International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2024: 7.101

A Comparison of Effectiveness of Hold - Relax Technique with Ultrasound and Maitland's Mobilization with Ultrasound in Improving Range of Motion in Osteoarthritis of Knee Joint

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Abstract: ***Osteoarthritis (OA) has been defined as "a heterogenous group conditions that leads to joint symptoms and signs which are associated with defective integrity of articular cartilage in addition to related changes in the underlying bone and at the joint margins". A total of 30 subjects fulfilled the selection criteria are included in study. They are assigned as Group A receive HOLD-Relax Technique with Ultrasound (n=15) and Group B receive Maitland's Mobilization with Ultrasound (n=15). Total study duration is 3 weeks, 20-30 minutes of 1 session for 5 days. The intra-group analysis showed that both Treatment A and Treatment B are effective in terms of improvement KNEE ROM TEST and in terms of reduction in VAS & WOMAC. However, the inter-group analysis compared the two treatment groups in terms of changes in all the outcome measures and the corresponding result showed that Treatment A is effective than Treatment Bin terms of improvement in Knee ROM Test and in terms of reduction in VAS, while there is no significant difference between two treatments in terms of reduction in WOMAC. Hence, we conclude that Treatment A (Hold-Relax Technique with Ultrasound) is effective than treatment B (Maitland's Mobilization with Ultrasound) in improving the value of KNEE Rand of Motion &Visual Analogue Scale.***

Keywords: VAS, WOMAC, Osteoarthritis

1. Introduction

Osteoarthritis (OA) has been defined as "a heterogenous group conditions that leads to joint symptoms and signs which are associated with defective integrity of articular cartilage in addition to related changes in the underlying bone and at the joint margins". It is a degenerative joint disease that involves the cartilage and many of its surrounding tissues that leading to damage and loss of articular cartilage as well as remodeling of subarticular bone, osteophyte formation, ligamentous laxity, weakening of periarticular muscles, and, in some cases, synovial inflammation. Joint pain, stiffness, and limitation of movement are the primary symptoms of OA. In 1961 WHO accepted the Kellgren and Lawrence system of classification of the severity of knee osteoarthritis. The classification ranges from grade 0 to 4; with grade 0 described as an OA that presents with no radiographic evidence and grade 4 characterized with marked joint space narrowing, severe sclerosis, large osteophytes and definite bony deformity. The knee joint is the major and most complex weight bearing joint of the body. 13% of women and 10% of men aged 60 years and above had symptomatic OA of the knee. The prevalence of OA knee is increasing due to the aging, obesity and overweight in the general population. Ultrasound has a greater frequency of 20,000 cycles per second (20 KHz). Ultrasound is a frequency between 0.7 to3.3 megahertz (MHz).The energy absorption at the depth of soft tissues is 2 to 5 cm. The effects of ultrasound are classified as thermal or non thermal effects. Acoustic streaming, micro streaming and cavitations, which may be capable of alerting cell membrane permeability and cell functioning, are the non thermal effects of ultrasound whereas the increase in tissue temperature constitutes the thermal effects of ultrasound. Continuous ultrasound is generally used to produce thermal effects, whereas pulsed ultrasound is used for non thermal effects. With this rise in the prevalence of OA especially knee OA, several studies have investigated several treatment modalities such as ultrasound, resistant exercise, combination therapies and other have shown that the use of ultrasound is effective for pain reduction in patients with knee OA, other studies found no such effects. Hold relax technique is a stretching or relaxation technique designed to obtain a lengthening reaction of muscles whose action is antagonist to the movement limited in range. Hold relax technique is an effective, simple, and pain- free technique. It is used to increase the range of motion in a joint. Proprioceptive neuromuscular facilitation (PNF) Stretching help to strengthen the muscles that are contracted and it is a good therapeutic tool for increasing active and passive flexibility. In Maitland mobilization, passive physiological and accessory oscillatory movements are applied to the joint to gain range of motion, lost due to pain or stiffness, and to restore optimal kinematics between the joint surfaces, where the grade, frequency and dosage of mobilization is determined by Severity, Irritability and Nature of the disorder. Maitland 'mobilization is also routinely used technique to increase range of motion in osteoarthritis.

