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Research Article

Effect of Mulligan's Mobilization Versus Muscle Energy Technique on Sacroiliac Joint Dysfunction

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Abstract: Sacroiliac joint dysfunction (SIJDF) is about 15% to 30% identified in a patient with low back aches. This Study aimed to determine the effect of mulligan mobilization versus muscle energy technique on sacroiliac joint dysfunction. The study was a randomized controlled trial that involved 66 participants with SIJDF, after a thorough evaluation the participants were divided into three groups. In experimental group I (Mulligan's mobilization group (MMG)), participants underwent Mulligan mobilization for 20 minutes. The experimental group II (Muscle energy group (MEG)) participants underwent the muscle energy technique for 20 minutes, and the third group underwent moist heat therapy (moist heat group (MHG)) for 20 minutes. For all three groups, 10 minutes of exercise were taught to the patients. All the participants of the groups were included based on pre-determined selection criteria, and all were willing to participate in the Study. The outcome measures of Pain, functional disability, and kinesiophobia were measured by the Numerical pain scale, Oswestry disability index, and Tampa scale respectively. The result was computed using One-way ANOVA, showing significant differences between the three groups. When significant differences were obtained on ANOVA, further analysis was done using a post hoc test. The values for the outcomes are Pain was compared with MMG vs. MEG is 8.045 and the MMG vs. MHG is 4.022 and MMG vs. MEG is 12.07, on Oswestry disability index MEG vs. MHG 9.85, MMG vs. MHG is 2.23 and MMG vs. MEG is 12.08. For kinesiophobia, MMG vs. MEG is 20.25, MMG vs. MHG is 15.35, and MMG vs. MEG is 35.60. This Study concludes that Mulligan's mobilization is more effective in reducing pain, improving function, and kinesiophobia in SI joint dysfunction than the other two groups.

Keywords: Pain intensity, kinesiophobia, sacroiliac joint dysfunction (SIJDF), Mulligan's mobilization, muscle energy technique, moist heat therapy.

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1. INTRODUCTION

Sacroiliac joint (SI) Pain is an underappreciated source of mechanical low back pain, affecting 15 and 30% of individuals with chronic, non-radicular pain[1]. In the general population, SI joint is a prevalent cause of low back discomfort. Because it connects the spine to the lower extremities[2]. Sacroiliac joint dysfunction (SIJD) pain is felt over the sacral sulcus and in the region of the posterior iliac spine, sometimes referring to the groin, buttocks, and posterior thigh and less often to the lower limbs[2]. SI joint pain represents a frequently misdiagnosed cause of lower back pain, affecting about 15% to 30% of individuals with mechanical low back pain below L5. The prevalence of SI joint dysfunction is one of the primary sources of lower back pain, from 0.4% to 35%[3]. SI joint dysfunction is associated with Pain and stiffness which can, later on, give motion restrictions. 60% of the body weight is received by the SI Joint and through the pelvis and lower extremities. Due to biomechanical alteration, muscles around the joint area get weakened[4]. Owning to anatomical location and overlapping pain referral patterns, these SI joint syndromes can be difficult to differentiate from other spinal disorders. Making an accurate diagnosis of SIJD is always challengeable[5]. The analysis of the pathomechanics of the sacroiliac joint is that anterior rotational forces tend to rotate the innominate bone anteriorly and downward around the acetabulum while the ilia lift and carry the sacrum upward, changing the relationship of the sacrum iliac joint to the acetabulum. Because the sacrum is placed within the innominate and is wider anteriorly than posteriorly the innominate bones rise and diverge on the sacrum, where they may become fixed, although more common bilaterally. This fixation frequently occurs unilaterally causing a pelvic obliquity, and a high iliac crest on the same side when the patient is positioned standing SIJD can only be identified through a mix of assessment techniques, including the history of the patient, palpatory observations, segmental motion tests, a comprehensive biomechanical examination, and the right diagnostic approaches[6]. To differentiate the conditions more clearly, special tests would be beneficial[7]. Many therapeutic interventions are available for the management of SI joint dysfunctions. Management of SI joint dysfunction focuses on alleviating pain and restoring the range of motion. In most cases, SI joint pain is effectively managed using non-surgical methods[8]. Muscle energy technique (MET) is one of the soft tissue manipulation methods which incorporate precisely directed and controlled, patient-initiated, isometric, or isotonic contraction designed to improve function and reduce pain[9]. MET requires that the patient perform voluntary muscle contractions in a precise direction where the clinician applies a counterforce not allowing movement. Mulligan's concept of mobilization is a specific therapeutic intervention for a couple of accessory mobilizations with physiological movements. The techniques are based on the application of sustained accessory joint mobilization, often in the weight-bearing position, which utilizes patient-generated operational or functional tasks through a specified range of joint motion[10]. Although various studies have identified the effects of the various therapeutic methods, there needs to be more studies to identify effective management of SI joint dysfunction. The study aims to identify the effect of Mulligan's mobilization versus muscle energy technique on Pain, functional disability, and kinesiophobia on SI joint dysfunction.

