Therapeutic efficacy of myofascial trigger point therapy in patients with bilateral knee osteoarthritis: A Randomized clinical trial

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Abstract: Knee osteoarthritis (OA) is one of the most common causes of disability in the older. Myofascial pain and dysfunction is partly responsible for pain and disability in this condition. This study investigated the efficacy of myofascial trigger point therapy on knee OA. In randomized clinical trial, 60 patients with bilateral knee osteoarthritis were divided into two 30 persons groups. Thirty patients were received 16 sessions of usual physical therapy. In addition to physical therapy, intervention group were received myofascial trigger points. Assessed Variables included pain, joint stiffness, physical function, range of motion of the knee and physical performance. There were no significant differences in assessed variables between two groups before treatment, statistically. After treatment, the above variables compared with the pre-treatment results of same group and then with the post-treatment results of the other group. Except for physical performance which was not significantly differing in control group, both groups demonstrated improvement in all variables after treatment. However, comparing the two groups revealed that all variables in intervention group are better than control one except for joint range of motion. Physical therapy is an effective approach for treatment of osteoarthritis of the knee. This effectiveness can be enhanced by adding the treatment of myofascial pain and dysfunction syndrome.

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1. Introduction

Osteoarthritis (OA) is the most common rheumatic diseases and the knee is one of the most common joints affected. Pain, stiffness and limited range of motion of the joint lead to reduced physical performance or activities, loss of employment and sometimes impairment of activities of daily living (Guzman, 2007; Bedson et al., 2005). Therefore, a comprehensive treatment approach is required for management of knee osteoarthritis. On the other hand, recent studies have claimed that there is a probable cause - effect relationship between osteoarthritis and myofascial pain syndrome (Bajaj et al., 2001). In fact, pain and physical dysfunction of knee osteoarthritis are partly due to myofascial pain or dysfunctions.

Myofascial pain or dysfunctions called myofascial pain and dysfunction syndrome is local pain or dysfunction syndromes characterized with presence of a palpable taut band within a skeletal muscle, presence of a hypersensitive spot within the taut band, reproduction of a referred pain sensation with stimulation of the spot and presence of a local twitch response with snapping palpation of the taut band. Pain on motion or limitation of motion and weakness in the muscles around the joint may be present, too (Mense et al., 2001; Cummings and Baldry, 2007).

Researchers have claimed that knee osteoarthritis is one of the predisposing causes of this syndrome in the muscles around the knee. On the other hand, myofascial pain and dysfunction with resultants limitation of joint motion and muscle imbalance around the joint can lead to joint degeneration or exacerbate the pain and accelerate the process of joint degeneration. A large number of trigger points in muscles around the joint with specific patterns of referred pain areas have been claimed (Bajaj et al., 2001).

Lifestyle modification, use of analgesic or non-steroidal anti-inflammatory medications, rehabilitation interventions, such as, use of physical modalities, therapeutic exercises, manual and mechanical therapies, prescription of orthoses and manipulation aids are recommended approach for management of people with knee osteoarthritis. Intra-articular injections and surgical procedures may also be necessary (Guzman, 2007). Also, it has been shown that treatment and correction of myofascial pain and dysfunction are effective in controlling symptoms of knee OA and improving joint function (Mense et al., 2001). A variety of treatment approaches are mentioned in this context (physical therapy, mechanical pressure on trigger points, stretching the muscles and myofascial release. Thus, it is thought that myofascial therapies would be helpful in the management of knee osteoarthritis (Mense et al., 2001).

This study examines the impact of treatment of trigger points of myofascial and dysfunction in patients with knee osteoarthritis.

2. Methods and Materials

A randomized controlled clinical trial with blinded outcomes assessment was conducted among patients with bilateral knee osteoarthritis referred to physiotherapy center of Tabriz Imam Reza Hospital, Iran.

2.1. Sample size

Participants were recruited among the patients referred to the physiotherapy center because of bilateral knee osteoarthritis. Thirty patients were allocated to control group and 30 patients were enrolled in the intervention group (sixty knees in each group.

