

# Effect of High-Level Laser Therapy on Alleviating Pain in Osteoarthritic Knee: A Narrative Review

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**Abstract:** ***Introduction:** Osteoarthritic knee is one of the most chronic disorder characterized by degeneration of the articular cartilage accompanied by pain, dysfunction. To treat this condition, recently a new form of laser therapy- high level laser therapy has been proved to have beneficial effect in alleviating pain. **Aim:** To understand the efficacy of high level laser therapy in the treatment of osteoarthritic knee. **Objective:** This narrative review is to evaluate the benefits of high level laser therapy in alleviating pain among patients with osteoarthritic knee. **Background:** High Level Laser Therapy is the new form of laser that consists of high wavelength, high power output. According to the recent studies, it has a greater penetration power into the deeper tissues by analgesic method of application, hence HLLT has been utilized for treating a wide variety of musculoskeletal problems. **Results:** High Level Laser Therapy when used for the clinical treatment purposes, has shown to promote synovial fluid thickening, even increasing the thickness of femoral cartilage all these contributing towards greater pain reduction in knee osteoarthritis. **Conclusion:** Use of HLLT is still under study to determine its efficacy in treating the most prevalent disorder-the knee osteoarthritis, even though applied in a shorter dosage.*

**Keywords:** High Level Laser Therapy, Osteoarthritis of knee, Pain, Laser Therapy

## 1. Introduction

Knee osteoarthritis is the most chronic disorder occurring among the elderly <sup>(1)</sup>. It is characterized by the loss of articular cartilage, inflammation <sup>(2,3)</sup>. The major symptom is pain that limits the functional activities. It is one of the major causes of disability <sup>(4)</sup>. Various other symptoms seen are muscular atrophy, stiffness, alterations in the articular cartilage and other passive structures like capsules, ligaments. <sup>(5,6)</sup>

Factors that associate with the causation of knee osteoarthritis are age, gender, heredity, knee trauma<sup>(7)</sup>. All these contribute in the osteoarthritis leading to pain due to bursitis, osteophyte formation, tendinitis <sup>(8)</sup>. The management includes the various treatment options like pharmacological and non-pharmacological methods like medication, exercise, ultrasound, laser therapy, hot pack treatment, TENS <sup>(4,9-11)</sup>. All these focus on pain alleviation, improving the functionality. <sup>(12)</sup>

In recent years, Laser therapy has been shown to have positive effects in the treatment of pain in patients suffering from knee osteoarthritis<sup>(9)</sup>. It is painless<sup>(13)</sup> and non-invasive method<sup>(7)</sup>.

Among both low level laser therapy [LLLT] and high level laser therapy [HLLT], HLLT has been found to have positive effects in the treatment of knee osteoarthritis. <sup>(9,14)</sup>

HLLT is a novel form of treatment option adapted recently for the osteoarthritic treatment <sup>(13,15)</sup>. It is a potent physical method and has various analgesic, anti-inflammatory, photochemical, photothermal effect <sup>(11,16)</sup>. It is advantageous as it has higher duration and deeper wavelength thereby penetrates into deeper tissues<sup>(17)</sup>. According to various studies, it has been shown to have greater impact on reducing a significant amount of pain as it can stimulate the joints more deeply-especially the neodymium-doped yttrium aluminum garnet (Nd:YAG) form of laser. <sup>(11)</sup>

HLLT causes increased oxygenation, thereby increased ATP production and increased metabolism and microcirculation<sup>(4)</sup>. It can stimulate tissue repair, and tissue regeneration with lymphatic and vascular activation<sup>(17)</sup>

Thereby, this narrative review is taken up to investigate the HLLT efficacy on pain alleviation in chronic knee OA condition.

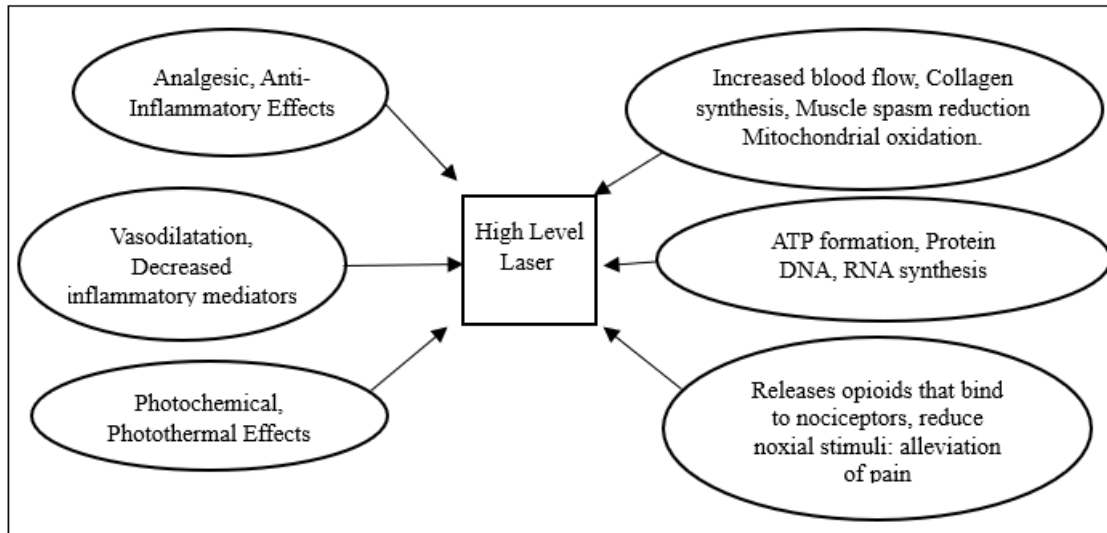


Figure 1: Pathophysiological effects of High Level Laser Therapy in alleviating pain. (1,3-5,9,18)

## 2. Methodology

The literature was reviewed from various databases like Scholar, Pubmed, CrossRef in between the years 2013-2024 using the keywords like “osteoarthritis”, “High Level Laser Therapy”, “Knee osteoarthritis”, “High Intensity Laser Therapy”, “HLLT”.

The inclusion criteria: i) papers containing randomized controlled trials. ii) papers focussing on the use of high level laser therapy in alleviating pain in patients suffering from

knee osteoarthritis. iii) studies based on comparison of HLLT with other interventions like low level laser, placebo, exercise therapy, sham laser. The exclusion criteria: i) the studies in which the use of HLLT is based only on improving range of motion, balance.

On the whole, a total number of 36 articles were selected. The articles selected are in English with full text accessible. During the process of assessing the eligibility for the narrative review, 14 articles were excluded with reasons represented in Figure 2. Finally, 14 articles are considered for the narrative review.

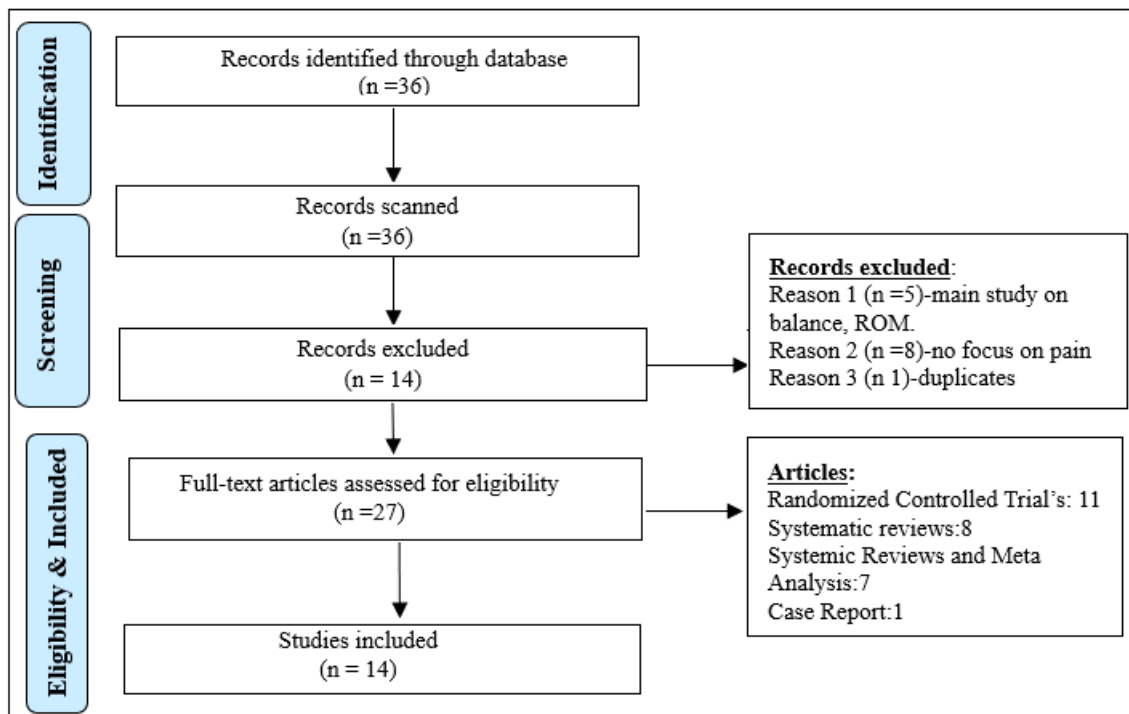


Figure 2: A flowchart of the search strategy.