2. Design and Methodology

Source of Data:
Data has been collected from Jaya college of physiotherapy and various clinics in and around Chennai. Only subjects

who are clinically diagnosed as OA knee will be included in the study. Subjects had been selected based upon the fulfillment of inclusion criteria. The purpose of the study was explained to all subjects and consent from each subject was obtained. The subject of thirty in total were randomly divided into group A & B. Group A receives hold-relax technique with ultrasound and Group B receives Maitland's mobilization with ultrasound.

Method of Collection of Data:
Primary data will be collected from the samples and 30 subjects of elderly population were included in the study after being randomly divided into GROUP A&B.

Study Design:
This study is based on the comparative study design**.**

Sampling Size:
A total of 30 subjects fulfilled the selection criteria are included in study. They are assigned as Group A receive HOLD-RELAX TECHNIQUE WITH ULTRASOUND (n=15) and Group B receive MAITLAND'S MOBILIZATION WITH ULTRASOUND (n=15).

Study Duration: Total study duration is 3 weeks.

Treatment Duration: 20-30 minutes of 1 session for 5 days in 3 weeks.

Sampling Criteria:

Inclusion Criteria: Patient diagnose with OA of knee, Gender –both male and female, Age-40 to 60, Self -reported knee pain, Unilateral or bilateral involvement, Pain in the medial knee compartment during weight bearing activities, Obesity, deformities of knee joint, crepitus, stiffness are included from my study.

Exclusion Criteria: Patient with Recent Surgeries, Recent injuries around the knee, Malignancy, Recent fracture, Below the age of 40 and above the 60, Presence of Rheumatoid arthritis, Infections like osteomyelitis and septic arthritis, Severe cardio-pulmonary disorder, Corticosteroid injection in the knee joint, not willing for participants are excluded from my study

Methodology:
Primary data will be collected from the samples and 30 subjects of elderly population were included in the study after being randomly divided into GROUP A&B.

Procedure:

Baseline treatment for both groups:

Isometric quadriceps exercise
Hold time: 5 seconds
Rest time for each repetition: 10 seconds
Repetition: 10 times

Hamstring stretching exercises
Hold time: 5 seconds
Rest time for each repetition: 10 seconds
Repetition: 10 times

Group A: hold-Relax with ultrasound (Duration-20 to 30 minutes)
After a basic treatment, the range of motion of knee joint is measured before starting the techniques
Position of the patient: sitting at the edge of plinth till range of 90 degree and prone.
Procedure: affected knee was flexed passively to the end of range with the therapist hand on the patient lower leg. patient then performed 5s of quadriceps contraction against the resistance of therapist patient were asked not to move at the end of 5s, the patient were asked to relax for 10 s and the therapist push the knee into more flexion and hold the new acquired range
Repetition: 5-7 times

Group B: Maitland's mobilization with ultrasound (Duration -20 to 30 min)
After the baseline treatment, the range of motion of knee joint is measured before starting the techniques
Tibiofemoral joint in posterior glide:
Patient position: high sitting till range attained 90 degree and prone later increase in range **Procedure:** palm of proximal hand was placed along the anterior border of the tibial plateau. With the elbows extended the body weight weaned onto the tibia, gliding it posteriorly
Oscillations: 10
Sets: 5

Patellofemoral joint-distal glide:
Patient position: supine with knee extended
Procedure: 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 feet. Placed the web space of the hand that was closer to the thigh around superior border of the patella, other hand was used in reinforcement. Glide was given to patella in a caudal direction, parallel to the femur.
Oscillations: 10
Sets: 5

Patellofemoral medial-lateral glide:
Patient position: supine with knee extended
Procedure: Finger were placed medially and thumbs laterally around the medial and lateral border of patella .glide was given to patella in a medial or lateral direction against restriction.
Oscillation: 10 Sets:5

