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ORIGINAL ARTICLE

The Effect of Type 1 Mobilization of Patello-femoral Joint on Reduction of Knee Joint Stiffness

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ABSTRACT
Knee osteoarthritis is one of the most common disabilities which has caused many limitations in human life. There are various ways to treat this disease. One of these methods is joint mobilization. In this experimental study, the effect of type 1 mobilization on reduction of joint stiffness caused by knee osteoarthritis has been investigated. This study was a single blind clinical trial in which sampling was conducted by a random sampling method. Thirty patients diagnosed with type 2 or 3 knee osteoarthritis were randomly divided into 3 groups: 1) Mobilization with exercise therapy, 2) Exercise therapy and 3) Mobilization. In addition, >0.2 W/Cm² ultrasound was used as placebo for 3 minutes for all groups. The duration of treatment was 10 sessions in 3 weeks. The material used for evaluation of joint stiffness was the WOMAC questionnaire (Likert Type). Evaluation was done before and after treatment and approximately one week after the last session of treatment. Data analysis indicated a significant difference between first and second groups (P = 0.008); while, there was no significant difference between other groups. Comparison of joint stiffness after treatment to that before the treatment showed a significant decrease only in the second group (P = 0.016); no significant change was observed in other groups. Variations in joint stiffness was not significant in the follow-up session compared to that before the treatment in any of the groups.This study showed that type 1 mobilization of a patellofemoral joint is not effective on reduction of joint stiffness caused by type 2 or 3 knee osteoarthritis.
Keywords: *Mobilization, Exercise Therapy, Knee Osteoarthritis, Joint Stiffness.*

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INTRODUCTION

Osteoarthritis is the most common joint disease which leads to disability in humans. This disease causes more disability and clinical symptoms in knee joints compared to other joints. According to available evidence, it is a major health problem throughout the world [1].

Various methods are used for treating this disease, although therapeutic effect of some methods is not clear. These treatments include:

Phonophoresis of NSAIDs (Non-Steroidal Anti-Inflammatory Drug) and corticosteroids [2], Capsaicin Ointment, laser therapy, TENS (Transcutaneus Electrical Nerve Stimulation), arthroscopy, acetaminophen, topical ointment of diclofenac, selective inhibitor of enzyme cyclooxygenase 2 (Cox2 inhibitors) such as celecoxibe, glucosamine supplements, ice massage, cold packs, hot pack, ultrasound waves, exercise therapy and manual therapies [1].

Mobilization is one of the techniques of manual therapy which involves passive, skillful, and continuous movements applied to the related joints or soft tissues in different ranges and speeds [3]. This therapeutic technique is divided into five motor ranges based on the area it is applied:

Type 1: Slow oscillations with small ranges, parallel to the joint surface, at the beginning of the range
Type 2: Slow oscillations with large ranges, parallel to the joint surface and within the free range
Type 3: Slow oscillations with large ranges, parallel to the joint surface, from the middle to the end of the range
Type 4: Slow oscillations with small ranges, parallel to the joint surface, at the limited end of the range
Type 5: Movement without oscillation with small ranges and high speed, parallel to the joint surface and after the limited pathologic range which is also called Thrust Manipulation [4].

One of the causes of physical dysfunction is joint stiffness in patients with knee osteoarthritis. According to the literature, type 1 mobilization refers to a pain reducing method [4]. In previous studies, mobilization has been known effective in reducing pain in joints like spine, elbow, ankle and knee [5, 6, and 7]. Because painful movement reduces movement and reduced movement is one of the causes of joint stiffness, joint stiffness is expected to reduce by reducing pain. Accordingly, type 1 mobilization is used as a prelude for other degrees of mobilization in reducing stiffness of joints such as shoulder [8]. Effect of other degrees of mobilization on reduced joint stiffness has been investigated in previous studies [9, 10]; in these studies, however, little attention has been paid to type 1 mobilization. Mobilization is very easy and requires no special facilities; no side effects have been reported. Particularly for the patellar-femoral joint, it is easy to access patella which moves in all directions easily with little limitation. Thus, mobilization is completely easy with the least energy in this joint. In addition, it is not required to bend the knee in mobilization of this joint. Thus, mobilization of this joint is possible in a position where there is minimal pain.

