Measuring Fascicle Lengths in Extrinsic and Intrinsic Thumb Muscles Using Extended Field-of-View Ultrasound

Taylor R. Rakauskas, Tamara Ordonez Diaz, Jennifer A. Nichols

Introduction

- Muscle fascicle lengths are an important tool for understanding the force-length and force-velocity properties of muscles [1].
- Ultrasound is accepted as a reliable measurement for muscle fascicles [1,2,3,4].
- The number of ultrasound studies examining the upper limb, especially thumb muscle fascicles, is limited.

**OBJECTIVE:** to test the reliability and validity of measuring muscle fascicle lengths of extrinsic and intrinsic thumb muscles using extended field of view ultrasound (EFOV-US) imaging.

Methods

**DATA ACQUISITION**
Eight healthy adult subjects (4 female, avg. age 21.6 ± 1.3 years, avg. height 175.85 ± 8.26 cm).

**DOWN SAMPLING**

**Extrinsic muscles**
- 10 ECU images
- 10 FPL images
- 15 APB images
- 5 best images determined
- Down sampling based on image quality
- 2 measurements taken from each image

**Intrinsic muscles**
- 10 ECU images
- 10 FPL images
- 15 APB images
- 5 best images determined
- Down sampling based on image quality
- 1 measurement taken from each image

Results and Discussion

Reliable fascicle length measurements were found for each muscle. Measurements for the ECU and APB were found to be consistent with the literature [4,5,6], but FPL images were consistently larger.

**ECU**
- Total images acquired: 10 ECU images
- Down sampling based on image quality
- 5 best images determined

**FPL**
- Total images acquired: 10 FPL images
- Down sampling based on image quality
- 5 best images determined

**APB**
- Total images acquired: 15 APB images
- Down sampling based on image quality
- 1 measurement taken from each image

Varying correlations with height and forearm length highlight the need to directly measure thumb muscle fascicle lengths, instead of relying upon anthropometric scaling.

**Measured**
- Mean Fascicle Lengths: ECU (5.12 ± 0.3 cm), FPL (6.15 ± 0.53 cm), and APB (4.0 ± 0.4 cm)

**Literature**
- Possible reasons for the FPL discrepancy include limb posture during measurement and prior studies involving cadaveric specimens.

**ANALYSIS**

Two-sided t-tests were performed to compare the subject averages with those reported in the literature.

**CONCLUSION:** EFOV-US was found to be a reliable tool for measuring muscle fascicle lengths of extrinsic and intrinsic thumb muscles. Continuing to measure thumb muscle fascicle lengths in vivo will inform our understanding of hand forces and hand pathologies.

References: