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Effect Of Magnetic Field Therapy Versus Progressive Pressure Technique In Treatment Of Lower Back Myofascial Pain Syndrome: A Randomized Clinical Trial

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Abstract

Background: low back pain affects about 60% to 90% of the working-age population in modern industrial society. Myofascial pain syndrome is a state characterized by increased tone of muscles with muscles shortening and related with trigger points that aggravated with activity of daily living.

Objective of the study: to examine the effects of magnetic field therapy versus progressive pressure technique in treatment of lower back myofascial pain syndrome. **Subjects and Methods**: Thirty patients were assigned randomly in to 2 groups. Subjects in the group (A) (n=15) with main age of 36.73(2.52) received magnetic field and traditional physical therapy program (Infrared radiation, ultrasonic, stretching and strengthening exercises for back muscles), and group (B) (n = 15) with main age of 37.27(2.52) consist of 15 patients receiving progressive pressure technique over the trigger points of back muscles followed by stretching exercise. The following parameters including pain severity, functional disability and lumbar range of motion (flexion, extension, right side bending and left side bending) were measured before and after treatment. **Results:** Mixed design MANOVA was used to compare the tested variables of interest in different test groups and measurement times. The alpha level was set at 0.05. Regarding within group's comparison, it revealed that there was significant increase ($p < 0.05$) in Range of flexion and extension and significant reduction ($p<0.05$) in pain severity, right and left side bending and functional disability at both groups post- treatment. Regarding between subject effects multiple pairwise comparisons revealed that there was no significant difference between both groups pre- treatment and post- treatment in pain severity, Range of flexion, Extension, while there was significant reduction ($p<0.05$) in range right and left side bending and functional disability at post-treatment in favor to group A compared to group B**. Conclusion:** on the basis of the present date, it is possible to conclude that both magnetic field therapy and progressive pressure technique were effective as a method of treatment for lower back myofascial pain syndrome patients with the parameters used in the present study.

Key words: Magnetic Field therapy, progressive pressure technique, myofascial pain syndrome.

INTRODUCTION

Low back pain (LBP) is the most frequent self-reported type of musculoskeletal pain. It is often recurrent and has important socioeconomic consequences. Estimates of the prevalence of LBP vary considerably between studies and reach 33% for point prevalence, 65% for one-year prevalence, and 84% for lifetime prevalence. **[1]** Chronic nonspecific LBP and its resulting disability have become an enormous health and socioeconomic problem. **[2]**

It is usually defined as pain, muscle tension, or stiffness localized below the costal margin and above the inferior gluteal folds. **[3]**

Myofascial pain syndrome is a pain state characterized by trigger points (TrPs). Although different states of TrPs are used among the different health care professions, the most commonly accepted definition maintains that: Myofascial TrP is a hyperirritable spot within a taut band of skeletal muscle that is cause painful on compression, stretch, overload, or contraction of the tissue which usually responds with a referred pain that is perceived distant from the spot. A myofascial TrP that leading to a clinical pain complaint. It is always tender, weakens the muscle, prohibits full lengthening of the muscle, refers a patient-recognized pain on direct compression, and mediates a local twitch response of muscle fibers when stimulated. **[4]**

Current guidelines on the treatment of nonspecific LBP are consistent in their focus on early and gradual activation, patient education, avoiding bedrest, and addressing psychosocial factors to prevent chronicity; and on prescribing analgesic medication for short periods, where necessary, in the case of acute LBP. **[5]**

The fact that there are many types for treatment LBP, either of which has various subcategories, is testament that no single approach has been able to demonstrate its superiority**. [6]**

The evidence shows that the impact of some interventions is supported (e.g. exercise) **[7]**, whilst other interventions are not effective for LBP (e.g. traction) **[8]**. This situation makes it very challenging for clinicians, policymakers, insurers, and patients to make decisions as regard which treatment is the most appropriate for chronic LBP.**[6][7][8][9]**.

