Fundamentals of Radio-physics

First Semester

Practical part –Experiment -1

Week5: Anode heel effect

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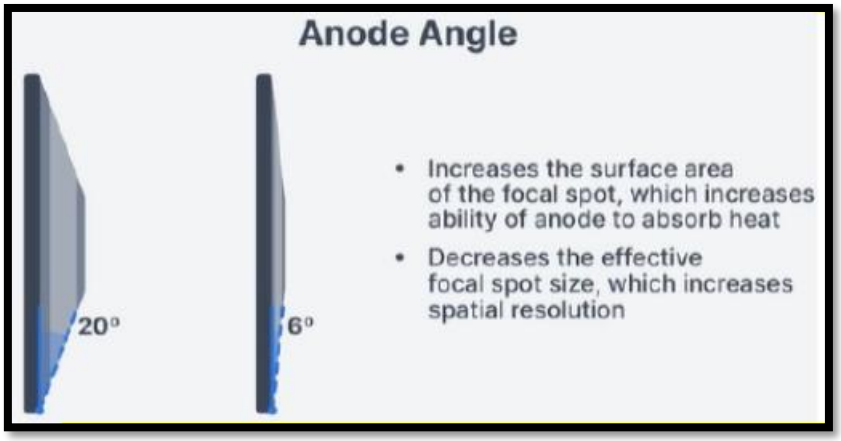
➢ Anode heel effect

Describe as varying radiation intensity across the x-ray field in the anode–cathode direction caused by attenuation of x-rays in the heel of the anode.

Remember the anode in general radiography is usually angled between 5-20 degrees.

This is a good thing for two main reasons.

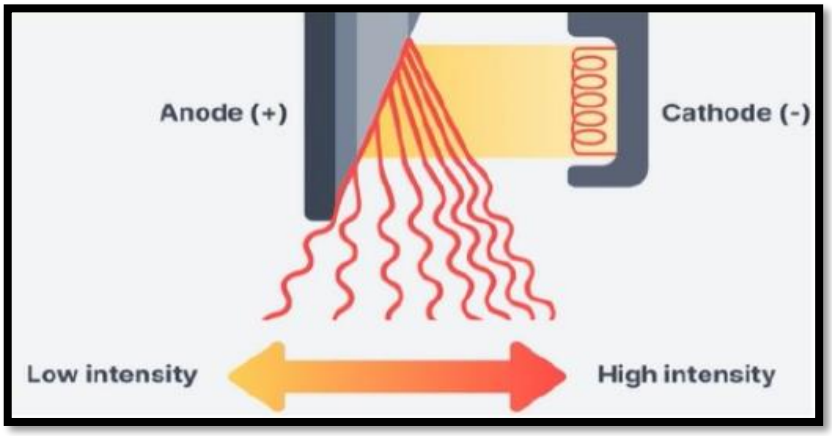
- **First)** the anode angle **increases** the surface area of the focal spot, which **increases** the ability of the anode to absorb heat.
- **Second)** the **angle helps to decrease** the effect of focal spot size and therefore **increase** spatial resolution of the radiograph

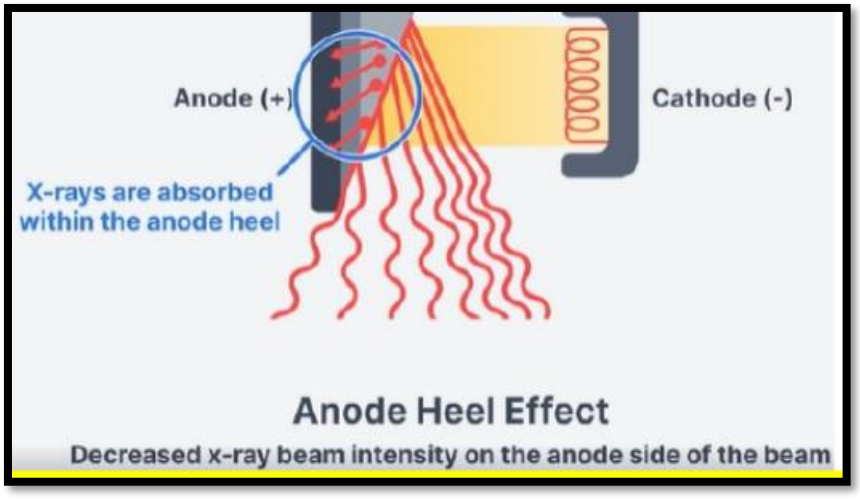


The angled anode does have one negative consequence. The angle of the anode does cause a variation of the beams **intensity** across the x-ray field. Specifically,

there are **fewer x-ray photons on the anode side of the beam compared to the cathode side of the beam**.