2. MATERIALS AND METHODS

This study is a randomized controlled trial approved by the Institutional Ethical Committee, KMCH hospital, Coimbatore. The ethical approval number is Ref: EC/AP/876/01/2022.

2.1. Recruitment and participants

This Study involves participants with low back pain. All the recruitment started from a pool of 150 participants who complained of low back pain and had sacroiliac syndromes. The study was conducted at OPD, KMCH, Coimbatore. The study was conducted from Sep 2021 to Feb 2022. All the low back pain participants who visited the OPD were evaluated individually. Evaluation of individual participants was done to identify the SI joint dysfunctions. The patients who complained of lower back pain were evaluated thoroughly by a senior orthopaedist to make a confirmatory diagnosis of SI joint dysfunctions. Eighty-five participants were selected for the Study and were grouped into three groups by random allocation using the computer. Each group had 28 participants, and they were all randomly allocated into three groups by the blinded assessor. The blinded assessor also took pre-intervention measurements. Before the study began, all the participants were given oral instructions about the condition and treatment. In addition, all the participants signed the written consent form, which the IEC approved. The patients who complained of lower back pain were evaluated thoroughly by senior orthopaedics to make a confirmatory diagnosis of SI joint dysfunctions. A blinded assessor evaluated all the participants and recruited the participants who fell under the pre-determined selection criteria. The selection criteria were as follows, a) history of sacroiliac pain for more than a month and reduced hamstring flexibility, b) age limit, c) age group of 22 years to 44 years, d) both genders involved, e) participants with more than three positive tests in the five tests for the sacroiliac joint dysfunction tests. The participants who didn't include in the Study were a) Spinal or pelvic injuries, b) fractures at the lower extremity, c) radiating pain with neurological deficit, d) recent history of spinal surgery, hip or knee dysfunction, f) tuberculosis spine, g) spondylolisthesis, h) facet joint syndrome in the lumbar spine, i) malignancy tumors, j) pregnancy, and k) psychiatric patients.

2.2. Interventions

The whole Study was carried out for six weeks. Once the Study was begun, 6 participants withdrew from the Study in the first week due to an increase in symptoms; later in the subsequent week, around 12 participants were withdrawn due to personal reasons, so the final calculation was made with 22 participants in each group. Experimental group-I participants underwent Mulligan's mobilization for 20 minutes, and exercises were given for 10 minutes. This group is called Mulligan's mobilization group (MMG). The second experimental group participants underwent the Muscle energy technique for 20 mins, and exercises were given for 10 mins. This group is called the Muscle energy group (MEG), and the third group underwent moist heat therapy for 20 mins and the exercises for 10 mins. This group is called the moist heat group (MHG). All participants were given a clear explanation of the Study.

3. MULLIGAN'S MOBILIZATION

3.1. Position of the therapist for an anterior innominate fault

I was standing directly in front of the patient's pelvis on the side, non-affected by the SIJ. Stabilizing hand: palms down on the sacrum, fingers pointing caudally so that the ulnar border is directly next to the SIJ on the same side. On the side of the affected sacroiliac joint, the fingers of the hand used for mobility are around the anterior part of the ASIS. Therefore, the mobilizing force is applied to the anterior aspect of the ASIS.

Fig 1: Anterior Nominate Mobilisation Technique

3.2. For a posterior innominate fault

Mobilizing hand: The lowermost hand was used as a moving hand. Its thenar eminence was positioned just medial to the major portion of the posterior iliac crest; thus, the fingers pointed outward. The same side's heels were employed to rotate or glide laterally toward the innominate about the sacrum. The second hand's palm can either stabilize the rest of the pelvis or support the mobile hand and aid in the execution of the lateral glide. Three sets of this approach, each with ten repetitions, were administered for 12 sessions on alternate days. The Pain is a result of the mobilization being performed in functional positions[10]. The exercise was done while standing and walking for participants who experienced sacroiliac joint Pain when walking, which is thought to be caused by an anterior or posterior innominate defect.

