

A Comparative Study between Muscle Energy Technique and Spinal Extension Exercise Program In Treatment Of Chronic Mechanical Low Back Pain Patients

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Abstract

Background: People with chronic low back pain often experience anger, fear, anxiety decline in physical ability, and inadequacy of role fulfillment. These stressors, along with negative affective states, increase the allostatic load. **Objective:** This study aimed to compare the efficacy of extension exercise program versus muscle energy technique in treating patients with chronic mechanical low back pain. **Subjects:** Forty patients participated in this study complaining of chronic mechanical low back pain. Patients were allocated into two equal groups. Group (A): received spinal extension exercise program and Group (B): received muscle energy technique. Treatment sessions were given three times per week for four successive weeks. Patients in both groups were assessed by the researcher before and after treatment for the outcome measures of pain, functional disability and lumbar range of motion. **Results:** There was significant increase in lumbar range of motion in both groups, also a significant decrease in the pain and functional disability in both groups. **Conclusion:** McKenzie and muscle energy technique had significant effect on range of motion on chronic mechanical low back pain patients. While muscle energy technique had better effect in decreasing pain intensity.

Key Words: Chronic mechanical low back pain – muscle energy technique – spinal extension program.

Introduction

Back pain that lasts for longer than seven to twelve weeks or frequently recurring is called chronic back pain. It intermittently affects an individual over a long period. Chronic back pain is also defined as pain that lasts beyond the expected period of healing⁽¹⁾. Mechanical pain is the general term that refers to any type of back pain caused by placing abnormal stress and strain on muscles of the vertebral column. Typically, mechanical pain results from bad habits, such as poor posture, poorly-designed seating, and incorrect bending and lifting motions⁽²⁾.

Mechanical low back pain (LBP) is a major cause of illness and disability, especially in people of working age. By definition, it excludes pain resulting from neoplasia, fracture or inflammatory arthropathy, or that is referred from anatomical sites outside the spine, and in most cases there is no clearly demonstrable underlying pathology⁽³⁾. There are many factors causing mechanical low back pain. These factors may come from excessive loads to normal spinal structures. The loads transmitted to the spine can be influenced by posture, body mechanics, trunk strength as well as

flexibility in addition to strength of the muscles of the pelvic girdle and lower extremities⁽⁴⁾.

Muscle energy technique is a class of soft tissue osteopathic manipulation methods. The patient's muscles are actively used, on request, from a precisely controlled position, in a specific direction, and against a distinctly executed therapist-applied counterforce. Muscle energy technique is a post isometric relaxation, as it reduces tone of a muscle or group of muscle after a brief period following an isometric contraction. Muscle energy technique involves the physiological response of the antagonist muscles, when muscle is isometrically contracted; its antagonist will be inhibited and will demonstrate reduced tone immediately. The effect of post isometric relaxation is mediated by afferent input from Golgi tendon organ (GTO), which has an inhibitory effect on the antagonist muscles mediated by the muscle spindle afferent⁽⁵⁾.

McKenzie method is one of many treatment modalities of LBP. It is a system of mechanical diagnosis and management of spinal pain syndromes, based on comprehensive and reproducible evaluation, knowledge of symptoms patterns, directional preference, and centralization phenomenon⁽⁶⁾.

The purpose of this study was to compare effect of muscle energy technique and extension exercise program on chronic mechanical low back pain patients.

Subjects, Materials and Methods:

This study was conducted at the department of physical therapy of Ras-el-teen general hospital from June 2017 to December 2017. After being approved by the hospital manager, an informed written consent form that explained the aim and procedures of the study was taken from all patients prior to participation in this study.

Patients suffering from chronic mechanical low back pain for at least three months and diagnosed by a neurologist or an orthopedist, with normal neurological examination were included in this study. Also all the included patients were of normal radiological findings of plain X-Ray, CT or MRI of the lumbar spine.

The researcher excluded patients with disc prolapse, neurological sign and symptoms indicated for surgery. Patient with radicular pain any previous back surgery spondylolisthesis or hip arthrosis, congenital musculoskeletal deformity. Female patient with pelvic lesion and pelvic adhesion. Pregnant female were excluded also.

Patients were distributed into two equal groups: **Group (A)**: composed of twenty patients (males and females) who received spinal extension exercise program for 12 sessions, three sessions per week. **Group (B)**: composed of 20 patients (males and females) who received muscle energy technique for 12 sessions, three sessions per week for successive four weeks.

