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The Effects of High-Intensity Laser Therapy on Pain, PPT, and ROM in Individuals with Myofascial Pain Syndrome: A Systematic Review

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Abstract

Introduction: Myofascial pain syndrome (MPS) is the most common musculoskeletal pain disorder. One of the suggested treatments for MPS is High-Intensity Laser Therapy (HILT). HILT is a treatment method for addressing musculoskeletal pain and inflammation. Although many studies have demonstrated the effects of HILT, these effects are controversial due to the placebo effect of the laser. Therefore, there is a need to evaluate HILT compared to other physical therapy methods to achieve the best outcomes. This systematic review aimed to investigate the effect of HILT on pain intensity, pressure pain threshold (PPT), and joint range of motion (ROM) in subjects with MPS.

Methods: PubMed/Medline, Scopus, Web of Science, and Science Direct were searched from inception to January 28, 2025, and the search was subsequently updated to August 2, 2025. Randomized controlled trials (RCTs) and clinical trials that assessed the effect of HILT on pain intensity, PPT, and joint ROM in subjects with MPS were included.

Results: Twelve RCTs were included. The within-group results indicated that HILT significantly improved pain intensity, PPT, and joint ROM. However, compared to the control group, HILT had superior or similar effects on pain intensity and joint ROM. Level B evidence indicates that HILT is more effective than placebo or sham and traditional treatments in the improvement of pain and ROM in patients with trapezius trigger points.

Conclusion: Compared to traditional treatments, HILT is more effective in reducing pain and increasing joint ROM in subjects with MPS. However, further studies comparing HILT with other treatments, especially dry needling, are needed to make a clinical decision.

Keywords: High intensity laser therapy, High power laser, Therapy, Trigger point, Myofascial pain, Systematic review

Introduction

Myofascial pain syndrome (MPS) is known as the most common musculoskeletal pain disorder, characterized by the formation of localized and tight areas in the muscle and fascia, termed trigger points. These trigger points cause dull, deep, aching, or often burning pain. In addition, MPS demonstrates a neuropathic pattern, evidenced by the referral pain.[1] Studies have shown that 30% to 85% of patients referred to clinics exhibit symptoms of MPS.[2]

It seems that several factors are involved in the development of trigger points in MPS, including muscle overuse, trauma, psychological stress, poor posture, and systemic factors such as hypothyroidism, deficiency of vitamin D, or iron. However, the exact mechanisms are not fully understood. Central sensitization and altered central pain modulation are also believed to play essential roles in chronic MPS. These lead to an overexcited state in the central nervous system, which increases pain sensitivity.[3,4]

Common approaches to MPS treatment comprise pharmacological and non-pharmacological therapies. Nonsteroidal anti-inflammatory drugs (NSAIDs) are the most commonly used drugs for MPS due to their analgesic and anti-inflammatory properties.[5] Some evidence supports the effectiveness of therapeutic methods such as electrotherapy, dry needling, acupuncture, ultrasound, friction massage, ischemic compression techniques, and exercise as non-pharmacological treatments for addressing MPS.[6-8]

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Therapeutic lasers are classified into two types based on their emission power: low-level laser therapy (LLLT) and high-intensity laser therapy (HILT).[9,10] HILT is also established as a high-power or class IV laser, with a power output exceeding 0.5 W. It typically acts within the infrared spectrum, authorizing deeper tissue penetration.[11,12] HILT has unique photomechanical, photothermal, and photochemical properties. Laser irradiation can modify cellular metabolism and functions, contributing to its various therapeutic effects, including anti-edema, pain relief, and biological stimulation.[13,14] Its pain-relieving mechanisms rely on neural inhibition, the release of endorphins and serotonin, and anti-inflammatory effects. HILT is an effective treatment for musculoskeletal problems, including spinal disorders, frozen shoulder, and neck pain.[15,16] HILT emits more diffuse light than LLLT, allowing deeper penetration (10–12 cm) and enabling faster and broader treatment with higher energy delivery.[13,17]

