

# Ultrasonic Probe Holder

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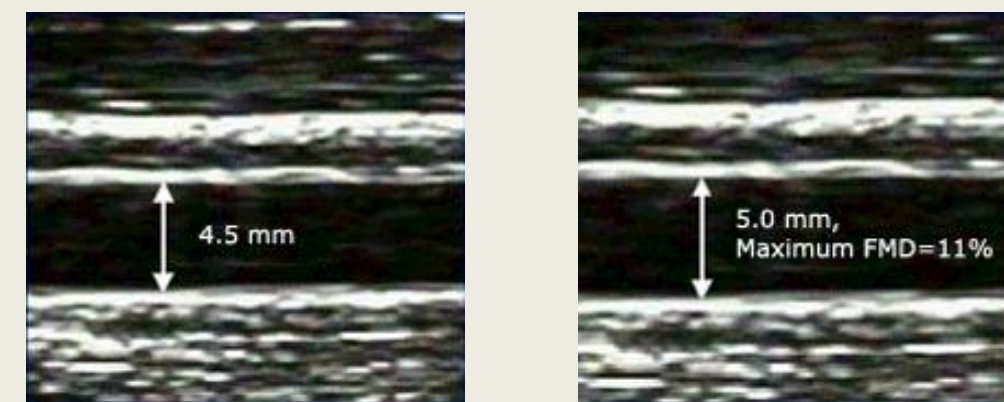
## Background

Ultrasonography: Transducer measures sound wave reflections off tissues in the body to measure anatomy and physiology without invasiveness

- Our Application: Use Ultrasonography to image cross-sections of brachial arteries in the arm.
- Measure epithelial response to changes in pressure
- Information gained can be used in diagnosis and treatment of Atherosclerosis.
- Applications are present in both research and clinical settings.

The Study:

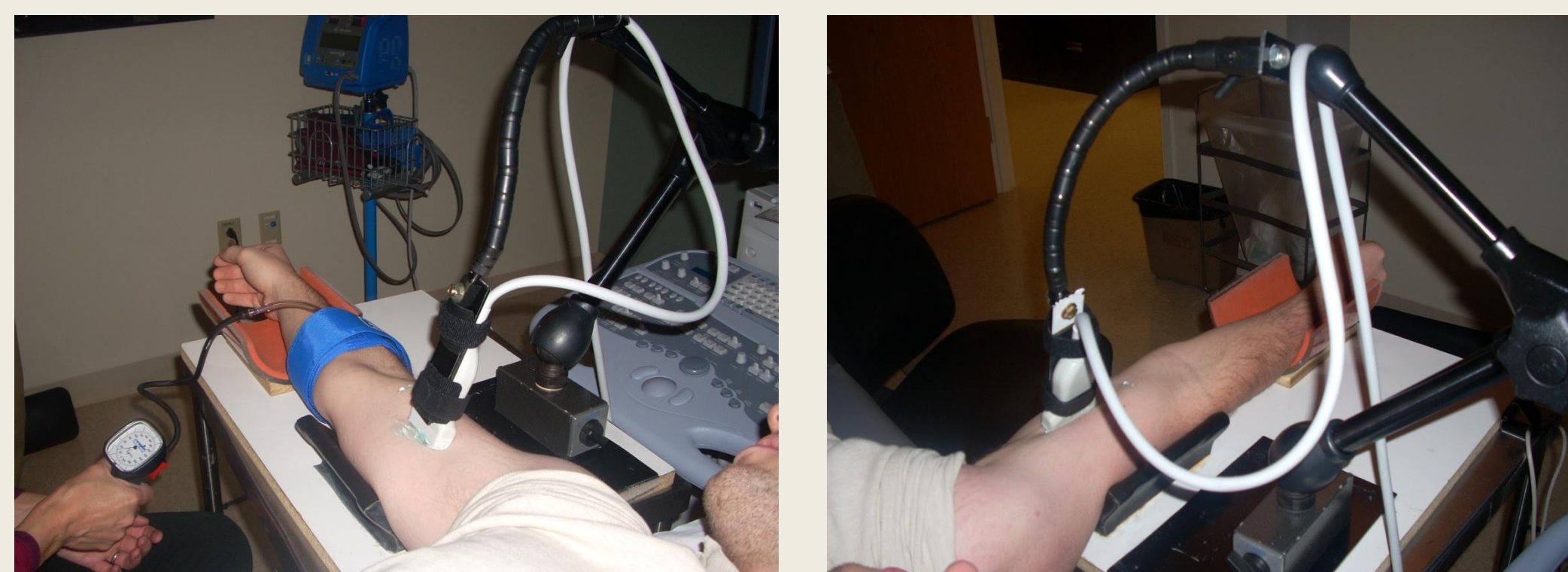
- Relaxed Patient with left arm extended and supinated.
- Image artery, constrict blood flow at the forearm, observe response of artery
- Release pressure and observe epithelial recoil



