

ORIGINAL ARTICLE

COMPARISON OF THE EFFECT OF LOW LEVEL LASER THERAPY AND THERAPEUTIC ULTRASOUND IN KNEE OSTEOARTHRITIS

Shaik Raheem Saheb¹, CH. Gangadhar², CH. Ganapathi Swamy³

¹Masters in Orthopaedics Physical Therapy, Department of physical therapy, Hyderabad Multi speciality hospital, Malakpet, Hyderabad, Telangana, India.

²Masters in Cardiac Physical Therapy, HOD Department of Physical therapy, Hyderabad Multispecialty hospital, Malakpet, Hyderabad, Telangana, India.

³Assistant Professor in Bio-Statistics, Department of community medicine, GSL Medical College, Rajahmundry, Andhrapradesh, India.

ABSTRACT

Background: Recently Low-level laser therapy (LLLT) is commonly used modality and thought it have analgesic and bio-modulatory effects. Our objective was to Know the effects of LLLT and possible changes in joint Stiffness, Pain and Disability of patients with knee osteoarthritis (KOA) and comparing it to the More commonly Used Modality Therapeutic ultrasound(US).

Methods: 40 subjects with a mean age of 52 years having clinical diagnosis of knee osteoarthritis and full filled the inclusive criteria are taken. After the initial measurements, the subjects are randomly assigned into 2 groups. Group-A performed the Low-level laser therapy, Group-B performed a ultrasound (US). Both Groups Received the Treatment in Duration of 4 weeks – once daily for 5 days a week. Along with this technique A standard exercise protocol was performed. After the treatment, subjects were evaluated for their pain profile using visual analogue scale, and WOMAC scale was used to know the status of pain, stiffness, and physical function.

Results: For within group comparison we used Paired t-test analysis, For Between group comparison we used Independent t-test for statistical analysis. At the end of 4 weeks It was found that subjects treated with Low level Laser therapy showed significant improvement in terms of VAS scores and WOMAC (P=0.000) and patients treated with US showed significant improvement in terms of VAS scores and WOMAC (P=0.000). When compared between Groups the VAS and WOMAC showed a significant improvement in Low Level Lasertherapy than the Ultrasound Group (P=0.000).

Conclusion: Our Results shows that the LLLT and Ultrasound Reduces pain, joint stiffness and Disability in Knee Osteoarthritis and LLLT is more effective than the Ultrasound.

Keywords: Low level laser, Ultrasound, osteoarthritis, joint Stiffness, WOMAC.

INTRODUCTION

Osteoarthritis is a chronic disorder of synovial joints in which there is progressive softening and disintegration of articular cartilage accompanied by new growth of cartilage and bone at the joint margins (osteophytes), cyst formation and sclerosis in the subchondral bone, mild synovitis and capsular fibrosis. Osteoarthritis is the most common joint disorder and more commonly affects the weight bearing joints such as knee. Complaints of patients with knee osteoarthritis (KOA) include pain and joint stiffness which make patients restrict their activities.¹

Physiotherapy modalities commonly used in the management of OA include Interferential therapy (IFT), Transcutaneous Electrical Nerve Stimulator (TENS), Therapeutic Ultrasound (TUS), Low Level Laser Therapy (LLLT), Acupuncture, exercise therapy and orthotic devices (Bjordal et al., 2007; Ottawa Panel, 2004; Deyle, 2000).²

According to John Z Srbely Ultrasound demonstrates the ability to evoke a broad range of therapeutically beneficial effects which may provide safe and effective applications in the management of osteoarthritis.³

According to Ahmad Alghadir et al Low level laser therapy

seemed to be an effective modality for pain relief and function improvement in patients with OA knee.⁴

NEED OF THE STUDY: Ultrasound is more commonly and Traditionally used Therapeutic modality in OA knee and it have positive effects in OA knee, Recently low level laser therapy is also commonly used and thought it have analgesic and bio-modulatory effects. And there is a Limited number of studies comparing the effects of LLLT versus Ultrasound in OA Knee and showing the Results are conflicts. The Aim of the study is to gather evidence of the analgesic effect of Low level laser therapy in decreasing joint stiffness and disability in subjects with OA knee, And Comparing it to the commonly used Modality Therapeutic US.

OBJECTIVE OF THE STUDY: To find the effect of Low level laser in subjects with OA knee.

To find the effect of Ultrasound in subjects with OA knee.

