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CROSSOVER RANDOMISED CONTROLLED TRIAL

The immediate effect of triceps surae myofascial trigger point therapy on restricted active ankle joint dorsiflexion in recreational runners: A crossover randomised controlled trial

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Summary *Objectives:* To investigate the immediate effect on restricted active ankle joint dorsiflexion range of motion (ROM), after a single intervention of myofascial trigger point (MTrP) therapy on latent triceps surae MTrPs in recreational runners.
Design: A crossover randomised controlled trial.
Participants: Twenty-two recreational runners (11 men and 11 women; mean age 24.57; ±8.7 years) with a restricted active ankle joint dorsiflexion and presence of latent MTrPs.
Intervention: Participants were screened for a restriction in active ankle dorsiflexion *in either knee flexion* (*soleus*) *or knee extension* (*gastrocnemius*) and the presence of latent MTrPs. Participants were randomly allocated a week apart to both the intervention (combined pressure release and 10 s passive stretch) and the control condition.
Results: A clinically meaningful (large effect size) and statistically significant increase in ankle ROM in the intervention compared to the control group was achieved, for the soleus ($p = 0.004$) and the gastrocnemius ($p = 0.026$).
Conclusion: Apart from the statistical significance ($p < 0.05$), these results are clinically relevant due to the immediate increase in ankle dorsiflexion. These results must be viewed in caution due

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to the carry-over effect in the RCT crossover design and the combined MTrP therapy approach.

Introduction

Running has many health benefits, although it also poses a significant risk of injury (Kindred et al., 2011). The average runner has a 37–56% risk of injury during the course of a single year's training (McDaniel et al., 2010). Despite efforts from biomechanics researchers, 30–70% of all runners will have a running related injury each year and this number has not declined over the past forty years (Herzog, 2012).

An adequate ankle range of motion (ROM) is considered to be a necessary component for functional activities such as running, ascending/descending stairs and normal gait (Cavanagh, 1990; Donatelli, 1996; Brukner and Khan, 2006). A disturbance of ankle ROM, may affect not only the ankle–foot complex but also the remaining joints of the lower extremities (Jia-Yuan You et al., 2009). Intrinsic factors such as anatomical and biomechanical abnormalities, lack of flexibility, poor strength and muscle imbalances are the most frequently associated risk factors related to foot and ankle running-related injuries (Hintermann and Nigg, 1998). With the increase in leisure activity participation there exists a parallel increase in the number of related injuries reported, with increased intrinsic and extrinsic risk factors becoming more apparent (Kennedy et al., 2005).

Adequate range of ankle dorsiflexion (>10°) is required in mid stance of gait to allow for the tibia to advance over the foot when propelling the body forwards during normal gait (Norkin and White, 2003). Reduced ankle dorsiflexion may alter lower limb biomechanics during gait placing the lower limb in an increased predisposition to injury (Fong et al., 2011) and may limit subtalar joint movement, preventing the ankle joint reaching a stable closed pack position needed during walking and running (Drewes et al., 2009). It is thought that increasing ankle dorsiflexion will benefit runners by reducing the degree of subtalar joint pronation, keeping the subtalar joint closest to its optimal position and limiting unwanted movement which could predispose to injury (Donatelli, 1996).

MTrPs are defined as hyperirritable areas within taut bands of skeletal muscle and classified as either active or latent (Travell and Simons, 1983; Simons et al., 1999). Active MTrPs are associated with spontaneous local and referred pain, whereas latent MTrPs only evoke local and referred pain when direct pressure is applied to them (Travell and Simons, 1992; Simons et al., 1999). Active MTrPs found in a specific region of the body (neck, back and shoulder) are often referred to collectively as a myofascial pain syndrome (MPS) (Simons et al., 1999). Latent MTrPs, like active MTrPs, may cause allodynia at the trigger point site and hyperalgesia away from the MTrP following applied pressure (Dommerholt, 2011) and may be associated with peripheral and central sensitisation (Dommerholt, 2011; Ge and Arendt-Nielsen, 2011). Active and latent MTrPs exhibit motor, sensory and autonomic components (Dommerholt et al., 2011). Related to this study, latent MTrPs are prevalent in healthy patients and may be a source of sensory-motor dysfunction (Ge and Arendt-Nielsen, 2011) and could develop into active MTrPs (Dommerholt, 2011; Ge and Arendt-Nielsen, 2011).

There is a paucity of clinical evidence on the efficacy of manual therapy on MTrPs/MPS in the lower limb, specifically evident in the triceps surae. A revised systematic literature review (SLR) on the effectiveness of non invasive treatments for active MTrP pain found twenty-three of the twenty six included trials assessed the treatment of MTrPs in the neck and/or upper trapezius region (Rickards, 2011).

Specifically related to MTrP intervention in the lower limb and the triceps surae, the immediate effect of soleus TrP pressure release showed a possible relationship between latent MTrPs in the soleus and restricted ankle ROM (Grieve et al., 2011). In clinical practice, manual therapy of active and latent MTrPs in the gastrocnemius and soleus has been effective in the management of plantar heel pain (Renan-Ordine et al., 2011). Two case studies have also examined TrP pressure release in the lower limb; one for reduced ankle ROM (Wu et al., 2005) and the other for hamstring dysfunction (Grieve, 2006).

There is minimal research suggesting that TrP pressure release on latent MTrPs may be an effective intervention for restriction in ankle ROM, however there is evidence suggesting that MTrPs may cause restricted joint ROM (Travell and Simons, 1983, 1992; Simons et al., 1999; Lucas et al., 2004; Fernández de las Peñas et al., 2005; Blanco et al., 2006). It has been previously proposed that soleus MTrPs specifically relate to a restriction of ankle dorsiflexion (Travell and Simons, 1992). Restricted joint ROM is commonly observed in healthy patients with latent MTPs, which may be due to the shortened sarcomeres inducing the shortening of the contracted taut band resulting in joint restriction (Ge and Arendt-Nielsen, 2011).

The primary aim of this RCT is to investigate the immediate effect on restricted active ankle joint dorsiflexion ROM, after a single intervention of MTrP therapy on latent MTrPs in the triceps surae (gastrocnemius and soleus) in asymptomatic recreational runners. This study builds on the previous work by Grieve et al. (2011).

Methods

Participants

Thirty healthy staff and students from the University of the West of England, Bristol volunteered for this study and were included if they ran at least twice weekly, had a unilateral restriction of active ankle dorsiflexion (<10°) *in either or both knee flexion* (*soleus*) *or knee extension* (*gastrocnemius*) and at least one identifiable latent MTrP within the soleus or gastrocnemius muscles. The exclusion criteria were: under 18 years old, diagnosis of Fibromyalgia Syndrome, inability to lie prone or flex the knee to 90°, Talipes Equinovarus, previous ankle fractures and/or surgery within