RESEARCH PAPER

Comparative Efficacy of Low-Level Laser and Dry Cupping for Treatment of Patients with Calf Muscles Trigger Points and Cramps

Nora Mohamed Mansour Mohamed *[1], Hala abdelgawad [2], Mona Ebrahim Morsy [3]

1. *Physiotherapist: Agouza Charitable Society Hospital, Cairo, Egypt*
2. *Professor of Physical therapy Department, Faculty of Physical Therapy, Sphinx University, Assiut, Egypt*
3. *Professor of phtobiology in medical applications of laser department, National Institute of Laser Enhanced Sciences Cairo University, Egypt*

ABSTRACT

Background: Myofascial trigger points (MTrPs) is a sensitive spot causing typical referral pain and more pain with pressure and extension, located within the taut band of skeletal muscle. This study was conducted to compare the efficacy of dry cupping and Low-Level Laser (LLL) in the treatment of calf muscle TrP and cramping.

Methods: The study was randomized, single blind, controlled trial included **sixty participants** at the National Institute of Laser Enhanced Sciences (NILES), Divided into four equal groups: **Group I (control):** received myofascial manual release for 10 min., **Group II**: received myofascial manual release followed by dry cupping for 5 min for each TrP on calf muscles, **Group III**: received laser beam (diode 905 nm) for 1.5 min delivered by probe to each TrP followed by myofascial manual release and Group IV: received same laser beam followed by myofascial manual release then dry cupping. All groups underwent 6 sessions for 2 weeks (3 sessions / week) and assessment was done before starting sessions and after full program by the same physiotherapist.

Results: Two weeks after treatment, the algometer was significantly higher in group IV compared to group I (P=0.012), whereas VAS was significantly lower in group IV compared to group I (P=0.012). The digital goniometer measurements showed no significant difference between group I and group IV two weeks post-treatment.

Conclusions: Both LLL acupuncture and cupping may be employed to treat myofascial pain syndrome with similarly efficacious results.

Keywords: Low-Level Laser, Dry Cupping, Calf Muscles Trigger Points and Cramps.

How to cite this article: Mohamed NMM, Abdelgawad H, Morsy ME. Comparative Efficacy of Low-Level Laser and Dry Cupping for Treatment of Patients with Calf Muscles Trigger Points and Cramps. Int J Drug Deliv Technol. 2026;16(60s):1932-1939. DOI: 10.25258/ijddt.16.60s.174

Source of support: None

Conflict of interest: None

INTRODUCTION

Myofascial trigger points (MTrPs) is a sensitive point causing typical referral pain and becomes more pain with pressure and stretch, located within the taut band of skeletal muscle. Trigger points (TrPs) is a chronic muscular condition that impacts individuals of different ages and social backgrounds, irrespective of their career, body complexion, or physical activity level. It is the primary cause of musculoskeletal dysfunction in 30% of the population [1]. The activation of MTrPs is induced by postural tension, immobility or abrupt movement, structural deficiencies, muscle shortening, and nutritional deficiencies. Psychological tension, mechanical overload, overuse, joint dysfunction, or abnormal motor control may all contribute to the formation of TrPs. In muscles that are overloaded, there is an excessive discharge of calcium from the sarcoplasmic membrane [2, 3].

For three decades or even more, low-level laser therapy (LLLT) has been the subject of research and clinical application. The analgesic, myorelaxant, tissue healing, and biostimulation effect of laser have been documented by numerous authors as effective in the treatment of musculoskeletal disorders [4, 5].

Despite its origins in Middle Eastern and Asian countries, dry cupping became more prevalent after it's garnered focus during the 2016 Summer Olympics. This technique depends on placing of cups to the skin utilizing mechanical suction or heat, providing a negative pressure that draws the skin onto the cup. The most widely acknowledged theory concerning cupping is that it induces localized hyperemia in the region of application, despite the absence of a consensus. Microcirculation is enhanced by capillary dilation, which induces metabolic changes that diminish muscle tone and facilitate healing [6, 7].

