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RESEARCH ARTICLE

EFFECT OF ILIOTIBIAL BAND MYOFASCIAL RELEASE ON FLEXIBILITY AND PATELLAR ALIGNMENT IN PATIENTS WITH KNEE OSTEOARTHRITIS

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Abstract

Background: Knee osteoarthritis (KOA) is a heterogonous disease that addresses specific problems such as iliotibial band (ITB) myofascial trigger points (MTrPs); creating undue joint stress & pain. **Purpose:** The purpose of this study was to investigate the effect of ITB myofascial release (MFR) techniques on its flexibility and on consequent change of patellar mal-alignment in patients with KOA; also pressure-pain threshold (PPT) was assessed as indicator of improvement. **Design and methods:** Parallel group randomized controlled trial; comprising four weeks intervention period. **Subjects:** Thirty-six KOA female patients aging between 50-59 years; were randomly distributed into two groups: *Group A (control):* 17 patients which were treated by exercise program, *Group B (experimental):* 19 patients which were treated by exercise program in addition to ITB MFR techniques. **Intervention:** two MFR techniques were used in combination; the ischemic compression (IC) technique and neuromuscular technique (longitudinal strokes); in addition to an evidence based exercise program. **Outcomes:** ITB flexibility (hip adduction angle) on digital protractor, Lateral Patellar mal-alignment using clinical technique and PPT using Wanger algometer. **Results:** MFR techniques had a significant effect (P-value <0.05) on all evaluated measures; although had insignificant effect when statistically compared to control group regarding ITB flexibility. **Conclusion:** exercise program in combination with ITB, MFR techniques have a significant effect in improving ITB flexibility, Patellar alignment and PPT in patients with KOA.

INTRODUCTION

KOA is a common disease, with a prevalence of 12.5% in populations aged 45 years *(Zhang et al., 2010).* In North Africa, the incidence of KOA is more frequent than that of hip OA *(Guermazi et al., 2004)*; According to the *World Health Organization, (2007)* about 5.5 million people suffer from OA in Egypt, representing about 7% of the population. Also KOA is a very Heterogonous disease resulting in a wide range of clinical presentations and varying rates of progression *(Chapple et al., 2011).*

Sources of pain in KOA could include body mechanics *(Wluka et al., 2006)* such as knee alignment, body mass index, and muscle strength, which influence the magnitude or manner of knee loading. Abnormal mechanics are thought to facilitate degradation of tissues and therefore triggers pain *(Maly et al., 2008).* Wide ranges of periarticular lesions occur around the knee joint, including iliotibial band friction syndrome (ITBFS) *(Vasilevska et al., 2009).*

Degenerative changes in KOA including medial compartment cartilage loss, joint narrowing and tibial plateau collapse leads to increased adduction moment and varus deformity *(Andriacchi and Mundermann, 2006),* altering the relationship of the ITB and the lateral epicondyle with the possibility of an increased friction leading to inflamation of the lower part of ITB near the knee joint *(Vasilevska et al., 2009; 2012).*

ITBFS symptoms include tightness in the ITB which may contribute to lateral patellar mal-alignment and lateral knee pain *(Fredericson and Wolf, 2005; Fairclough et al., 2007)* by pulling the patella laterally, thereby causing abnormal tracking of the patella in the trochlear groove *(McConnell, 1986; Doucette & Goble, 1992; Puniello, 1993; Ekman et al., 1994; Brody &Thein, 1998; Wu and Shih, 2004),* this is augmented by weakened medial soft tissues *(Fox, 1975; Papagelopoulos & Sim, 1997; Powers, 1998).* Also, the tightness of vastus lateralis obliquus, which have an important kinematic effect considering its angle of pull on the patella *(Hallisey et al., 1987)* and its interaction with the ITB *(Merican and Amis, 2008).*
Clinically, patients with medial sided KOA, occasionally also complain of laterally located pain. ITBF is unrecognized cause for lateral knee pain in patients with medial compartment KOA *(Vasilevska et al., 2009).*

