Case Report

Knee Myofascial Pain and Knee-Abdomen Syndromes; A Newly Identified Knee Disorders, Commonly Misdiagnosed as Arthritis, Multiple Case Study

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Abstract

Background: Knee osteoarthritis is a common orthopedic condition. Imaging based pathoanatomical findings are utilized as a cornerstone for diagnosis of the condition, 97% of asymptomatic knees demonstrate pathoanatomical findings, causing doubt of diagnosis and efficiency of intervention based on asymptomatically present pathoanatomical features. **Purpose:** This study explores myofascial dysfunctions as an alternative explanation to knee pain. Identifying new syndromes termed as knee myofascial pain and knee-abdomen syndromes. **Therapeutic intervention:** Describing 3 cases of knee osteoarthritis and one case of rheumatoid arthritis treated to full recovery as myofascial dysfunction. All of these cases were investigated and treated to complete recovery from specific myofascial continuity known as deep front line dysfunction, as a cause of knee pain. **Results:** Both syndromes demonstrated 50% to 100% pain reduction after one session of myofascial release, with no recurrence over long-term follow-up after discharge. **Conclusion:** Knee myofascial pain and knee-abdomen syndromes are clinically present commonly misdiagnosed as arthritic changes. Myofascial release produced an immediate major pain reduction ranging from 50 to 100%. High quality research is required to identify more accurate diagnostic criteria and consequently best treatment strategies.

Keywords: Knee, Myofascia, knee-abdomen, Osteoarthritis, Rheumatoid arthritis.

Introduction

Knee osteoarthritis (OA) is a common diagnosis [1-5], with a reported increased prevalence of 65% from 1974 to 1994 [2], and doubling since the mid-20th century [5]. OA is a significant contributor to global disability [6], with 303.1 million cases of OA identified globally by 2017 [6].

Orthopedic medicine diagnostic model depends on radiographic imaging as a cornerstone diagnostic tool [7]. Diagnostic pathoanatomical structure identified by imaging are reported in asymptomatic populations; spinal degeneration ,disc bulge and Spinal Cord Compression [8-10], Shoulder rotator cuff tendonitis and tears, labral abnormalities, bursal thickening, and acromioclavicular OA [11-16], hip's labral tears and cartilage deficit [17,18], femoroacetabular impingement [19], knee's OA, chondral deficits, osteophytes, meniscal tears, tendinopathies [20-25] and bone marrow oedema [26]. Knee radiological pathoanatomical findings are present in nearly all (97%) of asymptomatic/healthy individuals' knees [25], hence our understanding and treatment based on imaging outcomes is misleading. Presence of pathoanatomical features in asymptomatic individuals guided a shift toward dysfunction based diagnostic criteria instead of pathoanatomical ones for patient management of neck and low

back pains [27,28]. This mandate exploration of causes of knee pain instead of asymptomatically prevalent knee OA and degenerative changes.

Fascia as a part of the musculoskeletal (MSK) system has the potential to cause pain, dysfunction and disorders [29-34]. A multitude of techniques have been created & utilized by clinicians over the last century targeting this structure [35-40]. Fascia remains one of the least studied components of the MSK system. Lack of research regarding myofascial continuities and dysfunction exists, As many anatomists stated that anatomical description has been completed and no new knowledge is to be expected, causing a gradual reduction of budgets and research of anatomy [41]. A systematic review of 2016 investigated existence of myofascial lines presented by Tomas Myers in his book (Anatomy trains), concluded that most muscles are connected directly by connective tissue, with evidence regarding the existence of specific myofascial continuities that he termed the superficial back line (SBL), back functional line, and front functional line, these findings can provide a better understanding of musculoskeletal pain and dysfunction development, with a major need for further research [42].

Deep front line (DFL) is a myofascial continuity described in the structural integration text of anatomy trains; authored by Tomas Myers [43], Myers identified an anatomical connection

between the knee capsule and the abdominal structure through the adductor muscle, medial & posterior intramuscular septa of the thigh, and Iliopsoas muscle, with its two parts, iliacus and psoas major [43]. An explanation of distant structure mutual influence is provided through Biotensegrity [43,44], which is the transmission of a force between connected structures regardless of proximity.

