Original Article

Comparison of Effectiveness of Hold-Relax Technique and Maitland's Mobilization in Improving Range of Motion in Posttraumatic Stiffness of Knee Joint

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Abstract

Aims: This study aims to compare the effectiveness of Hold-Relax technique and Maitland's Mobilization in improving range of motion (ROM) in posttraumatic stiffness of knee joint. **Materials and Methods:** This was a randomized interventional comparative study with 30 subjects with posttraumatic stiffness of knee joint with restricted range of knee flexion were randomly allotted into two groups: Group A was given Hold-Relax technique and Group B was given Maitland's Mobilization consisted of Grade 3 posterior glide along with paraffin wax bath and isometric exercises of quadriceps and hamstring as a common baseline treatment for 5 days per week for 4 weeks. The baseline outcome measure was active knee flexion ROM measured by universal Goniometer before and after 4 weeks interventions. **Results:** Statistical analysis of data was done using paired *t*-test and unpaired *t*-test. Paired *t*-test showed that statistically significant increase in active knee flexion ROM in both the groups. On comparing by unpaired *t*-test it was found that both the techniques are equally effective in improving ROM. **Conclusion:** Both the Hold-Relax technique and Maitland's Mobilization are equally effective, in improving the knee flexion ROM.

Keywords: Hold-relax technique of proprioceptive neuromuscular facilitation, knee flexion range of motion, Maitland's Mobilization

Introduction

Knee stiffness is a common complication of femoral and tibial fractures and injuries to the extensor mechanism of the knee.[1] The reported rate of significance knee stiffness after various injuries and procedure around the knee is as high as 11% in the western literature, but may be much higher in underdeveloped countries. Severely restricted knee motion is a recognized complication of trauma around the knee.[2] Loss of motion following fracture is multifactorial; stiffness can be followed by prolonged immobilization, traction intra-articular and extra-articular fractures fixation.[3] Stiffness applies more severely to the knee than to any other joint of the lower limb.[4]

Joint stiffness from adhesion is common after fractures especially those that are near a joint. Stiffness is caused partly by intra-articular adhesions and partly by peri-articular and intramuscular adhesions.[5] Hold relax is a stretching or relaxation technique designed to obtain a lengthening reaction of muscle whose action is antagonistic to the movement limited in range.[6] Hold-relax technique is an effective, simple, and pain-free technique. It is used as a means of increasing the range of movement in a joint.[7] Hold-relax technique may be used early in the postimmobilization period. Proprioceptive neuromuscular facilitation (PNF) stretching has been found to help strengthen the muscles that are contracted, and therefore is a good therapeutic tool for increasing active and passive flexibility.[8]

Maitland's mobilization is also routinely used technique to increase the range in posttraumatic stiffness. Hence, the present study is uplifted to compare the effect of hold-relax technique

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and Maitland's mobilization to put forth the better treatment approach.[9]

Aim of study

To study and compare the effect of hold-relax technique and Maitland's Mobilization in improving range of motion (ROM) in posttraumatic stiffness of knee joint.

Materials and Methods

This was a randomized interventional comparative study. The study was conducted in outpatients department during 1 year between 1 June 2009 and June 2010. A total of 30 patients of both genders between 20 and 40 years of age with posttraumatic knee stiffness immediately after suture removal were included in the study who reported to the physiotherapy outpatient or inpatient department. They were screened clinically and radiologically for the eligibility criteria. They were requested to participate in the study, were given a brief idea about the nature of the study and the intervention. Prior to the commencement of the procedure, informed written consent was taken from the participants. Patients with restricted ROM and with Grade 3 or more than three power of knee muscle were included in the study. Patients with hypermobile and unstable joints, joint infection and loosening, soft tissue injuries around knee joints and other complications of postfracture were excluded from the study.

They were randomly assigned by odd and even number methods into two groups. Patients were treated with respective modalities for 5 days a week for 4 weeks. Patient's improvements were assessed by active knee flexion ROM by universal goniometer.

Active flexion ROM was intervention outcome measure was measured by universal goniometer. Patients were in prone position with hips in the neutral position and both the knee extended. The foot was over the edge of plinth. The axis of the goniometer was placed at the lateral femoral epicondyle, and the stationary arm was parallel with the femur, pointing at the greater trochanter while the movable arm with fibula, pointing toward the lateral malleolus. For the active range measurement, the patients were asked to actively flex the knee to the maximal extent.[10] This consisted of the assessment part the treatment was given separately to both the groups separately for 5 times a week.