Histological studies on the effects of decreased mobility of connective tissue have demonstrated loss of ground substance and water, formation of collagen inter-fiber cross links, haphazard lying down of newly synthesized collagen, and micro-adhesions formed from scar tissue that adheres to adjacent non-traumatized connective tissue *(Donatelli & Owens-Burkhart, 1981; Barlow & Willoughby, 1992).* These fascial restrictions contribute to MTrPs formation which increases the tension in the ITB *(Fredericson et al., 2002);* cause spot tenderness, muscle tightness, and fascial restriction *(Saxen, 1998; Baldry and Thompson, 2005).* These spots are painful on compression and give rise to referred pain which arises from the distal portion of ITB to the lateral aspect of the knee joint *(Fredericson & Weir, 2006),* The distal ITB, MTrPs are about 0-3 cm (mostly 2 cm) proximal to the lateral femoral epicondyle *(Pedowitz, 2005).*These physiological changes may result in restricted tissue mobility, altered neuro-dynamics, limited joint ROM, and ultimately influence function *(Winslow, 2014).*

MFR techniques focuses directly on these restricted myofascial elements, thus release the resulting tightness *(Zaky, 2009).* If the myofascial tightness remains untreated, the normal pain-free function, and smooth muscle contraction cannot be resumed *(Barnes, 1999).* Manual therapy can be used successfully, either as a sole modality or in conjunction with other physical therapy modalities; for the treatment of muscle-fascia disorders *(Kostopoulos and Rizopoulos, 2001; Tuttle, 2005).*

Although recognizing the burning lateral knee pain of ITBFS is not difficult, treating the condition can be a challenge in KOA patients, because there are underlying myofascial restrictions and MTrPs which can significantly contribute to the patient's pain and disability *(Fryer & Hodgson, 2005; Zaky, 2009).* MTrPs are unbelievably commonly overlooked or poorly treated while they are a major cause of a patient's musculoskeletal pain complaint *(Simons, 2002).*

The scientific documentation about MFR approach appears to be limited. There are no reliability studies, the controlled studies are few; 'Experimental evidence does not strongly exist to support the claims of clinical effectiveness for MFR techniques; this presents an obvious need to document the effects of MFR' *(Barnes, 1987; Morton, 1988; Remvig et al., 2008; Strauss et al., 2011).*
To the author's knowledge, there is no published studies have investigated the effect of MFR of ITB in the treatment of KOA. Therefore the main purpose of this current study is to investigate the effect of ITB MFR on hip adduction angle, patellar mal-alignment and PPT of MTrPs in patients with KOA.

MATERIALS AND METHODS

Participants

Thirty-six physically active female patients with tibio-femoral and patello-femoral joint OA were included in this study. They met the clinical criteria for diagnosis of KOA according to American College of Rheumatology *(Altman 1986; 1991).* Also, they had the following criteria prior to participation in the study: Age ranging between 50-59 years, Pain or difficulty in rising from sitting or climbing stairs and Positive Ober& Nobel tests.
Patients were excluded if they have rheumatoid arthritis, physical impairments preventing safe participation in exercise program or manual therapy or walking, such as: vision problems that affect mobility, body weight greater

than 120 kg, neurogenic disorder, back pain, advanced osteoporosis, inability to walk 10 meters without an assistive device, Knee varus deformity > 10^{o} , external tibial rotation, pescavus or any other predominant lower limb deformity that affects knee joint stress.

Randomization and allocation concealment

Study was conducted in the outpatients' clinic of physical therapy faculty, Cairo University. After all baseline criteria have been met, participants were randomized using sealed preset envelopes method; all patients were asked to sign a consent form for ethical issue.

The patients were randomized to: *Group A (control):* consisted of 17 patients which were treated by exercise program designed for KOA. *Group B (experimental):* consists of 19 patients which were treated by the same exercise program in addition to ITB MFR.

