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PILOT STUDY

Treating patellar tendinopathy with Fascial Manipulation

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Summary According to Fascial Manipulation theory, patellar tendon pain is often due to uncoordinated quadriceps contraction caused by anomalous fascial tension in the thigh. Therefore, the focus of treatment is not the patellar tendon itself, but involves localizing the cause of this incoordination, considered to be within the muscular fascia of the thigh region.

Eighteen patients suffering from patellar tendon pain were treated with the Fascial Manipulation technique. Pain was assessed (in VAS) before (VAS 67.8/100) and after (VAS 26.5/100) treatment, plus a follow-up evaluation at 1 month (VAS 17.2/100).

Results showed a substantial decrease in pain immediately after treatment ($p<0.0001$) and remained unchanged or improved in the short term.

The results show that the patellar tendon may be only the zone of perceived pain and that interesting results can be obtained by treating the muscular fascia of the quadriceps muscle, whose alteration may cause motor incoordination and subsequent pathology.

Introduction

Patellar tendinopathy is a very frequent pathology among sportspeople, who perform multiple jumps in sports such as basketball, volleyball, and beach-volley, such that it is also called "jumper's knee". Patellar tendinopathy is also reported in subjects who often climb stairs, hike, and squat (Eifert-Mangine et al., 1992; Molnar and Fox, 1993; Morelli and Rowe, 2004). Indeed, the continuous repetition of certain movements, above all excessive strength training of the extensor compartment (quadriceps),

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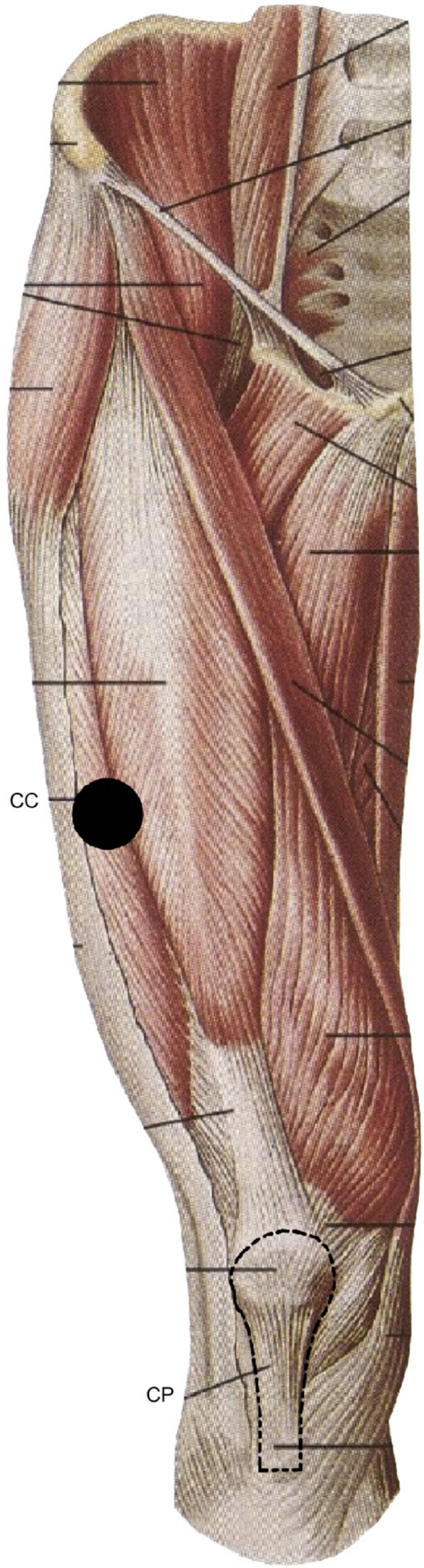
might cause various minor traumas and strains that are considered to be at the origin of this overuse syndrome. Symptoms, at first characterized by pain during strain, can evolve into inflammation (tendinitis) (Duri et al., 1999; Warden and Brukner, 2003) with pain at rest, and eventually lead to tissue alteration and, in some cases, even tendon rupture. The origin of these symptoms is commonly attributed to disease of the patellar tendon, and so the majority of known treatments focus directly on the tendon itself (Cyriax, 1982; Kountouris and Cook, 2007; Vulpiani et al., 2007; Willberg et al., 2007). In recent years, some authors (Simons et al., 1999; Stecco and Stecco, 2007) have begun to consider alterations of the patellar tendon as the consequence of chronic, uncoordinated movement of the knee joint due to incorrect activation of the knee extensor muscles. For this reason, many therapies, including quadriceps stretching, muscle energy techniques and tensional release through massage therapy (Chaitow, 2003), focus on the muscles of the extensor compartment. Similar principles can also be found in another manual technique, known as Fascial Manipulation (Stecco 1996, 2004), however, according to its theoretical model, continuous repetition of the same movement could cause "densification" of the muscular fascia, thereby altering the efficiency of muscle contraction. Other authors (Pellecchia et al., 1994; Rolf, 1997; Schleip, 2003) have also indicated that fascia is a plastic and malleable tissue, able to adjust to the mechanical, thermal and metabolic stresses, and can possibly be restored to its physiological condition through external manipulation treatment. Hence, the aim of this pilot study is to explore the effectiveness of Fascial Manipulation in alleviating the pain component in patellar tendinopathy and possible implications are also discussed.

