International Journal of Physiotherapy and Research,
Int J Physiother Res 2017, Vol 5(5):2379-84. ISSN 2321-1822
DOI: https://dx.doi.org/10.16965/ijpr.2017.213

Original Research Article

THRUST MANIPULATION VERSUS MUSCLE ENERGY TECHNIQUE ON SOMATIC DYSFUNCTION IN MECHANICAL LOW BACK PAIN PATIENTS

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ABSTRACT

Background: Low back pain is defined as discomfort or pain located at the area from the 12th rib down to the gluteal area.

Purpose: To compare short term effect of high velocity low amplitude thrust manipulation versus muscle energy technique on somatic dysfunction in mechanical low back pain patients in terms of pain and tenderness.

Subjects and Methods: 40 patients with mechanical low back pain, their ages range from 20- 30 years. They were randomly assigned into two equal groups. Group A (24±3.69 years) received a single high velocity low amplitude thrust manipulation technique for lumbar spine, while group B (24.3±3.57 years) received 3 contractions of muscle energy technique. Visual analogue scale and pressure algometer were used to assess pain and tenderness respectively pre and post treatment.

Results: The study revealed that there was significant decrease in pain and tenderness post treatment in both groups. While there was no significant difference in tenderness between both groups post treatment, there was significant difference in pain between both groups post treatment where group A revealed significant decrease in pain.

Conclusion: Both high velocity low amplitude thrust manipulation and muscle energy technique have significant short term effect on somatic dysfunctions in mechanical low back pain patients. However, high velocity low amplitude thrust manipulation is more effective in decreasing pain perception.

KEY WORDS: Mechanical low back pain, Somatic dysfunction, High velocity low amplitude thrust manipulation, Muscle energy technique.

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Access this Article online

Quick Response code

DOI: 10.16965/ijpr.2017.213

International Journal of Physiotherapy and Research
ISSN 2321- 1822
www.ijmhr.org/ijpr.html

Received: 07-08-2017	Accepted: 05-09-2017
Peer Review: 07-08-2017	Published (O): 11-10-2017
Revised: None	Published (P): 11-10-2017

INTRODUCTION

Low back pain (LBP) is defined as discomfort or pain located at the area from the 12th rib down to the gluteal area [1]. It affects annually 5 - 10% of the adult population [2], with predominance from 60% to 90% over a lifetime [3]. 50% of the population will have experienced a significant incident of LBP by age 30 [4]. In about 85% of these people, LBP is secondary to nonspecific or functional (mechanical) causes, where no specific underlying anatomic etiologic condition can be identified [5].

Patients with nonspecific LBP are frequently treated by using manipulative techniques directed at specific somatic dysfunctions diagnosed by palpation [6]. Incidence of somatic dysfunctions in lumbar spine is more in people with chronic LBP than those without chronic LBP [7].Somatic dysfunction is an altered or impaired function of the related somatic system components such as myofascial, arthrodial, skeletal structures as well as related neural elements, lymphatics and vascularity [8].

High velocity low amplitude (HVLA) thrust manipulation is applying a rapid therapeutic force in a short distance within the anatomic range of a joint to engage a restrictive barrier in at least one plane of movement to release this restriction [9]. Also muscle energy technique (MET) has been increasingly used by clinicians to treat LBP. It involves performing a voluntary muscular contraction in an accurate controlled direction against resistance precisely applied by a therapist. This isometric contraction primarily reduces the tone in a hypertonic muscle and reestablish its normal resting length through reciprocal inhibition. Shortened and hypertonic muscles are frequently identified as the major component of restricted motion of an articulation. [8].

A previous study has evaluated the short-term effect of HVLA thrust manipulation on flexion spinal mobility, pain perception, neural mechanosensitivity, and height recovery in patients with disc degeneration where there was immediate improvement after one single HVLA thrust technique [10]. Another study has compared between MET performed with strengthening and neuromuscular training versus strengthening and neuromuscular training alone in patients with acute LBP. Decreasing disability and improving function were better in MET group [11]. It was suggested that MET is a useful alternative technique for therapists to treat patients with any contraindications or precautions to HVLA thrust manipulation [12]. However, there is a gap in the literature in comparing the effect of HVLA thrust manipulation versus MET in treatment of somatic dysfunction in mechanical LBP patients regarding pain and tenderness.