Assessment procedures:

Patients in both groups were assessed before and after treatment for the outcome measures of pain intensity, functional disability and lumbar range of motion. Pain assessment was done using visual analogue scale (VAS). Functional disability assessment was done using Oswestry Disability Index (ODI). Assessment of lumbar range of motion was done using digital goniometer for measuring the range of flexion and extension. For each measurement, the subject performed three trials.

Modified Schober's test was used for assessing the range of lumbar flexion and extension while fingertip – to – floor test was used to assess the range of lateral flexion.

Statistical analysis:

- Statistical Package for Social Sciences (SPSS) computer program (version 19 windows) was used for data analysis. P value ≤ 0.05 was considered significant.
- Descriptive data are expressed as mean \pm standard deviation or number (%). Test of normality, Kolmogorov-Smirnov test, was used to measure the distribution of data measured pre-treatment MANOVA was used for measured range of motion. Comparison between variables in the two groups was performed using Mann Whitney test. Comparison between variables measured pre- and post-treatment in the same group was performed using Wilcoxon Signed Ranks test whenever it was appropriate clinical trial

Results:

- As illustrated in (**table 1**) no significant difference between both groups as regards to age, weight and height.

Table(1):General characteristics of both groups:

	Group A (n= 20)	Group B (n= 20)	t value	P value
Age (yrs.)	30.10 \pm 6.84	33.20 \pm 6.62	-1.457	0.153 (NS)
Gender				
Male [n (%)]	12 (60.0%)	10 (50.0%)	0.404	0.525 (NS)
Female [n (%)]	8 (40.0%)	10 (50.0%)		
Weight (kg.)	84.20 \pm 4.97	86.75 \pm 8.98	-1.111	0.276 (NS)
Height (cm.)	172.10 \pm 8.80	168.15 \pm 5.08	1.738	0.092 (NS)
BMI (kg/m²)	28.62 \pm 3.29	30.80 \pm 4.21	-1.823	0.076 (NS)

%= percentage, kg= kilo gram, cm= centimeter Ns= no significant, S= significant.

As illustrated in(**table 2**) the results of Oswestry scores in this study showed a significant decrease in disability in GA and GB and there was no significant difference between both groups. The percentage of decrease in Oswestry score in group B was higher(6.87%) than group A(4.82%).

Table(2): Comparison between mean values of Oswestry score within and between both groups:

	Group A (n=20)	Group B (n= 20)	Z[#] value	P value
Pre-treatment	52.95 \pm 6.33	52.22 \pm 14.45	-0.406	0.685 (NS)
Post-treatment	50.40 \pm 6.17	48.63 \pm 14.29	-0.298	0.766 (NS)
Mean difference	2.55	3.59		
% change	4.82 $\downarrow\downarrow$	6.87 $\downarrow\downarrow$		
Z^{##} value	-3.925	-3.926		
p value	0.001 (S)	0.001 (S)		

As illustrated in(**table3**) the results of pain scores in this study were significantly decrease in G A and GB and there was no significant difference between both groups. The percentage of decrease in VAS in group B was higher (72.97 %) than group A (49.29%).

Table 3:Comparison between mean values of VAS within and between both groups:

	Group A (n= 20)	Group B (n= 20)	t value #	P value
Pre-treatment	7.00 ± 1.45	7.40 ± 1.27	-0.927	0.360 (NS)
Post-treatment	3.55 ± 0.83	2.00 ± 0.86	5.820	0.001 (S)
Mean difference	3.45	5.40		
% change	49.29 ↓↓	72.97 ↓↓		
t value ##	14.693	23.081		
p value	0.001 (S)	0.001 (S)		

As illustrated in (table 4) the results of flexion in this study were significantly increase in G A and GB and there was no significant difference between both groups. The percentage of increase in flexion in group A was higher (19.80) than group B (16.67).

Table 4:Comparison between mean values of flexion within and between both groups.

	Group A (n= 20)	Group B (n= 20)	t value #	P value
Pre-treatment	51.00 ± 11.77	51.30 ± 10.01	-0.087	0.931 (NS)
Post-treatment	61.10 ± 11.92	59.85 ± 8.11	0.388	0.700 (NS)
Mean difference	10.10	8.55		
% change	19.80 ↑↑	16.67 ↑↑		
t value ##	-14.522	-7.616		
p value	0.001 (S)	0.001 (S)		

As illustrated in (table 5) the results of extension in this study were significantly increase in G A and GB and there was no significant difference between both groups. The percentage of increase in extension in group B was higher (33.38) than group A (29.61).