Blinding

- Allocation using sealed envelopes, assures blinding of both patient and researcher at admission and in intial evaluation.
- The statistician conducted the statistical analysis was blind to group allocation until the analysis were completed.
- The participants were informed that they are in a "physiotherapy trial group" but were not told which group is the experimental one.

Assessment Measures

- Lateral Patellar mal-alignment using Herrington's method.
- ITB flexibility (hip adduction angle) on digital protractor.
- PPT using Wanger algometer.

Evaluative procedure

- Evaluation procedure were done as a baseline measure after all inclusive measure proved to be positive, before randomization process and at four weeks follow up period. All evaluative measures were recorded from the most affected limb from patient prospective.

1. ***ITB flexibility***

A digital inclinometer (Pro 360 digital protractor) *(fig. 1)* was placed at the midpoint between the anterior-superior iliac spine and the patella, along the longitudinal axis of the lateral aspect of the thigh, to objectively measure IT band flexibility*(Ferber et al., 2010)* while applying the Ober's test to detect the exact adduction angle gained,which is reliable technique to assess ITB flexability (hip adduction angle) *(Reese & Bandy, 2003)*

Figure 1, digital inclinometer in Ober position

2. ***Patellar mal-tracking***

The *Herrington's, (2002)* method *(fig. 2)* was used clinically to determine the lateral patellar mal-tracking. By marking the epicondyles and mid-patellar position on zinc tape and measuring the medial and lateral distance with a flexible tape measure. In normal cases, the distance between the medial / lateral epicondyles and mid patella should be approximately equal.

If the patella is laterally displaced, the distance between the lateral epicondyle to mid patella, is less than the other medial aspect measure. *Herrington's, (2002)* method appears to have good inter-tester reliability and criterion validity *(Smith et al., 2009).*

Figure 2 The Herrington approach for the assessment of medio-lateral patellar position

3. ***Pressure-pain threshold***

Using a mechanical pressure Wanger algometer which has high reliability when measurements are taken the same day *(Chesterson et al., 2007)***,** pressure was increased with a speed (1kg/cm^2*) (Fischer, 1987; Fernández-de-las-Peñas et al., 2006; Gemmell et al., 2008)* steady and perpendicular to the identified MTrPs, subjects were instructed to say "now" when they first began to feel change of pressure to either discomfort or pain. The mean of 3 trials over each point was calculated *(Fryer & Hodgson, 2005; Fernández-de-las-Peñas et al., 2006).* A 10-s resting period was allowed between each trial *(Potter et al., 2006; Ylinen et al., 2007).* PPT recorded from each identified MTrPs whatever its number then a mean is calculated from the most affected side for each patient and this was used in data analysis.

Pressure thresholds lower than 3 kg are considered to be abnormally low *(Fischer, 1996),* it is important to place the tip of the algometer precisely on the MTrP region to avoid any major difference in readings among the consecutive measurements of the same MTrP *(Hong & Simons, 1998).*

Figure 3pressure algometer on MTrPs (final evaluation)

Interventions

Timing protocol

After the patients complete the baseline evaluation; the patient started the treatment program the next day according to patient allocation. Exercise session duration ranged between 20-30 min; each other day for four weeks (12 sessions). MFR has added between 5-20 min to the session duration depending on the targeted number of MTrPs.

This timing was recommended based on *Simons et al., (1999)* who stated that manual methods are more likely to require several treatments and the benefits may not be as fully apparent for a day or two.

