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Adding Deep Front Line Myofascial Release to Exercise Therapy in Knee Osteoarthritis

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Abstract

Background: Knee osteoarthritis (KOA) is one of the most common, chronic and degenerative diseases of the articular cartilage of the knee joint. The clinical presentation include pain, stiffness, swelling, joint deformity and functional impairment, whilst at an advanced stage, muscular atrophy may also occur, which decreases patient quality of life. Physical therapy intervention in form of (exercise, stretching, myofascial release, braces and assistive devices), acupuncture and Tai chi. One of the causes of pain in KOA originates from the myofascial trigger points (MTrPs) located in the surrounding muscles.

Aim of Study: To investigate the effect of adding deep front line myofascial release to selected exercises in decreasing pain, improving ROM and function on patients of KOA.

Patients and Method: 42 patients with mild to moderate KOA were recruited and randomly assigned into 2 groups. The control group received selective exercises of stretching and strengthening. The study group received myofascial release with instrumental assisted soft tissue technique to the deep front line in addition to the same exercises. Each group received 3 sessions per week into four consecutive weeks.

Results: There was a significant improvement in VAS, WOMAC and ROM post treatment in both groups compared with that pretreatment ($p>0.001$). Post treatment between group comparison revealed a significant improvement of VAS, WOMAC and knee flexion ROM of study group in favour of control group ($p<0.05$). While was no significant difference in extension ROM between groups post treatment ($p>0.05$).

Conclusion: Adding the deep line myofascial release to exercises has a superior result than using exercises alone in patients with KOA.

Key Words: Knee osteoarthritis — Myofascial release — Deep front line.

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Introduction

KNEE osteoarthritis (OA) is epidemiologically affects older people, especially women. It is pathologically characterized by gradual degeneration and loss of articular cartilage are observed during osteophytes development, inflammation of the synovial membrane and destruction of the hypochondriac bone. The clinical presentation include pain, stiffness, swelling, joint deformity and functional impairment, whilst at an advanced stage, muscular atrophy and tightness may also occur, which decrease patient quality of life by limiting movement capability, the prevalence of KOA has dramatically risen in recent decades [1]. The treatments of KOA can be divided into pharmacological treatment (like NSAIDs, cortico-steroid injection, Acetaminophen, glucosamine) and non-pharmacological treatments in form of Patient education, weight loss (for those who are obese), physical therapy intervention in form of (exercise, stretching, myofascial release, braces and assistive devices), acupuncture and tai chi [1]. Myofascial release technique is widely used as a treatment tool to ROM and flexibility. The mechanical stress during myofascial release maneuvers (MRM) generates pressure and frictional heating that can promote structural changes in the fascia, which can improve ROM, pain and function [2]. The myofascial lines release is considered an effective MRM. It is like releasing hamstring muscle which is part of the superficial back line to increase flexibility and ROM of cervical region.The deep front line is one of the myofascial lines that support the medial aspect of the body. It starts from the flexor group of foot and tipialis posterior muscles. In this line the tibialis posterior is connected to the adductors which are connected to the knee capsule [3]. According to this continuity any increased tension or tightness of these muscles or any muscle of this line may induce restriction and pain of the crossing joints like knee joint [3].

Aim of the Work:

To determine the effect of adding deep front line myofascial release to selected exercises on pain, ROM and function in patients with knee OA.

Method:

Study design: Double-blinded randomized clinical study (research assistant for assessment of patients and patients was blinded about the treatment group).

Patients: 42 patients of mild to moderate unilateral or bilateral (the primary knee was assessed) tibiofemoral OA grade II-III (K/L) was referred by the orthopedist who diagnosed knee OA based on clinical and radiological examination. After the explanation of the study and the procedure, all patients signed an informed consent before starting the study.

Inclusion criteria:

Mild to moderate unilateral or bilateral medial tibiofemoral primary OA grade II-III (K/L) **[4].** The age of the patients was ranged from 45 to 60 years old [5]. BMI was ranged from 18.5-29.9kg/m^2 [6].