The use of electromagnetic fields (EMFs) and in certain of the magneto-therapy has had a notable increase in the last decade in rehabilitation treatment and provides a non-invasive, safe, and, the source of pain and inflammation, easy procedure to directly treat the site of injury and other types of disease. **[10]**

Magnetic field therapy applied to treat osteoarthritis, promote bone healing and inflammatory diseases of the musculoskeletal system, alleviate pain, enhance healing of ulcers and reduce spasticity. **[11]**

Until now, no research has compared the effects of magnetic field therapy versus progressive pressure technique in treatment of lower back myofascial pain syndrome. As a result, this study will be carried out to identify which of the two therapy regimens is more effective in terms of treatment.

Objective of the study:

The aim of the study was designed to examine the effects of magnetic field therapy versus progressive pressure technique in treatment of lower back myofascial pain syndrome.

Subjects and Methods:

Study Design:

The study was designed as an experimental randomized clinical trial. The study was examined and approved by the ethical committee of Faculty Physical Therapy, Cairo University, Egypt, (approval number: P.T.REC/012/004023). The Helsinki Declaration Criteria for human research were followed in this study. A written informed consent was obtained from each patient.

Subjects:

Forty patients diagnosed clinically with lower back myofascial pain syndrome (according to location of trigger points at lower back muscles and aggravation of pain with back activities) were examined for eligibility in the study. (Figure: 1)

