

Osteoarthritis Knee & Low Level Laser Therapy-Evidence from Northeast India

Dr. Sharat Agarwal*

Associate Professor, Department of Orthopaedics & Trauma, North Eastern Indira Gandhi Regional Institute of Health & Medical Sciences (NEIGRIHMS), Shillong, India

DOI: [10.36348/sjm.2020.v05i06.002](https://doi.org/10.36348/sjm.2020.v05i06.002)

| Received: 05.06.2020 | Accepted: 15.06.2020 | Published: 16.06.2020

*Corresponding Author: Dr. Sharat Agarwal

Abstract

Although joint pain can be controlled with various modalities which includes the use of acetaminophen, NSAIDs and corticosteroid injections. It has been found that LLLT is an effective non invasive therapy to control inflammation and tissue degeneration and thus to relieve pain with subsequent quality of life improvement in various inflammatory & painful joint problems. **Material & Methods:** A retrospective analysis was done from the data on osteoarthritis knee patients (n=30) with chronic knee pain, treated with low level laser therapy applied at the knee joint line area over medial & lateral tibiofemoral condyles region. The various parameters like NRS; daily activities, work & leisure, anxiety & depression, social interaction (4 components of DALLAS pain questionnaire as found relevant for these patients to assess quality of life) were studied and analysed using appropriate statistical tools. **Results:** The majority patients were female (n=17) as against males (n=13). The paired t test revealed that there was significant difference in NRS score before and after laser therapy. The paired t test revealed that there was significant difference with positive improvement in daily activities, work & leisure, Anxiety & depression and social interaction scores before and after laser therapy. **Conclusion:** LLLT like Helium Neon (He-Ne) laser has the potential to be used with efficacy in patients of chronic knee pain due to osteoarthritis irrespective of age and sex, especially in Kellgren Lawrence OA grade 1, 2 & 3.

Keywords: Osteoarthritis, laser therapy, quality of life, non invasive modalities, musculoskeletal pain.

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INTRODUCTION

Pain especially the chronic form, is a complex process which deeply affects a person's life, forcing alterations in professional, personal, social and other aspects of everyday activities [1]. Knee pain is the third most frequent cause of chronic pain reported today after low back pain and headache, followed by neck pain, toothache and abdominal pain. Osteoarthritis of knee is the most common type among different causes of knee pain, and a major cause of chronic musculoskeletal pain and mobility, disability in the elderly, and therefore represents a significant burden to the health care provision [2]. Other causes of knee pain include rheumatoid arthritis, gout, joint effusions, systemic lupus erythematosus, psoriatic arthritis etc.

Due to aging in population, the prevalence, disability and associated costs of knee osteoarthritis are expected to steadily increase over next 25 years along with concerns about the increasing obesity-especially in developed countries [3]. Although pain and dysfunction due to osteoarthritis pain troubles 40% of the adults in the western world, no successful cure for OA has been

found till date [4, 5]. Common methods of treatment for OA of the knee include joint surgery, medication, electrotherapy, muscle strengthening and external mechanical load reducing devices. None of these treatment options have proven to be consistently successful in clinical practice, although they have all shown variable degree of success [6].

Low level laser therapy (LLLT) in musculoskeletal disorders refers to monochromatic light therapy with lasers which have a mean optical output of larger than 1 mW. LLLT has been used for treatment of OA for > 30 years for pain relief and has become increasingly popular non invasive non thermal treatment modality. Unfortunately, though many studies using laser therapy have been conducted over the years pertaining to the improvement of pain relief for various musculoskeletal conditions like rheumatoid arthritis, fibromyalgia, postoperative pain, headache, nervous system diseases, myofascial pain syndrome, chronic neck pain, and low back pain [7-12], the true effectiveness of this therapy is yet to be validated. Hence, laser therapies have yet to receive United States

Food and Drug Administration (US FDA) approval, except for the treatment of carpal tunnel syndrome.