Exclusion criteria:

Severe knee OA (grade IV according to K/L classification). Congenital or acquired inflammatory, rheumatic or neurological (systemic or local) diseases involving the knee **[4].** Patients was receiving oral or corticosteroids injection for the last 3 months Patients with ACL and meniscus injury **m.** History of knee surgery/fracture **[8].**

Patients and Methods

After including patients in the study, they were randomly assigned into 2 groups using random generator link (http://www.graphpad.com/quickcalcs/randomize)/) into two groups. It was conducted at the out-patient clinics of Cairo University hospitals (El-Kasr El-Ainy). From January, 2023 to May, 2023. Prior to data collection the study was approved by ethical committee of scientific research of Faculty of Physical Therapy, Cairo university (NO: P.T.REC/012/004281).

The control group received exercise program in form of stretching and strengthening, and treatment group received the myofascial release of the deep line in addition to the same exercise program of the control.

Assessment instrumentation:

Digital inclinometer: (digital inclinometer, 82201b-00 INSPEC, China) For ROM assessment.

Scales:

The visual analog scale (VAS) for pain assessment.

The Arabic version of reduced Western Ontario and McMasters University Osteoarthritis Index (Ar-WOMAC) index **[9].**

Assessment procedures:

All Patients were evaluated (before and after treatment).

Pain severity: Patients recorded pain intensity on a 100 mm VAS by drawing a vertical line on the horizontally positioned VAS. The left end of the VAS represented 'no pain' and the right end 'most severe pain imaginable' with no intermediate divisions or descriptive terms [in

Functional assessment:

The Arabic version of reduced WOMAC (Ar-WOMAC) index is used in the evaluation of knee OA. It is a reliable and valid scale to measure lower limb functional disability in patients with knee OA. It is a self-administered questionnaire consisting of 24 items divided into 3 subscales, each scale ranked from 0 to 4 [9].

ROM assessment: Patient was in prone position with the foot is outside plinth. The digital inclinometer was placed on lateral aspect of affected knee. From a starting position of 90° flexion, the patient moved the leg away from thigh to measure extension ROM. From maximum extension, the patient moved the leg toward thigh to measure flexion ROM. Each range of flexion and extention was recorded 3 times and the mean average was taken. The device was attached to the lower limb by a double-sided adhesive stick [11].

Treatment procedure:

A- *Control group:*

Exercise program:

All the patients received 12 sessions (3 times/week for 4 consecutive weeks).

Stretching exercise: It Stretch was applied in form of 30 second stretch and 30 second relaxation and repeated 3 times. The stretching was applied to the followingcalf muscle from supine position one of the therapist hand stabilizing knee into extension and the other hand applying stretch by moving ankle into dorsi flexion. Hamstring muscle done from side lying positon the affected leg was the lower most and the other one fixed by the therapist into extension and the stretch applied by the therapist body by moving the lower leg into extension knee flexion hip.

Strengthening exercise: It was applied in form of 3 sets every set 10 repetitions to the following: Quadriceps multiple angle isometrics at 30,60.90 degrees, patient was sitting with weights above ankle, each angle reached maintained 5 seconds hold. Gluteus Medias from clam shell position, where patient was side lying and asked to raise the affected

leg upward. Gluteus Maximus from half prone position with fixing the patient pelvic and moving the affected into extension with flexed knee. Calf muscle using thera band which was on planter surfaces as a resistance.

B- *Experimental group:*

They received the exercise treatment plus a 10-minute treatment of myofascial release of the deep front line myofascial release by Ergon technique. The muscles to be released from the deep front line were the tibialis posterior at the medial lower tibia behind the medial malleolus and adductor muscles at the medial compartment of thigh. The patient was side lying and gentle strokes are applied on the targeted muscles (the adductor muscles and tibialis posterior muscle).

Data analysis:

Statistical analysis:

Unpaired t-test was conducted for comparison of subject characteristics between groups. Chi squared test was conducted for comparison of sex distribution between groups. Normal distribution of data was checked using the Shapiro-Wilk test. Levene's test for homogeneity of variances was conducted to test the homogeneity between groups. Mixed MANOVA was conducted to investigate the effect of treatment on VAS, WOMAC and knee ROM. Post-hoc tests using the Bonferroni correction were carried out for subsequent multiple comparison. The level of significance for all statistical tests was set at $p<0.05$. All statistical analysis was conducted through the statistical package for social studies (SPSS) version 25 for windows (IBM SPSS, Chicago, IL, USA).

Results

Subject characteristics:

Table (1) showed the subject characteristics of study and control groups. There was no significant difference between groups in age, weight, height, BMI and sex distribution ($p>0.05$).

