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EFFECT OF MUSCLE ENERGY TECHNIQUE IN CHRONIC SACROILIAC JOINT DYSFUNCTION

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Abstract

Objective: The study conducted for evaluating the effectiveness of muscle energy technique in chronic SIJ dysfunction.

Methods: 30 patients with chronic sacroiliac joint dysfunction from both genders. Patients were divided into 2 groups 15 in each group .Group A: received muscle energy technique using post isometric relaxation technique to erector spinae, hamstrings, iliopsoas and quadratus lumborum plus conventional treatment program. Group B: control group received conventional treatment program only .Doppler imaging of vibration, palpation meter and visual analogue scale were utilized for evaluating patients (pre and post treatment).

Results: The study findings revealed a statistical significant decrease of anterior pelvic tilting angle in group A ($p < 0.001$), also a significant decrease of pain in the 2 groups compared with pre-intervention values ($p < 0.001$).

Conclusion: Muscle energy technique is an effective treatment for decreasing anterior pelvic tilting angle and reducing pain in patients with chronic sacroiliac joint dysfunction.

Key words: Muscle energy technique, Doppler imaging of vibration. Palpation meter.

INTRODUCTION:

Sacroiliac joint is a frequent origin of pain in pelvic girdle and lower back ⁽¹⁾. SIJ pain is a main cause of axial low back pain and referred lower extremity pain. It affects 10% - 25% of population ⁽²⁾. Dysfunction means loss of movement known as joint play or accessory joint movement and it implies incorrect functioning without trying to state a particular pathology or pinpoint a single structure. Loss of joint play (dysfunction) by irritation of SIJ structures either (capsule, ligaments or pain receptors located within the joint ⁽⁵⁾).

In spite of frequent occurrence of SIJ dysfunction, its assessment and management were inadequately explained in the published work ⁽⁶⁾. The clinical diagnosis for SIJ dysfunction is based on focused history and physical examination. Treatment of SIJ dysfunction still questionable too. The osteopathic technique consists of specified manipulation procedures for the joints aiming to regain its normal movements. Physical therapy approaches ensure correcting SIJ malalignment manually; emphasize restoring normal muscles balance and help in lumbar and pelvic muscles stability training. Despite that the output results after management of SIJ dysfunction are restricted and there is a need for further studies to compare between various treatments techniques ⁽⁷⁾.

There are numerous treatment techniques believed to be valuable for treating LBP conditions. e.g. muscle energy technique.

can be due to adaptive shortening, contracture, scarring, adherence or fibrosis ⁽³⁾. SIJ dysfunction is a condition of changed mechanics, either an increment or diminishing from the typical normal or the presence of an abnormal movement ⁽⁴⁾. SIJ dysfunction was recognized as a condition causing pain arising from the SIJ. SIJ dysfunction is caused by increased or abnormal motion of the ilia around the sacrum and more likely caused MET is a safe, not invasive and low cost technique ⁽⁹⁾.

Muscle Energy Techniques (MET) came from early work done by an osteopathic practitioner. This technique depends on a method of using low amplitude muscle contractions against resistance thinking that it would improve vascular circulation, and have a positive influence on static and dynamic posture. This technique was further modified by having patients use their muscles in a controlled position against a counterforce. The modification of the technique used muscle contraction to restore motion to areas of dysfunction in extremities and vertebral column. The musculoskeletal system has an important role in other systems. Segmental dysfunctions in one area can be corrected by using MET to free up that segment, and may release other involved areas. MET aims to normalize soft tissue structures, such as shortened or tight muscles. MET can be used to improve joint mobility by influencing the dysfunctional soft tissues. MET can be used to relax tight tense musculature, spasms, or fibrotic

changes due to chronic soft tissue problems. MET has several uses that can help increase muscle strength, increase range of motion (ROM), and decrease edema⁽¹¹⁾. In this study doppler imaging of vibrations(DIV) was objectively utilized for measuring SIJ. In this study DIV has been chosen as it crossed the gap between objective invasive techniques such as anaesthetic block injections and subjective non invasive manually applied SIJ pain provocation tests⁽¹²⁾.

