**LABORATORY PRACTICE #2**

**Measuring Sharpness of Recorded Detail,**

**Magnification, and Distortion**

**Procedure:**

Place a small bone such as a metacarpal or phalanx and a resolution test template on top of a 3 inch or 4 inch sponge and place an 8 x 10 inch 400-speed cassette under the sponge. Expose with a light technique as listed below and process the film.

Technique: 50 mA, 1/40 (0.025) sec., 45 kVp

Alternate Technique: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Analysis:**

When comparing levels of sharpness, magnification, or distortion, *any* difference between your numbers should be considered as significant. There is no need to deal with the significant ranges that you use for density and contrast comparisons. (This is because the geometry of x-ray is able to be accurately controlled, whereas electrical characteristics of equipment vary greatly.) Thus, a radiograph showing 1.3 LP/mm has more sharpness than one showing 1.27 LP/mm.

**A. Sharpness of recorded detail**

Sharpness of recorded detail may be thought of as how abruptly an edge *stops* and the adjacent density begins. If the edge gradually fades into the adjacent density, then we would say that it is blurred or unsharp and has low recorded detail.

If the edge of two adjacent densities are blurred into each other enough, it becomes impossible to distinguish these two densities as separate objects. Thus, *resolution* is the ability to distinguish two adjacent details as *separate* details.

The sharper the edges of lines are, the narrower and closer they may be and still be visible as separate lines. So, higher detail means that narrower lines can be recognized. The narrower the lines are, the more of them fit into a given area. For this reason, you can measure recorded detail or sharpness by determining how many lines can be crowded into a given area and still be recognizable as separate lines. The unit of measurement used for resolution is *Line Pairs for millimeter*, abbreviated LP/mm.

Refer to your radiograph of a resolution test template *and* any phantoms or bones you are using on a rectangular sponge 2-3 inches thick, with the film under the sponge or in the Bucky, unless the experiment tells you otherwise. When observing a radiograph, scan the line pairs from *thickest to thinnest*, until you reach the *first point* where you cannot visibly distinguish any more separate lines (they all blur into each other). Find this pair number of the template and read the LP/mm. This is how many line pairs can be distinguished in one millimeter. The higher the LP/mm number, the higher is the sharpness of recorded detail.

Some test templates do not have the LP/mm marked. For this type you must obtain a table from your instructor which lists the LP/mm corresponding to each line-pair number on the template.

(Caution: You may see a second or third area on the pattern image where the lines appear to be clear again. These are areas of false resolution, where two lines have been blurred directly on top of each other. The *first* point where you see the lines blurred into each other is the point where sharpness is lost.)

Based upon the identified blur point of the test template image, record the line pairs per millimeter resolved below:

LP/mm = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**B. Magnification**

Magnification, sometimes called *size* distortion, is the difference in total size between the real object and the image of the object. To determine magnification, measure the object’s width and record your measurement; then measure the object’s image on the radiograph in *exactly* the same area and record it. Finally, divide the object size into the image size. This will give a *factor* of magnification, which will always be greater than 1.0. For example, a factor of 1.5 means that the image was magnified 1.5 times from the object.

Real bone width = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Bone image width = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Factor of Magnification = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

To obtain the percentage of magnification, simply take the number to the *right* of the decimal point in your factory of magnification and multiply it by 100. Record this number below:

Percentage of Magnification = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ percent

**C. Distortion**

Distortion is the difference between the shape of the real object and the shape of the object’s image on the radiograph. Distortion may be calculated by first measuring widths and lengths of the object and the image and recording them below; then:

1. Divide the width of the *object* into its length. This will give you the ratio of difference between the object’s width and it length, an indication of its shape. Record this shape ratio number below.
2. Divide the width of the *image* into its length and record this shape ratio below.
3. Compare the two numbers you got from #1 and #2. If they are different *at all*, distortion of shape has occurred.

Real object shape ratio = \_\_­\_\_(length)\_ = \_\_\_\_\_\_\_\_\_\_\_\_

(width)

Image shape ratio = \_\_\_\_\_\_(length)\_\_\_ = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(width)

Has shape distortion occurred?

**NOTE:** These procedures explain how to actually measure recorded detail, magnification, and distortion. Many questions on your laboratory experiments may be answered without doing these calculations. You can often visibly determine:

1. Which resolution pattern image shows the thinnest lines resolved.
2. Which image is magnified most by superimposing the x-ray images on top of each other, and
3. Which image is distorted by observing them side by side or by superimposing them as in B.