Sustained manual pressure, referred to in this paper as manual pressure release (MPR), and previously referred to as ischaemic compression, inhibition and TrP pressure release is one of several techniques advocated for the treatment of MTrPs. MPR is performed by administering persistent, mildly excruciating manual force to the tissue

*Author for Correspondence: helmynora9@gmail.com

.

barrier of an MTrPs, typically with the thumb or fingertip. There is proof to suggest that the palpable MTrP bands and nodules are the result of localized elongation and shortening of the sarcomeres in a muscle fiber, which leads to the formation of "contraction knots" and "contraction discs." The sarcomeres' height has been proposed to be reduced by gentle pressure is applied to the MTrP 'contraction knot' in the affected muscle fibers, which leads to a concurrent extension of the sarcomeres. Within 60 seconds, the clinician typically experiences a discharge of the underlying tissues after maintaining the pressure.

The purpose of this investigation was to evaluate the efficacy of dry cupping and LLL in the management of calf muscle TrPs and cramping.

PATIENTS AND METHODS

This randomized, single blind, controlled clinical trial was carried out on sixty participants at the National Institute of Laser Enhanced Sciences from 4 / 2024 to 4 / 2025. Patients provided informed written permission. The researchers conducted the investigation subsequent to receiving authorization from the Ethics Committee of the National Institute of Laser Enhanced Sciences with reference number (NILES-EC-CU 24/6/9).

Inclusion criteria were patient with calf muscle TrPs and cramps defined as pain localized in the region of the calf muscle, by self or passive stretch for calf muscle, with at least 2 trigger points, aged within 18 to 60 years, gender male and female.

Exclusion criteria: patients had hyper tension medication, a history of polymyalgia rheumatica or inflammatory arthritis, as well as a gross structural or neurological abnormality that affected the calf muscles, diabetes, history of calf muscles strain; fibromyalgia: lumber disc herniation suspicion of serious pathology or referred pain; prior fracture or surgery to the ankle; lower limb; previous physiotherapy for this episode of calf pain, pregnancy or breastfeeding, had anticoagulation therapy and participants for whom LLLT was contraindication.

Grouping

Members were separated into 4 equal groups:

Group I (traditional group) (control group) (n=15): received myofascial manual release for 6 sessions within 2 weeks (3 sessions/ week). Myofascial manual release for 10 min each session. Assessment was done before starting sessions and after full program by the same physiotherapist

Group II (dry cupping and traditional) (n=15): received myofascial manual release for 10 min followed by dry cupping for 5 min for each TrP on calf muscles. 6 sessions for 2 weeks (3 sessions / week) were applied for this group. Assessment was done before starting sessions and after full program by the same physiotherapist.

Group III (LLL and traditional) (n=15): received laser beam (diode 905 nm) for 1.5 min delivered by probe to each TrP followed by myofascial manual release for 10 min. 6 sessions for 2 weeks (3 sessions / week). Assessment was done before starting sessions and after full program by the same physiotherapist.

Group IV (LLL, dry cupping and traditional) (n=15): received laser beam (diode 905 nm) for 1.5 min delivered by probe to each TrP followed by myofascial manual release for 10 min. then dry cupping for 5 min for each TrP. 6 sessions for 2 weeks (3 sessions / week). Assessment was done before starting sessions and after full program by the same physiotherapist.

All patients were subjected to full history taking including demographic data including age, gender, occupation, dominant Side: Right/left-handed (to assess muscle use patterns), chief complaint including symptoms, frequency of cramps/trigger points, location, history of present illness including pain type, severity, triggers, relief methods, associated symptoms, past medical history, comorbidities including diabetes, vascular/neurological disorders, muscle/electrolyte issues including medication history and family history, examination including inspection and palpation and range of motion (ROM) including active/passive dorsiflexion/plantar flexion, pain limitation during movement and neurological exam including achilles reflex, sensory testing, muscle strength (resisted movements).

