TREATMENT OF PROXIMAL HAMSTRING PAIN USING ACTIVE RELEASE TECHNIQUE o APPLIED TO THE MYOFACIAL MERIDIANS: *A CASE REPORT*

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Background

Hamstring injuries are among the most, if not the most, common soft tissue injuries in athletes (2,4,6,7,8). The high rate of re-injury and persistence of the complaint (1,4,6,8,9) make the management of hamstring conditions difficult, and often frustrating, for the attending physicians, trainers, and the athletes themselves. Furthermore, the lack of consensus as to the proper treatment and rehabilitation of this condition serves to further this aggravation (6). Factors causing hamstring injuries have been studied for many years and various suggestions as to the underlying cause of the problems have surfaced. Some of the more commonly noted etiologic factors include muscle weakness, strength imbalance, lack of flexibility, fatigue, inadequate warm-up, and aberrant posture (1, 2, 3, 5, 6, 7, 8, 9, 14). Traditionally, these etiological factors have been thought to be independent of one another. However, a theoretical model for hamstring injury proposed by Worrell and Perrin (21) considered the interaction between these etiological factors as being most important, and as such, treatment and rehabilitation should specifically assess and correct deficits in all of these areas (9).

Hamstring conditions usually result from non-contact injuries that present in 2 forms: (i) sudden onset with immediate incapacitating pain, and (ii) slow insidious onset with muscle tightness. Often the slow onset of hamstring strain will develop into a sudden onset (9). This concept leads one to believe that an underlying presence of increased myofascial tension may precipitate hamstring conditions, as well as being a cause for the high rate of recurrence and chronicity of the problem. Literature has suggested that passive muscle stiffness primarily reflects the (lack of) extensibility of the connective tissue elements in parallel with the muscle fibers (parallel elastic component) (22, 23). McHugh et al. (1999) looked at the role of passive muscle stiffness in symptoms of exercise-induced muscle damage (14). They proposed that strain imposed by **active** lengthening of stiff muscle is transferred from the rigid tendon-aponeurosis complex to the muscle fibers resulting in myofibrillar strain (14).

Correction of the underlying causes of hamstring injuries has been approached in a variety of ways. Following the usual progression of treatment rendered, passive therapy is usually performed first followed by a more **active** rehabilitation protocol. The final phase of therapy often includes more detailed sport-specific rehabilitation protocols involving proprioceptive and plyometric exercise. In the case of chronic hamstring complaints, passive therapy is commonly used by the

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practitioner to address pain control and flexibility. Many methods of passive therapy are presently being utilized by practitioners in order to affect changes in soft tissue structures including massage, Graston **technique** o, and PNF/PIR stretching. Another common treatment method utilized by therapists in managing soft tissue complaints is **Active Release Technique** o (ART) developed by Dr. Michael **Leahy**. **Leahy** (20) proposed a mechanism to explain increased tissue stiffness, or tension, called the cumulative injury cycle. In this cycle, repetitive micro-injury in tight muscles leads to an increase in the friction and tension within the myofascial structures. This tension leads either to decreased circulation to the tissue in what is termed the "chronic cycle", or it leads to the "inflammation cycle" whereby a tear or crush injury ensues, followed by inflammation. Both of these cycles lead to the same result: an accumulation of adhesions and fibrosis within the tissue. This in turn increases the tightness of the tissue. As such, the cumulative injury cycle is self-perpetuating and as this downward spiral continues, the symptoms and syndromes of cumulative injury disorder are produced. It is the goal of ART o, as with other soft tissue techniques, to remove these "adhesions" thereby decreasing tissue tension, and thus stopping the cumulative injury cycle. In the case of ART o, the involved tissue is taken from a shortened position to a fully lengthened position while the contact hand holds tension longitudinally along the soft tissue fibers and the lesion (see figures)(20). The effectiveness of this treatment method has been described in a variety of case reports and is utilized by many practioners for the treatment of a variety of conditions involving soft tissue dysfunction (LIST THE REF'S). However, as with any treatment method, effectiveness is subject to proper diagnosis as well as to anatomical and biomechanical considerations.

