# Assessment of Hand Tendon Rotation by using High Frequency Ultrasound Vector Doppler Imaging

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## Background, Motivation and Objective

Injuries to the hands, wrists, and fingers often involve damage to multiple tissues. The ability to measure tendon movements during the rehabilitation process would provide important information for quantifying tendon injuries for clinicians. Traditionally, people consider that tendon is a single spring-like structure during force transmission and ignores its twisted structure. Recently, people believe that the torsion fiber structure (to make tendon rotation during movement) can provide tendon a degree of elasticity and improve efficiency of force transmission. However, it is still difficult to observe the hand tendon rotation *in vivo* by using current imaging modalities. Ultrasound imaging is one potential tool for this purpose, however, the resolution of traditional ultrasound is insufficient for hand tendon imaging and lacks the function for tracking the tissue rotation. Therefore, the purpose of this study to develop a high frequency ultrasound vector Doppler imaging for tracking the hand tendon rotation.

## Statement of Contribution/Methods

Vantage 256 (Verasonics) with a 40 MHz array transducer (MS550D) were used in this study. Three title plane waves with angles were transmitted to human hand for acquiring the compounding image of tendon at a high frame rate of 1 kHz. The movement of tendon was tracked by using multi-beam Doppler method. After a segmentation process of tendon, the vector Doppler velocity data were color-encoded as a function of time on the B-mode image. Subjects are asked to move their fingers from flat to hook shape in a constant speed during ultrasound examination, as shown in Fig. 1(a).

## Results/Discussion

Fig. 1(b) shows the vector Doppler imaging of human hand tendon during movement. The arrow represents the rotation direction, and length of arrow represents the velocity value. The color map also represents the direction of tendon movement. It is obvious that a counterclockwise rotation of tendon was observed clearly during finger moving. The trajectory of flexor tendon rotation in cross-section view was also obtained, as shown in Fig. 1 (c). All the experimental results showed the potential of 40 MHz ultrasound vector Doppler imaging as a tool for visualizing the tendon rotation and would provide a quantitative information of tendon function for assessing the rehabilitation process after injuries.

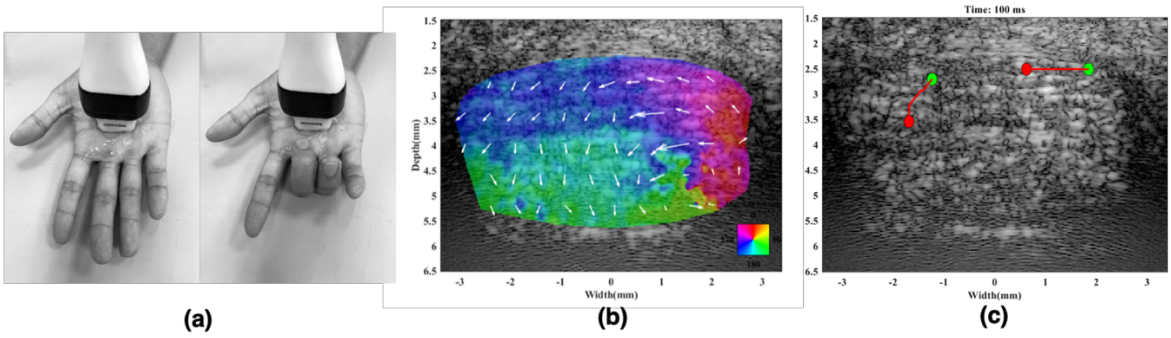


Fig. 1