

Comparative Effects of Hold Relax Technique and Mulligan Mobilization on Pain, Range of Motion and Function in Post-Operative Knee Joint - RCT

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A B S T R A C T

Background: Knee stiffness is a common consequence of knee fracture, that can result in the loss of range of motion, strength, pain and difficult to perform daily life activities. This stiffness can be seen in 11% of the patient. It is due to prolong period of immobilization. Many treatment techniques have been used to treat the pain, knee stiffness and functional mobility. Mulligan's mobilization and hold relax technique was also used to treat pain, increase range of motion and functional mobility of knee joint.

Objective: To compare the effects of hold relax technique and mulligan's mobilization on pain, range of motion and function in post-operative knee joint.

Methodology: It was randomized clinical trial, the research had been carried out from January to March 2022 at the DHQ Hospital Jhang, Pakistan. 34 subjects of both genders 26 were males and 8 were females were randomly assigned into two groups based on their inclusion and exclusion criteria. The study was done at DHQ hospital Jhang. Subjects in one group were given Mulligan's mobilization along with Moist heat pack (baseline treatment) and the other group were given hold relax technique along with moist heat pack (baseline treatment) for 4 weeks. Recorded values were analyzed by using spss. Group A was assigned the mulligan mobilization technique, while Group B was assigned the hold-relax technique. Both interventions were conducted over six weeks, with three sessions per week. Both groups also received baseline treatment, which included the application of a hot pack and ultrasound therapy. The outcome measure used was numeric pain rating scale used for pain, goniometer used to measure range of motion and time up and go test to measure the functional mobility

Results: After treatment protocols both groups showed effective outcomes in decreasing pain and stiffness of knee joint and improving functional mobility. Mean value of NPRS was reduced from 4.47 ± 1.13 to 1.65 ± 0.93 in MWM group while in hold relax group from 4.35 ± 1.22 to 2.35 ± 0.99 . Mean value of knee flexion ROM was increased from 56.76 ± 6.11 to 109.1 ± 4.04 in MWM group while in hold relax group from 57.35 ± 5.62 to 85.88 ± 4.76 . Mean value of TUG test was reduced from 25.41 ± 2.39 to 9.29 ± 0.69 in MWM group while in hold relax group from 24.29 ± 2.34 to 15.29 ± 0.99 . The group treated with the Mulligan technique showed significantly greater improvements compared to the group treated with the hold-relax technique in patients with knee stiffness.

Conclusion: In the management of post-operative knee stiffness, Mulligan mobilization is more efficient than the hold relax approach.

Keywords: Hold-Relax, Knee Stiffness, Mulligans mobilization, NPRS, Range of Motion.

Introduction

Human body has many complex joints Knee is one of them. Knee joint plays a very major role in the movement of the human body.¹ Knee stiffness is a common consequence

that can result in a loss of range of motion, strength, pain and the difficulty to return to former levels of activity. It is a possible consequence following any intra-articular or extra-articular trauma. Knee stiffness is one such problem that

requires a detailed examination following any accident. Postoperative knee stiffness is seen in 11% of patients.² Total knee replacements, cruciate ligaments repair and trauma rigidity of the knee joint is prevalent. Contractures in flexion and extension and combined contractures are the three types of post-traumatic knee stiffness.³ Intra articular and extra articular fibrosis as well as the quadriceps femoral apparatus adhesions that leaves scar reasons limited range of motion, often known as knee stiffness. Various other MSK injuries that affect the knee joint include patellar tendon repair, knee arthroplasty and burns. Total knee arthroplasty is expected to raise by 673 percent to 3.48 million procedures among the US population.⁴

Hamstring flexibility is important for knee mobility because it is a two joint muscle. There is a change in the bio-mechanical analysis in the kinetic chain involved during the gait study due to the existence of imbalance of muscles and bone disease.⁵ In a comprehensive review and meta-analysis, the maximum reported mean knee flexion was 108° at 12 months after TKA.⁶ In the United States, isolated anterior cruciate ligament (ACL) injuries have been reported to happen at an occurrence of 68.8 per 100 000 people.⁷ In reality, individuals with ACL reconstruction with Return to activity generally have significant quadriceps weakness, with documented impairments in the knee extensors exceeding 20% when compared to the contralateral uninvolved limb.⁸ The injuries still results in postoperative knee discomfort. According to reports, this condition happens in 3% to 18% of patients who suffer tibial plateau fractures. According to reports, this condition happens in 3% to 18% of patients who suffer tibial plateau fractures.⁹ TKA and THA are among the most effective treatments, with an increasing number of patients undergoing the procedure each year throughout the world to relieve pain and improve function.¹⁰ A problematic consequence of complicated knee fracture is knee stiffness.¹¹ The knee joint is one of the key joints that plays a significant role in a person's everyday functionality.¹²