As described in various anatomy texts, the hamstring muscle group is described as occupying the posterior compartment of the thigh and consists of three muscles: (i) Semitendinosus, (ii) Semimembranosus, and (iii) Biceps Femoris. These hamstring muscles, spanning the hip and knee joints, arise from the ischial tuberosity deep to the gluteus maximus. They are innervated by the tibial division of the sciatic nerve with the exception of the short head of biceps femoris innervated by the peroneal division (all via spinal segments L5, S1, and S2)(30). Both of the "semi" muscles, as well as the long head of biceps femoris attach proximally to the ischial tuberosity. Semitendinosus inserts distally to the medial surface of the superior part of the tibia while Semimembranosus attaches to the posterior part of the medial condyle of the tibia. The long head of biceps femoris joins the short head arising from the linea aspera to insert onto the side of the head of the fibula.

This description of the origin and insertions of muscles is somewhat misleading when considering how strain and tension is distributed throughout the body. The muscle-bone concept presented in standard anatomical descriptions gives a purely mechanical model of movement. It separates movement into independent muscular functions failing to give a picture of the seamless integration in a living body (19). Functionally, the tissue that provides this integration is the

myofascia. The word myofascia denotes the inseparable nature of muscle tissue (myo) and its accompanying connective tissue (fascia). The myofascial units communicate and extend across lines and broad planes within the body (24). These myofascial connections, termed "myofascial meridians" by Myers (19), transmit strain and tension throughout connections within the body. As stated by Myers, muscles never attach to bone. Their movement pulls on the fascia, the fascia is attached to the periosteum, and the periosteum pulls on the bone. In other words, muscles and fascia are continuous with each other, transmitting tension, strain, and lines of pull from one structure to the next. Therefore, if one of the structures within a meridian develops tension, it will be distributed along the entire myofacial continuum. With this in mind, theoretically there is "only one muscle; it just hangs around in 600 or more fascial pockets" (19). In his text "Anatomy Trains" (19), Myers describeds 7 myofacial lines or "meridians." Two of these meridians, the "superficial back line" (SBL) and the "superficial front line" (SFL), are directly related to the present case.

The purpose of this case report is to describe the use of ARTo, applied to the myofascial meridians, as a method of relieving pain and tissue tension present in a case of a chronic hamstring injury. The case also outlines the importance of the myofascial sling system (myofascial connections), which plays an important role in both the force/tension distribution throughout the body, as well as in the complete management of soft tissue dysfunction.

Case Presentation

A thirty-eight year-old competitive tri-athelete presented to the clinic with a complaint of chronic proximal hamstring pain and tightness in the right leg. The pain was described as constant and exacerbated by running. The complaint stemmed from a running injury that she had suffered two years prior in which she developed what was diagnosed as an acute tendonopathy of the proximal hamstring. This condition resulted in her ceasing her training regimen. At that time, the patient was treated using the RICE principle of acute injury management that served to greatly decrease the pain intensity. Since then, a residual subjective feeling of “discomfort/pain” and “tightness” remained that she felt greatly decreased her running performance. The patient decided to stop running altogether, which subsequently forced her to stop participating in the Ironman Competition, in which she had competed for many years. Shortly after the resolution of the acute phase of the injury, the patient then sought out chiropractic care for her complaint. The practitioner managed the condition using electro-acupuncture, home stretching, as well as **Active Release Technique** o directed solely on the hamstring muscle group. This treatment protocol, which lasted approximately six months, served to lessen the symptoms for short periods of time (1-2 days), however failed to resolve the complaint and allow the patient to return to running.

Upon presenting to our clinic, approximately 2 years after the initial incident, the symptoms had not lessened nor had the patient returned to any running activities. Postural examination revealed moderate anterior head carriage, internally rotated shoulders, and anterior pelvic tilt causing an increased lumbar lordosis. During lateral postural examination, it was noted that dorsiflexion of the ankles was present. This gave the impression that the patient was leaning forward (see figure). It should be noted that these findings are consistent with a “tight” superficial front line (see discussion). Muscle length testing resulted in mild discomfort as well as a mildly decreased range of motion in the right hamstring relative the left (approximately 15 degrees). Also, the right rectus femoris and both the right and left pectoralis major muscles demonstrated a decreased range of motion. Palpatory findings revealed tenderness in the proximal hamstring myotendinous junction and hamstring insertion, as well as tightness and fibrosis in the ipsilateral plantar fascia, gastrocnemius, sacrotuberous ligament, long dorsal sacral ligament, and the mid-thoracic longissimus thoracis. Non-painful dykinesis (decreased joint play) was noted in the right subtalar joint with joint palpation. Gait analysis revealed a 'hunched forward posture' resulting in excessive dorsiflexion of both ankles. No other gait abnormalities were observed. Manual muscle testing of the lower limb musculature was unremarkable and was graded as 5/5 bilaterally. Sensory testing of the lower extremities was bilaterally symmetrical and all reflexes were graded as 2+. Systems review did not reveal any concurrent illness or disease processes.

