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A Comparative Study for Immediate Effectiveness of Muscle Energy Technique and Mulligan Taping In Sacroiliac Dysfunction (Hypomobility) - Randomized Clinical Trial

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ABSTRACT

Background - Muscle energy technique and Mulligan taping both are widely used in treatmentof SI joint disorders. MET is a manual therapy technique that involves voluntary muscle contractions against a controlled counterforce, aiming to improve joint mobility and reduce pain by enhancing muscle function and joint alignment. Mulligan Taping, on the otherhand, involves the application of adhesive tape in specific patterns to support joint function, facilitatemovement, and provide proprioceptive feedback, potentially improving joint mobility and stability. While both techniques are employed in clinical practice extensively, there is a need for comparative study to evaluate their effectiveness specifically in the context of SI joint hypomobility.

Aim- This study compare the effectiveness of Muscle energy technique and Mulligan taping in SI joint dysfunction in terms of pain and range of motion.

Method- This study sample consist of 12 patients divided into 2 groups (either group A for muscle energy technique or group B for Mulligan taping). A convenient sampling was done for the study. : Once patients met the requirements, the prospective patients were treated at the clinic, where they were screened to determine if they met the studies inclusion criteria. This was achieved if a positive diagnosis of sacroiliac joint dysfunction was made. Each patient randomly divided into groups by means of tossing a coin. Outcomes are measured in terms of pain indicated by visual analogue scores and lumbar rangeof motion using a full scale goniometer, before and after intervention. Comparison of the pre interventional and post interventional outcome measures between the groups was done by using paired and unpaired t test. Probability values less than 0.05 were considered statisticallysignificant and probability values less than 0.0001 were considered highly significant.

Result- After 3 months of treatment, result of the present clinical trial indicate that both Muscle Energy Technique and Kinesio-Taping Technique effectively reduce pain and disability. Changes in the visual analogue scores and lumbar range of motion revealed statistically significant reduction in pain and increase Range of motion after intervention for both the groups ($p< 0.05$). However Kinesio

taping was found to be better in increasing range of motion while Muscle energy technique was found better in reducing pain

Conclusion – In conclusion, this randomized controlled study, conducted on 12 volunteers of both genders diagnosed with Sacroiliac joint dysfunction, investigated the effectiveness of Muscle Energy Technique (MET) and Kinesio-taping using the Mulligan Technique. The findings demonstrated significant improvements in relieving Sacroiliac joint dysfunction, reducing pain, and enhancing functional ability measured by VAS and range of motion assessments. Consequently, both interventions prove to be effective therapeutic approaches for managing Sacroiliac joint dysfunction.

Keywords - SIJ dysfunction, LBP, MET, Mulligan taping, VAS, ROM, Goniometer

1.INTRODUCTION

“It is now beyond doubt that sacroiliac joint dysfunction can lead to secondary painful spinal disorders." {Mooney}

‘Dysfunction’ is a term given by Mennell in 1960 for the accessory joint movement due to loss of normal movement. This term indicate improper functioning without pinpointing a specific pathology or attributing it to a single structure. Dysfunction, characterized by the loss of normal joint movement, can arise from various factors including muscle tightness, postural imbalance, joint stiffness, inflammation, contractures or fibrosis.

The sacroiliac joint (SIJ) is a complex and somewhat enigmatic structure. It plays a crucial role in anchoring the pelvis with the sacrum, which acts as a supportive "framework" for the more mobile lumbar spine and lower limb [1]. Anthropologists often use the SIJ to determine the age of skeletal specimens due to its structural characteristics. The joint is known for its extreme stability, supported by its bony configuration and the strongest ligaments in the human anatomy [2].

Low back pain (LBP) is a common condition, impacting about 70% people at some point in their lives[3]. Sacroiliac joint dysfunction is a significant but often undervalued source of low back pain or buttock pain, believed to cause about 15% of such cases [4,5]. Research using controlled fluoroscopically guided diagnostic blocks has identified the SIJ as the pain generator in 13% to 30% of chronic low back pain cases [6].