Biotensegrity concept has been studied on the myofascial continuity of the plantar fascia, calf, hamstring and paraspinals, known as the superficial back line [43], with therapeutic based evidence regarding the practical application of Biotensegrity was established, when myofascial release (MFR) was performed on the plantar fascia, an immediate increase of lumbar and hip range of motion was achieved [45], while shortening of calf and hamstring was proven to be associated with plantar fasciitis [46-48]. Treatments based on the SBL myofascial continuities was advocated by Myers, and proven effective by research, as stretching of elements of the SBL; the calf and hamstring is determined as an effective treatment for plantar fasciitis [49-51], surgical release of Proximal Medial Gastrocnemius was effective too [52,53].

One issue hindering research and clinical development of manual techniques is descriptive terminology / Nomenclature. Many terms are used within each profession providing manual therapy, as Physical therapy, chiropractic, osteopathy, and others. These techniques are similar linguistically, even though they are indicating different & diverse techniques, & theoretical frameworks. This issue led to attempts to unify inter-professions research in spinal manipulation [54]. Fascial/myofascial release or manipulation are used interchangeably between clinicians and researchers, with no unification attempts produced yet, hence this paper, uses the term of "myofascial release" to indicate any technique or research regrading either fascial or myofascial manual treatment, while specifying in great details the techniques utilized in treating the presented case studies.

Myofascial release was effective clinically in a multitude of studies of fibromyalgia [55,56], cervical spine dysfunction [57], patellar tendinopathy [58], pubescent postural hyperkyphosis [59], systemic lupus erythematous [60], rotator cuff tear [61], Spastic Cerebral Palsy [62]. Even more effective than some standardized physical therapy in cases of low back pain [63]. MFR also positively affects the autonomic nervous system's parasympathetic activity with an increase in vagal tone [64,65]. An increase in parasympathetic activity can explain the psychological effects of MFR, as improvement of state-trait anxiety [66], and anxiety and depression in fibromyalgia patients [55]. Evidence regarding MFR

structural integration is lacking quantity because of small sample size and lack of control of some studies [67]. This paper present 3 cases that have been encountered with knee pain and medical diagnosis of knee OA and one case of rheumatoid arthritis (RA). All of these cases were investigated and treated to complete recovery from specific myofascial continuity known as deep front line dysfunction, as the cause of knee pain.

Myofascial release was the primary treatment applied to the accessible structure of the patients' DFL, through Myers's MFR techniques of DFL. MFR in its simplest form targeted restoration of mobility of myofascial and fascial layers from within, and with the surrounding structure. MFR techniques utilized with the cases included four variations of application:

1. Muscle was stroked in a longitudinal slow manner, aiming to mobilize fascia over muscles or fascial layers over each other. Which will be referred to as passive release.
2. Separation force applied perpendicularly through a parallel myofascial structure to restore mobility and separation between them. Which will be referred to as separation technique.
3. Force was applied to the myofascial structure while the muscle contracts, aiming to immobilize fascia while muscle contracts and mobilize below it. Which will be referred to as active release.
4. Special form in which combination of the previous is utilized.

The DFL includes the following structures which MFR was targeted to each, tibialis posterior figure (1&2), toes' long flexors figures (3&4), knee capsule (no direct release), pes anserine figure (5), adductors of the thigh figure (6,7&8) & related intramuscular septa figure (9&10), Iliopsoas figure (11,12&13), quadratus lumborum figure (14&15), diaphragm figure (16), abdominal fascia figure (17&18) and lateral raphe figure (19) [43]. Home exercise program consisted of self-stretching of hip adductors, and strengthening of antagonistic muscles of the hip flexors and adductors, specifically the gluteus maximus and medius, to utilize reciprocal control of the tight muscles of the DFL, as advocated by Janda [68], noting that most of the patients became pain free after the first session of MFR, before performing stretching or strengthening exercises, that's utilized as a home exercise program. Utilized MFR techniques are demonstrated on volunteer subject, that provided consent for publication.

Figure (1) passive superiorly directed MFR of tibialis posterior.

Figure (2) passive superiorly directed MFR of tibialis posterior.

Figure (3) passive superiorly directed MFR of tibialis posterior & toes' long flexors.

Figure (4) passive superiorly directed MFR of tibialis posterior & toes' long flexors.