Myofascial release technique

The patient is on side lying position to treat the superior limb; which was slightly flexed at both hip and knee to be advanced forward and completely supported on the bed to gain maximum relaxation for effective release *(Simons, 2002).* The adduction gained by positioning and gravity put the muscle in elongated position as emphasized by *Lewit, (1991)* for effective passive release and gently helps the patient relax more completely as recommended by *Simons, (2002).*

A. Ischemic compression technique

This technique consists of applying a relevant pressure by the pad of the therapist's thumb on the skin of the patient for 30 s - 1 min, in order to get 'contact' with the fascia *(fig. 4a)* while putting the TrPs halfway between the fingers (index & middle) *(fig. 4b)* to keep it from sliding to one side during the release *(Alvarez & Rockwell, 2002).* The therapist's thumb remained in contact with the skin overlying the MTrPs for the entire procedure to ensure accurate re-location of pressure for MFR *(Fryer & Hodgson, 2005).*

Patients received MTrPs, MFR technique over each MTrPs that was found. Pressure was released when there was decreased tension in the MTrPs or when the MTrPs was no longer tender or the one minute had elapsed, which ever occurred first *(Simons et al., 1999; Travell & Simons, 1983).* The total time of successive pressures was for five minutes or more (upon each MTrPs) until the release is felt by the therapist's thumb *(Andrade & Clifford, 2001).* This sequence was methodologically similar to a chiropractic technique developed earlier by *Nimmo, (1980).*

B. neuromuscular technique

Patients also received a neuromuscular technique (longitudinal stroke) *(Chaitow, 2010).* The thumb of the therapist was placed over the taut band and longitudinal strokes were applied slowly with moderate pressure which was not painful for the patient *(fig. 4c),* the technique was applied for 3 min as recommended by *Fernández-de-las-Peñas et al., (2006).* This technique has been found to be effective for reducing MTrP pressure sensitivity *(Iba´n˜ez-Garcı´a et al., 2009).*

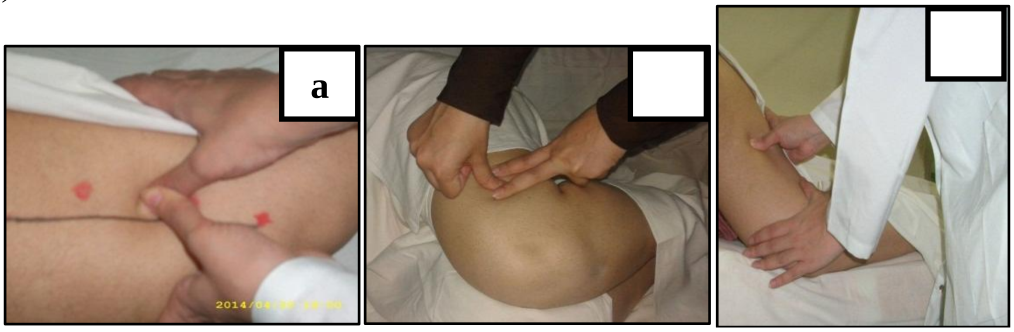

Figure 4 a & b ischemic compression technique c : longitudinal stroke

Exercise Program

We had used a proposed exercise program developed by *Quilty et al., (2003)* and recommended by *Bennell et al., (2005)* and was proved to be effective in improving motor control and function *(Gomaa et al., 2011),* particularly around the hip and pelvis, rather than on lower limb strengthening and aerobic fitness *Bennell et al., (2005),* also showed little increase in quadriceps strength *(Quilty et al., 2003) table (1).*

This exercise program was used to avoid the direct major effect of pure strengthening exercise on either pain or function *(Toppet al., 2002;Thomas et al., 2002)*, strengthening exercise although widely used could have masked the true results of experimental intervention (MFR) already used.