In Fascial Manipulation, a map of over one hundred fascial points exists, that, when treated appropriately, are believed to restore tensional balance. In order to select the points to be treated the fascial system is first divided into basic elements, or myofascial units (MFUs). Each MFU includes all of the motor units responsible for moving a joint in a specific direction and the overlying muscular fascia. Hence, movements of single body segments are considered to be governed by six MFUs, responsible for movements in the three spatial planes (sagittal, frontal, horizontal). All the forces generated by a MFU are considered to converge in one point, called the centre of coordination (CC); each CC has a precise anatomical location within the muscular fascia. If the fascia in this specific area is altered, or "densified", then the entire MFU contracts in an anomalous manner resulting in non-physiological movement of the corresponding joint, which can be a cause of joint pain. According to the Fascial Manipulation model, the area where the patient perceives pain is called the centre of perception (CP), thus, for each MFU one CP is described. In patellar tendinopathy, the MFU of extension of the knee, called MFU of antemotion genu (AN-GE), is the more frequently implicated. It is formed by the knee joint, the monoarticular muscular fibres of vastus medialis, intermedius and lateralis, the biarticular muscular fibres of rectus femoris and the relative muscular fascia. The patella and the anterior region of the knee are considered as the CP of this MFU, while the CC is situated over the vastus intermedius muscle, halfway on the thigh (Figures 1 and 2). The location of this CC overlaps with the acupuncture point ST32 (Bossy et al., 1980), and with one of the trigger points of the quadriceps group, as described by Simons et al. (1999).

Figure 1 Deep fascia (fascia lata) of the thigh.



Materials and methods

Eighteen patients (13 males, 5 females; mean age 29.2), with unilateral sub-acute (from 1 to 3 months) or chronic (more than 3 months) patellar tendon pain (mean duration of symptoms 8.6 months) were treated according to the methodology of Fascial Manipulation (Table 1). Subjects with clinical signs of acute joint inflammation (oedema, heat, and rubor) were excluded from this study, as were subjects with meniscopathy and advanced degenerative osteoarthritis, as evidenced by MRI and X-rays. A complete physical examination of the knee was carried out, including inspection of the joint, assessment of the range of motion, muscle strength, and palpation.

Prior to commencing treatment, patients were asked to evaluate the severity of their pain, as experienced during two specific movement tests, on a VAS scale from 1 to 10 [10 = worst possible pain, 0 = no pain]. This subjective evaluation was repeated after one treatment session and the sessions were then suspended. At a follow-up, 1 month after treatment, a third measurement was recorded. The mean value of the VAS scale measurements was then calculated (Table 2) and the analysis of the differences in pain was accomplished by comparing the results obtained with appropriate statistical tests (Kurskal–Wallis test and Dunn's multiple comparison test as a control).

