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Impulsive acoustic radiation force: imaging approaches and clinical applications

Kathryn Nightingale[a], Mark Palmeri[b], Liang Zhai[b], Kristin Frinkley[a], Michael Wang[b], Jeremy Dahl[b], Brian Fahey[b], Stephen Hsu[b], David Bradway[b] and Gregg Trahey[b]
[a]Biomedical Engineering, Duke Univ., 136 Hudson Hall, Durham, NC 27708, USA
[b]Duke University, PO Box 90281, Durham, NC 27708, USA

Focused acoustic radiation force can be used to locally mechanically excite tissue, and the tissue response can be monitored with conventional ultrasonic displacement estimation methods. Many groups are currently exploring the potential for radiation force based methods to derive information about tissue stiffness associated with different pathologies. These techniques can be implemented on a modified diagnostic ultrasound scanner, using the same transducer for both generating the radiation force excitation and monitoring the tissue response. Multiple locations within an imaging field of view can be interrogated sequentially, by electronically controlling the push and track apertures and beam locations. A variety of data processing and imaging approaches are under investigation. Images are generated of the tissue displacement magnitude within the region of excitation at a given time after radiation force application. These images portray relative differences in tissue stiffness, and provide interesting structural information that is well correlated with, and often exhibits improved contrast over, matched B-mode images. Methods for quantifying tissue stiffness through monitoring shear wave propagation, as originally proposed by Sarvazyan, are also under investigation. Results from ongoing clinical studies using these methods in a variety of organs (e.g. liver, prostate, breast, and heart) will be presented.