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Intra-rater reliability and smallest detectable change of compression sonoelastography in quantifying the material properties of the musculoskeletal system

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Abstract

Musculoskeletal conditions can change tissue elasticity. Knowledge of musculoskeletal elasticity could therefore aid clinical diagnosis and management. Sonoelastography is an ultrasound-based system that examines the material properties of tissues, and it may be useful in musculoskeletal practice. Therefore, it is important to establish its clinimetric properties. This study aimed to explore the intra-rater reliability and the smallest detectable changes of sonoelastography in examining musculoskeletal structures. A quantitative reliability design was used to examine 22 healthy participants using a compression sonoelastography system that produces color-coded images. The deltoid, biceps brachii, brachioradialis, rectus femoris, gastrocnemius medius muscles, and Achilles tendon were examined twice at 1-hr intervals to assess the intra-rater reliability. The sonoelastography images were analyzed using the strain index, strain ratio, and color pixels. The intra-rater reliability and the smallest detectable changes of each outcome variable were determined. The intra-class correlation coefficient was used to quantify the repeatability of the measurements, and the smallest detectable changes were calculated to determine clinically important differences above the error of measurement. The intra-rater reliability for the strain index, strain ratio, and color pixel analysis ranged from moderate to excellent (intra-class correlation coefficients: .734–.950, .776–.921, and .754–.990, respectively), with color pixel analysis demonstrating the highest reliability. The smallest detectable changes were determined for all structures, including the Achilles tendon (0.11 for the higher boundary of the strain index, 1.80 for the strain ratio, and 2.90% for red pixels, representing soft tissues). Color pixel analysis may be more reliable for sonoelastography interpretation compared with the strain index and strain ratio. The calculated smallest detectable changes could be used to identify clinically important differences.

KEYWORDS

elasticity, muscle, reliability, sonoelastography, strain, tendon