## 3. Results

### Characteristics of included studies

The study design, sample sizes and groups, various types of interventions, outcome measures, follow up were all included

in the Table 1. All the studies were RCT’s comparing the use and efficacy of HLLT in the treatment of patients with knee osteoarthritis along with co-interventions like exercise, placebo, sham laser, CPT. The mean age of all the study population ranges from 50 to 70 years. The final evaluation

ranged from normal pre and post treatment and 6 weeks to 4 months. Pain, ROM, stiffness, function were all assessed with VAS, WOMAC, KOOS scales.

**Clinical outcomes**

In all the studies assessing pain perception, HLLT usage has shown to have greater effect in the reduction of pain, mainly

through the values of VAS scales. Even the studies measuring the other variables like function, stiffness as assessed by WOMAC scale are even shown to have major significant improvement. There were no side effects observed in all the studies that used HLLT for the treatment of pain.

**Table 1:** Characteristics of included studies

Author, Year of Publication	Study Design	Sample Size	Mean Age, SD	Outcome Measure and Follow-Up	Intervention
Poenaru et al, 2024	Review	HLLT and Control Groups		VAS, WOMAC, 6MWT, KOOS 10 days to 12 weeks	
Kulkarni et al, 2024	Case Report		73 years	VAS, WOMAC, NPRS, MWT Follow-up 0-12 days	Laser Therapy, Ex, Ultrasound.
Taheri et al, 2023	RCT	HLLT group(n=26) Control group(n=26)	52.27±8.30 57.08±8.06	VAS, WOMAC Follow up after 3 months	HLLT Others
Astri et al, 2023	RCT	Control group(n=31) HLLT group(n=30)	59.55±7.22 61.93±7.15	VAS Follow up upto 6 therapies	LLLT HLLT
Ahmad et al, 2023	RCT	Control group(n=17) HLLT group(n=17)	57.94±10.56 51.18±9.79	KOOS, NPRS Follow up after 12 weeks	LLLT+Ex HLLT+Ex
Silva et al, 2023	Review	HLLT and Control Groups		VAS, WOMAC, dolorimeter Follow up 2 weeks to 6 months	
Sriratna et al, 2022	RCT	HLLT group(n=21) Control group(n=21)	66.1±8.4 65.0±8.5	VAS, WOMAC Follow up after 6 weeks; 4-12 weeks	HLLT Sham Laser
Viliani et al, 2022	RCT	HLLT group(n=16) Control group(n=18)	65.5±1 67.2±3	WOMAC Follow up after 4 months	HLLT
Koevska et al, 2021	RCT	HLLT group(n=36) Control group(n=36)	61.36±8.14 60.36±7.45	VAS Follow up after 10 therapies	HLLT LLLT
Wysynka et al, 2018	Review	HLLT and Control Groups		VAS, WOMAC, dolorimeter Follow up after 1-4 months	
Ciplak et al, 2018	RCT	Control group HLLT group	56.91±7.86 51.62±10.3	VAS, WOMAC Follow up after 6 weeks	Hotpack+ TENS+US HLLT+ Hotpack
Nazari et al, 2018	RCT	HLLT group(n=30) Control group(n=30) Control group(n=30)	61.5±3.9 62.4±3.14 62.24±3.87	VAS, WOMAC Follow up after 4 and 12 weeks	HLLT CPT ET
Joo Kim et al, 2016	RCT	Control group(n=10) HLLT group(n=10)	65.5±4.0 65.3±4.2	VAS, WOMAC Follow up during pre and post treatment	CPT CPT+HLLT
Kheshie et al, 2014	RCT	HLLT group(n=20) Control group(n=18) Control group(n=15)	52.1±6.47 56.56±7.86 55.6±11.02	VAS, WOMAC Follow up after 6 weeks	HLLT LLLT+ Ex Placebo+ Ex