Palpation meter (PALM) is an accurate tool for evaluating skeletal alignment in clinical setting for both healthy and patient populations. It measures the tilt angle and space between any two marked points in the body. It can give the height discrepancy between the two landmarks palpated⁽¹³⁾.

Subjects and Methods:

Subjects: Survey was done to include all patients with chronic SIJ dysfunction depending on orthopedist referral .Simple randomization was used to include 30 patients taking in our consideration the inclusion criteria. Subjects divided on 2 equivalent groups (A, B). Each group consisted of 15 subjects. **Group A** :Received muscle energy technique (MET) including post isometric relaxation technique to the posterior spinal stabilizers(erector spinae) and (hamstrings) , anterior stabilizers (Iliopsoas muscle) that stabilize the spine anteriorly and control lumbar pelvic rhythm and to (quadratus lumborum muscle) as lateral stabilizer of the spine⁽¹⁶⁾.It was done 3 times per session for 12 sessions with time of hold for each position 5 sec⁽¹⁵⁾ plus conventional treatment

used to measure sacroiliac mobility. The DIV technique is a non-invasive, measurable technique, easy to apply, safe and was efficiently and objectively utilized for measuring SIJ.

program in that consisted of ultrasonic, infrared and therapeutic exercise program in the form of finger to toes, bridging exercise, back extension from prone, sit-up exercise, knee to chest exercise and stretching back muscles.

Group B: Received conventional treatment program that consisted of ultrasonic, infrared and therapeutic exercise program in the form of finger to toes, bridging exercise, back extension from prone, sit-up exercise, knee to chest exercise and stretching back muscles and acted as a control group.

Subjects age ranged between 30 – 50 years, had pain over the SIJ and had SIJ hypo mobility or intermediate mobility with threshold difference <3 for hypo-mobility and from 3 to 7 for intermediate mobility⁽¹⁷⁾. The exclusion criteria were as follows: Acute injury or fracture in the lower limbs, Pregnant females, Inflammatory pathology, Any hip joint pathology, Previous hip operations or recently received intra-articular injections, Stenosis / Spondylolisthesis /disc disease, Congenital spinal deformity ,previous major lumbar spine surgery ,Hyper mobility of SIJ (Subjects with threshold difference more than 7)⁽¹⁷⁾. A written consent was obtained from all the participants.

PROCEDURES:

I- Measurement procedures:-

The following measurements were taken for all participants in the first session and four weeks later SIJ stiffness, anterior pelvic tilting angle and pain intensity level. **1- Sacroiliac joint mobility:** was measured by Doppler imaging of vibrations (DIV). The vibration generator was held by the researcher, this vibration generator tip was directed to the ASIS of the participant. Vibrations of 60 Hz were applied unilaterally through vibration generator (Thrive 707A Full Body Massager) to the ASIS. The vibrations transmitted in upward direction up to the SIJ area. A sonographer assessed received vibrations using Color Doppler Imaging (CDI) apparatus (Toshiba Aplio 500 Platinum Ultrasound Machine). Patient was requested to lie prone at the edge of the treatment table with the ASIS slightly outside the table, with his head moved away from the ASIS receiving vibration, and his arms rested beside their bodies. The position of each participant was adjusted by the researcher, the VG was held by the researcher that the tip of the VG was directed toward the ASIS of the patient, so that a gentle but steady contact was made by the VG applicator tip to the target ASIS. The sonographer utilized doppler mode, doppler signals obtained from vibrating elements of the sacrum and ilium appeared as red or blue coloration on the color doppler monitor. First, the sonographer established the threshold level (TL) for the ilial segment by recording the color gain taken when the doppler color image of ilial landmark noted measurement) figure (2).

participant was requested to uncover their lower back and superior buttock region. Pre-warmed ultrasound gel was used over the SIJ region for effective transmitting of ultrasound from transducer device to the sacroiliac joint. The transducer was used transversely extending over medial and lateral sides of the SIJ. The sonographer adjusted the scan plane until proper sacral and ilial bony landmarks were distinguished. Image quality was optimized by adjusting depth and focus.



Figure (1): Patient position during Doppler imaging of vibration.

receiving vibration (first set Second, for the sacral segment, another TL was set when the color doppler image of the sacral vibrating segment was detected across the target joint line (second set of measurement) figure (3). The sacral TL was subtracted from the ilial TL, the result pointed to the amount of vibrational loss through the examined SIJ.