After TKA, postoperative rehabilitation helps patients heal faster and enhances their quality of life.¹³ Knee stiffness can occur even after a technically excellent TKA ,due to arthrofibrosis, which is a maladaptive biologic response to surgery.¹⁴ In several long-term research of ACL reconstruction, success rates of 75 to 94 percent in

maintaining optimal knee function have been documented.¹⁵ Fractures of the distal femur account for 3-6 percent of all femoral fractures and 0.4 percent of all fractures.¹⁶ The existence of extensive periarticular tissues that have fibrotic changes or intra articular adhesions might cause post-traumatic stiffness.¹⁷ Knee arthrofibrosis can develop as a result of knee surgery, trauma, or immobilization.¹⁸ procedures around knee joint are maximum of 11%, although it could be much higher in developing nations.¹⁹ During the last decade, the number and rate of hip and knee replacements have doubled and tripled, respectively.²⁰ HR is a method of relaxation and stretching that aims to produce muscular expansion reflex that is opposed to the movement that is restricted in range. The hold-relax technique is a painless, effective, and easy approach.¹⁹ Mobilization always given at right angles also parallel to the limited mobility of joint, according to Mulligan.³ MWM's purpose is to provide instant pain relief, possibly via regulating non-opioid pain sensory pathways and correcting micro positional errors.²¹

Methodology

Study design was a randomized clinical trial. The study was conducted in District head quarter hospital Jhang. The duration of study was six months (January to March 2022). Each participant was informed about the study methodology and the consent form obtained from the participant. Total 34 participants of both genders were randomly allocated to two groups⁽¹⁹⁾: 17 in Mulligan Mobilization group and 17 in Hold Relax technique group. Ethical Approval number for this study is REC/RCR & AHS/22/0110, In this study, a consecutive sampling technique was employed to recruit post-operative knee patients. Participants were then allocated to groups using a simple random sampling method, with assignments concealed in sealed opaque envelopes labeled as "0" for Group A and "1" for Group B. The study was single-blinded, with the assessor being blinded to group assignments. At the beginning of the study, a 30-minute formal education session was conducted by the physiotherapist responsible for the treatment. Inclusion criteria: 1) Both genders of age between 20 to 40 years 2) Patients with knee pain 3 or more than 3 on NPRS were included in the study. 4)Patients in which the power of knee muscle was more than 3 or of grade 3. 5)Unilateral knee joint

fracture after suture removal or knee area fractures that were solely treated conservatively after the removal of any kind of implants like metal etc. **6)** Participants with post traumatic stiffness of knee joint must have at least of 70 degree of knee flexion. Exclusion criteria: 1) Hyper-mobile and unstable joint. 2) Soft tissue injuries. 3) Involved knee should not include any implant at the site of fracture or around the fracture. 4) Joint infection and loosening. 5) Other complication of post fracture and TKA.

Intervention: Patients were treated for 3 days a week for 6 weeks. Patient's improvement were assessed by using NPRS. Active knee flexion ROM by using universal goniometer and functional mobility by using time up and go test. Common baseline treatment for both groups were 10 minutes of moist heat pack. **Group A:** patients were treated by mulligans mobilization, Medial glide MWM for knee flexion (supine): Patient with the knees flexed lies supine holding a strap belt placed around the foot. Distal femur is stabilized medially with one hand. Medially glide proximal tibia with other hand. While the glide is sustained, the patient actively moves the knee into flexion and returns to the starting position. This therapy session was conducted three times a week for six weeks, with a frequency of 3 sets of 10 repetitions per session. **Group B:** patients were treated by Hold Relax Technique of PNF included, 5 repetitions were given 3 times a week for 6 weeks. HR technique included, patient was in sitting position, at the edge of plinth until 90 degree of knee flexion gained and then in prone. After that with the therapist's hand on the patient's lower leg, and the affected knee was passively flexed to the limit of its range. Following that the patient contracted their quadriceps for 5sec while being resisted by the therapist. Patient requested that not to move. Patient requested to complete relaxation for 10 sec at the end of 5 seconds, after which the therapist further flexed the knee and held it there. Participants were evaluated at first baseline (pretreatment) and at the end (post treatment)

Outcome measure: The Numeric pain rating scale, a 10 point scale with 0 representing no pain and 10 representing severe pain, is most widely used validated measure for assessing pain in clinical studies.²³ Goniometer for Range of motion This technique make use of a device

called Goniometer, which claims to be able to quantify precisely the motion occurring in the simple and the composites joint.²⁴ Time up and go test for functional ability: The test involves timing how long it takes a person to stand up from the chair and walk as fast as possible to a 3-meter walk, turn around, come back and sit down. The duration of the test was timed using a stopwatch and recorded to the nearest 1/100 of a second.²⁵