2.2. Patients

Clinical and radiographic diagnostic criteria of America College of Rheumatology for the classification and reporting of osteoarthritis of the knee (Knee pain plus osteophytes, plus at least 1 of the following 3 criteria: age >50 years; stiffness <30 minutes; crepitus) was used for selection of patients with knee osteoarthritis. Myofascial trigger point features for diagnosis of coexistent myofascial pain and dysfunction in patients with knee osteoarthritis were taut band, twitch response, weakness without atrophy, localized pain with or without tenderness in insertion or origin of tendons, ligaments and joint capsules on bones around knee and referred pain (Mense et al., 2001).

The inclusion criteria were age of 50 years or older, diagnosis of bilateral knee osteoarthritis, and myofascial pain and dysfunction. Patients with other rheumatic diseases such as rheumatoid arthritis or systemic lupus erythematosus, history of surgery or fractures in lower limbs, severe disability such as walking disability with or without crutches, contraindications for physical modalities, intra-articular corticosteroids injection in the last 6 months, unilateral osteoarthritis and patients who were unable to cooperate were excluded from the study.

After obtaining written informed consent from all participants, a computerized randomization schedule, in blocks of 30, was generated. Participants were randomized to 1 of 2 blocks (groups): control group or intervention group.

The study project manager, who remained blind to participants' group allocation, carried out all outcomes assessments. Assessments were conducted at baseline (pretreatment) and at the sixteenth Session of physical therapy and/or intervention (post-treatment). The results were extracted, compared and analyzed by statistician. Finally, the study project manager was informed of the study results.

The control group was received conventional physical therapy for 16 sessions by a trained physiotherapist. In addition to the conventional physical therapy, intervention group was received myofascial therapy by the same physiotherapist. During this period, patients in both groups received the acetaminophen 1,500 mg per day.

In conventional physiotherapy, patients were receiving physical modalities for 15-20 minutes. The hot pack was used as surface heating modality and the transcutaneous electrical nerve stimulation (TENS) with high frequency (More than 60Hz) as pain modification modality in painful parts of knee. These modalities were usually applied in the knees, simultaneously. Ultrasonic waves (Ultrasound) with a 3 MHz probe was applied as deep heat modality for 5 minutes in per 10 square cm area around the knee (patellar edges, articular lines, and popliteal fossa), tendons and painful or tight and/or shortened muscles. The non-thermal properties of ultrasound were also considered. In the first two sessions, patients were taught on how to modify lifestyle and work in order to maintain energy and take care of their joints. Then, regarding the patients' knee condition, the instructions were given on range of motion exercises and stretching and/or strengthening exercises for hamstring and calf muscles, quadriceps, hip adductors and iliotibial band. After ensuring that the patients were learned, they were advised to perform these exercises, 30 repetitions a day over 3 sets. The patients were regularly questioned on compliance with these trainings and exercises.

In the intervention group, physiotherapy interventions were same as control group. In addition, patients of this group were treated for associated myofascial pain and dysfunction (Mense et al., 2001). There are many treatment approaches in this field such as physical therapies, applying mechanical pressure on trigger points, stretching of tight muscles and myofascial release. However, to minimize interventions, save the time or self performing options, we choice just spray-stretching technique and massage therapies. After physiotherapy, the tight muscles around the knees were treated with spray-stretching technique. In this study, we used LP cold spray which was available in the market. For this, lower limbs of the patients were examined with detail. Location of trigger points in muscles and insertions around the knee was determined (quadriceps, hip adductors, iliotibial band and tensor fasciolata, hamstring and calf muscles). For spray– stretching, the involved muscles were placed in stretch position and cold spray was obliquely sprayed from the trigger points to referred pain in parallel with muscle fiber. In this situation, a constant stretch was applied to compensate the reduced range of motion. Due to chronicity of disease with multiple trigger points in the most muscles around the knee and regarding results of patient assessments in each session, spraying – stretching method was applied in alternate in all the muscles around the knees (Simons and Travell, 1999). This was repeated 2- 3 times per session for in each selected muscles group. Then, after performing range of motion exercises, hot packs were used for 10 minutes. In addition to the spray technique-stretch technique, friction massage were given to all trigger points in muscles around the knee, the patellar and articular medial and lateral lines of the knee joint for 2 minutes. Pressure during massage can cause a mild and tolerable discomfort in the area but after a massage or a maximum of 15 to 20 minutes later, the discomfort was completely resolved. The method was taught to patients to massage each region containing the trigger points for 2 minutes, two times per day, too.

