

Purpose: High resolution and contrast are very important for the detection of micro-calcifications and tumor masses in mammography screening. A very good measure of contrast versus resolution is the Modulation Transfer Function (MTF). In this study, we performed the measurement of the 2-dimensional (2-D) point spread function (PSF) and determined the 2-D MTF for regular and magnification screen film mammography.

Method and Materials: The experimental set up consists of the mammography machine, a pinhole camera mounted on test stand and the screen-film cassette. The pinhole camera has circular aperture (10 μm diameter) in a lead disk. The pinhole camera was carefully aligned with the vertical line under the x-ray tube focal spot. We used a Molybdenum anode/ Molybdenum filter x-ray tube with a nominal focal spot size of 0.3 mm. We exposed the film-screen using 30 kVp and 10 mAs exposure settings. The exposed films were processed and scanned using a transmission scanner with 4,800 x 4,800 dpi resolution to obtain the PSF. The PSF was processed with 2-D Fourier transform to obtain the 2-D MTF.

Results: The obtained PSF was a double Gaussian function of space at high magnification (2.5) and was closer to a single Gaussian at low magnification (1.15). The spatial resolution in the image plane in all directions was observed to decrease with increasing magnification. The image resolution was focal spot limited as expected. However, the variation of limiting resolution with magnification did not exactly fit the theoretical expectation.

Conclusion: We have successfully measured the 2-D PSF and the 2-D MTF for a screen film mammography in regular and magnification modes. While magnification provides a magnified view of a small part of the breast it has a lower limiting resolution due to the focal spot blurring and may compromise the detection of micro calcifications.