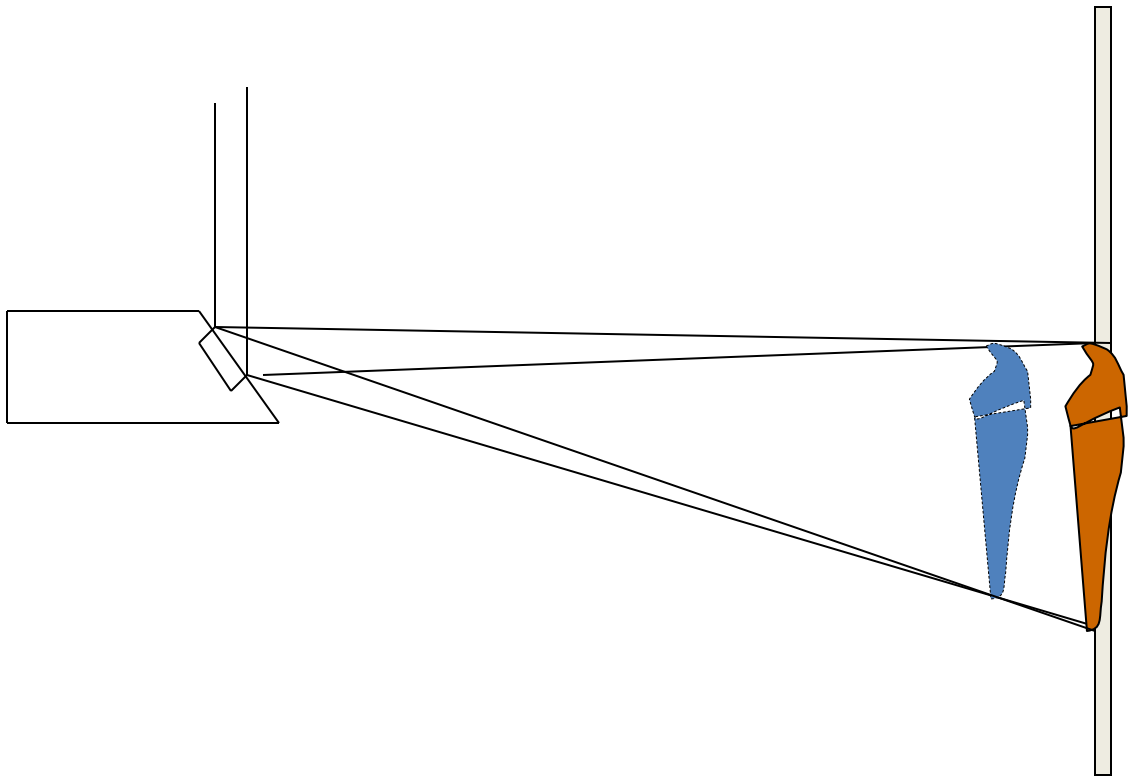
- The x- ray beam should strike the object and the film at right angles.
  - governs motion unsharpness

Rule no 5



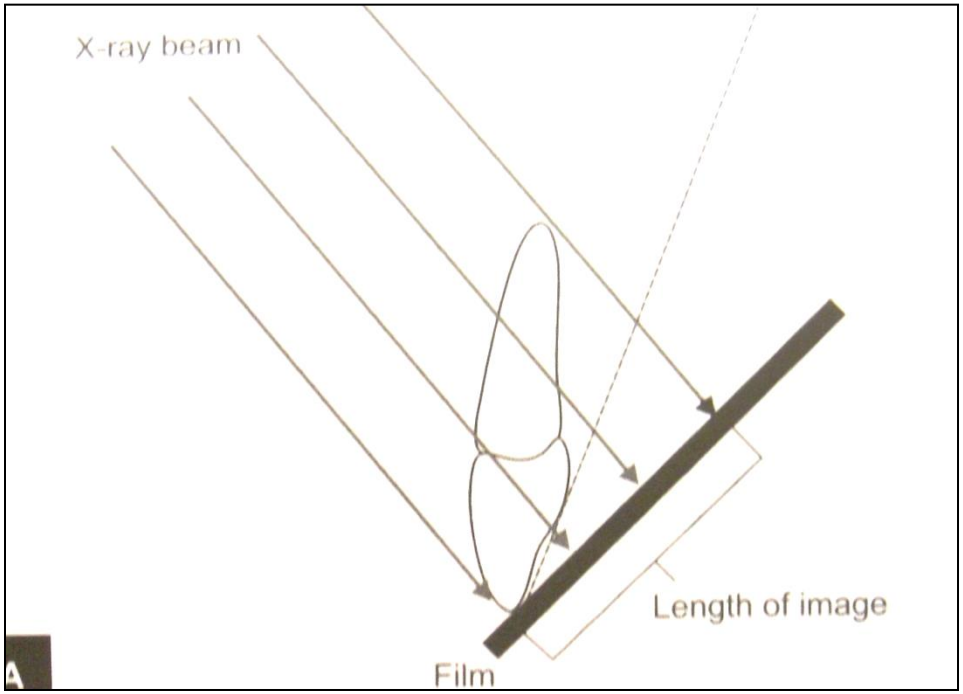
If the central beam passes through the object and film at right angles, then there are least chances of image distortion

