

# EFFECT OF MUSCLE ENERGY TECHNIQUES ON FUNCTIONAL ABILITIES IN PATIENTS WITH DISCOGENIC UNILATERAL SCIATICA

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## Abstract

**Background:** Chronic discogenic sciatica has a significant impact on one's quality of life. It causes discomfort and/or paresthesia in the sciatic nerve or a lumbosacral nerve root linked with it. It also has a negative impact on one's emotional and physical well-being. In people suffering from chronic sciatica, a Muscle Energy Technique can reduce pain, impairment, and enhance lumbar spine and hip joint range of motion, paraspinal muscle length, and gross motor function without creating negative side effects. The goal of this study is to see how a MET strategy combined with traditional physical therapy affects pain, disability, and straight leg raise ROM in persons with persistent discogenic sciatica.

**Results:** The Visual analogue scale, Oswestry disability index, Modified Rolland and Morris scale, and Goniometric straight leg raise after-intervention values for each group were considerably greater than the pre-intervention values. The study group had significantly higher post-intervention values than the control group (visual analogue scale,  $p = 0.042$ ; Oswestry disability score,  $p = 0.035$ ; modified Rolland and Morris scale,  $p = 0.034$ ; goniometric straight leg raise,  $p = 0.000001$ ).

**Conclusion:** When compared to traditional physical therapy alone, adding 6 weeks of MET training to traditional physical therapy improved pain, impairment level, and goniometric hip range of motion in persons with chronic discogenic sciatica. **Keywords:** Discogenic sciatica, radiculopathy, disability level, pain intensity, goniometric straight leg raise, Muscle Energy Technique.

## I. BACKGROUND

Sciatica is an invigorating condition in which the patient gets pain and/or paresthesia in the course of the sciatic nerve or the corresponding lumbar and sacral nerve root. Often, a common mistake is referring to any low back pain or radicular leg pain as sciatica. Sciatica is particular to the pain that is a lineal result of sciatic nerve or sciatic nerve root pathology. The sciatic nerve is devised from the L4 through S2 nerve roots which coalesce at the pelvis to form the sciatic nerve. It's about 2 cm in diameter, the sciatic nerve is considered the largest peripheral nerve in the body [1]

It is critical to know that most cases of sciatica result from an inflammatory condition that makes an irritation of the sciatic nerve. Conversely, direct compression of the nerve leads to more severe motor dysfunction which is often not seen. [2]

The majority of sciatica cases is because of a discogenic lesion with compression or impingement of nerve root, but lumbar stenosis plus (less often) tumors are possible causes [3]

A number of therapies, those exercises involving neuromuscular re-education, resistance training, therapeutic agents, and manual advanced therapy, are used in physiotherapy protocols to manage acute and chronic LBP. [4]

Muscle Energy Technique (MET) is a manual therapy technique that employs a muscle's own energy in the form of moderate isometric contractions to relax the muscles via autogenic or reciprocal inhibition, and then easily stretch the muscle. MET is an active approach in which the patient is also an active participant, as opposed to static stretching, which is a passive technique in which the therapist does all the work. The ideas of Autogenic Inhibition and Reciprocal Inhibition are the foundations of MET. Autogenic Inhibition MET occurs when a submaximal contraction of a muscle is followed by elongation of the same muscle, while Reciprocal Inhibition MET occurs when a submaximal contraction of a muscle is followed by lengthening of the opposite muscle. [4]

Autogenic Inhibition METs depend on the principle of autogenic inhibition. Post Isometric Relaxation (PIR) and Post Facilitation Stretching (PFS) are the two most well-known kinds of MET that rely on autogenic inhibitory principles (PFS) [ 5]

Muscle Energy Techniques can be used to treat any disease in which the goal is to relax and lengthen muscles while also improving joint range of motion (ROM). Almost any joint in the body can be safely treated with muscle energy treatments. Many sportsmen use MET as a prophylactic measure to avoid future joint and muscle injuries. It is most useful for people who have limited range of motion in their neck and back owing to facet joint dysfunction, as well as for other conditions like shoulder discomfort, scoliosis, sciatica, asymmetrical legs, hips, or arms, or to treat persistent muscular pain, stiffness, or injury. [6]

## II. METHODOLOGY

This study which is a randomized controlled was conducted between January of 2021 and May of 2021. 30 adult patients, diagnosed as having chronic discogenic sciatica (males and females), participated in the study. They were selected from different physical therapy clinics in Dumyat governorate. Their age was from 25 to 40 years. they all match inclusion criteria. The participants' demographic data are shown in Table 1.