Several studies have been carried out on the effect of HILT in improving pain, pressure pain threshold (PPT), and joint range of motion (ROM).[18-20] The study conducted by Ahi et al. revealed that HILT is as effective as dry needling.[21] Another study reported that neuromuscular manual therapy is more effective than HILT in PPT in patients with trigger points.[22] To date, there has been little information about the effect of HILT on the management of MPS, and there are several gaps and conflicting data. The study was designed to systematically review the effect of HILT on pain, PPT, and ROM in individuals with MPS.

Methods

Identifying and Selecting Studies

Eligibility Criteria

The present systematic review was carried out following the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines.[23] Randomized controlled trials (RCTs) and clinical trials assessed the effect of HILT on pain, PPT, and joint ROM as the main outcomes in individuals with MPS who were included. We used the following PICOS framework to outline eligibility criteria: Participants: Individuals diagnosed with MPS; Intervention: receiving HILT; Comparator: Other interventions or no treatment; Outcomes: Pain, PPT, and ROM; Study design: RCTs and clinical trials. The exclusion criteria were as follows: 1. non-original or non-clinical trial studies, reviews, commentaries, letters to the editor, opinions, or any studies with no original data, 2. non–full texts, conference abstracts, abstract papers, and short communications, and 3. non-English language.

Search Strategy

A comprehensive search of electronic databases, including PubMed/Medline, Scopus, Web of Science, and Science Direct, was performed from inception to January 28, 2025, and the search was subsequently updated to August 2, 2025. Other databases like ProQuest, Google Scholar, and World Wide Science were searched for gray literature. The reference lists of selected studies were also reviewed to identify further relevant studies. The search utilized a combination of the following keywords: "high-intensity laser therapy", "high power laser therapy", "high-level laser therapy", "laser", "trigger point", and "myofascial pain syndrome". Details of the complete search strategy for PubMed are available in Supplementary file 1. Due to the importance of the Cochrane search, the search was repeated in Cochrane, and no new articles were added.

Study Selection and Data Extraction

A comprehensive search of several databases was conducted by two independent reviewers (MS, ZF), and duplicate results were removed by using EndNote 21.3 software. Two reviewers (MS, ZF) screened the titles and abstracts of all retrieved studies independently and eliminated any unrelated publications. The same reviewers assessed the full texts of the included studies based on the eligibility criteria. The data extraction was performed independently by two reviewers (SR, ZK). Any disagreements between the reviewers were addressed through discussion with a third reviewer (MK). The information, including authors, publication year, area, sample characteristics (number, mean age), details of the interventions (e.g., type and duration of treatment sessions), outcomes and measurements, and main results, was extracted from the included studies.

Risk of Bias Assessment

The methodological quality of the included studies was appraised by two independent reviewers (MS, ZK) according to the PEDro scale. Any disagreement was resolved with the third reviewer (MK).

The PEDro Scale is a robust tool for assessing the quality and rigor of articles in systematic reviews. It examines articles across multiple dimensions, such as methodological soundness, relevance, evidence strength, and transparency in reporting. Regarding the PEDro Scale, reviewers can objectively evaluate articles based on specific criteria like study design, sample size, statistical analysis, bias management, and overall contribution to the discipline.[24]

Results

Initially, a total of 4,834 valid studies were detected through four databases. After removing duplicates, 2,955 studies were screened at the title and abstract level regarding the eligibility criteria, and 28 full-text studies were preserved. Finally, 12 studies were included.[18-22,25-31] The PRISMA flowchart displays the selection process of the studies (Figure 1).

Study Characteristics

The current systematic review was conducted to summarize the effects of high-intensity Laser therapy on pain[18-21,25-31], PPT[19,20,22,28-30], and ROM[19-21,25,26,29,31,32] in individuals with myofascial pain syndrome.

