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Myofascial trigger-point compression therapy as an adjunct to exercise program is superior in alleviating chronic low back pain compared to exercise program alone

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Abstract:	<p>Background</p> <p>Current guidelines for the treatment of low back pain (LBP) endorse physical exercise programs and a range of non-pharmacological complementary therapies. Myofascial trigger points (MTrPs) compression therapy is a well-established form of manual therapy, which aims to induce temporary ischemia and over-stimulation of mechanoreceptors over a desired area in order to restore tissue normal functional conditions required for healing response. The purpose of the current study was to evaluate the effect of MTrPs compression therapy as an adjunct to active exercise program in alleviating chronic non-specific low back pain.</p> <p>Methods</p> <p>One-hundred and three patients with chronic non-specific LBP were retrospectively reviewed, 45 of them were treated with MTrPs compression therapy as an adjunct to physical exercise program (MTrPs group) and 58 were treated with exercise program alone (control group). Pain and functional scores were compared before initiating treatment and at 3-month follow-up.</p> <p>Results</p> <p>Pain reduction at 3-month follow-up was 5.6 points (0-10 numerical scale) in the MTrPs group compared to 3.6 points in the control group ($p < 0.001$). Oswestry Disability Index and SF-12 life quality scores also improved significantly more in the MTrPs group compared to the control group at 3-month follow-up ($p < 0.001$).</p> <p>Conclusions</p> <p>Myofascial trigger points compression therapy as an adjunct to active exercise program provides superior pain and disability relief to patients with chronic LBP compared to active exercise program alone.</p>
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ABSTRACT

Background: Current guidelines for the treatment of low back pain (LBP) endorse physical exercise programs and a range of non-pharmacological complementary therapies. Myofascial trigger points (MTrPs) compression therapy is a well-established form of manual therapy, which aims to induce temporary ischemia and over-stimulation of mechanoreceptors over a desired area in order to restore tissue normal functional conditions required for healing response. The purpose of the current study was to evaluate the effect of MTrPs compression therapy as an adjunct to active exercise program in alleviating chronic non-specific low back pain.

Methods: One-hundred and three patients with chronic non-specific LBP were retrospectively reviewed, 45 of them were treated with MTrPs compression therapy as an adjunct to physical exercise program (MTrPs group) and 58 were treated with exercise program alone (control group). Pain and functional scores were compared before initiating treatment and at 3-month follow-up.

Results: Pain reduction at 3-month follow-up was 5.6 points (0-10 numerical scale) in the MTrPs group compared to 3.6 points in the control group ($p<0.001$). Oswestry Disability Index and SF-12 life quality scores also improved significantly more in the MTrPs group compared to the control group at 3-month follow-up ($p<0.001$).

Conclusions: Myofascial trigger points compression therapy as an adjunct to active exercise program provides superior pain and disability relief to patients with chronic LBP compared to active exercise program alone.

Keywords: Trigger points compression therapy; chronic low back pain; low back pain treatment; myofascial pain syndrome, low back pain prevention.

BACKGROUND

Chronic low back pain (LBP) is one of the most common complaints in orthopedic practice, affecting millions of people around the world as a leading cause of disability [1, 2]. Among the variety of biophysical causes of chronic LBP, a myofascial origin of pain commonly exists and characterized by the presence of myofascial trigger points (MTrPs), located in fascia, tendons, and/or muscle, leading to symptomatic pain response [3]. MTrPs are small, 2-5mm nodules located in taut “rope-like” bands of skeletal muscle detectable in palpatory examination, which may generate considerable pain and discomfort. The processes in which MTrPs develop is not fully understood, however it is generally believed to be related to muscle overload and overuse [4, 5].

Although active exercise programs remain a first-line treatment for non-specific chronic LBP, passive manual therapies including massage and soft tissue compression techniques, remain therapeutic options [6]. Manual therapy aimed at MTrPs deactivation, for alleviating musculoskeletal pain, was firstly described in the 1980's by Travell and Simons, who recognized the relationship between MTrPs and myofascial pain syndrome [3]. It is suggested that continuous compression at MTrPs over-stimulates local mechanoreceptors which leads to neurotransmitters depletion and results in pain attenuation. Also, rapid reperfusion with oxygenated blood, once the obstruction of the local blood flow is released, is believed to restore the normal functional conditions of the muscle and contribute to its recovery [7-9]. Several studies evaluated the effect of MTrPs compression therapy on musculoskeletal pain syndromes and found it to be effective in relieving pain and disability [10-12].

The purpose of the current study was to evaluate whether MTrPs compression therapy as an adjunct to conservative physical exercise program, focuses on core muscles strengthening, would provide

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4 clinical benefit compared to exercise program alone in alleviating chronic non-specific low back
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6 pain and disability in adults.
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10 **PATIENTS AND METHODS**

11 *Study design and selection of participants*

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14 We retrospectively analyzed data of patients with non-specific LBP lasting for more than 3 months
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16 treated in our spine surgery clinic between January 2017 and December 2018. Detailed medical
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18 history was obtained from each patient followed by a thorough physical examination by one of two
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20 spine consultants (G.G and E.B). Plain radiographs of the lumbar spine were performed in all cases.
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22 The inclusion criteria were: (1) non-specific LBP lasting for more than 3-month duration; (2)
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24 normal neurological examination with no findings of motor or sensory deficit; (3) no radicular
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26 symptoms or physical findings; (4) no “red flag” signs that may suggest a serious spine pathology
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28 (e.g., history of trauma, malignancy, fever, weight loss, neurological deficit, bladder or bowel
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30 dysfunction) [6]; (5) anterior-posterior and lateral lumbar spine radiographs with no pathological
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32 findings; (6) no medication prescribed; (7) an age of 18 to 65 years. Exclusion criteria were defined
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34 as: (1) radicular signs or neurological deficit; (2) previous spine injury or surgery; (4) systemic
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36 conditions which may induce pain (e.g., fibromyalgia, rheumatoid arthritis, malignancy, infection);
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38 (6) psychiatric disorders; (7) osteoporosis; (8) pregnancy; (9) incomplete medical record with
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40 missing clinical or outcome measure data. The study was approved by our Institutional Ethics
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42 Committee, the requirement for informed consent was waived.
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56 *Intervention*

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58 After a diagnosis of non-specific LBP without neurological involvement was made, all patients
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60 were referred to conservative physical therapy, focusing on stretching and active core muscles
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4 strengthening. The exercise program was supervised by trained physiotherapists experienced in
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6 treating patients with musculoskeletal disorders. The physical therapy exercise program included
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8 instructional and training sessions of 45 minutes twice a week for 4-6 weeks, in which the patients
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10 were instructed how to perform core muscles stretching and strengthening exercises independently
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12 at home on a daily basis. Thereafter, all patients attended a weekly check-up exercise session for
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14 additional 4-6 weeks. A follow-up visit in our outpatient spine clinic was scheduled for 3-month
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16 time. No medication was prescribed for the study cohort.
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21 Patients who were initially seen in our outpatient clinic by E.B, in addition to the aforementioned
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23 treatment plan, were also referred to MTrPs compression therapy. The manual therapy was
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25 performed by an expert in alternative medicine, experienced in treating patients with
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27 musculoskeletal disorders (G.P). The patients were instructed to lie down in the supine or prone
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29 position. Several MTrPs were identified over the lumbar erector spinae muscles and over the
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31 common main muscles associated with LBP (e.g., gluteus maximus, piriformis, hamstrings,
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33 quadratus lumborum, iliopsoas, tensor fascia lata) according to previously described diagnostic
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35 criteria including: (1) presence of a palpable hypersensitive taut band in the low back and
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37 associated muscles; (2) induction of pain similar to the patient's usual symptoms by compression
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39 at the MTrPs; (3) induction of pain by stretching the muscle including the MTrPs [Takamoto et al.
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41 2015; Gerwin et al. 1997]. Manual constant pressure was applied to each MTrP for a period of 1-2
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43 minutes at controlled intensity aiming to produce pain response ranging between comfortable pain
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45 (approximately 4/10 on a 0-10 numerical scale) to maximally tolerable pain (approximately 7/10
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47 on a 0-10 numerical scale) [10-12]. The sequence of MTrPs compression was repeated for several
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49 times during a treatment session of 45 minutes, which was carried out once a week for 6
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51 consecutive weeks.
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Outcome measures