Fig: 2 Posterior Nominate Mobilisation Technique

Self-Mobilization: At the end of the treatment session, self-mobilization was taught to the patient for anterior innominate: The patient was in all fours position with a towel under the ipsilateral knee and asked to sit on their feet with the hands relatively fixed on the couch, which produces the postero-lateral glide. For posterior innominate, the towel was placed on the contralateral knee, and he was asked to sit on his feet, which provided an anteromedial glide.

4. MUSCLE ENERGY TECHNIQUE

The participants in group B were given the Muscle energy technique. Muscle energy technique (MET) exercises[32] include post-isometric relaxation techniques for spinal stabilizers like the erector spine and hamstrings, anterior stabilizers like the Iliopsoas muscle, which stabilizes the spine anteriorly and regulates the lumbar pelvic rhythm, and lateral stabilizers like the quadrates lumborum muscle[11]. It was administered three

times each session for a total of 12 sessions, with each position being held for 7–10 seconds. The limitation barrier was then identified, and the subjects were instructed to do a 20–30% isometric contraction, maintain it for 7–10 seconds, and then relax for 2–3 seconds. Instructions for proper breathing were given. Then, three times per session, the limb was moved past the restriction barrier on an exhalation and kept there for 10 to 30 seconds.

4.1. Hamstrings muscle [31]

The subject was lying supine with the leg hung over the therapist's shoulder. The therapist's hand was on the anterior lower part of the thigh of the unaffected limb; the other hand was on the anterior lower part of another thigh just above the knee joint to maintain the knee in the extended position. First, the therapist flexes the subject's hip and extends the knee. Next, the participant performed a mild knee isometric flexion (20-30% of maximal contraction), by pressing his ankle joint against the top of the therapist's shoulder. Then, after relaxation, the therapist stretched the leg to the new barrier and held the position for 30 seconds.

Fig 3: Muscle Energy Technique for Hamstring Muscle

4.2. Iliopsoas muscle

The supine position was used in which the patient lies with the buttocks at the edge of the table, the nonaffected leg fully flexed at the hip and knee and held in that position by the patient. The affected limb was allowed to hang freely. The Therapist placed the hand on the anterior lower part of the thigh, the other hand was on the anterior upper part of another leg. After the isometric contraction, the thigh was taken very slightly beyond the restriction barrier, on an exhalation, with a fair degree of pressure towards the floor, and held there for 10–30 seconds[30].

Fig 4: Muscle Energy Technique for Iliopsoas Muscle

4.3. Quadratus lumborum muscle

The subject lies supine with the feet crossed at the ankle. The patient was placed in a side bending, away from the treated side, so that the pelvis was towards that side, and the feet and head were away from that side (banana-shaped). The therapist put one hand under the subject's shoulders to grasp the treated side axilla. The subject grasped the therapist's arm with the treated side hand at the elbow, making contact more secure. The therapist's other hand was placed on the anterior superior iliac spine on the treated side. The patient was instructed to very lightly sideband towards the treated side producing an isometric contraction in quadratus lumborum. After 7 seconds, the patient was asked to relax completely, then to the sideband towards the non-treated side, as the therapist bent backward slightly to sideband the patient.

