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Effect of instrument assisted soft tissue mobilization versus kinesiotape for chronic mechanical low back pain: a randomized controlled trial

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Abstract

Introduction. The primary purpose was to compare the effect of conventional program, instrument assisted soft tissue mobilization (IASTM) and kinesiotape (KT) in patients with chronic mechanical low back pain (CMLBP).

Methods. 51 participants were randomly enrolled into three equal groups. Group A (n = 17) received conventional program, Group B (n = 17) received conventional program plus IASTM, and Group C (n = 17) received conventional program plus KT. The participants were evaluated before and after eight sessions using the Visual Analogue Scale (VAS), pressure algometer, dual inclinometer, and Oswestry Disability Index (ODI).

Results. Between pre-treatment and post-treatment, the three groups demonstrated a significant pain reduction (57.2%, 61.2%, and 57.77%; $p < 0.0001$), a significant increase in pain pressure threshold (PPT) [right (Rt): 56%, 53.2%, and 35.6%; left (Lt): 49%, 50.55%, and 41.36%; $p < 0.0001$], a significant improvement in the range of motion (ROM) (flexion: 38.59%, 43.55%, and 35.7%; extension: 72.4%, 88.73%, and 65.56%; Rt lateral flexion: 79.05%, 78.03%, and 55.42%; Lt lateral flexion: 85.33%, 96.37%, and 64.66%; Rt rotation 135%, 116.5%, and 188.48%; Lt rotation: 203%, 140.48%, and 224.24%; $p < 0.0001$), and a significant improvement in the functional disability index (56.8%, 49.55%, and 46.99%; $p < 0.0001$). No significant difference in pain, PPT, ROM and function was found among the three groups.

Conclusions. Conventional program, IASTM and KT are effective methods for improving pain, ROM and function on CMLBP.

Key words: mechanical low back pain, physiotherapy, soft tissue therapy, kinesiotape

Introduction

Low back pain (LBP), especially in developing countries, is a serious public health issue. The prevalence of LBP has been found to be over 84% during one's lifetime and the incidence of the chronic mechanical low back pain (CMLBP) at around 23%, with 11–12% of those affected being disabled [1]. It is estimated that 70–85% of the working population has suffered from a LBP episode, with many reports of long periods of absence from their jobs, restricting their physical activity and affecting their output and the quality of life. Furthermore, healthcare practitioners such as doctors and nurses are burdened by LBP because they do not apply ergonomic principles [2].

Conventional programs consist of stretching and strengthening exercises, which is efficiently used to reduce pain and enhance function in CMLBP patients. During a systematic review of exercise therapy to optimize outcomes with CMLBP patients, 43 trials of 72 exercises were performed. Thirty-five of the 43 trials involving 59 exercises provided a decrease in pain outcome, and 29 of the 43 trials involving 50 exercises provided an improvement in functional outcomes [3]. Another systematic review including 35 trials of the effect of physical rehabilitation interventions on CLBP showed a significant pain decrease and functional improvement in the exercise groups [4].

Instrument assisted soft tissue mobilization (IASTM) is used to minimize pain and enhance the range of motion (ROM) and function by using specially designed devices that manipulate the soft tissue [5]. In the available literature, only two studies have investigated the different effects of IASTM on CMLBP patients, and both reported a reduction in pain. In the first study, pain was reduced by improved flexibility of the hamstring and its effect on LBP. The second study examined the impact of IASTM on ROM in LBP patients and reported improvement of ROM in LBP patients [6, 7].

Kinesiotape (KT) is the application of the adhesive flexible tape to reduce pain and swelling after injury, protect joints and soft tissues and improve proprioception. The most important function of the tape is to support any segment during movement [8]. The tape flexibility can lift the skin to create larger space with the muscle, improve blood flow and drainage in the taped area, reduce pain, raise ROM, and improve the activities of daily living (ADL) [9]. In the available literature, 13 studies of KT's effects on CMLBP patients have been examined. Twelve studies of 13 studies reported a pain decrease. Moreover, 6 of the 13 studies have shown ROM improvement; 3 studies have shown an improvement in flexion ROM, and 1 study reported an improvement in extension ROM. Eleven of the 13 studies reported an improvement in functional level of CMLBP patients [9–21].