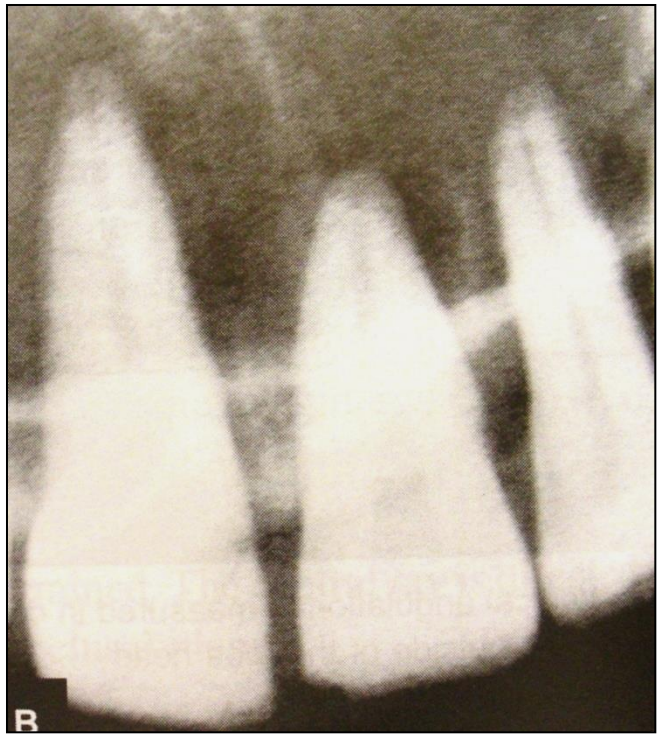
Rule no 5



If vertical angle increases, then the image is foreshortened.

Rule no 5





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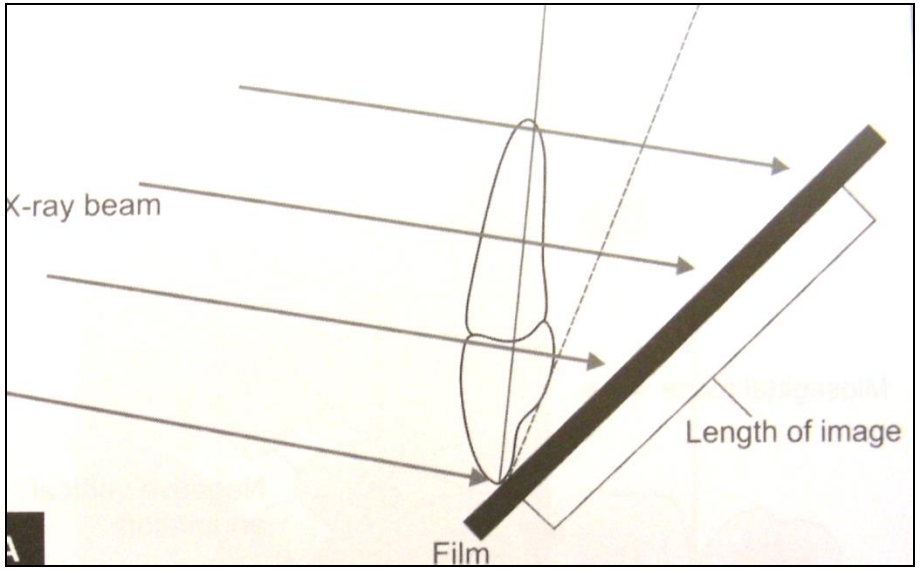
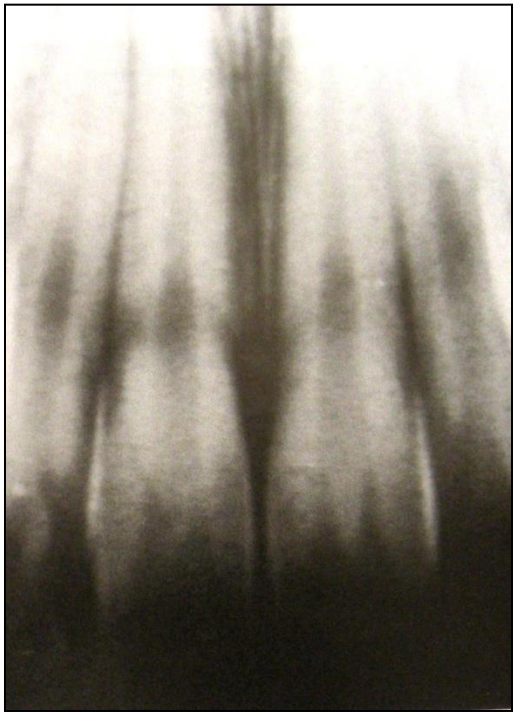




