Radiography Concepts Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Score:

**LAB #7: Distortion: Beam-Part-Receptor Alignment**

Materials needed: A dry femur bone; A smooth-edged coin; Flat, stackable sponges to total *at least* 3 inches (8 cm) of thickness, and a 45-degree smooth angled sponge of at least 6 inches (15 cm) thickness.

**Procedure**

Place a 10" X 12" (25 X 30 cm) CR cassette or DR detector on the tabletop, centered to the x-ray beam. Collimate the field 1 inch (2.5 cm) smaller than the cassette on all sides, (and do not change collimation throughout the experiment). Then stack sponges to create an OID of 3 - 4 inches (8 - 10 cm). For each exposure, either a smooth-edged coin must be precisely centered to the central ray on top of the sponges, or the head of a dry femur bone must be precisely centered to the CR. When centering the head of the femur, arrange the bone with its shaft angled laterally about 20 degrees to the side *such that the lower rim of the smooth head portion of the bone runs lengthwise to the table*. (You will need additional sponges to the side to support the shaft of the bone.) This arrangement allows accurate measurements to be taken of any lengthwise distortion of the spherical head.

The SID must be carefully maintained at 40 inches (100 cm) for all exposures. Therefore, compensate the tube-tabletop distance for all angles and use a tape measure to double-check the SID. When using angled beams, be sure to slide the cassette under the sponges such that the entire field is on the cassette. When off-centering, the central ray does not need to be on the cassette plate. To keep track of the many exposures, use lead number markers on each exposure.

Recommended technique for all exposures: 46 kVp at 2 mAs

Exposure #1: Spherical bone: X-ray beam centered and perpendicular (vertical)

Exposure #2: Spherical bone: Beam angled 35 degrees but centered.

Exposure #3: Coin: Beam centered and perpendicular.

Exposure #4: Coin: Beam angled 35 degrees but centered.

Exposure #5: Coin angled 45 degrees to the cassette. *Tape the coin to a 45-degree*

*angle sponge at a spot which will precisely* ***maintain the OID created by***

***the previously stacked flat sponges.*** Use a tape measure to check this,

measuring to the **center** of the angled coin. The x-ray beam is perpendicular to the cassette and centered to the coin.

Exposure #6: Coin angled 45 degrees to cassette. *Tape the coin to a 45-degree*

*angle sponge at a spot which will precisely* ***maintain the OID created by***

***the previously stacked flat sponges.*** Use a tape measure to check this,

measuring to the **center** of the angled coin. The x-ray beam is angled 45 degrees so it is perpendicular to the coin and centered to it.

Exposure #7: Coin angled 45 degrees to cassette. *Tape the coin to a 45-degree*

*angle sponge at a spot which will precisely* ***maintain the OID created by***

***the previously stacked flat sponges.*** Use a tape measure to check this,

measuring to the **center** of the angled coin. The x-ray beam is angled *isometrically* at an angle of 22.5 degrees, splitting the difference between the coin and the cassette, centered to the coin.

**Analysis**

Note the direction of x-ray tube shift or angle in each case. Remember that for *magnification* to be present, the *width* of the image (perpendicular to tube shift or angle) must also increase, not just the length. When length increases or decreases along the direction of the tube shift or angle, but width does not, shape distortion is present, but not magnification. It can be helpful to superimpose the images over each other and align them for comparison.

1. Visually compare Exposures #1 and #2. Does angling the x-ray beam cause distortion of a

spherical object?

2. Would off-centering the beam cause the same *type* of effect as angling? Why? (See textbook)

3. Visually compare Exposures #3 and #4. Does angling the x-ray beam cause distortion of a *flat*

object when the thin object is kept parallel to the cassette?

4. Would off-centering the x-ray beam cause shape distortion when the object is thin, flat and

parallel to the cassette? (See textbook)

5. Visually compare Exposures #3 and #5. Does angling the part in relation to the cassette cause

distortion when the beam is centered and perpendicular to the cassette? If so, in what

way, (foreshortening or elongation)?

6. Visually compare Exposures #3 and #6. Does angling the x-ray beam so that it is perpendicular to the part eliminate distortion when the part is angled in relation to the

cassette? Is this image foreshortened, elongated, or not distorted?

7. Visually compare Exposures #3 and #7. Does angling the x-ray beam *isometrically* eliminate

distortion when a flat object is angled in relation to the cassette? What is the name

of the principle involved? (See textbook.)

8. Examine the *width* of the coin images in Exposures #5 and #6, compared to the width of the

coin image in Exposure #3: Does tilting of the object or angulation of the x-ray beam

cause *magnification* of these images?

9. Examining all of these images, are there any significant changes in sharpness, contrast or

density from changes in alignment as long as the SID and OID have been maintained?

10. Remember that for *magnification* to be present, the *width* of an object must be enlarged as well as the length of the object, (see textbook). Scanning over all these images, did the *width* of the coin or femoral head (crosswise to the direction of any angle) ever change? Is beam-part-receptor alignment a controlling factor for image *magnification*?