

Evaluation of Post-Isometric Relaxation Technique on Myofascial Tightness of Lumbo-Pelvic Musculature

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ABSTRACT

Background: Chronic lumbar dysfunction is the most common complaint of the working age population. The non-specialized connective tissues forming the fascial planes of the back have received little attention from researchers. Myofascial abnormalities may lead to connective tissue fibrosis, increased tissue stiffness and further movement impairment which may contribute to LBP chronicity. **Purpose:** to determine the efficacy of a post-isometric relaxation on the myofascial tightness of lumbo pelvic musculature. **Methods:** forty patients (male and female), their age range from 30-55 years, with chronic low back pain (more than three months) were assigned randomly to two equal groups. The control group (n=20) underwent a four weeks specific physical therapy treatment program (Infra Red Radiation, ultrasound, transcutaneous electrical nerve stimulation and therapeutic exercises). The treatment group (n=20) underwent a four weeks specific post-isometric relaxation intervention plus the physical therapy program. Outcome measures include pain intensity, lumbar movements and functional disability index were measured. **Results:** After intervention, post-isometric relaxation technique showed a statistically significant ($P < 0.05$) reduction in pain intensity from (7.7 ± 1.42) to (5 ± 1.34) and functional disability levels from (56 ± 12.06) to (30.35 ± 9.16) and also revealed a statistically significant improvement in the lumbar spine range of movement from (30.75 ± 11.65) to (41.25 ± 7.39) . **Conclusion:** This findings support the view that the functional integration of specific post-isometric relaxation technique are effective in reducing pain and functional disability in patients with chronic low back pain.

Key words: Post-isometric relaxation, chronic low back pain, outcome measures.

INTRODUCTION

Chronic low back pain (cLBP) is a poorly understood condition causing substantial disability and health care costs worldwide³⁸. To date, efforts to understand the pathophysiological

mechanisms leading to chronic lumbar dysfunction have chiefly focused on structural pathology of the vertebrae and associated tissues¹², neuropsychosocial factors^{18,22} and abnormalities of motor control^{34,37}. In contrast, the non-specialized connective tissues forming the fascial planes of the back have received little attention.

Also, several investigators have proposed that fascia and non-specialized connective tissues could be involved in the pathophysiology of LBP²⁶. Human subjects with LBP had, on average, 25% greater perimuscular connective tissue thickness and ultrasound echogenicity in the lumbar region than did subjects without LBP after adjusting for body mass index²⁰.

Lumbar dysfunction is a serious health problem affecting 80% of people at some time in their life. It affects the mobility of the lumbar region and adjacent joints leading to functional disability¹⁰. The delay in recruitment pattern of trunk stabilizer results in decreased muscle stiffness and poor spinal segmental control¹³. Although it has been proposed that altered muscle activation patterns in cLBP can stabilize the spine during movement, thus preventing further injuries, this adaptation comes at the cost of a limited range of motion³⁷. A considerable amount of research on LBP has focused on structural abnormalities of spine-associated tissues (e.g. disc herniation, facet joint degeneration) with emphasis on diagnostic imaging (e.g. X-ray, CT scan, MRI). However, the association between symptoms and imaging results has been consistently weak, and up to 85% of patients with low back pain cannot be given a precise pathoanatomical diagnosis using these methods¹².

A key component of pain-related behavior is fear of pain with consequent decrease in physical activity^{36,41}. While rest may be initially important in acute low back injury (e.g. disc herniation, muscle sprain), it is increasingly recognized that timely

resumption of physical activity is critical to successful rehabilitation³⁹. Post isometric relaxation (PIR) refers to the effect of the subsequent reduction in tone experienced by a muscle, or group of muscles, after brief periods during which an isometric contraction has been performed⁸.