2.3. Investigated outcomes

The primary outcome measures were pain, stiffness of joints and physical disability measured by Western Ontario and McMaster University Osteoarthritis Index (WOMAC). This questionnaire evaluates 24 different parameters about pain, stiffness, and functional problems (disability) and is an important one in pharmacologic or rehabilitation interventions in patients with osteoarthritis of the knee. It is a valid questionnaire for assessments of therapeutic results of interventions used for knee osteoarthritis (Guzman, 2007; Bellamy et al., 1988). This questionnaire was also used, domestically (Noushin et al., 2006). In this questionnaire, the pain of knee was scored for right or left knee, separately. For convenience, the patients were questioned on their pain, stiffness, dysfunction (disability) in following descriptors for all items: none, mild moderate, severe, and extreme. These correspond to an ordinal scale of 0-4.

This questionnaire was rated from 0 to 116 that high score means more joint pain and stiffness, severe physical disability (20 scores for pain each knee, 8 scores for stiffness and 68 scores for physical disability).

Secondary outcomes include range of knee motion (ROM) and physical performance. Range of motion was measured with Goniometer, according a system of measurement based on 0 to 180 degrees proposed by the American Academy of Orthopedic Surgeons. In this system, anatomical position is considered to be zero (extended knee) and up to 180 degrees for knee flexion.

For this purpose, the patient was simply lying prone and the knee range of motion was measured in flexion and extension, actively three times. The mean knee range of motion was recorded for each patient.

Timed Up and GO (TUG) test was used for assessment of physical performance of the patients. This test measures, in seconds, the time taken by an individual to stand up from a standard arm chair, walk a distance of 3 meters, turn, walk back to the chair, and sit down again. This test was repeated three times and the mean was recorded for each patients.

2.4. Ethical considerations

Patients signed a written consent and no additional financial cost to the patient and his companions was imposed.

2.5. Statistical analysis

All the results were expressed as mean ± SD and frequency distribution. Chi-Square and Fisher's Exact Tests were used to examine the frequency distribution of the results and Repeated Measures ANOVA was used for quantitative comparison between the two groups. Kolmogorov-Smirnov test was used for assessment normality of the results. MANOVA test was used for assessment of the effects of intermediate and confounding variables. A P-value of < 0.05 was considered statistically significant. The statistical analyses were conducted using the SPSS 15.0 for Windows (version 15.0).

3. Results

No subjects dropped out during the study, and no adverse effects were detected after the application of the treatment. That is, all sixty patients entered into the intervention and control groups continued the full course of treatment. In control group, 80% (n = 24) patients were female and 20% (6 cases) male. In the intervention group, 83.3% of patients (25 patients) were female and 16.7% (5 patients) male. No significant differences for sex (P = 0.793) or age (P = 0.793) were noted. The mean of age of control and intervention groups were 59.13 ± 0.30 and 56 ± 5.44, respectively. There was no significant differences statistically between the groups for age (P = 0.676), too. Average Index Body Mass (BMI) of control group was 28.10±3.1 and of intervention group was 29.16 ± 3.5 kg per square meter (P = 0.713).

3.1. Primary outcomes (WOMAC)

There were no significant differences between the groups for right and left knee pain intensity (P = 0.832 and P = 0.555, respectively), for joint stiffness (P= 0.404) and for physical disability (P = 0.713) at baseline (Table 1).

Posttreatment, significant improvement (Tab 1, figures 1, 2 and 3) were evident in pain for both control group and intervention group ((P<0.001 in right knee in both groups, P <0.004 in left knee in control and P <0.004 in left knee in intervention group). However, the intervention group results were more improvement in pain scores than control one (P<0.0001 for right knee pain and P<0.01 for left knee pain).