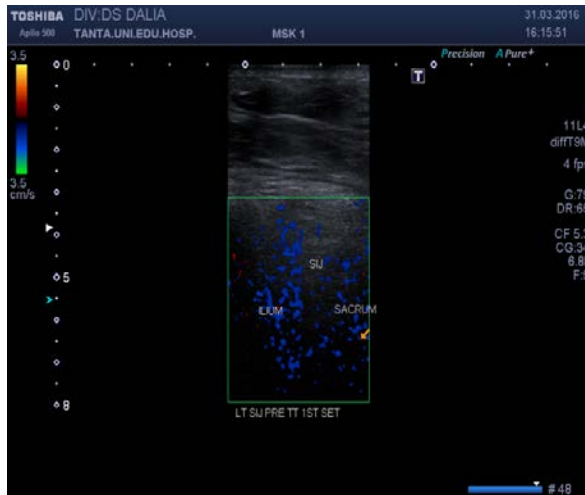


Figure (2): Doppler imaging of vibrations screen capture of the left ilial threshold level (first set of measurement).



Figure (3): Doppler imaging of vibrations screen capture of the left sacral threshold level (second set of measurement).

The recordings were taken in two sets for each unilateral SIJ, for the ilial and sacral Landmark, starting with the Left, to achieve two individual sets of measurements (Session 1, first set left SIJ; and Session 1, second set left SIJ). The same measures are repeated for the right SIJ that the patient position was altered so that the contra lateral right ASIS was placed properly and the patient position was adjusted to be the same as the original one, the same recordings and measurements repeated (Session 1, first set right SIJ and Session 1, second set right SIJ).

2-Anterior pelvic tilting angle was measured by Palpation Meter (PALM): It was used to measure the tilting angle of the pelvis. A mark was put on a point just inferior to ASIS; another mark was put just inferior to PSIS. The calipers of the PALM

were put on these two points. Then inclinometer determined the inclination in degrees between the two points.

3-Pain intensity level assessment: by Visual Analogue Scale (VAS).

II- Treatment procedures:

1-Muscle energy technique for group (A): MET was performed in the form of post isometric relaxation technique for iliopsoas, hamstrings, erector spinae and to quadratus lumborum muscles. The restriction barrier (where no further movement appreciated) was identified then the subjects were instructed to make a contraction of about 20 - 30% of maximum voluntary isometric contraction, hold it for 7-10 seconds, relax for 2-3 seconds. Appropriate breathing instructions was given. After that the limb, on an exhalation, be taken very slightly

beyond the restriction barrier and held there for 10–30 seconds, It was done 3 times per session for 12 sessions. For **iliopsoas** muscle: The supine test position was used in which the patient lied with the buttocks at the edge of the table, non related leg fully flexed at hip and knee and held in that state by the patient. The leg on the affected side was allowed to hang freely. Therapist hand was placed on the anterior distal part of the thigh; other hand was placed on the anterior proximal part of the other leg. After the isometric contraction, the thigh was taken very slightly beyond the restriction barrier, on an exhalation, with a light degree of pressure towards the floor and held there for 10–30 seconds. For **hamstrings** muscle: The subject was lying in supine position with his leg hanged over therapist's shoulder. Therapist hand was placed on the anterior distal part of the thigh of the unaffected limb; the other hand was placed on the anterior distal part of the other thigh just above knee joint to maintain the knee in extended position. The subject's hip was passively flexed and the leg extended until tension. The subject provided a moderate knee flexion isometric contraction (20-30% of maximal contraction), by pressing his ankle joint against the top of the researcher's shoulder. This was followed by relaxation, and then the leg was passively stretched by the researcher to the palpated barrier or tolerance to stretch and held for 30 seconds. For **erector spinae** muscle: The patient was sitting on the treatment table, back towards the therapist. The therapist passed a hand in front of the patient's axilla on the side to which the patient was to be rotated, across the front of the patient's neck, to rest on the