The purpose of this study was to compare short term effect of HVLA thrust manipulation versus MET on somatic dysfunctions in mechanical LBP patients in terms of pain and tenderness.

MATERIALS AND METHODS

Study sample: Patients with specific non mechanical LBP, fractures, tumors, infections, structural deformity, inflammatory disorders, cauda equine syndrome, previous spinal surgery, systemic diseases and neurological disorders were excluded. The age range was 20-30 years and the BMI ranged from 20 to 25kg/m2. In total, 40 patients with mechanical LBP who were recruited from Agouza police authority hospital participated in this study. They had limited range of motion (ROM) of lumbar spine and pain at mid to end range of active or passive motion. They were randomly assigned into two equal groups; Group A received HVLA thrust manipulation and Group B received MET. All participants were asked to sign a consent form for ethical issue.

Study design: Experimental pre-post design, pain and tenderness are dependent variables while somatic dysfunction of LBP is the independent variable. Pain was measured by visual analogue scale (VAS) and tenderness was measured by pressure algometer. Measurements were collected twice, pre and post treatment.

Instrumentations: Pressure algometer was used for tenderness assessment, it is a semi-objective and reliable measurement which is consequently applied when determining the effect of treatments [13]. Pain was assessed by VAS, which is a 10 cm horizontal line, 0 represented no pain while 10 represented extremely intense pain.

ASSESSMENT PROCEDURES

Somatic dysfunction determination: Oscillation test was performed to determine the level of somatic dysfunction where a rhythmical oscillation force was applied on every spinous process from L1 to L5. If there was tenderness or resistance, somatic dysfunction was suspected.

Tenderness assessment: Three short consecutive measurements with 10 seconds in between were performed by pressure algometer at the spinous process of the selected level. The

patient was required to say 'yes' at the moment of experiencing pain and the applied pressure was recorded.

Pain assessment: Patients also were asked to place a vertical mark along VAS where they felt pain, then the distance from left extreme point of the line (no pain at all) to the patients mark was measured and recorded.

Treatment procedures:

HVLA thrust manipulation: The patient was placed in side lying position. Both hips and knees were in full flexion. The upper lever was placed in flexion and light rotation via traction on the underlying arm. Lumbar lordosis should be avoided. Rotation lever was focused to the level to be manipulated. The patient was instructed to straighten the underlying leg while the upper leg was held passively in full flexion. The grade of flexion/extension in the underlying hip was passively adjusted so that the lever was focused at the level of somatic dysfunction. This adjustment must result in the foot being off the table with the toes pointing to the ground. The upper lever was supported by the therapist's body, the distal surface of the elbow was used to contact posteriorly on the iliac crest so that the forearm was pointing in a cranial direction. Correction of lesion is focused mainly on the side bending component more than the rotation component to avoid facet joint compression. The manipulative thrust was via a body-drop during an exhalation from the patient [14] as shown in Fig. (1).

Fig. 1: High velocity low amplitiude thrust manipulation for lumbar spine.

MET for lumbar spine: The patient was placed in side lying position, knees and hips were flexed. The upper lever was placed in flexion and light rotation via traction on the underlying arm. The upper lever was focused to the vertebral level being treated, the underlying leg was straightened until this lever resulted in extension at that level. The leg was then brought back until flexion occurs at the same level, then the upper ankle was taken by the therapist and is lifted until left side bending occurred at that level. The patient was instructed to lift the shoulder away from the table while simultaneously pushing the ankle back to the table [14] as shown in Fig.(2).

Fig. 2: Muscle energy technique for lumbar spine.

