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The intra-rater reliability of locating and measuring the severity of latent trigger points in the quadriceps

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ABSTRACT

Background: Trigger points (TrPs) in the lower-limb are under-investigated and may be a contributory factor in knee pathologies.
Objectives: The purpose of this study was to establish the intra-rater reliability of assessing the location and severity of latent TrPs in the quadriceps.
Methods: Twenty-nine asymptomatic subjects were palpated for TrPs in the middle and quadriceps. The location and severity was then measured using the anatomical landmark system (ALS) and pain pressure threshold (PPT). The subject was re-tested the next day.
Results: The intra-class coefficient [$ICC_{(3,1)}$] for the ALSs and PPTs were found to be reliable. Gender appears to be a factor in the severity of TrPs in the quadriceps. Females reported some of the features of TrPs more often than males (jump sign, twitch response, referred pain).
Conclusion: Further investigation is needed to understand the relationship between TrPs around the knee and knee pathologies, particularly in females.

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1. Introduction

Myofascial trigger points (TrPs) in the lower limb have been reported to be associated with pathologies such as patella femoral pain syndrome (Roach et al., 2013) and knee osteoarthritis (Bajaj et al., 2001; Yentür et al., 2003; Itoh et al., 2008; Mayoral et al., 2013). All TrPs have distinct features, they are taut bands (TB) within the muscle that are parallel to the orientation of the muscle and spot tenderness (ST) that produces exquisite pain locally or as referred pain (RP). Other features are RP that follows a specific pattern; a jump sign (JS), where the limb or subject involuntary recoils from pressure applied to a TrP; or a twitch response (TR), where there is uncontrolled twitching in the muscle which may be palpated by the therapist or felt by the subject (Travell and Simons, 1992).

There are two types of TrPs, active and latent. Active TrPs are spontaneously painful and are recognised by the patient as their current pain, known as familiar pain. The pain caused by the compression of a latent TrP is not familiar to the subject (Ge et al., 2014). Latent TrPs can cause a muscle to fatigue sooner than healthy muscles thus affecting muscle activation (Ge et al., 2012). Latent TrPs have been shown to have a negative effect on strength (Celik and Yeldan, 2011). Latent TrPs can become active TrPs with overuse or trauma (Al-Shenqiti and Oldham, 2005; Myburgh et al., 2008; Lucas et al., 2009; McEvoy and Huijbregts, 2011; Hsieh et al., 2007).

Older inter-rater studies which reported low reliability may not have considered study design, regional anatomy or the severity and complexity of the symptoms of patients (Nice et al., 1992; Wolfe et al., 1992). Later, more reliable inter-rater studies incorporated asymptomatic subjects (Gerwin et al., 1997; Lew et al., 1997). All of the intra-rater reliability studies in relation to locating TrP have reported moderate to excellent reliability (Al-Shenqiti and Oldham, 2005; Barbero et al., 2012; Dibai-Filho et al., 2015).

The reliability of locating TrPs is dependent on the site of the TrP (Gerwin et al., 1997; Al-Shenqiti and Oldham, 2005; Myburgh et al., 2008; Lucas et al., 2009; McEvoy and Huijbregts, 2011). The majority of reliability studies have investigated TrPs in the upper limb (Wolfe et al., 1992; Gerwin et al., 1997; Lew et al., 1997; Sciotti et al., 2001; Al-Shenqiti and Oldham, 2005; Bron et al., 2007; Myburgh

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et al., 2011; Barbero et al., 2012; Skorupska et al., 2015;Mora-Relucio et al., 2016). While reliability studies of TrP in the lower limb have focused on the gluteal region (Njoo and van der Does, 1994; Hsieh et al., 2000; Skorupska et al., 2015).

The architecture of the vastus medialis (VM) and vastus lateralis (VL) of the quadriceps and the type of contraction which stress them may play a role in the sarcomere length and angle as well as the activation levels of those muscles (Babault et al., 2001; Blazevich et al., 2007; Arnold et al., 2013). This prolonged sarcomere shortening may lead to TBs, latent TrPs and altered structure of the musculature. Distorted muscular architecture and function may be a predisposing factor in patients suffering from osteoarthritis (Staehli et al., 2010). TrPs in the quadriceps have been associated with knee osteoarthritis (Henry et al., 2012; Mayoral et al., 2013).

In order to offer a continuation of care to a patient, it is important that a therapist can reliably relocate and measure the severity of TrPs to document a patient's progression. The ALS allows the location of a TrP to be measured once palpated (Barbero et al., 2012). The aim of the present study is to establish the intra-rater reliability of measuring the location and severity of latent TrPs in the VM and VL of asymptomatic subjects.

2. Methods

2.1. Experimental design

The study was an observational design to test the intra-rater reliability of measuring the location and assessing the severity of latent TrPs in the VM and VL (see Fig. 1). The variables measured were: TrP location, measured using the ALS (Barbero et al., 2012); the difference in distance (ΔTrP) from the TrP from the first session and TrP from the second session; as well as the severity of latent TrP analysed using the PPT (Sciotti et al., 2001).

