

LMRT Image Production & Evaluation – Detailed Review + Assignment

EXPOSURE FACTORS

mAs (Milliampere-seconds)

Controls quantity of radiation (number of photons)

Directly affects image density (brightness)

↑ mAs = ↑ density & ↑ patient dose

kVp (Kilovoltage Peak)

Controls beam quality (penetration)

Affects contrast

↑ kVp = ↓ contrast (long scale), ↑ penetration, ↑ scatter

Exposure Time

Controls motion

Longer time = ↑ motion blur

SID (Source-to-Image Distance)

Affects exposure intensity & magnification

↑ SID = ↓ density (requires ↑ mAs)

- mAs controls the _____ of radiation.
- kVp controls the _____ of the beam.
- Increasing mAs will _____ image density.
- Increasing kVp will _____ contrast.
- Longer exposure time increases _____.
- Increasing SID will _____ image density.
- To maintain density when SID increases, _____ must be increased.
- kVp primarily affects _____ and _____.
- mAs has a _____ relationship with density.
- Increasing kVp increases _____ radiation.
- Short exposure time reduces _____.
- Increasing SID reduces _____.
- mAs is calculated by _____ × _____.
- High kVp produces _____ contrast.
- Low kVp produces _____ contrast.

IMAGE QUALITY FACTORS

Density

Overall brightness of image

Controlled by mAs

Contrast

Difference between black and white

Controlled by kVp and scatter

Spatial Resolution (Detail)

Sharpness of structures

Affected by:

- Focal spot size
- OID
- SID
- Motion

Distortion

Misrepresentation of size/shape

Caused by poor alignment or OID/SID issues

- Density refers to image _____.
- Contrast refers to differences in _____ and _____.
- Spatial resolution refers to _____.
- A small focal spot improves _____.
- Increasing OID increases _____.
- Increasing SID improves _____.
- Motion reduces _____.
- Distortion affects _____ and _____.
- Shape distortion occurs due to improper _____.
- Size distortion is mainly caused by _____.
- Decreasing OID will _____ magnification.
- Increasing SID will _____ distortion.
- High detail requires a _____ focal spot.
- Motion produces _____.
- Increasing OID decreases _____ quality.

SCATTER & GRIDS

Scatter Radiation

Produced mainly by Compton interactions

Causes fog → decreases contrast

Controlling Scatter

Collimation (BEST method)

Grids

Lower kVp (when appropriate)

Grids

Improve contrast by absorbing scatter

Disadvantage: ↑ patient dose

Grid Cutoff

Caused by misalignment, wrong SID, or improper centering

- Scatter radiation _____ contrast.
- The primary interaction producing scatter is _____.
- Collimation reduces _____ radiation.
- Grids improve _____.
- Grids increase patient _____.
- Grid cutoff is caused by improper _____.
- Increasing field size increases _____.
- Higher kVp increases _____ radiation.
- Scatter creates _____ on the image.
- The BEST way to reduce scatter is _____.
- A grid absorbs _____ radiation.
- Grid ratio affects _____.
- Higher grid ratios require more _____.
- Improper centering can cause _____.
- Larger body parts produce more _____.

DISTANCE & INVERSE SQUARE LAW

Inverse Square Law

If distance doubles → exposure = 1/4

Increasing distance reduces intensity → must increase mAs

Describes how radiation intensity changes with distance

As distance increases → intensity decreases rapidly

Applies to:

- SID changes
- Radiation exposure
- Technique adjustments
- Double the distance → exposure becomes 1/4
- Triple the distance → exposure becomes 1/9
- Half the distance → exposure becomes 4× greater

When SID increases:

Image becomes lighter (less density)

Must increase mAs to compensate

When SID decreases:

Image becomes darker (more density)

Must decrease mAs

Formula for Technique Adjustment

$$\frac{mAs_1}{mAs_2} = \left(\frac{D_1}{D_2}\right)^2$$

Used to maintain same image density when distance changes.

- The inverse square law involves _____ and _____.
- Intensity is inversely proportional to _____.
- Doubling distance reduces exposure to _____.
- Halving distance increases exposure by _____.
- Increasing SID requires increasing _____.
- Distance affects _____ and _____.
- Short SID increases _____.
- Long SID reduces _____.
- Exposure intensity decreases with increasing _____.
- Inverse square law is used to adjust _____.

IMAGE EVALUATION

Common Errors & Fixes

Problem	Cause	Fix
Too dark	High mAs/kVp	Reduce mAs
Too light	Low mAs	Increase mAs
Low contrast	High kVp/scatter	Lower kVp, collimate
Blur	Motion	Reduce time
Magnification	High OID	Reduce OID
Quantum mottle	Low mAs	Increase mAs

- A dark image indicates excessive _____.
- A light image indicates insufficient _____.
- Low contrast is often caused by high _____.
- Motion causes _____.
- Magnification is caused by high _____.
- Quantum mottle is due to low _____.
- Increasing mAs reduces _____.
- Decreasing kVp increases _____.
- Blur reduces _____ quality.
- Collimation improves _____.
- Increasing SID reduces _____.
- Increasing OID increases _____.
- Grids improve _____ but increase _____.
- Short exposure time reduces _____.
- Proper alignment reduces _____.