

AbstractID: 3725 Title: Heel-Effect in Screen-Film Mammography Artifact Analysis

Purpose: To quantify the effect of mammographic x-ray field inhomogeneity due to the “heel effect,” which is routinely observed during the medical physicist’s artifact analysis of screen-film mammography (SFM) systems, and to assist the medical physicist when evaluating artifact analysis test films.

Method and Materials: Artifact tests were performed on a variety of common SFM systems using typical screen-film combinations following the method of the 1999 ACR Mammography QC manual, which is consistent with MQSA requirements for medical physics surveys and equipment evaluations. Measurements of the optical density of 24 x 30 cm test films provided a measure of the density profile along a line parallel to the anode-cathode axis. To measure the x-ray field intensity profile independent of screen-film characteristics, a narrow strip of optically stimulated luminescence (OSL) material was placed on top of the uniform acrylic slabs.

Results: Test films demonstrated reduction of optical density with distance from the chest wall for all x-ray machines tested and all screen-film combinations tested. Variation in the degree of density reduction was observed among individual x-ray machine models and for different screen-film combinations. The OSL data correlated the trends in x-ray exposure with those in optical density observed on test films.

Conclusion: The “heel-effect” is a well-known source of field inhomogeneity which can be amplified by the contrast of the screen-film combination. This industry-wide sampling illustrates the range of variation to be expected both in terms of x-ray exposure and film optical density and provides a guide to the medical physicist who must evaluate whether or not an individual artifact analysis test result is “Acceptable”.

Conflict of Interest (only if applicable):

J.S. is employed by a manufacturer of mammographic x-ray systems. J.G. is employed by a manufacturer of OSL media.