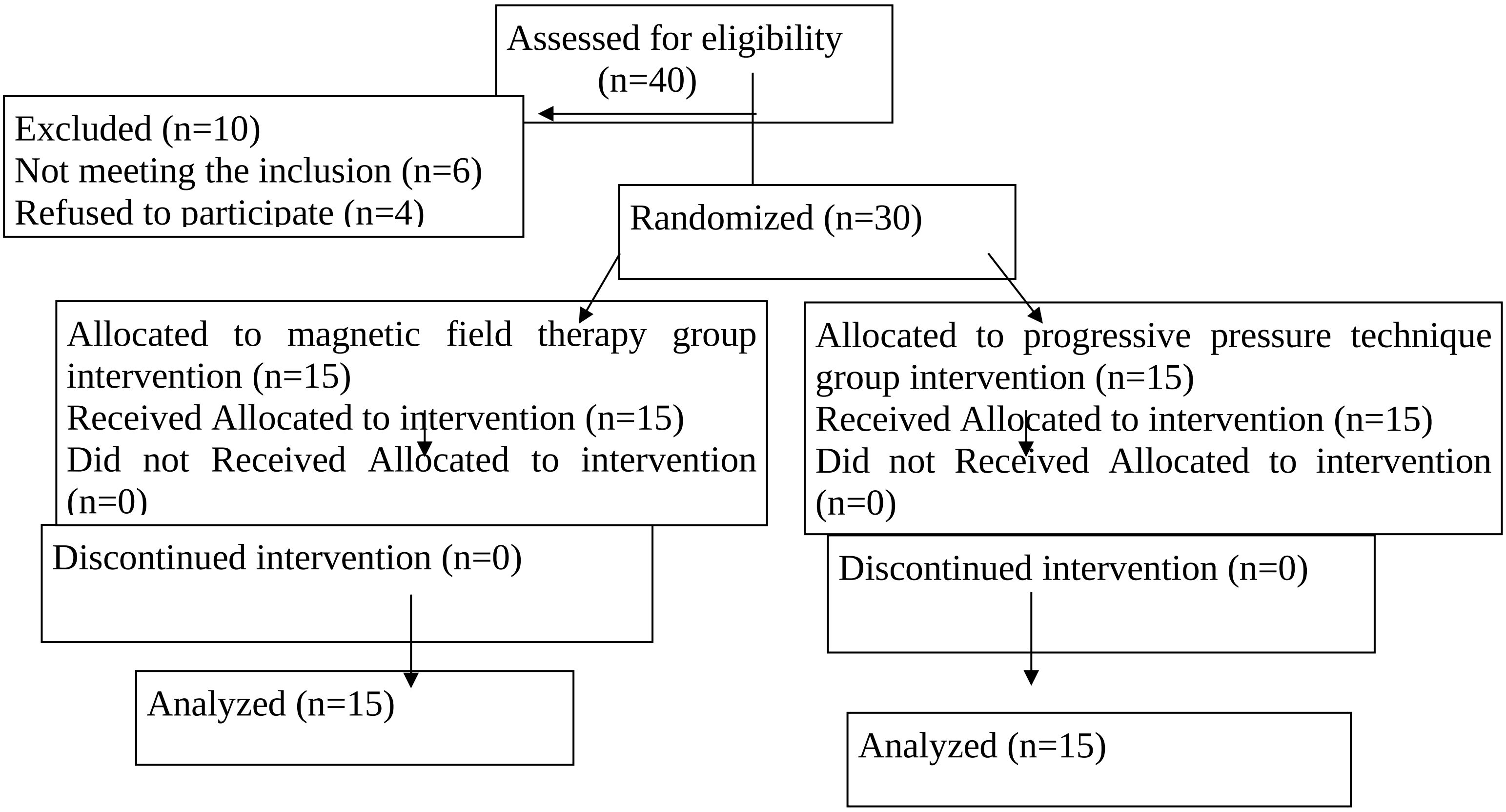

Figure (1): Participant flow diagram.

Inclusion criteria:

- Patients (office worker) with low back pain for 3 months ago.
- Patients had strong trigger points in low back muscles.
- The range of age of the patients from 20 to 40 years old.

Exclusion criteria:

- Pregnant women.
- Previous back surgery.
- Compression fracture at vertebras.
- Deficit of neurological system.
- Current lower extremity symptoms.
- Decreased activity tolerance related to cardiopulmonary disease.

The experiment continued with 30 patients, their age ranges from 20 to 40 years signed an informed consent. The subjects were assigned randomly (one by one for each group) in to: group(A) 15 patients) received (magnetic field and traditional physical therapy program infrared, ultrasonic, stretching exercises and strengthening exercises for back muscles), for 12 session over four weeks period. Group (B) 15 patients received progressive pressure technique over the trigger points of back muscles followed by stretching exercise for 4 sessions over two weeks period.

Instrumentations:

A- Instrumentations used for evaluation:

Patients were assessed just before and just after the treatment sessions. The assessment procedures included the following items.

1- Pain assessment:

Pain assessed by (Visual analog scale (VAS). VAS is a scale that uses a 10cm line with 0 (no pain) and 10 (worst pain) on the other end and allows continuous data analysis. Patients were asked to place a mark a long the line to denote their level of pain. **[12]**

2- Functional disability:

Functional disability of each patient was assessed by Oswestery disability questionnaire. It is valid and reliable tool. It is consists of 10 multiple choice questions for back pain, patient select one sentence out of six that best describe his pain, Higher scores indicated great pain.[Scores(0-20%)minimal disability,Scores(20%-40%)moderate, Scores (40% - 60%) severe, Scores(60%-80%) crippled, Scores (80% - 100%) patients are confined to bed. **[13]**

3- ROM assessment:

a- Assessment of lumbar flexion and extension:

Modified-modified Schober flexion technique was used based on the work of **Williams et al., (1993) [14].** This method is reliable and valid in measuring range of motion of lumbar flexion.

The investigator stood behind the standing patient to identify the posterior superior iliac spines with her or his thumbs, and then an ink mark was drawn along the midline of the lumbar spine horizontal to the posterior superior iliac spines. Another ink mark was made 15 cm above the original mark , the distance between superior and inferior skin marks was measured. Then the investigator instructed the patient to bend forward into full lumbar flexion and the new distance between superior and inferior skin marks was measured.

Then the investigator instructed the patient to bend backward into full extension and the new distance between superior and inferior skin marks was measured as a straight line. The change in the normal difference between marks was used to indicate the amount of lumbar extension .This test was performed for three consecutive times and the mean value was considered as lumbar extension range of motion

b- Lateral flexion:

Lateral flexion was measured as the distance from the tip of the index finger to the floor at maximal comfortable lateral flexion based on the work of **Ponte et al. (1984) [15]**. The subject was instructed to move as far as possible into lateral flexion. This test was performed for three consecutive times for each side and the mean value for each side was considered as the lateral flexion range of motion.

