

# Effect of Muscle Energy Technique on Anterior Pelvic Tilt in Lumbar Spondylosis Patients

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**Abstract**—Background: Muscle Energy Techniques (MET) have been widely used by manual therapists over the past years, but still limited research validated its use and there was limited evidence to substantiate the theories used to explain its effects. Objective: To investigate the effect of Muscle Energy Technique (MET) on anterior pelvic tilt in patients with lumbar spondylosis. Design: Randomized controlled trial. Subjects: Thirty patients with anterior pelvic tilt from both sexes were involved, aged between 35 to 50 years old and they were divided into MET and control groups with 15 patients in each. Methods: All patients received 3sessions/week for 4 weeks where the study group received MET, Ultrasound and Infrared, and the control group received U.S and I.R only. Pelvic angle was measured by palpation meter, pain severity by the visual analogue scale and functional disabilities by the Oswestry disability index. Results: Both groups showed significant improvement in all measured variables. The MET group was significantly better than the control group in pelvic angle, pain severity, and functional disability as p-value were (0.001, 0.0001, 0.0001) respectively. Conclusion and implication: the study group fulfilled greater improvement in all measured variables than the control group which implies that application of MET in combination with U.S and I.R were more effective in improving pelvic tilting angle, pain severity and functional disabilities than using electrotherapy only.

**Keywords**—Anterior pelvic tilt, lumbar spondylosis, muscle energy technique exercise, palpation meter.

## I. INTRODUCTION

THE body segments are balanced in vertical column by muscles and ligaments; only proper posture helps to maintain this balance [1]. So, body posture mal alignment and the sequencing changes of hip and lumbar spine movement patterns act as a risk factor for the development of LBP and reduction of hip mobility [2].

Neutral alignment is the balancing of the pelvis on the heads of the femurs. Researchers recognize that pelvic alignment is the cornerstone of overall skeletal alignment which allows for efficient performance of movements such as hip joint external rotation and effective muscle recruitment [3].

Lumbar spondylosis is a degeneration of the lumbar vertebrae which can be progressive or irreversible. The lumbar region is mostly affected because it is the most exposed to mechanical stress due to the loading of the spinal segments while standing and the spinal motion. Lumbar spondylosis

patients experience osteophytes which produce pain and joint stiffness that limit the range of motion [4].

Degenerative flat back can be divided into two types based on pelvic position during walking: one with posterior pelvic tilt and other with anterior pelvic tilt. The anterior pelvic tilt is when the hip flexor muscles known as the iliacus and Psoas muscles located on the front of the lumbo-pelvic-hip complex become tight and over-active, they will pull on the top of pelvis and the lumbar spine of the lower back. This in turn will bring the pelvis forward causing the anterior pelvic tilt [5].

The anterior pelvic tilt is one of the pelvic abnormalities that disturb the neutral position of the pelvis, which results in hyperlordotic curvature and affects body balance and stability through disturbing the link between muscles, ligament and fascia and doesn't allow the center of gravity and base of support to meet at one line as common for economy of effort [6].

MET is a type of osteopathic manipulative treatment used in physical therapy commonly used around the spine particularly in lumbopelvic pain. It has been widely used by manual therapists over the past years, but still limited research validated its use and there was limited evidence to substantiate the theories used to explain its effects [7] as well as the effect of MET as an isolated treatment has not been determined [8].

The theory behind MET suggests that if a joint is not used to its full range of motion, its function will lessen and it will be at risk of suffering strains and injuries. This form of muscular therapy makes use of a patient's own muscle energy, while the therapist presents a stationary surface (resistance or antforce) to correct an asymmetry by targeting a contraction of the hip flexors on the painful side of the low back and moving the innominate in a corrected direction. So the patient will contract their muscle with varying intensities against resistance in order to stretch the muscle and joint to its full potential [9]. MET can be employed to reposition a dysfunctional joint and treat the affected musculature by increasing its flexibility [8]. So, the purpose of this study was to investigate the effect of MET on correcting pelvic tilting in patients with lumbar spondylosis.

## II. MATERIALS AND METHODS

Patients with diagnosed lumbar spondylosis were recruited from the outpatient clinic of Kafr Al-Zaiat hospital into a randomized controlled trial using letters and recommendations from physicians.

Thirty patients out of seventy were finally included in this study. Primary examination was done for every patient to get a complete picture of their health status and to know if the

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patient was able to undergo the study or if there were any contraindications. Measurements were performed under the following standardized conditions: (1) measurements were carried out by the same investigator and (2) the same angle was assessed before and after therapy for each patient by using palpation meter (PALM).

