Opportunity and Significance

Ultrasound Shear Wave Elastography uses an implemented force to cause a change in mechanical property of soft tissue. Due to malignant cells being made up of multinucleated cells, they hold differing mechanical properties than healthy tissue, leading to the ability to detect different tumors like melanomas. The force induced is one of the variables of a programmable ultrasound as well as the transducer elemental arrangement, as being explored in this study. In this research, a programmable Verasonics Vantage 128 ultrasound machine with L7-4 linear array transducer was used.

Technical Objectives

In this study, a mechanical source for the “push beam” was implemented using an oscillation probe technique. This will bypass the need for expensive external equipment usually paired with the programmable ultrasound. Further, the elements of the transducer were arranged into 5 subgroups of 12 elements with 17 elements in between them. The subgroups simultaneously transmit an unfocused beam while the rest of the elements are off. All elements are on for the echo detection.

Related Work and State of Practice

Various techniques are being studied in real time ultrasound elastography in tumor detection, however, practiced methods require expensive equipment with high frequency machines.

Technical Approach, Accomplishments and Results

Mechanic Oscillation setup is depicted below in Figure 1:

![Figure 1: Transducer Subunit Transmission Depiction](image1)

Elemental arrangement of the transducer are depicted below in Figure 2:

![Figure 2: Mechanical “Push-Wave” System](image2)

A full single Field-of-View Two-Dimensional Shear Wave Speed Map from a Local-Frequency-Estimation is depicted below in Figure 3:

![Figure 3: CUSE Mechanical-Source Speed Map Result of 1540 m/s Speed of Sound Phantom](image3)

Next Steps for Development and Test

Once method is confirmed using inclusion phantoms, a series of clinical trials will be conducted. Dr. Daveluy runs histology clinics twice a week and stated they see roughly one melanoma case a clinical day. This leaves room for method verification leading to a noninvasive practice in early melanoma detection.

Commercialization Plan & Partners

Dr. Nasiriavanaki lead a group of research students in a series of research projects dealing with an optical coherence tomography and a programmable verasonic vantage 128 ultrasound machine in reference to dermatology.

Dr. Daveluy will give us the opportunity to validate this method within clinical settings. Dr. Nasiriavanaki will further the commercialization of the method.

An IRB approval is needed to conduct clinical trials, however this should be attainable as the ultrasound machine is already FDA approved. Further commercialization requirements available upon request.

References