Fig 5: Muscle Energy Technique for Quadratus Lumborum Muscle

5. MOIST HEAT THERAPY

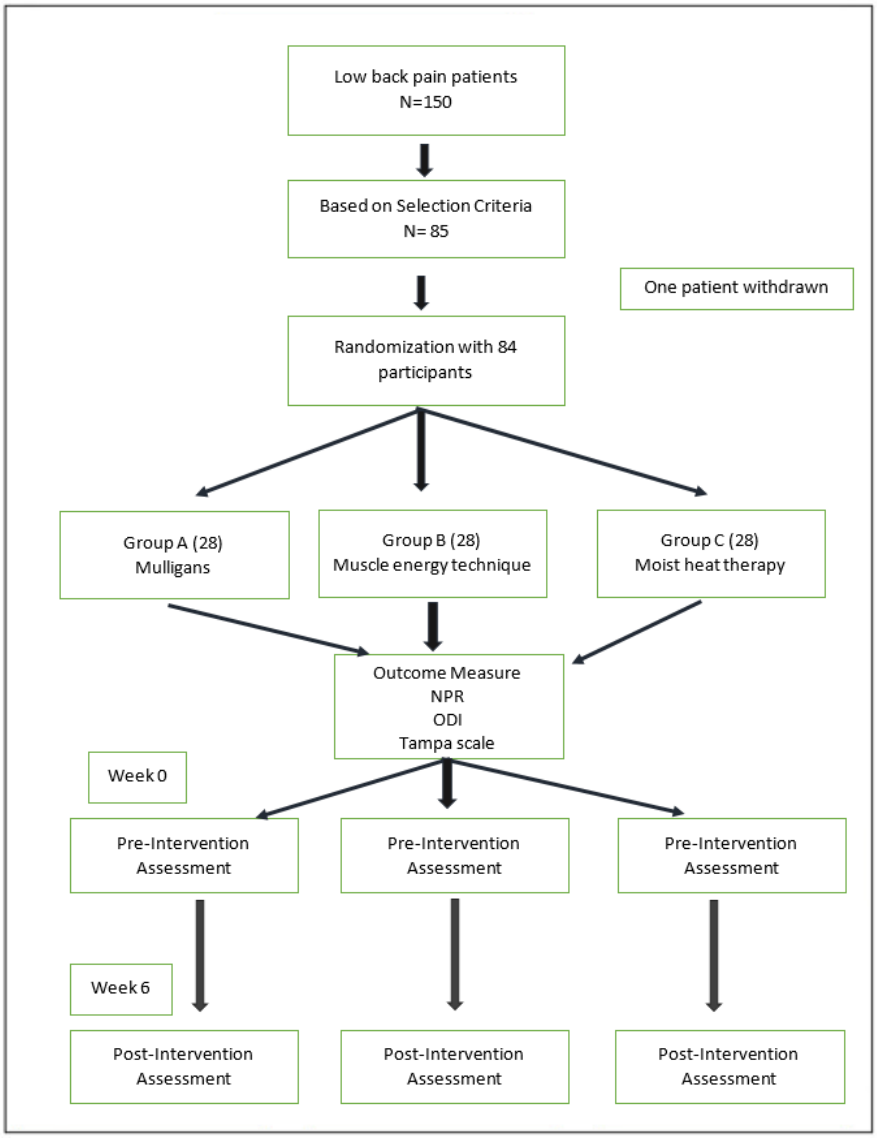
The patient was positioned in prone lying and the hot pack was wrapped in a terry cloth towel and applied over the affected area for 20 minutes once a day for six secessions per week.

Fig 6: Moist Heat Therapy

5.1. Outcome measures

The outcome measures were Pain, functional disability, and kinesiophobia. The Pain was measured using the Numerical pain scale, functional disability was measured using the Oswestry disability index, and kinesiophobia was measured using the Tampa scale for kinesiophobia. The Numerical pain scale was measured using a 10cm scale where 0 indicates no pain and 10 indicates intolerable Pain; the patient was asked to touch how much pain they felt. The Oswestry disability questionnaire contains Pain or discomfort during various ADL activities. The participants were instructed to select the appropriate response. The Tampa scale of kinesiophobia measures the fear of movement, designed with the questions, and the participants were instructed to mark the best possible answers. All the outcome measures have high reliability and validity. The measurement was taken on the first visit by the participants and at the last visit. Subsequent data were collected, but the first and last measurements were taken for the analysis. All the study data reports were stored and arranged at the KMCH PMR department, and the case sheets and assessment reports of all the subjects were kept in the locked cupboard. The rest of the e-data were safely present and secured in the password-protected desktop. The subjects' personal details were saved separately and notified by unique a code number. The store access is limited to the institution's research faculties and authorized persons.

5.2. *Flow Chart*



6. STATISTICAL ANALYSIS AND SAMPLE SIZE

The sample size selected for the Study is based on the power analysis of 85%, with mean 10 points differences in the pain values and the functional disability. So, based on the analysis, this Study selected 28 participants. First, statistical analysis was done to identify the effect of the groups; the characteristics of the groups were explained in tables I & II. Next, the values were identified at three intervals used for the analysis using one-way ANOVA, and the results showed significant differences between the groups and the three values. Once the ANOVA identified the differences, the post hoc test was applied to identify the number of differences in the groups. It has shown that the critical value of at $p < 0.05$.