METHODS:

For assessment: The respondent selected a whole number (0–10 integers) that most accurately represented the intensity of their suffering using **visual analog scale. Electronic goniometer:** utilized to quantify the range of motion of the dorsiflexion. a device utilized in physical therapy to quantify the ROM of a joint. The two "arms" are hinged together, with one being stationary and the other being movable. Each goniometer is positioned at specific locations on the body and its centre is aligned with the joint of interest. The therapist can precisely measure the range of motion in degrees by observing the hash markings on the hinge. **Pressure algometers:** are beneficial for quantifying the pressure pain thresholds of the calf muscle. The minimal pressure (force) that activates discomfort is known as the pressure threshold. A force indicator with a rubber disc of 1 cm2 surface area is denoted as the pressure threshold meter (PTM). It has been demonstrated that the instrument is effective in clinical settings for quantifying deep muscle tenderness. PTM is capable of diagnosing trigger points, fibrositis, myalgic patches, arthritis activity, and pain sensitivity.

Interventions

The intervention group underwent dry cupping. The MTrPs was initially identified on the calf muscle by the therapist. Subsequently, the participant assumed a prone position with their ankle hanging over the edge of the bed. In order to enhance the suctioning of the plastic vacuum cup, ultrasound gel was applied to the TrP as a lubricant, and the cup was subsequently inserted. In order to generate a suction force, the cup was evacuated of air. The cup was positioned on the treated site for a duration of five minutes. The therapist then held the cup in position to prevent it from losing its tension while the participant performed an active ankle dorsiflexion exercise. Immediately following the ankle dorsiflexion exercise, the cup was held in place for a period of three minutes. Therefore, the cup was maintained in its position for a total of 10 minutes. **Myofascial manual release:** For the administration of muscle TrPs, various

manual methods have been suggested. The immediate pain relief of muscle TrPs through TrP pressure release using was detected by a recent systematic review, which found moderate to strong evidence. Pressure was administered to TrPs until the clinician observed an increase in muscle resistance (tissue barrier). The therapist preserved the pressure until the elastic band was discharged. The procedure was repeated for 90 seconds (typically three repetitions) and the pressure was increased to restore the muscle TrP tension to the previous level.

Patients were additionally managed a neuromuscular technique (longitudinal stroke) to the gastrocnemius muscle. This approach is effective in decreasing the sensitivity of TrP to pressure. The therapist's forefinger was placed over the elastic band, and three longitudinal strokes were executed from the caudal (ankle) to the cranial (knee) region while the patient was in a prone position. For two weeks and six sessions, the patient underwent moderate pressure strokes at a moderate rate for a duration of ten minutes each [8].

LLL acupuncture: this group managed by LLLT with diode laser with 905 nm wavelength for 1.5 min max output 3 mW, direct contact with the skin, delivered by probe per each TrP in continuous-wave mode. In contact mode, the laser was used by applying mild pressure to the handpiece tip over the muscle trigger points that had been previously identified. Three sessions of laser therapy were administered each week for two weeks. Manufacturer's instructions were followed, and protective spectacles were worn by both the operator and the patient. The laser device's tip was also utilized as directed. This tip also had the closest diameter to the receptacles used for cupping.

Statistical analysis:

All statistical analysis was conducted using SPSS v27, which was developed by (IBM Inc. Armonk, NY, USA). The two groups were compared using an unpaired Student's t-test for quantitative data, which were provided as means and standard deviations (SD). Repeated measures ANOVA tests was used to analyse differences across multiple time points or conditions with the same individual. A two-tailed P value below 0.05 was considered statistically significant.

RESULTS

The algometer, digital goniometer, and VAS results post-treatment were insignificantly different between the control group and Group II. The algometer, digital goniometer, and VAS results post-treatment were insignificantly different between the control group and Group III. Group IV had significantly lower VAS after intervention than control group (P = 0.042). The group I and group IV had equal algometer and digital goniometer results post-treatment. **Table 1.**

Table 1: Comparison between control group, group 2, group 3 and group 4 post-treatment