Table 1 brief description of exercise program

Exercise	Holding time	Repetitions	Notes
Buttock squeeze	5 s hold	5 repeats.	contraction of hip adductors
SLR	10 s hold	5 repeats	On each side.
Terminal knee extension	5 s hold	5 repeats.	On each side.
Leg press		5 repeats.	done against the wall,
Half squats		5 repeats	with co-contraction of the gluteus and hip adductors
Step ups		5 repeats	on each leg
Hamstring stretch	15-20 s hold	5 repeats	on each leg
ITB stretch	15-20 s hold	5 repeats.	on each leg
Standing balance		5 repeats	On each leg with a piece of thera-band
Hip abductor strengthening	5 s hold	5 repeats	On each leg

RESULTS

All raw collected data of measured variables were subjected to normality testing using both Kolmogorov-Smirnov statistic, with Lilliefors significance level and Shapiro-Wilkin order to determine the type of statistical analysis. For normally distributed data (pre-treatment and post-treatment), the multivariate ANOVA is used in testing the differences amongst the groups also the pre-post testing for each variable. As for not normally distributed data comparison between two groups was done using Mann-Whitney test. Wilcoxon-signed ranks test was used to compare two consecutive measures in the same group**.**

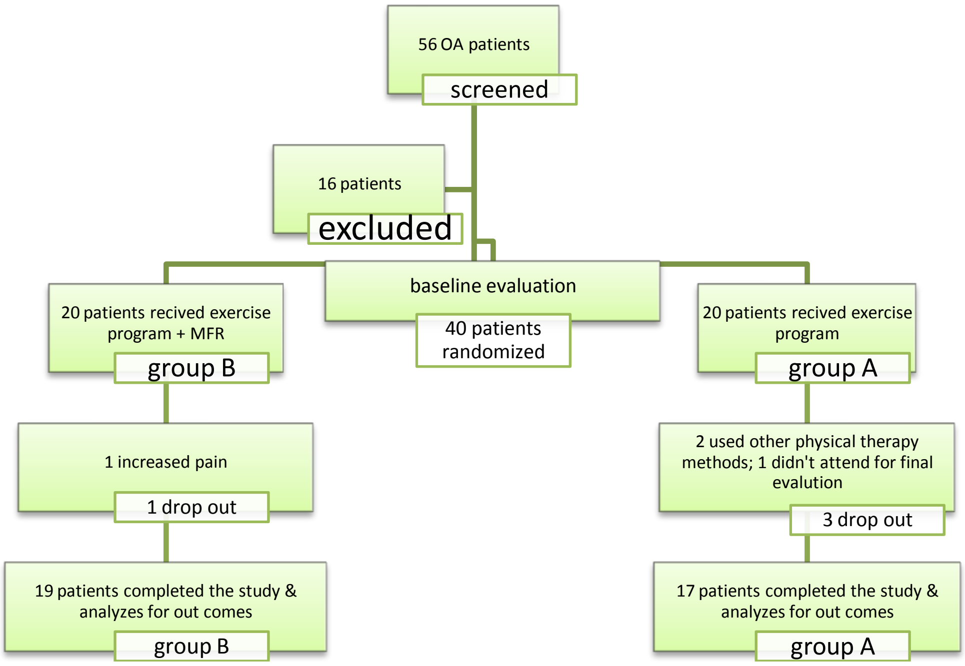

Figure 5 flow diagram

Iliotibial band flexibility

The results for the MANOVA tests showed that there is no significant difference between groups in the post-treatment adduction angle values (F-test = 3.711, p-value = 0.062).

The results of MANOVA tests for control group (A) revealed improvement in adduction angle values by 25.69% increase after treatment but considered statistically not significant (F-test= 0.813; P-value= 0.373); while in experimental group (B) showed highly significant improvement in adduction angle values by 45.35% increase after treatment (F-test= 8.356; P-value= 0.000) as showed in table (2).