A recent focus in the physiotherapy management of patients with chronic back pain has been the specific osteopathic manipulative techniques. This program is proposed to be integrated with physical therapy program for best benefits of patient to provide dynamic stability and fine control to the lumbar spine. In no study have researchers evaluated the efficacy of this intervention in a population with chronic low back pain where the function of the lumbar spine was compromised. Identifying which treatment works best for whom' in low back pain has been an on-going aim of clinicians and has been a research priority over the last decade³¹.

SUBJECTS, MATERIALS AND METHODS

Subjects

Forty patients of either gender between the ages of 30 and 55 years and had persisted low back pain longer than 3 months⁶.

Study Design. A randomized controlled clinical trial, test-retest design with one control and one experimental group and a non-blind investigator was used. At entry to the trial, participants signed an informed consent form and then undertook the testing procedure (described later), performed by an independent investigator. After completion of the initial testing, the participants were assigned randomly to either the control group or a myofascial release group. Randomization was performed independently. Cards numbering from 1 to 40 were shuffled in a container and, in a blinded manner, alternately placed into either the control or experimental group. In this way, 20 cards were allocated randomly to either group. The intervention period was 4 weeks. At the completion of the intervention period, patients were again tested by the same investigator.

Instrumentations

A- For Evaluation:

1. Pain measures: a visual analogue pain scale (VAS) was used to assess each patient's average symptoms²⁹.
2. Lumbar spine range of movement in standing: This was measured using inclinometers²³.
3. Functional measures: The Oswestry disability questionnaire was used¹⁴.

B- For intervention:

1. Infrared Radiation (IRR): model is 2004/2 N, a power of 400 w, voltage 203 v and frequency of 50/60 Hz.
2. Ultrasonic Device: Phyaction U 190, 230 V, 300 mA/50-60 Hz, Plus: 8 w.
3. Transcutaneous Electrical Nerve Stimulation (TENS): (Dc: 6 v, Watts: 6 w, CE: 0120)

Treatment Procedure:

Both treatment group are received the following intervention protocols 3x/ w/4wks (infrared Radiation (IRR), ultrasonic, Transcutaneous Electrical Nerve Stimulation (TENS), therapeutic exercise program (finger to toes, bridging exercise, back extension from prone, sit-up exercise, knee to chest exercise and stretching lower back muscles).

At this point the experimental group was received a post-isometric relaxation intervention while the control group is discharged. Post-isometric Relaxation Technique (PIR): Every patient received all treatments of control group, in addition to post-isometric relaxation techniques¹. PIR technique was done for psoas muscle group, hamstring, tensor fascia lata, Piriformis, quadratus lumborum and erector Spinae muscles^{8,30}.

RESULTS

Statistical analysis revealed no statistically significant differences between CG and PIR groups on entry to the trial. Analysis of differences within each group after the intervention period revealed significant differences in the PIR group after the intervention period, with a decrease in pain intensity ($t = 7.37$, $P < 0.0001$) and a reduction in functional disability levels ($t = 9.05$, $P < 0.0001$) and lumbar spine ROM improvement (flex, ext, R & L side bending ($t = 4.22$, 4.97 ,

4.14, 5.05 and $P < 0.001$, 0.001, 0.001, 0.001 respectively), (Table 1). CG showed a statistically significant, but clinically insignificant, reduction in pain intensity ($t=4.86$, $P=0.001$), decreased in functional disability level ($t=4.64$, $P < 0.0001$) and lumbar spine ROM flex, ext, R & L side bending ($t=1.67, 2.74, 3.15, 3.2$ and $P < 0.11, 0.01, 0.005, 0.005$ respectively) were detected in the control group (Table 1).