The patients were excluded if they suffered from bone disease, discogenic state with radiculopathy or not, any underlying disease such as malignancy, infection or systemic disease of the musculoskeletal system, any sensory problems or disturbances, and evidence of previous vertebral fractures or major spinal structural abnormality. Furthermore, a compulsory two week washout period was conducted for all patients who previously had any anti-inflammatories or analgesics. The use of all nonessential pain relievers were prohibited 12 hours prior to therapeutic exercise session and 24 hours prior to all testing sessions. This study was approved by faculty of Physical Therapy ethical committee and all patients signed a confirmed consent form prior to participation in the study.

The patients were classified randomly into study and control groups of equal numbers, 15 patients in each group. The study group received MET exercise with I.R and U.S. while the control group received application of I.R and U.S only. Each group received 3 sessions / week for 4 weeks.

The tilting angle of the pelvis was measured before and after four weeks of treatment using PALM (Baseline Evaluation Instrumentations 12-1180 U.S.A) which is considered the objective way to perform skeletal alignment evaluations [10]. Also the patients' pain and functional disability were measured using visual analogue scale (VAS) and Oswestry disability index (ODI) respectively before and after four weeks of the therapeutic sessions.

During measuring tilting angle of the pelvis, PALM was suspended from the investigator's neck by the adjustable cord to free the fingers for palpation. During measurement, PALM should be kept level from front to back by adjusting the cord length by the cord lock. The inclinometer scale is in one degree from 0 to 30 degree on either side. Patient was in standing position and the investigator stood beside him. First of all, the investigator detected the location of ASIS which was located about 45 degree inferior and laterally to umbilicus, then PSIS was located when traced the ilium around from the ASIS to the patient's back. Then the tilting angle was measured using the pointed tip portion of PALM by placing the pad of the index finger on the flat portion of the tip to guide into proper contact with the respective landmark and read the angle degree from the inclinometer scale.

The MET carried out for the study group involved the iliopsoas and lower back muscles where isometric contraction of the agonist muscle was performed for 10 seconds after that the patient was asked to relax for 2-3 seconds and then the examiner stretched the contracted muscle in the opposite direction for 10 seconds. This was repeated 3 times for each muscle. The duration of exercise session ranged from 5 to 10 minutes.

#### *A. Iliopsoas Muscle*

The patient was in supine lying position, the buttocks were rested at the edge of the bed, the non-treated leg was held in a fully flexed position at hip and knee by the patient's hand and the treated leg was allowed to hinge freely. The investigator stood front to the patient with one hand supporting the flexed limb and the other hand held the thigh of the affected leg at the knee joint to resist the patient to flex the hip.

The patient started to isometrically contract the thigh toward hip flexion 10 seconds, followed by relaxation 3 seconds, and then the investigator took the thigh through the restricted range with slight painless pressure toward the floor on the anterior aspect of the thigh for 10 seconds. This exercise was repeated 3 times during the session.

#### *B. Lower Back Muscle*

The patient was in supine lying position and clasped his or her hands in front of both knees, while interlacing fingers together and the investigator assessed this position by his or her hand, then the patient pulled both knees towards the chest and stopped when felt pain in the lower lumbar region. This is the restriction range. Shorter than this range, the patient pushed their knees against their hands for 10 seconds, followed by relaxation for 3 seconds and then he pulled both hands toward the chest to stretch the back muscle for 10 seconds, this was repeated for 3 times during the session.

### III. RESULTS

Data were first analyzed using the Kolmogorov-Smirnov test to recognize a normal distribution. The differences between the beginning and post treatment measurements were analyzed using the paired Student t test. The differences between the two groups were analyzed using the unpaired t test. Level of significance for all tests was set at (0.05). Statistical tests were performed using SPSS version 17. A statistical power analysis suggested that sample sizes above 10 subjects per group were required to achieve more than 80% power.

Basic characteristic in form of age, weight and height were gathered for each patient to calculate mean and standard deviation. MET group consisted of fifteen subjects, with an average age (40.06±3.08) year's old, height (165.26±6.93) Cm, and weight (81.53±8.08) kg. On the other hand, the control group also consisted of fifteen subjects, with an average age (39.13 ±1.84) years old, height (168.2±6.33) cm, and weight (82.8±7.59) kg.

The result of this study has shown that pain severity, functional disability, and anterior pelvic tilt angle improved in both groups after treatment as shown in Table I.