Significant improvement in joint stiffness scores (Tab 1 and figure 2) was noted in both groups (P < 0.001 in both groups). Again, this improvement in intervention group was more than control group (P< 0.001). Disability indices were improved in both groups (P< 0.001 in both groups). Improvement of the disability indices in the intervention group was significant compared with control group (P=0.022). Again, the difference in this index in intervention group was significantly more than the control group.

3.2. Secondary outcomes (ROM and TUG)

There was no significant differences between the intervention and control group for range of motion of the right and left knees (P= 0.652 and P= 0.991, respectively) at the baseline.

Post treatment, range of motion of the knees in both two groups were increased (P=0.003 in right knee and P<0.001 in left knee of the control group and P <0.001 in both knees of the intervention group). Although the improvement of the range of motion of the knees in the intervention group was more than the control group, no significant statistic differences were noted between the intervention group and control group (P= 0.322 and P= 0.226 in the right and left knee, respectively).

Before treatment, time of walking in the TUG test in control and intervention groups (Table 1) had no statistically significant difference (P = 0.878). This time, after treatment in the control group was lower than pre-treatment but was not statistically significant (P value= 0.47). However, this time had a significant reduction in the intervention group (P <0.001). This reduction in the intervention group was statistically significant (P<0.03).

Table 1: Comparison of variables between two groups before and after the treatment

variables	Intervention (M±SD)			Control (M±SD)			P-value between two groups	
	Pretreatment	Post treatment	P-value	Pretreatment	Post treatment	P-value	Pretreatment	Post treatment
Pain in right knee	12.70±2.87	7.50±3.24	<0.001	12.53±3.17	10.43±3.20	<0.001	0.832	<0.001
Pain in left knee	12.26±3.75	6.76±3.53	<0.001	11.70±3.64	9.06±3.18	0.004	0.555	0.10
Stiffness in both knees	5.60±1.27	3.06±1.28	<0.001	5.90±1.18	4.63±1.15	<0.001	0.404	<0.001
Physical disability	40.70±7.26	32.46±7.89	<0.001	41.20±7.54	37.20±7.67	<0.001	0.795	0.022
Right range of motion	112.50±12.57	118.50±9.75	<0.001	111.00±13.2	115.93±10.15	0.003	0.652	0.322
left range of motion	109.83±11.17	118.33±11.47	<0.001	109.83±12.62	114.66±11.37	<0.001	0.991	0.226
Physical performance	14.13±2.63	11.86±2.55	<0.001	14.26±3.75	12.86±3.44	0.47	0.874	0.030

Pain, stiffness and physical disability is based on the rating WOMAC, range of motion on the rating degree and physical performance in terms of seconds in the TUG

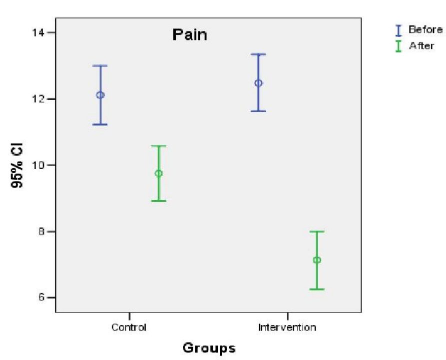

Figure 1: The pain intensity in control and intervention groups before and after treatment in right knee

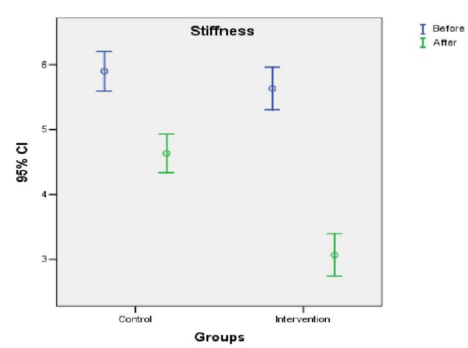

Figure 2: The joint stiffness in control and intervention groups before and after treatment

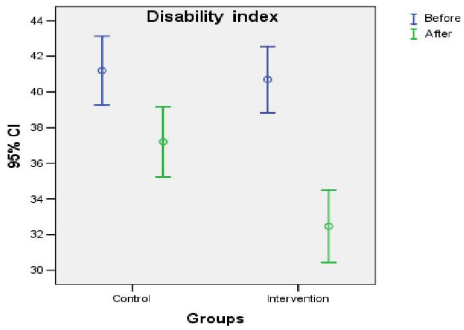

Figure 3: Changes in the disability index in control and intervention groups before and after treatment

