



Effect of low level laser therapy along with exercise in osteoarthritis knee- An experimental study

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Abstract

Background and Purpose: Osteoarthritis is a major cause of impairment and disability among elderly. Physical therapy as a treatment in knee OA aims to increase ROM, decreased pain and improve daily functional activities. Knee O A patient complains of pain, reduction in ROM and functional limitations. Study was done to assess effect of exercise along with exercise in patients with knee osteoarthritis.

Material & Methodology: It was an experimental study. 30 patients were taken as per the inclusion and exclusion criteria, which were divided in two groups and given LLLT (3days/week) for 3 weeks followed by exercise protocol for 8 weeks as per allotted group. The pain, ROM, QOL was recorded post intervention.

Results: There was statistical significant reduction in pain, increase ROM, increase QOL post intervention. (pvalue <0.006). On comparison of control vs experimental group there was a significant reduction in pain (WOMAC: 21.41±7.15vs 15.73±3.63), QOL (Lequesne questionnaire 7.57±2.32vs 5.37±1.73), ROM (128.73±4.95vs132.73±2.43) respectively.

Discussion and Conclusion: Low Level Laser Therapy along with exercise is helpful in improvement of pain, functionality, activity and ROM in patients with OA knee.

Keywords: osteoarthritis, low level laser therapy, exercise, VAS, WOMAC, lequesne questionnaire

Introduction

Osteoarthritis of the knee is reported to be a major health problem worldwide [1,2]. This type of joint disease affects approximately 80% of the population by the age of 65.¹ According to the World Health Report, 2002 OA is the fourth leading cause of years lived with disability [2]. It is estimated that by 2030 the prevalence of symptomatic OA will reach 30% attributed to increasing life expectancy and the rising number of persons with obesity [3, 4]. OA is a major cause of disability and is among the most frequent forms of musculoskeletal disorders [5]. It is characterized pathologically by both focal loss of articular cartilage, marginal and central new bone formation [6]. It is a complex disease whose etiology bridges biomechanics and biochemistry. Evidence is growing for the role of systemic factors (such as genetics, dietary intake, estrogen use, and bone density) and of local biomechanical factors (such as muscle weakness, obesity, and joint laxity). These factors are particularly important in weight-bearing joints [7].

OA most commonly affects hands, feet, spine and the large weight bearing joints such as hip and knee [1, 8]. According to Centre for Disease Control, the lifetime risk of developing OA of the knee has been estimated at 46 % [1].

OA is caused by wear and tear on the knee joint. When cartilage begins to wear down in the knee joint, the bone begins to get exposed and irritated, Sometimes causing bone spurs to form [9]. Clinical manifestations include joint pain, stiffness, decreased ROM, muscle weakness, proprioceptive changes [9], difficulty in activities of daily living (ADL) such as walking, climbing, descending stairs and housekeeping [10]. This is often worse in the morning, after sitting or driving for a while and going down stairs.

Joint pain is the dominant symptom when the joint is moved and relieved with rest [4]. Persistent pain even during rest or

at nocturnal rest may be a sign of advance OA [11]. Person with knee OA tend to avoid physical activity in an attempt to relieve pain [4]. It shows that the behavior overtime reduce the strength of muscles of the knee joint and reduce the ROM. Pain and decreased ROM in affected joints are important risk factors for the occurrence of functional disability [4, 12].

The objectives of the management of knee OA are pain relief, maintenance and improvement of mobility and minimizing disability. International guidelines for treatment of knee OA provides a patient centered a holistic approach to the disease and a balanced combination of pharmacological and non-pharmacological modalities [13].

Non-Steroidal Anti- Inflammatory Drugs (NSAIDs) are widely used to treat the pain and stiffness associated with osteoarthritis, the high incidence of serious upper gastrointestinal side effects with NSAIDs can limit their use. [14] To avoid or to reduce the side effects associated with NSAIDs, physical agents such as US, TENS and Muscle strengthening exercise are frequently used [14-19].

Regular participation in physical activity has been recognized for several years as being beneficial in management of knee OA. [20, 21, 22] while there is agreement that exercise therapy can be helpful. The effect of exercise therapy on pain, quadriceps strength in physical function appears to be small to moderate in most clinical trials. Physical therapy may be useful for its local action against pain. [23] In earlier stage of the disease patients are often referred for physical therapy to reduce impairments and improve overall physical function. So that individual can meet the demands of daily living as long as possible. [24] Physiotherapy treatment aims to relieve pain, improve function, quality of life, mobility, joint function, knee stabilization, reduce the load on the joint, promote

adaptation of certain activities, prevent deformities and slow the progression of the disease [25].