Clinical outcome was assessed based on patients' self-reported: (1) back pain during daily activity using a 0 to 10 numerical scale, where 0 indicates no pain and 10 indicates severe pain; (2) back related disability using the Oswestry Disability Index (ODI) on a 0 to 100% scale, where a higher score indicates more disability and poorer function [13]; and (3) SF-12 life quality questionnaire on a 0 to 100% satisfaction scale, where a higher score indicates more satisfaction and better life quality [14]. Data was collected from the patients' medical record at the first outpatient clinic before initiating treatment and at 3-month follow-up visit (approximately 1-month after the final MTrPs compression therapy session in the MTrPs group).

Data analysis

Continuous parameters are presented as means \pm standard deviation and categorical parameters are presented as proportions. Comparisons between the MTrPs group and the control group were performed using unpaired two-tailed t-test for continuous data and the Fisher's exact test for categorical data. Comparisons within each group between outcome measures before and after treatment were performed using paired two-tailed t-test. Data analysis was performed with the use of MedCalc Statistical Software version 19.2.6 (MedCalc Software bvba, Ostend, Belgium). A probability of less than 0.05 was considered statistically significant.

RESULTS

One hundred and three patients were included in the study, 45 patients in the MTrPs compression therapy as an adjunct to exercise program group (MTrPs group) and 58 in the exercise program

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4 alone group (control group). The mean age, gender distribution, body mass index and duration of
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6 symptoms were similar for both groups (Table 1). Baseline pain level and functional scores were
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8 also similar for both groups (Table 2). Patients' pain level decreased significantly following
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10 treatment at 3-month follow-up in both groups, however, pain reduction in the MTrPs group was
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12 significantly greater compared to the control group (5.6 points vs. 3.6 points respectively, $p < 0.001$).
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14 Similarly, the ODI and SF-12 scores improved significantly following treatment in both study
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16 groups, but to a significantly greater extent in the MTrPs group. Specifically, the ODI score
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18 improved by 36% in the MTrPs group compared to 22% in the control group ($p < 0.001$) and the
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20 SF-12 score improved by 41% compared to 29% respectively ($p < 0.001$). Comparisons of outcome
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22 measures between the groups and within each group before and after treatment are summarized in
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24 Table 2.
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33 **DISCUSSION**

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35 Despite ample research in the field and numerous treatment options, chronic LBP of unknown
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37 origin remains a world wide concern and a major cause of disability. Current guidelines for the
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39 treatment of LBP endorse physical exercise programs and a range of other non-pharmacological
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41 complementary therapies including manual therapy, acupuncture, spinal manipulation and yoga
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43 [15]. Myofascial trigger points (MTrPs) compression therapy is a well-studied form of non-
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45 pharmacological complementary manual therapy, which aims to induce temporary local ischemia
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47 and over-stimulation of mechanoreceptors in order to restore tissue normal functional conditions
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49 and healing response [7-9].
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55 The purpose of the current study was to evaluate the effect of MTrPs compression therapy as an
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57 adjunct to conservative physical therapy active exercise program in alleviating chronic non-specific
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59 low back pain and disability in adults.
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4 Supporting the results of previous studies patients in our control group demonstrated significant
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6 improvement in their pain and functional score, following participation in an active exercise
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8 program focusing on core muscle stretching and strengthening [15, 16]. Interestingly, patients in
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10 our intervention group, treated with MTrPs compression therapy in addition to active exercise
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12 program, demonstrated significantly greater improvement in their outcome measures compared to
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14 control patients who were treated with active exercise program alone. These finding emphasizes
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16 the importance of combining treatment strategies in patients with chronic LBP as endorsed by
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18 current guidelines [1, 6, 15].
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23 Takamoto et al. [12] compared MTrPs compression therapy to other forms of manual therapy in
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25 63 patients suffering from acute LBP and reported MTrPs to be the most form effective manual
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27 therapy with pain relief equivalent to 5/10 at 1 month following the end of treatment sessions.
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29 Schneider [10] evaluated a cohort of 30 patients with chronic LBP and compared the treatment
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31 outcome of MTrPs compression therapy with and without low-frequency shock wave therapy as
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33 an adjunct. Pain relief in his study following MTrPs compression therapy alone was equivalent to
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35 only 1/10, while pain relief following combined therapy was approximately 3/10. Comparing our
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37 results to those of others is difficult because of different set up between the studies. Nevertheless,
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39 be believe our favorable results in terms of pain relief, highlight the importance of adhering to
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41 current guidelines endorsing active exercise programs as a first-line treatment for LBP, and
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43 highlight the potential benefit of combining treatment strategies.
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49 Our study has a number of limitations. Firstly, this was a retrospective study with a limited cohort,
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51 a study design known to have inherent disadvantages. Secondly, outcomes were evaluated at a very
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53 short follow-up of 3 months from initiating treatment (approximately 1 month after the final MTrPs
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55 therapy session), which makes the duration of treatment efficacy unclear. Nevertheless, the prompt
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57 improvement in pain and functional scores of our patients after more than 12 months in average of
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4 disabling symptoms, suggests the treatment (especially in the MTrPs group) is effective regardless
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6 of its efficacy duration. Finally, patients in the MTrPs group received more treatment sessions (and
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8 more personal nature of treatment during the manual MTrPs therapy sessions) compared to control
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10 patients, which may serve as a confounding factor affecting the outcomes.
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15 16 **CONCLUSION**