4. Discussion

There is a complex interrelationship between joint dysfunction (e.g., knee osteoarthritis) and myofascial trigger points. Myofascial pain and dysfunction are often developed in patients with primary osteoarthritis of the knee and if not treated, with creation imbalance of muscles that control joint movement would intensify the primary dysfunction of that joint (Bajaj et al., 2001; Ingber, 1999). Thus, treatment of the myofascial trigger points in muscles surrounding the joint would be effective in control of the primary joint disturbance and disabilities that would occurred.

This study shows that physical therapy in patients with bilateral knee osteoarthritis can improve joint function. Adding, the myofascial pain and dysfunction treatment intensifies the effects of physical therapy. Except for physical performance, physical therapies result in significant improvement in all assessed outcomes (pain, stiffness, joint range of motion and disability). Except for range of motion, improvements in the intervention group were more than the control group (Wikkins and Philips, 2008; Deyle et al., 2000; Fransen et al., 2007; Perlman et al., 2006).

Overall, this study agreed with the studies claimed that the physical therapy can improve joint pain scores, joint stiffness scores, joint function and physical disabilities occurred. Other studies revealed that treatments of the myofascial pain and dysfunction are useful in patients with musculoskeletal conditions and knee osteoarthritis (Yentür et al., 2003; Hains, 2002; Itoh et al., 2008; Puett and Griffin, 1994).

The effectiveness of physical modalities in improving symptoms of osteoarthritis and other musculoskeletal conditions have been reviewed in several studies.

In a study conducted by Puett and colleagues, pain scores were improved with TENS (Puett and Griffin, 1994). In several studies, superficial heat (hot packs) and deep heat (ultrasound) modalities that reduce pain intensity and improve joint stiffness and range of motion have been used for the treatment of osteoarthritis (Puett and Griffin, 1994).

In our study, pain intensity was reduced in both groups. To some extent, this can be attributed to the effects of the TENS and physical modalities.

Limitation of range of motion is a potential complication of the knee osteoarthritis that is probably due to changes occurred in the cartilage tissue or shortening of muscle and tendon (Wrightson and Malanga, 2001). The effectiveness of the ultrasound to improve the range of motion with influence on the collagen of muscle and tendons has been shown (Basford, 2005). Post treatment, joint range of motion was improved in both groups.

Myofascial pain syndrome and dysfunction can result in limitation of the joint range of motion and its treatment or correction will be effective in augmentation of improving the joint range of motion. In a study conducted by Itohand colleagues on patients with knee osteoarthritis, it is revealed that treatment of myofascial trigger points was more effective than acupuncture (Itoh et al., 2008). In this study, patients were divided into three groups. The patients were allocated to myofascial trigger point injection group, specific Chinese acupuncture point's injection group or control group. Both intervention groups had less pain than the control group.

Interestingly, the injection of trigger points had better outcome than injection to specific Chinese acupuncture point's injection. Joint stiffness was improved in the both intervention groups. Our study results are consistent with this study. The only difference is that we applied non-invasive approaches. In our study, pain and stiffness were also improved in both groups, more in intervention group than control one. In the study of Itoh one patient from ten patients was excluded from injection of trigger points group due to the intensification of pain, but no certain complications were observed in our study. It is noteworthy that, some researchers have been described that the main cause of some joint stiffness is myofascial pain dysfunction and claimed that its treatment may be effective in reducing joint stiffness (Friction, 1990).

In a study conducted by Yentür, it was shown that combined injection of the trigger points with intra-articular hyaluronic acid injection have better therapeutic effects than hyaluronic acid injection therapy (Yentür et al., 2003). In this study, patients, who received myofascial pain and dysfunction syndrome treatment, have more improvement in some parameters, such as, pain, stiffness and function. Moreover, the intervention group showed more increase in the joint range of motion than the control group. In this study, intra-articular hyaluronic acid injection group received hyaluronic acid alone (without other treatment, such as ultrasound or stretching exercises).