B- Instrumentation used for treatment:

1. **ASA Magnetic field (Automatic PMT Quattro pro):**

ASA magnetic field is a device for magneto therapy, its model is (Automatic PMT Quattro pro) and its serial number is (00001543), consists of an appliance, motorized bed and solenoids. The appliance must be connected to electrical mains supplying 230v ± 10% at a frequency of 50 or 60 Hz with earth connection. The intensity and spatial lay out of the generated magnetic field depend on the type of solenoid used.

2. Infrared radiation:

Infrared has been used as a form of heat for many purposes. Its model is 4004/2N. The power of device 400w, voltage 203v and frequency of 50/60Hz. Infrared is sometimes chosen as a form of heat prior to stretching, traction, mobilization, massage and exercise therapy.

3. Ultrasonic device:

Ultrasonic device Phyaction 190 serial number 2745, 230V, 300 mA / 50 - 60Hz, Pus: 8w. It is used for pain relief and break down of adhesions in the case of LBP.

Treatment procedure:

A- Group (A) magnetic field therapy:

This group was consisted of 15 patients. They received:

- Infrared radiation for 20 minutes/session at distance of 60 cm from lumbar region, while patients in prone lying position for 12 session 3/week every other day for one month. **[16]**

- Ultrasound: for 5 minutes, 1Hz, continuous mode of application 1.5w/cm2. **[17]**
- Moderate stretching exercises for 30 seconds for calf muscles, hamstring, and back muscles from long setting. **[18]**
- Strengthening exercises for back muscles (active back extension and bridging). **[19]** Every exercise was down 3 times at session with hold for 6 seconds.
- Pulsed Electromagnetic Field, frequency 10 Hz, intensity of 20 gauss and duration of 15min. **[20]** while patients in prone lying position expose lumbar to (PEMF), 3 sessions per week every other day for one month.
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B- Group (B) progressive pressure technique:

Sustained gentle pressure was applied using thumb or four fingers for 90 Sec. to 120 Sec. moving inward toward the center of the MTrp. once tissue resistance is felt; pressure was maintained until resistance dissipates (melting away). This cycle was repeated 3 times with 90-s resting period between each compression. At the end, either further relaxation of the tissue will be felt or no new gains will be achieved. **[21]**

Muscles treated by progressive pressure technique:

1-Iliocostalis lumborum:

Stretching position: long sitting, trunk flexion, reaches with the arm to the opposite side. Ischemic compression was applied from side lying position.

2-Quadraus lumborum:

During trigger point therapy and while the patient is in side lying position, the patient's arm was placed in extension to elevate the rib cage; adduction to drop the iliac crest lower and upper leg is in extension, and use a pillow or bolster under the non-treated side to open up a wider space where trigger points can be easier identified and pressure is applied perpendicular. Stretching position: the position of patient is in a semi prone position with the leg in extension and adduction. The therapist supports the area of iliac crest and the lower thoracic cage by his hands while spreading the hands apart or in semi supine with the leg in flexion and adduction, the therapist supports the area of the lower thoracic cage and iliac crest with his hands while spreading the hands apart.

3-Gluteus medius:

Stretching position: the position of patient is in a supine position. The involved side is in hip flexion and adduction. The patient facilitates movement by using one hand to assist hip flexion and the other to assist hip adduction. Ischemic compression was applied from side lying position.

4-Piriformis:

Stretching position: the patient is in supine position. The involved side is in hip flexion above 90 degrees, adduction, and external rotation. Emphasis is on external rotation. The patient facilitates movement using both hands and the other leg to assist hip flexion, adduction and external rotation. Ischemic compression was applied from side lying position.

5-Stretching exercise:

For effective trigger point therapy, it must always be followed by stretching exercises to maintain the degree of relaxation and bring the muscle to an ergonomically correct state. The stretch should be very slow in rate and exceeds 30 seconds. **[21]**

Statistical Analysis

The Statistical Package for Social Science (SPSS) software version 23 for Windows was used for all statistical analyses. Covariance homogeneity and data normality are tested using the Box's test and the Shapiro-Wilk test, respectively. 2x 2 mixed design MANOVA was used to compare the tested variables of interest in different test groups and measurement times. The alpha level was set at 0.05.