Figure (5) passive superiorly & laterally directed MFR of pes anserine forming

Figure (6) separation technique of hip adductors applied at three hand placements as arrows indicate.
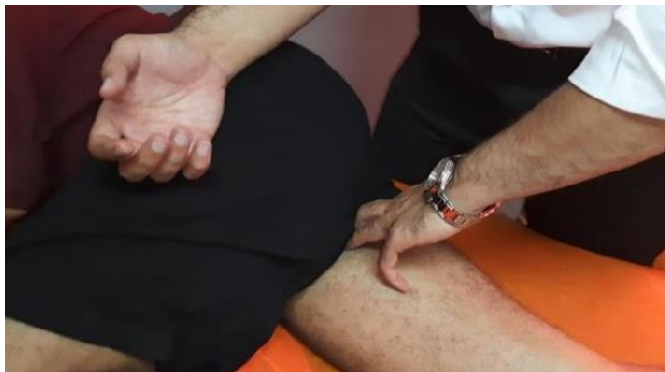

Figure (7&8) passive inferiorly directed MFR of the adductors at ischio-pubic ramus. Muscles are contacted underneath the ischio-pubic ramus at at three hand placements as arrows indicate
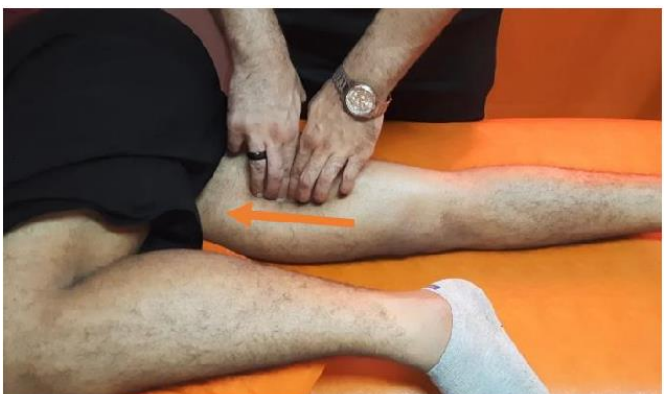

Figure (9) passive superiorly directed MFR of the medial intramuscular septum.

Figure (10) passive superiorly directed MFR of the posterior intramuscular septum.

Figure (11) contact point of the iliacus muscle medially to the anterior superior

Figure (12) active release of the iliacus, as the iliacus is contacted with pressure & the patient is instructed to slide his heel & extend his lower limb.

Figure (13) contact point of the psoas major (SM) muscle is medial to the anterior superior iliac with posterior sliding on the inner pelvic surface until contact is achieved with the muscle, confirmed with muscle contraction with active hip flexion & differentiated from the abdominal wall contraction as a harder & deeper contraction.

Active release is performed as the patient is instructed to raise their pelvis from the table & gradually lower their pelvis making gradual contact with each vertebra, while contact with pressure is maintained on SM causing relative

Figure (14) contact point of quadratus lumborum (QL) muscle, through compression of the lateral abdominal wall with posteriorly directed motion, until contact is established with anterior surface of QL.

Figure (15) special form release of the QL, as cephalic hand hooks QL & pulls it posteriorly, maintaining pressure on its anterior surface. the caudal limb forearm brings the pelvis into side bending, lengthening the QL muscular tissue under the relatively immobilized QL's fascia.

Figure (16) special form release of the diaphragm. Fingers are inserted into the lower costal margin to contact the lowest part of the diaphragmatic myofascia. Ribs pulled slightly laterally to expand the chest & maintaining relative immobilization contact on the myofascial structure. Patient is instructed to continue breathing regularly for five breaths.

Figure (17) special form release of the abdominal fascia. Fingers are inserted behind the rectus abdominis muscle as deep as possible, with an anteriorly directed lift of the umbilicus is performed, while the patient is instructed to take deep five breaths.

Figure (18) special form release of the abdominal fascia. Hands are placed on the abdomen, maintaining downward force equivalent to the weight of the therapist's upper limbs. Patient is instructed to keep breathing normally, while the position is maintained for 3 minutes. The technique aims to reflect diaphragmatic breathing force to mobilize abdominal fascia.

Figure (19) passive superiorly directed MFR of the lateral raphe. Fingers are inserted deeply as the tissue allows superior to the posterior part of the iliac crest, maintaining contact pressure, superior gliding motion is initiated.

Case Study 1

26 years old female patient complains of bilateral knee pain three months post caesarean section (C-section) delivery. Patient's pain was 6/10 numerical pain rating scale (NRS) [69], exacerbated with weight-bearing flexion as squatting. No clear mechanism of injury with no history of knee pain prior to C-section. Patient demonstrated touch provoked pain over all components of DFL especially hip adductors when compared to other muscle groups, and extreme tenderness on C-section scar line, which friction massage was directed toward it to restore mobility to the scar tissue as part of the treatment. Post one session of MFR pain reduced to 0/10 either in rest or weight-bearing flexion, with no need for other treatment modalities or MFR sessions. 18 months follow-up revealed no recurrence of pain. Patient also complained of low back pain (LBP) that resolved after MFR.