3. Methodology

t-Test: Paired Two Sample for Means

	A_KNEE ROM TEST_PRE	*A_KNEE ROM TEST_POST*
Mean	**88.67**	**103.33**
SD	**8.34**	**8.80**
Observations	15	15
Df	14	
t Stat	**-24.82**	
P(T<=t) one-tail	**0.000**	

t-Test: Paired Two Sample for Means

	A_VAS_PRE	*A_VAS_POST*
Mean	**6.87**	**3.47**
SD	**1.06**	**1.13**
Observations	15	15
Df	14	
t Stat	**14.47**	
P(T<=t) one-tail	**0.000**	

t-Test: Paired Two Sample for Means

	A_WOMAC TEST_PRE	*A_WOMAC TEST_POST*
Mean	**64.93**	**34.60**
SD	**6.24**	**4.95**
Observations	15	15
Df	14	
t Stat	**26.02**	
P(T<=t) one-tail	**0.000**	

t-Test: Paired Two Sample for Means

	B_KNEE ROM TEST_PRE	B_KNEE ROM TEST_POST
Mean	**87.33**	**98.67**
SD	**11.78**	**12.32**
Observations	15	15
Df	14	
t Stat	**-14.79**	
P(T<=t) one-tail	**0.000**	

t-Test: Paired Two Sample for Means

	B_VAS_PRE	B_VAS_POST
Mean	**6.07**	**3.27**
SD	**0.96**	**1.16**
Observations	15	15
Df	14	
t Stat	**16.04**	
P(T<=t) one-tail	**0.000**	

t-Test: Paired Two Sample for Means

	B_WOMAC TEST_PRE	B_WOMAC TEST_POST
Mean	**61.93**	**34.53**
SD	**8.26**	**4.98**
Observations	15	15
Df	14	
t Stat	**16.41**	
P(T<=t) one-tail	**0.000**	

t-Test: Two-Sample Assuming Equal Variances

	A_KNEE ROM TEST Diff	B_KNEE ROM TEST Diff
Mean	**14.67**	**11.33**
SD	**2.29**	**2.97**
Observations	15.00	15.00
Df	28.00	
t Stat	**3.44**	
P(T<=t) two-tail	**0.002**	

t-Test: Two-Sample Assuming Equal Variances

	A_VAS Diff	B_VAS Diff
Mean	**-3.4**	**-2.8**
SD	**0.91**	**0.68**
Observations	15	15
Df	28	
t Stat	**-2.05**	
P(T<=t) two-tail	**0.049**	

t-Test: Two-Sample Assuming Equal Variances

	A_ WOMAC TEST Diff	*B_ WOMAC TEST Diff*
Mean	-30.33	-27.40
SD	4.51	6.47
Observations	15.00	15.00
Df	28.00	
t Stat	-1.44	
P(T<=t) two-tail	0.161	

4. Discussion

OA Knee is the result of degeneration of the articular cartilage in the knee joint. These changes usually develop slowly and get worse over time. OA Knee causes pain, stiffness, and swelling. in chronic stages, it also causes reduced function and disability, no longer able to do daily task or work. In this study, patients are assessed through goniometer, VAS and WOMAC for OA Knee. A sample of 30 subjects fulfilling the inclusion criteria have randomized into 2 groups of 15 subjects each. All participants were clearly explained about the treatment procedure. Group A- HOLD-RELSX TECHNIQUE WITH ULTRASOUND for about 3 weeks. Group B - MAITLAND'S MOBILIZATION WITH ULTRASOUND for about 3 weeks. All the subjects were randomly divided into two groups. The informed consent was obtained from the all participants and they underwent treatment for 3 weeks. The outcome measure were recorded on before and after of the treatment using goniometer, VAS and WOMAC on the first and last day of treatment. The outcome measures were recorded using, GONIOMETER-Used to measure range of motion of knee joint VAS (Visual analog scale)-used to assess pain, WOMAC (Western Ontario and Mc Master Universities Osteoarthritis Index)-Used to assess pain, stiffness, and functional ability. The first objective of the study was to compare the effectiveness of Hold-Relax with ultrasound and Maitland's mobilization with ultrasound in improving range of motion in osteoarthritis of knee joint in terms of Goniometry, VAS and WOMAC.