PIR group revealed a statistical significant difference between pre and post treatment; pain intensity level as the pain level pre treatment was (7.7 ± 1.42) and for post treatment was (5 ± 1.34) where the t-value was (7.37) and P-value was (0.0001), there was a significant difference between pre and post treatment lumbar flexion ROM as the lumbar flexion ROM pre treatment was (30.75 ± 11.96) and for post treatment was (41.25 ± 7.39) where the t-value was (4.22) and P-value was (0.001), there was a significant difference between pre and post treatment lumbar extension ROM as the lumbar extension ROM pre treatment was (8.25 ± 2.86) and for post treatment was (16.25 ± 4.14) where the t-value was (4.97) and P-value was (0.001), there was a significant difference between pre and post treatment lumbar (Rt) side bending ROM as the lumbar side bending ROM pre treatment was (6.25 ± 3.49) and for post treatment was (11.75 ± 2.91) where the t-value was (5.14) and P-value was (0.001), there was a significant difference between pre and post treatment lumbar (Lt) side bending ROM as the lumbar side bending ROM pre treatment was (7 ± 2.91) and for post treatment was (12 ± 3.32) where the t-value was (5.05)

and P-value was (0.001), and finally, there was a significant difference between pre and post treatment functional disability as the functional disability pre treatment was (56 ± 12.06) and for post treatment was (41.25 ± 7.39) where the t-value was (9.05) and P-value was (0.0001) as shown in table (1).

Two samples paired t-test revealed that there was no significant difference between groups (A) and (B) in the combined dependant variables pre-treatment, while revealed a statistical significant difference between both groups in the combined dependant variables post-treatment as shown in table (2). Pre treatment there was no significant differences between group (A) and (B) in: (I) pain intensity level where the t-value was (0.43) and P-value was (0.669), (II) lumbar flexion & extension ROM where the t-values were (1.19, 1.45) and P-values were (0.248, 0.163) respectively, and lumbar Rt & Lt side bending ROM where t-values were (0.18, 0.81) and P-values were (0.858, 0.428) respectively, and finally, (III) functional disability where the t-value was (0.89) and P-value was (0.386) as shown in table (2). Post treatment there was a significant differences between group (A) and (B) in: (I) pain intensity level where the t-value was (3.26) and P-value was (0.004), (II) lumbar flexion & extension ROM where the t-values were (4.31, 6.68) and P-values were (0.000, 0.000) respectively, and lumbar Rt & Lt side bending ROM where t-values were (2.88, 3.85) and P-values were (0.01, 0.001) respectively, and finally, (III) functional disability where the t-value was (3.04) and P-value was (0.007) as shown in table(2).

Table (1): Paired t-test of the dependant variables in each group.

Group	Variable	Pre treatment	Post treatment	Paired t-test		
		Mean \pm SD	Mean \pm SD	t-value	P-value	Significance
Group (A)	Pain level	8.00 \pm 2	6.9 \pm 1.8	4.86	0.0001	S
	Lumbar flexion ROM	27.19 \pm 12.68	29.06 \pm 12.89	1.67	0.11	NS
	Lumbar Extension ROM	7.18 \pm 2.42	8.56 \pm 2.80	2.74	0.001	S
	Lumbar RT side bending ROM	5.93 \pm 4.74	7.68 \pm 4.28	3.15	0.005	S
	Lumbar LT side bending ROM	5.31 \pm 3.73	7.5 \pm 3.06	3.2	0.005	S
	Functional disability	50.47 \pm 17.8	40.87 \pm 11.52	4.64	0.0001	S
Group (B)	Pain level	7.7 \pm 1.42	5 \pm 1.34	7.37	0.0001	S
	Lumbar flexion ROM	30.75 \pm 11.69	41.25 \pm 7.39	4.22	0.0001	S
	Lumbar extension ROM	8.25 \pm 2.68	16.25 \pm 4.14	4.97	0.0001	S
	Lumbar RT side bending ROM	6.25 \pm 3.49	11.75 \pm 3.27	5.14	0.0001	S
	Lumbar LT side bending ROM	7 \pm 2.91	12 \pm 3.32	5.05	0.0001	S
	Functional disability	56 \pm 12.06	30.35 \pm 9.16	9.05	0.0001	S

P-value = Probability

S = Significance

NS = Non significance

Table (2): Paired t-test of the dependant variables in both group.