Case Study 2

63 years old female patient complains of unilateral knee pain with a history of C- section delivery. Patient complains of exacerbated knee pain after stepping into a hole on the beach, patient had knee pain for 20 years, diagnosed as knee OA, modified to OA & meniscal injury after the steppage incidence.

Patient's pain was 8/10 NRS, exacerbated with weight-bearing flexion as squatting or going upstairs. Patient demonstrated touch provoked pain over all components of DFL especially hip adductors when compared to other muscle groups. Patient underwent two treatment sessions of MFR to the DFL. Post 1st session pain was reduced to 2/10 during rest, patient was prescribed a home exercise program (HEP) of strengthening to weak gluteus medius and maximus, and quadriceps, and stretching of hip adductors. 2nd session was 10 days later. Post 2st session

pain was reduced to 0/10. Patient was instructed to continue her HEP. Follow-up after 3 month and 1 year revealed no recurrence of pain. To be noted that prior to MFR patient had physical therapy for multiple years with no significant improvement.

Case Study 3

56 years old female patient complains of LBP with bilateral knee pain. as Knee pain was diagnosed as OA. Patient utilized a handheld cane during walking. Patient's knee pain was 8/10 NRS during rest, exacerbated with weight-bearing flexion as squatting or going upstairs to 10/10. No clear mechanism of injury. Patient demonstrated touch provoked pain over all components of DFL especially hip adductors when compared to other muscle groups. Post one session of MFR pain reduced to 0/10. Patient was prescribed HEP of strengthening for weak gluteus and quadriceps. Patient did not continue treatment as COVID-19 pandemic happened. 8 months follow-up revealed no recurrence of knee symptoms during rest or regular activities of daily living, pain appeared during going upstairs reaching 5/10 NRS, with cessation of cane use as a walking aid. Patient's low back pain reduction was reported.

Case Study 4

58 years old female patient complains of unilateral knee pain, diagnosed with RA, presented with flexion deformation with an inability to extend the knee over 20° flexion, either in weight-bearing or non-weight bearing, with 8/10 pain during standing reaching 10/10 with active or passive full knee extension force. Patient reported pain variation was enough severity to prevent sleeping at some nights. Patient demonstrated touch provoked pain over all components of DFL especially hip adductors when compared to other muscle groups. Patient underwent 11 sessions of PT, once per week. 1st session treatment included MFR of DFL & strengthening exercise of the weakened gluteus medius and maximus, and quadriceps muscle, and stretching of hip adductors. Directly after MFR pain reached 0/10 of non-weight-bearing and 3/10 in weight-bearing with inability to perform full knee extension, exercise did not alter pain levels. Patient was prescribed HEP of strengthening exercise to the forementioned muscle, stretch to hip's adductors and heel prop to increase knee extension. After 4 session of MFR and strengthening HEP patient achieved 0/10 non-weight and weight- bearing, pain increased with standing or walking over 15 minutes, and reduced with rest and medications, the same medication was reported to have a much lesser effect on pain before. With no improvement in knee extension. As pain was controlled 5th session targeted increase of knee's extension range of motion (ROM) with mobilization and stretching exercise, pain levels increased with mobilization to reach 6 /10 of non-weight-bearing and 8/10 in weight-bearing. The 6th session included MFR targeting pain reduction, which caused 0/10 pain outcome, also introduced balance exercises. The following 5 sessions alternated between increasing ROM & reducing pain. After 11 sessions pt achieved 0/10 either in non-weight or weight-bearing with full knee extension range of motion. Pain occurs after hour of standing or walking. Knee pain had not prevented sleep over the last 2 weeks of therapy. Patient was discharged from PT as no further improvement has been achieved, with an advice of lifetime maintenance of her prescribed HEP. 3 months follow-up revealed no regression of the case or reappearance of pain. Patient's low back pain reduction was also reported.

Patient received physical therapy before with pain improvement that never reached 0/10 or complete knee extension, and NSAIDs had minimal effect on pain. By contacting her previous physical therapists, knee joint mobilization and exercise were too painful and performed withing tolerance but still knee extension was never achieved. By the 4th month after discharge patient reported to the physical therapy clinic with reappearance of knee pain with limitation of knee extension. Patient had one month of vacation when she stopped her HEP, after 2 weeks of cessation of HEP pain reappeared and progressed rapidly, by the time of this article was written patient restarted Physical Therapy with pain of 8/10 during standing. Post one session patient pain reduced to 4/10 with improved knee extension, and she'll continue receiving the same previous treatment.