MATERIAL & METHODS

A retrospective analysis was done with the patients diagnosed with osteoarthritis of knee of more than 30 years of age, who were managed with low level laser therapy for knee pain on an outpatient basis (OPD) in the department of orthopaedics & Trauma at our hospital from January 2018 to May 2019. The therapy used low intensity laser therapy (He-Ne laser of continuous mode) of 632.8 nm wavelength with energy of 3-7 J/cm² (optimum energy-4 J/cm²) with a penetration depth of 0.8 cm (using IR 27 ROLAND SERIE, USA machine) to evaluate the efficacy of this mode of treatment for OA knee associated chronic pain. They were graded based on Kellgren-Lawrence grading on radiographs of knee taken in standing antero-posterior, lateral and sunrise views. Patients were evaluated with Numeric pain rating scale (NRS) and modified, the DALLAS Pain Questionnaire, where we studied few components of the pain Questionnaire relevant to the assessment for a patient of chronic knee pain, as to how quality of life was getting affected in patients with knee pain based on four parameters like daily activities, Work & Leisure activities, Anxiety & depression due to chronic knee pain & Social interaction by limiting the functional performance. These patients (n=30) of OA knee (grade 1, 2 & 3) had been subjected to low intensity LASER therapy as one sitting of 30 minutes over the knee joint line per day for five days in a week for 4 consecutive weeks. Pre and 3 months post laser therapy- NRS and modified DALLAS scoring were studied.

RESULTS

Amongst the patients undertaken in the study, 13 patients were male and there were 17 female patients. Pie diagram shows the characteristics of patients according to sex. Out of 30 patients included in this study, 17 (56.6%) were females and 13 (43.4%) were males (Fig-1). This was obvious it has been found that osteoarthritis of knee is more common in females as compared to males. The response of the patients to treatment was measured in terms of five principal parameters like NRS; daily activities, work & leisure, anxiety & depression, social interaction (4 components of DALLAS pain questionnaire as found relevant for these patients to assess quality of life).