Table I: Demographic analysis of the participants

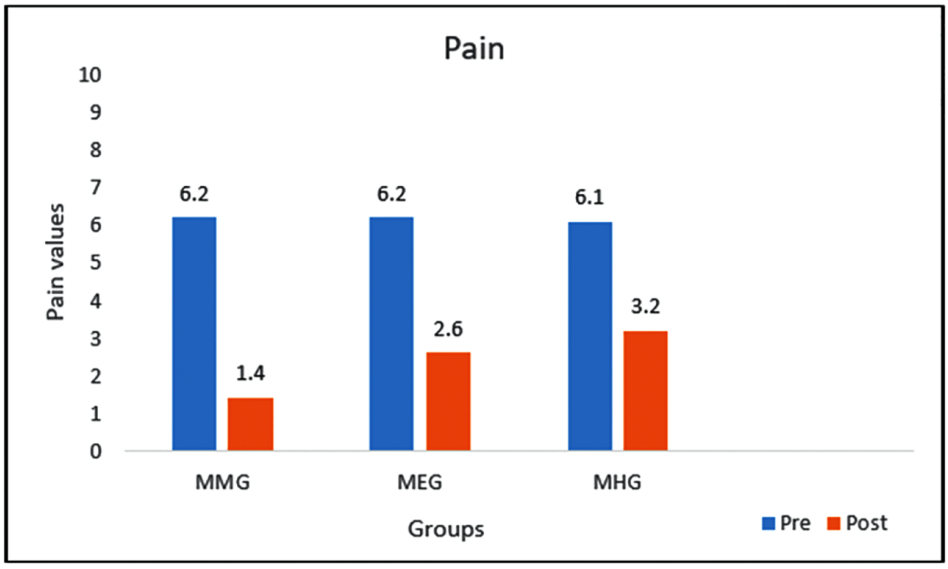
Characteristics	Mean	S. D
Male	34.07	5.95
Female	33.51	5.85
Age	33.73	5.86
Weight	77.83	11.4
Height	153.63	5.68

Table II: Pain Scale, Oswestry Disability & Kinesiophobia Analysis between the Groups

Outcome measures	Sum of Squares	df	Mean square	F value	Significance
Numerical Pain Scale					
Between Groups	35.85	2	17.925	37.76	0.0001
Within Groups	29.91	63	0.475		
Total	65.76	65			
Oswestry Disability					
Between Groups	511.88	2	255.92	41.35	0.0001
Within Groups	389.91	63	6.189		

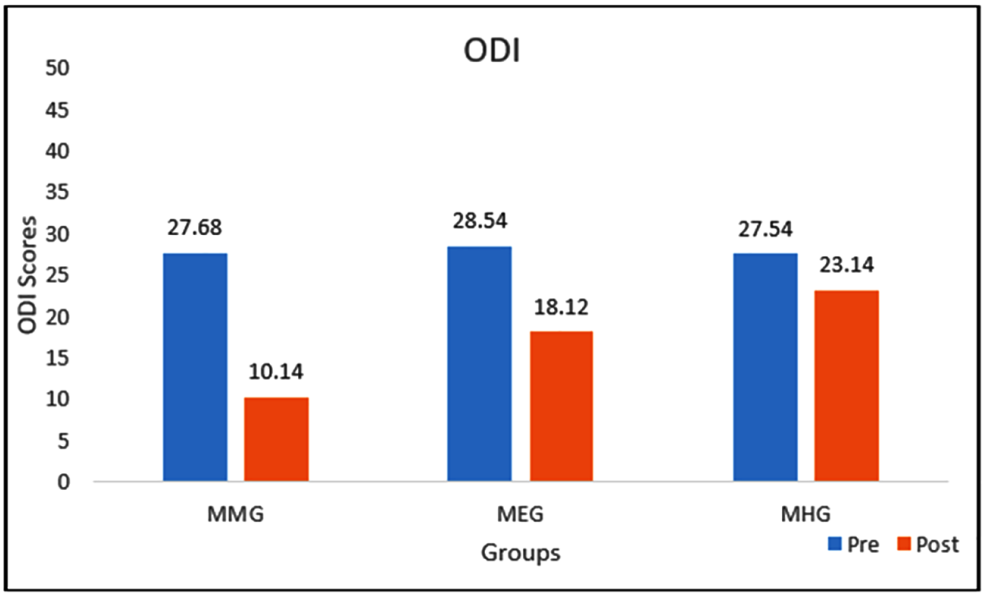
Total	901.76	65			
Kinesiophobia					
Between Groups	1146.80	2	573.40	315.76	0.0001
Within Groups	112.59	63	1.816		
Total	1259.39	65			

The results have identified that there were significant differences shown within the groups and between the groups. One-way ANOVA showed that there were significant differences exist between the three groups. The p-value corresponding to the F-statistic of one-way ANOVA is lower than 0.05, suggesting that one or more treatments are significantly different.



