



Inter-device Reliability of Musculoskeletal Ultrasound Imaging: Handheld Versus Established Unit in Measuring Lumbar Multifidus Contraction



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Introduction

- Purpose:** to determine the inter-device and intra-rater reliability of rehabilitative ultrasound imaging (RTUI) when comparing a handheld unit (Butterfly iQ) to an established standard unit (Sonosite M-MSK) when measuring the lumbar multifidus muscle (LMM) contraction.
- Background:** RTUI can be utilized in the physical therapy setting to assess voluntary contraction of deep musculature like the LMM. Established units, such as the Sonosite M-MSK, may not be utilized in physical therapy clinics due to high cost and space restrictions. There is limited research on the reliability of smaller, less expensive, handheld RTUI equipment in comparison to traditional units when imaging musculoskeletal structures.
- Hypothesis:** The handheld Butterfly iQ will demonstrate less reliable measurements when compared to the Sonosite unit ($ICC < 0.75$).

Study Design and Methods

- Reliability Study
- Subjects
- N=42 healthy subjects
 - 30 Females and 12 males, 23-65 years old (mean age 38.5)
 - Exclusion criteria: history of LBP within the past year, diagnosed spinal dysfunction, pregnancy, and inability to lay prone
- Study Overview: Figure 1
 - A physical therapy student novice user, received basic training (2 hours) in RTUI techniques for measuring the LMM with both devices while supervised by two experienced users
 - Participants were provided with verbal instructions on how to contract the LMM and positioned prone with a pillow under the abdomen
 - L4 spinal process was marked, and all images were taken at this location
 - Participants were verbally cued to contract the LMM for 10 seconds
 - An image was recorded with each device for a single contraction
 - This process was repeated a total of 3 times
 - The researcher measured each image with on screen calipers
 - The researcher was blinded to the thickness value

Study Procedure

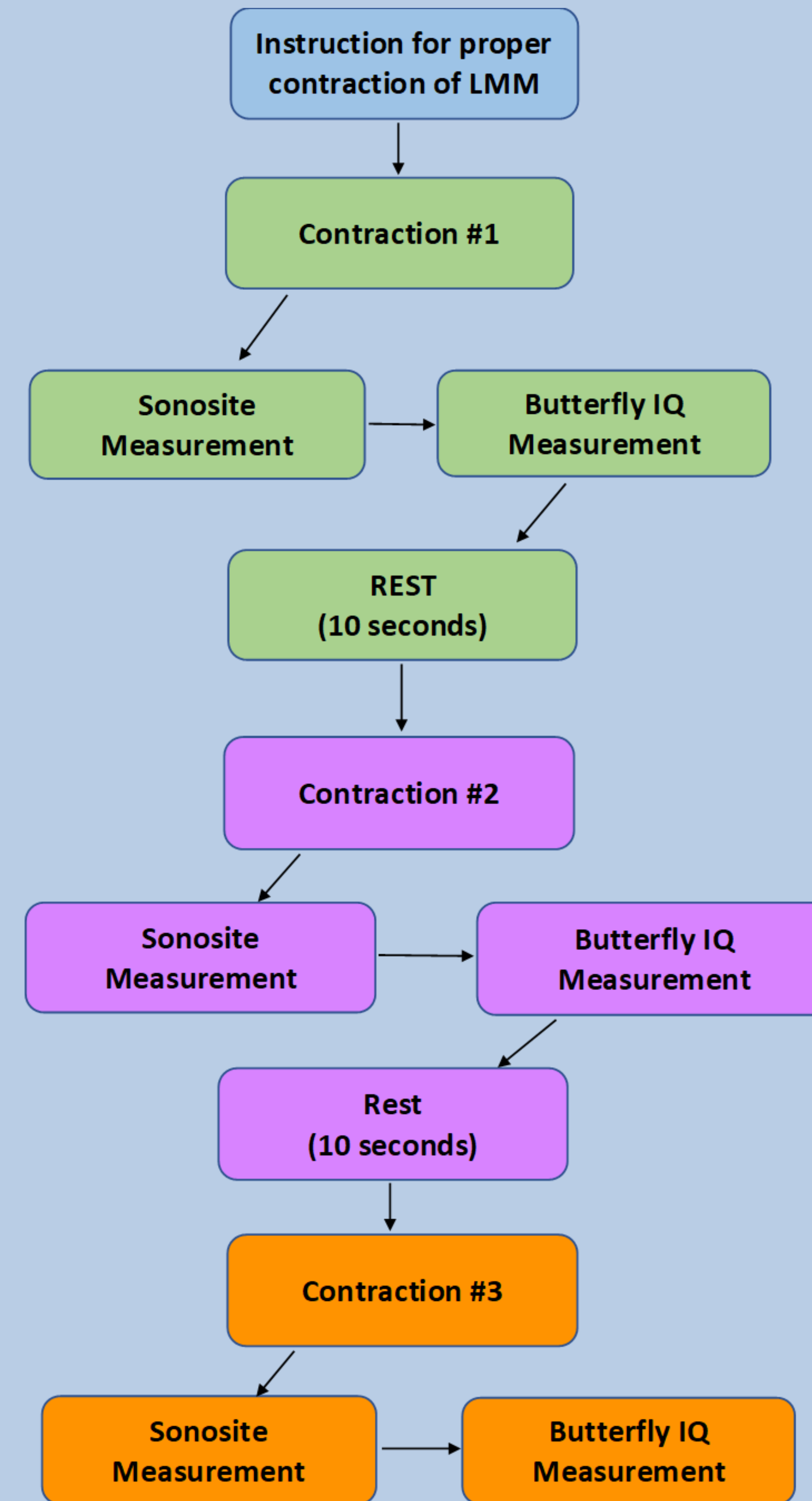


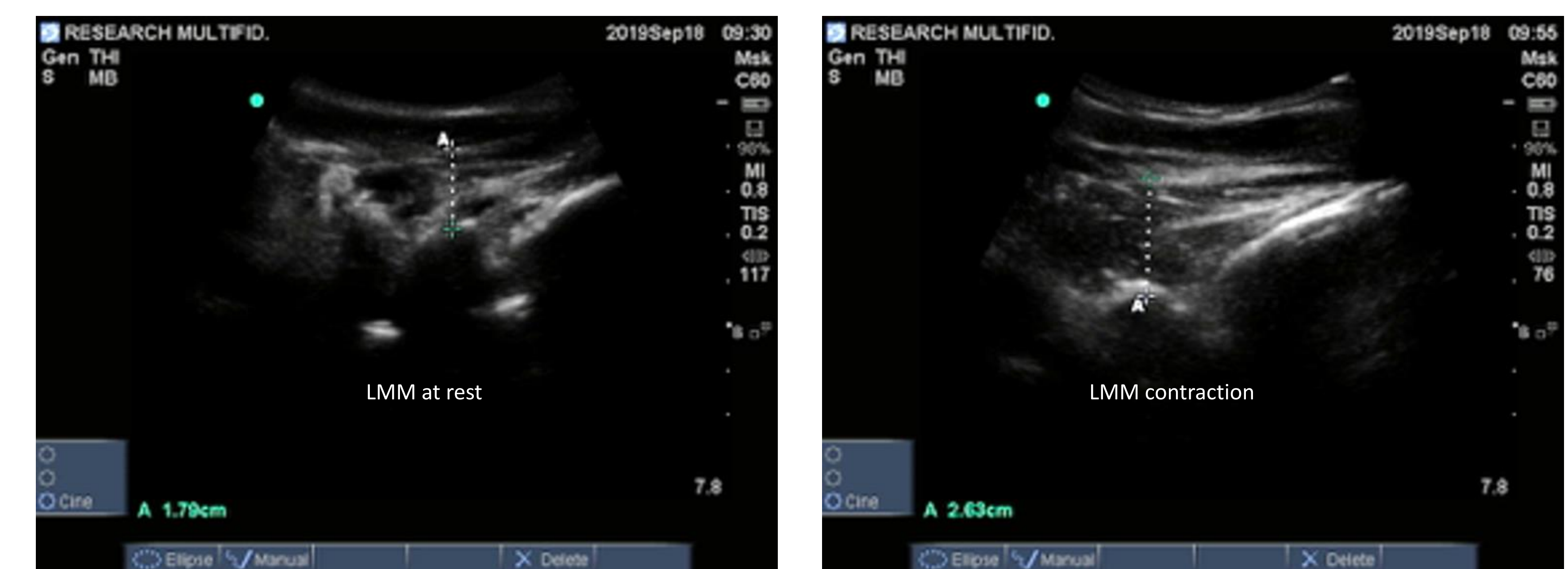
Figure 1

Results

- Inter-device reliability between the two units is good to excellent ($ICC > 0.75$) when measuring the contraction of the LMM
- The intra-rater reliability of each device is good when measuring the contraction of the LMM
- ICC values for both inter-device and intra-rater reliability increase when participant 22 data was omitted
- Participant 22 had BMI > 37, was unable to contract the LMM regardless of education and cues and was a statistical outlier

Value	Inter-device Reliability	Inter-device Reliability (without P22)
ICC	.81	.86
ICC (of the averages)	.95	.92
Value	Intra-rater Reliability	Intra-rater Reliability (without P22)
Butterfly IQ ICC	.76	.85
Sonosite ICC	.88	.89

LMM Ultrasound Images



Subject Positioning



Conclusion

- The Butterfly iQ handheld ultrasound unit demonstrates good to excellent inter-device reliability when compared to the Sonosite M-MSK unit.
- Secondary result of the study suggests novice students have good intra-rater reliability when using either unit to measure the LMM.
- Incorporating RTUI in a DPT curriculum may be feasible to enhance student education.
- Handheld ultrasound units can be an effective and efficient tool for patients and clinicians in a physical therapy setting due to lower cost and ease of use
- Future research:
 - Investigate Inter-device reliability between handheld and established RTUI units by assessing other musculoskeletal structures.
 - Compare the inter-rater reliability of handheld ultrasound imaging units between novice and experienced physical therapists.
 - Examine the use of handheld ultrasound imaging in a DPT curriculum.