

Comparison of Gastrocnemius Shear Wave Elastography Stiffness Over 5 Different Zones

ANTHONY S. PETERSON, KARLEE PETERSON, ASHLEY ALLAN, RAY M. MERRILL,
& J. BRENT FELAND

Modality Lab; Exercise Sciences Department; Brigham Young University; Provo, UT

Category: Undergraduate

Advisor / Mentor: Feland, J. Brent (brent_feland@byu.edu)

ABSTRACT

A few studies report that shear wave elastography (SWE) is a reliable method of measuring gastrocnemius muscle stiffness. To date there are no studies assessing variance in stiffness measures at different locations on the muscle. This led us to ask whether the spot at which gastrocnemius stiffness is measured matters.

PURPOSE: To determine if measurement site on the medial and lateral gastrocnemius affects SWE stiffness values. **METHODS:** Twelve subjects (3 men, 9 women) completed this study (Mean age is 23.0 (SD = 1.0) for men and 21.7 (SD = 2.0) for women (t p = 0.3035). Mean height (cm) is 179.5 (SD = 2.9) for men and 167.1 (SD = 7.8) for women (t p = 0.0256). Mean weight (kg) is 74.9 (SD = 10.4) for men and 62.5 (SD = 9.7) for women (t p = 0.0892). Subjects wore shorts and lay prone on a treatment table with their bare feet hanging off the edge of the table. Ultrasound images to confirm borders of the medial and lateral gastrocnemius were confirmed and marked. SWE of both the Medial head (MG) and lateral head (LG) were taken with each head area divided into 4 zones (1=superior medial, 2=superior lateral, 3=inferior medial, 4=inferior lateral). A fifth zone was collected at the center of the muscle at 70% of the length of the lateral malleolus to lateral femoral epicondyle. All 5 points were assessed for SWE in both a relaxed and neutral (90°) ankle joint position. Three separate elastogram frames were used to calculate muscle stiffness using both the velocity (m/s) and young's modulus model (kPa) utilizing an overall area analysis for each.

RESULTS: MG velocity and kPa values were significantly greater than LG in the relaxed and neutral positions (p<0.0001 for all). For velocity and kPa, in the relaxed position there was no difference between measurement zones (p=0.1407 and p=0.0978 respectively), but there were differences in the neutral position (p<0.0001) with zone 1 & 4 representing lower & greater stiffness levels respectively and zone 5 tending to represent the middle value based on SNK grouping analysis of means. **CONCLUSION:** MG stiffness is greater than LG regardless of position while intrinsic stiffness of MG increases more relative to LG when placed in neutral. Measurement of stiffness is best represented at the center of the muscle belly in the neutral position, but zones 2,3 and 5 produce similar stiffness values in the relaxed position.