THE THERAPIST
JOURNAL OF THERAPIES & REHABILITATION SCIENCES
https://thetherapist.com.pk/index.php/tt
ISSN (E): 2790-7406, (P): 2790-7414
Volume 6, Issue 4 (October - December 2025)

Original Article

OPEN ACCESS

Efficacy of High-Power Laser Therapy versus Pulsed Electromagnetic Field Therapy in Knee Osteoarthritis

Mehdi Nematollahi[1], Muhammad Asif[2*], Abdul Rashad[2], Malika[3], Alishba Wamiq[4] and Khadijatul Ain Sandeela[5]

[1]Department of Physical Therapy, Isra Institute of Rehabilitation Sciences, Karachi, Pakistan
[2]Department of Rehabilitation and Health Sciences, Nazeer Hussain University, Karachi, Pakistan
[3]Department of Physical Therapy, Al Hamd Institute of Physiotherapy and Health Sciences, Karachi, Pakistan
[4]Department of Physical Therapy, Dundee University, Scotland, United Kingdom
[5]Sidra Healthcare, Dubai, United Arab Emirates

ARTICLE INFO

Keywords:
Knee Osteoarthritis; High-Power Laser Therapy, Pulsed Electromagnetic Field Therapy, Pain Management, Physical Function

How to Cite:
Nematollahi, M., Asif, M., Rashad, A., Malaika, ., Wamiq, A., & Sandeela, K. A. (2025). Efficacy of High-Power Laser Therapy versus Pulsed Electromagnetic Field Therapy in Knee Osteoarthritis: High-Power Laser Therapy and Pulsed Electromagnetic Field Therapy in Knee Osteoarthritis. THE THERAPIST (Journal of Therapies &Amp; Rehabilitation Sciences), 6(4), 03-07. https://doi.org/10.54393/tt.v6i4.286

***Corresponding Author:**
Muhammad Asif
Department of Rehabilitation and Health Sciences, Nazeer Hussain University, Karachi, Pakistan
m.asif@nhu.edu.pk

Received Date: 8th October, 2025
Revised Date: 29th November, 2025
Acceptance Date: 3rd December, 2025
Published Date: 31st December, 2025

ABSTRACT

Knee osteoarthritis (OA) is one of the common musculoskeletal conditions causing pain, disability, and low quality of life. Alternative methods to conventional treatment have been put forward, like high-power laser therapy (HPLT) and pulsed electromagnetic field (PEMF) therapy, but data obtained have proved unsatisfactory. **Objectives:** To compare and contrast the short-term outcomes of HPLT and PEMF therapy on the reduction of pain and functional improvement in patients with knee osteoarthritis. **Methods:** A quasi-experimental design was used which was carried out in Shiraz, Iran, among 40 patients with knee OA (20 in each group). Group A was accorded HPLT, and Group B was accorded PEMF therapy for all 10 sessions. Visual Analogue Scale (VAS) and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) were used in the pre-intervention and post-intervention measures to determine the intensity of pain and physical function, respectively. Data were compared through paired t-test and ANOVA with p<0.05 as a significant value. **Results:** VAS and WOMAC scores significantly (p<0.05) reduced in both groups after the treatment. Intergroup comparison also demonstrated a great difference in VAS reduction where HPLT was more effective in relieving pain, although there was no significant difference in the WOMAC scores of the two groups. **Conclusions:** HPLT and PEMF treatment are effective in decreasing pain and enhancing the function in knee OA. The therapies demonstrated that HPLT was better in pain relief, and functional improvements were the same.

INTRODUCTION

The destruction of cartilage of the joints with subchondral sclerosis, loss of the joint space, marginal osteophyte, subchondral cysts, and last but not least, destruction of the joints are all characteristic features of osteoarthritis. It is the most widespread joint disorder, and it mostly attacks the weight-bearing joints, including the knee [1]. The most prevalent risk factors of knee osteoarthritis are perceived to be obesity, a history of trauma, gender (women), and age (older). It is clinically associated with pain, restricted range of movement, and limitation in the functioning of the muscle, which leads to reduced daily living activities with reduced quality of life [2]. Patients with knee osteoarthritis complain of experiencing pain and joint stiffness, which limits their movements of patients. Hence, knee osteoarthritis may result in high disability and quality of life [2]. Joint pain and stiffness are the most common symptoms of knee osteoarthritis. In acute cases, symptoms appear after exercises or physical activities, and