Results

Statistical analysis of the data was done by using independent sample t test to find between group comparison between two group. Paired sample t-tests were conducted to determine differences within each group. The Table presents baseline socio-demographic data, including mean and standard deviation, showing a comparison of participants' age, weight, height, and Body Mass Index (BMI) between the two groups. (Table 1) The baseline measurements for the Numeric Pain Rating Scale (NPRS), Range of Motion (ROM), and Timed Up and Go (TUG) test. The pre-treatment values for both groups were comparable across NPRS, ROM, and TUG test metrics. (Table 2)

Results of between group comparisons of knee flexion range of motion. An independent samples t-test was used to compare differences between groups. Results show significant reduction in post-treatment values of knee flexion range of motion with p value <0.05. This also showed the results of between group comparison of time up and go test. Between groups comparison was performed by independent sample t test. Results shows significant difference on pre and post treatment values of time up and go test with p value <0.05. (Table 3)

Comparison of knee flexion range of motion across both groups. Pair t test was used for within comparison. Results showed significant difference. As $p < 0.001$, mean value of knee flexion range of motion in Mulligan's was 52.35 ± 7.097 and in hold-relax was 28.52 ± 4.926 . This table also shows comparison of time up and go test across both groups. Pair t test was used for within comparison of TUG. Results showed significant difference. As $p < 0.05$, mean value of TUG in mulligan's was 16.11 ± 2.619 and in Hold-relax technique was 9.000 ± 2.345 . (Table 4)

Table 1: Comparison of Demographics among two Groups			
Variables	Group A Mulligan's Mobilization (n=17) (Mean ± SD)	Group B Hold-Relax Technique (n=17) (Mean ± SD)	p-Value
Age of Participants	31.18±3.68	30.65±4.94	0.479
Weight in kg	72.00±4.69	70.71±4.87	0.975
Height in m	172.29±5.2	172.06±5.91	0.869
Body Mass Index	23.76±1.48	23.94±1.03	0.359

Significance level: $p < 0.01^{**}$

Table 2: Baseline Measurement for NPRS, ROM and TUG			
Variables	Group A Mulligan's Mobilization (n=17) (Mean ± SD)	Group B Hold-Relax Technique (n=17) (Mean ± SD)	P value
Numeric Pain Rating Scale	4.47±1.13	4.35±1.22	0.007**
Knee Flexion Range of Motion	56.76±6.11	57.53±5.62	0.101
Time up and go test	25.41±2.39	24.29±2.34	0.364

Table 3: Between Group Comparison of knee Flexion Range of Motion and Time up and Go Test				
		Group A Mulligan's Mobilization (n=17) (Mean ± SD)	Group B Hold-Relax Technique (n=17) (Mean ± SD)	P value
Knee Flexion Range of Motion	Pre-treatment	56.76±6.11	57.35 ± 5.62	0.772
	Post-treatment	109.12 ± 4.05	85.88 ± 4.76	<0.05*
Time up and go test	Pre-treatment	25.41 ± 2.4	24.29 ± 2.34	0.179
	Post-Treatment	9.25 ± 0.69	15.3 ± 0.99	<0.05*

Significance level: $p < 0.05^*$

Table 4 Within Group Comparison of Variables			
Variables		Paired Difference Mean ± SD	P value
Group A Mulligan's Mobilization method	Knee flexion ROM Pre & Post	52.35 ± 7.097	<0.001***
Group B Hold-relax technique	Knee flexion ROM Pre & Post	28.53 ± 4.93	<0.001***
Group A Mulligan's mobilization method	TUG_Pre & Post	16.12 ± 2.62	<0.001***
Group B Hold-relax technique	TUG_Pre. & Post	9.00 ± 2.35	<0.001***

Significance level: $p < 0.001^{***}$

Discussion

In this study the aim was to check the comparative effects of hold relax technique and mulligan's mobilization on pain, range of motion and functional mobility. The outcome measure pain was assessed by NPRS and ROM by using universal goniometer and functional mobility by TUG test. This study concluded that Mulligan's mobilization had better effects in reducing pain and increasing range of motion so that functional mobility improved with pretreatment mean value of pain on NPRS was 4.471 ± 1.1246 and post treatment mean value of pain was $1.647 \pm .9315$, pretreatment mean value of knee flexion ROM was 56.76 ± 6.109 and post treatment mean value of knee flexion ROM was 109.12 ± 4.045 . The duration of this study was 6 weeks. The

previous study conducted by, Sumit Raghav, et al. in 2018 was in accordance with the current study that showed the results in patients with knee stiffness of MWM vs conventional treatment on ROM, that concluded MWM is effective in reduction of pain and knee stiffness with pretreatment mean value of pain on VAS was $4.37 \pm .799$ and post treatment pain mean value was $1.20 \pm .775$ and pretreatment mean value of knee flexion ROM was 73.67 ± 14.075 and post treatment mean value of knee flexion ROM was 106.00 ± 10.556 .³