Physical therapy is recommended treatment for knee osteoarthritis by both the American College of rheumatology and European League against Rheumatism (American College of Rheumatology Subcommittee on Osteoarthritis Guidelines, 2000; Bennell et al., 2004). However, certain studies claimed that physical therapy has no affect therapeutic effects. For example, in a study conducted by Bennell and his colleagues, 73 patients with knee osteoarthritis received a treatment program of physical therapy, such as, exercise, massage, taping and mobilization (Bennell et al., 2004).

Compared with 67 patients of the placebo group, there were no significant differences in important outcomes such as pain and global improving at 12th and 24th weeks. The authors attributed this to the placebo effect and spontaneous recovery. Finally, the authors suggested that as knee osteoarthritis is a heterogeneous condition, it is possible that subgroups of patients may respond differently to different modes of physiotherapy. This will allow the development of targeted physiotherapy programmers' for particular subgroups. Apparently, these findings are in conflict with our study results because we see improvement in pain and function and other outcomes in both groups. However, we have no placebo group. In fact, in parallel with the intervention group, improvement in the placebo group may occur. Rather, modalities and procedures used in our study were different from that study.

Compared with pretreatment, walking speed of the intervention group had increased in Timed Up and GO (TUG) test. Improvement of this outcome with the treatment of knee osteoarthritis has been shown in other studies, too (Perlman et al., 2006). For example, in a study that was performed by Perlman, the group received massage therapy demonstrated significant improvements in walking speed (Perlman et al., 2006). This study also showed the improvement in the WOMAC questionnaire.

Perhaps, the main and very important advantages of our studies were simplicity and low cost of self performing friction massage. The authors of this study admitted the high cost and high time consuming of their intervention.

Perhaps the most important part in the WOMAC questionnaire was assessment of physical function in patients with knee osteoarthritis. Since disability resulting from osteoarthritis is mostly due to pain, it is expected that reducing of the pain results in improving of function (Doherty et al., 2004). This can be issued in our and other studies. In all these studies, improvement of the performance can be issued in the physiotherapy group. It is expected that adding trigger point therapy to physiotherapy program will result in more reducing of the pain and more improving of the function. Our study issued this.

In our study, female to male sex ratio in 60 patients was approximately four to one. In another study was conducted by Bayat and colleagues in Baghaietollah hospital of Tehran (Iran) on patients with knee osteoarthritis in 100 individuals, 84 patients were female. This ratio is nearly consistent with our study gender ratio. It is obvious that finding the overall prevalence of this entity and exact female and men ratio in Iran need more and larger studies. It is claimed that females are more susceptible to osteoarthritis. However, it is expected that this ratio in Iran is very high (Friction, 1990). Knee osteoarthritis is a disease with multiple risk factors and indentifying of these will help effectiveness of prevention strategy.

More studies will be helpful in this field. Although general practitioners have not enough clinical experience, specialists in various clinical fields of medicine such as rheumatologists, orthopedics and rehabilitation specialists report high prevalence of knee osteoarthritis in Iran. Unfortunately, little studies have been conducted on this entity and its applicable treatment in our medical system so that even its prevalence is unknown in Iran. This study could trigger broader and more complete studies in the field.

Although the study project manager remained blind to patients' group allocation, physiotherapist who treats the patients knew patients' group allocation.

This issue and probably more accuracy and more time consuming by physiotherapist can affect improvement rate of the patients, although the patients didn't aware from their group allocation and interventions that performed for control and intervention group. Neglecting various associated diseases such as lumbar discopathy and foot disorders can affect improvement rate and function of the patients. Satisfaction and health status and attitudes of patients may affect the results of this study, too.

Failures to follow patients after treatment to evaluate the durability of these treatments and failure to assess the patients' compliance with the instructions given during the treatment period are the issues that can affect the results of this study.

5. Conclusion

In patient with osteoarthritis conventional physical therapy was alone effective in reducing pain, and improving stiffness, joint range of motion and function.

Adding myofascial trigger pint and dysfunction therapy in patients with bilateral knee osteoarthritis enhance the effectiveness of physical therapies and help improving physical performance in activities of daily living and vocation.

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