If vertical angle decreases, the resultant image is elongated

Rule no 5

In the paralleling angle technique, angulations are regulated by position indicating devices

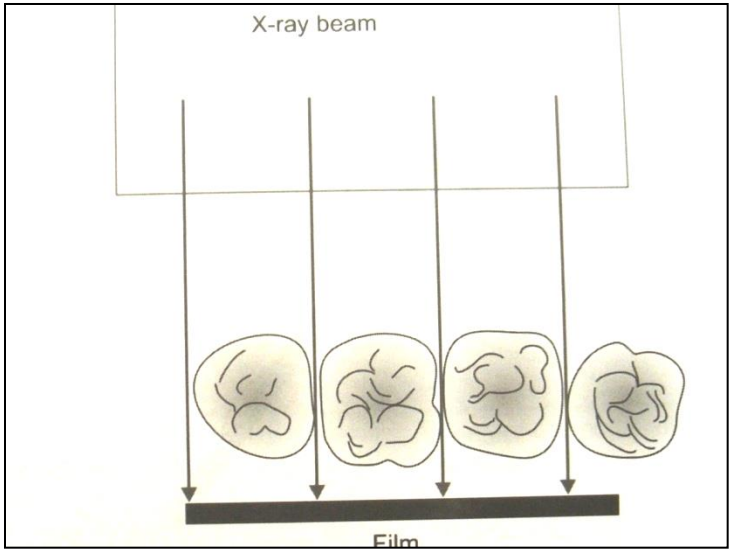
Rule no 5

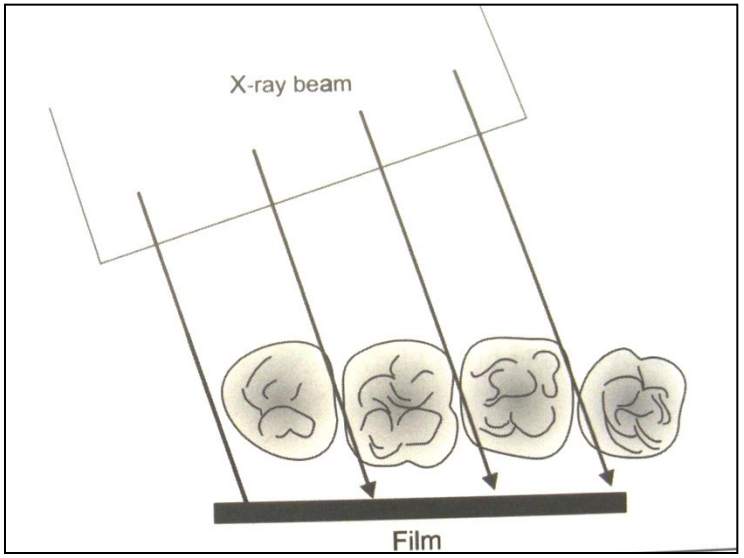
- Vertical angulations for Bisecting Angle technique

