Name: _____ Date: _____ Team: _____

Lab Experiment # 7

Inverse Square Law

Digital Radiography (DR)

Purpose

This experiment is designed to demonstrate the effect of changes in SID on radiation exposure to the digital image receptor, the exposure index, overall image brightness, and radiation exposure to the patient when using computed radiography.

Learning Objectives

After completing this lab, you should be able to:

1. Use the laboratory equipment properly.
2. Set up the control console and ceiling tube mount correctly.
3. Function effectively in group work.
4. Perform the experiment independently.
5. Explain the effect of SID on the radiation exposure to the IR.
6. Evaluate the effect of SID on the LGM numbers and image brightness.
7. Predict the effect of the change in SID on digital image quality and patient exposure.

Materials Needed

- 10 x 12 inch Computed Radiography IR
- Hand phantom
- Set of lead numbers

Pre-Lab Discussion

Inverse Square Law

The change in intensity is <u>inversely</u> proportional to the <u>square</u> of the change in distance.

The amount of radiation received at a given point is inversely proportional to the square of the distance between the point and the radiation source.

Therefore:

As distance **INCREASES**, radiation intensity **DECREASES** ***rapidly***

As distance **DECREASES**, radiation intensity **INCREASES** ***rapidly***

Consequently:

As distance **INCREASES**, ***EI*** **DECREASES** ***significantly***

As distance **DECREASES**, ***EI*** **INCREASES** ***significantly***

Symbolically:

$$\uparrow \left\| \frac{\text{Intensity}_{\text{new}}}{\text{Intensity}_{\text{old}}} = \frac{(\text{Distance}_{\text{old}})^2}{(\text{Distance}_{\text{new}})^2} \right\| \downarrow 2$$

Distance = SID

Radiographically:

- ✓ An INCREASE in SID will DECREASE intensity ***dramatically***.
- ✓ A DECREASE in SID will INCREASE intensity ***dramatically***.

Practice Drill No. 4 – Inverse Square Law

1. The intensity of an x-ray beam is 15 mR at a 400-cm SID. (SID = source-image receptor-distance) What would the **new intensity** be at a 200-cm SID?

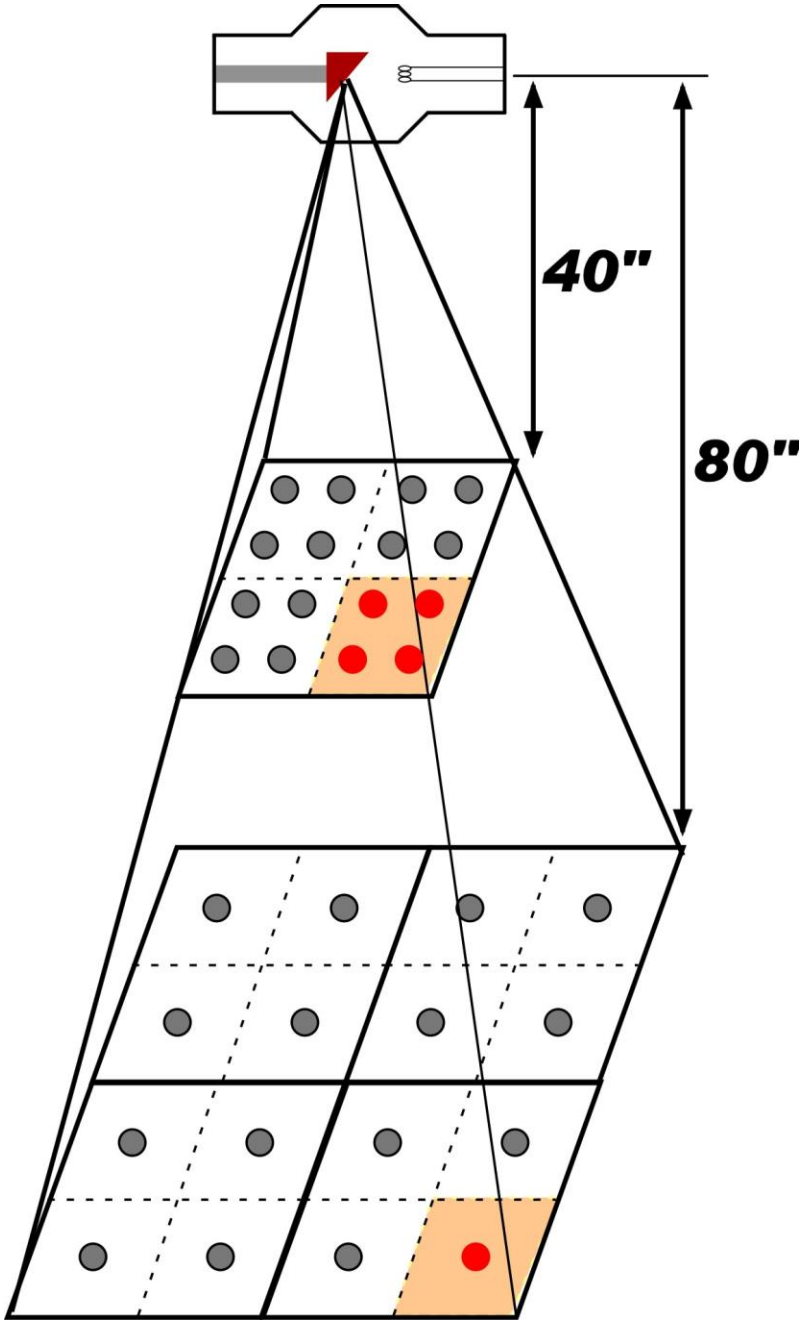
Solve using the formula:	***Illustrated Thought Process:***
	The **distance** (↑/↓) _____
	by a factor of _____
	Relationship: _____
	So, the **intensity** (↑/↓) _____
	by a factor of _____
	New intensity:

2. A patient receives an exposure dose of 80 mR at a 50-cm SSD. (SSD = source-skin-distance) What would the **new entrance skin exposure** be at a 100-cm SSD?

Solve using the formula:	***Illustrated Thought Process:***
	The **distance** (↑/↓) _____
	by a factor of _____
	Relationship: _____
	So, the **exposure** (↑/↓) _____
	by a factor of _____
	New exposure:

Remember, to "increase by a factor of" means multiply; to "decrease by a factor of" means divide.

65 kVp 1 mAs



A

EI 400

B

EI 100

Dosimeter Worksheet

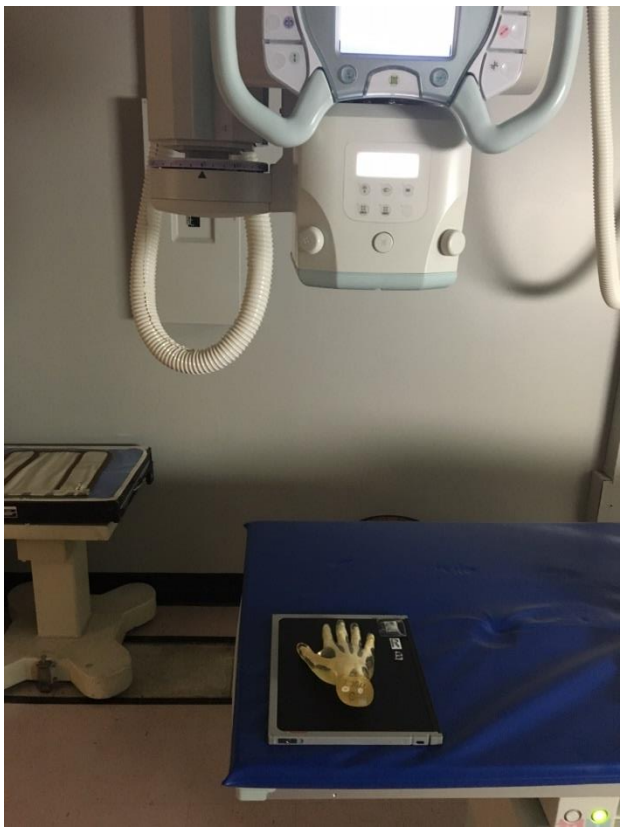
Exposure 1	Exposure 2	Exposure 3
20-inch Distance	**40-inch Distance**	**60-inch Distance**
Actual dosimeter reading	Actual dosimeter reading	Actual dosimeter reading
Record the dosimeter reading in the row above. Then, calculate the expected dosimeter readings and record them in the boxes to the right.	Expected dosimeter reading	Expected dosimeter reading

Procedure Computed Radiography

Hand Radiograph

Instructions for Exposures 1 through 6.

1. When adding images to your new exam use system diagnostic menu.
2. Use the digital radiography FPD
3. Direct the central ray **perpendicular** to the third MP joint.
4. Tape the appropriate ID markers onto the image receptor within the collimated light field so they do not obscure any areas of interest.
   (The room, side and exposure number must be labeled on **all** radiographs.)
5. Set the x-ray tube, mode of operation and focal spot size as indicated on **Worksheet** .
6. Make all the exposures using the settings indicated on **Worksheet** .
7. In the worksheet write EI numbers. Indicate overall image brightness and noise level of each image.



Worksheet

FPD

	kVp	Focal Spot	SID	mAs	mode	Bucky/TT	EI
1	65	S	20”	1	manual	TT	
2	65	S	30”	1	manual	TT	
3	65	S	40”	1	manual	TT	
4	65	S	50”	1	manual	TT	
5	65	S	60”	1	manual	TT	
6	65	S	80”	1	manual	TT	

Worksheet

	LGM	Briefly describe the overall brightness, contrast and noise level of each image.
1		
2		
3		

4		
5		
6		