Results

Mixed design MANOVA revealed that there were significant within- subject effect and treatment*time effect (F = 454.903, p = 0.0001, Partial Eta Squared=0.992) (F = 54.344, p = 0.0001*, Partial Eta Squared=0.934) respectively. Also, there was significant between- subject effect (F= 20.866, p = 0.0001*, Partial Eta Squared=0.845). The descriptive statistics of within and between groups differences at 95 % CI for the effects of interventions for all dependent variables were presented in table (1), Concerning to the within subject effect, the multiple pairwise comparison tests was used to compare between pre and post treatment in both groups, and it revealed that there was significant increase (p <0.05) in Range of flexion and extension and significant reduction (p<0.05) in pain severity, right and left side bending and functional disability at both groups post- treatment. Regarding between subject effects multiple pairwise comparisons revealed that there was no significant difference between both groups pre- treatment and post-treatment in pain severity, Range of flexion and Extension in while there was significant reduction (p<0.05) in range right and left side bending and functional disability at post-treatment in favor to group A compared to group B.

Table (1). Descriptive and Inferential Statistics of the Dependent Variables in the Experimental and Control Groups Pre and Post the Study Period.

		Group (A) (n = 15)	Group (B) (n = 15)	P value*
Pain Severity	Pre training	6.06 ± 1.22	5.86± 1.64	0.708 NS
	Post training	3.43± 0.53	3.5 ± 1.93	0.899 NS
	% of change	43.39 ↓↓	40.27 ↓↓	
	P value**	0.001S	0.001S	
Range of Flexion	Pre training	3.7± 0.56	3.7 ± 0.56	1.00 NS
	Post training	6.56 ±0.69	6.6± 1.87	0.939 NS
	% of change	77.29↑↑	78.37 ↑↑	
	P value**	0.001S	0.001S	
Range of Extension	Pre training	1.54 ± 0.24	1.54± 0.24	1.00 NS
	Post training	2.44 ± 0.25	2.60± 0.54	0.312 NS
	% of change	58.44 ↑↑	68.83 ↑↑	
	P value**	0.001 S	0.001S	
Range of Right side Bending	Pre training	48.6 ±3.72	48.58 ±3.41	0.984 NS
	Post training	19.45 ± 1.15	34.8 ± 3.67	0.001 S
	% of change	59.97 ↓↓	28.36 ↓↓	
	P value**	0.001S	0.001S	
Range of Left side bending	Pre training	49.21 ± 3.15	49.24 ± 3.13	0.977 NS
	Post training	19.32 ± 0.9	35.44 ± 2.85	0.001 S
	% of change	60.73 ↓↓	28.02 ↓↓	
	P value**	0.001S	0.001S	
Functional Disability	Pre training	47.13 ± 4.15	47.46± 3.99	0.824 NS
	Post training	27.66 ± 2.09	35.8 ± 5.34	0.001S
	% of change	41.13 ↓↓	24.56 ↓↓	
	P value**	0.0001S	0.0001S	

* Inter-group comparison; ** intra-group comparison of the results pre and post training.
NS P > 0.05 = non-significant, S P < 0.05 = significant, P = Probability.

DISCUSSION

Lower back myofascial pain syndrome is one of the most common causes of inappropriate back function. Magnetic therapy has been reported to be effective in the treatment of patients with back pain. This study was conducted to examine the effects of magnetic field (Frequency of 10Hz, intensity of 20 Gauss and duration for 15 minutes precession, three sessions per week for successive 12 weeks) versus progressive pressure technique on improvement of pain, functional disability and back range of motion in treatment of lower back myofascial pain syndrome.

All patients in both groups had symptoms of low back pain. This aggress with **(Hoy 2010) [22](Lidgren 2003) [23]** who they reported that low back pain affects personal lives, causing activity limitations and work absence, but also brings with it an economic burden, with high socioeconomic costs.