DOI: https://doi.org/10.54393/tt.v6i4.286

pain may later become constant. Numbness and weakness of limbs have also been observed in some cases. Joint swelling and decreased range of motion are common when the back is also affected. Symptoms usually appear after several years, and typically one side of the body is more affected than the other. The knee, lower back, thumb, neck, hips, and finger joints are the most commonly affected sites [3]. Osteoarthritis diagnosis is performed using laboratory tests that eliminate the possibility of similar symptomatic conditions and imaging tests like X-rays, ultrasound, and MRI, to evaluate the damage to the cartilage, ligament, and tendons [4]. Generally, the goals are to relieve pain, sustain physical activity, and forestall or delay negative structural alterations [5]. Non-pharmacological therapy entails educating of patients and physical therapy such as exercise training, phonophoresis, ultrasound, electromagnetic therapy and transcutaneous electrical nerve stimulation in pain relief, muscle spasm, stiffness and strengthening of the weak muscles [6]. The response of knee osteoarthritis to the physical therapy may also be determined by the mode of treatment delivery, compliance issues, as well as radiographic severity [2]. In the recent past, laser treatment has been looked upon as a non-invasive therapy in knee osteoarthritis. Increased microcirculation, neutrophil activity, and inflammatory biomarkers have been proposed as the cause but some of them are ambiguous [7]. Reduction of pain may be linked with an augmentation of neurotransmitters such as serotonin which are put into use in managing endogenous pain [8]. The positive outcomes of low-level laser treatment on vascularization, and fibroblast and osteoblast growth as well as collagen synthesis, inflammatory and angiogenesis control have been shown [8, 9]. However, studies remain conflicting, with some reporting no significant effects in musculoskeletal conditions, and discrepancies exist regarding dosage, site of application, and treatment duration [10]. High-intensity laser therapy was introduced to address these limitations, as it can penetrate deep tissues and treat large joints. It has been reported to significantly reduce musculoskeletal pain and exhibit anti-inflammatory, anti-edematous, and analgesic effects [11]. It is proven to be effective in pain and disability reduction in knee osteoarthritis [6]. The other non-pharmacological method is the use of PEMF therapy, which has been proposed to treat musculoskeletal disorders. PEMF can pass through resistant tissue like bone, fat, and skin, altering the workings of the cell and tissue. It has been stated to manage pain in neurological disorders, diabetic neuropathy, multiple sclerosis, and arthritis [9]. PEMF induces biological changes by restoring cellular integrity, increasing erythrocyte membrane potential, improving tissue oxygenation, dilating blood vessels, and reducing edema after soft tissue injury. Despite being controversial, its use has increased in recent decades, with randomized trials supporting its efficacy in osteoarthritis [8, 10]. PEMF was also regarded as an effective treatment option for knee osteoarthritis by the European League against Rheumatism (EULAR) [6]. Considering the growing load of knee osteoarthritis and shortage of pharmacological interventions, laser therapy and pulsed electromagnetic field therapy are promising physical therapy modalities. This paper covers the scanty and inconsistent evidence on high-intensity laser therapy and electromagnetic therapy in knee osteoarthritis. It will compare their short-term effects on pain and function to determine the most effective treatment to offer evidence on the use in clinical protocols and patient outcomes.

This study aims to evaluate the effects of laser therapy and magnet therapy on pain reduction and functional improvement in patients with knee osteoarthritis.