The included studies were conducted in different

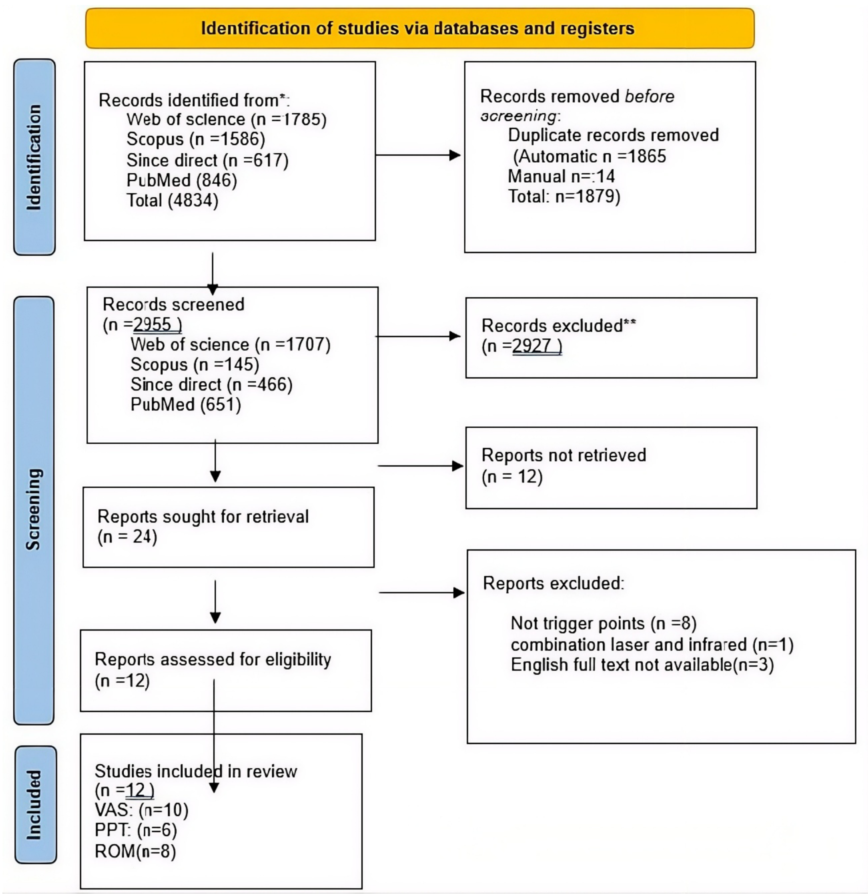

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram of the review process

countries, including Turkey[21,25], Saudi Arabia[20,26], Egypt[19,27,29,30], Iran[18,28,31], and Italy.[22] They had a total of 584 participants diagnosed with MPS, both genders with a mean age range of 35.53 years.[18-22,25-31]

All studies examined active trigger points[18-22,25-30] The muscles involved in most studies were the upper trapezius.[18-22,25-28,30,31] One study treated trigger points of the vastus medialis muscle and medial head of the gastrocnemius muscle,[29] and another one worked on the splenius capitis muscle[22]). Table 1 contains a detailed description of the included studies.

Intervention

The intervention duration varied from 2 to 7 times a week for 2 to 6 weeks. The total treatment sessions varied from 5 to 15 (Table 1).

Various treatment protocols were employed across the studies. The treatments accompanying laser therapy in the intervention group included therapeutic exercises[21,25,26,29,31], conventional physiotherapy[18,19,27,30], the progressive pressure release technique[13], passive stretching exercises[28], and laser therapy used as a standalone treatment.[16]

In the control group, ultrasound, manual therapy, dry needling, electrotherapy, traditional physiotherapy, therapeutic exercises, and sham or placebo of HILT were prescribed.

Regarding the laser parameters, different characteristics were used in the studies, including continuous or pulsed mode, wavelengths of 810 nm, 980 nm, or 1064 nm, frequencies ranging from 5 Hz to 100 kHz, peak power between 7 W and 30 kW, average power from 3 W to 10.5 W, and total energy ranging from 125 J to 2957 J (Supplementary file 2).