Treatment procedure: Movement tests, as indicated by Fascial Manipulation protocol, were performed before treatment to evaluate each MFU involved in movement of the knee joint (Figure 3). Results from these movement tests were scored according to Fascial Manipulation protocol, on a scale from 1 to 3 asterisks: pain = *, weakness = * and limited movement = * (Table 3). The CCs of the most dysfunctional MFUs (those with two or three asterisks) were then subjected to a comparative palpation assessment prior to selection of the points requiring treatment.

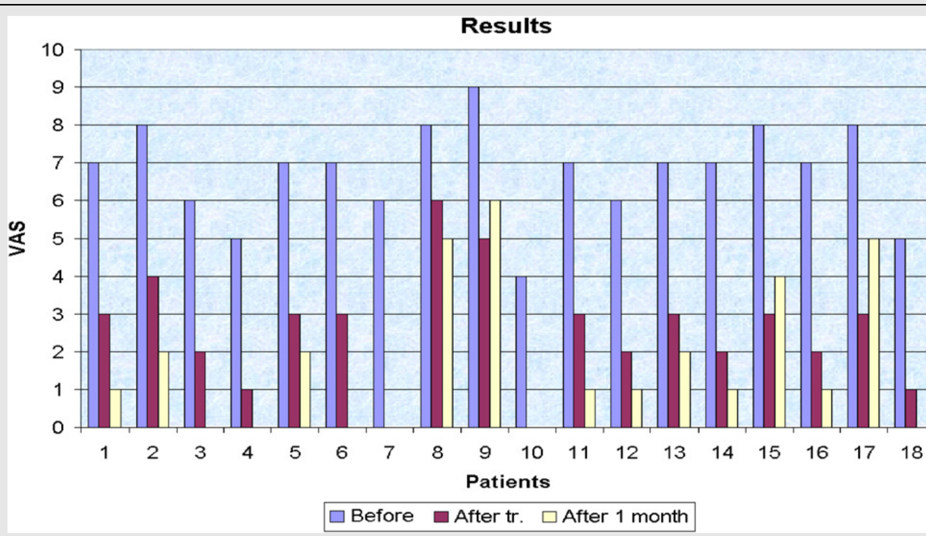
Two specific movement tests were also evaluated: going down a 30 cm high step, weight bearing on the suffering limb, and a flat-feet jump, starting from a position of total knee bending (squatting) (Figure 4). Subjective pain experienced during these two tests was assessed using the Vas scale measurement procedure.

Figure 2 Schematic representation of the centres of coordination (CC) and perception (CP). The CC is over the vastus intermedius muscle, and the CP is located over the anterior part of the knee.

Table 1 General characteristics of subjects.

Patient	Gender	Age	Duration of symptoms (months)	Sport
1	M	32	6	Basket
2	M	34	11	None
3	M	30	5	Soccer
4	F	17	1	Volley
5	M	37	10	None
6	F	35	2	Soccer
7	M	40	1	Bike
8	M	18	6	Basket
9	M	36	15	Running
10	M	19	4	Basket
11	M	33	24	None
12	F	31	5	Running
13	F	17	12	Basket
14	M	31	6	Beach-volley
15	M	42	18	None
16	F	17	3	Volley
17	M	38	24	Body build
18	M	19	3	Volley
Total	13 M, 5 F	Mean value 29.2	Mean value 8.67 months	/

Table 2 Results: VAS scale measurement of pain experienced during two specific movement tests (going down a 30 cm high step and flat-feet jump test) before treatment, immediately after treatment and 1 month after treatment.



An operator, other than the therapist who treated the patients, performed the movement tests and supervised the pain assessments.