Effect of treatment VAS, WOMAC and knee ROM:

Mixed MANOVA revealed a significant interaction effect of treatment and time ($F=19.56$, $p=0.001$). There was a significant main effect time ($F=88.07$, $p=0.001$). There was a significant main effect of treatment ($F=6.98$, $p=0.001$).

Within group comparison:

There was a significant decrease in VAS, and WOMAC post treatment in both groups compared with that pretreatment ($p>0.001$). The percent of decrease in VAS and WOMAC of study group was 67.77, 65.78 and 64.58% respectively and that in control group was 28.05, 16.78 and 30.69% respectively. (Table 2).

There was a significant increase in knee flexion and extension in study group ($p<0.001$) and control group ($p<0.05$) post treatment compared with that pretreatment. The percent of increase in flexion and extension ROM of study group was 22.75 and 1.56% respectively and that in control group was 10.62 and 1.03% respectively. (Table 3).

Between group comparison:

There was no significant difference between groups pre treatment ($p>0.05$). Comparison between groups post treatment revealed a significant decrease in VAS and WOMAC of study group compared with that of control group ($p<0.05$). (Table 2).

There was a significant increase in flexion ROM of study group compared with that of control group ($p<0.001$) while was no significant difference in extension ROM between groups post treatment ($p>0.05$). (Table 3).

Table (1): Comparison of subject characteristics between the study and control groups.

	Study group	Control group	MD	*t*-value	*P*-value
	Mean ± SD	Mean ± SD			
Age (years)	51.90±3.89	50.67±4.66	1.23	0.93	0.35
Weight (kg)	79.09±1033	81±9.63	—1.91	—0.61	0.54
Height (cm)	173.76±9.52	173.09±726	0.67	0 *25*	0.80
BMI (kg/m^2)	26.15±224	26.96±1.99	—0.81	—124	0.22
Sex, N (%):					
Females	13 (62%)	16 (76%)		(x2=1.002)	0.31
Males	8 (38%)	5 (24%)			

SD : Standard deviation. x2: Chi squared value.
MD: Mean difference. p-value: Probability value.

Table (2): Mean VAS and WOMAC pre and post treatment of study and control groups.

	Pre treatment	Post treatment	MD	% of change	value
	Mean ± SD	Mean ± SD			
VAS:					
Study group	6.33±1.49	2.04±1.43	4.29	67.77	0.001
Control group	6.81±1.24	4.90±1.37	1.91	28.05	0.001
MD	—0.48	—2.86			
	pC1.26	p1:1.001			
WOMAC:					
Study group	54.67±11.79	18.71±4.52	35.96	65.78	0.001
Control group	51.67±8.74	43±6.91	8.67	16.78	0.001
MD	3	—24.29			
	p1:1.35	pC1.001			

SD : Standard deviation. MD: Mean difference. p-value: Probability value.

Table (3): Mean flexion and extension ROM pre and post treatment of study and control groups.

ROM (degrees)	Pre treatment	Post treatment	MD	% of change	value
	Mean ± SD	Mean ± SD			
Flexion:					
Study group	94.92±17.86	116.51±9.36	—21.59	22.75	0.001
Control group	93.65±15.84	103.60±13.22	—9.95	10.62	0.006
MD	1.27	12.91			
	p1:1.81	p1:1.001			
Extension:					
Study group	88.52±2.13	89.90±0.43	—1.38	1.56	0.001
Control group	88.71±2.17	89.62±0.80	—0.91	1.03	0.02
MD	—0.19	0.28			
	p1:1.77	pC1.16			

SD : Standard deviation. MD: Mean difference. p-value: Probability value.

Discussion

The result of this study revealed that both the control and experimental groups showed significant improvement in all out comes measured. While in between groups comparison the experimental group was superior to the control in all the measured outcomes except in extention which wasn't significantly different.

Referring to references, the current study comes into line with Farzana et al., **[12]** the study reveals Myofascial release combined with conventional care is more effective than conventional care alone for patients with KOA. When applied a 12 sessions of treatment over 4 weeks. They found that both groups had significant outcomes compared to baseline ($p<.05$) in pain, disability, ROM, and muscle strength except for the hamstring. The experimental group's outcome was superior to the conventional group in all outcome measures ($p<.05$).

Do-Hyun Kim et al., **[13]** also compared the effects of Graston and self-myofascial release techniques on knee joint flexibility, hamstring, and quadriceps strength. They found that: 1) The ROM of the knee joint and quadriceps muscle strength were significantly increased in both groups. 2) Hamstring muscle strength was significantly reduced in both groups. 3) There were no significant differences between the Graston group and self-myofascial release group for any variable.