A diagnosis of chronic proximal hamstring tendonopathy was given. Treatment frequency was three times a week for the first two weeks, followed by twice per week for the next three weeks. Treatment included **Active Release Technique** o applied to the right superficial back line (see discussion) including the plantar fascia, gastrocnemius, hamstrings group (including the proximal tendon), sacrotuberous ligament, long dorsal sacral ligament, and the ipsilateral erector spinae. Drop piece manipulation was performed for a total of three visits until the subtalar dyskinesis was resolved. Home stretches for the hamstring muscle group, and the superficial front line (see discussion) were also prescribed at a frequency of 2 times per day, holding each stretch for 40 to 60 seconds per repetition. Postural advice was also administered in order to relieve stress placed on tissues when using the computer, driving, talking on the phone, etc.

The patient reported a subjective decrease of 60-70% in pain intensity and tightness after only two treatments. By the fifth visit, the pain was only felt during testing of the end range of motion. At this time the patient began running again. She was also started on eccentric hamstring exercises. This included eccentrics on the hamstring curl machine which involves performing the concentric portion with both legs, then the eccentric portion is done only with the symptomatic leg. Repetitive eccentric hamstring catches were also prescribed (9). In addition, proprioceptive training was added to the treatment. This consisted of proprioceptive leg drops (see diagram) and rocker/wobble board training. By the

eighth visit, the patient had progressed to 8-10 km runs with no restrictions or pain caused by the hamstring group. The only factor interfering with the patients run lengths at this point was cardiovascular deconditioning stemming from her lack of training. Simultaneously, during visit eight, end range of motion testing was unremarkable. At this point, the patient progressed to more extensive rehabilitative protocols (such as plyometrics in order to improve running economy and kinaesthetic awareness of the joints ADD REFERENCES).

Discussion

As mentioned earlier hamstring conditions are usually the result of either a sudden onset of tissue injury with immediate incapacitating pain, or a slow insidious onset preceded by muscle tightness which may later develop into an acute strain of the tissue (9). Consequently this concept leads one to believe that an underlying presence of increased myofascial tension or stiffness may precipitate hamstring conditions. **Active Release Technique** o is a widely used method of soft tissue therapy aimed directly at relieving tissue tension and restoring normal biomechanical function. Various clinical case reports have cited the benefits of this **technique** in managing a variety of musculoskeletal conditions.

The reader may now be wondering why this **technique**, if so effective, did not provide the desired results when applied by the previous treating practitioner in this particular case? The answer may lie in the anatomy of the hamstrings muscle group, as well as in the concept of the myofascial continuum referred to earlier.

Recall that of the seven myofacial meridians described in Myers text (19), two meridians, the superficial back line, and the superficial front line are of direct relevance in this case. Theoretically, the “superficial back line” (SBL) extends from the plantar fascia, around the calcaneous, into the Achilles tendon, which continues with the gastrocnemius. It is important to note that tightness in these structures will create a compressive force in the subtalar joint by forcing the calcaneous into the tallus. This will create dyskinesis, or “fixation”, of the subtalar joint. This was one of the findings identified and subsequently treated in the current case study. From the gastrocnemius, the line continues up the hamstrings, into the sacrotuberous ligament, to the long dorsal sacral ligament, and up the ipsilateral erectors all the way to the galea aponeurotica. Part of this meridian, or “myofacial sling” as it is often termed, has, in part, been demonstrated by the work of Vleeming, Goudzwaard, Stoeckart, and Snijders (16, 17, 18, 25, 26, 27). These authors used force transducers in embalmed cadaveric specimens to demonstrate force translation between the biceps femoris (the most commonly injured hamstring muscle), the sacrotuberous ligament, the long dorsal sacral ligament, and the thoracolumbar fascia.