Methodological Quality

The methodological quality of the included studies was assessed using the PEDro scale (Table 2), which evaluates key methodological aspects such as randomization, allocation concealment, blinding, and follow-up. Accordingly, seven of 12 studies had fair quality,[18,19,22,26-29,31] and five had good quality.[19-21,25,27,30]

Items: 1. Eligibility criteria were specified, 2. Subjects were randomly allocated to groups (in a crossover study, subjects were randomly allocated an order in which treatments were received), 3. Allocation was concealed 4. The groups were similar at baseline regarding the most important prognostic indicators, 5. There was blinding of all subjects, 6. There was blinding of all therapists who administered the therapy, 7. There was blinding of all assessors who measured at least one key outcome, 8. Measures of at least one key outcome were obtained from > 85% of the subjects initially allocated to groups, 9. All subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome were analyzed by intention to treat, 10. The results of between-group statistical comparisons are reported for at least one key outcome, 11. The study

Table 1. Detailed description of the included studies

Reference	Country	Study design	Sample's number (Mean age)	Intervention	Outcome	Result	Class
Dundar, Turkmen et al. 2015 [25]	Turkey	RCT	EG: N = 38 (40.2 ± 12.9) CG: N = 37 (38.4 ± 12.1)	EG: HILT + TE CG: sham HILT + TE (Once/day for 15 days during of 3 weeks)	- VAS -AROM of cervical (GNM) -Disability (NDI), -Quality of life (SF-36)	Both groups show significant improvement in outcomes after the intervention. All outcomes increased significantly more in the HILT group.	II
Alayat, Mohamed et al. 2016 [26]	Saudi Arabia	RCT	EG: N = 30 (35.67 ± 0.86) CG: N = 30)35.27 ± 0.67(	EG: HILT + TE CG: PL + TE (12 sessions, twice a week for 6 weeks)	-VAS -CROM (GNM), -Functional activity (NDI)	Both groups improved after the intervention, with the HILT group showing a statistically significant greater gain.	II
ahmed, abu taleb et al. 2020 [27]	Egypt	RCT	EG: N = 25 (29.22 ± 5.3) CG: N = 25 (30.12 ± 5.66)	EG: HILT + traditional PT CG: traditional PT (2 sessions/week for 4 weeks)	-VAS	After the intervention, both groups demonstrated significant improvements in outcomes. Compared to CG, VAS increased significantly more in the HILT group	II
Alayat, Battecha et al. 2020 [20]	Saudi Arabia	RCT	EG: N = 25 (28.47 ± 5.07) CG: N = 25 (27.70 ± 4.56)	EG: laser + PPRT CG: PL + PPRT (3 times/week for 4 weeks)	-VAS -PPT (pressure algometer), -CROM (GNM)	Post-intervention, both groups improved; the HILT group had a greater improvement.	II
Parandnia, Yassin et al. 2020 [28]	Iran	RCT	EG1: N = 15 (27.06 ± 5.21) CG: N = 15 (25.86 ± 4.17)	EG: HILT + PSE CG: DN + PSE (5 sessions for three weeks)	-VAS -PPT (pressure algometer)	Both groups show significant improvement in outcomes after the intervention. No significant difference was observed between groups	II