They also had muscle spasm, decrease of functional ability and back range of motion due to pain and this agree with **Jari et al., (2004)[19].**

A. magnetic field therapy group (group A):

To examine the analgesic effects of (PEMF), comparison between pre and post results of pain assessment using visual analogue scale fore the patients in the magnetic field therapy group. The results showed a the PEMF seem to have great effect in reducing the pain intensity in low back patients, independently of the low back pain condition, These results come in agreement with **Omar, et al., (2012)[24], Lee, et al., (2006) [25], Park et al., (2014)[26]**.

That revealed significant pain relief due to application of fore patient with low back pain.

The PEMF therapy is based in a wide range of frequencies with low frequency signal, which will produce activation of multiple intracellular pathways and membrane disturbances. **[27][28]**

The PEMF therapy has been pointed out as an effective and relatively safe tool for conservatively treat the low back pain that agree with **Omar, et al., (2012)[24], Lee, et al., (2006)[25], Park et al., (2014)[26], Harden (2007)[29], Oke, and Umebese (2013)[30].** Furthermore, it has a high potential of compliance due to its low risk of side-effects and high tolerance. **[25]**

In fact, when analyzing the pain intensity alone, the included studies effect sizes indicate a tendency to a greater reduction on pain intensity for the PEMF groups. Considering the minimal clinically important difference (MCID) minimal change in an outcome score that is clinical meaningful for the patients – all studies showed that the PEMF was able to produce a clinical meaningful pain reduction since the mean differences were higher than the minimum 2-point. **[31]**

Several scoring systems are frequently used in the clinical environment in order to measure the disability associated to the low back conditions, which should be reliable, valid and sensitive to clinically relevant changes, taken into account both patients' and physicians' perspective and is short and practical to use **[32], [33], [34], [35]**

Although, impairments such as decreased range of movement or decrease straight leg raise can be clinically observed by physiotherapists, the direct observation of activity restriction is not sufficient. Therefore, the physiotherapists have the need to rely on the patient's self-report assessment to measure the impact of low back pain on daily activities. **[32].**

Several studies have been demonstrating the PEMF effectiveness in reducing the disability related to the low back pain **[24][25][26][30]** Regarding the studies included in this systematic review, the disability assessment was mostly made by the Oswestry Disability Index,**[36]** showing improvements after application of PEMF therapy, however with small effect sizes.

To examine the effect of the (PEMF) on reducing functional disability, comparison between pre and post results of functional disability using oswestry disability questionnaire for the patients of experimental group there was considerable decease in functional disability at the end of the treatment. These result are consistent with **Jacobson et al., (2001) [37]** who stated that the effect of magnetic field extend to the structures in the higher levels such as connective tissue, muscle and organs, thus producing less inflammation, improve circulation, diminution of pain and hence improve function. It has been reported that PEMF therapy yields several benefits into the acute pain relief, bone unification, wound healing, inflammation control and edema, as well as, chronic pain associated with joint-associated soft tissue injury and connective tissue (cartilage, tendon, ligaments and bone) injury, osteoarthritis, fibromyalgia, osteoporosis, skin ulcers and further potential applications.**[38][39][40][41]**.

The improvement in functional ability for patients in this study could be attributed to the positive anti-inflammatory and analgesic effect of magnetic filed which lead to decease pain and inflammation and improve back functions.

Concerning lumbar range at motion, there was significant increase at lumbar (flexion, extension, RT side bending and Lt side bending after treatment at patients by magnetic field. These results come in agreement with **Hinman (2002)[42]**, who reported that application of magnetic field to the musculoskeletal problem can reduce pain, inflammation and enhance movement. Magnetic field decreases joint and muscle pain, decreases joint swelling and stiffness and improve soft tissue repair so increase mobility and a quality of life**. [43]**

The improvement in trunk range of motion in patients in this study could be attributed to the positive analgesic effect, anti inflammatory effect and reduction at muscle spasm so improve lumbar mobility and range of motion. **[20]**

