

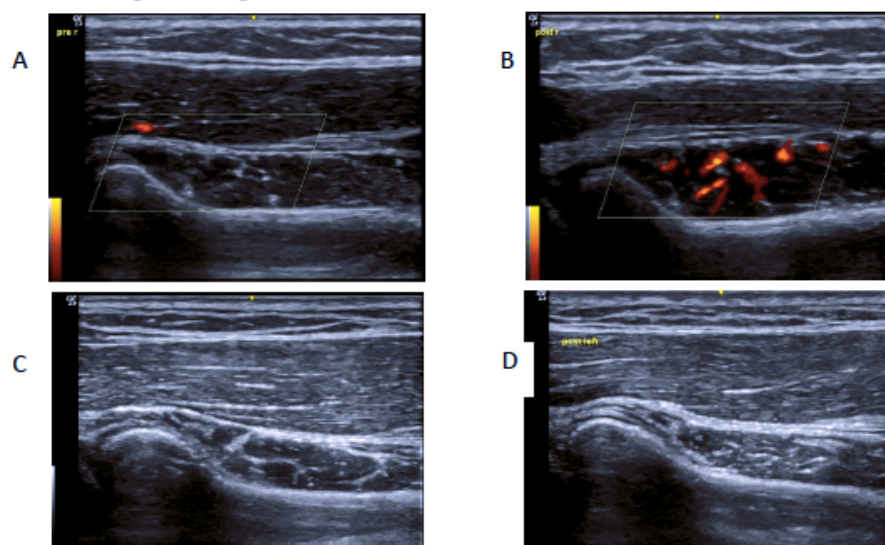
## Manual therapy improves blood flow and muscle fiber orientation of the forearm extensors

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**Context:** The use of manual therapy is commonly used by clinicians for the decrease of pain and improvement of blood flow and range of motion at the elbow joint. Several therapeutic treatments can be used to accomplish these aims, such as positional release therapy (PRT), instrument-assisted soft tissue mobilization (IASTM), and thermal ultrasound (US). However, it is unknown how blood flow and tissue fiber alignment change when these interventions are compared to one another. **Methods:** Twenty-five participants (fifty elbows) (Age:26.0±4.5years; Height:69.3±4.3cm; Mass:81.8±16.9kg) volunteered to be in this controlled laboratory study and were screened for exclusion criteria in an athletic training facility. Diagnostic ultrasound application was performed by a blinded investigator before and after the interventions. Prior to taking the initial blood flow and muscle fiber measurement, the participant sat quietly. The treatment interventions as well as diagnostic ultrasound was applied randomly to each elbow about 1cm below the elbow joint at the common extensor tendon. For PRT (13 elbows), one treatment was applied for 30 seconds-2 minutes using the Fasciculatory Response Method. For US (12 elbows), one treatment with a 5cm ultrasound head, moved continuously with settings of 3MHz, 100% duty factor (thermal), 1.6 Wcm<sup>2</sup>. The treatment lasted 6 minutes. Participants in the IASTM group (13 elbows) received a choreographed protocol lasting 3 minutes. The fourth intervention group (12 elbows) was a combination of all three interventions. Separate one-way ANOVAs were used to assess differences across interventions for blood flow and tissue fiber alignment using pre-post change scores of area (mm<sup>2</sup>) (Figure 1). A negative change score indicated area was smaller post-intervention.

**Results:** The data from four elbows (1 PRT, 1 US, and 2 combo) was considered to be an outlier or the image unreadable and were removed. Blood flow was significantly higher following PRT (691.54±1237.16mm<sup>2</sup>) compared to IASTM (18.73±227.10mm<sup>2</sup>) (p=.050; ES=.73) and US (-10.09±479.26mm<sup>2</sup>) (p=.042; ES=.72), but not different from the combination intervention (627.64±820.22mm<sup>2</sup>) (p=.849). Seventy-five percent of elbows in the PRT intervention showed improvement in blood flow, 54% in the IASTM group, 45% in US, and 73% in the combination group showed improvement. Tissue fiber orientation was significantly better following IASTM (-5756.00±8156.19mm<sup>2</sup>) compared to PRT (-1552.54±3896.58mm<sup>2</sup>) (p=.042; ES=.66), but no difference was demonstrated among the other interventions (p>.066). All elbows (100%) that received IASTM showed improved tissue orientation, 77% in the PRT group, 64% in US and 64% in the combination group. **Conclusions:** Manual therapy, particularly PRT and IASTM, seem to be better at increasing blood flow and muscle fiber orientation, respectively. As clinicians, it is important to choose the most appropriate intervention for the treatment goal. **Word Count:** 429

Pre-Post images of changes in blood flow and muscle fiber orientation



A. Pre image of blood flow; B. Post image of blood flow following PRT;  
C. Pre image of extensor muscles; D. Post image of extensor muscles following IASTM

**Citation:** Speicher TE, Selkow NM, Warren A. Manual therapy improves blood flow and muscle fiber orientation of the lateral forearm extensors. Poster accepted at: The American Institute of Ultrasound in Medicine; 2019; Orlando, FL.