So we could say the **cathode side has higher intensity**, and **the anode side has the lower intensity**

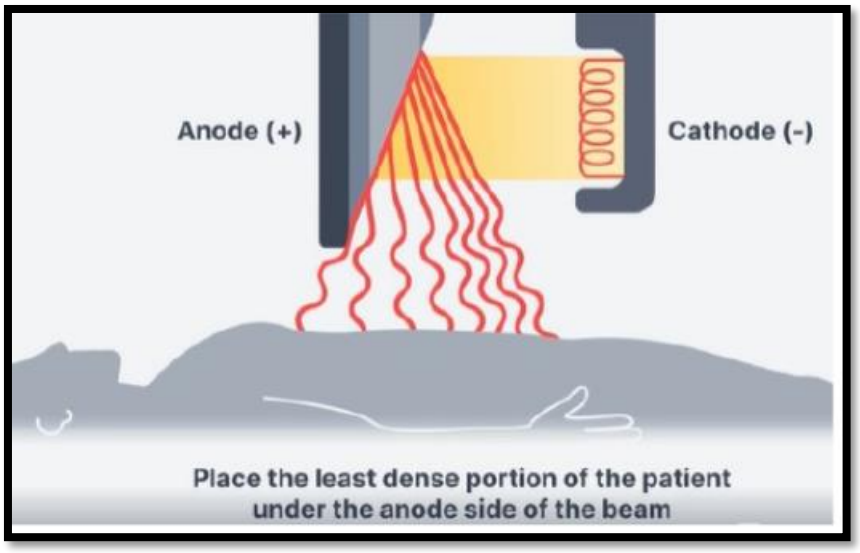




E.g.

When performing an abdominal x-ray, the upper abdomen is less dense than the lower abdomen because the lower abdomen includes the very dense pelvic bone if we purposefully place the anode side of the beam over the upper abdomen and the cathode side over the lower abdomen, this allows for more even exposure to the receptor.

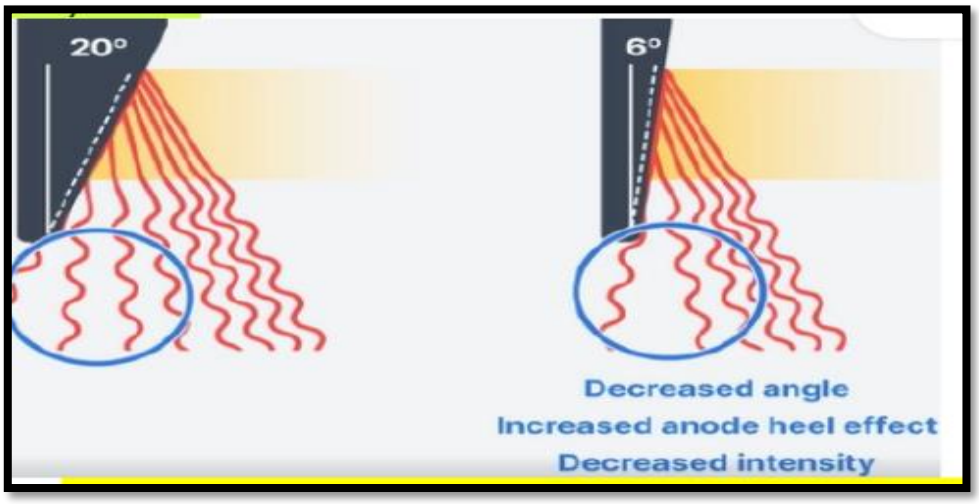
The high intensity cathode portion of the beam is placed over the densest portion of the patient and the low intensity anode side of the beam is placed over the least dense portion of the patient



A few variables can actually change the extent of the anode heel effect. -In other words, the change in beam intensity across the beam isn't always the same. **Decreasing the anode angle (making it steeper or smaller) increases the anode heel effect**

this is because more x-rays get absorbed in the anode and the beam intensity on the anode side decreases.

When we decrease the anode angle from 20-5 degrees, an increased number of x-ray photons get absorbed in the anode angle and so we have an increased difference in the intensity between the anode side and the cathode side of the x-ray beam



The relationship between anode angle and heel effect in inverse, meaning as the anode angle decreases the anode heel effect increases. (increased difference in the intensity across the x-ray beam

Patient Positioning for Examinations That Can Take Advantage ofthe Heel Effect

Examination	Position Toward the Cathode	Position Toward the Anode
PA chest	Abdomen	Neck
Abdomen	Abdomen	Pelvis
Femur	Hip	Knee
Humerus	Shoulder	Elbow
AP thoracic spine	Abdomen	Neck
AP lumbar spine	Abdomen	Pelvis

The heel effect can be used to advantage inradiography because the cathode end of thetube can be placed over a thicker body part, resulting in a more even exposure to the image receptor.