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Dissertation Announcement

SHEAR STRAIN ELASTOGRAMS: ULTRASONIC ESTIMATION AND IMAGING OF THE LOCAL SHEAR STRAIN IN INHOMOGENEOUS MATERIAL UNDER AXIAL COMPRESSION

Arun Thitai Kumar

Elastography is an imaging technique that applies a quasi-static compression to a region of material and detects stiffness variations within an ultrasonically scanned tissue volume to create strain elastograms. The axial strain (along the direction of compression) elastograms have been well-established during the last fifteen years. Whereas, there is a paucity of literature regarding imaging shear strains and the information that shear strain elastograms may convey. It is known that among breast lesions, malignant tumors are generally more firmly bonded to their surroundings than are benign tumors. Yet, there are currently no methods available to image this information directly. We hypothesize that imaging the local shear strain distribution will provide information about the bonding at the tumor-surrounding tissue interface. Therefore, the overall goal of the research work reported in this dissertation is to demonstrate the feasibility of generating shear strain elastograms using standard ultrasound elastographic techniques. Further, to demonstrate that these elastograms convey information about the bonding at the interface between two or more materials.

In order to establish the utility of shear strain elastograms, the image quality of shear strain elastography was investigated in terms of image quality parameters (signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR), and resolution). Subsequently, the feasibility of using shear strain elastograms to visualize the bonding at an inclusion-background interface was explored. Finally, we investigated the feasibility of producing in *vivo* shear strain elastograms and extracting from them features that provide meaningful information about bonding at the interface between a tumor and the surrounding tissue.

The work reported in this dissertation led to the conclusion that it is feasible to produce shear strain elastograms of acceptable image quality using standard elastographic technique. Furthermore, the feasibility of utilizing shear strain elastograms to visualize bonding at an inclusion-background interface was established. This was demonstrated using simulations as well as data from an *in vivo* study of breast tumors.

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Place: E-313-D3
Date: 4/17/06
Time: 3:00 pm