Barassi et al. 2021 [22]	Italy	RCT	EG: N = 10 CG: N = 10 Overall mean age (54.29)	EG: HILT CG: NMT (twice a week for 3 weeks, for a total of 6 treatments)	-Disability (NDI) -PPT (pressure Algometer)	Both groups demonstrated statistically significant improvements in outcomes post-intervention. NDI increased significantly more in the HILT group and PPT increased significantly more in NMT	II
Ahmed, El Kasem et al. 2022 [29]	Egypt	RCT	EG: N = 20 (46.6 ± 6.995) CG: N = 20 (46.3 ± 5.774)	EG: HILT and TE CG: sham HILT and TE (3 days a week for 4 weeks)	-PI (blood cortisol level test) - PPT (pressure algometer) -knee ROM (digital electronic goniometer) -knee function (KOOS-PS questionnaire)	The interventions improved both groups, and the HILT group showed a larger gain.	II
Ahi and Sirzai 2022 [21]	Turkey	RCT	EG1: N = 35 (38.4 ± 7.6) EG2: N = 34 (38.0 ± 9.0) CG: N = 36 (38.1 ± 9.7)	EG1; TE + HILT (15 min/day, 15 session) EG2: TE + DN (2 times/week, for 3 weeks) CG: Exercise group: TE (15 min/day, 15 session)	-VAS -Disability (NDI) -Quality of life (SF-36) -Neck ROM	Both groups show significant improvement in outcomes after the intervention. Compared to exercise group, all outcomes increased significantly more in the HILT group Compared to DN group, no significant differences were found.	II
Sargolzehi, Namvar et al. 2022 [18]	Iran	RCT	EG: N = 16 (32.7 ± 11.3) CG: N = 16 (33.6 ± 10.3)	EG: HLLT + traditional PT CG: traditional PT (12 sessions, 3 days a week for 4 weeks)	-VAS -Disability (NDI) -Muscle activity of the UTM (RMS by surface electromyography)	Post-intervention, both groups improved significantly in outcomes, but the HILT group experienced a markedly greater enhancement across all outcomes.	
Taleb, Ahmed et al. 2022 [30]	Egypt	RCT	EG: N = 25 (29.22 ± 5.3) CG: N = 25 (30.12 ± 5.66)	EG: HILT + traditional PT CG: traditional PT (2 sessions/week for 4 weeks)	-VAS -PPT (pressure algometer) -Neck functional activities (NDI) -CROM	Both groups show significant improvement in outcomes after the intervention. All outcomes increased significantly more in the HILT group	II
Gawaan, Mohmmed Ali et al. 2023 [19]	Egypt	RCT	EG: N = 20 (47.30 ± 7.97) CG: N = 20 (47.15 ± 7.21)	EG: pulsed HLLT + traditional PT CG: traditional PT (3 times per week for one month)	-VAS -PPT (pressure algometer), -CROM (goniometer)	Following the intervention, both groups exhibited significant improvements in outcomes, with the HILT group showing a substantially larger increase across all outcomes.	II
Yassin, Parandnia et al. 2024 [31]	Iran	RCT	EG1: N = 16 (27.09 ± 5.21) CG: F = 16 (25.89 ± 4.17)	EG1: HLLT + TE CG: DN + TE (twice weekly, 3 weeks, 5 sessions)	-VAS -CROM (inclinometer & goniometer) Disability (NDI),	After the intervention, outcomes improved significantly in both groups, with no notable between-group difference.	II

provides both point measures and measures of variability for at least one key outcome

The PEDro scores of the studies ranged from 4 to 8 out of 10. Most studies demonstrated adequate randomization and baseline comparability; however, blinding the participants and therapists was frequently