Low Level Laser Therapy (LLLT) was added 20 years ago to existing physical therapy agents used in physiotherapy in the treatment of OA. LLLT is a light source that generates extremely pure light of single wavelength. The effect is not thermal but rather related to photochemical reactions in the cells. The laser instrument produces a very thin beam of light in which high energies are concentrated. Application of this light is called "Low Level Laser Therapy" [26]. Over the past 50 years Low Intensity Laser Therapy research using wavelength in the red to infrared (600-900nm) has been applied to *in vitro* cellular studies and *in vivo* animal and human studies [27]. Its application was initiated based on previous work that demonstrated properties of LLLT that exerts the influence on fibroblast and osteoblast proliferation [28], Collagen synthesis [29] and bone regeneration [30]. LLLT utilizes light energy to stimulate tissue for the purpose of regeneration and accelerate healing [31].

LLLT is believed to speed healing and reduce inflammation and pain. LLLT has been found to increase the level of stress proteins, thereby improving the repair of cartilaginous erosions [32] and significantly increase number of chondrocytes and the thickness of the articular cartilage [1]. LLLT has been used to control pain in different musculoskeletal conditions [1].

Despite its widespread use, the results of the experimental and clinical studies are conflicting. The results of some placebo-controlled studies suggest that low power-laser treatment may be useful for reducing the pain in cervical osteoarthritis and medial and lateral epicondylitis [23]. However, very few controlled clinical studies of low power laser applied for the treatment of knee OA have been reported, the findings of these studies are also contradictory [33]. The results obtained from the trial of Stelian *et al.* suggest that laser treatment may be useful in reducing the pain and disability associated with Knee difference between the actively and the placebo treated groups [34].

The aim of the study was to evaluate the efficacy of Low Level Laser Therapy along with the exercise to decrease pain, increase range of motion, functionality, activity and improve quality of life in patient with OA Knee.

The objective of the study was (1) to identify pretreatment observation in experimental group and control group. (2) to assess / compare pain, range of motion, functionality, and activity in experimental and control group. (3) to identify the efficacy of Low Level Laser Therapy and exercise in experimental group and exercise in control group.

Review of Literature

- Sarah Rubia *et al* (2015) [4] in their study on effect of Low Level Laser Therapy (904 nm) and static stretching in patients with knee osteoarthritis: A protocol of randomized controlled trial concluded that LLLT along with muscle stretching provides greater pain relief and functional improvement in patients with OA knee.
- Ahmad Alghadir *et al* (2014) [35] conducted a single – blinded randomized clinical study on effect of Low Level Laser therapy in patients with chronic knee OA concluded that LLLT seemed to be an effective modality for short term pain relief and functional improvement in patients with chronic knee OA.

- Takashi Nakamura *et al* (2014) [36] conducted study on Low Level Laser Therapy for chronic knee joint pain concluded that 830 nm LLLT was an effective form of treatment for chronic knee pain caused by knee osteoarthritis.
- Hassan soleimanpour *et al* (2014) [37] conducted a prospective, descriptive study on the effect of Low Level Laser Therapy on knee OA concluded that LLLT is the effective in reducing pain in knee OA.
- A.S.AIRashoud *et al* (2014) [38] conducted study on efficacy of Low Level Laser Therapy applied at acupuncture points in knee OA: A randomized double – blind comparative trial concluded that short term application of LLLT to specific acupuncture points in association with exercise and advice is effective in reducing pain and improving quality of life in patients with knee OA.
- Seyed Mansour Rayegani *et al* (2012) [11] conducted study on therapeutic effects of Low Level Laser Therapy (LLLT) in knee osteoarthritis compare to therapeutic Ultrasound concluded that there is significant improvement in pain, stiffness and disability in patients treated with Low Level Laser Therapy.
- Ho Jang *et al* (2012) [8] conducted Meta – analysis on pain relief effects by laser irradiation on joint areas concluded that laser therapy on the joint reduces the pain in patients with knee OA.
- Vanessa Ovanerssian *et al* (2011) [39] conducted study on short term efficacy of Low Level Laser Therapy in patient with knee OA: A randomized, placebo-controlled, double- blind clinical trial concluded that the treatment with Low Level Laser alleviated pain and improved functional ability over short term, among patient with knee OA.
- Jun Iwanoto *et al* (2011) [40] conducted effectiveness of exercise for OA of the knee concluded that muscle strengthening and aerobic exercise are effective in reducing pain and improving physical function in patients with mild to moderate OA of the knee.
- Patricia Pereira Alfredo *et al* (2011) [41] conducted a randomized double blind study on efficacy of Low Level Laser Therapy associated with exercise in knee OA concluded that Low Level Laser Therapy when associated with exercise is effective in yielding pain relief, function and activity in patients with knee OA.
- F. kahan *et al* (2011) [1] conducted study on Laser Therapy for the treatment of arthritic knee: A clinical study concluded that laser therapy should be considered as the treatment of choice in the management of pathologies of the knee.
- Inversen *et al* (2010) [42] conducted study on Managing hip & knee osteoarthritis with exercise concluded that exercise appears to reduce pain and improve function for persons with knee OA and provide pain relief for persons with hip OA.

