AbstractID: 6663 Title: Integration of a pressure sensing array into ultrasonic strain imaging

Purpose: Mechanical in vitro tests have shown differences between fibroadenomas and invasive ductal carcinomas (IDCs) in their non-linear stress/strain behavior, which could be utilized to differentiate between the two lesion types (and potentially eliminate an unneeded biopsy). Stress and strain measurements are required to quantify this non-linear behavior in vivo. We are investigating the feasibility of integrating a pressure sensor to obtain a surface stress measurement during ultrasound strain image acquisition. The prototype pressure sensor plate design, methods for calibration and initial results will be presented.

Methods/Materials: A custom pressure sensing array was obtained from Pressure Profile Systems, Inc. A variety of tests were performed with the array to gauge its stability, sensitivity and calibration in reference to its application in ultrasound elastography. Measurements on elastographic phantoms were also performed with comparisons to finite element analysis (FEA) simulations. In addition, data was collected from a small clinical trial at the University of Wisconsin Breast Center.

Results: Initial tests show that the pressure sensor array is stable in an ultrasound imaging environment. A reliable calibration technique was also developed. Measurements on phantoms have shown modest agreement with FEA simulations. However, geometric inhomogeneities on the surface of the sensor as well as the variability of the absolute calibration have made an accurate map of the pressure distribution difficult to obtain. From the clinical work the device has been shown to be sensitive enough to detect initial contact with the breast, a crucial objective in quantifying non-linear stress/strain behavior.

Conclusions: The pressure sensor has demonstrated the ability to measure a relative surface pressure from initial contact to full compression during an ultrasound strain image acquisition, providing a method to quantify the non-linear stress/strain behavior in breast lesions. However, system limitations may hamper efforts to obtain accurate surface pressure maps for modulus reconstruction.