AbstractID: 13787 Title: An Anthropomorphic Software Breast Phantom for Tomosynthesis Simulation: Power Spectrum Analysis of Phantom Reconstructions

Purpose: To validate an anthropomorphic software breast phantom for simulation studies by analyzing breast structure in projection and reconstructed images.

Method and Materials: Twenty computer breast phantoms were generated: ten 450 ml phantoms with 40% glandular tissue compressed to 5-cm thickness and ten 1500 ml phantoms with 20% glandular tissue compressed to 7.5-cm thickness. Monoenergetic ray tracing was done to create synthetic projection view images, and maximum likelihood expectation maximization (MLEM) with 8 iterations was used to reconstruct the images. Regions of interest (ROIs) were extracted, and the squared modulus 2D FFT was taken to obtain periodograms for each ROI. The radial average of each periodogram was taken, and the power-law exponent of this approximated 1D power spectrum is β, a description of the amount of structure in the ROI. This was repeated for both projection view images and reconstructed slices, and the average β was calculated for each projection view and for each reconstructed slice.

Results: For these twenty phantoms, we found that $\langle\beta\rangle$ in the reconstructed images were lower than the $\langle\beta\rangle$ values in the projection view images. For the 450 ml phantoms, $\langle\beta\rangle$ was measured to be 3.09 ($\sigma = 0.25$) in the projection and 2.82 (0.48) in the reconstruction. For the 1500 ml phantoms, $\langle\beta\rangle$ was measured to be 2.86 (0.43) in the projection and 2.73 (0.66) in the reconstruction. Published data show that $\langle\beta\rangle$ decreases from 3.06 to 2.87 in clinical tomosynthesis images.

Conclusion: We found that the changes in $\langle\beta\rangle$ between projection views and tomosynthesis reconstructed slices are comparable for the anthropomorphic phantom and clinical breast images. This supports the fact that this phantom can provide realistic breast texture.

Conflict of Interest: Research sponsored by Hologic, Inc. and Dexela Ltd.