

PhD Thesis title: ‘The Role Of Tissue Sound Speed As A Surrogate Marker Of Breast Density’

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ABSTRACT:

Breast density is one of the strongest predictors of breast cancer risk as women with densest breasts have a three- to five-fold increase in risk compared to women with least dense breasts. Breast density is currently measured with mammography, the present gold standard for breast imaging. There are many shortcomings to using mammography for measuring breast density, including the use of ionizing radiation. Ultrasound tomography (UST) does not use ionizing radiation and can create tomographic breast sound speed images. These sound speed images are useful because breast density is proportional to sound speed. The purpose of this work was to assess the ability of UST to measure breast density and its ability to measure changes in breast density over short periods of time.

A cohort of 251 patients was examined using both UST and mammography. Many different associations were found between the UST density measurement, the volume averaged sound speed, and the mammographic percent density. Additional associations were found between many other UST and mammographic imaging characteristics. UST density was found to correlate with various patient characteristics in a similar manner to mammographic density. Additionally, UST was used to examine the effects of tamoxifen on breast density. Tamoxifen has been shown to reduce mammographic density and breast cancer risk for some women.

Preliminary data for 52 patients has shown promising results so far. UST density has decreased for approximately a similar percentage of patients as has been measured for mammographic density. These changes have been measured over short time frames that could not be achieved using mammography.

These results show that UST's ability to measure breast density is consistent with mammography, the current standard of care. UST has the potential to become a safe and effective approach that can be used to reliably assess breast density and serial changes in breast density.

References to author publications that relate specifically to the dissertation:

Sak, M., et al. *Breast density measurements using ultrasound tomography for patients undergoing tamoxifen treatment*. Proc. SPIE8675, Medical Imaging 2013: Ultrasonic Imaging, Tomography, and Therapy, 8675.

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Sak, M., et al. *Relationship between breast sound speed and mammographic percent density*. Proc. SPIE7968, Medical Imaging 2011: Ultrasonic Imaging, Tomography, and Therapy, 79680N (March 25, 2011).

Duric, N., Boyd, N., Littrup, P., Sak, M et al., *Breast density measurements with ultrasound tomography: A comparison with film and digital mammography*. Medical Physics, 2013. **40**(1): p. 013501-12.