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FASCIA SCIENCE AND CLINICAL APPLICATIONS: PILOT SINGLE BLIND RANDOMISED CONTROL TRIAL

The immediate effect of bilateral self myofascial release on the plantar surface of the feet on hamstring and lumbar spine flexibility: A pilot randomised controlled trial

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Summary *Background:* Self myofascial release (SMR) via a tennis ball to the plantar aspect of the foot is widely used and advocated to increase flexibility and range of movement further along the posterior muscles of a proposed "anatomy train". To date there is no evidence to support the effect of bilateral SMR on the plantar aspect of the feet to increase hamstring and lumbar spine flexibility.
Aim: The primary aim was to investigate the immediate effect of a single application of SMR on the plantar aspect of the foot, on hamstring and lumbar spine flexibility. The secondary aim was to evaluate the method and propose improvements in future research.
Design: A pilot single blind randomised control trial.
Participants: Twenty four healthy volunteers (8 men, 16 women; mean age 28 years ± 11.13).
Method: Participants underwent screening to exclude hypermobility and were randomly allocated to an intervention (SMR) or control group (no therapy). Baseline and post intervention flexibility was assessed by a sit-and-reach test (SRT). A one way between groups analysis of covariance (ANCOVA) was conducted to compare between group outcome SRT measurements. Baseline pre-intervention and control SRT measurements were used as the covariate in the analysis.

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Results: There was a significant increase ($p = 0.03$) in the intervention SRT outcome measurements compared to the control group, with a large effect size.
Conclusion: An immediate clinical benefit of SMR on the flexibility of the hamstrings and lumbar spine was indicated and suggestions for methodological improvements may inform future research.

Introduction

Flexibility is defined as the ability to move a single or series of joints through an unrestricted pain-free range of motion (ROM), with ROM as the degrees of freedom around a particular joint (Brigstocke et al., 2013). The terms muscle length and flexibility are often interchanged, as it refers to the ability of a muscle crossing a joint to lengthen to end of range (Reese and Bandy, 2010). Flexibility is vital for all movements and changes in flexibility may cause abnormal loading of the musculoskeletal system which could lead to injury (Wilson, 2002; Ylinen, 2008). Decreased hamstring flexibility is considered to be a predisposing factor for lower back pain (Esola et al., 1996), participants with lower back pain were found with tightness in their hamstrings (Marshall et al., 2009).

Fascia is a connective tissue which surrounds every nerve, blood vessel and muscle fibre in the human body resulting in the connection of bones, muscles and organs which form large networks throughout the body (Schleip et al., 2012). Based on the tensegrity principle, previous studies have highlighted the presence of continuity and connectivity between fascia or muscle that may be anatomically distant from each other (Langevin, 2006; Kassolik et al., 2009). Anatomical dissections have confirmed the continuity of the fascial system in the upper and lower limbs (Stecco et al., 2007, 2008). A "schematic map" of the body's fascia connections, namely "anatomy trains" has been suggested and proposed that any tension at a particular part of an "anatomy train" may have detrimental effects resulting in global decreased flexibility (Myers, 1997, 2014). For example, issues related to the plantar fascia may be associated with tight hamstrings and lumbar lordosis (Myers, 2014). Reduced flexibility and tightness in the hamstrings (Harty et al., 2005) and tightness in the calf muscles are a possible aetiological factor for plantar fasciitis (Bolívar et al., 2013). There is a correlation between hamstring and lumbar spine flexibility, indicating some degree of connectivity (Esola et al., 1996; Marr et al., 2011).

The "anatomy train" suggested to be most related (to injuries of) the lumbar spine and hamstrings is the superficial back line (SBL) (Myers, 2009, 2014). The SBL contains the plantar fascia and short toe flexors (lumbricals, flexor accessorius and flexor digitorum brevis), the achilles and the muscle group triceps surae (gastrocnemius and soleus), the hamstrings (semimembranosus, semitendinosus and biceps femoris), sacrotuberous ligament, the fascia of the sacrolumbar area, erector spinae and finally the epicranial fascia which extends and attaches to the supra orbital ridge on the anterior surface of the cranium (Myers, 2014).

Myofascial therapies cover a numerous and varied spectrum of techniques, including osteopathic soft-tissue techniques, structural integration (Rolfing), massage including connective tissue massage (CTM), instrument assisted fascial release, myofascial trigger point therapy, strain-counter strain and muscle energy technique (MET) (Simmonds et al., 2012). Myofascial release (MFR) techniques have evolved as a result of current research and investigation via dissection and real time ultrasound and elastography (Chaitow, 2012). However in reviewing the literature, there is still theory and hypothesis in relation to the exact mechanism underlying the efficacy of fascial manual therapy. Pilat (2012) in the widely acknowledge text, Fascia-The Tensional Network of the Human Body (pp 312–313), has identified varying hypotheses and authors in the literature related to the mechanical stimuli of the fascia and the resultant types of reaction, namely;

- *piezoelectricity* linked to mechanical tension (Pilat, 2003) and properties of elasticity, flexibility, elongation and resistance depend on an information flow transmitted electrically through the connective tissue matrix (Oschmann, 2003).
- fascial system is innervated by *mechanoreceptors* (Stecco et al., 2008), that when manual pressure or traction is applied may create a range of responses that facilitate movement.
- *viscolelastic* properties of fascia have been observed in numerous studies and concepts for practical treatment applications have been defined by varying authors, including; Rolf (1994), Barnes (1997), Cantu and Gordin (2001) and Pilat (2003, 2009).

Self myofascial release (SMR), works under the same principles as myofascial release and has been adapted to allow regular and frequent applications, without a therapist's intervention (Sullivan et al., 2013). The difference between the two techniques relates to the individual using their own body mass to exert pressure on the soft tissue as they roll over the dense foam roller (FR) (MacDonald et al., 2013) or a tennis ball on the plantar aspect of the foot (Myers, 2014).

Recently the effect of SMR with an FR on flexibility and force production (MacDonald et al., 2013; Sullivan et al., 2013) and a comparison to postural alignment exercises and static stretches (Roylance et al., 2013) was investigated. The above identified SMR research evidence, as in