contralateral shoulder. The patient was drawn into flexion, side bending and rotation. When the patient has been taken to the comfortable limit of flexion, he was asked to look towards the direction from which rotation has been made while holding the breath for 7–10 seconds. The patient was then asked to release the breath. The practitioner waited for the patient's full exhalation and then took the patient further in all the directions of restriction, towards the new barrier. For **Quadratus lumborum** muscle: The patient lied supine with the feet crossed at the ankle. The patient was arranged in a side bending, away from the side to be treated, so that the pelvis was towards that side, and the feet and head away from that side (banana shaped). Therapist put his cephalad hand under the patient's shoulders to grasp the treated side axilla. The patient grasped the therapist's cephalad arm at the elbow, with the treated side hand, making the contact more secure. The practitioner's caudad hand was placed on the anterior superior iliac spine on the treated side. The patient was instructed to very lightly sidebend towards the treated side producing an isometric contraction in quadratus lumborum. After 7 seconds the patient was asked to relax completely, and then to sidebend towards the non treated side, as the therapist simultaneously bent backwards slightly, in order to sidebend the patient⁽¹⁴⁾.

2-Traditional therapeutic exercise program: was performed by the patient under the therapist supervision and consisted of strengthening exercises in the form of bridging exercise, back extension from prone, sit-up exercise. These exercises were

performed to strengthen the abdominal and back muscles. They performed from crook lying and prone positions and stretching exercises that consisted of finger to toes, knee to chest exercise and stretching back muscles. Hold time for the stretching force was fixed to 30 seconds for every stretching maneuver followed by 30 seconds rest. Repetitions: 3 times / session⁽¹⁴⁾.

3-Ultrasound treatment: The Chattanooga Intellect ultrasound made in USA. model 2013 was used in this study. Patient was in prone lying position. The skin was coated with an acoustic gel not containing any pharmacologically active substance. US was applied to the right and left sacroiliac joints by the therapist stroking the applicator in circular movements at right angle. Continuous US waves with 1MHZ frequency and 1,5 watt/cm² power were applied with a

4cm diameter applicator. US treatment lasted 8 minutes .

4- Infrared therapy: Beurer IL 30 Germany infrared lamp was used in the study. Patient was in prone lying position. Infrared lamp was adjusted so the energy stroked the patient at a right angle. Treatment lasted for 10 minutes.

Statistical analysis

- Descriptive statistics and ANOVA test were used for comparison of the mean age, weight, height, and BMI of the three groups. Two way mixed MANOVA was used to investigate the effect treatment and time on sacroiliac mobility, anterior pelvic tilting angle, and VAS.

Results: The subjects' general characteristics are shown in Table (1) ($p > 0.05$).

Table (1): Descriptive statistics and ANOVA test for the mean age, weight, height, and BMI of the 2 groups (MET, control group).

	<i>Control group</i>	F- value	p-value
Age (years)	38.26 ± 3.59	1.11	0.33
Weight (kg)	79.66 ± 2.76	0.5	0.6
Height (cm)	158.26 ± 2.89	0.6	0.55
BMI (kg/m²)	31.79 ± 0.39	0.14	0.86

Table (2): Alterations in the measured variables in the MET, control group at baseline and following treatment

	Baseline	Post-treatment
<u>RT sacroiliac mobility</u>		
<i>MET group</i>	3.53 ± 1.92 TU	4 ± 2.2 TU
<i>Control group</i>	4 ± 1.85 TU	4.33 ± 1.91 TU
<u>LT sacroiliac mobility</u>		
<i>MET group</i>	2.86 ± 1.55 TU	3.53 ± 1.76 TU
<i>Control group</i>	3.13 ± 1.99 TU	3.6 ± 1.68 TU
<u>anterior pelvic tilting angle:</u>		
<i>MET group</i>	4.13 ± 1.24 degrees	1.53 ± 0.83 degrees
<i>Control group</i>	4.06 ± 1.86 degrees	3.86 ± 1.72
<u>Pain intensity level:</u>		
<i>MET group</i>	5.2 ± 1.42	1.06 ± 0.25
<i>Control group</i>	5.26 ± 1.98	2.06 ± 1.33

Discussion: The study conducted in the faculty of physical therapy, Cairo university through July 2015 to