Durga et al., (2018) **[14]** found that hamstring flexibility was significantly increased in response to remote release of the plantar fascia and sub occipital muscles as a part of the superficial back line, static stretching alone or as a combination of the tow techniques when applied on Fifty-eight asymptomatic participants for seven sessions of therapist administered intervention were delivered over a period of 10 days, which was followed by a 2-week self-administered home program.

Pedrelli et al., **[15]** showed that in the quadriceps of subjects with anterior knee pain, Fascial Manipulation was effective in reducing pain and enhancing muscle activation patterns in functional tasks.

Kuruma et al., **[16]** studied effects of myofascial release and stretching technique on ROM and reaction time, concluded that Myofascial release

(MFR), has been identified in increasing quadriceps and hamstrings ROM as well as it eases the movements of the knee joint.

The myofascial release maneuver was effective in improving pain, ROM and function as it increasing muscles flexibility so improving ROM, reliving the trigger points withen the muscles so reliving pain which in response improving function of the knee.

The extension ROM was significantly improved in bothe groups but in between it wasn't that's because in the collected sample the limitation in extension wasn't sever enough to contrast the effect difference as many patients of the study and control groups weren't have limitations in extension ROM.

In contrast, Johnny et al., **[17]** reported in a study done to investigate the effect MFR and exercise for the popliteus muscle regarding pain, function and health related quality of life in people suffering from KOA, that There were not any concordant results for any of the outcome measurements even though each participant had positive changes in one or more of the different measurements mainly regarding pain, function in daily living or quality of life. But the result of this study cannot be generalized as it was done on only 4 patient which is considered very small sample.

In another study done by Harish & Kashif, **[18]** reported that the comparison of Maitland mobilization and MFR technique in reducing pain level and increasing the ROM in knee OA patients. They observed a significant improvement in the patients' ROM and pain level after the treatments, but no significant difference between treatment options.

Ethical clearance:

Ethical clearance has obtained from the ethical committee of scientific research of the faculty of Physical Therapy, Cairo University (No: P.T.REC/012/004281).

Conflict of interest:

There was no conflict of interest to conduct this study.

Conclusion: Adding the deep line myofascial release to exercises has a superior result than using exercises alone in patients with KOA.

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إضافة الإفراج العضلى للخط الأمامى العميق فى حالات الالتهاب العظمى المفصلى للركبة

تعتبر الالتهاب العظمى المفصلى للركبه من أكثر الامراض المزمنه التى توثر على الغضاريف الموجوده بالجسم. يعانى مرضي خشونه الركبه من آلام بالمفاصل وتيبس بالمفاصل مما يؤدى إلى التأثير على الجانب الوظيفى لمفصل الركبه سبب من أسباب الالم بالركبه هو وجود قصر فى العضلات التى تحيط بالمفاصل لذلك كان العرض من الدراسه هو دراسه تأثير إضافه الإفراج العضليى الليفى للخط العميق الامامى إلى بعض من التمارين المختاره على تقليل الالم وزياده مدى الحركه والتحسن الوظيفى والحساسيه لوضعيه المفصل فى حالات الاتهاب العظمى المفصلى للركبه. شارك فى الدراسه ٤٢ مريض. تتروح حالاتهم من بسيطه إلى متوسطه الشده وتم توزيعم عشوائياً وتم توزيعهم إلى فريقين. الفريق المحايد استقبل علاجاً فى صورة تمارين علاجية فى صورة استطاله للعضلات القصيره وتقويه للعضلات الضعيفه حول الركبه واستقبل فريق الدراسه إفراج عضلى ليفى للخط الأمامى العميق بالإضافة إلى التمارين العلاجيه المختاره استقبل كل فريق ٣ جلسات لمده أربعه أسابيع متتالية وكانت النتائج للدراسه هو وجود تحسن واضح لكلا الفريقين فى تخفيف حده الالم وزياده المدى الحركه وتحسن الجانب الوظيفى. نستخلص من ذلك أن إضافه الإفراج العضلى للخط الأمامى العميق بالإضافة إلى التمارين العلاجيه أفضل من استخدام التمارين العلاجيه منفرده فى حالات الالتهاب العظمى المفصلى للركبه.