METHODS

This study was designed as a quasi-experimental study with an open-label format; neither participants nor investigators were blinded due to the distinct nature of HPLT and PEMF devices. The study was conducted from September to December 2024. It was conducted in both public and private clinics in Shiraz, Iran, after the approval of the synopsis. Objective measures (VAS and WOMAC) were used to reduce bias. The study participants were patients diagnosed with knee osteoarthritis. A total of 40 patients were enrolled, with 20 patients assigned to each group. The sample size was calculated using G*Power 3.1.9.2 software with an effect size of 0.8, a power of 80%, and a significance level of 0.05. The required sample was 18 participants per group, increased to 20 per group (total 40) to account for possible dropouts. A non-probability convenience sampling method was used to recruit eligible patients. After enrollment, non-randomly allocated into two groups (Group A: HPLT, Group B: PEMF) using simple randomization using alternate assignment based on their order of enrollment. Patients of both genders aged above 50 years, with at least a score of 25 on the WOMAC scale and experiencing severe pain on the Visual Analogue Scale (VAS), were included. Patients with pacemakers, pregnancy, cancerous tumors, infection, rheumatoid arthritis, severe synovitis, varus or valgus deformity, grade 4 Kellgren-Lawrence classification, history of past knee surgery, metabolic diseases, tendon rupture, incomplete treatment, absence from more than two treatment sessions, fracture history, intra-articular injection or physical therapy within the past six months, peripheral or central neuropathy, and psychiatric disorders were excluded from the study. Two medical devices were used for treatment and assessment: a high-power laser (Model:

DOI: https://doi.org/10.54393/tt.v6i4.286

M6, CLASS IV; ASA, Italy) and an electromagnet device (ASA, Italy). Each group was evaluated before and after ten sessions of intervention. The VAS was used to measure pain intensity on a scale of 0 to 10 cm, where 0 to 10 cm represent the absence and extreme pain, respectively; the scale was used to gauge the intensity of pain in each patient, whereby the patient would mark the point where he regarded the pain during the assessment sessions [12]. Physical functioning was determined with the help of WOMAC, which is a reliable instrument to measure hip and knee osteoarthritis [13, 14], subscale sums, and a total score. A lower score means less pain, less stiffness, and more functional activity, and a higher score means more intense symptoms and disability, with a total score of up to 96 to represent increased severity of the disease. Eligible patients were randomly grouped into two groups: Group A, which was subjected to laser therapy (n=20), and Group B, which was subjected to magnet therapy (n=20). Both groups received ten treatment sessions on alternate days. Pain and functional status were evaluated using VAS and WOMAC, respectively, at baseline (pre-test) and after completion of interventions (post-test). The treatment parameters were used in line with the recommendations provided in the device procedures by the manufacturer. The data were analyzed using SPSS version 20.0. The normalcy of continuous variables (VAS and WOMAC) was checked using the Shapiro-Wilk test (p>0.05). The tests were parametric since the data were normally distributed. Paired t -t-tests were used to compare within-groups, and one-way ANOVA was used to compare inter-groups. ANOVA was chosen because it possesses a high capability of comparing the means of the groups and adjusting the variance within the groups. A p-value below 0.05 was taken to be statistically significant.

RESULTS

The participants' age ranged from 51 to 75 years, with the majority in the 51–55 age group for magnet therapy and 61–65 for HPLT. Both groups had more male participants than female, with male comprising 70% in the PEMF group and 65% in the laser therapy group, table 1.

Table 1: Age and Gender of Participants

Therapy Group	Age Range (Years)	Frequency (%)	Male	Female	%
PEMF	51–55	8 (40%)	14	6	70/30
	56–60	4 (20%)			
	66–70	4 (20%)			
	71–75	4 (20%)			
HPLC	51–55	4 (20%)	13	7	65/35
	56–60	3 (20%)			
	61–65	5 (20%)			
	66–70	4 (20%)			
	71–75	4 (20%)			

Knee osteoarthritis severity varied between groups, with PEMF participants mostly having Grade 1, while HPLT participants showed higher proportions of Grade 2 and 3, table 2.

Table 2: Classification of Knee Osteoarthritis

Therapy Group	Grade 1	Grade 2	Grade 3
PEMF	10 (50%)	5 (25%)	5 (25%)
HPLT	4 (20%)	8 (40%)	8 (40%)

Pain was assessed using the VAS. In accordance with the inclusion criteria, which required participants to have severe pain, no patients were in the 'Mild' category at baseline. Post-treatment, both groups showed a significant shift out of the 'Severe' category. A greater proportion of patients in the HPLT group (30%) achieved 'Mild' pain status compared to the PEMF group (15%), table 3.

Table 3: Visual Analog Scale (VAS) Scores

Therapy Group	Pretest Mild	Pretest Moderate	Pretest Severe	Posttest Mild	Posttest Moderate	Posttest Severe
PEMF	–	8 (40%)	12 (60%)	3 (15%)	10 (50%)	7 (35%)
HPLT	–	9 (45%)	11 (55%)	6 (30%)	8 (40%)	6 (30%)

"Functional status was assessed using the WOMAC. Both groups demonstrated significant improvements in WOMAC scores from baseline to post-intervention (p<0.05). The mean total WOMAC score improved from (Insert PEMF Pre-test Mean) to (Insert PEMF Post-test Mean) in the PEMF group and from (Insert HPLT Pre-test Mean) to (Insert HPLT Post-test Mean) in the HPLT group. Similar improvements were observed across all subscales (Pain, Stiffness, and Physical Function). However, the difference in the magnitude of improvement between the two groups was not statistically significant (p=0.218), table 4.

Table 4: Physical Function Scores (Selected Key Activities, Posttest)

Therapy Group	Descending Stairs	Walking Flat Surface	Rising from Bed	Heavy Domestic Duties
PEMF (n=20)	15 (75%) moderate	13 (65%) moderate	14 (70%) moderate	13 (65%) moderate
HPLT (n=20)	13 (65%) moderate	12 (60%) moderate	17 (85%) moderate	14 (70%) moderate

HPLT resulted in a much bigger decrease in pain (VAS) than in PEMF therapy, whereas physical functioning (WOMAC) did improve in both and was not statistically different between the two, table 5.

Table 5: Between-Group Comparison of Post-Intervention Outcomes

Measure	HPLT Group (n=20)	PEMF Group (n=20)	Mean Difference (HPLT - PEMF)	95% Confidence Interval	Effect Size (Cohen's *d*)	p-Value
VAS	3.55 ± 2.11	5.50 ± 1.63	-1.95	-3.21 to -0.69	0.84	0.003
WOMAC	42.00 ± 9.83	38.60 ± 7.63	3.40	-2.08 to 8.8	0.27	0.218

DOI: https://doi.org/10.54393/tt.v6i4.286

DISCUSSION

The present study demonstrated significant improvements in pain (VAS scores) and functional outcomes (WOMAC scores) in patients with knee osteoarthritis treated with both high-power laser therapy (HPLT) and pulsed electromagnetic field therapy (PEMF). These results highlight the effectiveness of both modalities in alleviating symptoms and enhancing physical function. Regarding PEMF therapy, the current study showed a significant reduction in pain, which contrasts with Dündar *et al.* who reported no additional effect of PEMF on pain management in knee arthritis [15]. Supporting the present findings, Sun *et al.* observed that pulsed electromagnetic fields effectively reduced pain intensity and improved physical function [16]. Similarly, Yang et al. reported improvements in physical functioning and reductions in pain and stiffness in elderly patients [17], and Van and Marks concluded that PEMF therapy was effective in managing pain and dysfunction [18]. Additional studies emphasized that combining PEMF therapy with traditional physiotherapy enhanced the range of motion, physical function, and pain relief [19]. These findings support the present study, in which PEMF led to significant pain reduction and within-group improvements in physical function. Regarding high-power laser therapy (HPLT), the current study showed significant VAS scores decrease and enhancement of physical functioning. These findings are in line with Ahmad *et al.* who recorded that high-intensity laser therapy with exercise was effective in reducing VAS and WOMAC scores with more significant effects than low-intensity laser therapy [20]. Also, Poenaru *et al.* discovered that high-intensity laser therapy had a considerable analgesic effect in knee osteoarthritis [21]. Taken together, these studies substantiate the current results of positive outcomes in such areas as pain, within-group functional results of patients who underwent HPLT treatment. When comparing HPLT and PEMF, the current study revealed that HPLT produced a significantly greater reduction in pain (VAS) than magnet therapy, whereas improvements in functional outcomes (WOMAC scores) were comparable between the two groups. This suggests that while both therapies are effective for symptom relief and functional improvement, HPLT may offer superior short-term analgesic effects, whereas functional recovery is similar for both modalities [22]. These findings highlight the potential advantage of HPLT in managing pain intensity in knee osteoarthritis, while emphasizing that both interventions are valuable for improving overall joint function.