## Motivation

- Sonographers will be able to perform other tasks/patient monitoring for more comprehensive studies
- Availability of holders to position and stabilize the probe in ultrasound studies could improve effectiveness of procedure
- Ergonomically improves job design for sonographer
- Probe holders would reduce work stress that may lead to an increased risk of work related musculo-skeletal disorders in sonographers
- With wrist held in deviated position for 5+ min, significant pressure on the Ulnar Nerve in the Carpal Tunnel.
- Many clinics currently limit studies to 1 h due to strain on sonographers.

## Device in Use



## Abstract

Advanced atherosclerosis, an inflammation of the arteries, can lead to thrombosis and heart attacks or strokes. Vascular reactivity studies examines the brachial arteries' reaction to occlusion. An ultrasonic probe must be held in the correct orientation for 5 min. Since the images are influenced by motion artifact caused by slight movements of the sonographer's hands, a probe holder that stabilizes an ultrasonic probe in the correct orientation would improve the quality of the sonogram. A prototype was constructed that enables the probe to be moved in any direction by adjusting a string of ball and socket joints. Major motion can be achieved by loosening one knob and moving an articulated arm. Any sized probe can be attached to the device using Velcro straps. The prototype also contains a comfortable arm rest that stabilizes the patient's arm. Test show that the prototype eases use and effectiveness of the probe holder.

## Redesign Elements

### Clamping



- Sandwich design too complicated and not enough rigidity
- Used a metal bar that is covered with rubber padding
- Used Velcro strips to secure the probe to the metal bar