Table 2 Results of comparing two groups in adduction angle values

Adduction angle	Pre-treatment		Post-treatment		Pre versus post-treatment			
	CONT. A	EXP. B	CONT. A	EXP. B	CONT. A		EXP. B	
					pre	post	pre	post
Mean ± SD	13.741 ± 3.73	13.474 ± 3.68	17.27 ± 4.44	19.58 ± 2.63	13.741 ± 3.73	17.27 ± 4.44	13.474 ± 3.68	19.58 ± 2.63
Levene's test	F = 0.650 P-value= 0.426		F = 4.045 P-value= 0.054					
Type III Sum of Squares	0.642		48.027		9.391		29.887	
df	1		1		1		1	
Mean Square	0.642		48.027		9.391		29.887	
F-Test	0.047		3.711		0.813		8.356	
p-value	0.830		0.062		0.373		0.000	
% of improvement					↑25.69 %		↑45.35 %	

Patellar mal-alignment

Comparing the median values of patellar mal-alignment values between the two groups pre-treatment using Mann-Whitney test, revealed no significant difference (Mann-Whitney U = 128; p-value= 0.242).

Comparing the median values of patellar mal-alignment values between the two groups post-treatment showed significant improvement (Mann-Whitney U = 58; p-value= 0.000) in favor of experiment group.

Wilcoxon test results of the control group revealed significant improvement in patellar mal-alignment values by 14.89% decrease after treatment (z = -2.333; p-value = 0.020); also the results of the experiment group revealed highly significant improvement by 42.66% decrease after treatment (z = -3.879; p-value= 0.000) as shown in Table (3).

Table 3 Results of comparing two groups in patellar mal-tracking values

Patellar mal-tracking	Pre treatment		Post-treatment		Pre versus post-treatment			
					CONT. A		EXP. B	
	CONT. A	EXP. B	CONT. A	EXP. B	Pre	Post	Pre	Post
Mean ± SD	13.82 ± 3.76	12.36 ± 3.86	11.76 ± 3.03	7.10 ± 3.84	13.82 ± 3.76	11.76 ± 3.03	12.36 ± 3.86	7.10 ± 3.84
Median	0*		5*		15	10	15	5
Minimum – Maximum					5-20	10-20	5-20	0-15
U-value	128		58					
z-value	-1.169		-3.532		-2.333		-3.879	
p-value	0.242		0.000		0.020		0.000	
% of improvement					↓14.89 %		↓42.66%	

***median difference**

Pressure-pain threshold

Comparing the median values of PPT between the two groups pre-treatment using Mann-Whitney test, revealed no significant difference (Mann-Whitney U = 129.5; p-value= 0.315).

Comparing the median values of PPT between the two groups post-treatment showed significant improvement (Mann-Whitney U = 35; p-value= 0.000) in favor of experiment group.

Wilcoxon test results of the control group revealed improvement in PPT by 3.44% increase after treatment which consider not significant (z = -0.447; p-value = 0.655); while the results of the experiment group revealed highly significant improvement by 124.73% increase after treatment (z = -3.527; p-value= 0.000) as shown in Table (4).

Table 4 Results of comparing two groups in PPT

PPT	Pre treatment		Post-treatment		Pre versus post-treatment			
					CONT. A		EXP. B	
	CONT. A	EXP. B	CONT. A	EXP. B	Pre	Post	Pre	Post
Mean ± SD	0.853 ± 0.38	1 ± 0.408	0.882 ± 0.55	2.247 ± 0.86	0.853 ± 0.38	0.882 ± 0.55	1 ± 0.408	2.247 ± 0.86
Median	0*		5*		1	0.5	1	2
Minimum – Maximum					0.5-1	0.5-2	0.5-2	0.2-3.5
U-value	128		58					
z-value	-1.169		-3.532		-0.447		-3.527	
p-value	0.242		0.000		0.655		0.000	
% of improvement					↑3.44 %		↑124.73%	

***median difference**

DISCUSSION

MFR techniques had a significant effect (P-value <0.05) on all evaluated measures; although had insignificant effect when statistically compared to control group regarding ITB flexibility, After 4 weeks of intervention *(3 sessions /week)*, experimental group showed a significant improvement in iliotibial band flexibility, patellar mal-tracking and pressure-pain threshold.While the control group showed a significant improvement only in patellar mal-tracking.
All our patients are females as per the inclusion criteria to avoid the possible confounding effect of gender since estrogen has been associated with OA risk *(Franklin, 2010),* Also other study revealed that leptins increased the risk of OA in women but not in men *(Karvonen-Gutierrez et al., 2012).*