	Maxillary Universal	Dentition Indian	Mandibular Universal	Dentition Indian
Anterior	+40 to +50	+45	-15 to -25	-20
Canines	+45 to +55	+45	-20 to -30	-25
Premolars	+30 to +40	+30	-10 to -15	-15
Molars	+20 to +30	+30	-5 to 0	-10 to 0

Textbook of Oral and Maxillofacial Radiology: Freny R. Karjodkar, I ed. 2006

Rule no 5

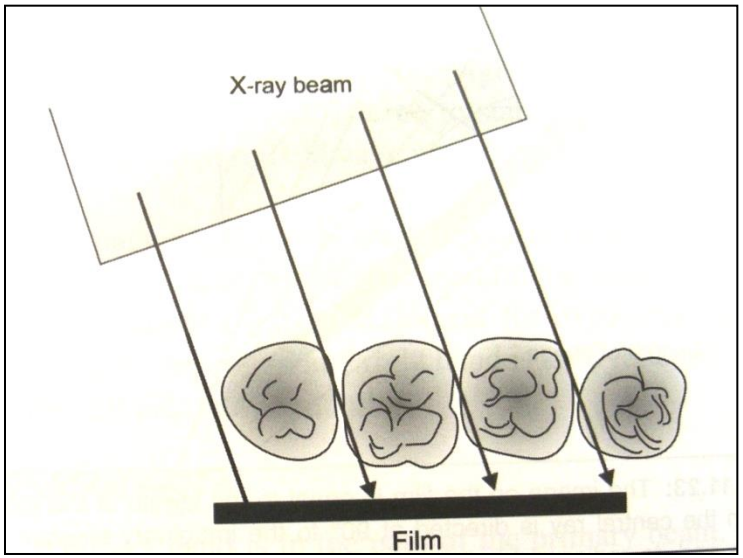


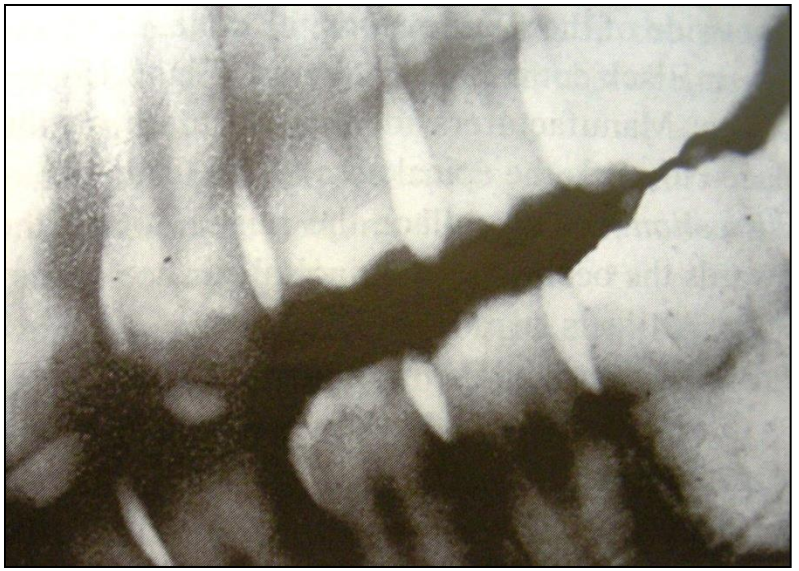


The horizontal angulations is usually zero degrees.

If the horizontal angulations is increased mesially or distally, overlapping of the structures occurs.