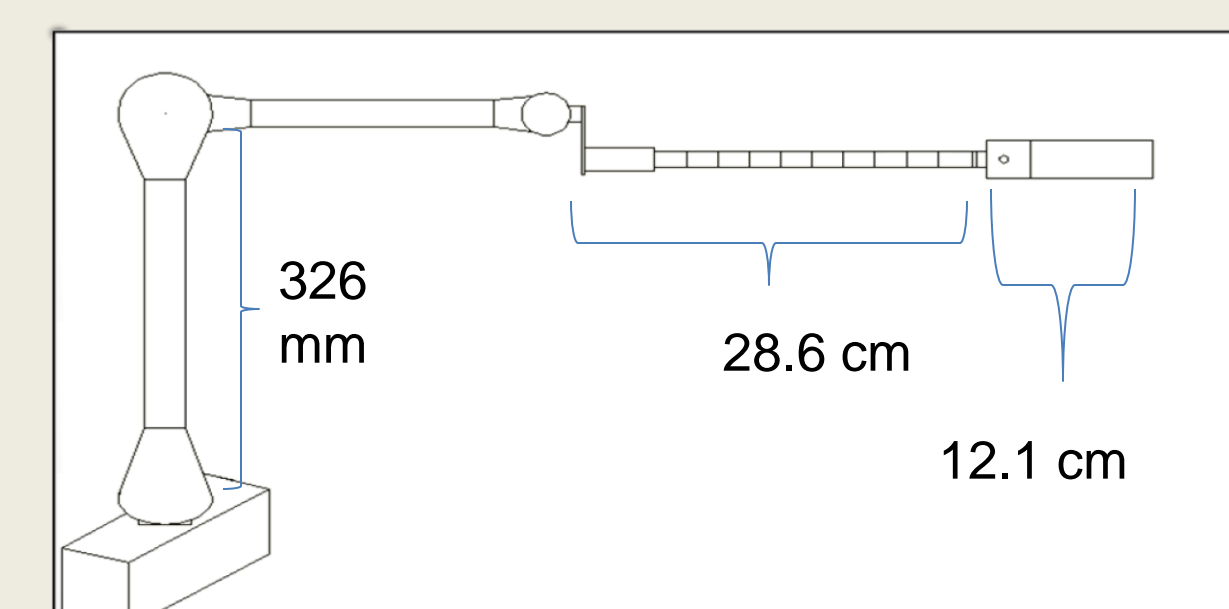
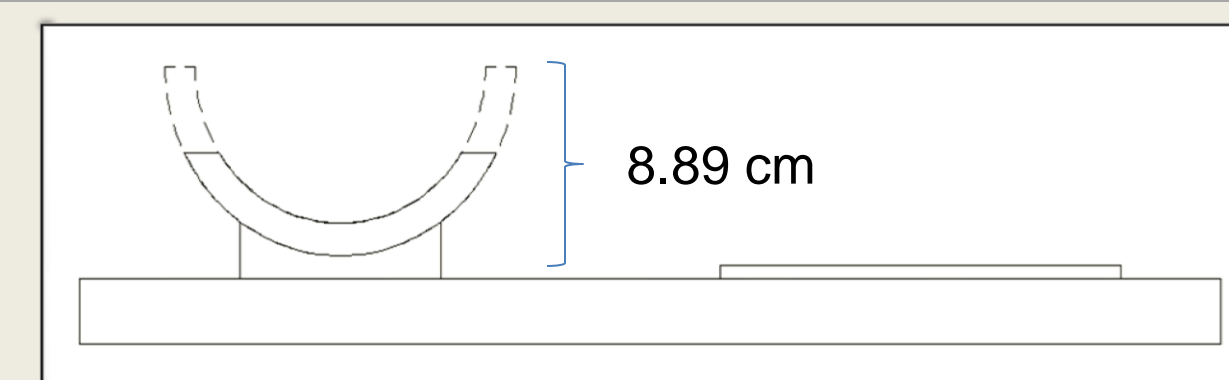
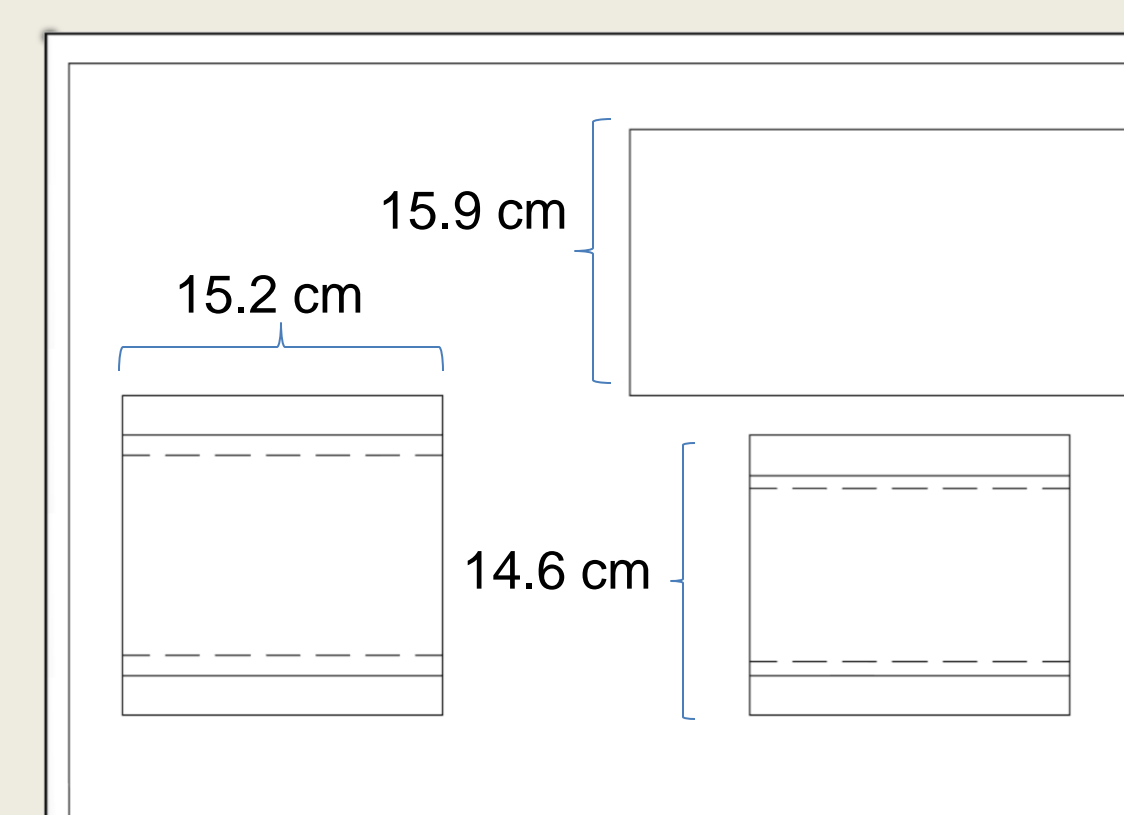
### Positioning