Statistical analysis: All data were collected from the two groups. Statistical analysis was carried out using the SPSS statistics software version 20 (SPSS, Inc., Chicago, IL). The mean (X) and standard deviation (SD) were calculated regarding the age, weight, and height. Paired t-test was used to compare pain and tenderness before and after treatment for each group. Unpaired t-test was used to compare short term effect of HVLA (group A) versus MET (group B) on pain and tenderness. The significance level was set as P value less than 0.05

RESULTS

Participants' characteristics: The study sample consisted of 40 males patients divided equally into two groups. Group (A) received HVLA thrust manipulation, their mean age and BMI were (24±3.69) years and (24.6±3) kg/m2 respectively. While group (B) received MET, their mean age and BMI were (24.3±3.57) years and (24.7±2.1) kg/m2 respectively. Unpaired t-test proved that there was no significant difference between the two groups in their age, height, weight, and BMI. Demographic characteristics are presented in table 1

Table 2 demonstrates that there was no significant difference in pain or tenderness between

both groups pre-treatment, also there was no significant difference in tenderness between both groups post-treatment. However, there was significant difference in pain between groups A and B post treatment in favor to group A. Table 3 shows that there was significant difference in tenderness and pain in both groups between pre and post-treatment.

Table 1: General Characteristics of subjects in both groups.

General characteristics	Group A	Group B	t-value	P-value	significance
	Mean ±SD	Mean ±SD			
Age (yrs)	24±3.69	24.3±3.57	-0.261	0.796	N.S
Weight (kg)	77.5±10.14	72.9±7.1	1.392	0.172	N.S
Height (cm)	173.4±8.1	171.6±5.3	0.83	0.412	N.S
BMI (kg/m2)	24.6±3	24.7±2.1	1.009	0.32	N.S

N.S **:** Non-significant

Table 2: Pre and post treatment pain and tenderness mean values scores for each group.

Variables	Group A	Group B	t-value	P-value	significance
	Mean ±SD	Mean ±SD			
Tenderness (pre-treatment) (kg/cm2)	0.89±0.3	0.76±0.24	-2.611	0.313	N.S
Pain (pre-treatment)	4.5±1.4	4.4±1.2	-0.242	0.81	N.S
Tenderness (post-treatment) (kg/cm2)	1.86±0.44	1.8±0.51	-0.261	0.796	N.S
Pain (post-treatment)	2.2±0.7	3.3±0.9	2.538	0.015	S

N.S: Non-significant S: Significant

Table 3: Pre and post treatment pain and tenderness mean values scores within groups.

Variables	Pre-treatment	Post-treatment	t-value	P-value	significance
	Mean ±SD	Mean ±SD			
Tenderness (group A) (kg/cm2)	0.89±0.3	1.86±0.44	-8.442	0	S
Pain (group A)	4.5±1.4	2.2±0.7	6.319	0	S
Tenderness (group B) (kg/cm2)	0.76±0.24	1.8±0.51	-7.959	0	S
Pain (group B)	4.4±1.2	3.3±0.9	2.979	0.008	S

S: Significant

DISCUSSION

This study was conducted to compare short term effect of HVLA thrust manipulation versus MET on somatic dysfunctions in mechanical low back pain patient, measured variables included tenderness by pressure algometer and pain by VAS. The results showed that there was no significant difference in tenderness between both groups post-treatment. However, there was significant difference in pain between both groups post-treatment in favor to group (A) which received HVLA thrust manipulation, also pain and tenderness decreased significantly post treatment in both groups

Our results can be explained by balancing mechanism of both HVLA thrust manipulation and MET on the neurological component of somatic dysfunction, where HVLA can normalize the altered behavior of the mechanoreceptors in the articular and periarticular structure of the zygapophyseal joint. Dishman and Bulbulian [15] concluded that HVLA lumbosacral spinal manipulation displays a short-term impact on the attenuation of alpha motor neurons activity. This seems to be linked to a reduction of muscle tone and pain perception. On the other hand, when there is somatic dysfunction, the multifidi, rotators and intertransversarii muscles alter joint mechanics locally and alter the behavior of the erector spinae muscle. These muscles are the deep layer of the erector spinae muscle which are dense in spindles and function more as proprioceptors than prime movers. MET can primarily reduce hypertonicity of these deep muscles and reestablish their normal resting length. Afferents from Golgi tendon organs and gamma afferents from spindle receptors feed back to the cord; gamma efferents return to the intrafusal fibers resetting their resting length, and this changes the resting length of the extrafusal fibers of the muscle [8].