The SIJ's role in low back pain has been acknowledged by many researchers, including Lee (1989, 1992), Vleeming, and Mooney (1992). There is significantly interesting to understand the SIJ's function in relation to the musculoskeletal system and its connection to low back pain (Vleeming , 1992, 1995). The joint may

cause pain due to any disease, trauma, swelling, or movement dysfunction, which can manifest as either hypomobility or hypermobility. According to Porterfield and DeRosa (1991), the SIJ normally works as a triplane shock absorber, transferring the weight of the upper body into the pelvis and lower limbs and absorbing the force of heel strike. When the SIJ is not effectively mobile, it cannot absorb stress effectively from daily activities, leading to overstress in other structures and contributing to pain and dysfunction in musculoskeletal system. [7].

ANATOMY OF SACROILIAC JOINT

The sacroiliac joints (SIJs) are unique in their structure, comprising both synovial and syndesmotic components. This dual composition contributes to the joint's complex functionality and stability. The synovial part of the sacroiliac joint is C-shaped. The convex surface of the ilium, which forms part of this C-shape, faces anteriorly (towards the front) and inferiorly (downward).

According to LGF Gils and CM Crawford (1997), while sacroiliac joints exhibit relatively more mobility in younger individuals, this mobility diminishes with age. Compared to the spinal joints, the movements in the sacroiliac and symphysis pubis joints are minimal.

The stability and function of the sacroiliac joints are supported by a network of robust ligaments: long posterior sacroiliac ligaments, short posterior sacroiliac ligament , posterior interosseous ligament, anterior sacroiliac ligaments , sacrotuberous ligament and sacrospinous ligament and iliolumbar ligament. These ligaments, by limiting excessive movement, ensure that the SI joints remain stable under various physiological loads.

The sacroiliac joints and symphysis pubis lack direct muscular control over their movements, although they benefit from the stabilizing effects of surrounding muscles that support pelvic stability. The muscles which support the pelvis and the lumbar spine and the hips can be divided into inner and outer groups.

The inner group of SIJ muscles consist of- Multifidus, Transversus abdominis, Pelvic floor muscles**.** The outer group consists of - Erector spinae muscles (including iliocostalis, longissimus, and spinalis), Gluteus maximus and Piriformis.

These inner and outer groups of muscles work synergistically to stabilize the SIJs, maintain pelvic alignment, and support the spine during various movements and activities. Dysfunction or imbalance in these muscles can contribute to SIJ pain and instability.

BIOMECHANICS OF SACROILIAC JOINT

The sacroiliac joint (SIJ) exhibits relatively small but crucial rotational and translational movements, primarily occurring in the sagittal plane. These movements, which involve both compression of the articular cartilage and slight motion between joint surfaces, are essential for the functional integrity of the pelvis and lumbar spine. The motions occurring at the SIJ are:

✓ Nutation

✓ Counternutation

Nutation is the forward tilting of the base of sacral bone relative to the ilium. According to Jam Acad Ortho Surgery 2004,in nutation, When transitioning from a lying to a standing position or while doing early trunk flexion, the sacrum moves bilaterally. The iliac comes closer, while the ischial tuberosities move further apart, causing the innominates (pelvic bones) to undergo external rotation and out-flaring. Normally, nutation occurs bilaterally. If it happens unilaterally, it indicates pathology. For example, unilateral nutation can result in an apparent short leg on the affected side, with the anterior superior iliac spine (ASIS) positions higher on one side while the posterior superior iliac spine (PSIS) lower on the another. Nutation is limited by various ligaments which are anterior sacroiliac, sacrospinous, and sacrotuberous ligaments. This posture offers greater stability compared to counternutation. Nutation commonly happens during a posterior pelvic tilt, causing the sacrum to descend along its short axis and move posteriorly along its long axis