To know whether Low level laser is more effective than the Ultrasound in subjects with OA knee.

METHODOLOGY

It was proposed to study the effect of low level laser therapy (LLLT) and Ultrasound (US) in the management of OA knee. This was Experimental design, Randomized control trail. Consent to carry out study was granted by institutional ethical clearance committee.

Subjects: A total number of 40 patients, both Male and Female and clinically diagnosed mild to moderate knee OA were recruited for the study.

Sampling Design: It was convenient sampling method, however allocation was done randomly using the random number table.

Sample Size: 62 subjects were selected among them 51 subjects full filled the inclusive criteria and In which 7 subjects left the study provided no reasons and 4 subjects was absent continuously more than 4 sessions. And Subjects were randomly assigned to two groups Group 1 and group 2 with 20 subjects in each group.

Inclusion criteria: Both male and female patients with mild to moderate knee osteoarthritis (KOA) were recruited to the study.

Inclusion criteria comprised: 1-Mild destructive alterations detected by radiograph (Kellgren-Lawrence stage 1-3) ⁵; 2-lack of history of other joint disorders such as RA, Calcium pyrophosphate deposition disease (CPPD), gout, knee fracture or surgery; 3- knee pain for at least 2 months.

Exclusion criteria consisted of: 1-considerable deformity of the varus or valgus, ankylosis, or severe flexion contracture; 2 -Physiotherapy or intra articular injection during the past 6 months; 3-Severe destructive alterations detected by radiograph (Kellgren-Lawrence stage-4); and the common contraindications for laser therapy and ultrasound therapy.

Outcome measures: 1.Pain intensity: Measured by means of Visual Analogue Scale (VAS). A 10 cm line marked with numbers 0 to 10 was used where 0 symbolized no pain and 10 as maximum pain. Patient was asked to mark his pain on this line as per the severity. ⁶

2. WOMAC Questionnaire was used. The **Western Ontario and McMaster Universities Arthritis Index (WOMAC)** is a widely used, proprietary set of standardized questionnaires used by health professionals to evaluate the condition of patients with osteoarthritis of the knee and hip, including pain, stiffness, and physical functioning of the joints. The WOMAC measures five items for pain (score range 0–20), two for stiffness (score range 0–8), and 17 for functional limitation (score range 0–68), Physical functioning questions cover everyday activities such as stair use, standing up from a sitting or lying position, standing, bending, walking, getting in and out of a car, shopping, putting on or taking off socks, lying in bed, getting in or out of a bath, sitting, and heavy and light household duties. Reliability for the physical function scale has been more consistent and stronger.⁷

PROCEDURE

A detailed case history and physical status were recorded various examinations were conducted prior to treatment in order to rule out other Disease. After initial measurements, The subjects are randomly assigned into 2 groups. Group 1 Received low level laser therapy for a period of 4 weeks once daily 5 days per week, Power 50 mW, Continuous wave, wavelength 880 nm., The dose delivered was 6 J/point In one session, a patient was given a total dose of 24 J/cm². Treatment was administered over the femoral and tibial condyles (Laser irradiation was aimed at the synovia and cartilage in the joint line). The points that were irradiated were the medial and lateral epicondyles of the tibia and femur, the medial and lateral knee joint gap, and the medial edge of the tendon of the biceps femoris muscle and semitendinous muscle in the popliteal ditch.

Group 2 received Pulsed ultrasound with the intensity of 1.5 – 2 w/cm², 1 MHz, for 5 minutes per knee, in the duration of 5 days per week with the total duration of 4 weeks.

Along with these techniques a standard exercise protocol was given to the groups. The exercise program consists of 5minutes warm-up stretching program followed by range of motion exercise and finally isometric exercise and isotonic exercises. The exercises were localized to the quadriceps and hamstrings group of muscles. The exercise was of low intensity for 15 minutes. The exercise protocol used was adopted from Deyle and Henderson (2000).⁸

After the treatment, subjects were evaluated for their pain profile using visual analogue scale and WOMAC Questionnaire.

RESULTS

The results of this study were analyzed in terms of pain relief indicated by decrease in Knee pain on VAS, Improvement in Pain, stiffness and physical function in OA was indicated in terms of improvement in WOMAC Score. Comparison was done both within each group as well as in between the two groups. So as to evaluate the intra group and inter group effectiveness of LLLT and US which are under considerations in the present study.