However, few studies of IASTM have investigated CMLBP and most of them have been case studies. In several experimental and case studies, IASTM can improve the function, ROM and decrease pain after a sport injury. For the future, a well-designed experimental study on human should support the scientific basis and reliability of IASTM. In addition to, IASTM research, which focuses mainly on tendons, there

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are needs to extend to other soft tissues, such as muscles and ligaments [22, 23]. Also, no studies in the literature compared IASTM versus KT on CMLBP. Accordingly, the purpose of this study was to compare effect of IASTM and KT in CMLBP. It was hypothesized that there is no significant difference between IASTM and KT on pain intensity, pain pressure threshold (PPT), ROM and function in CMLBP.

Subjects and methods

Design

A randomized controlled trial was implemented to compare the effect of IASTM and KT on CMLBP using pain intensity level, PPT, and lumbar range of motion (LROM) and function. Data collection was carried out before and after 8 sessions for 4 weeks. The study was performed between June 2019 and March 2020 and in accordance with the Declaration of Helsinki.

Recruitment procedures

The patients were recruited from a private clinic in Dakahlia governorate, a private clinic in Giza governorate, and an outpatient clinic of Cairo University (Cairo, Egypt).

Sample size calculation

G*Power (version 3.1.9.2; Franz Faul, Kiel University, Germany) was used to evaluate the sample size and power estimation. A pilot study was conducted on 3 subjects from each group and revealed that the calculation based on an *F*-test, the type I error rate was set at 5% (alpha level, 0.05), the effect size was 0.49 of the main outcome variable, the Visual Analogue Scale (VAS), and the type II error rate was at 90% power. For the study, 42 subjects were the minimum sample size for the three groups, thus each group had 14 subjects.

Allergy test

All patients were considered eligible for a KT allergy test immediately after initial assessment. This test was performed with a small piece of KT attached to the thoracic spine and left for 24 hours. The trial excluded patients allergic to the tape.

Randomization

The demographic information was gathered from the patients after signing the consent form, and then the participants were distributed into three groups. Randomization was carried out by writing the name of each participant on a chit, then randomly withdrawn for every group.

The control group (group A) consisted of 17 participants who received a conventional program of stretching and strengthening exercises. Group B consisted of 17 participants who received the conventional program plus IASTM. Group C consisted of 17 participants who received the conventional program plus KT. All patients completed the study (Figure 1).

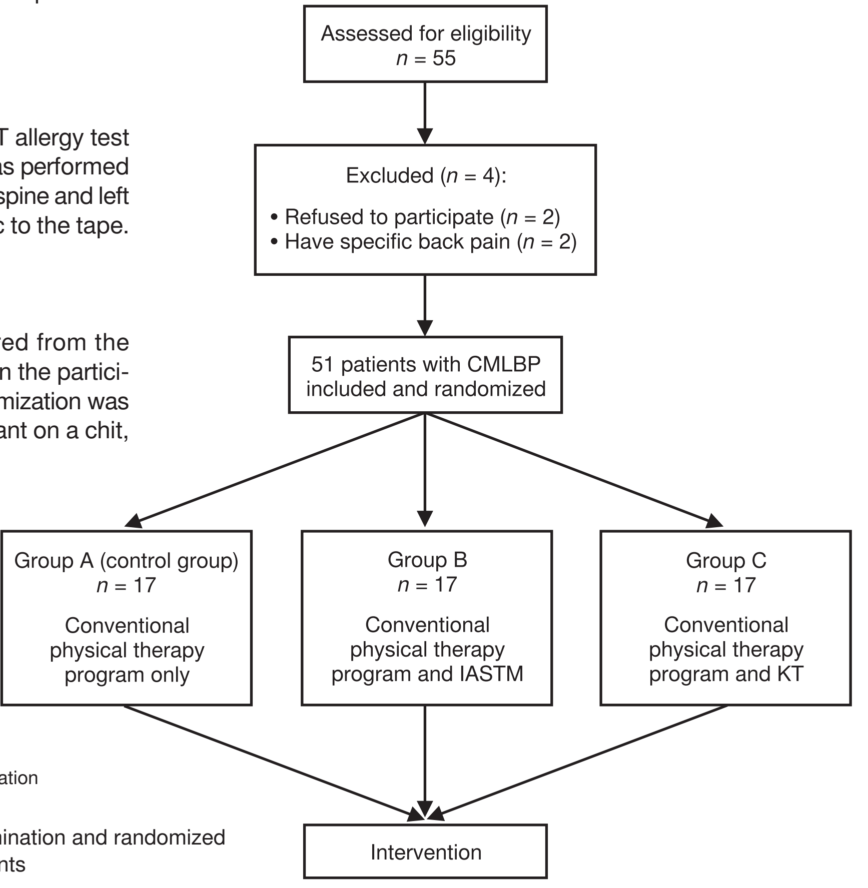
Subjects

The orthopaedist or orthopaedic surgeon referred 55 patients with diagnosed CMLBP to physical therapy. After screening, 51 patients from both sexes in the age range 22–45 years, height 150–183 cm, weight 58–110 kg and BMI 22.7–33.3 kg/m^2 fulfilled the criteria for inclusion (Figure 1) following the 2010 Consolidated Standards of Reporting Trials (CONSORT). Inclusion criteria were more than 3 months with LBP due to chronic lumbar sprain, strain, postural strain, prolonged sitting or standing, and physically inactive or physical exercising less than one hour per week [24]. Participants were excluded if they had neurological, infectious, or systemic diseases; radicular pain due to nerve root involvement; osteoporosis; lumbar compression fracture; spondylolisthesis; spondylosis; spinal deformities; history of spinal surgeries; cardiac pacemaker; disruption of the major ligaments; or allergy from KT.

Instrumentation

All variables were assessed before and after the treatment program.

VAS was used to assess pain intensity. VAS is a self-reported pain measuring scale, usually comprising a 10 cm long horizontal or vertical line. No pain and worst pain are the extremes of the line. Each participant was instructed to mark the point on the line that precisely matched their pain [25].



CMLBP – chronic mechanical low back pain
IASTM – instrument assisted soft tissue mobilization
KT – kinesiotape

Figure 1. Study selection diagram for examination and randomized allocation of participants

Figure 2. Commander algometer

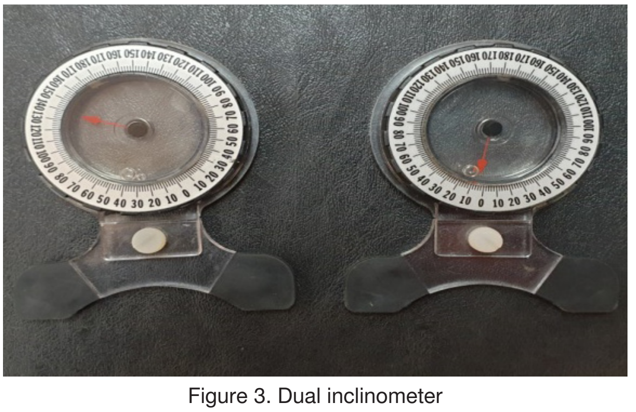


Figure 3. Dual inclinometer

The PPT was evaluated using a Commander Algometer (JTECH Medical, Midvale, Utah, USA) (Figure 2). The researcher marked the measuring points with a skin pen on anatomic landmarks of the paraspinal muscles at the L3 vertebra level bilaterally when the participant lay prone. A 1 cm^2 metal sensor probe of the algometer was applied to the skin slowly and perpendicularly to the marked point. The participant was asked to demonstrate when "pain or discomfort" was experienced and at that time the measure was stopped [21].

Lumbar ROM was evaluated using a dual inclinometer (UI01) (Figure 3). A circular hand-held inclinometer with a weighted pendulum gravity indicator, that remained oriented in the vertical direction. To measure LROM, two inclinometers were used. While the patient was standing, one inclinometer was on the sacrum, and the other was on the first lumbar vertebra [26]. The therapist measured the LROM in all directions (flexion, extension, side bending, and rotation).

Back functional disability was evaluated with a validated Oswestry Disability Index (ODI) version in Arabic. It consisted of a ten-section questionnaire with six answers from 0 to 5 for each section. The sections contained pain intensity, personal care, lifting, walking, sitting, sleeping, sex life (if applicable), and social life. Score and interpretation were easy. It has been shown that ODI was a valid and reliable questionnaire in the measurement of disability for specific conditions [27]. The original ODI version was updated and translated into several languages.

Interventions

The same physical therapist conducted the conventional program, IASTM, and KT.

Conventional program

Manual passive stretches for the hamstring from supine, iliopsoas from prone, and back extensors from cross sitting were performed. Each stretch position was held for thirty seconds for three repetitions per session. Procedures and handling were conducted as clearly explained in the literature [28].

The participant applied progressive back extensors and abdominal strength exercises from the prone and crook lying positions, respectively. In the first week, the goal was set at 10 repetitions but the patient's limits of fatigue and tolerance controlled the progression of repetitions. In the back extensor strength exercises, the therapist asked the patient to lift his head and shoulders off the plinth while the therapist stabilized the pelvis and lower limbs of the patient then relaxing. In abdominal strength exercises, both the hips and knees were semi-flexed in a supine position. The therapist supported the patients' feet and asked the patient to lift his head with shoulders off the plinth while crossing hands on the chests then relaxing. In the anterior and posterior pelvic tilt from the crook lying position, the therapist asked the patient to arch their lower backs, hold, relax, and repeat and then press the lower back against the plinth, hold then relax, and repeat. The conventional program was applied two times per week for 4 weeks [29].

Instrument assisted soft tissue mobilization

The M^2T blade was used (Figure 4). Before applying IASTM, the conventional program was conducted. The investigator used an instrument with inclination on the skin of 45° for 40–120 sec on the posterior fascia and the sacrum of the participant from the prone position. IASTM on posterior fascia caused microtrauma stimulation of the erector spinae muscles (Figure 5). Applying the IASTM for around