Table 2. The PEDro scores of included studies

Author	Years	1	2	3	4	5	6	7	8	9	10	11	Total PEDro Score	Quality
Dundar U. et al.[25]	2015	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	8/10	Good
Alayat M.S. et al.[26]	2016	Y	Y	N	Y	N	N	N	N	N	Y	Y	4/10	Fair
Ahmed H.M. et al.[27]	2020	Y	Y	N	Y	N	N	N	N	Y	Y	N	4/10	Fair
Alayat M.S. et al.[20]	2020	N	Y	N	Y	Y	Y	Y	N	N	Y	Y	7/10	Good
Parandnia A. et al.[28]	2020	Y	Y	N	Y	N	N	Y	N	N	Y	Y	5/10	Fair
Barassi G. et al.[22]	2021	Y	Y	Y	N	N	N	Y	N	N	Y	N	4/10	Fair
Ahmed B.B. et al.[29]	2022	Y	Y	N	Y	N	N	Y	N	Y	Y	N	5/10	Fair
Ahi E.D. et al.[21]	2022	N	Y	N	Y	N	N	Y	Y	N	Y	Y	6/10	Good
Sargolzehi M. et al.[18]	2022	Y	Y	N	Y	N	N	Y	N	N	Y	Y	5/10	Fair
Taleb E.A. et al.[30]	2022	Y	Y	Y	Y	N	N	Y	N	Y	Y	Y	7/10	Good
Gawaan N.M. et al.[19]	2023	Y	Y	Y	Y	N	N	N	N	Y	Y	Y	6/10	Good
Yassin M. et al.[31]	2024	Y	Y	N	Y	N	N	Y	N	N	Y	Y	5/10	Fair

lacking, increasing the risk of performance bias. Additionally, some studies had small sample sizes and inadequate follow-up periods, which may have influenced the reliability of the results.

Quality of Evidence

Three experts conducted a thorough critical review of the selected publications, categorizing them using criteria adapted from the guidelines of the European Federation of Neurological Societies.[33,34] The studies were sorted into four categories (I–IV), reflecting a descending hierarchy of evidence quality. To assess the effectiveness of HILT in trigger points, the experts compared their classifications, reached a consensus, and assigned evidence levels (A to C).

In terms of grading the "level of evidence," we consistently considered recommendations for a specific indication.

The overall confidence in the evidence is moderate, suggesting that while the findings are promising, further high-quality randomized controlled trials (RCTs) with better blinding and larger sample sizes are necessary to strengthen the conclusions.

Outcomes

Effect of HILT on Pain Intensity

Ten fair to good quality studies assessed the effect of HILT on pain intensity. They all utilized a visual analog scale (VAS).[18-21,25-28,30,31] Each of these studies specifically focused on the upper trapezius muscle, and a significant within-group reduction in pain intensity was observed following the intervention. However, in three studies, no significant differences were found compared to the control group.[21,28,31]

Effect of HILT on PPT

Six fair to good quality studies assessed the effect of HILT on PPT. All studies used an algometer.[19,20,22,27-30] Five studies focused on the upper trapezius muscle[19,20,22,28,30], and one study assessed the vastus medialis and the medial head of the gastrocnemius muscle.[23] All studies showed significant within-group and between-group improvements in PPT[19,20,22,28-30], except for two studies that found no significant between-group effects.[22,28]

Effect of HILT on ROM

Eight fair to good quality studies evaluated the effect of HILT on joint ROM.[19-21,25,26,29-31] Seven studies assessed cervical ROM using either an inclinometer[30,31] or a goniometer[13-15, 19, 20, 25] in participants with involvement of the upper trapezius muscle. One study measured knee ROM with a goniometer, focusing on the vastus medialis and the medial head of the gastrocnemius muscle.[23] Significant within-group.[19-21,25,26,29,31,32] and between-group improvements.[19,20,25,26,29,32]were observed. However, two studies found no significant differences compared to the control group.[21,31]

Discussion

This systematic review examined the effects of HILT on pain intensity, PPT, and joint ROM in individuals with MPS. Across the included randomized controlled trials, HILT consistently demonstrated beneficial effects on these primary outcomes, and no serious adverse events were reported. Considering the limitations of the included studies, which involve inadequate blinding, allocation concealment, and sample size, and considering that the level of evidence of these studies is II, the repetition of some results, which cannot be graded based on classified evidence due to heterogeneity in methodology, should be interpreted with caution.

Ten studies showed significant within-group pain improvement following HILT.[18-21,25-28,30,31] In the between-group comparisons, seven studies[18-20,25-27,30] reported superior effects of HILT, whereas three studies found no significant differences.[21,28,31]

The photochemical and photothermal mechanisms of HILT are believed to contribute to pain reduction by alleviating the energy crisis within trigger points. HILT may increase the release of endogenous opioids and β-endorphins, reduce substance P levels, inhibit A-delta and C-fiber activity, and enhance the release of enkephalins and endorphins.[35,36]

In the between-group comparisons, level B evidence indicated that HILT is more effective than placebo or sham treatments in pain reduction in individuals with trapezius trigger points.[20,25,26] HILT also demonstrated greater effectiveness than several traditional treatments (combination of stretching exercise, ROM exercise, ultrasound (US), and hot pack,[18] combination of ROM exercise, myofascial release, and stretching exercise,[19] combination of transcutaneous electrical nerve stimulation (TENS), US, and stretching exercise,[30] combination of TENS, US, passive, and isometric exercise[27]). The findings of the present review regarding pain reduction in individuals with MPS are consistent with previous reviews demonstrating the analgesic efficacy of low-level laser therapy in neck and myofascial pain disorders. Some authors have further suggested that HILT may serve as an alternative to low-level laser therapy due to its potentially greater therapeutic effects.[11,37]

Compared with dry needling treatment, no significant differences in pain intensity outcomes were observed following HILT.[21,28,31] Substantial evidence supports the effectiveness of dry needling in the management of myofascial trigger points[38-40]; however, HILT may be preferable due to its non-invasive nature and more favorable safety profile.[21,28,31] The meta-analysis by Alsarhan et al. demonstrated that low-intensity laser therapy provides superior long-term outcomes compared to dry needling for trigger points in the temporomandibular muscles.[41] Moreover, the systematic review by Sadeghnia et al. showed that high-intensity laser therapy and dry needling yield similar effects on pain intensity in individuals with active upper trapezius trigger points.[31] Despite these findings, additional high-quality studies are required to establish stronger clinical recommendations.

Six studies reported significant within-group improvement in PPT following HILT.[19,20,22,28-30] Between studies, the between-group findings were inconsistent. Four studies reported superior effects of HILT,[19,20,29,30] whereas one study found no significant difference[28] and another showed significantly less improvement in PPT compared with the control group.[22]

Laser therapy reduces the release of histamine and bradykinin in injured tissues and stimulates sensory receptors, thereby increasing the pain threshold. Additionally, it may alleviate trigger point pain through direct neural modulation, including the inhibition of A-delta and C fibers and the enhanced release of enkephalins and endorphins.[22,35,42]

In one randomized controlled trial comparing HILT with dry needling, no significant differences were found in PPT between the two interventions.[28] These findings are consistent with the systematic review by Sadeghnia et al, which compared the effects of low-intensity and high-intensity laser therapy with dry needling on the PPT of trigger points. Such discrepancies may be attributed to variations in treatment protocols, laser parameters, target muscles, and follow-up durations across studies. Therefore, additional well-designed trials are required to clarify the relative effectiveness of HILT and dry needling in improving PPT.[38]

Another study compared the effect of neuromuscular manual therapy (NMT) and HILT on trigger points and reported greater improvements in PPT in the NMT group. The superior effect of NMT may be attributed to its multimodal 30-minute treatment protocol, which included techniques such as touch, brushing, kneading, friction, ischemic compression, and stretching. The combination and longer duration of these manual interventions likely produced a stronger therapeutic stimulus. The mechanism behind this response is likely rooted in the capacity of the ischemic compression to induce a rapid increase in local blood flow upon release, leading to greater perfusion.[43] Additionally, it can be hypothesized that NMT provides a stronger analgesic effect for pressure pain by more intensely stimulating Aβ fibers, which in turn inhibits nociceptive signals from Aδ and C fibers.[44] These physiological mechanisms could account for the faster and more pronounced pain-modulating effects of NMT compared with HILT.[22]