- Combined the articulated arm with a gooseneck
- Provides more flexibility by enabling small adjustments

## Final Design

• CAD drawings of final design



## References

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## Acknowledgements

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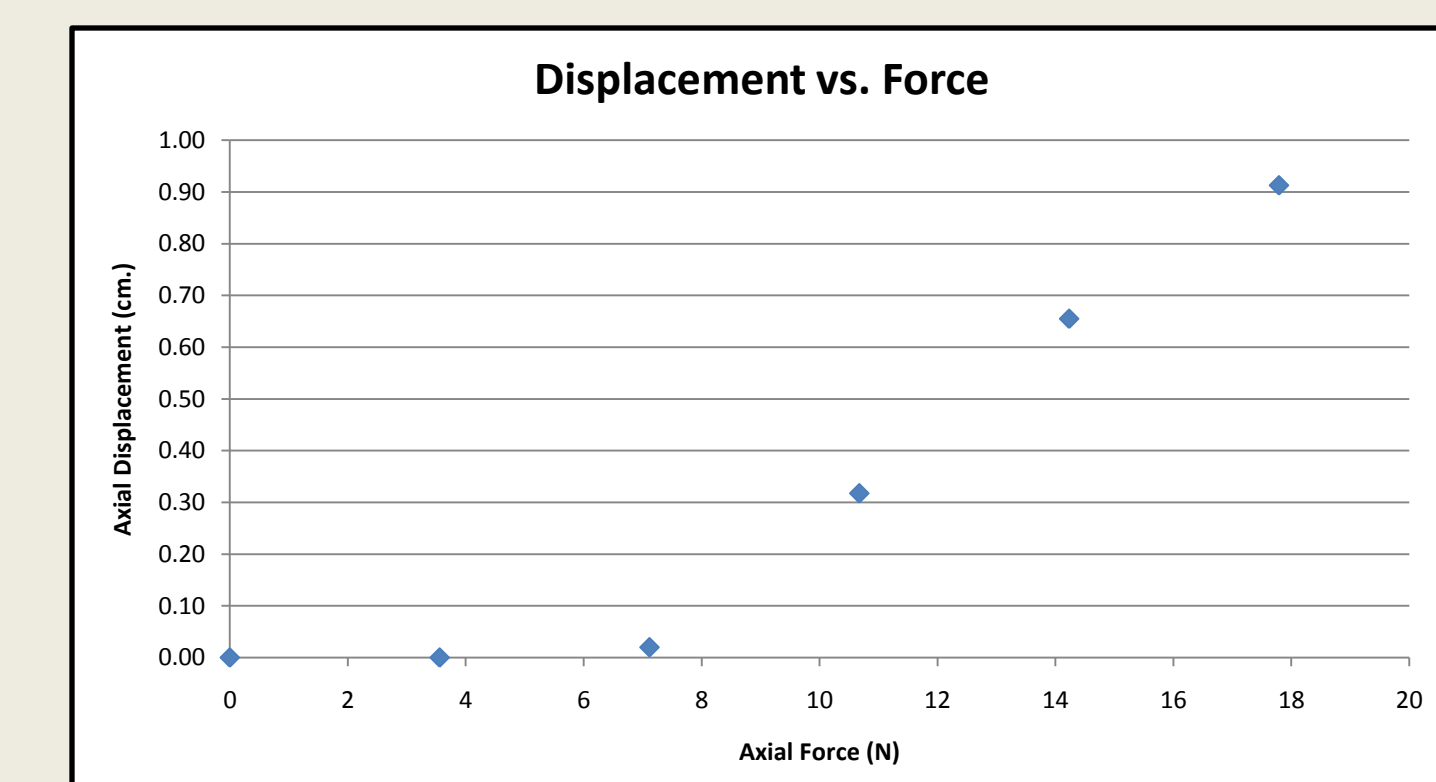
## Verification

- IRB approval obtained April 9, 2010 enabling 12 months of testing.