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18 Our findings showed that myofascial trigger points compression therapy as an adjunct to active
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20 exercise program for the treatment of chronic LBP, decreased pain and improved functional
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22 outcomes significantly more than an exercise program alone. More randomized clinical trials
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24 comparing different treatment strategies for LBP over a long-time follow-up should be encouraged.
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33 34 **LIST OF ABBREVIATIONS**

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36 LBP: Low back pain; MTrPs: Myofascial trigger points; ODI: Oswestry Disability Index
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DECLARATIONS

Ethics approval and consent to participate: The study was approved by our Institutional Ethics Committee, the requirement for informed consent was waived.

Consent for publication: Not applicable.

Availability of data and materials: The data used to support the findings of this study are available from the corresponding author upon request.

Competing interests: The authors declare that they have no competing interests.

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Authors' contributions: RM and OU designed the study, analysed and interpreted the data and were the major contributors in writing the manuscript. GP, GL and GG collected, analysed and interpreted the data. EB contributed to the data acquisition and analysis and substantively revised the manuscript. All authors read and approved the final version of the manuscript.

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Table 1. Comparison of demographic and clinical data between the groups			
	MTrPs therapy group (N=45)	Control group (N=58)	p value
Age, years \pm SD	55 \pm 14	52 \pm 17	0.34
Gender, n (%)			0.84
- Female	26 (58%)	32 (55%)	
- Male	19 (42%)	26 (45%)	
BMI, kg/m ² \pm SD	25 \pm 3	24 \pm 4	0.16
LBP duration, months \pm SD	18 \pm 24	16 \pm 17	0.62
<i>Comparisons between the groups were performed using unpaired two-tailed t-test, apart from age parameters which were compared using Fisher's exact test. SD- Standard deviation; BMI- Body mass index; LBP-Low back pain.</i>			

Table 2. Comparison of outcome measures between the groups and within each group before and after treatment			
	MTrPs therapy group (N=45)	Control group (N=58)	p value*
Pain level, 0-10 scale			
- Baseline	7.8 ±1.2	7.4 ±2.1	0.25
- 3-month follow-up	2.2 ±1.8	3.8 ±2.3	<0.001
- p value [†]	<0.001	<0.001	
ODI, 0 -100% scale			
- Baseline	49 ±16	45 ±20	0.28
- 3-month follow-up	13 ±15	23 ±17	0.002
- p value [†]	<0.001	<0.001	
SF-12, 0-100% scale			
- Baseline	36 ±22	38 ±26	0.68
- 3-month follow-up	77 ±21	67 ±24	0.03
- p value [†]	<0.001	<0.001	
<i>Values are presented as mean ±standard deviation.</i>			
<i>* Comparisons between the groups were performed using unpaired two-tailed t-test.</i>			
<i>† Comparisons within each group were performed using paired two-tailed t-test.</i>			
<i>MTrPs- Myofascial trigger points; ODI- Oswesrty disability index.</i>			