Subjects were chosen based on the results of a prior research of MET on persistent LBP and sciatica [7]. These criteria were History of sciatica for more than 12 weeks or has at least 3 episodes of intermittent sciatica, each last for more than 1 week either accompanied with pain at low back during the 3 months before the study. Medically and radiologically diagnosed as discogenic chronic sciatica [8], with mild to moderate disability according to modified Rolland and Morris scale. Both males and females, aged from 25 to 40 years old. Be able to understand and follow the instructions during testing and treatment procedures. [9]

Patients were excluded if they have Fracture of pelvis, spine or lower extremities, also if they are hospitalized for severe trauma or have Peripheral neuropathy of diabetes or any other autoimmune disease such as rheumatoid arthritis, systematic lupus, cancer or severe osteoporosis. The protocol of this study was approved by the ethical committee of the Faculty of Physical Therapy, Cairo University, Egypt (No: P.T.REC/012/ 002996). The clinical trial registration number is NCT04918238.

Inclusion and exclusion criteria were applied to cases of chronic LBP and sciatica identified by a consultant and recommended for PT. Patients were assigned into both groups (control and study) based on the sequence established by the computerized randomization technique after the study's purpose was stated and informed consent was given. The pain intensity was recorded by the visual analogue scale (VAS), which was a horizontal line with 10 cm long with no pain at one end and the worst pain or agony at the other. The original author's Oswestry disability index and the Roland Morris disability questionnaire (RMDQ) were used to assess degree of disability. [9] All were recorded before and after treatment.

## III. PROCEDURES:

Thirty patients with low back pain and sciatica are gathered and blindly divided into 2 groups, a control group and a study group, 15 for the study group and 15 for the control group. Each patient will be evaluated and tested

individually before and after 6 weeks of treatment. Treatment is conducted through 3 sessions per week. All assessment and treatment sessions got happened in a quiet room in order to prevent any distraction for the patient.

**For selection:**

1- MRI on lumbar spine:

Magnetic Resonance Imaging was the modality of choice to determine the most common cause responsible for sciatic nerve compression. All types of disc lesions (disc prolapse, disc bulge, protrusion and extrusion) will be accepted if it shows a kind of compression on the nerve roots either L4, L5 or S1 associated with symptoms of radiculopathy in their myotomes and dermatomes [10]

2- Universal goniometer: Goniometric measurements of passive flexion of hip joint during the straight leg raising (SLR) have been approved as tool defines the mechanosensitivity of neural structures of the sciatic continuum [11]. The participant positioned on a bed in supine lying position. Test was performed without pillow under the patient's head [12]. The test performance needed two examiners. The first examiner stood beside the patient, maintaining the ankle in neutral and the foot in the vertical plane, elevated slowly the leg and asked the patient to signal feeling of any pain. Before measuring hip flexion range, the examiner instructed that the lumbar spine of patient had been in contact with the plinth. Then, the second examiner stood beside the patient, the examiner put the fulcrum of the goniometer over the femur's greater trochanter; the stationary arm was placed parallel to the edge of the plinth and the moving arm was placed parallel to the mid of the thigh [13]. GSLR was used before and after treatment.

**For evaluation:**

- Visual analogue scale (VAS): The VAS is a very reliable and valid measure for assessing musculoskeletal pain. The patient's pain was measured using a 10-cm VAS scale, with 0 indicates no discomfort and 10 means severe pain. [14]. VAS was used before and after the treatment protocol.

- Arabic version of Modified Roland Morris disability questionnaire (RMQ): This survey provides statements that people have used to describe themselves while they are experiencing back discomfort on a certain day. People may recognize themselves as they read the list, prompting them to check the appropriate box. The amount of boxes the patient fills in determines the patient's score. This quiz allows you to track changes over time. [15]. On a 24-point scale, larger numbers indicate higher levels of disability. Each relevant statement will be marked, and the patient will be instructed to do so. This procedure will be applied before and after the treatment protocol to detect the prognosis in functional abilities through interpretation of the scores before and after the treatment. Disability level that will be included is mild to moderate level of disability.