	Group 1 (n=15)	Group 2 (n=15)	P value
Algometer	37.19 ± 6.08	33.29 ± 11.70	0.198
Digital goniometer	9.67 ± 1.60	7.06 ± 3.77	0.240
VAS	4.20 ± 1.32	4.87 ± 1.25	0.130
		Group 3 (n=15)	
Algometer	37.19 ± 6.08	38.04 ± 13.06	0.787
Digital goniometer	9.67 ± 1.60	10.39 ± 4.86	0.561
VAS	4.20 ± 1.32	3.80 ± 1.82	0.417
		Group 4 (n=15)	
Algometer	37.19 ± 6.08	44.25 ± 7.60	0.072
Digital goniometer	9.67 ± 1.60	10.99 ± 1.60	0.062
VAS	4.20 ± 1.32	2.73 ± 1.28	**0.042***

*Data are presented as mean ± SD. VAS: visual analogue scale. *: statistically significant as p value <0.05.*

In control group, algometer and digital goniometer were significantly increased post-treatment and after 2 weeks of treatment compared to before (P <0.001, <0.001). VAS was significantly decreased post-treatment and after 2 weeks of treatment compared to before treatment (P <0.001). In group II, algometer and digital goniometer were significantly higher post-treatment and after 2 weeks of treatment compared to before (P <0.001, <0.001), while VAS was significantly lower post-treatment and after 2 weeks compared to before treatment (P <0.001). In group III, algometer and digital goniometer were significantly higher post-treatment and after 2 weeks of treatment compared to before (P <0.001, <0.001), while VAS was significantly lower post-treatment and after 2 weeks of treatment compared to before treatment (P <0.001) In group IV , algometer and digital goniometer were significantly increased post-treatment and after 2 weeks of treatment compared to before (P <0.001, <0.001), while VAS was significantly decreased post-treatment and after 2 weeks of treatment compared to before treatment (P <0.001). **Table2**

Table 2: Comparison of control group, group 2, group 3 and group 4 before and post-treatment

		Before	After	2 weeks	p value
Group I	**Algometer**	32.57 ±5.98	37.19 ±6.08	35.23 ±5.93	**< 0.001***
	Digital goniometer	8.84 ±1.52	9.67 ±1.60	9.16 ±1.49	**< 0.001***
	VAS	5.60 ±1.35	4.20 ±1.32	4.73 ±1.28	**< 0.001***
Group II	**Algometer**	26.34 ±9.87	33.29 ±11.70	32.33 ±11.30	**< 0.001***
	Digital goniometer	5.64 ±3.29	7.06 ±3.77	6.82 ±3.68	**< 0.001***
	VAS	7.20 ±1.37	4.87 ±1.25	5.33 ±0.98	**< 0.001***
Group III	**Algometer**	32.94 ±11.78	38.04 ±13.06	36.29 ±12.49	**< 0.001***
	Digital goniometer	9.19 ±4.65	10.39 ±4.86	9.61 ±4.37	**< 0.001***
	VAS	5.33 ±1.88	3.80 ±1.82	4.47 ±1.88	**< 0.001***
Group IV	**Algometer**	25.09 ±10.69	44.25 ±7.60	43.69 ±7.50	**< 0.001***
	Digital goniometer	4.99 ±2.87	10.99 ±1.60	10.77 ±1.59	**< 0.001***
	VAS	7.13 ±1.51	2.73 ±1.28	3.13 ±1.19	**< 0.001***

*VAS: visual analogue scale, *: statistically significant as p value <0.05.*

There was an insignificant difference between control group and group II regarding the algometer, digital goniometer, and VAS 2 weeks after treatment. The algometer, digital goniometer, and VAS 2 weeks after treatment were insignificantly different between both groups. Compared to controls, group IV exhibited a significantly greater algometer 2 weeks post-treatment (P=0.012), In contrast, group IV exhibited a significantly reduced VAS than group I (P=0.012). Controls and group IV exhibited an insignificant difference in the digital goniometer two weeks following treatment. Table 3, Figure 1

Table 3: Comparison between control group, group 2, group 3, group4 2w after treatment