Group: A Hold – Relax Technique with Ultrasound

According to Cakir, S., Hepguler, S., Ozturk, C., Korkmaz, M., Isleten, B. and Atamaz, F.C., 2014, The study on Efficacy of therapeutic ultrasound for the management of knee osteoarthritis prescription in this common OA patient sub group. This study concluded that US could be efficacious for decreasing pain and may improve physical function in patients with knee OA. According to.Bonnar BP, Deivert RG, Gould TE 2004, The study on The relationship between isometric contraction duration during hold relax stretching and improvement of hamstring flexibility. This study concluded that All 3 hold-time conditions produced significant gains in range of motion compared to baseline measurements. According to Spernoga SG, Uhl TL, Arnold BL, Gansneder BM 2001, the study on Duration of maintained hamstring flexibility after a one-time, modified hold-relax stretching protocol. this study concluded that A 1-time, modified hold-relax stretching protocol was effective in increasing hamstring flexibility as measured by AKE. However, the gains in ROM lasted for only 6 minutes after the final stretch, and this protocol may not be any more effective than static stretching.

The baseline mean difference of knee ROM for hold –relax technique with ultrasound by (table 4) was 88.67 after the end of 3 weeks the mean difference was increasing the value 103.33.the paired t –test done in comparison of pre and post –test mean score showed that t = - 24.82, p = 0.000 < 0.05. The baseline mean difference of VAS for hold -relax technique with ultrasound by (table 5) was 6.87 after the end of 3 weeks the mean difference was decreased the value 3.47.the paired t -test done in comparison of pre and post-test mean score showed that t = 14.47, p = 0.000< 0.05. The baseline mean difference of WOMAC for hold -relax technique with ultrasound by (table 6) was 64.93 after the end of 3 weeks the mean difference was decreased the value 34.60.the paired t- test done in comparison of pre and post-test mean score showed that t = 26.02, p = 0.000 < 0.05.

Group-B Maitlan's Mobilization with Ultrasound

According to Cheraladhan E. Sambandam1 Sejal N. Sailor2 Jagatheesan Alagesan3 *1 Cheraladhan E. Sambandam, Sumandeep Vidyapeeth 2 Sejal N. Sailor, Sumandeep Vidyapeeth, 2011, the study on Effect of Mulligan Mobilization and Maitland Mobilization in Subjects with Unilateral Tibiofemoral Osteoarthritis. The study concludes that Mulligan mobilization is more effective than Maitland mobilization (MWM) in Tibiofemoral joint osteoarthritis. **According to Yang, P.F., Li, D., Zhang, S.M., Wu, Q., Tang, J., Huang, L.K., Liu, W., Xu, X.D. and Chen, S.R., 2011,** the study on Efficacy of ultrasound in the treatment of osteoarthritis of the knee. This study concluded that Ultrasound treatment significantly alleviates joint symptoms, relieving joint swelling, increasing joint mobility and reducing inflammation, in osteoarthritis patients. **According to MIKLÓS POZSGAI 1,2, ERZSÉBET KÖVESDI 3, BALÁZS NÉMETH4, ISTVÁN KISS4, NELLI FARKAS5, TAMÁS ATLASZ6, MÁRK VÁCZI 6* and NÓRA NUSSER1,2* 2021,** the study on Effect of End-range Maitland Mobilization in the Management of Knee Osteoarthritis, this study concluded that both interventions were effective in alleviation of pain and improvement of physical function. oscillatory Grade III or IV endrange Maitland mobilization in addition to conservative therapy provided superior effect on alleviation of pain in general and during certain functional activities, on flexion PROM of both knees, on right hamstring peak muscle force and on 6MWT, compared to conservative therapy alone, in patients with moderate- to-severe OA. these outcome measures are good indicators for evaluating the effect of end-range Maitland mobilization