Common baseline treatments given in both groups were paraffin was bath paint method, isometric quadriceps and hamstring static exercises. Paraffin wax bath-Paint method for 15 min was given to all patients. That was followed by isometrics static quadriceps exercises. This exercise was emphasized right from the 1st day of treatment. The static quadriceps exercise was first taught on the unaffected leg and the contraction felt by the patient along with the therapist. The patients were positioned in long sitting position, a towel was placed underneath the popliteal fossa and the patients were asked to the press the rolled towel by isometrically contracting the quadriceps with the hold time of 6 s and repeated for 10 times with 10 s rest in between each repetition. It was followed by static hamstring exercises to the patients. Same as above first static hamstring exercise was taught on the unaffected leg. The patients were positioned in long sitting position, with the knee in slight flexion over a towel roll. The patients were asked to isometrically contract the knee flexors just enough to feel the tension developing in the muscle group gently pushing the heel into the treatment table and holding the contraction for 6 s and repeated for 10 times with 10 s rest in between each repetition.[11,12]

In group a, hold-relax technique of PNF given after basic treatment. The patient was positioned in sitting at edge of plinth till range attained 90° and prone after that. Hold-relax technique of PNF included, the affected knee was flexed passively to the end of range with the therapist's hand on the patient's lower leg. Patients then performed 5 s of quadriceps contraction against the resistance of the therapist. Patients were asked not to let move. At the end of 5 s, the patients were asked to totally relax for 10 s and the therapist pushed the knee into more flexion and hold at that newly acquired range 5 repetitions were given in a session for 5 days a week for 4 weeks.[10,13]

Treatment given for Group B was Maitland's mobilization after baseline treatment. At tibiofemoral joint in posterior glide method, patients were positioned in high sitting till range attained 90° and prone later increase in range. Palm of proximal hand was placed along the anterior border of the tibial plateau. With elbows extended, the body weight weaned onto the tibia, gliding it posteriorly. Posterior glide of Maitland's Grade 3 was applied for 2–3 oscillations/s for 1 min, 5 sets each day.[1,14,15]

Patellofemoral (PF) joint-distal glide, patients were positioned in supine, with knee extended; progression was done till the knee was taken at the end of the available range in flexion. Therapist was stood next to the patient's thigh, facing the patient's feet. Placed the web place of the hand that was closer to the thigh around superior border of the patella, other hand was used for reinforcement. Glide was given to patella in a caudal direction, parallel to the femur.[16]

In PF medial-lateral glide, patients were positioned supine, with knee extended. Fingers were placed medially and thumbs laterally; around the medial and lateral borders of the patella. Glide was given to patella in a medial or lateral direction, against the restriction,[14] mobilizing the patella with two sets of five to 10 oscillations[17] (The hand placement of the therapist and position of patients were taken from standard text book).

Ethical clearance

The Institutional Ethics Committee of DMIMSDU has approved the Research work proposed to be carried out at Ravi Nair Physiotherapy College, Sawangi(M), Wardha. Date : 7th Feb 2009 with Reference no DMIMS(DU)/IEC/2009/165.

Results

Statistical analysis of data was done using paired *t*-test

and unpaired *t*-test. Student's paired *t*-test was used to find effectiveness of pre- and post-hold-relax technique and Maitland's Mobilization. Student's unpaired *t*-test was used to compare the effectiveness between hold relax technique and Maitland's Mobilization.

Mean age of patients in Group A was 31.46 ± 6.32 and in Group B was 33.66 ± 5.39. There was no significant difference between the mean ages of the patients in both groups ($P < 0.3$).

In the present study, preinterventional mean of active knee flexion ROM was 38.73° ± 11.29° in Group A and 35.46 ± 11.67 degrees in Group B, respectively [Table 1 and Figure 1]. Whereas postinterventional mean of knee active flexion ROM was 101.13° ± 12.33° in Group A and 91.66° ± 13.58° in Group B, respectively [Table 1 and Figure 1].