#### *A. Anterior Pelvic Tilt Angle*

MET group showed significant improvement in anterior pelvic tilt angle post treatment than the control group as ( $t=3.92$ ;  $P=0.001$ ). The percentage of improvement in the MET group post treatment was 18.57% while for the control group was 4.7% as shown in Fig. 1.

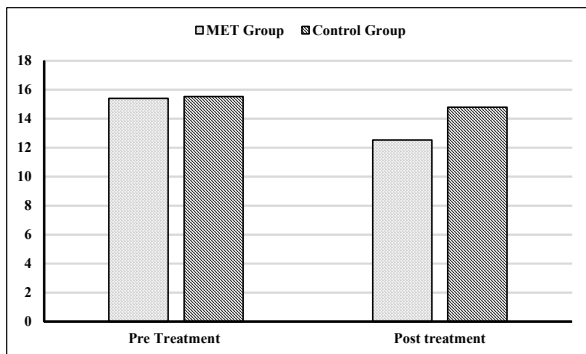


Fig. 1 Pre and post pelvic tilt angle in both groups

**B. Pain Severity**

MET group showed significant improvement in pain severity post treatment in comparison to the control group, as (t=5.21; P=0.0001). The percentage of improvement in the MET group post treatment was 53.72% while for the control group was 24.72% as shown in Fig. 2.

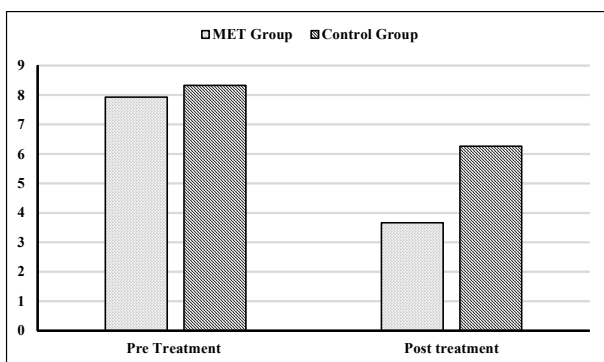


Fig. 2 Pre and post pain severity in both groups

**C. Functional Disability**

MET group showed significant improvement in functional disability post treatment in comparison to the control group, as (t=5.8; P=0.0001). The percentage of improvement in the MET group post treatment was 59.05% while for the control group was 18.64% as shown in Fig. 3.

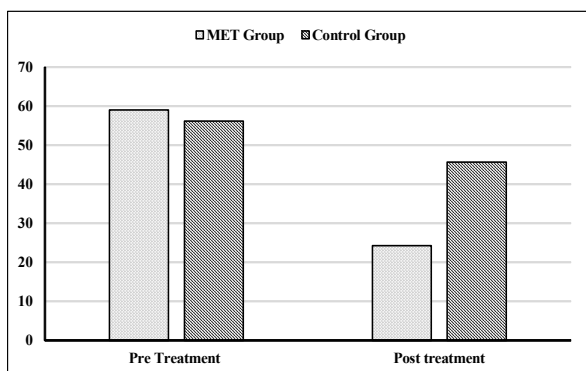


Fig. 3 Pre and post functional disability in both groups

TABLE I  
MEANS, STANDARD DEVIATION AND PAIRED T-TEST FOR STUDY AND CONTROL GROUPS

Variables		MET group	P-value	Control group	P-value
Anterior pelvic tilt angle	Pre	15.4±1.45	0.0001*	15.53±2.19	0.0001*
	Post	12.53±1.12		14.8±1.93	
Pain severity	Pre	7.93±1.33	0.0001*	8.33±1.23	0.0001*
	Post	3.66±1.29		6.26±1.43	
Functional disability	Pre	59.01±8.32	0.0001*	56.15±11.81	0.0001*
	Post	24.15±8.58		45.67±11.28	

\*Data presented as mean± standard deviation; \*p <0.05(significant)

IV. DISCUSSION

In the current study, MET in the study group had an important effect on correcting pelvic tilting, reducing pain and improving function than the control group alone. These findings are the contrary to our hypotheses where there was significant difference between groups as the anterior pelvic tilting, pain severity and functional disability were highly improved in the MET group followed by the control group.

It is an agreement that exercises are safe, effective and reduce the risks of future low back pain. This was further improved in our current study after the usage of MET in patients suffering from chronic low back spondylosis which helped to improve the muscular condition accompanied with such cases [10]. MET was used alone without adding any other muscular exercises, to improve that MET could cause improvement in the current cases.