Material and Methods

The study was done between October 2014-october 2015. The study setting was OPD of BHRC and OPD of IIMS Indore, (M.P.). 30 patients with 2 -4 grade of OA according to Kellgren-Lawrence grade⁴³ were selected as per inclusion and exclusion criteria. Inclusion criteria was patient both male & female, age 50-75, Pain, Crepitus. Exclusion criteria was OA of hip, previous surgery around

knee joint, deformity of leg, foot, Cancer, DM. Outcome measures were Visual Analogue Scale (VAS), Western Ontario Mac Master Universities Index (WOMAC), Lequesne questionnaire, Goniometer.

45 patients were assessed among them 30 patients were selected according to the inclusion and exclusion criteria. After informed consent they were assessed and all patients were evaluated at two different intervals:

- Pre Treatment
- Post Treatment

Subjects pain was assessed using VAS, functionality using Lequesne Questionnaire, ROM using goniometer and activity using WOMAC at 1st day and after 8th week of the treatment.

Patients were the divided in to two groups.

- a. Experimental group
- b. Control group

Experimental Group

Subject in the experimental group received low level laser therapy three times in a week for three weeks along with exercise three times a week following initial assessment. In

this group energy was irradiated over the joint onto five points of the synovial region of the medial side of the knee and in four points at the lateral side, at 3J per point. Total dose per knee was 27J per treatment.

The laser equipment had an identical pen. The pens semiconductor consisted of gallium arsenide with wavelength of 980nm, frequency of 300Hz. The parameters followed the recommendation of the World Association of Laser Therapy (WALT)⁴⁴ for osteoarthritis.

Control Group

After initial assessment the subjects in the control group were given exercise.

Exercise

All patients follow the same training programme. The intervention divided into three phases: P-1, P-2, P-3 during eight weeks with three sessions a week. Each session lasted 45 minutes:

- 10 minutes warming up;
- 30 minutes 2-3 sets with P-1, P-2, and P-3;
- 5 minutes stretching (hamstring, quadriceps, adductors, gastrocnemius).

Table 1: Exercise programme conducted over the eight weeks of treatment

Phases	Exercises
P1 (week 1–week 2) Objectives: Range of Motion Motor Learning Balance Coordination	Each exercise had 30 repetitions and 2 sets: <ul style="list-style-type: none"> • Sitting in the chair with a weight on the ankle, knee and stretch the foot to rotate alternately in and out then change legs • Lying prone. Bend the knee slowly as much as possible. Stretch the knee slowly • Standing with support. Bend the knees to approximately 60 degrees. Push up again • Walk on a 3 m line without stepping off the line • Walk–standing. Transfer your body weight from one leg to the other
P2 (week 3–week 5) Objective: Strengthening	Each exercise had 20 repetitions and 3 sets: <ul style="list-style-type: none"> • Standing. Bend your knees to approximately 60 degrees, and up again • Walk sideways by crossing legs. To right and left • Standing on a balance board. Hold the balance • Lying prone. Bend one knee as much as possible • One foot-standing on a step. Bend your knee until the other foot touches the floor, push up again
P3 (week 6–week 8) Objective: Strengthening	Each exercise had 20 repetitions and 3 sets: <ul style="list-style-type: none"> • Walk sideward by crossing steps. To right and left • Standing on one leg. Bend the knee to approximately 60 degrees, and up again • Standing on a balance board. Keep the balance. More difficult if eyes are closed • Standing on the floor. Get up on your toes, hold 1–2 seconds, and get down again • Sitting with weight around the ankle. Stretch the knee slowly, hold the stretch 3–4 seconds, and slowly down again

Statistical Analysis

The analysis of the gathered data had done by using both descriptive and inferential statistics. The descriptive statistics had used to identify the features and the characteristic of the selected subjects. The inferential

statistics used to test the hypothesis in order to make a comparison between pre and post intervention scores on WOMAC, Lequesne Questionnaire and range of motion of patients with osteoarthritis of knee from the gathered data. Results on continuous measurements presented on Mean ±

SD (Min-Max) while the results on categorical measurements presented in numbers or percentage.