On comparing preinterventional versus postintervention values, both the groups showed statistically significant increase in active knee flexion ROM. It is used as a means of increasing the range of movement in a joint. Hold-relax technique may be used early in the postimmobilization period. This was done using paired *t*-test Group A ($t = 39.90$, $P < 0.0001$), Group B ($t = 19.89$, $P < 0.0001$) [Table 1].

In the present study, preinterventional mean of active knee flexion ROM was 38.73° ± 11.29° in Group A and 35.46° ± 11.67° in Group B respectively. Whereas postinterventional mean of knee active flexion ROM was 101.13° ± 12.33° in Group A and 91.66° ± 13.58° in Group B respectively [Table 2 and Figure 2]. On comparing preinterventional values of range by unpaired *t*-test, it was found that there was no significant difference between the groups whereas postinterventional values of range; both the groups showed statistically no quite significant difference between the groups in active knee flexion ROM. This was done by using unpaired *t*-test. T value of pretreatment ($t = 0.7786$, $P < 0.4428$), *t* value of posttreatment ($t = 1.998$, $P < 0.0555$) [Table 2].

Discussion

Fracture's around knee joint is frequently encountered clinical setting. Knee stiffness is most common complication following fractures of bones around knee joint. Stiffness applies more severely to the knee than to any other joint of the lower limb. Joint stiffness from adhesion is common after fractures especially those that are near a joint. Posttraumatic stiffness of knee joint presents with sign and symptoms of decreased ROM, joint play, and muscle flexibility, muscle atrophy with weakness and poor muscle endurance and pain. This study was performed in Krishna College of Physiotherapy outpatient or inpatient department on 30 patients of posttraumatic stiffness of knee joint were selected randomly including 5 females and 25 males.

They were divided into two groups of 15 patients each Group A was given hold-relax treatment and the Group B was given Maitland's mobilization for 4 weeks, 5 days per week.

Active range of knee flexion was the major outcome which was assessed before (pretest) and after (posttest).

The Group A was given hold-relax technique along with paraffin wax bath and isometric exercises of quadriceps and

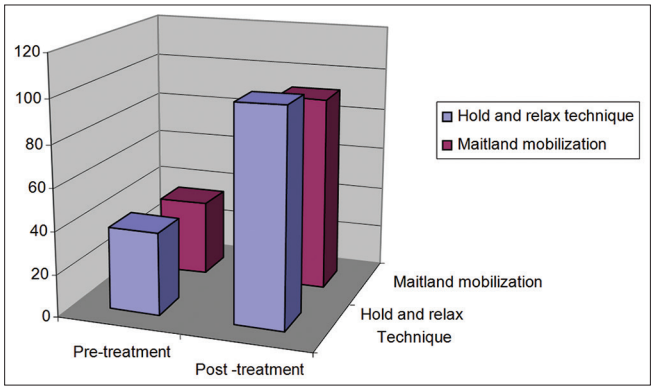

Figure 1: Efficacy of hold and relax technique and Maitland technique in mobilization of knee flexion (paired *t*-test)

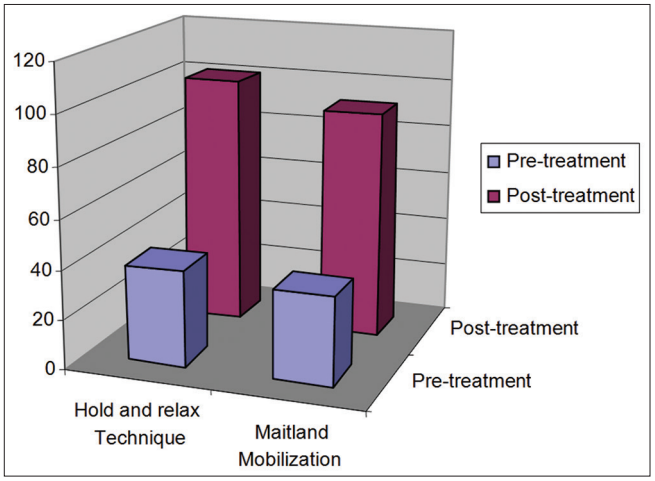

Figure 2: Comparison between hold and relax technique and Maitland technique in mobilization of knee flexion (unpaired *t*-test)

Table 1: Efficacy of hold and relax technique and Maitland technique in mobilization of knee flexion (paired *t*-test)