The aim of this study was to compare the hold-relax technique and mulligan's mobilization on pain, ROM and functional mobility. The study showed that mulligan's mobilization was more effective in increasing range of motion

with the pretreatment mean value of knee flexion ROM 56.76 ± 6.109 and post treatment mean value of knee flexion ROM was 109.12 ± 4.045 . This was in accordance with previous study conducted by, arun and sreedeve in 2018 demonstrated the short term effects of mobilization with movement in patients with post traumatic knee stiffness. One group pre to post study design was used to obtain data. The outcome measure was active knee flexion range of motion which was assessed by using universal Goniometer. The MWM technique was given with 3 sets of ten repetitions on each treatment session for the duration of 3 days. The mobilization with movement technique significantly improves the active knee flexion range of motion with baseline mean value was 91.1 ± 8.9 and post treatment mean value was 113.8 ± 8.7 .²⁶

In terms of pain, function, and balance, they found that both therapy modalities had similar outcomes. However, compared to KT method with exercise, mobilization with movement with exercise showed a short-term beneficial effect on pain and hamstring muscle flexibility. In 2017, serdar et al. compare the short term effects of MWM on functional mobility, pain and balance in patients with patellofemoral pain with kinesiotaping. The aim of this study was to compare the hold-relax technique and mulligan's mobilization on pain, range of motion and functional mobility. This study concluded that Mulligan's mobilization had better effects with pretreatment mean value of pain on NPRS was 4.471 ± 1.1246 and post treatment mean value of pain was $1.647 \pm .9315$, pretreatment mean value of knee flexion ROM was 56.76 ± 6.109 and post treatment mean value of knee flexion ROM was 109.12 ± 4.045 and improved functional mobility mean value pre TUG score was 25.41 ± 2.4 and post treatment TUG score was $9.25 \pm .69$.²⁷

Shamim, et al. directed a research in 2020 compare the sequel of mulligans mobilization versus myofascial release on pain, ROM, and functional capacities in knee osteoarthritis participants. In terms of discomfort, range of motion, and functional capacities, both MWM and myofascial release technique were shown to be helpful, but MWM delivered faster results than myofascial release. This study concluded that Mulligan's mobilization had better effects in reducing pain and increasing range of motion so that functional mobility improved with pretreatment mean value of pain on NPRS was 4.471 ± 1.1246 and post treatment mean value of pain was $1.647 \pm .9315$, pretreatment mean value of knee flexion ROM was 56.76 ± 6.109 and post treatment mean

value of knee flexion ROM was 109.12 ± 4.045 and improved functional mobility mean value pre TUG score was 25.41 ± 2.4 and post treatment TUG score was $9.25 \pm .69$.²⁸

The objective of this study was to compare the effects of hold-relax technique and mulligan's mobilization on functional mobility of knee joint in post-operative knee joint patients. Hold relax technique was effective in improving functional mobility. But mulligan's mobilization was more effective. Another systemic review done by chistopher, et al. on the Hold relax and contract-relax on increasing the hamstring flexibility to no intervention and other stretching techniques. According to this systemic review both Hold-relax and Contract relax were effective in improving hamstring flexibility.²⁵

The aim of this study was to check the effects of hold relax technique and mulligan's mobilization. The outcome measure were pain. Range of motion and functional mobility of knee joint in post operative knee patients. Hold relax technique showed reduction in pain and improving functional mobility and increasing ROM. But in comparison with mulligan, mulligan's mobilization showed better results. Previous study conducted by amit, et al. on neurodynamic sliding versus PNF stretching (Hold-Relax) in hamstring flexibility in collegiate students. In this study 60 participants of age between 20-30 years of both male and female with hamstring tightness were included in the study. The outcome measure used was active knee extension AKE. The participants were divided into two groups. One Group were given PNF stretching (HOLD-RELAX) and other group were treated with neurodynamic sliding technique. For both interventional group, the technique was performed 3 times a week for total treatment duration of four weeks. Participants who received hold relax technique reported significantly improved hamstring flexibility. With those of Group receiving neurodynamic sliding.²⁴

Conclusion

Hold relax technique and Mulligan's mobilization were effective in reduction of pain and stiffness of knee joint and increasing functional mobility. But on the base of statistical analysis this study tells that Mulligan's mobilization was more effective treatment technique as compared to Hold relax technique in decreasing pain, knee stiffness and improving functional mobility. Mulligan's Mobilization technique have been

developed to overcome positional faults and joints with subtle mechanics changing.

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