A single therapist performed all treatments and the CC of AN-GE was treated in all cases. The treatment of this CC is performed with the patient supine, and the therapist standing to the side of the suffering limb. The therapist uses their elbow over the muscular fascia in the area between vastus lateralis and rectus femoris muscles, halfway on the thigh (Figure 5), applying pressure towards the vastus intermedius. Once the most altered area has

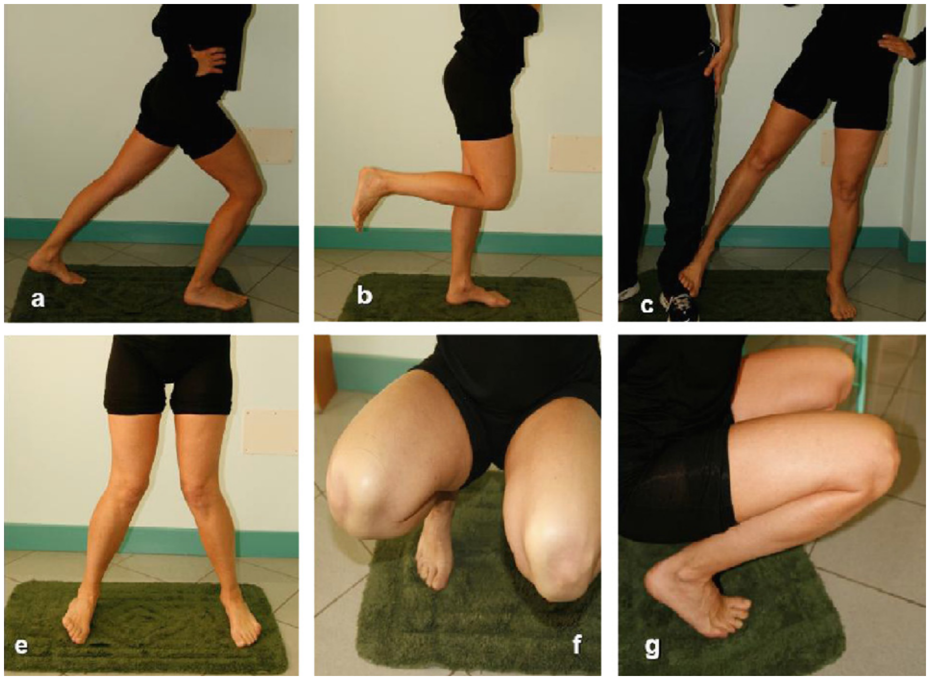


Figure 3 The motor tests for the knee segment according to Fascial Manipulation technique: (a) AN-GE test, (b) RE-GE test, (c) LA-GE test, (e) ME-GE test, (f) IR-GE test, and (g) ER-GE test.

Table 3 Evaluation of movements before treatment, according to fascial manipulation.

Patient	AN	RE	LA	ME	IR	ER
1	**	*	*			
2	***	*			*	
3	**					
4	*					
5	**	*				
6	**			*		
7	**					
8	***	*				*
9	***	**	*		*	
10	*				*	
11	**	*				
12	**					
13	**	*				
14	**					
15	***	**				
16	**			*		
17	***	*				
18	*					

been located, static pressure is initially applied and, subsequently, a deep friction or mobilization of the fascial tissues is employed. Verbal feedback from the patient aids in accurate localization of the exact point that provokes local and referred pain. Intermittent friction is maintained for a total of about 5 min, until the fascia glides freely and the patient refers that pain has decreased significantly.

All patients were asked to suspend sporting activities for at least 4 days after treatment, to avoid further stress on the treated structures.

At a 1-month follow-up, the two specific movement tests were re-assessed and VAS scale measurements were recorded.

Results

According to the results of the movement tests, all patients demonstrated a deficit (pain and/or weakness and/or limited movement) in the MFUs on the sagittal plane, with a specific involvement of the MFU of AN-GE. Pain assessments of the entire study group during the two specific movement tests before treatment (mean VAS 67.8/100) and after treatment (mean VAS 25.6/100) indicated a significant decrease of pain immediately after treatment ($p < 0.0001$) in all patients.

In particular, two cases (nos. 7 and 10) had a complete regression of pain immediately after treatment (mean VAS from 50/100 to 0/100) and this result was maintained at the 1-month follow-up. In another four patients (nos. 3, 4, 6, and 18), a good immediate post treatment result was

Figure 4 On the left: going down a 30 cm high step, weight bearing on the suffering limb; on the right: flat-feet jump test, starting from an angle of total knee bending.

