Reliability of the Upper Trapezius Muscle and Fascia Thickness and Strain Ratio Measures by Ultrasonography and Sonoelastography in Participants With Myofascial Pain Syndrome

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ABSTRACT

Objective: The purpose of this study was to assess the intra- and interexaminer reliability of the upper trapezius muscle and fascia thickness measured by ultrasonography imaging and strain ratio by sonoelastography in participants with myofascial pain syndrome.

Methods: Thirty-two upper trapezius muscles were assessed. Two examiners measured the upper trapezius thickness and strain ratio 3 times by ultrasonography and sonoelastography independently in the test session. The retest session was completed 6 to 8 days later.

Results: A total of 87.5% of participants had trigger points on the right side, and 22.5% had trigger points on the left side. For the test session, the average upper trapezius thickness, fascia thickness, and strain ratio measured by first and second examiners were 11.86 mm and 11.56 mm, 1.23 mm and 1.25 mm, and 0.94 and 0.99, respectively. For the retest session, the previously mentioned parameters obtained by first and second examiners were 11.76 mm and 11.39 mm, 1.27 mm and 1.29 mm, and 0.96 and 0.99, respectively. The intraclass correlation coefficients indicated good to excellent reliability for both within-intraexaminer (0.78-0.96) and between-intraexaminer (0.75-0.98) measurements. Also, the intraclass correlation coefficients and standard errors of measurement of interexaminer reliability ranged between 0.88 to 0.93 and 0.05 to 0.44 for both muscle and fascia thickness and 0.70 to 0.75 and 0.04 to 0.20 for strain ratio of upper trapezius, respectively.

Conclusion: Upper trapezius thickness measurements by ultrasonography and strain ratio by sonoelastography are reliable methods in participants with myofascial pain syndrome. (J Chiropr Med 2017;16:316-323)

Key Indexing Terms: *Trigger Points; Ultrasonography: Diagnostic Imaging; Elasticity Imaging Techniques; Myofascial Pain Syndromes*

INTRODUCTION

Myofascial pain syndrome (MPS) is one of the leading causes of chronic pain and imposes large financial costs to societies.[1] Tenderness to palpation, referral pain, autonomic disorders, taut bands in muscles, and trigger points (TrPs) are introduced as main symptoms of MPS.[2] TrPs are closely associated with pathophysiology and clinical manifestation of MPS that may be active or latent.[3] Active TrPs provide spontaneous pain and are responsible for MPS. Latent TrPs are tender to palpation but do not provoke the specific pattern of referral pain in related muscles.[4] However, many studies have focused on active TrPs.[5]

Assessment tools such as thermography,[6] pressure algometry,[7] microanalytical system,[3] electromyography,[8] magnetic resonance elastography (MRE),[9] ultrasonography imaging (USI),[10] and sonoelastography (SE)[11] have been

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Paper submitted February 16, 2017; in revised form June 20, 2017; accepted June 28, 2017.
1556-3707
© 2017 National University of Health Sciences.
https://doi.org/10.1016/j.jcm.2017.06.003

used to provide versatile information about the MPS. Notably, the effectiveness of therapeutic modalities on pain relief is unclear because of lack of objective, repeatable, and reliable clinical outcome measures.[12]

USI is a noninvasive, real-time, and low-risk instrument that is commonly used in musculoskeletal injuries to visualize soft tissues such as muscle, nerve, tendon, ligament, and fascia.[13] In addition, SE is an ultrasound-based imaging technique that shows the stiffness of soft tissues.[14] The tissue stiffness can be calculated through tissue strain induced by probe compression that is lower in softer tissues.[15] Although SE is not currently used in routine clinical practice, it may be useful for differentiating many musculoskeletal conditions such as congenital muscular dystrophy,[16] myositis,[17] chronic low back pain,[18] plantar fasciitis,[19] cervical stiffness,[20] neck muscle hardness,[21] and MPS.[11]