Discussion

All presented cases demonstrated major pain reduction on NRS ranging from 50% to 100% after one treatment. Case 1 demonstrated tenderness to C-section scar line, & complete resolution of pain from MFR with no need for further treatment or HEP. Cases 2 and 4 required more than one treatment session with concomitant muscle imbalance that required directed exercise. All of the 4 cases are termed to have knee myofascial pain syndrome, while case 1 had a sub-classification of knee myofascial pain syndrome to be termed knee-abdomen syndrome, as knee pain's primary cause is abdominal fascia incision of C-section through DFL.

All patients demonstrated touch provoked pain over all components of DFL when compared to other muscle groups, especially hip adductors, this pain was not identified by the patient until touch provoked it. This finding is the only present symptom of both syndromes, that to can be used diagnostically prior to MFR, the only sure sign is major pain reduction following MFR.

The four presented cases are representations of different patterns of knee pain of myofascial origin. In case 1 deep front line dysfunction (DFLD) was a standalone dysfunction, while in cases 2 and3 DFLD was associated with muscle imbalance, & in case 4 was associated with muscle imbalance and RA. The three recurring patterns are observed repeatedly clinically, as the most common pattern is DFLD with muscle imbalance especially weakness of gluteus medius and maximus, and quadriceps. Weakness of the gluteus medius and maximus can be attributed to tightness inhibition relation [68], as tightness of specific muscle can reciprocally inhibit its antagonist and vice versa. Whether tightness of adductors or iliopsoas muscles caused weakness of gluteus medius and maximus, or weakness of the muscles caused tightness and dysfunction of the DFL is unknown to the authors. Sound clinical judgment requires managing both components as patient's treatment, whether one treatment of exercise alone or MFR alone well be enough to treat patients to full recovery is unknown & untested.

The second identified pattern is less common & encountered only twice by the authors, in which DFLD rises as a complication to C-section, & treated to 0/10 NRS within one session. The third pattern coexistence of DFLD and muscle imbalance with RA, in which treatment was required to all three components. Medications for RA with MFR and exercise.

Within the three presented patterns, standalone DFLD required minimal duration treatment of MFR alone, demonstrating immediate and long last recovery with no need for further treatment. DFLD with muscle imbalance required combined treatment with multiple sessions & HEP. After the disappearance

of pain and normalization of muscle strength pain did not recure during long-term follow-up. The third pattern of DFLD with muscle imbalance and RA demonstrated slowest recovery rate with recurrence of symptoms with cessation of physical activity and HEP.

This scientific paper represents a general call to the biomedical community to start a widespread research of the presented syndromes and the most efficient and effective treatment strategies, and subsequent changes to OA diagnostic criteria, as well as generation of diagnostic criteria for knee-abdomen and knee myofascial pain syndromes.

Conclusions

Knee myofascial pain syndrome and knee-abdomen syndrome are newly identified causes of knee pain usually misdiagnosed as knee OA or arthritic changes. Knee-abdomen syndrome demonstrated complete resolution after one treatment session with no recurrence over long-term follow-up and is defined as DFL myofascial dysfunction with a direct cause of abdominal fascia incision. Knee myofascial pain syndrome is a DFL myofascial dysfunction associated with muscle imbalance that required addition of therapeutic exercises to MFR, with multiple sessions of treatment. Both syndromes demonstrated 50% to 100% pain reduction after one session of MFR, with no recurrence over long-term follow-up after discharge, unless another active cause was present as RA. Patients demonstration of touch provoked pain over components of DFL is the only present symptom of both syndromes, that can be used diagnostically prior to MFR. High quality research is required to identify more accurate diagnostic criteria and best treatment strategies.

Ethics approval and consent to participate

The presented cases were not preplanned as a clinical study. This paper represents reporting of clinical cases suspected & treated as myofascial dysfunction; hence no ethical committee approval was sought. Each case had an explanation regarding possibility of myofascial dysfunction contributing to her Knee pain, and verbal consent were given prior to MFR

List of abbreviations

Knee osteoarthritis (OA)
Musculoskeletal (MSK)
Superficial back line (SBL)
Deep front line (DFL)
Myofascial release (MFR)
Numerical pain rating scale (NRS)
Low back pain (LBP)
Deep front line dysfunction (DFLD)

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper

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Authors' contributions

I.T identified & performed clinical treatments, researched & co-written the article.

O.K researched & edited the article

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