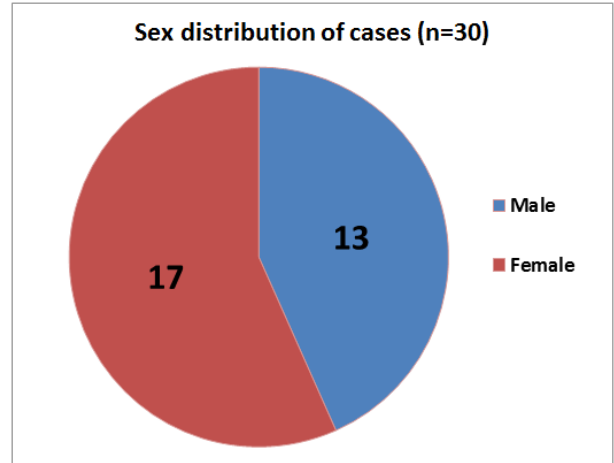


Fig-1: Sex distribution of the cases

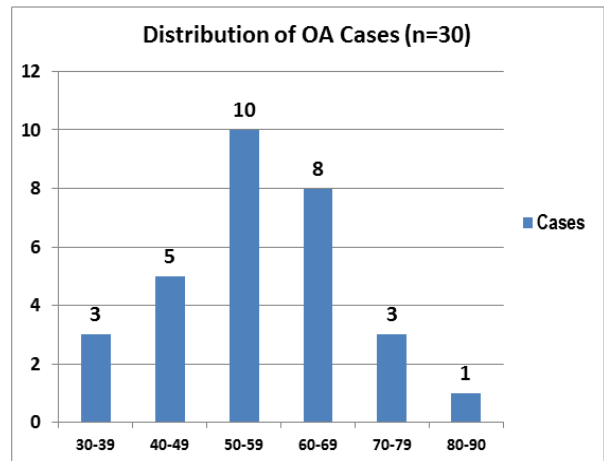


Fig-2: The age wise distribution of the cases in our study was as follows

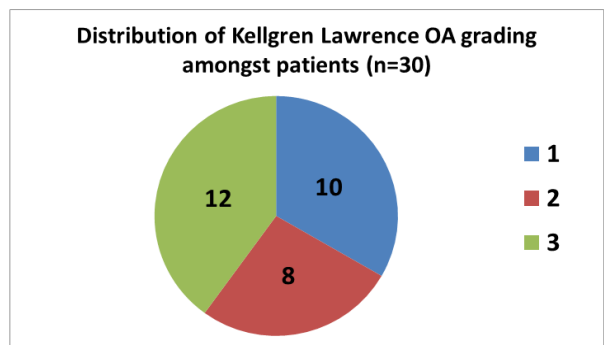


Fig-3: The distribution of cases with respect to Kellgren-Lawrence grading is as follows

Table-1: Pre and Post NRS and Modified parameters from DALLAS Pain Score of Participants (N=30)

SCORE	Pre Score		Post Score		df	't' test	'p' value	95% CI	
	Mean	S.D	Mean	S.D				Lower	Upper
NRS Score	7.17	1.14	0.07	0.25	29	35.55	0.00	6.69	7.50
Daily Activities	33.86	14.43	1.30	2.32	29	13.37	0.00	27.58	37.54
Work and Leisure activities	27.5	10.48	0.5	1.52	29	14.01	0.00	23.05	30.94
Anxiety & Depression	33.3	12.68	0.83	2.30	29	14.72	0.00	27.98	37.01
Social Interaction	22.66	9.16	0.33	1.26	29	13.92	0.00	19.05	25.61

Note- P value<0.05 is significant.

The paired t test was applied to find out the significance difference between pre-score and post-score at $p < 0.05$ at level of significance. The mean score of NRS in pre test was 7.17 ± 1.14 whereas in post test it was 0.07 ± 0.25 . The paired t test revealed that there was significant difference in NRS score before and after laser therapy. The pre-test mean score of daily activities was 33.86 ± 14.43 whereas in post test it was 1.30 ± 2.32 and the calculated t value was 13.37. The mean score of work and leisure activities in pre-test was 27.5 ± 10.48 whereas in post-test it was 0.5 ± 1.52 and the calculated t value was 14.01. The pre-test mean score of anxiety & depression was

33.3 ± 12.68 whereas in post test it was 0.83 ± 2.30 and the calculated t value was 14.72. The pre test mean score of social interaction was 22.66 ± 9.16 whereas in post test it was 0.33 ± 1.26 . The paired t test revealed that there was significant difference with positive improvement in daily activities, work & leisure, Anxiety & depression and social interaction scores before and after laser therapy.

The differences in five parameters of females and males before treatment were not significant, highlighting equality of pre-treatment conditions of patients across gender (Table-2).

Table-2: A pre-treatment comparison of responses of female (n=17) and male (n=13) patients in their activities. The values are expressed as mean \pm sd

Parameters	Female	Male	t value	p value
NRS	7.08 ± 1.32	7.24 ± 1.03	0.36	0.724
Daily Activities	34.23 ± 20.03	33.59 ± 8.74	0.11	0.915
Work & Leisure	29.23 ± 10.58	26.18 ± 10.54	0.79	0.440
Anxiety & Depression	30.77 ± 7.87	35.29 ± 15.36	1.05	0.305
Social-Interest	22.69 ± 9.92	22.65 ± 8.86	0.01	0.990

Table-3: A post-treatment comparison of responses of female (n=17) and male (n=13) patients in their activities. The values are expressed as mean \pm sd

Parameters	Female	Male	t value	p value
NRS	0.08 ± 0.28	0.00 ± 0.00	1.00	0.337
Daily Activities	1.38 ± 2.90	1.24 ± 1.86	0.16	0.873
Work & Leisure Activities	0.77 ± 1.88	0.29 ± 1.21	0.79	0.437
Anxiety & Depression	0.77 ± 1.88	0.88 ± 2.64	0.14	0.892
Social-Interest	0.38 ± 1.39	0.29 ± 1.21	0.19	0.853

Similarly, the differences in five parameters of females and males after treatment were not significant, highlighting equality of post-treatment conditions of patients across gender (Table-3).

DISCUSSION

The scientific literature strongly suggests that LLLT modulated pain attenuation takes place through its effect on prostaglandin (PG) synthesis, increase in change of PG type G & PG type H2 into PG type I2, increase in glucocorticoids urinary excretion, which are beta-endorphin synthesis inhibitor, increase in pain threshold in nerve fibres, increase in serotonin urinary excretion, decrease in histamine and serotonin secretion, decrease in bradykinin synthesis, change in

nor epinephrine and epinephrine activity, increase in ATP production, increase in local microcirculation, lymph node circulation enhancement and oedema decline [13-15]. Our study showed that there is significant improvement in pain and quality of life parameters assessed by modified parameters taken from the DALLAS pain scale after the therapy.

Anna Angelova *et al.*, in a randomized clinical study, evaluated the effect of high intensity laser therapy (HILT) in patients with OA. They found it to be effective therapy in comparison to Sham laser [16]. Enas Fawazey Youssef *et al.* in their study concluded that addition of LLLT to exercise training program is more effective in the treatment of patients with knee OA [17]. In a prospective study conducted by Shaik

raheem Saheb *et al.*, on the relative efficacy of LLLT & ultrasound in subjects of knee OA, found LLLT to be more effective than ultrasound reducing pain, joint stiffness and stability [18]. Abdullah Raddah Kheshie *et al.* in a prospective RCT, compared LLLT & HILT in combination with exercises found them to be more effective than exercise alone in knee OA [19]. A prospective study was conducted by Takashi Nakamura *et al.*, on LLLT, found it to be an effective form of treatment in chronic knee pain [20]. N. Marquina *et al.* conducted a RCT utilizing a therapeutic low energy system for pain in knee disorders & found it to be effective [21]. In a metaanalysis was done by He Jang *et al.*, consisting of 22 trials showed that laser therapy reduces knee joint pain and might be a good alternative to the use of non steroidal anti i-inflammatory drugs (NSAIDs) [22]. Rayegani *et al.*, also compared the pain relief obtained with LLLT vis-a-vis ultrasound (US) found a preference for LLLT in giving pain relief [23]. A prospective study conducted by Fukuda *et al.*, analysed the efficacy of LLLT using Lequesne, VAS (visual Analog Scale), Timed Up & Go (TUG), goniometry & dynamometry before and after the treatment. It revealed the efficacy of LLLT in inducing pain relief and functional improvement in patients of knee OA [24]. Pain relieving effect & improvement of micro circulation as found on thermography was found in a study conducted by Bela Hegedus *et al.*, [25]. Bjordal JM *et al.*, did an analysis including many studies to investigate if low level laser therapy of the joint capsule can reduce pain in chronic joint disorders. They concluded that with the suggested dose range significantly reduces pain and improve health status in chronic joint disorders, but the heterogeneity in patient samples, treatment procedures and trial design calls for cautious interpretation of the results [26].

CONCLUSION

LLLT has the potential to be used with efficacy in patients of chronic knee pain due to osteoarthritis irrespective of age and sex, especially in Kellgren-lawrence OA grade 1, 2 & 3. However Helium Neon (He-Ne) laser which has been used here, may not be readily available in all hospitals and has limitation with regard to its use in obese patients due to its limited tissue penetration power. Patients compliance & motivation can be another potential problem as it requires patient to visit hospital for few weeks for sustained therapy. More randomized controlled studies are required to establish the efficacy of various intensity lasers and their correlation with different grades of knee OA, especially as adjunctive therapy with the availability of platelet rich plasma, hyaluronic acid supplementation, mesenchymal stem cells (MSC), slow acting systemic potentially cartilage regenerating therapies, acupuncture and laser acupuncture currently available in the orthoped's armamentarium. However, LLLT hold a promise as a non invasive therapy, which can be successfully tried in all patients of knee OA.

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