Arabic version of Oswestry disability index scale: The ODI continues to be a reliable indicator of condition-specific impairment [16]. The ODI has a high level of consistency [17]. The cumulative score for each portion of the questionnaire's six assertions was 5. (Total score/ (5xnumbers of questions answered) x 100 percent) is the final score. [18]. The ODI score ranged from 0 (no disability) to 100 (complete disability) (maximum disability). Scores ranging from 0 to 20 indicate "minimal disability," 20 to 40 suggest "moderate disability," 40 to 60 indicate "severe disability," 60 to 80 indicate "housebound," and 80 to 100 indicate "bedbound." [19]. The study included people with mild to moderate disabilities.

**For intervention:**

After a preliminary selection based on the inclusion and exclusion criteria, subjects will be assigned to one of two groups: Group A received muscle energy technique with lateral recumbent positioning along with conventional physiotherapy, and Group B received conventional physiotherapy three days per week for six weeks. [20]



MET to increase side bending ROM of lumbar spine.



MET to increase rotation ROM of lumbar spine.

After treatment, RMQ, ODI, VAS and G.SLR will be used again to identify the prognosis.

These data were then compared to data gathered at the conclusion of the sixth week for both groups to see how the intervention affected the patients. Patients were given a practice trial to familiarize themselves with each test technique after the clinician described it to them.

### Study group

Subjects in the study group were received traditional treatment in addition to MET.

The MET group was handled in a position of lateral recumbent on a medical bed on the opposite side of their affected side of bending.

MET entails bringing the patient's trunk into a specified range of lumbar ROM until the barrier is engaged, depending on the condition. Pathological motion barriers are attained before the physiologic barrier is reached, and they have specific characteristics of restriction because of an elevated neuromuscular barrier with a certain degree of elasticity [21].

The physiotherapist stood in front of the patient, then kept one hand on the lumbar area while the other flexed the subject's knees joints and hip joints till reaching the barrier at the spinal segment targeted.

The physiotherapist treated flexion and rotation dysfunction by moving the hips and knees posteriorly, causing the spine to extend. The patient will next be asked to straighten his or her bottom leg, with the foot of the leg above being placed in the popliteal area of bottom leg's. After that, the physiotherapist pulled patient's body anteriorly and superiorly from the arm below, rotating and side-bending the lumbar spine until the barrier was engaged at the treated vertebral segment. The other hand of physiotherapist been placed on the patient's upper aspect of shoulder, and the patient been asked to push anteriorly with shoulder using around 30% of his or her effort against the physiotherapist's force for 3 to 5 seconds. To re-engage the barrier, the physiotherapist pulls the patient in anterior and inferior direction from the arm positioned below. The technique will be repeated 3–5 times with a 2–3 second break between each repetition. To handle the component of side-bending, the physiotherapist bent both subject's lower limbs and moved the ankles toward the roof till the abnormal barrier was achieved. The patient was then instructed to use roughly 30% of his or her strength to push his or her ankles toward the floor against the physiotherapist's hard resistance. By raising the patient's ankle further higher, the barrier will be re-engaged, and the approach have been repeated 3 to 5 times with a 2–3 second pause in between. [22]

### Control group:

Subjects only received the traditional physical therapy protocol per session as following:

Infrared radiation on the low back area for 15 minutes [23], Ultrasound waves (Digi sonic device) for 10 minutes on the trigger areas of low back [23], Myofascial release of the thoracolumbar fascia [24], Stretching of the Para spinal muscles and the hamstrings, Mobilization of the lumbar and thoracic spine from prone lying position [25], and strengthening of abdominal muscles, multifidus and transversal's abdominal muscle [26]

#### IV. DATA ANALYSIS

SPSS for Windows, version 26 was used for statistical analysis (SPSS, Inc., Chicago, IL). Data were checked for normality, homogeneity of variance, and the existence of extreme scores before final analysis. This investigation was carried out as a prerequisite for the study of difference's parametric computations. Preliminary assumption testing found that data for all measured variables was not normally distributed, as determined by the Shapiro-Wilk test ( $p < 0.05$ ). According to Levene's homogeneity test of variances, there was homogeneity of variances ( $p > 0.05$ ) and covariances ( $p > 0.05$ ). Non-parametric statistics were utilized as a result. The Mann-Whitney U test was used to determine whether the dependent variable differed among the two independent groups. The Wilcoxon test was done to see if there was any difference among the groups. Demographic parameters of two groups of study were compared using an unpaired t-test to see if there was a difference before treatment. The alpha level for this experiment was settled to 0.05.