From all of the above, it was approved that application of magnetic field therapy is effective as a treating method for patients with lower back myofascial pain syndrome owing to its analgesic and anti-inflammatory effects so it helps in reducing pain and functional disability and improving lumbar range of motion. No side effects of magnetic field have been en reported in literature. **[44]**

B. progressive pressure thechnique group (group B)

This finding come in agreement with other studies showing the effects of trigger point release in patients with myofascial pain syndrome. **Kostopoulos et al**., **(2008)[45]** compared efficacy of ischemic compression, passive stretching, and the combination of ischemic compression and passive stretching for the first time and reported that the combination was significantly more effective for pain reliefs than the others. **Lake et al., (2009)[46]** evaluated the efficacy of ischemic compression on 13 patients with 40 myofascial trigger points and reported that ischemic compression was significantly efficient for treatment in comparison with control group, but did not define the optimum level of ischemic compression.

Hanten et al., **(2000) [47]** studied the efficacy for the combination of ischemic compression and stretching for patients with MPS on neck and upper back. Patients underwent the combination therapy for 5 days and then the duration of pain sensations in 24 hours, PPT and VAS measured 3 days after the treatment were compared with those measured before treatment. Results revealed that a home program, consisting of ischemic pressure and sustained stretching, was shown to be effective in reducing TP sensitivity and pain intensity in individuals with neck and upper back pain.

Hou et al., **(2002)[48]** investigated various combinations of physical therapeutic modalities for active upper trapezius trigger points and found IC with quantified pressure and duration provided immediate reduction of trigger point sensitivity and pain relief. The improvement in group A could be attributed to the following mechanisms: The shortened sarcomeres are the main cause of myofascial trigger points formation and the local ischemia at site of trigger points. Thus, by the use of the ischemic compression and stretching, the shortened sarcomeres will flatten and be lengthened. This local stretch decreases actin and myosin overlap, and also causes flush of blood at site of compression once the pressure is removed from the trigger point. This improves the topical circulation and thus reduces release of noxious painful substances, all of this tends to inhibit the trigger points activity and decrease the sensitivity of myofascial trigger points. **[49]**

The deactivation of trigger points and reduction of muscle spasm by removing myofacial restrictions can restore normal activation and function of muscles, hence improve functional disability. **[50][51]** Stretching and exercises of the trunk muscles following myofascial therapy induce muscular relaxation and pain relief. **[52]** This explanation come in agreement with **Simons (2004)[53]** when he proposed an integrated hypothesis of the etiology of MTrPs, where acute or chronic muscle overload results in trauma to the motor endplate and subsequent release of acetylcholine. Excessive amounts of acetylcholine result in the formation of contraction knots (areas of localized sarcomere shortening), which are in a state of continued contraction and hypoxia and result in local ischemia. The combination of increased energy instance in the face of loss of energy supply causes the release of sensitizing noxious substances, which are proposed to be responsible for the pain associated with MTrPs, so treatment of TrPs should be focused on improving circulation in the affected area and equalizing the length of sarcomeres in the involved MTrP.

Conclusion

On the basis of the present data, it is possible to conclude that both magnetic field therapy and progressive pressure technique therapy were effective in reducing pain, functional disability and improving lumbar rang of motion in patients with lower back myofascial pain syndrome.

Acknowledgment:

The authors would like to thank all individuals who participated in this study.

Ethics Statement:

The study was designed as an experimental randomized clinical trial. The study was examined and approved by the ethical committee of Faculty Physical Therapy, Cairo University, Egypt, (approval number: P.T.REC/012/004023). The Helsinki Declaration Criteria for human research were followed in this study. A written informed consent was obtained from each patient.

Authors Contributions:

AMF, AMY and GMR took part in the concept and design of the study. AMF and AMY contributed to applying each treatment according to the treatment schedule. SAA and BAA participated in acquisition of data. GMR contributed to Data analysis and interpretation. All authors collaborated on the study's statistical analysis, interpretation of the data, writing, and editing.

Disclosure statement:

No authors have any financial interest or received any financial benefit from this research.

Conflict of interest:

Authors state no conflict of interest.

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