Therefore, this study was conducted to evaluate the effect of type 1 mobilization of patellar femoral joint on reduction of joint stiffness caused by knee osteoarthritis.

MATERIALS AND METHODS

This study was a single side blind clinical trial (patients did not know about grouping) conducted in 2007, in Hakim Mess Physiotherapy Clinic located in Mes Sarcheshmeh, Iran. Sampling was done randomly among patients referring to this clinic from various class of people living in this city and its surrounding towns and villages. according to nonparametric data and lack of suitable criteria for determining the sample size in this type of data as well as the similar studies [6,5], the number of samples was considered 30 patients (18 females and 12 males). By providing the informed consents, these patients were randomly divided into three equal groups (each group containing 10 people):

1- Mobilization with exercise therapy
2- Exercise therapy
3- Mobilization

The subjects were randomly assigned in three groups by order of enrolling in the study. That is, the first patient was assigned to the first group, the second patients was assigned to the second group, the third patient was assigned to the third group, the fourth patients was assigned to the fourth group and so on.

Inclusion criteria included:

1… BMI (Body Mass Index) less than or equal to 30
2… Lack of any physical disorder unrelated to knee which prevents to take part in sessions needed for the study.
3… Type 2 or 3 osteoarthritis based on the grading system of Kellgren- Lavranke
4… A moderate or severe degree of pain based on the WOMAC scale (Western Ontario and McMaster Universities)
5… A moderate or severe degree of physical function based on the WOMAC scale

Exclusion criteria included:

1.. Inability to attend the sessions
2.. Cortisone injection into the knee joint during the past 30 days
3.. surgery on each of the lower limbs in the past 6 months
4.. Patients with one of the following with knee osteoarthritis: Rheumatoid arthritis and any other systemic inflammatory arthropathy, Avascular Necrosis, previous fractures around the joints, Paget's disease near the joint, prolonged chronic infection in the joint.

Exercise therapy involved strengthening exercises to strengthen the adductor muscles (adduction in the hip joint with a slight bend in knee in lateral position) and hip abductor (abduction in hip joint in lateral position) and quadriceps (raising lower limbs in a flat form or SLR (Straight Leg Raise)) and VMO (Vastus Medialis Oblique) (adduction in hip joint in oblique route at supine position while maintaining external rotation in hip joint). These exercises were done three times, with 30 seconds rest. If there was pain during these exercises, strengthening the mentioned muscles was done isometrically by doing ten contractions for 10s successively with an intensity that does not intensify the pain. Therefore, there was no exclusion due to intensified pain.

Mobilization was conducted as follows:

The patient lied supine and was asked to relax completely. If the patient felt a lack of relaxation and there was yet patellar movement, the patient was asked to have a deep breath and relax again. This operation was repeated if necessary. By ensuring relaxation, the degree of patella's glide in and out was evaluated by placing two thumbs on the outside of patella and gliding inward; in this way, the range needed for type 1 mobilization was determined. If there was any slack, this range was first taken and the patella was

moved to the main range; then, type 1 mobilization was performed for 1 minute. The patient was placed on the front side and type 1 mobilization was done to the front side in the order that was mentioned. Meanwhile, the rhythm of mobilization was approximately 1 to 2 times per second.

In addition to the above treatments, >0.2W/Cm^2 ultrasound was used as placebo in all three groups. Treatment was performed for ten sessions over three weeks. In this study, WOMAC questionnaires was used to evaluate the joint stiffness. Furthermore, several studies have examined this questionnaire and confirmed its validity and reliability [16-11].

Evaluation was done before and after treatment and in a follow-up session (about one week later). Then, the data obtained from the study was analyzed by SPSS 11 using nonparametric statistical tests (because the data was ordinal), as follows. For comparison of groups, Kruskal-Wallis test and for comparisons within group (comparison of the results before and after treatment and follow-up session), Wilcoxon test were used.

The level of significance was considered 0.05 in this study. Meanwhile, this study was approved by the Ethics Committee of Tarbiat Modarres University.