#### V. RESULTS

Demographic and clinical criteria of participants:

The baseline characteristics of the participants showed that no statistically significant differences existed between both the groups ( $P > 0.05$ ), as shown in Table 1.

It was clear also that there was no significant difference among both groups by gender, the  $\chi^2$  value was 0.315 ( $P > 0.05$ ).

Pretreatment comparison among both groups

No statistically significant differences were noticed regarding pretreatment among the two groups in each of variables measured ( $P > 0.05$ ), as shown in Table 2.

Pretreatment and post-treatment comparison in each group

A significant improvement in all variables measured ( $P < 0.05$ ) in both groups, as shown in Table 2.

Post-treatment comparison between both the groups

There was statistically significant improvement in all variables measured between both groups ( $P < 0.05$ ) in G.SLR, ODI, RMQ and VAS there was a significant improvement favoring study group ( $P < 0.05$ ), as shown in Table 2.

Table1. General characteristics of participants in both groups

	Control group $\bar{x} \pm SD$	Study group $\bar{x} \pm SD$	P- value
Age (Years)	37.93 $\pm$ 3.86	37.0 $\pm$ 5.07	0.575
Height (cm)	170.46 $\pm$ 10.34	170.93 $\pm$ 6.45	0.883
Weight (kg)	87.6 $\pm$ 15.02	94.93 $\pm$ 13.4	0.169
BMI (kg/m <sup>2</sup> )	30.13 $\pm$ 4.19	32.8 $\pm$ 6.62	0.198
<b>Gender</b>			
Male	4 (26.66 %)	7 (46.66 %)	0.450
Female	11 (73.33 %)	8 (53.33 %)	

P-value: probability value; \*Significant at  $P < 0.05$

Table 2. Comparison between both groups in all measured variables.

Variable	Time	Control group $\bar{x} \pm SD$	Study group $\bar{x} \pm SD$	P- Value
VAS (score)	Before	7.06 $\pm$ 1.43	6.93 $\pm$ 1.03	0.603
	After	4.46 $\pm$ 1.06	3.6 $\pm$ 1.18	0.042*



	<i>P</i> Value	0.001*	0.0001*	
ODI (score)	Before	20.33 ± 5.4	19.13 ± 5.11	0.771
	After	15.33 ± 4.09	11.66 ± 4.04	0.035*
	<i>P</i> Value	0.001*	0.001*	
RAM (score)	Before	12.13 ± 3.6	11.13 ± 4.53	0.464
	After	8.46 ± 2.53	6.13 ± 3.33	0.034*
	<i>P</i> Value	0.001*	0.001*	
G.SLR (score)	Before	39.8 ± 8.03	41.26 ± 9.89	0.370
	After	57.46 ± 11.66	82.0 ± 7.86	0.000001*
	<i>P</i> Value	0.001*	0.00001*	

$\bar{x}$ : Mean; SD: Standard deviation *P*-value: probability value; \*Significant at  $P < 0.0$

The sample size was calculated by comparing the VAS scores of patients with Unilateral Discogenic Sciatica treated with muscular energy techniques to those treated with a traditional physiotherapy program. The mean SD of (VAS) in group (A) was approximately 3.55 0.83, while it was around 2.00 0.86 in group (B), as described in earlier publications. [27]. We calculated that the minimum required sample size for each group was 9 participants in order to reject the null hypothesis with 95 percent power at the 0.05 level and an effect size of 1.82 using Student's t test for independent samples. G Power and Sample Size Calculations program (William D. DuPont and Walton D., Vanderbilt University, Nashville, Tennessee, USA), version 3.0.11 for MS Windows.