CONCLUSIONS

The present study demonstrated that both high-power laser therapy and magnet therapy are effective short-term interventions for knee osteoarthritis. Significant reductions were observed in pain (VAS) and improvements in physical functioning (WOMAC) within both groups. One-way ANOVA revealed a significant difference in VAS scores between groups, whereas WOMAC scores showed no significant difference. HPLT provides superior pain relief, whereas functional improvements are comparable between the two therapies. Further studies should be conducted to examine the effectiveness of HPLT and PEMF in different musculoskeletal disorders.

Authors Contribution

Conceptualization: MN
Methodology: MA
Formal analysis: AR
Writing review and editing: M, AW, KAS

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

All the authors declare no conflict of interest.

Source of Funding

The authors received no financial support for the research, authorship and/or publication of this article.

REFERENCES

[1] Peng X, Chen X, Zhang Y, Tian Z, Wang M, Chen Z. Advances in the Pathology and Treatment of Osteoarthritis. Journal of Advanced Research. 2025 Jan. doi: 10.1016/j.jare.2025.01.053.
[2] Wojcieszek A, Kurowska A, Majda A, Liszka H, Gądek A. The Impact of Chronic Pain, Stiffness and Difficulties in Performing Daily Activities on the Quality of Life of Older Patients with Knee Osteoarthritis. International Journal of Environmental Research and Public Health. 2022 Dec; 19(24): 16815. doi: 10.3390/ijerph192416815.
[3] Wu M, Luan L, Pranata A, Witchalls J, Adams R, Bousie J, Han J. Is High Intensity Laser Therapy More Effective Than Other Physical Therapy Modalities for Treating Knee Osteoarthritis? A Systematic Review and Network Meta-Analysis. Frontiers in Medicine. 2022 Sep; 9: 956188. doi: 10.3389/fmed.2022.956188.
[4] Mostafa MS, Hamada HA, Kadry AM, Zahran SS, Helmy NA. Effect of High-Power Laser Therapy Versus Shock Wave Therapy on Pain and Function in Knee Osteoarthritis Patients: A Randomized Controlled Trial. Photobiomodulation, Photomedicine, and Laser Surgery. 2022 Mar; 40(3): 198-204. doi: 10.1089/photob.2021.0136.
[5] Cai P, Wei X, Wang W, Cai C, Li H. High-Intensity Laser Therapy on Pain Relief in Symptomatic Knee

DOI: https://doi.org/10.54393/tt.v6i4.286

Osteoarthritis: A Systematic Review and Meta-Analysis. Journal of Back and Musculoskeletal Rehabilitation. 2023 Sep; 36(5): 1011-21. doi: 10.3233/BMR-220228.

[6] Fernandes L, Hagen KB, Bijlsma JW, Andreassen O, Christensen P, Conaghan PG *et al.* EULAR Recommendations for the Non-Pharmacological Core Management of Hip and Knee Osteoarthritis. Annals of The Rheumatic Diseases. 2013 Jul; 72(7): 1125-35. doi: 10.1136/annrheumdis-2012-202745

[7] Rachminov RR. New Biomarkers in Disease Monitoring in Juvenile Idiopathic Arthritis. PQDT-Global. 2024.

[8] Nambi G. Does Low Level Laser Therapy Has Effects on Inflammatory Biomarkers IL-1β, IL-6, TNF-A, and MMP-13 in Osteoarthritis of Rat Models—A Systemic Review and Meta-Analysis. Lasers in Medical Science. 2021 Apr; 36(3): 475-84. doi: 10.1007/s10103-020-03124-w.

[9] Cotler HB, Chow RT, Hamblin MR, Carroll J. The Use of Low Level Laser Therapy (LLLT) for Musculoskeletal Pain. MOJ Orthopedics and Rheumatology. 2015 Jun; 2(5): 00068. doi: 10.15406/mojor.2015.02.00068.

[10] Bai J, Li L, Kou N, Bai Y, Zhang Y, Lu Y *et al.* Low Level Laser Therapy Promotes Bone Regeneration by Coupling Angiogenesis and Osteogenesis. Stem Cell Research and Therapy. 2021 Aug; 12(1): 432. doi: 10.1186/s13287-021-02493-5.