RESULTS

Average age was 44.5 in the first group, 45.1 in the second group, and 44.3 in the third group. Therefore, there was no significant difference between three groups (P= 0.853) in this regard. Mean BMI was 25.76 in the first group, 25.64 in the second group and 26.04 in the third group. Therefore, there was no significant difference between three groups (P= 0.971) in this regard. In terms of gender, there was no significant difference between men and women in the three groups (P= 0.668). In the first group, no significant difference was observed between pre-treatment, post-treatment and follow-up session (P>0.05).

In the second group, there was a significant difference between pre-treatment and post-treatment (P>0.05); however, no significant difference was found between pre-treatment and follow-up session (P>0.05).

In the third group, there was no significant difference between pre-treatment, post-treatment and follow-up session (P>0.05).

In comparison between groups, there was a significant difference between pre and post treatment in the first and second groups. However, there was no significant difference in post-treatment and follow-up sessions and pre-treatment and follow-up session between the three groups (P>0.05) (Table 1). Table 2 presents the stiffness degree before and after treatment and follow-up session in the three groups.

Table 1- Comparison of joint stiffness in different stages of the treatment in three groups

Groups	P Value	
	Comparison of pre and post treatment	Comparison of pre-treatment and follow up session
First	0.087	0.197
Second	0.016	0.102
Third	0.916	0.581

Table 2- Stiffness degree in treatment groups in various stages of evaluation

Groups	Joint stiffness (standard deviation + mean)		
	Pre-treatment	Post-treatment	Follow-up
First	3.8±2.04	4.4±2.12	4.3±1.57
Second	4.5±1.65	3.2±1.40	3.8±1.55
Third	4.1±2.38	3.9±1.97	4.3±2.41

DISCUSSION

This study showed that type 1 mobilization is not effective on reduction of joint stiffness in patients with knee osteoarthritis. Although exercise therapy alone reduced stiffness, adding type 1 mobilization to exercise therapy caused no significant change in joint stiffness.

Although type 1 mobilization can improve movement of the patient through reducing the pain, this application can be used to reduce or to prevent stiffness in the early stages of knee osteoarthritis; however, it is not effective on reduction of joint stiffness in type 2 and 3 osteoarthritis, due to greater extent and severity of joint capsule shortness; since it does not directly exert stretching on joint capsule.

According to Suraj & Kumar (2006), although the conventional treatment (including TENS, ultrasound and exercise therapy) increases the range of motion in patients with knee osteoarthritis, addition of knee

mobilization increases its effect on increasing the range of motion of joints in patients with knee osteoarthritis [5].
Moss and colleagues (2007) showed that tibial-femoral joint mobilization reduces the time to reach the stand position from sitting position; however, there was no significant difference between this group and controls who only experienced hand contact (P= 0.061) [6].
Fuji and colleagues (2010) showed that distal tibial-femoral joint mobilization increases range of motion of the ankle joint [9].
Seiger and Draper (2010) showed that mobilization with short-wave diathermy can increase range of motion of ankle joint after surgery [10].
Clearly, this studies used higher degrees of mobilization. It seems that higher degrees of mobilization could increase the range of motion of the joints because of the tensile force applied to the tissues.
In the present study, type 1 mobilization has been just applied to femoral-patellar joint which is only one part of the knee joint, while, in other studies, mobilization was not only applied to femoral-patellar joint but to all knee joint. Therefore, tensile forces have been applied to entire tissues surrounding the knee joint. This could also be another reason for inconsistency between the results of this study with other researchers.
Thus, it can be concluded that type 1 Mobilization alone will not be effective on reduction of joint stiffness in patients with knee osteoarthritis. However, further studies are required in this field. It is recommended that future studies use other methods of evaluation in addition to WOMAC questionnaire to measure knee stiffness. Furthermore, given that knee stiffness section of the WOMAC questionnaire includes only two items, it seems necessary to investigate its validity and reliability separately from other parts of the WOMAC questionnaire.

CONCLUSION

Although type 1 mobilization of patellar-femoral joint can be used as a prelude for other degrees of mobilization to reduce joint stiffness, it cannot be effective alone on reduction of joint stiffness caused by type 2 or 3 osteoarthritis.

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