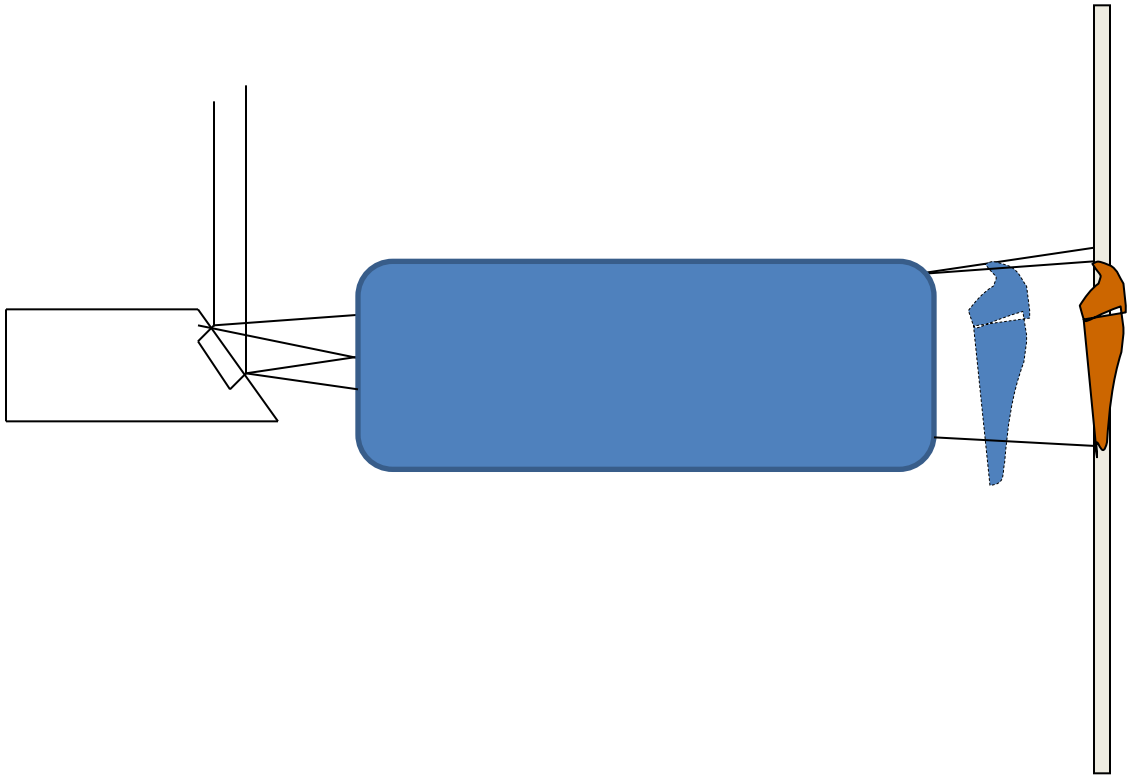
Rule no 5





Proximal overlapping seen due to incorrect horizontal angulation

Rule no 5

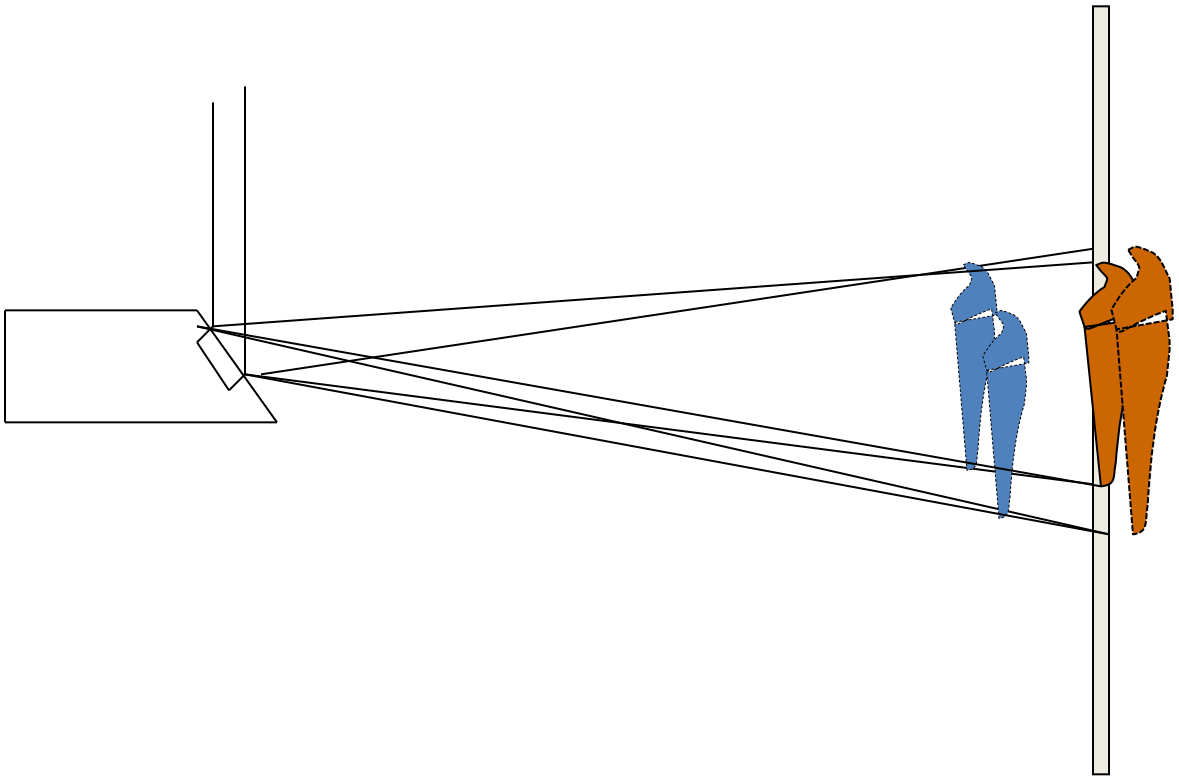


If central beam doesnt pass through the centre of the object, then it may result in cone cut or coning off.