Counternutation is the backward tilting of the base of sacral bone with respect to the ilium. During counternutation, the ilia moves further apart, and the ischial tuberosities move closer together, causing the innominates to undergo internal rotation and in-flaring. Pathologically, if counternutation occurs unilaterally, such as during the extension of one limb, the affected lower limb may medially rotate. Pathological counternutation can result in the ASIS being lower and the PSIS higher on one side. Counter-nutation is constrained by the posterior sacroiliac ligaments and countered by the robust long posterior sacroiliac ligament, which is reinforced by the multifidus muscle. This movement takes place during an anterior pelvic tilt, where the sacrum moves forward along its long axis and then upward along its short axis. During walking, the pelvis exhibits a reciprocal flexion and extension pattern, causing slight, out-of-phase rotations of each side. At normal walking speed, the advancing limb's heel strikes the ground while the opposite limb's toes are still in contact with the ground [13]. This creates oppositely directed torsions on the iliac crests. These slight SIJ movements during walking help dissipate potentially damaging stresses, protecting the pelvic ring.

Forces that create a nutation torque (closed packed position of SI joint), therefore help in stabilizingit. The toque is created by three forces-

- Gravity
- Passive tension from stretch ligaments
- Muscle activation

MUSCLE ENERGY TECHNIQUE

Fred Mitchell, Sr., first described Muscle Energy Techniques (MET) in 1948. These techniques are utilized to address somatic dysfunction, particularly issues such as reduced range of motion, muscle hypertonicity, and pain. MET involves the patient actively contracting a muscle against resistance provided by the therapist. MET is believed to be particularly helpful in lengthening postural muscles, which are prone to shortening. Theoretically, the active contraction performed by the client against the resistance produced by the therapist is an isometric contraction and may therefore be helpful in strengtheningmuscles.

Research by Wilson in 2003 suggests that incorporating MET alongside resistance exercises may yield superior outcomes in reducing low back pain and improving overall function compared to neuromuscular re-education and resistance exercises alone.

In a study by Brodin, reduction of more than two steps in a nine point pain scale was achieved using MET for patients with low back pain.

KINESIO-TAPING using MULLIGAN TECHNIQUE

Dr Kase developed Kinesio® Tex, and the Kinesio Taping® method in 1973. Kinesio Taping® has the ability to aid in lymphatic drainage, reduce swelling and inflammation, support muscles and joints, and improve proprioception (awareness of body position in space). These effects contribute to pain reduction, enhanced muscle function, and quicker recovery times in patients with various musculoskeletal conditions and improve fitness level. Kinesio taping has become the benchmark taping technique in physical therapy rehabilitation. Kinesio taping utilize the special type of tape. Unlike traditional athletic tape, Kinesio Tape® is elastic in nature and can stretch up to 140% of its original length. This elasticity allows it to conform to the body's contours and provides a constant pulling force (shear force) on the skin when applied. The fabric of Kinesio Tape® is breathable as it is air permeable, which enhances comfort and allows for prolonged wear. It is also water-resistant, making it suitable for use during activities that involve sweat or exposure to water. This durability enables it to be worn for multiple days, providing continuous therapeutic benefits.

Research, such as Mark D. Thelen's study on Kinesio Tape for shoulder pain, suggests that KT may improve pain-free range of motion immediately post-application. This highlights its potential benefit in acute pain management and functional improvement.

Studies, like J. McConnell's work on chronic low back and leg pain, explore novel taping techniques to address specific pain patterns, such as following dermatomes to alleviate tissue inflammation and pain .

Some case reports suggest that therapists may focus on addressing neuromuscular impairments to manage chronic pain in the sacral region. While many authors recommend taping for pain reduction, increased range of motion (ROM), and improved function in various areas [40], specific research on taping techniques for sacroiliac joint (SIJ) pain or dysfunction remains scarce.

By conducting a comprehensive investigation, comparing the effectiveness of MET and Mulligantaping on SI joint dysfunction, this study seeks to contribute to the existing body of knowledge regarding various treatment in musculoskeletal conditions.