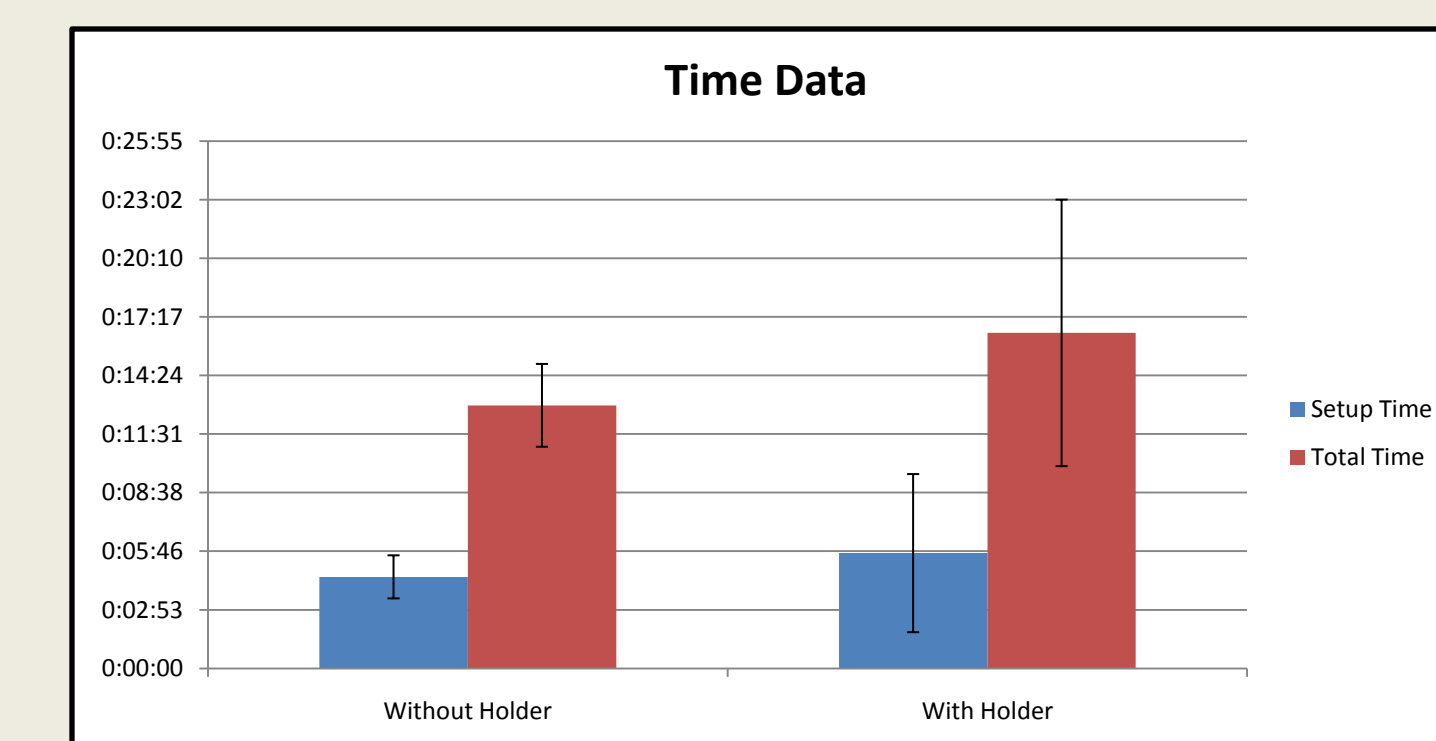
### Tests

- **Ease of Use:**
  - Two Technicians operated with the device and rated its usability with direct feedback
  - Efficiency of use was measured with set-up times and procedural times. Compared data to baseline of same procedure without device
- **Device Effectiveness:**
  - Obtained ultrasound data from healthy subjects .
  - Made acquisitions with and without the device for each test subject
  - Clinical Data Efficacy: Presented data to technicians and clinicians to distinguish and rate quality of data between studies with and without device. Used numerical rating.
- **Analysis:**
  - Identified any design flaws from usability feedback.
  - Determined degree of procedural/diagnostic improvement from clinical data efficacy study

## Data



- Displacement of probe vs force applied. No more than 8.90 N applied during procedure



- Initial data for the time study with  $n = 4$ . Error is relatively high due to small number of tests.

## Discussion/Future Work

- Testing has been very promising with the final design.
- The device was effective in maintaining image quality
- Probe was well stabilized and did not show signs of shifting during the study.
- The device is usable. Still, with the device it is a different technique which will require practice for any technician to master.
- While the concept of this device is not novel in the field, the design is unique.
- There may be a limited market interest in the device so pursuit of publication and/or intellectual property protection may be made.
- Submission to Journal of Ultrasound Medicine.