Our current findings go in line with the systematic review of Day and Nitz [12] who suggested that MET is a useful alternative technique for therapists to treat patients with any contraindications or precautions to HVLA thrust manipulation. Cleland et al. [16] concluded that treatment outcomes depend on utilizing thrust manipulation, because there were no dramatic improvements in patients treated without thrust techniques in their study. This may explain the significant difference in pain between both groups post-treatment in favor to group (A) which received HVLA thrust manipulation in our study.

Vieira-Pellenz et al. [10] supported our results where they evaluated the short-term effect of HVLA thrust manipulation on spinal mobility, pain perception, neural mechanosensitivity, and height recovery on 40 males with disc degeneration at L5-S1. The study revealed that the treatment group that received HVLA thrust

manipulation had significant improvements in all variables while there was no change in the control group that received placebo intervention except for spinal mobility in flexion. Selkow et al [17] also supported our results where they examined the short term effect of MET on 20 patients with non-specific lumbopelvic pain, they reported that subjects who received MET demonstrated a significant de-crease in VAS worst pain 24 hours after treatment while there was an increase in worst pain in the control group which received sham treatment. However, the technique used in the later study was different from that of our study. Where they used MET directed at the lumbopelvic region using the isometric contractions of the hamstring and iliopsoas muscles, but in our study MET was directed at the lumbar spine using the isometric contractions of erector spinae.

On the other hand, our findings do not agree with the study of Cherkin et al [18] who compared between HVLA thrust manipulation and McKenzie method, they found that both had similar effects (based upon pain and functional status) in LBP, patients who received these treatments improved by marginally better results than those who received only advices. The systematic review of Rubinstein et al. [19] also concluded that there is strong evidence suggesting no clinical difference between thrust manipulation and other techniques to reduce pain and improve function in chronic LBP patients. Franke et al [20] also disagreed with our results as they suggested that MET is not effective in LBP. However, they reported that the studies included in their systematic review showed poor quality evidence for this non-significant effect in terms of pain and function.

This disagreement can be explained due to the wide variety of manual therapy techniques. The clinical situation often needs changing treatment protocol based on the progressing reaction of the patient to manual therapy. This continuous re-evaluation process results in increasing treatment variability.

Limitations: The study was limited by psychophysiological factors that may interfere with the patient response. Moreover, there were no female patients in the sample because of cultural and social limitations where female patients are used to be treated by a female therapist. Future studies should include both genders and medium to long term results.

CONCLUSION

Based on the findings of this study, both HVLA thrust manipulation and MET have significant short term effect on somatic dysfunction in mechanical LBP patients, where pain and tenderness decreased significantly post-treatment. There was no significant difference in tenderness between both of them. However, HVLA thrust manipulation has statistically more significant effect on pain than MET. Exploring the effect of HVLA thrust manipulation and MET on somatic dysfunction can assist clinicians in developing more effective treatment for mechanical LBP patients, using particularly HVLA thrust manipulation in treating pain.

Conflicts of interest: **None**

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How to cite this article: Mohamed Hussien ElGendy, Rania Nagy Karkousha, Ahmed Salah Eldin Hassan, Ramy Raafat Mourad. THRUST MANIPULATION VERSUS MUSCLE ENERGY TECHNIQUE ON SOMATIC DYSFUNCTION IN MECHANICAL LOW BACK PAIN PATIENTS. Int J Physiother Res 2017;5(5):2379-2384. **DOI:** 10.16965/ijpr.2017.213