Eight of the included studies reported significant within-group improvements in joint ROM following HILT.[19-21,25,26,29,31,32] In the between-group comparisons, six trials[18-20,25-27,30] demonstrated superior effects of HILT compared with control or alternative interventions, whereas two studies found no significant difference.[21,31] The potential mechanisms underlying ROM improvements may be related to the ability of HILT to reduce muscle spasm and decrease neuromuscular excitability by promoting relaxation of actin–myosin cross-bridges within taut bands.[45] Moreover, the high-power pulsed emission used in HILT may exert a photomechanical effect that produces micro-massage of soft tissues, contributing to the relaxation of hyperirritable muscle fibers.[22,42,46]

Based on the between-group comparisons, Level B evidence indicates that HILT is more effective than placebo or sham treatment in improving cervical ROM among patients with upper trapezius trigger points.[20,25,26] Likewise, several studies demonstrated that HILT produced greater improvements in ROM than traditional therapeutic interventions.[18,19,27,30] In contrast, two randomized controlled trials comparing HILT with dry needling reported no significant differences between the two techniques.[21,31] These findings are consistent with previous reviews suggesting that dry needling does not provide superior outcomes compared with HILT.[38,41] Furthermore, the systematic review by Sadeghnia et al. indicated that both low- and high-intensity laser therapies with dry needling have similar effects on ROM in patients with trigger points based on Level C evidence.[38] Collectively, these results highlight the need for additional high-quality trials to determine whether HILT or dry needling offers greater long-term clinical benefit.

Dosage analysis: All articles focus on active trigger points. The recommended dose and type of laser treatment are as follows:

Wavelength of Laser: 1064 nm[20-22,25-28] and 980 nm[27,29,30] have been used in most studies.

Peak Power: The power used for active trigger points typically ranges from 3 to 7 watts,[18,19,21,22,25,26,28,29] and most studies employed a pulsed mode.[18-22,25-28]

Energy Density: Energy density is generally recommended to be between 25 and 50 joules per square centimeter for treating active trigger points.[18-22,25-28,31]

Treatment Time: The duration of treatment sessions is usually between 10 and 15 minutes.[19-21,25,26,29,31]

Limitations

This systematic review explores some limitations. The included studies had small sample sizes and were not blinded, and some focused exclusively on either male or female participants. Few trials incorporated sham controls or follow-up assessments. Due to heterogeneity, a grading system could not be applied to some results. On the other hand, Grade B evidence also indicates that repeated results should be interpreted with caution.

Most of the articles examined the effects of HILT on the upper trapezius muscle with pain in the neck region, emphasizing the need for further research on other muscles, considering their superficial or deep anatomical locations and other orthopedic or neurological disorders. Due to heterogeneity, it appears that meta-analysis with subgroup analyses could strengthen the interpretation of the results. However, more homogeneous studies in terms of methodology are needed for more robust conclusions. More high-quality studies are required to determine the optimal efficacy, dosage, and treatment parameters, such as wavelength, energy, and duration. Future research should also focus on comparing HILT with different control groups, especially dry needling, extending the intervention duration, and incorporating long-term follow-up assessments.

Conclusion

All included studies illustrated improvements in pain intensity, PPT, and joint ROM following HILT therapy. Nevertheless, when these results are compared with other treatment methods, some inconsistencies emerge. According to Level B evidence, HILT has been shown to be more effective than placebo and sham interventions in reducing pain intensity and enhancing ROM in patients with trapezius trigger points.[20,25,26] Additionally, HILT could be more effective than traditional treatments. However, high-quality studies are essential to address current limitations and evaluate improvements in PPT. Such studies should employ distinctive designs, including blinding, inclusion of both sexes, different control groups (particularly dry needling), sham and placebo comparisons, larger sample sizes, and long-term follow-up.

Authors' Contribution

Conceptualization: Mehrdad Sadeghnia, Zinat Kalbali
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Supplementary File

Supplementary file 1. Search strategies.
Supplementary file 2. A comprehensive summary of HILT parameters

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