Figure 5 Treatment position of the centre of coordination AN-GE according to the Fascial Manipulation technique.

recorded (mean VAS from 57.5/100 to 17.5/100) and, furthermore, at the follow-up, tendon pain had disappeared completely (VAS 0/100). At the follow-up, nine cases (nos. 1, 2, 5, 8, 11, 12, 13, 14, and 16) demonstrated a further reduction in pain as compared to immediately after treatment (mean VAS from 31.1/100 to 17.8/100). Only three patients (nos. 9, 15, and 17) referred that while pain had decreased immediately after treatment (mean VAS from 83.3/100 to 36.7/100) it had then increased again (to mean VAS 50/100), although not to the pre-session levels.

Discussion

According to this pilot study, it is evident that after one session of Fascial Manipulation a certain reduction of pain was recorded in every patient and that these results can be maintained or may partially regress. The aim of the Fascial Manipulation therapy is to restore gliding between the intrafascial fibres. Raising the temperature of selected areas of the fascia (corresponding to the CC points), via manual pressure, could allow for transformation of the ground substance, transforming it from a pathological status of GEL (dense fascia) to a physiological status of SOL (fluid fascia). This variation in density probably allows for two events. Firstly, during the application of manual pressure, the connective tissue adapts and the intrafascial free nerve endings may slide within the fascia more freely, which could explain the sudden decrease in pain during massage in the treated area. The second event could evolve over the following days: with enhanced fluidity of the ground substance, physiological tensioning of the fibres within the fascia during muscular contraction could allow for correct deposition of new collagen and elastic fibres according to the lines of applied force. Subsequent restoration of gliding between connective tissue layers of the fascia would enable tensional adjustments during muscular contraction, resulting in appropriate tensioning of periarticular structures such as tendons and capsules. This restitution of elasticity to the fascia could also explain the satisfactory results maintained over time.

In the Fascial Manipulation model, the CC is considered a point of vectorial convergence for muscular forces or the point of the muscular fascia where altered myofascial traction concentrates. Thus, for each segment, we can identify six CCs, one for each direction on the three planes of movement. A pathological CC can be pinpointed by a specific clinical exam (movement tests), and not only by palpation, which differs somewhat from the procedure for trigger point identification. Hence, a CC could be considered as a type of "key trigger point".

The myofascial connections within each MFU, and between different MFUs, can provide an alternative explanation for referred pain distribution (Stecco et al., 2007, 2008), which often does not follow either nerve pathways or the morphology of a single muscle (Hwang et al., 2005). When muscular fascia alters, it is feasible that the various motor units of the implicated muscles cannot coordinate their activity appropriately. Subsequent unaligned joint movement could cause non-physiological stretch of the receptors within the fascia, resulting in a nociceptive signal (Baldissera, 1996). In this way, according to Fascial Manipulation theory, when the CC is in an altered state it can be considered as the origin of pain (cause), and the joint (CP) as the area where pain is referred (consequence).

In those cases with partial resolution of symptoms, even though there had been some reduction in pain, indicating a correct interpretation of the problem, we hypothesize that more treatment sessions would have been necessary. In fact, the muscular fascia guarantees the anatomical and functional continuity of the anterior compartment muscles. In particular, the deep fascia of the ileopsoas continues with the fascia of the rectus femoris, and the fascia lata is continuous with the crural fascia that envelops the tibialis anterior muscle. Hence, if, for hypothesis, the fascia lata is chronically densified, then it is possible that alterations will occur in contiguous muscular fasciae in an attempt to compensate for this anomalous tension, with consequent alterations in the CCs of adjacent segments.

In those cases where we have recorded a re-intensification of pain after treatment, it should be pointed out that, as compared with other patients in the study group, they were far more complicated clinical cases. In fact, they did not only present tendinopathy, but case 9 also reported low back pain, case 15 Achilles tendinopathy and subcalcaneal pain and case 17 groin pain. Clinical cases such as these lead us to hypothesize a global disorder, or a postural imbalance involving numerous body segments. To make our study as consistent as possible, we decided to treat the same CC in all patients. In everyday practice, this CC has proven to be the most frequently involved point in this disorder. However, by treating one single CC, responsible for the imbalance of one single MFU, it cannot be enough to restore balance in similar global disorders.

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