Overall, this study aims to bridge the gap in our understanding of various interventions to improve SI joint dysfunction. By understanding the relative benefits and mechanisms of these interventions, clinicians can make more informed decisions regarding the optimal therapeutic approach for managing SI joint hypomobility

Hypothesis:

Null Hypothesis (H_0):

There is no significant difference in the immediate efficacy of Muscle Energy Technique (MET) and Kinesio taping using the Mulligan technique in persons with low backache with hypomobility of SI joint.

Experimental Hypothesis (H_1):

Muscle Energy Technique (MET) is significantly more effective than Kinesio taping using the Mulligan technique in providing immediate relief in persons with low backache with hypomobility of SI joint.

2.METHODOLOGY

RESEARCH DESIGN

The study was a comparative, randomized, clinical trial. It is a pretest-posttest quasi experimentaldesign.

SAMPLING

A convenient sampling was done for the study.

SOURCE OF DATA

Data was collected from Qi Spine Clinic, from 18th January 2023 till April 2024.

SAMPLE SIZE

This study involved 12 participants divided into 2 groups. There were 6 participants in group A and 6 participants in group B.

METHOD

Upon enrollment in the study, each patient was randomly allocated to a treatmentgroup (either group A for the muscle energy technique or B for taping treatment). Assigning consecutive patients who presented to the clinic into either Group A or Group B by means of tossing acoin. Physical examination and regional examination of the regional back musculature in order to decide if they were eligible for the study. The patients were required to review the information letter and subsequently sign the consent form before being permitted to participate.

Inclusion Criteria: The assessment ensured that the patient was accepted into the study on the basis of the following criteria:

✓ Participants who are diagnosed with SIJ dysfunction.

✓ Participants exhibiting asymmetry of the pelvis

✓ Pain and tenderness in SIJ area

✓ Positive results on special clinical tests using Forward flexion test, Faber's test andCompression test

✓ Individuals who expressed willingness to take part in the trial

Exclusion Criteria: Patients exhibiting any of the following contra-indications:

✓ Subjects who might show allergy to taping such as Dermatitis

✓ Tumors

✓ Acute TB

✓ Pregnancy

✓ Fractures

Materials Required:

✓ Data recording form

✓ Consent form

✓ Assessment form

✓ Couch or bed

✓ Measuring tape

✓ Kinesio Tape

✓ Scissors

✓ Goniometer (full scale and half scale)

✓ Pencil

✓ Weighing machine

PROCEDURE

Prior to carry out the research, Participants provided written informed consent prior to their involvement. Effectiveness is measure in terms of pain and lumbar ROM with the help of VAS scale and goniometry respectively.

❖ Visual Analog Scale (VAS)

Intensity of pain was measured with the help of Visual Analog Scale (VAS). It's a 10-centimeter line graded from 0 to 10, with 0 indicating no pain and 10 indicating the most severe pain imaginable. Participants are instructed to indicate their current pain intensity on this scale based on its severity at the time of assessment. Readings are taken pre and post intervention.

❖ Lumbar Range of Motion

It is taken in order to compare the effect of the therapy performed for the sacroiliac iliac joint dysfunction. Given by OTSG Health Policy and Services directorate:

✓ Flexion

A full scale goniometer can be used for obtaining the reading. The placement is as follows;

1.Position the fulcrum of the goniometer vertically along the patient's side in line with iliaccrest.
2.Stationary arm of the goniometer is to be placed parallel to the femur.
3.The moving arm should be parallel to the mid-axillary line.

The patient is instructed to lean forward at the waist until the pain aggravates; reaching towards yourtoes, do not bend your knees.

✓ Extension

A full scale goniometer can be used for obtaining the reading. The placement is as follows;

1.Position the fulcrum of the goniometer vertically along the patient's side in line with iliaccrest.
2.Stationary arm of the goniometer is to be placed parallel to the femur.
3.The moving arm should be parallel to the mid-axillary line.

The patient is instructed to lean backwards at the waist until the pain aggravates; do not bounce and donot bend your knees.