Evidently, both USI and SE are useful imaging methods to identify pathologic conditions of muscles in MPS.[22] Changes in muscle function and stiffness are key clinical outcomes in patients with MPS.[23,24] Assessment of muscle thickness changes by USI and mechanical properties of muscle using SE have been considered in many clinical trials.[25-28] The previously mentioned measurements quantify the changes in myofascial structures after treatments, especially dry needling.[29,30]

On one hand, the reliability of USI, as an instrument for measuring muscle thickness, has been reported in some studies.[31-35] However, the reliability of the upper trapezius muscle and fascia thickness in participants with MPS using USI were not reported in previous research.[11] On the other hand, muscle stiffness is an important factor that should be evaluated in participants with MPS.[22] There are limited methodological studies about the reliability of SE in participants with MPS.[36] Nevertheless, measurements of muscle and fascia thickness and strain ratio for the upper trapezius muscle have not been established in participants with MPS.[10,11] Therefore, the aim of the present study was to assess intra- and interexaminer reliability of USI and SE measures of the thickness and strain ratio of the upper trapezius in participants with MPS.

Methods

Participants

Participants with MPS were eligible and met inclusion criteria if found to have TrPs in the upper trapezius muscle unilaterally or bilaterally. One examiner did a thorough musculoskeletal evaluation to rule out other causes of muscle pain. Participants were included in the study if they fulfilled the following criteria: presence of at least 1 active trigger point in the central region of upper trapezius, age between 20 and 40 years, and pain duration $\geq$3 months. Participants were excluded if they had concomitant fibromyalgia, degenerative joint disease, cervical nerve root irritation, thoracic outlet syndrome, upper extremity entrapment syndromes, bursitis, severe joints immobility, and torticoli. Moreover, participants with history of rheumatoid arthritis, pregnancy, abnormal laboratory results, facial neuralgia, fracture, dislocation, neck and shoulder myopathy, neuropathy, myelopathy, cancer, infection, pulmonary diseases, HIV, and surgical interventions in the neck, shoulder, and other regions of the trunk were also excluded. Additionally, participants who had received a physical therapy program or any local injection therapy within the last 3 months and those with history of dry needling; nonsteroidal anti-inflammatory drug, opioid, or alcohol use; addiction; psychological problems; and athletics were ruled out too.[10,11] The Ethics Committee of the University of Social Welfare and Rehabilitation Sciences approved this study, and all participants were asked to read and sign a consent form.

Clinical Examination

The standard clinical criteria for diagnosing MPS were (1) palpable taut bands, (2) local tenderness in the taut bands (TrPs), and (3) pain recognition.[2] Undoubtedly, local twitch response and referral pain were confirmatory findings.[2,11] The examiners determined the presence or absence of TrPs in the upper trapezius muscle. Palpation was made in the central region of the upper trapezius muscle between the C7 spinous process and the acromion process that coincided with the presence of active TrP.[11] Active TrPs are associated with spontaneous pain, acutely tender to palpation and referral pain, but latent TrPs are painful only when palpated and don't produce referral pain. Consequently, the examiners recorded the number of TrPs and marked the key and active trigger point in central region of the muscle for measurements. Finally, they did all the procedures and measurements independently. The examiners were experienced, certified, and trained in diagnosis of MPS.

Measurement of the Upper Trapezius Muscle and Fascia Thickness by USI

All participants were placed in the relaxed prone position with their elbows on the examination bed and the head midway on a special pillow.[37] The C7 spinous process was found through flexion-extension method of the cervical spine.[38] The examiner palpated the most prominent 2 cervical spinous processes with the index and middle fingers in the seated participant's cervical spine during flexion. Consequently, through an assisted extension of the cervical spine, if the upper palpated cervical spinous process moved anteriorly while the lower one remained fixed, the latter would be marked C7. If both of the palpated spinous processes remained fixed, the upper cervical spinous process would be considered to be C7 and marked.[38] Eventually, the examiner drew a line between C7 and acromion process and marked the midpoint of this line.

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