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ORIGINAL RESEARCH

Reliability of assessment of upper trapezius morphology, its mechanical properties and blood flow in female patients with myofascial pain syndrome using ultrasonography

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KEYWORDS
Myofascial pain syndrome;
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Summary *Objective:* In the present study, the intra-rater reliability of upper trapezius morphology, its mechanical properties and intramuscular blood circulation in females with myofascial pain syndrome were assessed using ultrasonography.
Design: A total of 37 patients (31.05 ± 10 years old) participated in this study. Ultrasonography producer was set up in three stages: a) Gray-scale: to measure muscle thickness, size and area of trigger points; b) Ultrasound elastography: to measure muscle stiffness; and c) Doppler imaging: to assess blood flow indices.
Results: According to data analysis, all variables, except End Diastolic Velocity (EDV), had excellent reliability (>0.806). Intra-class Correlation Coefficient (ICC) for EDV was 0.738, which was considered a poor to good reliability.
Conclusion: The results of this study introduced a reliable method for developing details of upper trapezius features using muscular ultrasonography in female patients. These variables

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could be used for objective examination and provide guidelines for treatment plans in clinical settings.

Introduction

A common complaint in the field of musculoskeletal dysfunction is myofascial pain syndrome (MPS) with complex sensory and motor abnormalities (Ballyns et al., 2011). This syndrome is associated with the presence of myofascial trigger points (MTrP) and its prevalence is so high that 85% of people with chronic pain suffer from it (Maher et al., 2013; Müller et al., 2014; Tekin et al., 2013). Trigger points are palpable as painful spots, that are localized in taut bands in skeletal muscle (Fernández-de-las-Peñas and Dommerholt, 2014). Several symptoms, such as restricted range of motion, increased muscle tension, reduced related fascia elasticity, weakness, local and referral pain and abnormal autonomic phenomena, may be consequences of the formation of trigger points in muscles (Müller et al., 2014). In MPS, postural muscles, such as the upper trapezius are most frequently involved (Gemmell and Allen, 2008). Trigger points, which are based on clinical findings, are divided into two categories: 1) active and 2) latent. In the active MTrP, there are two types of pain, spontaneous pain in a resting condition and pain in response to movement, muscle stretching and manual stimulation (Hidalgo-Lozano et al., 2010) but in the latent form, spontaneous pain is not observed (Shah and Heimur, 2012). It has been suggested that some conditions, such as direct trauma or muscle over-use contractions without adequate recovery time, may lead to changes in the intramuscular blood circulation leading to the formation of trigger points (Ballyns et al., 2011; Maher et al., 2013). Based on normal physiological mechanisms, intramuscular blood flow correlates with contraction and relaxation of the muscle. Rhythmic muscle contractions enhance intramuscular blood flow with muscular pump, but sustained muscle contractions may develop intramuscular pressure high enough to diminish the muscle blood flow potentially encouraging the formation of trigger points (Bron and Dommerholt, 2012). Despite numerous studies on MPS, there are controversial opinions regarding the pathophysiology and etiology (Ballyns et al., 2011; Sikdar et al., 2009). Based on Simons' the Integrated Hypothesis, "energy crisis" suggests that prolonged sarcomere contraction may result in pressure on capillaries, alteration of local required metabolic products, resulting in tissue damage and local hypoxia (Shah et al., 2008). The active trigger points in this syndrome may also be associated with changes in the viscoelasticity of the muscle fiber properties. These changes are characterized by hard taut band of muscle fibers and palpable nodules, which alter muscle stiffness and reduce the range of motion (Ballyns et al., 2011; Dommerholt, 2011).

The MTrP can be identified by physical examination, but this assessment is a subjective method that influenced by the examiner experience level (Barbero et al., 2012; Dunning et al., 2013). The low inter—rater reliability has been found for this method (Shah and Heimur, 2012) and no objective criteria as golden standard have been reported in the diagnosis of MTrP and monitoring the clinical outcomes (Shah and Heimur, 2012; Vulfsons et al., 2012). The application of objective and noninvasive methods in order to obtain accurate, repeatable, and reliable diagnostic indexes to identify trigger points is therefore required. Moreover, it seems that measuring intramuscular blood circulation and muscle stiffness can be useful in the objective evaluating the effectiveness of treatments.

Ultrasonography is a suitable method for obtaining real time and dynamic images from muscle, connective tissue and blood flow (Shankar and Cummings, 2013). It can be used to quantify the mechanical properties of tissues and to indicate the changes in morphology and viscoelastic characteristics, as well as to establish the relationship between the muscle function and structure (Sikdar et al., 2009, 2013). The quantification of muscles features, such as morphometric properties, muscle stiffness and intramuscular blood circulation, is useful in clarifying the pathophysiology of MPS. In addition, ultrasonography can be used in the differentiation of trigger point from healthy surrounding tissues especially in deep and inaccessible muscles.

Sikdar et al. (2009) applied ultrasonography, for the first time, to evaluate the upper trapezius muscle. Ultrasonographic parameters including gray scale, sono Doppler and ultrasound elastography have been evaluated in this study (Sikdar et al., 2009). The use of ultrasonography for evaluating MPS seems to clarify the relationship between clinical findings and measurable variables (Shah and Heimur, 2012). However, the reliability of ultrasonographic measures of upper trapezius should be assessed for the clinical use of this method. The reliability levels of ultrasonographic variables determine the potential usefulness of this technique in evaluating musculoskeletal dysfunction. No study-to the best of our knowledge-has reported the reliability of ultrasonographic scanning of upper trapezius. Therefore, the aim of this study was to investigate the intra-rater reliability of ultrasonographic features of upper trapezius, including muscle thickness, elasticity and circulation in females with MPS.

Materials and method

Subjects

Students and patients with neck pain problem in the physical therapy clinic of the School of Rehabilitation were invited to participate in this study. Clinical evaluation was performed on all subjects by physical therapists to confirm