✓ Side-flexion

A full scale goniometer can be used for obtaining the reading. The placement is as follows;

1.Position the fulcrum of the goniometer over the spinous process of L5.
2.Stationary arm of the goniometer should be in line with the crease of the buttocks.
3.The moving arm should be in line with an imaginary line drawn between C7and L5.

The patient is instructed to bend sideways at the waist until the pain aggravates; do not bend your knees,or raise your buttocks.

Participants are divided into 2 groups named as GROUP A and GROUP B.

GROUP A: Muscle Energy Technique for SIJ

Here, the subjects underwent muscle energy technique and a pre and post intervention reading was recorded

Position of the patient: Side-lying with the SIJ dysfunction side on the uppermost.

Technique: The lowermost lower limb is extended at the hip joint until there is movement at the PSISfollowed by same side rotation of the lumbar spine and the uppermost lower limb is flexed until thereis movement at the L5. The therapist performs an isometric hold relax of the hip abductors after which the lumbar ROM and VAS reading can be recorded.

GROUP B: Kinesio-Taping for SIJ

In this study, participants underwent Kinesio taping using Mulligan's Technique, and their readings were recorded before and after the intervention.

Position of the patient: Standing with the arms crossed at the chest.

Technique: The therapist stabilizes the sacrum with one hand while placing the fingers of the another hand on the ASIS (anterior superior iliac spine). Pull the ilium on the sacrum and ask the patient to perform flexion, extension provided there is no pain. Then with 5 cm kinesio tape is to be wrapped in an oblique manner from the ASIS to end over the lumbar spine and a second tape is applied in order to secure the first tape. Lumbar ROM and VAS reading is recorded before and after the taping.

3.DATA ANALYSIS

The study analyzed the results based on relief of pain signified by reductions in visual analogue scores and lumbar range of motion before and after intervention. Intra-group and inter-group differences were analyzed to assess and contrast the effectiveness of both the treatment approaches under investigation.

Statistical Analysis

The study's statistical analysis utilized MedCalc version 10.2.0 software for data processing and interpretation. Initially, the data was inputted into an Excel spreadsheet for organization and subsequent processing. Different statistical metrics, such as mean, standard deviation, and significance tests like chi-square, paired t-tests, and unpaired t-tests, were utilized to analyze scores across all participants. Nominal data such as age, sex, and affected side were analyzed using the chi-square test. Comparison of before and after intervention outcomes between both groups utilized paired and unpaired t-tests. A probability value of <0.05 was considered statistically significant, while a value of <0.0001 was deemed highly significant.

Demographic data

- **Age distribution-**

The average age of participants was 34.67 years in Group A and 35.5 years in Group B. There was no significant difference in the mean age between the two groups.

- **Sex distribution-**

The study included 12 participants, consisting of 2 males and 10 females. In Group A, there were 2 males and 4 females, whereas Group B had no males and 6 females. Analysis using the chi-square test indicated no statistically significant difference between the groups ($X^2 = 0.6$, $p = 0.7345$).

- **Side involvement Distribution**

The study included twelve participants. Of these, seven had involvement on the right side—four in Group A and three in Group B—while five participants had involvement on the left side, with two in Group A and three in Group B. ($X2 = 0.333$, $p = 0.5637$).

- **Radiation**

In Group A, 5 participants reported radiating pain, and 1 participant reported no radiating pain. In Group B, 3 participants had radiating pain, and 3 reported no radiating pain. The data were analyzed using a chi-square

test ($X2 = 0.375$, $p = 0.5403$).

- **Height**

The average height of participants in Group A was 161.3 cm, and in Group B, it was 159.17 cm. There was no statistically significant difference in height between the two groups.

- **Body Weight**

The average body weight of participants was 62.5 kg in both Group A and Group B. Statistical analysis indicated that there was no notable difference in body weight between the two groups.

- **Body Mass Index**

Group A had an average BMI of 24.06 kg/m², whereas Group B averaged 24.71 kg/m². Statistical analysis indicated that there was no significant difference in BMI between the two groups.

