

AbstractID: 5267 Title: A Novel Approach to Assessing Breast Density Utilizing Sound Speed Measurements

Purpose: Women with high mammographic breast density are at a 4- to 7-fold increased risk of developing breast cancer compared to women with fatty breasts. The purpose of this work is to investigate the potential of assessing breast density via acoustic velocity measurements obtained with ultrasound computed tomography.

Method and Materials: A sample of approximately 50 patients was imaged with our computed ultrasound tomography clinical prototype. Each data set was comprised of 45 tomograms ranging from near the chest wall through the nipple region. Whole breast acoustic velocity was determined by creating image stacks and evaluating the sound speed frequency distribution. The acoustic measures of breast density were evaluated by comparing these results to two mammographic density measures: (1) qualitative, as determined by a certified radiologist using the BIRADS Categorical Assessment based on a 1 (fatty) to 4 (dense) scale, and (2) quantitative, via digitization and computerized analysis of archival mammograms. The former involved a radiologist's visual assessment of each mammogram, while the latter required scanning cranio-caudal films with a Vidar VXR-16 DosimetryPro digitizer and implementing semi-automatic segmentation routines.

Results: Approximately 60 m/s difference in acoustic velocity was found between the fatty and dense BIRADS categories. This investigation indicated a positive correlation between BIRADS category and acoustic velocity of the breast. In addition, a strong correlation between the mean acoustic velocity and quantitative measures of percent breast density was demonstrated (Pearson correlation coefficient 0.651, $p < 0.001$).

Conclusion: These results support the hypothesis that utilizing acoustical velocity as an analogue to mammographic breast density is feasible. Our approach to evaluating breast density has the potential to provide a safer, non-ionizing, and more quantitative means of evaluating breast density, thus better elucidating the relationship that exists between breast density and breast cancer risk.