In the MET group, there was a significant improvement in anterior pelvic tilting angle in which this improvement was 18.57% with P-value (0.0001), but in control group the improvement was lesser; as the percentage of improvement was 4.7%. This indicated the role of MET in stretching the shortened muscle and regaining its strength which required regaining of lumbopelvic stability and correcting its abnormality. Many studies were done for determining the effect of MET on muscle abnormalities and R.O.M even in asymptomatic subject. There are a number of studies that supported the use of MET for pain syndromes [10]-[14].

In a relative study conducted by Fryer [13] aiming to determine MET theory, practice and concept and what changes should be done to make it more effective especially in pelvic asymmetry found that it is likely to be common and unrelated to biomechanical dysfunction. An asymmetrical static pelvic finding should be considered an incidental finding unless supported by positive motion, or pain provocation tests which is concurrent with the current study as we concentrated on the most effective muscle acting to regain pelvic stability (iliopsoas and lower back muscle).

Once this stability is regained, the body balance will also be regained through improving muscle condition by emphasizing on the shortened and the weak muscles which was gained through MET exercise. According to origin and insertion of those muscles, MET helps to stretch muscles and regain its strength in order to allow the pelvic bone to return to its normal condition and be at the same level although it takes time to achieve this. It is a common belief within schools of

manual therapy that isometric contraction and relaxation of a long muscle under stretch enhances that stretch.

Shlenk et al. [15] conducted a randomized controlled trial using MET to enhance the cervical spine range which proved to increase in all six planes of motion. So, three years later, Shlenk decided to further investigate the effect of MET on restricted lumbar spine range of motion in asymptomatic patients with the same age group as in the cervical trial. It was found that the average range of lumbar extension for the MET group significantly increased while the control group decreased and these results highly agreed with the current result which indicated that MET exercise was beneficial in increasing R.O.M and correcting angles. The last two studies agreed with our result but the author used asymptomatic patients where in this study exercise or specific treatment modalities were applied on symptomatic patients with specific disease having pain, disability and deformity which made the results more beneficial, effective and important because it is used for improving patients' condition and decrease their suffering.

Up to our best of knowledge, very few studies investigated the effect of MET on anterior pelvic tilt. Selkow [16] used MET for iliopsoas and hamstring muscle in anterior pelvic patients with non-specific back pain. Although pelvic tilt was not measured and used during patients selection only, found that MET is an effective form of manual therapy used to correct lumbopelvic pain or low back pain. Also, Niemisto et al. investigated the effect of MET in combination with stabilizing exercises and physical consultation in one group, and physical consultation only for another group in chronic low back pain (CLBP) patients. The MET with stabilizing exercises group was more effective in reducing pain severity than the physical consultation group [17]. Moreover, when Handel et al. [18] investigated the effect of contract-relax stretching training (similar to MET) on muscle performance in athletes confirmed that this technique markedly improved muscle flexibility more markedly than that under the active condition. On the contrary, Keshnee [19] investigated the relative effectiveness of MET as opposed to specific passive mobilization in the treatment of acute and sub-acute mechanical low back pain. It was noted that there was no additional benefit of MET over passive mobilization as the patients who were exposed to passive mobilization recovered to the same extent as those treated with MET. There was a shortening in Keshnee's study which made it differ from our study as the treatment period is too short, patients received only four treatment sessions over a two week period and this wasn't sufficient to give an accurate result and may cause a significant change in pelvic angle. As we mentioned before we concentrated on a specific muscle for treatment of anterior pelvic tilt but the author applied MET on a group of muscle not the most effective muscle. So, all previous results and studies prove that MET is an effective therapeutic tool for treating pelvic tilt by improving muscle imbalance and shortening to regain lumbopelvic stability and correct pelvic asymmetry. All these studies supported our results but we practically differ by using single modality which is the

exercise only conjunction with electrotherapy which helped us to prepare cases before exercise. The application of heat helped to improve muscle circulation and increase blood supply, which allowed the muscle to be less painful during stretching and made the patients cooperative.

Regarding pain functional disability improvement in the current study, occurred due to receiving regular treatment sessions and using effective pain controlling modalities including electrotherapy and the exercises. There were many studies that supported our result. Long et al., in 2004 studied the role of specific exercises in managing LBP through a randomized control trial using large patient numbers and the outcome measures included pain intensity and disability. Patients were divided into an exercise group and a medication group. Pain and disabilities were significantly improved in the exercise group exercise compared with the second one (medication) in every outcome [20].

#### IV. CONCLUSION

MET is an effective treatment for treating pelvic tilt through its effect on muscle imbalance and shortening to regaining lumbopelvic stability and correct pelvic asymmetry.

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