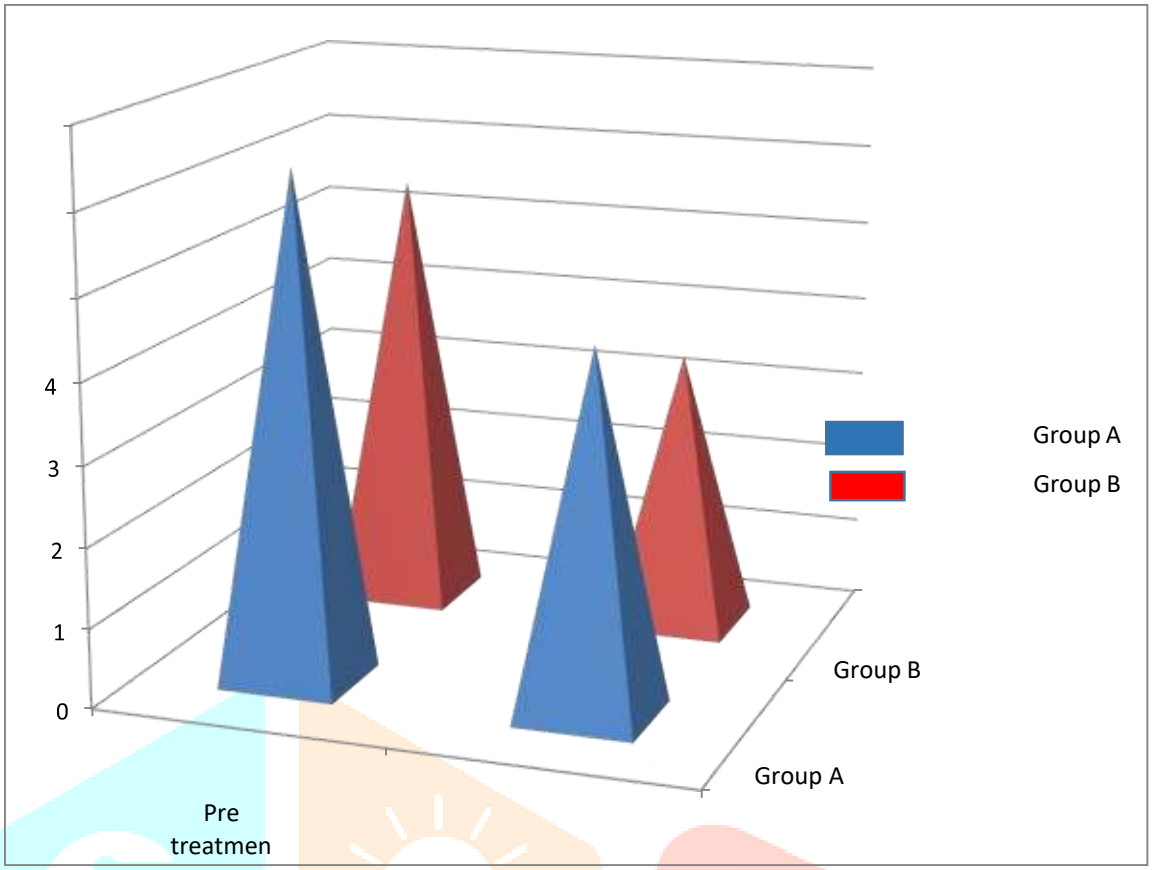
4.RESULT

❖ Visual Analogue Scale (VAS) Score

The pre intervention values of VAS score was 6.33 in group A and 5.50 in group B whereas values of post intervention VAS score was 4.50 in group A and 3.50 in group B. Statistically significant reductions in pain, as indicated by changes in the VAS scores, were observed post-intervention in both groups ($p < 0.05$), analyzed using paired t-tests.

When comparing before and after intervention values between the two groups with the help of unpaired t-tests, a statistically significant difference was found at a significance level of $p < 0.05$.