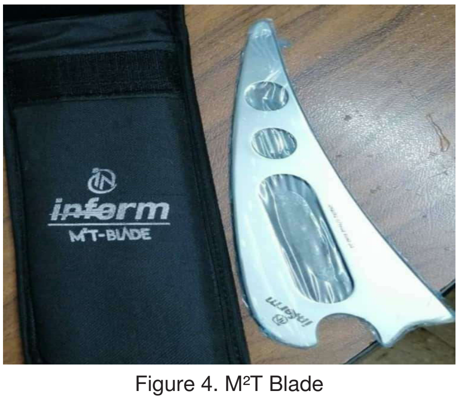


Figure 4. M^2T Blade

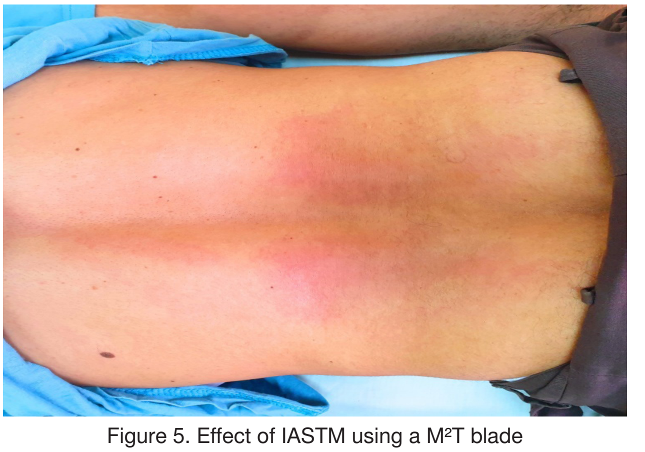


Figure 5. Effect of IASTM using a M^2T blade

twenty seconds parallel to a muscle fibre direction at a 45° angle was done. This was instantly followed by applying the IASTM perpendicular to the muscle fibres at a 45° angle for an additional twenty seconds, resulting in roughly forty seconds for each side. The IASTM was applied two times / week for 4 weeks [7, 22].

Kinesiotape

Before applying KT, the conventional program was conducted. Two I-Tapes were used from the lumbar erector spinae origin (iliocostalis lumborum) to its insertion. They were set parallel to the spinal processes of the spinal column in the paravertebral (bilateral) muscles. The region to be handled was clean, without hair while the KT length should be measured during full flexing of the lumbar spine. After removing the backing paper for the first 4–5 cm of tape, the initial anchor point is applied with zero tension on the sacral region (S_1) at the level of the posterior superior iliac spine. Then the participant is asked to fully flex the trunk, then the backing paper is removed from the tape with the exception of the 4–5 cm from the terminal section. The "I" shape was applied to the skin in the paravertebral area, at a tension of 10–15%, to the 12^{th} thoracic vertebra (T_{12}). At the end, zero tension percent, the final anchor point is set directly over the T_{12}. On the other side, the same technique is applied. Several times, the therapist's hand rubbed the tape to ensure that the adhesive film adhered to the skin. The KT was applied twice a week for 4 weeks (Figure 6) [30].

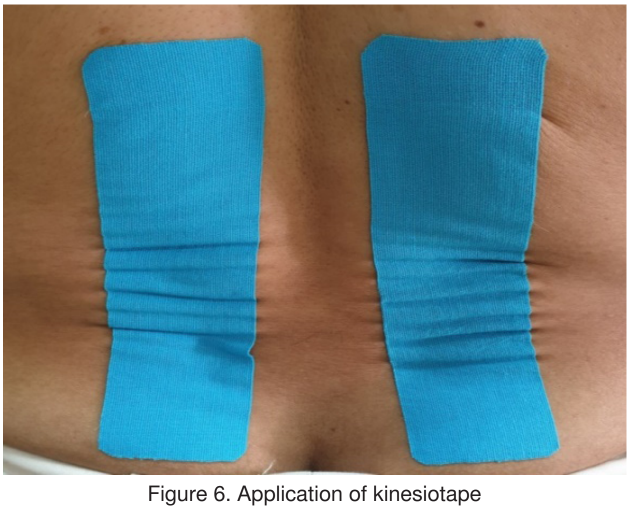


Figure 6. Application of kinesiotape

Statistics

All data were analysed using Statistical Package for the Social Sciences (version 23; IBM Corp., Armonk, NY, USA). Descriptive statistics, such as mean ± standard deviation (*SD*), were analysed for all variables. Numerical data for normality was tested by measuring the data distribution, calculating the mean and median values, drawing a histogram and box plots, and checking for normality (Shapiro–Wilk tests). The demographic and anthropometric data were normally distributed; therefore, analysis of variance (ANOVA) was used to compare the mean age, weight, height, and BMI between the three groups. VAS, PPT, LROM, and functional disability index data showed non-parametric distributions; therefore, the Wilcoxon signed-rank test was used to compare the pre-treatment and post-treatment within each group, and the Kruskal–Wallis test was used to compare the three groups. The α level was set at $p < 0.05$.

Ethical approval

The research related to human use has complied with all the relevant national regulations and institutional policies, has followed the tenets of the Declaration of Helsinki, and has been approved by the local ethics and research committee of Cairo University (approval No.: P.T.REC/012/002244).