In the running athlete, the hamstring is subject to eccentric force loading as the leg is propelled forward just prior to heel strike. It is this required increase in eccentric muscle activity that appears to be related to hamstring injuries occurring in the late swing phase of gait as the foot strikes the ground (5). Thus, if there is increased tension in any part of the SBL, it will cause increased tension in the hamstring, which is already subject to micro injury and tears via running mechanics, during eccentric loading. Therefore, the hamstring becomes the "weakest link" in the myofacial sling, which may explain why it becomes the symptomatic tissue in running athletes.

The other myofascial meridian involved in the present case was the "superficial front line" (SFL). This sling represents the myofacial connection running from the anterior crural compartment, to the subpatellar tendon, and up the rectus femoris to the anterior inferior iliac spine (AIIS). From the AIIS, tension is transferred via the bony pelvis to the rectus abdominus, up the sternalis muscle or sternochondral fascia, to the sternocleidomastoid. The patient's static posture helped to identify the SFL as being involved in the current case. Tension in the SFL may have resulted in the anterior head carriage with rolled forward shoulders via the upper component of the sling, as well as anterior pelvic tilt of the lower trunk via the pull of the rectus femoris. Interestingly, the anterior pelvic tilt serves to increase lumbar lordosis, which has been identified as a postural contributor to hamstring injury (7).

The SBL and SFL are thought to have a reciprocal relationship, such that contracture, or shortening of one will draw tension via lengthening/stretching of the other. Following the works of Janda (28, 29), anterior head carriage and anterior pelvic tilt are common postural compensations. This follows the theory and observation by Myers (19) that it is very common for the SFL to be pulled down, and thus "locked short", while the SBL hikes up the back thus drawing tension into it ("locked long"). This pattern is encouraged by improper posture, such as that of individuals slumping forward while at the computer screen or driving their cars.

Returning to the original question of why ART o to the hamstrings alone was insufficient in dealing with this case, the meridian concept may provide the answer. By treating the entire SBL with **active release technique** and stretching, while simultaneously stretching the SFL, the lines of pull/strain within the patient were balanced. Thus, any tension that was causing chronicity of the symptoms was relieved, and the myofascial mechanics were returned to normal.

The concept of adverse neural tension has also been identified as a possible cause for repetitive hamstring strain. Turl and George (1998) noted that 57% of their study population suffering from grade I repetitive hamstring strain were diagnosed with adverse neural tension using the slump test (6). Their theory describes how repeated injury to the hamstrings can produce inflammation and possible scarring that interferes with normal mobility and nutritional well-being of the sciatic nerve. The slump test procedure has the patient sit at the edge of the table with the plinth in contact with the popliteal fossa at the back of the knee. The patient is instructed to flex the neck and slump the shoulders forward as the practitioner applies overpressure. The patient is then instructed to extend the knee as much as possible. In order for the test to be positive, the patient's original hamstring pain must be reproduced and then decreased on cervical extension. This combination of movements draws tension directly into the SBL. Therefore, Turl and George's diagnosis of adverse neural tension using the slump test would be positive in patients with tension in the superficial back line such as the patient in the current case (6).

By dealing with the affected tissues, the "locked short" SFL and the "locked long" SBL, symptoms in this patient were effectively relieved. However, other predisposing factors of this type of pattern (example: aberrant posture) must also be addressed in order to sustain the soft tissue alterations. This includes postural retraining by way of patient instruction, postural reminders (e.g. a note placed on the top of the computer screen reminding the patient to correct their posture), as well as home stretching in order to sustain the corrected posture.

In addition to postural corrections, rehabilitative efforts are essential in order to aid with tissue healing, and to correct other predisposing factors such as muscle weakness, strength imbalance, lack of flexibility, and fatigue.

Conclusion

The focus of this case report was to describe how treating an entire myofacial meridian could be very effective in resolving chronic or recurring hamstring problems. Focused soft tissue treatment protocols directed solely at the hamstring muscle group may fail to adequately resolve patient symptomatology because they do not address lines of tissue tension. Methods of soft tissue treatment, in our case **Active Release** Techniques o, while effective, are limited to the practioner's knowledge of the involved anatomy and soft tissue mechanics. Many manual medicine therapists direct such treatment protocols in isolation. Due to the recent publication of literature regarding continuums between various structures by way of connective tissue, manual therapists should consider revising the way they identify and deal with tension and strain development within the body. More research is needed to demonstrate the presence of these lines of pull, as many of them are currently only theoretical constructs.

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