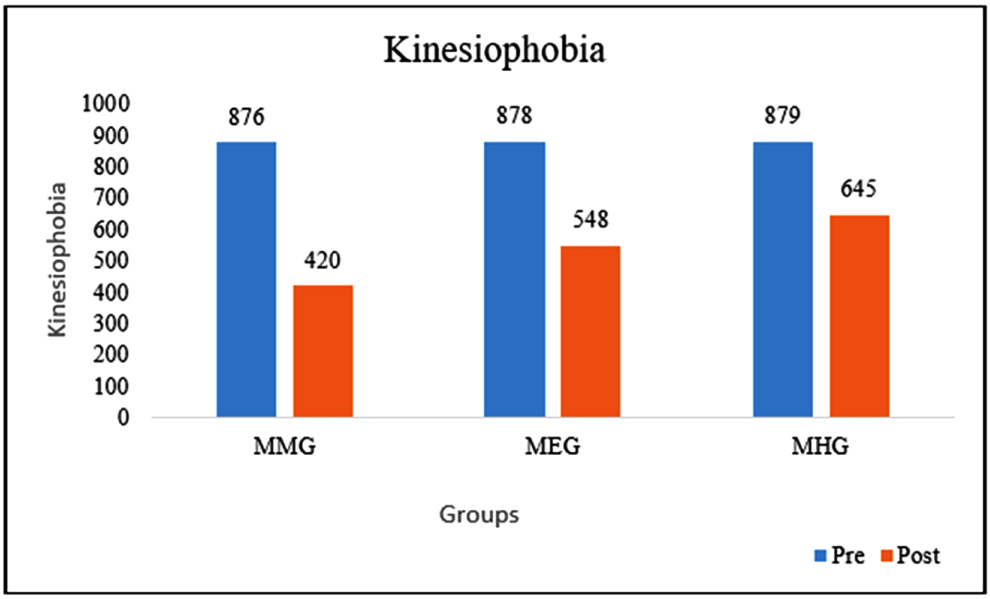
Graph I: Pain Scale values between the groups

This graph shows the value of Pain scores between the groups. It was shown that the MMG group produces a significant reduction of Pain when compared with other groups.



Graph II: Disability values between the groups

The graph displays the disability values between the groups. It was shown that the MMG group has a marked reduction in disability compared to the other groups.



Graph III: Kinesiophobia Scores between the groups

The graph displays the fear of movement values between the groups. It was shown that the MMG group has a marked reduction of kinesiophobia compared to the other groups.

Table III: Post hoc Test on the Pain Scale

Treatment pairs	Tukey HSD Q Statistics	Tukey HSD p-value	Tukey HSD Influence
MMG vs. MEG	8.045	0.001	p <0.01
MEG vs MHG	4.022	0.162	p <0.05
MMG vs. MHG	12.067	0.001	p <0.01

Table IV: Post hoc Test on the Oswestry Disability Index

Treatment pairs	Tukey HSD Q Statistics	Tukey HSD p-value	Tukey HSD Influence
MMG vs. MEG	9.855	0.001	p <0.01
MEG vs MHG	2.228	0.164	p <0.05
MMG vs. MHG	12.084	0.001	p <0.01

Table V: Post hoc Test on the Kinesiophobia

Treatment pairs	Tukey HSD Q Statistics	Tukey HSD p-value	Tukey HSD Influence
MMG vs. MEG	20.25	0.001	p <0.01
MEG vs MHG	15.35	0.001	p <0.05
MMG vs. MHG	35.60	0.001	p <0.01

Post hoc test analysis found a significant difference between the groups of MMG when compared with MEG and MMG when compared with MHG. The results of this Study showed both groups were improved, whereas a significant improvement was noted in MMG compared to MEG and MHG. So, this study rejects the null hypothesis.