Simons, (2002) suggested that MFR may cause pain reduction and might remove the involved MTrPs by modifying the length of sarcomeres. Some studies indicated that blood supply may be limited in the neighborhood of the palpable MTrPs *(Sikdar et al., 2010).* It seems that MFR could be effective when ischemia and hypoxia are removed from the area. After pressing the MTrPs, ischemia may be created, and when that pressure was released, a sudden increment in local blood flow was inevitable. Consequently, increasing local blood flow may clean out pain-producing substances from the area, and stimulation of pain receptors may be reduced accordingly *(Sarrafzadeh et al., 2012).* Finally, by returning the condition of the area to normal, sarcomeres might be relieved from the short position and pain, and poor blood flow may be decreased or eliminated *(Simons, 2002).*

The improvement in iliotibial band flexibility could be explained by decreased tension in the ITB; As MTrPs cause spot tenderness, increased muscle tightness, and fascial restriction *(Baldry & Thompson, 2005; Fredericson et al., 2002; Saxen, 1998)*.These physiological changes may result in restricted tissue mobility, altered neuro-dynamics, and limited joint ROM *(Winslow, 2014).* The goal of soft tissue mobilization is to rehydrate connective tissue, stimulate the production of ground substance, assist in orienting of collagen fibers, and break micro-adhesions *(Chaitow, 2010; Clements et al., 1999).* The result is improved soft tissue mobility, reduced stress on pain sensitive structures *(Winslow, 2014)* and by consequence increase PPT; just as found in our results.
Although anecdotal evidence suggested that reduction in tenderness frequently occurs during MFR, but it was possible that this occurs due to an unintentional release of pressure by the practitioner; but it was also possible that slight reductions in pressure were caused by the release of tissues in response to treatment *(Fryer & Hodgson, 2005).*

This was farther augmented by several studies as *Shultz et al., (2007)* who revealed that the subjective pain report showed a negative correlation to the PPT evaluation, suggesting that more painful areas could withstand less applied pressure. This is also comparative to a study by *Hong et al, (1997)* who showed significant correlation between pain intensities and the incidence of reproducible pain.
Our results regarding significant increase in PPT about 1.2 kg/cm^2 post-treatment agree with many previous studies as a study by *Gemmellet al.,(2008)* who considered an increase post-treatment on PPT of at least 1 kg/cm^2 was used to indicate a clinically important change. This value was estimated based on previous studies that found a mean

difference on PPT of 0.05 kg/cm^2 between the left and right upper trapezius muscles *(Antonaci et al., 1998)* and a side-to-side difference in another study of 2 kg/cm^2 *(Fischer, 1988)*. In addition, *Ruiz-Saez et al., (2007)* also found an increase of at least 1 kg/cm^2 was associated with a statistically significant effect

The decreased tension in ITB could be also attributed to global muscle relaxation as manual touch stimulates some Ruffini endings which then trigger the central nervous system to change the tonus of some motor units in muscle tissue which is mechanically connected to the tissue under the hand *(Schleip, 2003)*. Deep manual pressure specifically if it is slow or steady stimulates interstitial and Ruffini mechanoreceptors, which results in an increase of vagal activity, which then changes not only local fluid dynamics and tissue metabolism, but also results in global muscle relaxation, as well as a more peaceful mind and less emotional arousal *(Schleip, 2003)*. Myofascial manipulation involves a stimulation of intra-fascial mechanoreceptors. Their stimulation leads to an altered proprioceptive input to the central nervous system, which then results in a changed tonus regulation of motor units associated with this tissue *(Schleip, 2003)*.