	Group 1 (n=15)	Group 2 (n=15)	P value
Algometer	35.23 ± 5.93	32.33 ± 11.30	0.272
Digital goniometer	9.16 ± 1.49	6.82 ± 3.68	0.065
VAS	4.73 ± 1.28	5.33 ± 0.98	0.147
		Group 3 (n=15)	
Algometer	35.23 ± 5.93	36.29 ± 12.49	0.756
Digital goniometer	9.16 ± 1.49	9.61 ± 4.37	0.561
VAS	4.73 ± 1.28	4.47 ± 1.88	0.567
		Group 4 (n=15)	
Algometer	35.23 ± 5.93	43.69 ± 7.50	**0.012***
Digital goniometer	9.16 ± 1.49	10.77 ± 1.59	0.054
VAS	4.73 ± 1.28	3.13 ± 1.19	**0.012***

*** Significance is defined as a P-value of 0.05 or less.*

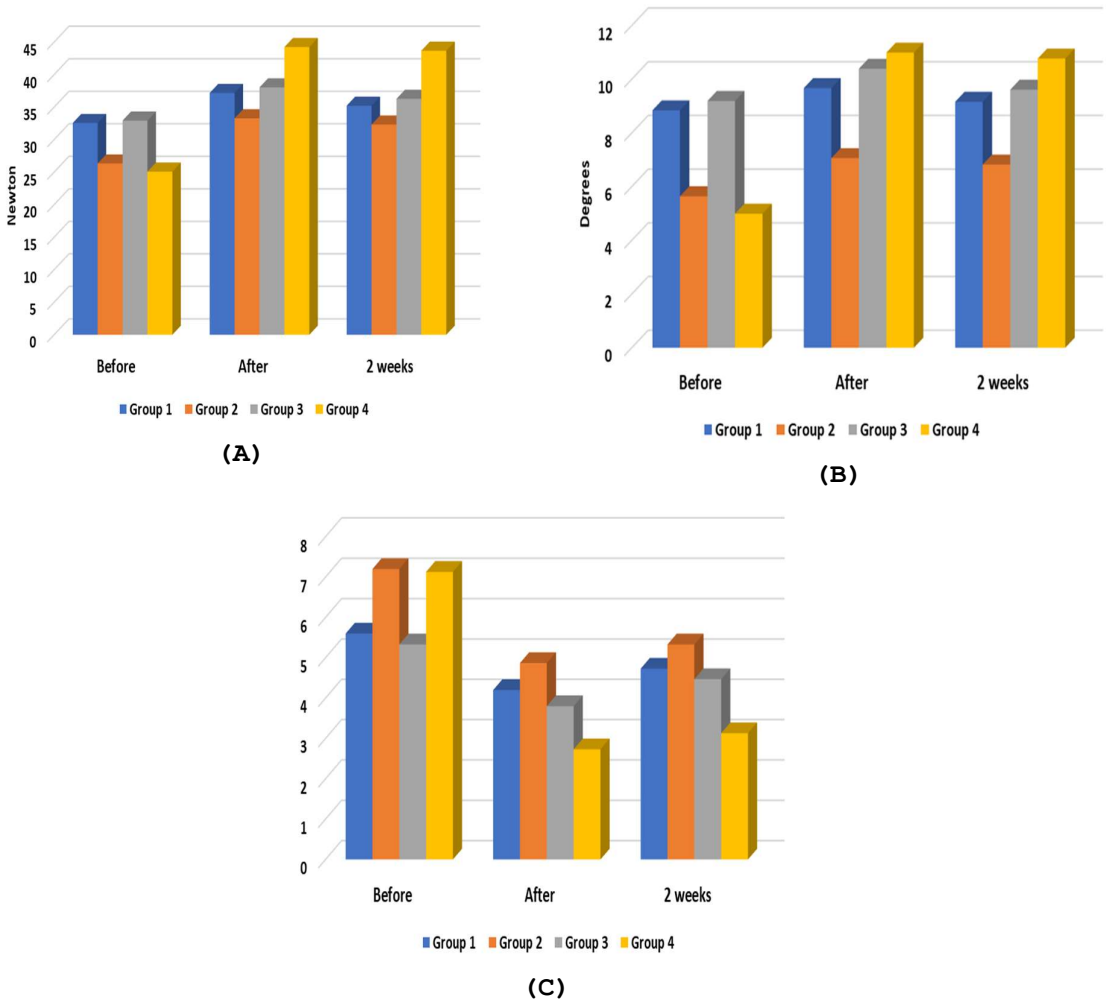

Figure 1: (A) Mean Algometer values (N) in the 4 study groups over the study period, (B) Mean Goniometer values (Degrees) in the 4 study groups over the study period and (C) Mean VAS values in the 4 study groups over the study period

DISCUSSION

Myofascial pain is a prevalent musculoskeletal complaint, and the diagnosis of myofascial pain syndrome is frequently made as a result of the lack of understanding of the pathophysiology of the symptoms. Although the criteria for myofascial pain syndrome are met by approximately one-third of individuals seeking treatment [9].