Rule no 6

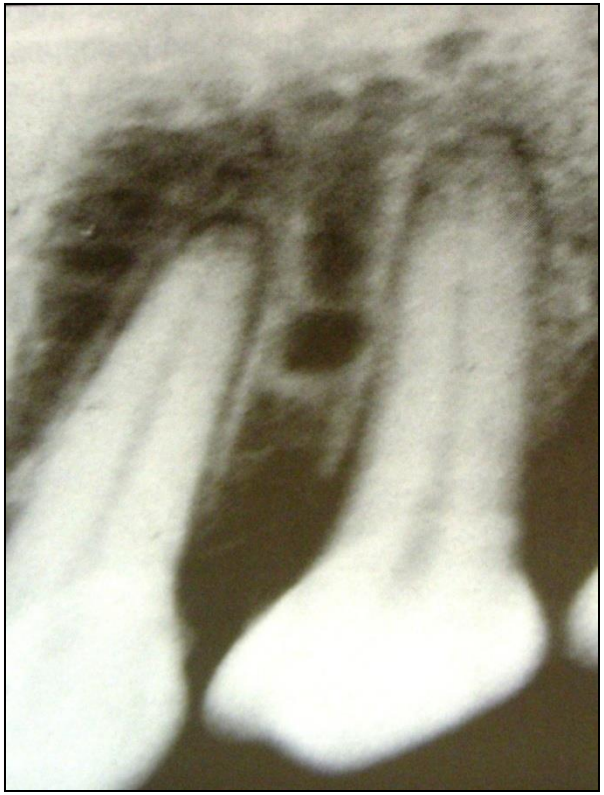
- Proposed by Mason and Lincoln
- There should be no movement of the tube, film or the patient during an exposure
  - governs distortion

Rule no 6



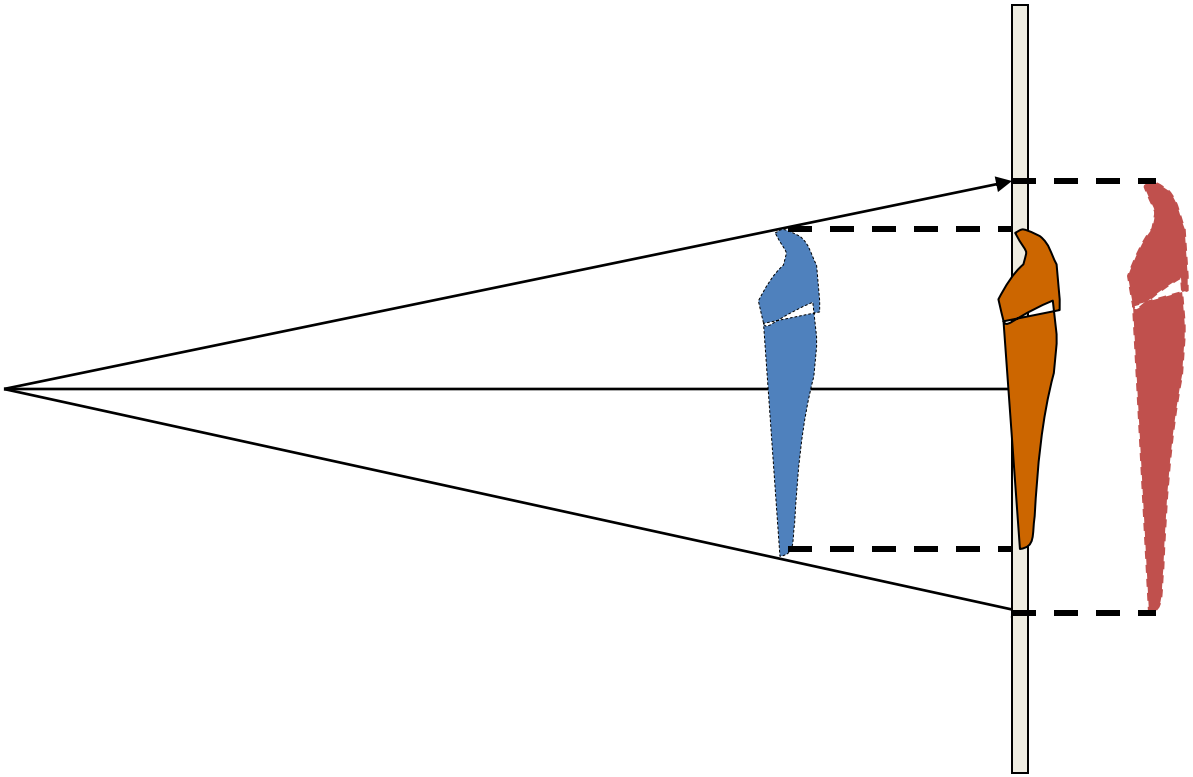
Blurring of image owing to penumbra formation