## VI. DISCUSSION

The goal of this study was to see how effective MET was in treating persons who had chronic discogenic sciatica. In the VAS, ODI, MRMQ, and goniometric straight leg raise test, both groups showed considerable improvement. In the goniometric straight leg raise (GSLR), there was a significant difference between the groups, as well as in VAS, ODI, and RMQ.

### Pain

After treatment being accomplished, both groups' pain scores got improved considerably, with a significant difference between them. A post isometric relaxation stretch therapy for the patient's group of muscles was used in this study to stretch a short or constricted muscle and mobilize a restricted articulation back into its correct position. [28]. Golgi tendon reflex inhibition, sympathetic excitation triggered by somatic efferent, and activation of periaqueductal grey matter, which been generated by muscle and joint proprioception stimulation, can all explain the hypoalgesia effect. [29]. Another mechanism for MET's therapeutic effects could include variable biomechanical mechanisms such changes in tissue fluids, better proprioception, motor planning, programming, control, and also neurophysiologic responses [30].

Plenty of studies using MET in conjunction with other modalities or in comparison to other types of treatment have been done, however the outcomes have been mixed. The findings cannot be generalized to acute LBP because these trials included both acute and chronic LBP in sciatica patients. In acute LBP, MET combined with interferential therapy (IFT) was reported to be superior to IFT alone in terms of VAS, ODI, and spinal ROM [31]. In non-specific acute and chronic LBP patients, MET has been proven to be more effective than transcutaneous electrical nerve stimulation (TENS). [32] After four weeks of treatments, MET and strain counter strain groups (SCS) had equivalent results in chronic LBP patients. [33]. In another study, MET was found to be as effective as Sacroiliac joint manipulation and it was effective than Transcutaneous Electrical Stimulation for treating SI joint dysfunction. [34].

When combined with traditional physiotherapy, MET has been shown to help relieve pain in various joints such as the shoulder [35] [36], the knee [37], the temporomandibular joint [38], and the cervical spine. [39] [40]. This

is the first study that we are aware of that compares the extra effect of MET to the standard regimen. The data demonstrated that including MET into a standard practice significantly improved VAS.

Disability questionnaire:

Both the Modified ODI and the RMDQ scores showed a clear difference between the both groups, indicating that they had greatly improved. Reduced handicap may be due to decreased discomfort and increased range of motion. In clinical trials, both outcome measures have been used to document LBP-related disability. The ODI was employed as both an inclusion criterion and an outcome measure to assess the treatment's success in this study. RMDQ has been shown to track the short-term impact of therapies in mild to moderate LBP.

Subjects with an ODI disability score ranged from 20% to 60% are better candidates for MET intervention, according to research [42].

Goniometric hip joint straight leg raise test:

Both groups improved, but the study group outperformed the control group by a large margin. A reduction in impairment and an improvement in hip joint range of motion could be due to enhanced lumbar spine ROM. Stiffness of the musculature and facets of lumbar spine after a prolonged chronic complaint leads to increase of the shear and compressive stresses on the disc materials which might affect its health and ability to bear the weight. So, recovery of the mobility of the disc surrounding structures is essential in relieving the stresses on disc material thus lessen the deterioration of disc lesion [42]. The ROM of the deteriorated segment diminishes as the lumbar spine degenerates, although the patient often needs to retain the entire ROM that was previously available. The patient's lumbar spine may produce pain during this period. The main goal of hybrid moment loading is to keep the deteriorated lumbar spine models' ROM at the same level as the normal lumbar spine model's overall ROM. The volume of the nucleus pulposus reduced as disc degeneration progressed, as did the tissue's ability to keep hydrated, resulting in further disc height loss and changes in disc tissue properties. [43] [44] [45]

#### Limitations:

Corona crisis affected the size of the sample because of the governmental decisions of curfew. Females patients refused to record their sessions on a video tape for the sake of documentation for personal and religious reasons. Some of patients didn't complete the protocol of treatment due to different causes and they already got excluded from the study.

## VII. CONCLUSION

The findings demonstrated that MET has a significant favorable effect in goniometric straight leg raise in chronic sciatica patients, as well as an increased effect in pain and impairment. When the groups were compared, it was discovered that both the MET and the control groups benefited from pain and disability reduction. In chronic sciatica patients, lumbar range of motion increased.

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