2.2. Testing procedure

Data was captured between January and March 2016 in the physiology laboratory in Institute of Technology Carlow. Ethical approval was sought and granted from the Institute of Technology Carlow's Ethics Board. Informed consent was also given by subjects. Prior to testing, subjects completed a screening form. Testing was conducted by the same rater with two years clinical experience, with additional training on locating and treating TrPs (Jones et al., 2007). Subjects were informed to refrain from vigorous exercise 24 h prior to testing. Subjects presented for baseline testing where physiological measurements were recorded. The second session was conducted the following day between 16 and 32 h after the first session.

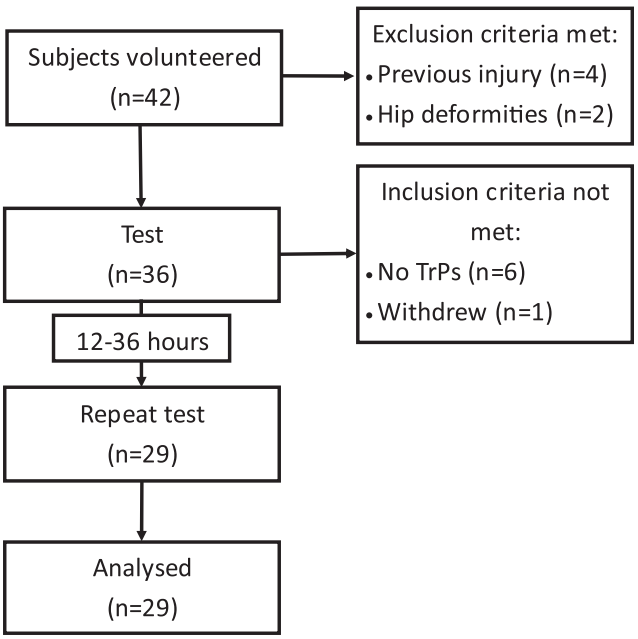

Fig. 1. Study flow chart. Where TrPs is trigger points.

2.3. Subjects

Forty-two asymptomatic subjects were recruited from the student body of the Department of Science and Health, Institute of Technology Carlow. Using convenience sampling, recruitment was conducted verbally prior to lectures and interested potential subjects entered their name on an enrolment form. Subjects were excluded if any of the following conditions were met: systemic diseases of the musculature or nervous system, congenital or childhood hip disease, history of hip or knee trauma, surgery in the lower extremity in the past 12 months, inflammatory joint disease, tumours in the lower limb, and or lower back injury in the past six months. The exclusion criteria were self-reported and physician history was not requested. Subjects were also excluded if they had PPT of more than 35 N (Sciotti et al., 2001).

2.4. Locating the TrPs

Testing was completed on the dominant leg. TrPs were located in the middle and distal portions of the VM and VL using the palpation method. A random order with computer randomisation was used to prevent anticipation bias in relation to the PPT (Mutlu and Ozdincler, 2015). If more than one TrP was present the most painful TrP was used. TBs and STs are needed to be present in order to be classified as a TrP. Other features (JS, RP, TR) were also recorded. The TrPs were marked with a '+' using a Sure Code® ultraviolet (UV) marker (*Securikey*, Aldershot, UK) for the first session and a red Lumocolor® whiteboard marker (*Staedtler*, Nuremberg, Germany) for the second session (Mora-Relucio et al., 2016).

2.5. Anatomical landmark system

The location of each TrP was measured using a modified ALS (Barbero et al., 2012). A line (ALS_{d}) was drawn using a UV marker from the anterior superior iliac spine (ASIS) to the apex of the patella in supine position for the VM and from the ASIS to the head of the fibula for the VL in side lying. A perpendicular line (*Y*-line) was drawn from the TrP to the ALS_{d}. The distance from the ASIS to the intersection of the ASL_{d} and *Y*-line was measured (*X*-line). Data was measured while being illuminated by a Safescan® UV lamp (*Safescan* BV, Zoetermeer, the Netherlands). The order of the muscle for the re-test was randomised and the ALS was measured. The ΔTrP was also measured while being illuminated with a UV lamp (Mora-Relucio et al., 2016).

2.6. The pressure pain threshold

The PPT was measured using a Commander™ algometer (*JTech Medical*, Midvale, Utah, USA) and was described to the subject as '*The point where the sensation of pressure turned to a perception of pain*' (Ohrbach and Gale, 1989). To prevent bruising a 1 cm^2 head was used (Takahashi et al., 2005). The pressure was increased at a rate of 1 $N \cdot s^{-1}$ until the subject reported the change of the pressure to pain (Nussbaum and Downes, 1998). The rater was blinded to the pressure placed through the algometer via the maximum pressure

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