AbstractID: 14122 Title: Photoacoustic Tomography for Imaging in the Mammographic Geometry

Purpose: To add spectroscopic photoacoustic tomography (S-PAT) to an ultrasound imaging system in the mammographic geometry to test whether this minimally invasive and ultimately inexpensive modality can detect and interpret small vascular anomalies, providing information supplemental to that of x-ray and ultrasound much as is done with MRI. Blood oxygenation and blood volume information from S-PAT might replace or exceed information provided by MRI resolution, possibly without contrast agents.

Method and Materials: The specimen surface is flooded with a <25 ns pulse of light from a tunable, 720-900 nm plus 1064 nm, laser. An 8 cm diameter, 570 element PVDF array in a square grid of 3.2 mm spacing serves as the ultrasound receiver of the thermoacoustic signals produced by optical absorption. 20 channels were multiplexed to acquire the 570 signals. Delay-and-sum beamforming produces an image of the thermoacoustic sources. The receiver bandwidth, here 0.4 to ~3 MHz at -12 dB is critical, as the center frequency from a spherical target is inversely proportional to the object diameter. A 3 mm ID tube of blood was imbedded in porcine tissues, 24mm of fat and 28mm of loin to the 725 nm illuminated surface and 45mm of loin to the receiver. 256 pulses of 70 mJ from a preliminary laser were averaged.

Results: The blood tube could be easily discerned at the resolution anticipated for the acoustic frequency from the blood tube and the available receiver aperture.

Conclusion: This described example is through optical and acoustical path lengths greater than that required for imaging from each side of most breasts at modest compression. This and similar results *in vitro* give hope of adequate sensitivity to blood collections in the breast of appropriate spatial frequencies. S-PAT should be compatible for integration in a combined tomosynthesis/ultrasound/optical breast imaging system.
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