Regarding the significant effect of MFR combined with exercise on patellar alignment, *Hernandez-Molina et al., (2008)* mentioned that therapeutic exercise, especially that incorporating specialized supervised exercise training and an element of strengthening, is an efficacious treatment for OA. Although muscle power can be enforced by strengthening exercise, the strength of the vastus medialis does not surpass the traction power provided by the contracted ITB *(Wu & Shih, 2004); Flavey et al., (2010)* state that to be effective in treatment of ITBFS, tension in the muscular component of the band must be reduced with soft-tissue therapies. The gained decrease in ITB tension contributed directly in correcting the lateral patellar mal-alignment.

Although we had used pressure intensity around PPT for each patient, there is still no agreement about the amount of pressure that it is necessary to apply during a pressure technique *(Ferna´ndez de lasPen˜as et al., 2006)*. As clinical experience confirms that slowly sustained stretches are much more effective at releasing MTrPs tightness than rapid brief stretches *(Simons, 2002);* while *Hou et al., (2002)* found that a higher pressure (an average of PPT and pain tolerance) applied for 90 s produced the most significant pain relief; however, significant improvement was also obtained with lower pressure at the PPT level each patient. Some authors' claimed that is unnecessary to apply excessive force which provoke ischemia *(Simons et al., 1999; Lewit, 1991)*. There seems to be no reason to provoke additional ischemia in a point already suffering severe hypoxemia and loss of oxygen *(Hong and Simons, 1998; Mense et al., 2001)*.

Previous studies on MFR were short term studies, although their results were effective this is not applied in clinical practice, our results after relatively long period of treatment (four weeks) supported the short term effect of the previous studies as well as the long term effect of MFR.

Regarding exercise effect in control group; our results supports the large body of evidence demonstrating the beneficial clinical effects of exercise in patients with knee OA, exercise therapy is regarded as the corner-stone of conservative management *(Ettinger et al., 1997;Vogels et al., 2003; Messier et al., 2004)*. Exercise can improve physiological impairments associated with OA including muscle strength, joint range of motion, proprioception, balance and cardiovascular fitness *(Farr et al., 2008; Jan et al., 2008; Lange et al., 2008; Sekir&Gur, 2005)*. Other potential benefits of exercise include improvements in mobility, falls risk, body weight, psychological state and metabolic abnormalities *(Bennell & Hinman, 2011)*.

A recent study by *Sorour et al., (2014)* had a similar study design revealed that Isometric exercise and acupressure provide an improvement of pain, stiffness, and physical function in patients with knee OA, while isometric exercise leads to more improvement of stiffness and physical function, the acupressure acts better on pain; Recommending a combination of both in treatment of OA. This is consistent with our results as the MFR has its most powerful effect on pressure-pain threshold then iliotibial flexibility, then joint mal-alignment.

In our present study, an important consideration revealed in the post treatment was the issue of pain and discomfort created during MFR sessions; but no participants reported adverse effects/discomfort later. Small sample size limits results generalization, also results in wide confidence intervals. We only examined the short-term effects of MFR and Post-treatment follow up was not included.

In the present study the BMI of included patients was high, which may influence knee joint stress as being well documented risk factor of OA *(Lee & Kean, 2012);* and could minimize the effect of MFR. All evaluative measures were taken from the most affected limb although the MFR techniques were applied to both limbs; which also, could mask the true effect of MFR.

Randomized controlled design with control group received hands-on intervention strengthens the evidence of clinical effectiveness which should not be underestimated. Only one researcher applied all measurements pre and post treatment which improved consistency and reliability of measurements. It is unlikely that the results for the MFR could be explained by spontaneous remission or through natural resolution, as it was a requirement of the study for the KOA to have been a chronic stable condition.
Although Myofascial release therapy is effective in reducing pain and improving ROM, according to the author knowledge there are very few literatures supporting this concept.

Conclusion:

Exercise program in combination with ITB MFR techniques have a more significant effect in improving ITB flexibility and Patellar alignment in patients with KOA than exercise program alone.

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