

# Mechanical Response of Fascia Associated with Acupuncture Meridians during Acupuncture Needling

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**BACKGROUND** Ultrasound elastography has seen a surge of interest in areas ranging from lesion detection in the breast and prostate to assessing fibrosis in the liver and kidney. We are using elastography techniques to characterize the mechanical response of connective tissue to acupuncture needling. Previous studies have shown that the perimuscular fascia is largely responsible for the “needle grasp” phenomenon that frequently accompanies acupuncture treatment. Local to the needle there is a winding of connective tissue fibers around the rotating needle. Further manipulation results in measurable tissue displacement in phase with the needle perturbation, particularly within the fascial bands, both local to the needle, and at significant distances from the needle site. The recognition of this phenomenon has important implications when paired with our parallel studies on the cellular response to tissue stretching.

**HYPOTHESIS** Traditionally, acupuncture is performed at specified locations on the body. Many of these sites lie on perimuscular fascial planes, closely paralleling classical acupuncture meridians. The hypothesis of this study is that tissue displacement will be different at traditional acupuncture sites when compared to control (non-acupuncture) points and that displacement measured parallel to the fiber orientation will be greater than that measured perpendicular to it.

**METHODS** *In vivo* ultrasonic imaging was performed on the thighs of 8 normal human subjects at four locations. Two acupuncture points (AP), and two control points (CP) were imaged with the transducer probe oriented longitudinally (L) and transversely (T) for both points. The acupuncture needling was performed by a computer-controlled acupuncture needling instrument. Ultrasound RF data were acquired continuously during needling using a GE System Five scanner (linear array transducer 6.9 MHz) at 13.2 frames/s. Each needling procedure consisted of needle insertion, 8 uni-directional clockwise needle revolutions, and a single 2 mm oscillation of the needle. Tissue displacements were estimated using cross-correlation techniques (Ophir et al. 1991). For the purpose of analysis, the ultrasound image and displacement map were divided into four quadrants: upper left (Q1), lower left (Q3), upper right (Q2) and lower right (Q4). The needle was in Q1.

**RESULTS** Preliminary analysis in 8 subjects indicated that tissue displacement during needle rotation was both greater in magnitude at the needle site (Q1) and more anisotropic at the AP than at the CP. At the AP, the total tissue displacement in Q1 was greater in the longitudinal direction than in the transverse direction (mean±SE 3554±875 vs. 2944±735 μm respectively). In contrast, at the CP, about the same amount of motion in Q1 occurred in both directions, (2293± 854 vs. 2195±1010 μm) which was less than the amount of motion at the AP in the transverse direction. For the AP in Q2 (on the side of the image away from the needle) nearly 66% of the Q1 displacement was observed, while for the CP, less than 50% propagated to Q2.

**CONCLUSIONS** These preliminary results support our previous finding that tissue winding and needle forces are greater at APs than a CPs and also suggest that the tissue forces created by the acupuncture stimulus may propagate for longer distances

along acupuncture meridians, compared with non-meridians. We anticipate having the results from approximately 12 additional subjects by the time of presentation of this data.

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