[HLLT: High Level Laser Therapy, CPT: Conventional Physical Therapy, US: Ultrasound  
ET: Exercise Therapy, TENS: Transcutaneous electrical nerve stimulation, LLLT: Low Level Laser Therapy  
VAS: Visual Analog Scale, WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index,  
KOOS: Knee Injury and Osteoarthritis Outcome Score, OA: Osteoarthritis, KO: Knee Osteoarthritis,  
NPRS: Numerical pain rating scale]

**4. Discussion**

This narrative review is done to understand the effect of high level laser therapy in the pain alleviation on treatment of patients with knee osteoarthritis. HLLT is a recent therapy used to treat various musculoskeletal conditions causing pain, function, stiffness. Various studies included has shown that the HLLT has shown to significantly cause reduction in the VAS and WOMAC scales. Results of our review has shown that HLLT provides efficient pain relief. HLLT has longer wavelength and has a greater penetration in the deeper tissues. It has been shown to produce various effects in reducing pain in patients suffering from knee OA.

Astri et al compared HLLT and LLLT effects on pain relief in patients with knee OA. 61 patients were randomized into two groups. The study has shown greater improvement in VAS

score causing pain reduction after the treatment with HLLT compared to LLLT.

Koevska et al also conducted an RCT that compared the effects of HLLT and LLLT effects on pain relief, resulting in significant pain reduction after the treatment with HLLT on the basis of assessment of VAS score.

Ahmad et al had conducted a double blind RCT that has shown that the treatment providing HLLT+Ex was beneficial in reducing the pain when compared with the control group receiving LLLT+Ex and even has improved the functional ability.

Ciplak et al’s research has shown that HLLT+Hotpack can reduce pain efficiently compared to other treatment options.

Another RCT conducted by Nazari et al has shown that the application of HLLT has shown greater relief in patients when compared to control groups that received LLLT and Ex.

Joo Kim et al concluded from their research that application of HLLT+CPT has significant decline in both the VAS, K-WOMAC in comparison with CPT.

Kheshie et al study shows that HLLT combined with exercise is more effective in decreasing pain and increasing functional performance than placebo laser with exercise.

Some studies have investigated the pain alleviation in KOA patients which is very much significant when treated with HLLT+ exercise, indicating the beneficial effects of HLLT when given with exercise.

Pain being the chief complaint in patients with knee OA restricts the patients from performing ADL's. Knee osteoarthritis also causes decreased muscle strength and joint mobility. Hence the application of HLLT has shown to cause significant effects that alleviate pain. HLLT has shown to have anti-inflammatory and analgesic effects. It has photothermal and photochemical effects that on the tissues thereby causing collagen production, improved vascular permeability, nerve fiber regeneration, mitochondrial oxidation, ATP formation<sup>(9,12,18)</sup>

Laser therapy irradiation causes vasodilation thereby improving blood flow and nutrition to the particular site of injury. Even though LLLT is effective in the treatment of knee osteoarthritis, HLLT is proven to be much more strong and effective treatment option for knee osteoarthritis, as per various studies. It is also considered safe as have no adverse side effects after treatment.

HLLT has the ability to improve the functional ability as the pain is decreased according to various studies. It decreases the inflammatory mediators and reduces inflammation and even helps in the reduction of edema by fluid exudation. It even causes reduction in the muscle spasm and stiffness. The application of HLLT is also said to cause tissue healing.

The main benefit is that it helps in reducing pain is through the . Even the anti-inflammatory effect blocking cyclooxygenases and lipooxygenases.<sup>(19)</sup>Even the reduction in pain causes a significant increase in the range of motion of patient thereby increasing the quality of life of patient.

Overall, the review shows the superiority of HLLT in the alleviation of pain in knee osteoarthritis compared to LLLT.

## 5. Conclusion

HLLT could be a promising modality in alleviating KOA pain, according to the studies. It is more effective in pain reduction and in the improvement of functional ability. Patients treated with HLLT showed better results, compared to patients treated with LLLT. It is clinically relevant in providing a potent pain-reducing effect. It improved VAS, WOMAC scores in patients suffering from Knee Osteoarthritis.

## 6. Limitations and Future Considerations

This study has certain limitation that there are limited number of studies with poor methodology and less sample size. For future consideration the study should include larger sample size with well-defined methodology to provide the effect of high level laser on pain alleviation in OA knee condition.

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