We found that the algometer, digital goniometer, and VAS after results were insignificantly different between group I and group II. There was an insignificant difference between group I and group II regarding the algometer, digital goniometer, and VAS after 2 weeks results.

In line with our results, Salemi et al. [10] found that the cupping therapy group exhibited a reduced VAS at the post-treatment stage than the traditional group.

A previous meta-analysis of dry cupping in comparison to an active control group did not reveal any significant differences. In comparison to no treatment, dry cupping was determined to have a medium effect, despite the low quality of the evidence [11].

The current study found that the algometer, digital goniometer, and VAS post-treatment results were insignificantly different between control group and group III.

A previous article utilized LLLT to treat MPS at acupoints and compared the efficacy of the treatment and placebo, which is consistent with our findings. The researchers did not observe any substantial disparity between the categories. The outcome appeared to be comparable to our investigation; nevertheless, further research is necessary to determine the effectiveness of LLLT on acupoints in the treatment of MPS-related symptoms. [12].

However, Chang et al. [13] determined that the effect of LLLT TrP application on pain relief and cervical ROM in

cervical MPS patients was comparable to that of acupoint application. However, only LLLT TrP application significantly improved pain and ROM in comparison to group I. Application of LLLT TrP may be more advantageous because of its localized effects on the muscle. In the present study, VAS after therapy was significantly lower in group IV than control group (P = 0.042). The control group and group IV had equal algometer and digital goniometer results after treatment.

Lin et al., [14] allocated participants randomly into 2 groups: the active group (real LA and soft cupping) and the placebo group (sham laser and soft cupping). Both groups experienced a decrease in their VAS scores five days following the intervention; however, no statistically significant difference was observed between the two groups during this time. For example, the intervention group experienced a pain intensity of 2.11±4.60, while the control group experienced a pain intensity of 2.12±5.09. In the present study, in group I (control group), algometer and digital goniometer were significantly increased post-treatment results and after 2 weeks of treatment compared to before (P <0.001, <0.001). VAS was significantly decreased post-treatment results and after 2 weeks of treatment than before (P <0.001).

Lauche et al. [15] comprised patients who were assigned to either a treatment group or a waiting-list control group. In both groups, patients demonstrated an increase in PPTs on the foot; however, the effect was twice as significant in the TG group as in the WL control group. Another systematic review that involved MPS indicated that kinesiology taping, dry-needling and dry cupping enhanced cervical ROM. [7].

Karagözoğlu et al., [16] found that VAS scores were significantly different in the placebo group between before and after intervention (p = 0.001).

The current study showed that in group II, algometer and digital goniometer were significantly higher post-treatment results and after 2 weeks of treatment than before (P value <0.001, <0.001), while VAS was significantly lower post-treatment results and after 2 weeks of treatment than before (P <0.001).

Sajedi et al., [17] Discovered that the pain score in the cupping group was 19% lower post-treatment, and this difference was statistically significant (P<0.01). The number of identified trigger points decreased in both groups as a result of treatment. The cupping group, on the other hand, experienced a substantially greater reduction in the fourth to eighth sessions than the LLL acupuncture group, indicating that cupping was more effective at the designated time points. The present results of the VAS pain score indicate that the pain reduction in the cupping group was significantly greater than that in the laser group at the conclusion of the third treatment session.

A previous meta-analysis showed that six trials. The treatment of chronic neck pain, plantar fasciitis, and fibromyalgia was performed using dry cupping therapy in six trials. The six trials found in the meta-analysis demonstrated a statistically significant effect on pressure pain thresholds in favor of dry cupping [15, 18-21].