The Shapiro-Wilk test used to identify the normality of the data for score noted on WOMAC, Lequesne Questionnaire and range of motion at pre (baseline) and post (at 8th week) observations in both the groups, are insignificant ($p > 0.05$) except the ROM and Lequesne Questionnaire at post in experimental group, and ROM at post in control group, were significant. Overall, it concluded that the observations came from a normal distribution. Therefore, a parametric test, Paired t-test used to identify the significance of mean differences in scores on WOMAC, Lequesne Questionnaire and the range of motion between pre and post interventions among knee osteoarthritis patients of experimental and control groups. Independent sample t-test was used to identify the significance of mean difference in scores on WOMAC, Lequesne Questionnaire and the range of motion of patients with osteoarthritis of knee of between experimental and control groups at pre (baseline) and post (8th week) interventions.

Table 2: The Frequency and Percentage Distribution of Patients According to Age

Age (year)	Experimental group		Control group	
	Frequency (n ₁)	Percentage (%)	Frequency (n ₂)	Percentage (%)
50-57	4	26.7	4	26.7
57-64	7	46.7	8	53.3
64-71	4	26.7	3	20.0
71-78	0	0.0	0	0.0
Total	15	100.0	15	100.0
Mean ± SD	60.33±4.42 year		59.13±4.93 year	

Table 3: The Frequency and Percentage Distribution of Patients According to Gender

Gender	Experimental group		Control group	
	Frequency (n ₁)	Percentage (%)	Frequency (n ₂)	Percentage (%)
Male	5	33.3	5	33.3
Female	10	66.7	10	66.7
Total	15	100.0	15	100.0

Table 4: Severity of Pain at Pre-Intervention on Visual Analogue Scale (Vas)

Score	Score on VAS in groups		Total
	Experimental (n ₂ =15)	Control (n ₂ =15)	
4	0 0.0%	1 6.7%	1 3.3%
5	3 20.0%	4 26.7%	7 23.3%
6	5 33.3%	4 26.7%	9 30.0%
7	3 20.0%	3 20.0%	6 20.0%
8	4 26.7%	3 20.0%	7 23.3%
Total	15 100.0%	15 100.0%	30 100.0%

Table 5: Severity of Pain at Post-Intervention on Visual Analogue Scale (Vas)

Score	Score on VAS in groups		Total
	Experimental (n ₂ =15)	Control (n ₂ =15)	
2	7 46.7%	1 6.7%	8 26.7%
3	4 26.7%	3 20.0%	7 23.3%
4	2 13.3%	3 20.0%	5 16.7%
5	1 6.7%	5 33.3%	6 20.0%
6	1 6.7%	3 20.0%	4 13.3%
Total	15 100.0%	15 100.0%	30 100.0%

Table 6: Comparison of Scores Noted on Womac, Lequesne Questionnaire and Range of Motion In Laser and Placebo Groups Between Pre and Post Interventions

Parameter	Sampling stage	Spread	MD	t-value	LOS
		Mean ± SD			
EXPERIMENTAL GROUP (n ₁ =15)					
WOMAC (Score)	Pre	31.35±7.77	15.62 point	8.60	p<0.001 #
	Post	15.73±3.63			
Lequesne Questionnaire (Score)	Pre	12.80±2.84	7.43 point	11.14	p<0.001 #
	Post	5.37±1.73			
Range of Motion (Degree)	Pre	128.73±4.95	4.00 degree	4.30	p<0.001 #
	Post	132.73±2.43			
Control Group (n ₂ =15)					
WOMAC (Score)	Pre	32.77±7.75	11.36	12.86	#

	Post	21.41±7.15	point		
Lequesne Questionnaire (Score)	Pre	12.67±2.75	5.10	13.82	p<0.001 #
	Post	7.57±2.32	point		
Range of Motion (Degree)	Pre	127.60±4.67	3.47	4.08	p<0.001 #
	Post	131.07±2.60	degree		