Statistical analysis:

All the statistical analyses were performed by using SPSS software trail version 21.0 and MS excel 2007. Discriptive statistical analysis is presented in the form of mean +/- Standard deviation and percentages. T test is performed to assess the mean significance differences between various discrete variables. For all statistical analysis (p<0.05) was considered as statistically significant.

Table 1: Pain Relief (Mean changes in VAS Score)

GROUPS		GROUP A US	GROUP B LLL
PRE TREATMENT	MEAN	7.65	7.50
	SD	.587	.688
POST TREATMENT	MEAN	4.3	3.05
	SD	.978	.998
p value		0.000	0.000
Inference		significant	significant

Pain relief was recognized by reduction in VAS score. For this VAS score was noted on the first day and the last day (After 4 weeks) of the treatment for all the subjects. However the difference between the 2 scores was considered for analysis of difference between the two groups.

The Average VAS score in group A (US) on 1st day was 7.65, which were reduced to an average of 4.3 on last day (After 4 weeks) of the treatment.

There was highly significant difference between the VAS Scores in the subjects in the Ultrasound group i.e $P < 0.000$.

The Average VAS score in group B (LLLT) on 1st day was 7.50, which were reduced to an average of 3.05 on last day (After 4 weeks) of the treatment.

There was highly significant difference between the VAS Scores in the subjects in the laser group i.e. $P < 0.000$.

Table 2: Pain Relief (Mean changes in VAS Score)

GROUPS	GROUP A US	GROUP B LLLT
POST TREATMENT	4.3	3.05
SD	.978	.998
p value	0.000	0.000
Inference	Significant	Significant

There was highly significant difference between the VAS Scores in the subjects in the Laser group than the Ultrasound group i.e. $P 0.000$.

Table 3: Pain, stiffness and physical function (Mean changes in WOMAC Score)

GROUPS		GROUP A US	GROUP B LLLT
PRE TREATMENT	MEAN	51.778	52.778
	SD	13.900	13.670
POST TREATMENT	MEAN	41.923	29.787
	SD	12.743	11.801
p value		0.000	0.000
inference		Significant	Significant

Improvement in Pain, stiffness and physical function in OA was indicated in terms of improvement in WOMAC Score. For that initial and final score was noted on 1st and last day (After 4 weeks) of the treatment in all the subjects. However the difference between two scores was considered for analysis of the difference between the two groups.

In the group A (US), the average womac score on 1st day was 51.778 and on last day (After 4 weeks) of the treatment were 41.923. There was highly significant difference between the womac score in the subjects in group A ($p 0.000$).

In the group B (LLLT), the average womac score on 1st day was 52.778 and on last day (After 4 weeks) of the treatment were 29.787. There was highly significant difference between the womac score in the subjects in group B ($P 0.000$).

TABLE 4: Pain, stiffness and physical function (Mean changes in WOMAC Score)

GROUPS	GROUP A US	GROUP B LLLT
POST TREATMENT	41.923	29.787
SD	12.743	11.801
p value	0.000	0.000
Inference	Significant	significant

There was highly significant difference between the Womac Scores in the subjects in the Laser group than the Ultrasound group i.e. $P 0.000$.

DISCUSSION

Our measurement results provide evidence that treatment with the low level laser therapy (LLLT) and ultrasound therapy resulted in significant improvement for all evaluated parameters pain, stiffness and disability. Ultrasound has demonstrated the ability to enhance tissue healing by means of facilitating protein synthesis and accelerating angiogenesis and it also promotes orderly collagen deposition to increase tissue tensile strength in healing,³ when compared between groups low level laser therapy effective than the ultrasound group. Many articles or studies have been published on the effects of LLLT and these articles show the favourable anti-inflammatory and analgesic effect of LLLT. Hassan Soleimanpour in his study The effect of low level laser therapy on knee osteoarthritis, Results said a significant reduction was observed Regarding the nocturnal pain, pain on walking and ascending the steps at the end of the treatment course and concluded LLLT is effective in reducing pain in knee osteoarthritis.⁹ The clinical efficacy of low power laser therapy on pain and function in cervical osteoarthritis by F.Ozdemir concluded Low power laser seems to be successful in relieving pain and improving function in osteoarthritis disease.¹⁰ Jan Magnus Bjordal et al Low-Level Laser Therapy in Acute Pain, A Systematic Review of Possible Mechanisms of Action and Clinical Effects in Randomized Placebo-Controlled Trials concluded LLLT can modulate inflammatory processes in a dose-dependent manner and can be titrated to significantly reduce acute inflammatory pain in clinical settings.¹¹ The effect of low-level laser in knee osteoarthritis, a double-blind, randomized, placebo-controlled trial, Hegedus B et al., Concluded that LLLT reduces pain in KOA and improves microcirculation in the irradiated area.¹²