The baseline mean difference of knee ROM for MATLAND'S MOBILISATION with ultrasound by (table 7) was 87.33 after the end of 3 weeks the mean difference was increasing the value 98.67.the paired t –test done in comparison of pre and post –test mean score showed that t = -14.79, p = 0.000 < 0.05. The baseline mean difference of VAS for MATLAND'S MOBILISATION with ultrasound by (table 8) was 6.07 after the end of 3 weeks the mean difference was Decreased the value 3.27.the paired t –test done in comparison of pre and post –test mean score showed that t = - 16.04, p = 0.000 < 0.05. The baseline mean difference of WOMAC for MATLAND'S MOBILISATION with ultrasound by (table 9) was 61.93 after the end of 3 weeks the mean difference was decreased the value 34.53.the paired t –test done in comparison of pre and post –test mean score showed that t = -16.41, p = 0.000 < 0.05.

Comparing the Inter Group Analysis of Group-A and Group-B:

There is significant difference between two treatments (A and B) in terms of average improvement in KNEE ROM TEST (t = 3.44, p = 0.002< 0.05). In addition, the mean improvement in the value of KNEE ROM TEST by Treatment A (14.67°) is greater than that of Treatment B (11.33°). Hence, we conclude that **Treatment A is significantly effective than Treatment B**in terms of mean improvement in the value of **KNEE ROM TEST**. There is significant difference between two treatments (A and B) in terms of average reduction in **VAS** (t = -2.05, p = 0.049< 0.05). In addition, the mean reduction in the value of VAS by Treatment A (3.40) is greater than that of Treatment B (2.80). Hence, we conclude that **Treatment A is significantly effective than Treatment B** in terms of mean reduction in the value of **VAS**. There is no significant difference between two treatments (A and B) in terms of average reduction in WOMAC TEST (t = -1.44, p = 0.161> 0.05). Hence, we cannot conclude that **Treatment A (or B) is significantly effective than Treatment B (or A)** in terms of mean reduction in the value of **WOMAC TEST**. The intra-group analysis showed that both Treatment A and Treatment B are effective in terms of improvement KNEE ROM TEST and in terms of reduction in VAS&WOMAC. However, the inter-group analysis compared the two treatment groups in terms of changes in all the outcome measures and the corresponding result showed that **Treatment A is effective than Treatment B**in terms of improvement in KNEE ROM TEST and in terms of reduction in VAS, while there is no significant difference between two treatments in terms of reduction in WOMAC. Hence, we conclude that Treatment A (HOLD-RELAX TECHNIQUE WITH ULTRASOUND) is effective than treatment B (MAITLAND'S MOBILIZATION WITH ULTRASOUND) in improving the value of KNEE Rand of Motion &Visual Analogue Scale.

5. Conclusion

The intra-group analysis showed that both Treatment A and Treatment B are effective in terms of improvement KNEE ROM TEST and in terms of reduction in VAS & WOMAC. However, the inter-group analysis compared the two treatment groups in terms of changes in all the outcome measures and the corresponding result showed that **Treatment A is effective than Treatment B** in terms of improvement in KNEE ROM TEST and in terms of reduction in VAS, while there is no significant difference between two treatments in terms of reduction in WOMAC. **Hence, we conclude that Treatment A** (HOLD-RELAX TECHNIQUE WITH ULTRASOUND) is **effective than treatment B** (MAITLAND'S MOBILIZATION WITH ULTRASOUND) in improving the value of KNEE Rand of Motion &Visual Analogue Scale.

6. Limitations and Recommendations

Limitations

The sample size was small, Short duration of the study and no long term follow up of the patients, Only osteoarthritis were taken.

Recommendations

Larger sample size can be taken, A study can be done with longer duration, In future studies, grading of osteoarthritis can be targeted, In future studies, different modalities and techniques can be used to improve the range of motion, Longer study duration and follow up can be done to assess long term benefits, Difference between male and female can be studied.

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