Groups	Pre-test Mean	Post-test Mean	P value	Inference
Group A	6.33	4.50	0.0032	Significant
Group B	5.50	3.50	0.0028	Significant



❖ Lumbar Range of Motion

Before the intervention, the measurements for flexion were 62.33 and 71.67 in Group A and Group B, respectively. For extension, the values were 17.17 in Group A and 15.17 in Group B. Right-side flexion measured 17.50 in Group A and 20.50 in Group B, while left-side flexion was 16.17 in Group A and 19.50 in Group B.

After the intervention, flexion measurements improved to 75.17 in Group A and 78.50 in Group B. Extension remained consistent at 20.67 in both groups. Right-side flexion increased to 21 in Group A and 23 in Group B, while left-side flexion improved to 19.50 in Group A and 23.17 in Group B.

On comparing before and after intervention values between both the groups with the help of unpaired t-tests showed a statistically significant difference with a p-value of 0.05.

Table 4.1 Flexion Range of Motion Paired t test

Groups	Pre-Test Mean	Post-Test Mean	P value	Inference
Group A	62.33	75.17	0.0156	Significant
Group B	71.67	78.50	0.0032	Significant

Table 4.2 Extension Range of Motion paired t test

Groups	Pre-Test Mean	Post-Test Mean	P value	Inference
Group A	17.17	20.67	0.0009	Significant
Group B	15.17	20.67	0.0057	Significant

Table 4.3 Side Flexion Right side Paired t test

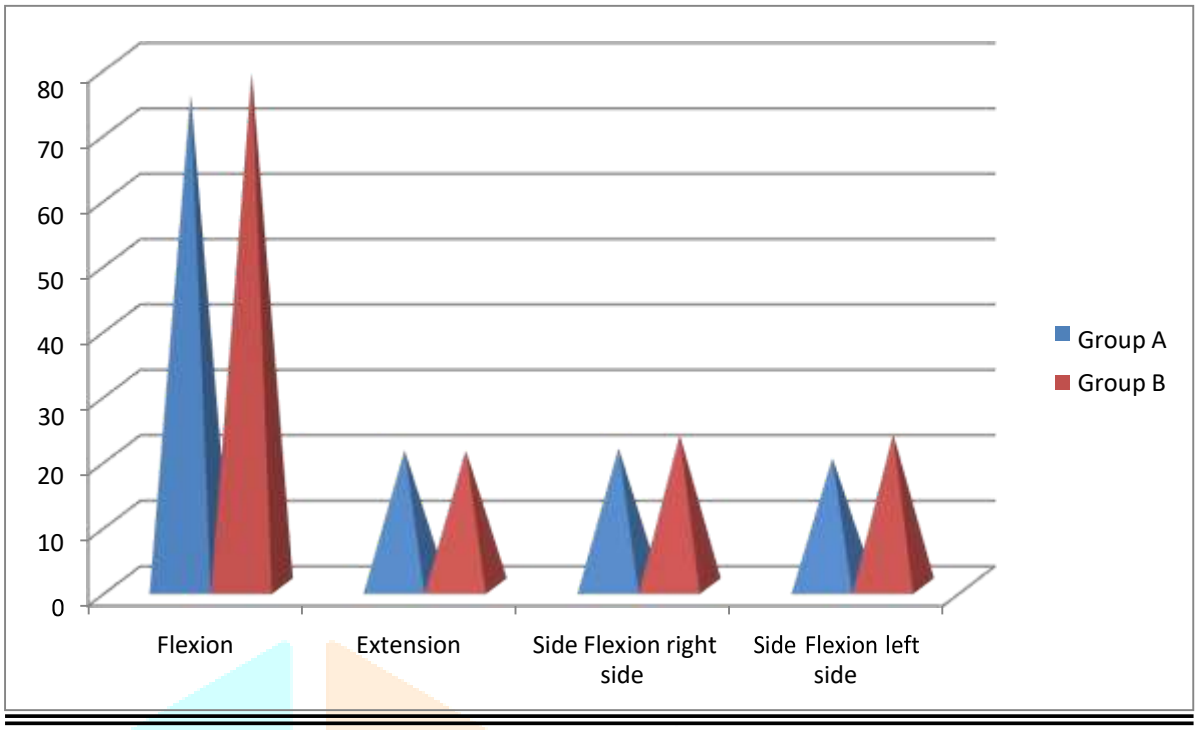
Groups	Pre-Test Mean	Post-Test Mean	P value	Inference
Group A	17.50	21	0.0144	Significant
Group B	20.50	23	0.0151	Significant