Table 7: Comparison Between Experimental and Control Groups in Scores Noted on Womac, Lequesne Questionnaire and Range of Motion at Pre and Post Interventions

Stage	Parameter	Group	Spread	MD	t-value	LOS
			Mean ± SD			
Pre Intervention	WOMAC (Score)	Experimental	31.35±7.77	1.42 point	0.50	p>0.05 ⊗
		Control	32.77±7.75			
	Lequesne Questionnaire (Score)	Experimental	12.80±2.84	0.13 point	0.13	p>0.05 ⊗
		Control	12.67±2.75			
	Range of Motion (Degree)	Experimental	128.73±4.95	1.13°	0.65	p>0.05 ⊗
		Control	127.60±4.67			
Post Intervention	WOMAC (Score)	Experimental	15.73±3.63	5.68 point	2.74	p<0.01 #
		Control	21.41±7.15			
	Lequesne Questionnaire (Score)	Experimental	5.37±1.73	2.20 point	2.95	p<0.006 #
		Control	7.57±2.32			
	Range of Motion (Degree)	Experimental	132.73±2.43	1.66°	1.81	p<0.08 ^
		Control	131.07±2.60			

Table 8: Comparison of Scores Noted on Vas in Experimental and Control Groups Between Pre and Post Interventions

Group	Sampling stage	Score on VAS	p-value ⊕
		Mean ± SD	
Experimental	Pre intervention	6.53±1.13	p<0.001 #
	Post intervention	3.00±1.25	
Control	Pre intervention	6.20±1.27	p<0.001 #
	Post intervention	4.40±1.24	

Table 9: Comparison among Scores Between Experimental and Control Group at Pre and Post Interventions

Intervention	Group	VAS	Mean Rank	Z-value ⊕	LOS
		Mean ± SD			
Pre	Experimental	6.53±1.13	16.63	0.73	p>0.05 ⊗
	Control	6.20±1.27	14.37		
Post (8 th week)	Experimental	3.00±1.25	11.17	2.76	p<0.006 #

Results

There was statistical significant reduction in pain, increase ROM, increase QOL post intervention (p value <0.006). On comparison of control vs experimental group there was a significant reduction in pain (WOMAC: 21.41±7.15vs 15.73±3.63), QOL (Lequesne questionnaire 7.57±2.32vs 5.37±1.73), ROM (128.73±4.95vs132.73±2.43) respectively.

Discussion

The effect of Low Level Laser in combination with a programme of exercise in patients with knee OA was assessed in this study. It was an experimental study with random distribution, positive results were found in Low Level Laser Therapy when associated with exercise in yielding pain relief, improvement function and activity compared to the control group.

Since knee OA is relatively common disease among adult and elderly people. Especially because of increased life expectancy among the population. Many studies have been conducted on knee OA, with the aim of finding effective resources for pain relief and improved QOL for these

patients.^{45,46} It was decided to study this population because of the high demand for treatment of impaired knee joints. LLLT is a widely used resource in clinics with well-established therapeutic results;⁴⁷ but in relation specifically to knee OA, the results remain controversial.^{48,49}

Low Level Laser in the infrared spectrum was used because this has deeper penetration than visible red light doses^[50, 51]. Thus, it can reach all the periarticular structures involved in OA and probably acts as an analgesic, an anti-inflammatory agent in relation to reactive synovitis and a reparative agent for cartilaginous tissue^[52-55].

A link has been established between synovial inflammatory activity and worsening of cartilage degeneration in OA^[56]. (Controlled laboratory trials have found that LLLT can reduce inflammation through reduction of PGE2 levels and inhibition of cyclooxygenase-2 (COX-2) in cellular cultures^[57-60]. It increases the lysosomal activity which involve in digestion of intracellular and extracellular material, plasma membrane repair, biogenesis and cell death^[61], thus it reduces inflammation and modulate or reduce pain in chronic joint disorders if the dose is adjusted to inhibit inflammatory activity in the joint capsule.

Several progressive and degenerative diseases have been effectively treated by means of LLLT, but there is controversy regarding results from studies analyzing pain and function among patients with knee OA, mainly because of the variations in the method used. In this study, care was taken to follow the WALT recommendations.

The psychologist Ronald Melzack and the anatomist Patrick Wall Gate proposed pain gate theory for pain in 1965. The gating system in the central nervous system opens and closes to allow the pain signals to the brain or to block the signals. According to them the nerve fibers with smaller diameter carry pain stimuli through the gate mechanism present in the spinal cord. But, the nerve fibers with larger diameter, which carry other stimulusuch as touch, pass through the same gate. The larger nerves inhibit the transmission of pain signals by smaller nerves through the gate.