Table 5:Comparison between mean values of extension within and between both groups.

	Group A (n= 20)	Group B (n= 20)	t value #	P value
Pre-treatment	39.35 ± 15.69	33.70 ± 10.72	1.330	0.191 (NS)
Post-treatment	51.00 ± 14.76	44.95 ± 12.53	1.397	0.170 (NS)
Mean difference	11.65	11.25		
% change	29.61 ↑↑	33.38 ↑↑		
t value ##	-11.766	-6.999		
p value	0.001 (S)	0.001 (S)		

As illustrated in (table 6) the results of right side bending in this study were significantly increase in GA and GB and there was no significant difference between both groups. The percentage of increase in right side bending in group A was higher (39.52) than group B (36.80).

Table 6: Comparison between mean values of right side bending within and between both groups.

	Group A (n= 20)	Group B (n= 20)	t value [#]	P value
Pre-treatment	29.10 ± 6.16	28.40 ± 5.71	0.373	0.711 (NS)
Post-treatment	40.60 ± 7.49	38.85 ± 4.85	0.878	0.387 (NS)
Mean difference	11.50	10.45		
% change	39.52 ↑↑	36.80 ↑↑		
t value ^{##}	-13.373	-17.281		
p value	0.001 (S)	0.001 (S)		

As illustrated in (table 7) the results of left side bending in this study were significantly increase in G A and GB and there was no significant difference between both groups. The percentage of increase in left side bending in group A was higher (50.35) than group B (40.13).

Table 7: Comparison of mean value of left side bending within and between groups:

	Group A (n=20)	Group B (n= 20)	t value [#]	P value
Pre-treatment	28.20 ± 3.50	29.65 ± 5.88	-0.948	0.351 (NS)
Post-treatment	42.40 ± 4.08	41.55 ± 4.62	0.617	0.541 (NS)
Mean difference	14.20	11.90		
% change	50.35 ↑↑	40.13 ↑↑		
t value ^{##}	-21.218	-14.796		
p value	0.001 (S)	0.001 (S)		

Discussion:

This study aimed to find if there is a difference between spinal extension exercise program and muscle energy technique in improving pain, functional disability and spinal mobility in patients with chronic mechanical low back pain.

The result found that, the two studied groups had no significant difference regarding the age, sex, height and weight, and this means they were homogenous and not participating in the results found.

On comparison between mean values of flexion within and between both groups it was found that the flexion were significantly increased in G A and GB and there was no significant difference between both groups. The percentage of increase in flexion in group A was higher in group A than group B.

On comparison between mean values of extension within and between both groups and it was found that the extension were significantly increased in G A and GB and there was no significant difference between both groups. The percentage of increase in extension in group A was higher than group B.

On Comparison between mean values of right side bending within and between both groups it was found that the right side bending were significantly increased in GA and GB and there was no significant difference between both groups. The percentage of increase in right side bending in group A was higher than group B.

On comparison of mean value of left side bending within and between groups it was found that the results of left side bending were significantly increased in G A

and GB and there was no significant difference between both groups. The percentage of increase in left side bending in group A was higher than group B. and this could be explained by McKenzie extension exercise program is a method of treatment focusing on sustained posture or repeated movement, which could improve pain intensity. It is based primarily on the identification of a directional preference for spinal movement and can form the basis for prescription of exercises. It incorporates repeated end range movements by examination; the classification of direction for exercise depends upon the patient's response to those repeated movements. Posture correction and maintenance of this correction are the important aspects of McKenzie exercises.

The results are supported and in agreement with **Clare et al., (2004)**⁽⁷⁾ who demonstrated that the **McKenzie method** showed significant short-term pain relief. As Symptom relief is the goal, it is accomplished through an individualized treatment program in which the patient performs specific exercises.

Studies done by **Udermann et al., (2004)**⁽⁸⁾ and **Sakai et al., (2008)**⁽⁹⁾ showed that there was significant reduction in pain intensity in patient group that received **McKenzie method**; as this training is designed to mobilize the spine and to strengthen the lumbar muscles and the improvements in strength seen in the participants in the present study were more likely to be due to decrease in pain inhibition than to neurological changes in muscle firing/recruitment patterns or to morphological (hypertrophic) changes in the muscle.

These results came in agreement with **Kilpikoski(2010)**⁽¹⁰⁾ showed that **McKenzie method** leads to improvement of low back pain symptoms such as pain in the short-term; as it leads to centralization of pain which showed a tendency to better pain recovery and a longer lasting treatment. Moreover, mckenzie therapy is more effective in comparison with passive treatments.