Informed consent

Informed consent has been obtained from all individuals included in this study.

Results

ANOVA revealed that no significant differences in the demographic and anthropometric data were found between the three groups (Table 1). Pearson's chi-squared test showed no significant difference in sex between the groups. The Wilcoxon signed-rank test revealed a significant difference in all variables, posttreatment, compared to the pre-treatment ($p < 0.05$) in the three groups. The Kruskal–Wallis test revealed no significant differences between the three groups in all variables (Table 2).

Discussion

The study results suggested that there was a highly significant difference in pain intensity level, pain pressure threshold, lumbar ROM and functional disability index after applying the conventional program, IASTM and KT on CMLBP. There were no significant differences between the three groups.

Table 1. Patients' demographic and anthropometric data

Item	Group A (control group) Mean ± *SD*	Group B Mean ± *SD*	Group C Mean ± *SD*	*F*-value	*p*-value
Age (years)	29.8 ± 4.8	31.59 ± 4.64	34.29 ± 6.9	2.81	0.07
Sex distribution (female/ male)	9/8	10/7	13/4	χ^2 = 2.18	0.336
Weight (kg)	74.5 ± 11	80.4 ± 12.26	74.65 ± 11.82	1.402	0.26
Height (cm)	166 ± 7.9	169 ± 8.3	163 ± 7.8	2.34	0.11
BMI (kg/m²)	26.98 ± 3.23	27.89 ± 2.87	28 ± 3.9	0.506	0.61

BMI – body mass index

Table 2. The effect on VAS, PPT, ODI, and ROM between and within the three groups

Outcomes	Item	Group A (mean ± *SD*)	Group B (mean ± *SD*)	Group C (mean ± *SD*)	χ^2	*p*
VAS	Pre	7.29 ±1.1	7.12 ± 1.27	6.82 ± 1.4	0.986	0.611
	Post	3.12 ± 1.12	2.76 ± 1.44	2.88 ± 1.9	1.086	0.581
	Percent of improvement	57.2%	61.2%	57.77%		
	p <	0.001	0.001	0.001		
Rt PPT	Pre	5 ± 0.85	5 ± 0.69	5.56 ± 0.92	3.920	0.141
	Post	7.8 ± 1.13	7.66 ± 1.43	7.54 ± 1.25	0.681	0.711
	Percent of improvement	56%	53.2%	35.6%		
	p <	0.001	0.001	0.001		
Lt PPT	Pre	5.3 ± 0.67	5.38 ± 0.58	5.56 ± 1	0.277	0.871
	Post	7.9 ± 1	8.1 ± 0.95	7.86 ± 0.85	0.710	0.701
	Percent of improvement	49%	50.55%	41.36%		
	p <	0.001	0.001	0.001		
ODI	Pre	14.7 ± 2.4	13.4 ± 2.7	16.64 ± 5.6	3.290	0.193
	Post	6.35 ± 1.87	6.76 ± 1.8	8.82 ± 4.85	1.590	0.452
	Percent of improvement	56.8%	49.55%	46.99%		
	p <	0.001	0.001	0.001		
Flexion ROM	Pre	32 ± 5	31.18 ± 3.75	31.94 ± 6	0.660	0.719
	Post	44.35 ± 3.12	44.76 ± 3.78	43.35 ± 6.99	1.003	0.606
	Percent of improvement	38.59%	43.55%	35.7%		
	p <	0.001	0.001	0.001		
Extension ROM	Pre	10.88 ± 3.72	9.94 ± 2.68	12.4 ± 5.15	2.078	0.354
	Post	18.76 ± 3.53	18.76 ± 3.65	20.53 ± 5.1	1.820	0.403
	Percent of improvement	72.4%	88.73%	65.56%		
	p <	0.001	0.001	0.001		
Rt lateral flexion	Pre	12.65 ± 3.26	12.29 ± 2.14	14 ± 4.29	1	0.607
	Post	22.65 ± 2.94	21.88 ± 2.18	21.76 ± 4.53	1.121	0.571
	Percent of improvement	79.05%	78.03%	55.42%		
	p <	0.001	0.001	0.001		
Lt lateral flexion	Pre	12.82 ± 3.8	12.4 ± 2.8	14.18 ± 4.7	1.007	0.604
	Post	23.76 ± 2.59	24.35 ± 2.57	23.35 ± 3.86	0.425	0.809
	Percent of improvement	85.33%	96.37%	64.66%		
	p <	0.001	0.001	0.001		
Rt rotation	Pre	2 ± 0.87	2.12 ± 0.78	1.65 ± 0.86	2.704	0.259
	Post	4.7 ± 1.36	4.59 ± 1.1	4.76 ± 2.1	0.028	0.986
	Percent of improvement	135%	116.5%	188.48%		
	p <	0.001	0.001	0.001		
Lt rotation	Pre	1.65 ± 0.7	2.47 ± 1.5	1.65 ± 1	3.084	0.214
	Post	5 ± 1.27	5.94 ± 1.75	5.35 ± 1.97	3.127	0.209
	Percent of improvement	203%	140.48%	224.24%		

