

Name: _____ Date: _____ Team: _____

Lab Experiment # 7

kVp Penetrability

Purpose

Evaluate how changes in mAs affect detector exposure (EI) when kVp is below the minimum needed to penetrate a body part versus above that minimum

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. Calculate the minimum kVp to penetrate the body part.
6. Explain how the relationship between mAs and signal intensity differs when the beam energy (kVp) is insufficient for penetration compared to when it is adequate or higher.

Materials Needed

- Body phantom (KUB or abdomen equivalent)
- Digital radiography system
- Table Bucky, grid, and standard SID (100–110 cm)
- Manual exposure control (AEC off)



The wireless digital (FPD) image receptor can only be handled by an instructor!

Procedure

Instructions for Exposures 1 through 11

1. Position the body phantom on the table and center the abdomen to the center of the Bucky.
2. Set the initial exposure to 40 kVp and 10 mAs.
3. Make five exposure like in the worksheet and observe the exposure indicators (EI) and DAP.
4. Continue increasing kVp until the image begins to show penetration through the central region of the phantom.
 - a. The lowest kVp that produces visible penetration is the minimum penetrating kVp.
 - b. At this point, the image receptor (IR) will begin to register exposure, and an EI value will appear.
5. Once this minimum penetrating kVp is found, make additional exposures at that same kVp with:
 - a. 20 mAs
 - b. 40 mAs
 - c. 80 mAs
6. Record the EI and DAP for each exposure.
7. Repeat the same set of exposures at a kVp below the minimum



Worksheet 1 minimum kVp

DR

	kVp	Focal Spot	SID	mAs	mode	DAP	EI TEI
1	40	Large	40"	10	manual		
2	45	Large	40"	10	manual		
3	50	Large	40"	10	manual		
4	55	Large	40"	10	manual		
5	60	Large	40"	10	manual		

Worksheet 2

Inadequate kVp (below minimum)

DR

	kVp below minimum	Focal Spot	SID	mAs	mode	DAP	EI TEI
6		Large	40"	20	manual		
7		Large	40"	40	manual		
8		Large	40"	80	manual		

Worksheet 3

Adequate kVp (Above minimum)

DR

kVp Above minimum	Focal Spot	SID	mAs	mode	DAP	EI TEI
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9		Large	40"	20	manual		
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10		Large	40"	40	manual		
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11		Large	40"	80	manual		
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Determine the **minimum kVp** using the formula:

$$\text{Minimum kVp} = (2 \times \text{part thickness in cm}) + 20$$

Compare this calculated value with the **minimum kVp you determined experimentally** from your exposures. Are they approximately the same?

Worksheet

EI DI TEI

When the kVp was **below the minimum**, what happened to the image and EI values as mAs increased? Why?

1 through 5

EI DI TEI

When the kVp was **above the minimum**, what happened to the image and EI values as mAs increased? Why?

1 through 5