Time of measurements	Variable	Group (A)	Group (B)	Paired t-test		
		Mean \pm SD	Mean \pm SD	t-value	P-value	Significance
Pre treatment	Pain level	8.00 \pm 2	7.7 \pm 1.42	0.43	0.669	NS
	Lumbar flexion ROM	27.19 \pm 12.86	30.75 \pm 11.96	1.19	0.248	NS
	Lumbar extension ROM	7.18 \pm 2.42	8.25 \pm 2.86	1.45	1.63	NS
	Lumbar RT side bending ROM	5.93 \pm 4.74	6.25 \pm 3.49	0.18	0.858	NS
	Lumbar LT side bending ROM	5.31 \pm 3.73	7 \pm 2.91	0.81	0.428	NS
	Functional disability	50.47 \pm 17.8	56 \pm 12.06	0.89	0.386	NS
Post treatment	Pain level	6.9 \pm 1.8	5 \pm 1.34	3.26	0.004	S
	Lumbar flexion ROM	29.06 \pm 12.89	41.25 \pm 7.39	4.31	0.00	S
	Lumbar extension ROM	8.56 \pm 2.8	16.25 \pm 4.14	6.68	0.00	S
	Lumbar RT side bending ROM	7.68 \pm 4.22	11.75 \pm 3.27	2.88	0.01	S
	Lumbar LT side bending ROM	7.5 \pm 3.06	12 \pm 3.32	3.85	0.001	S
	Functional disability	40.87 \pm 11.52	30.35 \pm 9.16	3.04	0.007	S

P-value = Probability

S = Significance

NS = Non significance

DISCUSSION

I. Pain intensity level: both CG and PIR groups revealed a statistical significant reduction in pain intensity level after the intervention period in patient with CLBP.

The analgesic effect of PIR could be explained by both spinal and supraspinal mechanisms; Activation of both muscle and joint mechanoreceptors occurs during an isometric contraction. This leads to sympatho-excitation evoked by somatic efferents and localized activation of the periaqueductal grey that plays a role in descending modulation of

pain. Nociceptive inhibition then occurs at the dorsal horn of the spinal cord, as simultaneous gating takes place of nociceptive impulses in the dorsal horn, due to mechanoreceptor stimulation¹⁶. PIR stimulates joint proprioceptors, via the production of joint movement, or the stretching of a joint capsule, may be capable of reducing pain by inhibiting the smaller diameter nociceptive neuronal input at the spinal cord level¹⁹. This is supported by the study of Degenhard et al., 2007¹¹, who reported that concentrations of several circulatory pain biomarkers (including endocannabinoids and endorphins) were

altered following osteopathic manipulative treatment incorporating muscle energy. The degree and duration of these changes were greater in subjects with C LBP than in control subjects. Moreover myofascial trigger point deactivation was shown to be enhanced by use of different forms of MET¹⁵. Consistent with these findings, Selkow et al., 2009³², who concluded that PIR for hamstring muscle, resulted in significantly less "worst pain reported in the past 24 hours" on VAS compared to the control group. Also the analgesic effect of MET is confirmed by work Strunk, 2008³⁵, Buchmann et al. (2005)⁵, and Wilson et al. (2003)⁴⁰.

On the other hand, Ballentyne et al., 2003³, 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.