Group	Mean±SD		*t*	df	*P*
	Pretreatment	Posttreatment			
Hold and relax technique	38.73±11.29	101.13±12.33	39.9	14	<0.0001
Maitland mobilization	35.46±11.67	91.66±13.89	19.89	14	<0.0001

SD: Standard deviation

Table 2: Comparison between hold and relax technique and Maitland technique in mobilization of knee flexion (unpaired *t*-test)

Group	Mean±SD	
	Pretreatment	Posttreatment
Hold and relax technique	38.73±11.29	101.13±12.33
Maitland mobilization	35.46±11.67	91.66±13.89
t	0.776	1.998
df	28	28
P	0.4428	0.0555

SD: Standard deviation

hamstring as a baseline treatment exercises for 5 s hold and 10 s relax with repetitions given for 5 sets, 5 times/week.

For the hold-relax technique of PNF, the working mechanism involves a reciprocal muscle inhibition technique throughout the exercise and a rhythmic contraction and relaxation leads to increase in ROM of the joint.[18,19] The advantage of hold-relax technique is that along with increase in ROM, it also helps in improving strength which is an essential factor which helps in early rehabilitation. PNF stretching has been found to help strengthen the muscles that are contracted, and therefore is a good therapeutic tool for increasing active and passive flexibility.[8]

Group B was given Maitland's Mobilization consisted of Grade 3 posterior glide at the rate of 2–3 oscillations/s for 1 min, with 5 repetitions along with a baseline treatment including paraffin wax bath and isometric exercises. The treatment helped in improvement in ROM of knee joint in this group.

Maitland's Mobilization that consists of gentle oscillating movements of the articular surfaces that create the movement of joints by means other than the musculotendinous units that normally acts on those particular segments. Joint mobilization are purported to relieve pain and improve ROM of injured joints.[9]

Paired *t*-test was used to find the effect of both the technique individually.

For the effect of hold-relax technique showed significant effect on paired *t*-test used ($t = 39.90$, $P < 0.0001$) and the effect of Maitland's Mobilization also showed significant difference in the values using paired *t*-test ($t = 19.89$, $P < 0.0001$) [Table 1].

The two groups were then compared using unpaired *t*-test which showed that there was no significant difference in pretest values ($t = 1.998$, $P = 0.0555$). The posttreatment means values of hold-relax technique were slightly higher than Maitland's Mobilization the difference was too small to be documented [Table 2].

The concept behind performing this study especially in knee joint was that there was no study on comparison of the two important techniques in posttraumatic stiffness of knee joint and there were very few studies of this technique individually on posttraumatic knee stiffness.

One of the advantages of using hold-relax technique is that it increases ROM and strength at the same time which helps in the early rehabilitation in posttraumatic stiffness.

Hence, the present study was conducted to find out the effect of hol-relax technique of PNF and Maitland's Mobilization in improving ROM in posttraumatic stiffness of knee joint.

Studies have being done previously by tiffany Chow and Gabriel had compared effect of active, passive and PNF stretching in improving the knee flexion range in patients with total knee replacement in the year 2005 in the department of rehabilitation sciences, Hong Kong. They concluded that all the three technique were equally effective.[10]

Another study was performed by Weng *et al*. Compared the effect of different stretching techniques on the outcomes of isokinetic exercise in patients with knee osteoarthritis. They concluded that stretching could increase the effectiveness of isokinetic exercise in terms of functional improvement in patients with knee osteoarthritis. PNF technique was more effective than static stretching.[20]

Whereas Bonnar *et al*. studied the relationship between isometric contraction durations during hold-relax stretching and improvement of hamstring flexibility and concluded that clinicians could choose any of the hold-times and procedure the same result to patient hip joint flexibility.[21]

However, there are very few studies done on posttraumatic knee joint. The present study included comparison of hold-relax technique with Maitland's mobilization in patients with posttraumatic stiffness.

From the statistical analysis, it was found that hold-relax technique and Maitland's Mobilization were equally effective in improving the active knee flexion ROM in posttraumatic stiffness of knee joint.[22-29]

Conclusion

Hold-relax technique (PNF) and Maitland's Mobilization are equally effective in improving ROM in patients with posttraumatic stiffness of knee joint.

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Conflicts of interest

There are no conflicts of interest.

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