7. DISCUSSION

Studies identified that mulligans mobilization has helped in reducing Pain and disability[12] Mulligan's mobilization aids in reducing pain; studies done by Abbott et al. stated that attempt to glide in the direction of pain reduction, the pain relief mechanism was hypothesized to be changed due to changes in nociceptive and motor system dysfunction possibly implying the role of hypoalgesia[13]. The study aims to identify the effect of mulligans mobilization versus muscle energy technique on Pain, functional disability, and kinesiophobia on SI joint dysfunction. Several studies stated that SI joint dysfunction is one of the sources of Pain in the lumbar region and the buttock region[14]. SI joint dysfunction has no specific pain distribution and is very difficult to diagnose[15]. The results of this study revealed a statistical improvement in all the post-intervention values in the mulligan mobilization group, muscle energy group, and moist heat therapy group. All three groups have reduced Pain, disability, and kinesiophobia. When comparing the three groups, the mulligan Group (MMG) has shown a remarkable improvement over the muscle energy Group (MEG) and moist heat group (MHG). Hubbard T hypothesized that mulligans mobilization reduces minor positional faults at the specific joints; correcting these faults would result in reduced pain and improved motion[17]. Brian Mulligan claims that when accurate mobilization is used to treat sacroiliac joint Pain, the Pain usually goes away[18]. Moist heat therapy would increase metabolism and wash away the metabolic products, increasing damage to the tissues[19] MET

works based on its neurophysiological principles and post-isometric relaxation on the agonist's muscle after isometric contraction. However, persistent corrective mobilization restores the pain-free function, and repeated applications result in long-lasting gains[20]. Applying heat therapy would increase tissue flexibility and muscle resistance and facilitate better muscle contraction and improvement in muscle functions[21]. Many studies have found the effectiveness of moist heat therapy on pain reduction and resolving the muscle's inability to contractions[22]. In addition, many studies identified that METs help in reducing Pain and dysfunction in the SI joint dysfunctions[24]. Stretch receptors in the Golgi tendon organ are located in the tendon of the agonist's muscles and also inhibit muscle contraction[25]. METs alter the asymmetrical position of the pelvis by focusing on hip muscle contraction and aligning the pelvic and SI joint[26]. Based on Chaitow's description of the neurophysiology of the muscle energy technique, which shows a subsequent decrease in the tone of the agonist's muscle following isometric contraction, it is possible to extrapolate that the technique reduces pain[27]. Lewis supports this observation that the increased muscle tension of the involved muscles, which produces discomfort and dysfunction, is reduced by restoring the full length of the muscle also because of the Golgi tendon organ responses to overstretching of the muscles by preventing further contraction[28]. Muscle energy techniques are the forms of soft tissue therapy that primarily work on the active muscles and also facilitate and control the voluntary isometric contraction of the targeted muscles. METs have been shown to restore pubis alignment with pelvic symmetry and help manage SI joint pain[29].

8. LIMITATIONS

There is no pure control group in the Study because all the groups were included with certain protocols. Future Study needs to have a separate control group to identify the effects of each intervention. The Study experiences a noticeable dropout rate, and it is exceedingly challenging to find participants for this Study. Since there are significant dropout rates during participant recruiting, this Study has used smaller samples. The home programs should be more strictly observed for this Study. Therefore, home programs for future Study need to be carefully maintained. The researcher has no control over additional variables like the individuals' daily activities, eating habits, stress at work, or travel. Future research should take these restrictions into account and use minimal effect sizes.

9. CONCLUSION

This Study concludes that Mulligan's mobilization and Muscle energy technique has been shown effective in reducing pain and improving function and kinesiophobia in participants with SI joint dysfunction. Furthermore, Mulligan's mobilization group was significantly improved in all the variables compared with the Muscle energy technique group; when compared with moist heat therapy, both the experimental groups showed significant improvement.

10. ACKNOWLEDGEMENT

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11. AUTHORS CONTRIBUTION STATEMENT

Prof Sivakumar and Prof Kamala kannan. M have conceptualized the work. Prof Kalpana, Prof Prakash, and Dr. Arun have gathered the data concerning this work. Prof Sivakumar, Prof Kamala kannan. M and Prof Kalpana have analyzed the data, and necessary inputs were given towards designing the manuscript. Finally, all authors discussed the methodology and results and contributed to the final manuscript.

12. CONFLICT OF INTEREST

Conflict of interest declared none.

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