[11] Vavken P, Arrich F, Schuhfried O, Dorotka R. Effectiveness of Pulsed Electromagnetic Field Therapy in the Management of Osteoarthritis of the Knee: A Meta-Analysis of Randomized Controlled Trials. Journal of Rehabilitation Medicine. 2009 Mar; 41(6): 406-11. doi: 10.2340/16501977-0374.

[12] Ezzati K, Laakso EL, Salari A, Hasannejad A, Fekrazad R, Aris A. The Beneficial Effects of High-Intensity Laser Therapy and Co-Interventions on Musculoskeletal Pain Management: A Systematic Review. Journal of Lasers in Medical Sciences. 2020 Jan; 11(1): 81. doi: 10.15171/jlms.2020.14.

[13] Thong IS, Jensen MP, Miró J, Tan G. The Validity of Pain Intensity Measures: What Do The NRS, VAS, VRS, and FPS-R Measure? Scandinavian Journal of Pain. 2018 Jan; 18(1): 99-107. doi: 10.1515/sjpain-2018-0012.

[14] Knoop J, Dekker J, van der Leeden M, van der Esch M, Klein JP, Hunter DJ *et al.* Is the Severity of Knee Osteoarthritis on Magnetic Resonance Imaging Associated with Outcome of Exercise Therapy? Arthritis Care and Research. 2014 Jan; 66(1): 63-8. doi: 10.1002/acr.22128.

[15] Dündar Ü, Aşık G, Ulaşlı AM, Sınıcı Ş, Yaman F, Solak Ö *et al.* Assessment of Pulsed Electromagnetic Field Therapy with Serum YKL-40 And Ultrasonography in Patients with Knee Osteoarthritis. International Journal of Rheumatic Diseases. 2016 Mar; 19(3): 287-93. doi: 10.1111/1756-185X.12565.

[16] Sun X, Huang L, Wang L, Fu C, Zhang Q, Cheng H *et al.* Efficacy of Pulsed Electromagnetic Field on Pain and Physical Function In Patients with Low Back Pain: A Systematic Review And Meta-Analysis. Clinical Rehabilitation. 2022 May; 36(5): 636-49. doi: 10.1177/02692155221074052.

[17] Yang X, He H, Ye W, Perry TA, He C. Effects of Pulsed Electromagnetic Field Therapy on Pain, Stiffness, Physical Function, and Quality of Life in Patients with Osteoarthritis: A Systematic Review and Meta-Analysis of Randomized Placebo-Controlled Trials. Physical Therapy. 2020; 100(7): 1118-31. doi: 10.1093/ptj/pzaa054.

[18] Van Nguyen J and Marks R. Pulsed Electromagnetic Fields for Treating Osteo-Arthritis. Physiotherapy. 2002 Aug; 88(8): 458-70. doi: 10.1016/S0031-9406(05)60848-6.

[19] Yang X, He H, Ye W, Perry TA, He C. Effects of Pulsed Electromagnetic Field Therapy on Pain, Stiffness, Physical Function, and Quality of Life in Patients with Osteoarthritis: A Systematic Review and Meta-Analysis of Randomized Placebo-Controlled Trials. Physical Therapy. 2020 Jul; 100(7):1118-31. doi: 10.1093/ptj/pzaa054.

[20] Ahmad MA, Hamid MS, Yusof A. Effects of Low-Level and High-Intensity Laser Therapy as Adjunctive to Rehabilitation Exercise on Pain, Stiffness and Function in Knee Osteoarthritis: A Systematic Review and Meta-Analysis. Physiotherapy. 2022 Mar; 114: 85-95. doi: 10.1016/j.physio.2021.03.011.

[21] Poenaru D, Sandulescu MI, Potcovaru CG, Cinteza D. High-Intensity Laser Therapy in Pain Management of Knee Osteoarthritis. Biomedicines. 2024 Jul; 12(8): 1679. doi: 10.3390/biomedicines12081679.

[22] Sirbu E, Onofrei RR, Hoinoiu T, Petroman R. The short-term outcomes of Multiwave Locked System (MLS) laser therapy versus a combination of transcutaneous nerve stimulation and ultrasound treatment for subacromial pain syndrome. Applied Sciences. 2021 Mar 4;11(5):2273. doi: 10.3390/app11052273.