The decrease in disability after treatment by McKenzie might attribute to the efficacy of motor control exercises for patients with chronic low back pain and this is agreed by **Garcia(2014)**⁽¹¹⁾ who showed that the McKenzie method reduced disability. It also improves functional ability of subject to carry out daily activities without pain complaint.

This is agreed also by **slade, S. and keating(2006)**⁽¹²⁾ who showed that the McKenzie method reduced disability. As Trunk strengthening appears effective compared with no exercise while increasing exercise intensity and adding motivation increase treatment effects. Trunk strengthening, compared with aerobics or McKenzie exercises, showed no clear benefit of strengthening. It is unclear whether observed benefits are due to tissue loading or movement repetition.

SkikicEm, Suad T.(2004)⁽¹³⁾ showed that when McKenzie compared to passive therapies, strengthening exercises, the result shows short term relief of disability; as McKenzie exercises for low back pain are beneficial treatment for increasing flexibility of spine and improving the pain with better results in pain relief and also a successful method for decreasing and centralizing the pain and increasing spinal movements in patients with low back pain.

The increase in range of motion after treatment by McKenzie might attribute to improvement in pain from performing either repeated lumbar flexion, extension, or side glide/rotation tests and this agreed with the study by **(Long et al, 2004)**⁽¹⁴⁾ which

applied to 37 patients within 2 weeks. Follow up found greater improvement by the McKenzie method when compared with general mobilizing and stretching exercises.

The study by **(Browder et al 2007)**⁽¹⁵⁾ which applied to 42 patients within 6 months. Follow-up suggests substantial benefit of the mckenzie method compared with lumbar strengthening exercises. Which found greater improvement by the McKenzie method as compared with that of spinal manipulation.

This present study came in disagreement with randomized controlled trial applied on one hundred and forty-eight participants who suffered from non specific low back pain. Patients were randomized arranged into 2 study groups. One group received McKenzie method in addition to first-line care (advice, reassurance and simple analgesics), other group received first-line care alone when added to the currently recommended first-line care of acute low back pain, a treatment programme based on the McKenzie method does not produce appreciable additional short-term improvements in pain, disability, function or global perceived effect. However, the mckenzie method seems to reduce health utilization although it does not reduce patient's risk of developing persistent symptoms. This difference due to fact that participants and therapists were not blinded to treatment allocation. Lack of blinding is likely to exaggerate treatment effects on subjective outcomes such as pain. Finally, estimates of the effects of treatments in the present trial were very precise, as indicated by the narrow confidence intervals (it is unlikely that improvements seen after the addition of the mckenzie method to first-line care would be larger than 12% even in the best-case)⁽¹⁶⁾

These results disagreed with **Machado et al., (2006)**⁽¹⁷⁾ who showed that the mckenzie method. For chronic low back pain, were unable to draw conclusions about the effectiveness of the McKenzie method due to the lack of appropriate trials. The randomized controlled trials that have investigated the McKenzie method in patients with chronic low back pain compared the method with other interventions such as resistance training **(Udermann et al., 2004)**⁽¹⁸⁾, unsupervised exercises **(Sakai et al., 2008)**⁽¹⁹⁾ trunk strengthening, **(Petersen et al. 2007)**⁽²⁰⁾ and stabilization exercises **(Miller et al., 2005)**⁽²¹⁾

As the McKenzie method acts on the displaced internal intervertebral disc; the concept behind the mckenzie method focuses on re-alignment of the intervertebral disc, the nucleus pulposus, and reducing compressive loads on the annulus fibrosis and spinal nerves. When repeated movements induce centralization, the internal displacement of the nucleus pulposus is decreased, resulting in a decrease in the forces pressing into the annulus fibrosis and possible nerves **Machado et al., (2012)**⁽²²⁾.

Muscle Energy Techniques (MET) are among the most popular therapeutic modalities aimed at the improvement of elasticity in contractile and non-contractile tissues **de Lucena et al., (2016)**⁽²³⁾.