The group III in the current study showed that algometer and digital goniometer were significantly higher post-results and after 2 weeks post-treatment compared to before (P value <0.001, <0.001), while VAS was significantly lower post-treatment results and after 2 weeks of treatment compared to before (P value <0.001).

In line with our findings, Karagözoğlu et al., [16] found that VAS exhibited a statistically significant decrease post-treatment in the Nd: YAG laser group when the mean values of the variables measured pre- and post-treatment were compared (p = 0.001).

We showed that in group IV, algometer and digital goniometer were significantly increased post-treatment and after 2 weeks of treatment compared to before treatment (P <0.001, <0.001), while VAS was significantly decreased post-treatment and after 2 weeks of treatment than before treatment (P <0.001). There was an insignificant difference between control group and group II regarding the algometer, digital goniometer, and VAS after 2 weeks treatment. 2 weeks after treatment, the algometer was significantly higher in group IV compared to group I (P=0.012), whereas VAS was significantly lower in group IV compared to group I (P=0.012). 2 weeks after treatment, the algometer was significantly higher in group IV compared to group I P=0.012, whereas VAS was significantly lower in group IV compared to group I (P=0.012). There was an insignificant difference between group I and group IV regarding the digital goniometer after 2 weeks treatment.

Lin et al., [14] found that a significant difference was observed in the laser and cupping groups concerning the pain intensity on the day 5 than the day 1 (P<0.01).

Small sample sizes may result in an overestimation of treatment effects or the failure to identify a clinically significant effect, which were the limitations of the study. we did not compare the effects of different wavelengths of LLLT, did not assess the EMG due to limited resources and did not include the adverse effects of each treatment as dry cupping and LLLT. As the results of the current study did not concentrate on the long-term effects of LLLT with cupping, they can only be applied to the short-term impacts of LLLT.

CONCLUSIONS

Both cupping and LLL acupuncture may be used for the treatment of MPS with equal efficacy. The combination of both techniques in addition to the traditional method showed a synergistic effect and maximized their efficacy in lowering pain, but with no change in pain pressure threshold and digital goniometer.

Therefore, Larger cohort randomized clinical trials, LLL therapy cannot by itself, eliminate restricted temporomandibular joint movements and joint sound in MPDS patients and simultaneous utilization of other appropriate treatments are recommended. Additional research is necessary to standardize the optimal number of sessions necessary for the treatment of musculoskeletal conditions, as well as to evaluate the quality of life and the long-term outcomes of these methods.