II. Lumbar spine flexion and extension (ROM): Both PIR and CG groups showed a statistical significant improvement in lumbar spine ROM after the intervention period in patient with CLBP. The improvement in ROM can be explained by reduction of pain and a proposed hypothesis by Hong, 1999²¹; The cause of limited ROM in patients with CLBP, may be attributed to the presence of tight and contracted muscles, as muscle fibers respond to trauma or abnormal stress by releasing calcium from the sarcoplasmic reticulum or through the injured sarcolemma, which causes uncontrolled shortening activity and increased metabolism, this sustained muscle contraction decreases the blood supply, leading to an accumulation of waste products, and eventual muscle fatigue and also to the stimulation of the nociceptors which leads to more severe pain. This can lead to a self-perpetuating circle where shorting of the muscle leads to loss of sarcomeres, increase the proportion of the collagen in the muscles which aggravates pain and increases muscle stiffness, thus decreasing active lumbar ROM. The current findings of PIR group are supported by the work of Blanco et al. (2006)⁴, who proved significant improvement in active mouth opening following PIR in participants with temporomandibular joint (TMJ) dysfunction. Moreover, other studies confirmed the current findings as Willson et al., 2003⁴⁰, AL-Khayer and Gervitt, 2007² and Jisha, 2007²⁴ that muscle energy

techniques has been shown to improve joint range of motion, including spinal joints^{25,27}, other studies have showed that PIR is effective in increasing range of motion in the cervical spine³³.

III. Functional Disability: PIR groups revealed a statistical significant reduction in Function disability level after the intervention period in patient with CLBP. This improvement is the resultant of combined findings of pain reduction and increasing of lumbar spine mobility. PIR group is supported by a study of Wilson (2003)⁴⁰, who concluded that using PIR may benefit a patient to reduce low back pain and improve low back functional disabilities.

Conclusion

The findings of this study support the view that the functional integration of specific manipulative PIR techniques directed at the low back muscles are effective in reducing pain and functional disability and improving lumbar spine mobility in patients with CLBP.

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الملخص العربي

تقييم فاعلية الطاقة العضلية على القصر العضلي الليفي لعضلات المنطقة القطنية وعضلات الحوض

مقدمة: يعرف ألم أسفل الظهر بأنه الأكثر كلفة من الناحية الاقتصادية على مستوى العالم. تتراوح نسبة الإصابة به بين ٥٠% - ٨٠% بين البالغين. كما تبلغ نسبة عودة الألم بعد الشفاء منه ما بين ٥٠% - ٨٨%. تتعدد وسائل العلاج الطبيعي المستخدمة في علاج ألم أسفل الظهر إلا أنه بدأ التركيز في الآونة الأخيرة على استخدام العلاج اليدوي الإستيوباثي في صورة تقنية الطاقة العضلية للتحكم والسيطرة على هذا النوع من الألم. **الهدف:** تهدف هذه الدراسة إلى تقييم فاعلية تقنية الطاقة العضلية في التحكم والسيطرة على ألم أسفل الظهر المزمن. **الطريقة:** تم إجراء هذا البحث على أربعين مريضاً (رجال - نساء) تتراوح أعمارهم بين ٣٠ - ٥٥ عام ويعانون من ألم أسفل الظهر لمدة تزيد عن ثلاثة أشهر. تم تقسيم المرضى عشوائياً إلى مجموعتين متساويتين في العدد حيث تم علاج المجموعة الأولى بواسطة برنامج علاج طبيعي خاص يشتمل على أشعة تحت الحمراء، موجات فوق صوتية، ذبذبات كهربائية وتمارين علاجية والثانية بنفس البرنامج بالإضافة إلى تقنية الطاقة العضلية ٣ مرات لمدة ٤ أسابيع لمدة ١٢ جلسة. **النتائج:** أظهرت النتائج فروق ذات دلالة معنوية إحصائية بين المجموعتين تشير إلى تفوق تقنية الطاقة العضلية في السيطرة والتحكم في المتغيرات موضع الدراسة وهي شدة الألم ومدى الحركي للفقرات القطنية وكذلك مقياس أوسوستري للعجز الوظيفي قبل وبعد العلاج. **الخلاصة:** تقنية الطاقة العضلية لها تأثير في التحكم والسيطرة على ألم أسفل الظهر المزمن.

الكلمات الدالة: تقنية الطاقة العضلية - ألم أسفل الظهر المزمن.