Alfredo *et al.*, evaluating the use of laser associated with physical activity in patients with knee osteoarthritis, noted improvement in pain, range of motion and functionality, suggesting an anti-inflammatory activity and the endogenous modulation of pain through the action of serotonin as possible effects of the laser. The anti-inflammatory action may occur by changes in the cyclo oxygenase pathway of arachidonic acid metabolism, besides the suppression of TNF- α , IL- 1 β and hypoxia-inducing factor 1 α (HIF-1 α), other possible explanations are the periph-

eral release of β -endorphins and an interruption of nerve conduction via thin fibres, due to the formation of axonal varicosities.¹³ Lin YS, et al., Effects of helium-neon laser on levels of stress protein and arthritic histopathology in experimental osteoarthritis, low-power laser can enhance stress protein production in arthritic chondrocytes. The extragenic production of stress protein is well correlated with the therapeutic effect of low-power laser in preserving chondrocytes and the repair of arthritic cartilage in rats.¹⁴ Caroline Bublitz et al., their study Low-level laser therapy prevents degenerative morphological changes in an experimental model of anterior cruciate ligament transection in rats, laser therapy prevented features related to the articular degenerative process in the knees of rats after anterior cruciate ligament transection.¹⁵

According to Huseyin Demir et al., in their study comparison of the effects of laser and ultrasound treatments on experimental wound healing in rats, Tissue hydroxyproline level is accepted as an important parameter in the evaluation of collagen metabolism, the increase in the level of hydroxyproline and the number of fibroblasts, as well as stimulation of the collagen synthesis and the composition, and The laser treatment, however, was considered more effective than the ultrasound treatment in the first two phases of wound healing.¹⁶

E.KHAN et al., Laser therapy for the treatment of arthritic knees, Laser Therapy is active at both the cellular and systemic levels activating a variety of mechanisms including cartilage regeneration, DNA synthesis, improved microcirculation and an analgesic and anti-inflammatory effect. A number of animal studies have measured the beneficial effect of LILT on cartilage formation, cartilaginous erosion, production of superoxide dismutase, stress protein levels and chondrocyte proliferation. These studies induce an osteoarthritic state in the knees of rats or rabbits by means of chemical injections into the intracapsular space. LILT has been found to decelerate the arthritic process, regenerate articular cartilage, increase the levels of stress proteins, thereby improving the repair of cartilaginous erosion, and significantly increase the number of chondrocytes and the thickness of the articular cartilage.¹⁷ Recently Seyed Mansour Rayegani et al., in their study Therapeutic effects of low level laser Therapy in knee osteoarthritis compared to Therapeutic ultrasound, concluded low level laser therapy reduces pain, joint stiffness, and disability in knee osteoarthritis and is superior to placebo and Ultrasound Therapy.¹⁸ Limitation of the our study is a Less Sample Size, Duration of symptoms was variable, and pain relief which was observed by VAS and WOMAC questionnaire know the status of pain, stiffness, and physical function, both are Subjective scales and though found to be significant, And Long-term effectiveness is not evaluated.

CONCLUSION

Based on all the above Evidences and On the basis of this study, we are concluding that the LLLT and Ultrasound Reduces pain, joint stiffness and Disability in Knee Osteo-

arthritis and LLLT is more effective than the Ultrasound And It was Statistically Proved.

Suggestions for Future Research : The future research could be by more sample size, And Long term effectiveness of treatment need to evaluate and Particular stage of disease.

ACKNOWLEDGEMENT: We take this opportunity to express my profound gratitude and deep regards to almighty God. We are grateful to **Dr M. Pradeep Reddy MS**, Mch (ortho), chief joint Replacement surgeon for his valuable support & expert suggestions and help in permitting to take the patients from Hyderabad Multi speciality Hospital. Special thanks to Our PHYSIO TEAM And I thank my parents, my family members and who supported me a lot during this and I thank all my subjects for their support.

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