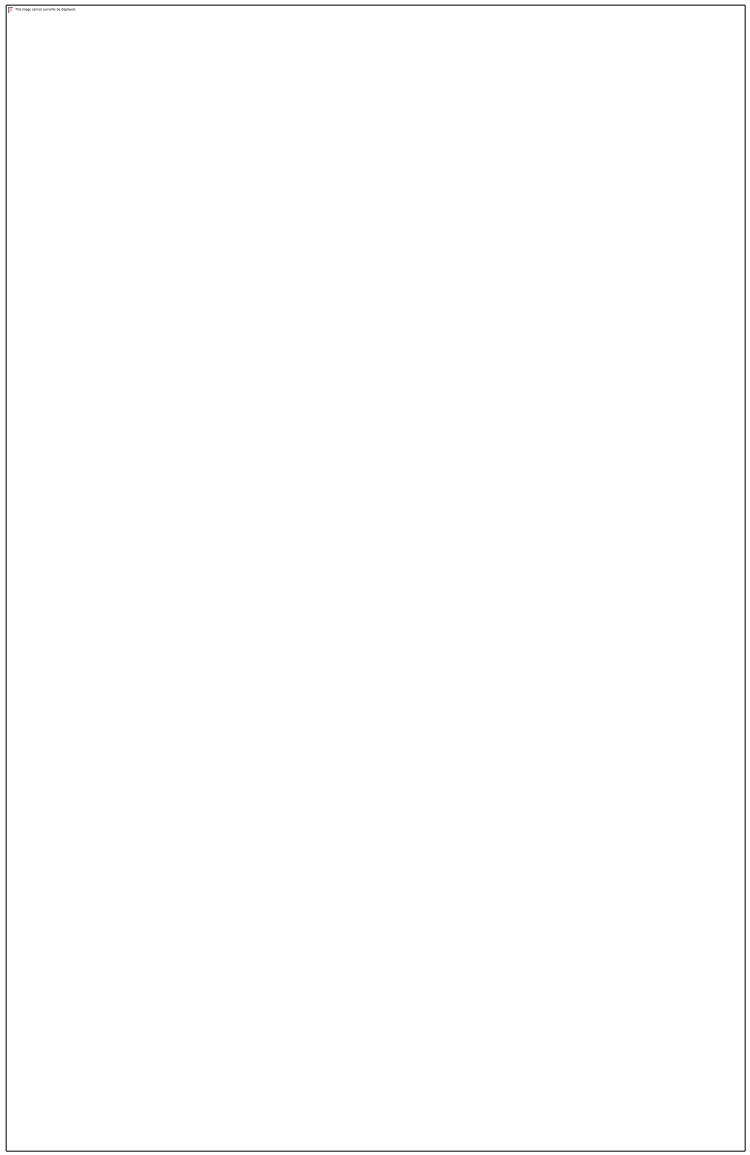
Rule no 6



The image outline becomes blurred owing to the penumbra formation


THANK YOU

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