The McKenzie method is oriented at the management of all structural abnormalities of the spinal discs. The aim of this therapy is to eliminate pain and normalize function of the affected spinal segment. Therefore, McKenzie method focuses on the treatment of spinal disc pathologies as the principal cause of pain. **Takasaki et al.**⁽²⁴⁾ documented positive changes in the spinal disc, i.e. the resolution of herniation, in patient treated with McKenzie method. However, various injuries and other medical conditions, as well as repetitive negative motor pattern, are also

reflected by the disorders of the musculofascial system. This can be reflected by the development of certain compensatory mechanisms, accumulation of muscular tension, motor limitation, and functional disorders. In contrast, the treatment of the musculofascial system is not included in the concept of McKenzie method. Therefore, the aim of including the muscle energy techniques in the proposed protocol of combined therapy was to potentiate its therapeutic effect through the relaxation and stretching of contracted musculature, strengthening of weakened muscles, reduction of passive muscular tension, improvement of joint mobility, and normalization of motor function ^(25,26).

On comparison between mean values of Oswestry score within and between both groups the researcher found that the results of Oswestry scores showed a significant decrease in disability in group A and group B and there was no significant difference between both groups, and the percentage of decrease in Oswestry score in group B treated by MET was higher than group A treated by MCKENZIE also on comparison between mean values of VAS within and between both groups it was found that the pain scores in this study were significantly decrease in group A and group B and there was no significant difference between both groups, and the percentage of decrease in VAS in group B was higher than group A, and this could be explained due to Muscle energy technique is a post isometric relaxation, as it reduces tone of a muscle or group of muscle after a brief periods following an isometric contraction. Muscle energy technique involves the physiological response of the antagonist muscles, when muscle is isometrically contracted; its antagonist will be inhibited and will demonstrate reduced tone immediately, this present study came in agreement with **Wilson et al., (2003)**⁽²⁷⁾, who stated that using MET and resistance exercises may benefit a patient greater than using neuromuscular re-education and resistance exercises to reduce low back pain and improve functional level.

These results came in agreement with **Niemisto et al., (2003)**⁽²⁸⁾, who found In a randomized trial of combined manipulation using muscle energy technique, stabilizing exercise, and physical consultation compared to physical consultation alone for chronic low back pain, the results were that the manipulative treatment with stabilizing exercises was more effective in reducing pain intensity and disability than physical consultation alone.

Also, the result of this study was supported by the findings of the study done by **Roland (2012)**⁽²⁹⁾, who stated that muscle energy technique is effective in relieving pain, improving range of motion and reducing disability in subjects with recurrent low back pain.

The results of this study also came in agreement with **Shiby (2012)**⁽³⁰⁾, who added that muscle Energy Technique was effective as Manipulation in the treatment of low back pain.

One study (**Mesquita 2012**)⁽³¹⁾, reported a significantly larger mean increase in lumbar flexion and extension in the MET group compared to control.

This present study disagreement with a study done by **Bindra (2012)**⁽³²⁾, with 30 participants, there was low-quality evidence of no clinically relevant difference between MET and other therapies regarding pain and functional status.

Conclusion:

McKenzie and muscle energy technique had significant effect on chronic mechanical low back pain patients but mckenzie had better effect in increase range of motion while muscle energy technique had better effect in decreasing pain.

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الملخص العربي

اجريت هذه الدراسة للمقارنة بين استخدام تقنية اطاله وتنبيه العضلات و تمارينات فرد العمود الفقري في علاج المرضى الذين يعانون من الام اسفل الظهر الميكانيكية المزمنة.

وشملت الدراسة ٤٠ مريضاً (ذكر وانثى) تم تقسيمهم الي مجموعتين متساويتين عددياً تلقت المجموعة الأولى تمارينات فرد العمود الفقري وتلقت المجموعة الثانية تقنية اطالة وتنبيه العضلات.

بعد أن تم القياس والتقييم لمستوي الألم و الاعاقة الوظيفية ونطاق الحركة قبل العلاج لكل المرضى تمت متابعة جميع المرضى و عمل اثني عشرة جلسة بمعدل ٣ جلسات أسبوعياً لمدة أربع أسابيع متتالية لكلتا المجموعتين وتم اعادة تقييم شدة الألم والاعاقة الوظيفية و نطاق الحركة.

لم يكن هناك فرق كبير بين المجموعتين غير ان تمارينات فرد العمود الفقري اظهرت تحسن ذو دلالة إحصائية في نطاق الحركة اكثر من نقص مستوي الألم علي حين تقنية اطالة وتنبيه العضلات اظهرت تحسن في نقص مستوي الألم اكثر من التحسن في نطاق الحركة.

والخلاصة فان كلا من تقنية اطالة وتنبيه العضلات و تمارينات فرد العمود الفقري اظهرت تحسن في علاج المرضى الذين يعانون من الام اسفل الظهر الميكانيكية المزمنة.