VAS – Visual Analogue Scale, PPT – pain pressure threshold, ODI – Oswestry Disability Index, ROM – range of motion, Rt – right, Lt – left

A conventional program could be effective in the improvement of function, ROM and flexibility of the back, endurance of cardiovascular, and muscle strength and decreasing LBP when performed every day. It is attributed that physical therapy exercises consisting of muscle strengthening and stretching help to regain balance, preserve normal lumbar lordosis that supports the spinal posterior structures from unnecessary loads, act as a shock absorber during unpredictable vertical loads, and enhance flexibility and strength; this is consistent with the study results of Hayden et al. [3], van Middelkoop et al. [4], and Albahel et al. [9].

IASTM decreased pain and improved ROM in this study, and it is attributed that the instrument aimed to prevent the atrophy of muscles and regain balance between the muscles and this agrees with the results of Moon et al. [6] and Lee et al. [7], who reported that the effect of IASTM (Graston technique) on the pain and ROM in CMLBP patients.

KT is effective in reducing pain, improving ROM and other functions in this study. KT decreases pain that attributed to the extensibility of the KT that raises the skin so it increases the distance between the muscle and skin, and declines oedema, which affects interstitial pressure and decompresses the subcutaneous nociceptors, thereby ensuring pain relief by improving blood flow and circulation of the lymphatic system. The contact between the tape and the skin creates cutaneous inputs into the central nervous system that causes nociceptive input reduction and activates descending pain inhibitory systems. The ROM and function improvement could be attributed to KT creating pressure which stimulates skin mechanoreceptor activity and increases motor unit recruitment in the spinal erector muscles, thereby improving back muscle performance during isometric endurance tests. The results of the current study agree with the studies by Albahel et al. [9], Castro-Sánchez et al. [10], Bae et al. [12], Shojaedin and Yousefpour [13], Luz Júnior et al. [14], Abdellatif et al. [15], Added et al. [16], Al-Shareef et al. [17], Köroğlu et al. [18], Kamali et al. [19], Norman et al. [20], Velasco-Roldán et al. [21] and are contradictory to the study by Paoloni et al. [11].

Study limitations

Long term follow up was not conducted.

Conclusions

Conventional program, IASTM and KT are effective methods for treatment of CMLBP. Moreover, there was no significant difference between the conventional program, IASTM and KT for CMLBP patients in decreasing pain intensity level, increasing PPT, increasing lumbar ROM and decreasing functional disability index after 8 sessions in 4 weeks of treatment.

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Disclosure statement

No author has any financial interest or received any financial benefit from this research.

Conflict of interest

The authors state no conflict of interest.

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