

Vibration Sonoelastography: Ultrasound Imaging of the Elastic Properties of Tissue

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Certain pathological conditions, such as malignant tumours, manifest themselves as changes in the tissue's mechanical stiffness. This is the basis for palpation. Several techniques for imaging tissue elasticity using ultrasound have been proposed: compression elastography (strain imaging), transient elastography and vibration sonoelastography. The latter involves imaging of vibration patterns resulting when low frequency vibration is applied to the tissue. Taylor et al have proposed estimation of the variance of the Doppler spectrum for sonoelastographic imaging using a modified ultrasound machine. Here we propose the use of power Doppler imaging for vibration sonoelastography. A power Doppler modality is available as standard on many ultrasound machines since it is useful for imaging blood flow and has good sensitivity to low velocities. The results of simulations are reported that explore the relationship between vibration frequency, vibration amplitude and the power Doppler image. These indicate that by generating appropriate vibration signals, the B-scan and power Doppler images can be combined to produce images of the elastic properties of tissue. Imaging experiments using liver phantoms are reported to illustrate the method. The possibility of three-dimensional power Doppler sonoelastography using a freehand scanning system is also discussed. Sonoelastographic imaging has the potential to provide a painless, risk-free and relatively economical imaging modality with application, for example, to breast or prostate tumour diagnosis and localisation.

Taylor L S, Porter B C, Rubens, D J, Parker, K J, "Three-dimensional sonoelastography: principles and practices", *Physics in Medicine and Biology* 45(6), 1477-94, 2000

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