Table 4.4 Side Flexion Left side Paired t test

Groups	Pre-Test Mean	Post-Test Mean	P value	Inference
Group A	16.17	19.5	0.0098	Significant
Group B	19.50	23.17	0.0484	Significant

Fig 4.2 Pre Treatment Lumbar ROM

Fig 4.3 Post Treatment Lumbar ROM



5.Conclusion

This randomized controlled study, conducted on 12 volunteers of both genders diagnosed with Sacroiliac joint dysfunction, investigated the effectiveness of Muscle Energy Technique (MET) and Kinesio-taping using the Mulligan Technique. The findings demonstrated significant improvements in relieving Sacroiliac joint dysfunction, reducing pain, and enhancing functional ability measured by VAS and range of motion assessments. Consequently, both interventions prove to be effective therapeutic approaches for managing Sacroiliac joint dysfunction.

6.DISCUSSION

The findings from this clinical trial indicate that both Muscle Energy Technique and Kinesio-Taping Technique effectively reduce pain and disability.

In this research, Group A underwent Muscle Energy Technique, while Group B received Kinesio-Taping using the Mulligan Technique. Pain relief and range of motion improvements were statistically significant in both groups. Comparison within each group shows significant changes in before and after intervention scores. However, Kinesio-taping was found to be better alternative in increasing the range of motion, while the Muscle Energy Technique was better at reducing pain.

In this study, Kinesio-taping was applied using the mechanical correction technique of the Mulligan Taping Method. Kinesio-taping aims to offer support while allowing unrestricted movement and enhancing lymphatic flow continuously throughout the day. In comparing the two groups, Kinesio-taping demonstrated superior improvement in range of motion. The results might have been even more significant if other application techniques, such as the ligament and fascia technique, had been used in conjunction with Kinesio-taping.

Previous studies have highlighted improvements in function, pain relief, and range of motion attributed to Kinesio-taping (KT). However, these findings are based on studies involving healthy individuals or case series, indicating a need for higher-quality evidence through further research. One proposed mechanism for pain relief is the gate control theory, suggesting that KT stimulates neuromuscular pathways by enhancing sensory input. This theory posits that increased input to large-diameter nerve fibres can inhibit nociceptive input from smaller fibres. Another perspective is that pain reduction may be influenced by the placebo response to applying KT, irrespective of its particular application technique. Nevertheless, prior research indicates that therapeutic taping has demonstrated more significant effects in decreasing pain and enhancing function compared to placebo taping and control treatments.

Drawing comparison with other studies posed challenges due to insufficient details in their abstracts. There is a significant lack of research exploring the use of Muscle Energy Technique (MET) and Kinesio-taping for Sacroiliac Joint dysfunction in the current literature. Nonetheless, the findings from our study strongly support the effectiveness of both MET and the Kinesio-taping technique using Kinesio Tex Tape in managing sacroiliac joint dysfunction.

7.Limitations

- One limitation of this analysis is the absence of a genuine control group.
- The sample size for the study was limited to 6 participants.
- The data collected was immediate and did not account for any carry-over effect.
- The study duration was brief.
- The prolong effects of the intervention were not evaluated.
- There was no control group due to ethical reasons.

8.Future Research

- Recommended with extended study duration, large sample sizes, and inclusion of a control group. This should also incorporate prolonged interventions and follow-up periods to assess sustained effects.
- This study is notable for its investigation into Muscle Energy Technique and Kinesio Taping, which have limited evidence for treating sacroiliac joint dysfunction.

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