June 2016 and intended to investigate the effectiveness of muscle energy technique in patients with chronic sacroiliac joint dysfunction. The patients participated in this study had symptoms of chronic SIJ dysfunction with the treatment protocol described before symptoms were improved in 4 weeks of treatment with the mean difference, The mean difference was -0.47 TU for group (A), The mean difference was -0.33 TU for group (B) and regarding LT sacroiliac mobility for group (A) The mean difference was -0.67 TU, for group (B) The mean difference was -0.47 TU, and

concerning anterior pelvic tilting angle, The mean difference was 2.6 degrees for group (A), The mean difference was 0.2 degrees for group (B) and as regards to pain, The mean difference was 4.14 for group (A), The mean difference was 3.2 for group (B).

The study attempted to be objective with respect to the outcome measures as SIJ stiffness that was measured by DIV, its validity and reliability in the assessment of SIJ mobility was demonstrated by **Damen**⁽¹²⁾ and **Buyruk**⁽¹⁸⁾. DIV is considered a safe, easy applied and noninvasive technique and thus it can be used as a clinical measurement of the SIJ⁽¹⁷⁾. Evaluating sacroiliac joint mobility is a confusing issue because the Objective methods for

determining SIJ mobility is confined to invasive techniques, on the other hand, non-invasive methods e.g. manual palpatory tests are subjective and its outcome is not accurate. DIV is non-invasive and objective method for measuring SIJ stiffness. It is regarded as means of detecting hypermobility and hypomobility in the SIJ. Doppler imaging of vibration can be utilized to check the effectiveness of various manual treatment techniques for the SIJ ⁽¹²⁾.

As regards to anterior pelvic tilting angle, palpation meter (PALM) was used. PALM is an accurate and precise tool for this measurement to both healthy and patient populations, it evaluates skeletal alignment and gives the height discrepancy between the two landmarks palpated, also it is regarded as a reliable means for evaluating skeletal alignment in the clinical setting ⁽¹⁹⁾.

Concerning to group (A) MET group, our study revealed that MET has no significant effect on sacroiliac mobility, this was matched with the study of Fryer⁽²⁶⁾ who concluded that pelvic asymmetry is produced by muscle imbalance and alteration in muscle tone. Muscle energy techniques apply shortening and elongation for muscles and fascial components so it is probably that MET has an effect on correcting obliquity of the pelvis and asymmetry by affecting muscles and fascial structures more than affecting the sacroiliac joint in a direct way.

It has been suggested that MET treats muscle imbalances in the lumbar and pelvic areas e.g. asymmetrical pelvic position. MET can adjust asymmetrical positions of

the pelvis by focusing on contracting hip extensors and hip flexors in the affected lower back region and putting the pelvic bones in the right position ⁽²⁷⁾. The finding of our study was supported by the work of Enas ⁽²⁸⁾ who investigated the efficacy of muscle energy technique for correcting forward tilting of the pelvis in lumbar spondylosis patients. 30 patients with anterior pelvic tilt were equally assigned on 2 groups 15 in every group. Both groups of the study showed significant improvement in tilting of the pelvis, pain intensity level and function abilities. The group that received MET was better than the other group in all the measured variables. The analgesic effect of MET could be explained by both spinal and supraspinal mechanisms; Stimulation of mechanoreceptors in both muscle and joint takes place during an isometric contraction. This results in sympathetic excitation as well as stimulation of the PAGA which plays a crucial part in alteration of descending pathway of painful signals. Suppression of nociceptive impulses takes place at the spinal cord level through gate control theory of pain by simultaneous transmission of both painful signals and mechanical receptors activation. MET stimulates joint mechanoreceptors through joint movement. This is supported by the study of Degenhard ⁽²⁹⁾ who reported that myofascial trigger point suppression was improved by applying different forms of MET. On the other hand, Ballentyne ⁽³⁰⁾ still argue and hesitate about the efficacy of MET in form of post- isometric relaxation PIR. They suggested that the PIR theory and its consequent hypoalgesic effects are poorly supported by research.

Conclusion:

The data obtained from this study revealed that MET has significant effect on decreasing anterior pelvic tilting angle and pain level in patients with chronic SIJ but it has no effect on sacroiliac stiffness.

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