Financial support and sponsorship: Nil
Conflict of Interest: Nil

REFERENCES

1. Basak T, Pal TK, Sasi MM, Agarwal S. A comparative study on the efficacy of ischaemic compression and dry needling with muscle energy technique in patients with upper trapezius myofascial trigger points. Int J Health Sci Res. 2018; 8:74-81.
2. 2. Hwang UJ, Kwon OY, Yi CH, Jeon HS, Weon JH, Ha SM. Predictors of upper trapezius pain with myofascial trigger points in food service workers: The STROBE study. Medicine (Baltimore). 2017; 96:72-95.
3. Sadeghnia M, Shadmehr A, Mir SM, Hadian Rasanani MR, Jalaei S, Fereydounnia S. The immediate effects of deep transverse friction massage, high- power pain threshold ultrasound and whole-body vibration on active myofascial trigger points. J Bodyw Mov Ther. 2023; 36:165-70.
4. Stergioulas A. Low-power laser treatment in patients with frozen shoulder: preliminary results. Photomed Laser Surg. 2008; 26:100-5.
5. Yeldan I, Cetin E, Ozdincler AR. The effectiveness of low-level laser therapy on shoulder function in subacromial impingement syndrome. Disabil Rehabil. 2009; 31:35-40.
6. Cao H, Li X, Yan X, Wang NS, Bensoussan A, Liu J. Cupping therapy for acute and chronic pain management: a systematic review of randomized clinical trials. J Tradit Chin Med. 2014; 1:49-61.
7. Charles D, Hudgins T, MacNaughton J, Newman E, Tan J, Wigger M. A systematic review of manual therapy techniques, dry cupping and dry needling in the reduction of myofascial pain and myofascial trigger points. J Bodyw Mov Ther. 2019; 23:539-46.
8. Renan-Ordine R, Alburquerque-SendÍn F, Rodrigues De Souza DP, Cleland JA, Fernández-de-las-PeÑas C. Effectiveness of Myofascial Trigger Point Manual Therapy Combined with a Self-Stretching Protocol for the Management of Plantar Heel Pain: A Randomized Controlled Trial. J Orthop Sports Phys Ther. 2011; 41:43-50.
9. Galasso A, Urits I, An D, Nguyen D, Borchart M, Yazdi C, et al. A Comprehensive Review of the Treatment and Management of Myofascial Pain Syndrome. Curr Pain Headache Rep. 2020; 24:43-65.
10. Salemi MM, Gomes V, Bezerra LMR, Melo TMS, Alencar GG, Montenegro I, et al. Effect of Dry Cupping Therapy on Pain and Functional Disability in Persistent Non-Specific Low Back Pain: A Randomized Controlled Clinical Trial. J Acupunct Meridian Stud. 2021; 14:219-30.
11. Wood S, Fryer G, Tan LLF, Cleary C. Dry cupping for musculoskeletal pain and range of motion: A systematic review and meta-analysis. J Bodyw Mov Ther. 2020; 24:503-18.
12. Waylonis GW, Wilke S, O'Toole D, Waylonis DA, Waylonis DB. Chronic myofascial pain: management by low-output helium-neon laser therapy. Arch Phys Med Rehabil. 1988; 69:17-20.
13. Chang WH, Tu LW, Pei YC, Chen CK, Wang SH, Wong AM. Comparison of the effects between lasers applied to myofascial trigger points and to classical acupoints for patients with cervical myofascial pain syndrome. Biomed J. 2021; 44:739-47.
14. Lin ML, Wu HC, Hsieh YH, Su CT, Shih YS, Lin CW, et al. Evaluation of the effect of laser acupuncture and cupping with ryodoraku and visual analog scale on low back pain. Evid Based Complement Alternat Med. 2012; 2012:21-9.
15. Lauche R, Cramer H, Choi KE, Rampp T, Saha FJ, Dobos GJ, et al. The influence of a series of five dry cupping treatments on pain and mechanical thresholds in patients with chronic non-specific neck pain--a randomised controlled pilot study. BMC Complement Altern Med. 2011; 11:63-98.
16. Karagözoğlu İ, Demirkol N, Parlar Öz Ö, Yılmaz S, Özcan M. New generation low level laser effect on masseter muscle oxygenation, bite force and algometric changes in myofacial pain syndrome: a randomised, placebo-controlled clinical trial. Lasers Med Sci. 2025; 40:48-80.
17. Sajedi SM, Abbasi F, Asnaashari M, Jafarian AA. Comparative Efficacy of Low-Level Laser Acupuncture and Cupping for Treatment of Patients with Myofascial Pain Dysfunction Syndrome: A Double-blinded, Randomized Clinical Trial: Comparison of the Effects of LLL Acupuncture and Cupping. Galen Med J. 2022; 11:1-13.
18. Cramer H, Lauche R, Hohmann C, Choi KE, Rampp T, Musial F, et al. Randomized controlled trial of pulsating cupping (pneumatic pulsation therapy) for chronic neck pain. Forsch Komplementmed. 2011; 18:27-34.
19. Lauche R, Spitzer J, Schwahn B, Ostermann T, Bernardy K, Cramer H, et al. Efficacy of cupping therapy in patients with the fibromyalgia syndrome-a randomised placebo-controlled trial. Sci Rep. 2016; 6:73-96.
20. Saha FJ, Schumann S, Cramer H, Hohmann C, Choi KE, Rolke R, et al. The Effects of Cupping Massage in Patients with Chronic Neck Pain - A Randomised Controlled Trial. Complement Med Res. 2017;24:26-32.
21. Ge W, Leson C, Vukovic C. Dry cupping for plantar fasciitis: a randomized controlled trial. J Phys Ther Sci. 2017; 29:859-62.