When pain sensation is produced in any part of body along with pain fibers, the other afferents particularly the touch fibers reaching the posterior column of spinal cord are also

activated. The dorsal column fibers send collaterals to the cells of substantia gelatinosa in the posterior grey horn. Thus, some of the impulses ascending via dorsal column fibers pass through the collaterals and reach substantia gelatinosa. So the pain sensation is suppressed. The gating of pain in posterior grey horn level is similar to presynaptic inhibition. This forms the basis for relief of pain. Electrical analgesia close the gate and block the pain/relieve pain by stimulating the release of endogenous pain relievers.

Previous studies of the analgesic effects of Low Level Laser application in musculoskeletal disorders have yielding conflicting results. There are reports of useful pain relief amongst growing evidence of a significant placebo action. The exact mechanism of pain reduction by laser therapy is not understood. Different experimental studies suggest that low power laser therapy has anti-inflammatory and analgesic effects. In another study, the authors have suggested that neuronal activity inhibition might be responsible for the therapeutic effect and that the laser irradiation selectively inhibited nociceptive signals at peripheral nerves. The results of these experimental studies are also affected by various factors such as the condition of the subject, the characteristics of the laser (wavelength, dosage, pulse), the irradiated areas and the application of time and period and it is possible that unknown mechanism may be involved in the pain reduction following low power laser treatment [61]. It also releases morphin which are natural pain relieving substances with in our body which inhibit the sensation of pain and help in reducing the pain.

Over the years more than 100 double-blind, placebo controlled studies have been published on the effects of LLLT. There are various possible explanations for the effects of LLLT treatment. The authors believed that a rise in pain threshold, improved blood flow and regeneration of knee cartilage are the main contributing factors [62, 63].

In a meta-analysis, Brosseau *et al* [26] stated that the reduction in the pain through using LLLT might be due to mechanisms such as physiological effects mediated by photochemical actions at cellular level in animal or human tissue, and through increased levels of the neurotransmitters implicated in pain modulation, such as serotonin. Some researchers have also concluded that LLLT has an effect on joint cartilage regeneration, achieved through proliferation of chondrocytes and synthesis and secretion of extracellular matrix. Through LLLT, there is improvement in local circulation, which leads to reduced edema and improved tissue oxygenation, which consequently may result in pain alleviation.

Gur *et al* [47] in studying two laser therapy regimes stated that applications of LLLT in different dose and duration had not affected results and both therapy regimes were a safe and effective method in treatment of knee OA. The results obtain from the trial of Stelian J *et al* [33] suggest that laser treatment may be useful in reducing the pain and disability with knee OA. In contrast, Tascioglu F *et al* [14] stated that with their chosen laser type and dose regimen the results suggested that LLLT has no effect on pain in patients with knee OA. In 2 other literature reviews, Bjordal JM *et al* [45] stated that low level laser therapy with minimum suggested dose range significantly reduce pain and improve health status in chronic joint disorders. Brosseau [26] stated that for OA the results were conflicting in different studies and might depend on the method of application and other features of the LLLT application.

The European League against Rheumatism (EULAR) suggests that low level laser therapy and exercises should be considered when planning optimal treatment for OA [7]. Strong evidence suggests that exercise reduce pain and disability in patients with OA. There is evidence that exercise is responsible for muscular strengthening and better flexibility, improved global functioning as well as better performance of daily living. Exercise is important for two reasons, Prevents joints from becoming stiffer and Strengthening the muscle supporting the joints. It can help in slowing down or even reversing some of changes.

Our findings suggest that low level laser therapy when associated with exercises is effective in yielding pain relief, function and activity in patients with knee OA.

Limitation

The major study limitations were the small number of patients and the absence of follow-up. Further studies should increase the number of patients and a long-term follow-up assessment.

Conclusion

All statements and inferences from the statistical analysis, the rejection of null hypothesis. Therefore, the alternative hypothesis is accepted which stated as "There is significant effect on pain, functionality, activity and ROM in patient treated with Low Level Laser Therapy along with exercise" that impacted the achievement of the entire selected objectives followed with fulfillment of the aim of the proposed research titled "Effect of Low Level Laser Therapy along with exercise in OA knee".

Conflicts of Interest

None

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Ethical Approved

Approved

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