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ORIGINAL ARTICLE

Effects of Low Level Laser Therapy on Knee Pain and Functional Status among Patients with Knee Osteoarthritis

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ABSTRACT

Objective: To determine the outcomes of low level laser therapy on knee pain and functional status among patients with knee osteoarthritis.

Methodology: A randomized controlled trial was conducted in physiotherapy department of Allied Hospital Faisalabad. Thirty four patients were randomly divided into experimental group treated with low level laser therapy combined with conventional exercises and control group treated with conventional exercises only. Numeric Pain Rating Scale, Western Ontario McMaster Universities Osteoarthritis Index (WOMAC) and goniometer were used as data collection tools. All the patients received 9 treatment sessions, 3 sessions per week for 3 weeks.

Results: Outcome measures including numeric pain rating scale, Western Ontario McMaster Universities Osteoarthritis Index (WOMAC) and goniometer showed significant results ($p<0.05$) after treatment in both groups but comparing pre and post mean difference of all these outcome measures depicted better results in experimental group treated with low level laser therapy combined with conventional exercises.

Conclusion: This study concluded that low level laser therapy had significant effects on pain, range of motion and functional status in patients with knee osteoarthritis.

Keywords: Knee pain, Knee function, Osteoarthritis, Low level laser therapy

INTRODUCTION

Osteoarthritis is characterized by the breakdown of bone and articular cartilage resulting in dysfunctional joint (1). About 80% of the population aged above 65 years of developed countries suffers from osteoarthritis. Clinical symptoms of OA usually appear after age of 40 and progresses gradually (2). Evidence shows that occurrence of OA continues to grow, influencing mostly elderly population becoming 7th most common disease by 2020. Knee OA is more frequent than hip OA with higher affecting rate in females as compared to males (3). Kellgren-Lawrence categorized knee osteoarthritis dependent on the properties of osteophytes. Grades 0-4 have been allocated with >2 demonstrating radiographic OA whereas grade 0 represents absence of OA and grade 4 represents severe OA (4). According to World Health Organization (WHO) recommendation, for better health benefits physical activity of moderate intensity for at least 150 minutes per week should be included in routine life. Physical inactivity is also leading cause of occurrence of other co morbidities along with OA (5). Quadriceps muscle weakness can lead to incite clinical diagnosis of knee osteoarthritis. Muscle dysfunction also play role in pathogenesis of knee OA (6). The results of laser therapy on the tissue repair depends on numerous factors such as wavelength of laser light, energy density, output power, number of sessions, treatment period and areas of application (7). Because of its provoking impact on metabolic activities of tissue and potential to modulate the inflammatory action after knee traumas, Low Level Laser Therapy (LLLT) is accounted as an ideal restorative option for treating OA (8). According to research, light energy emitted by laser is absorbed by mitochondrial receptors which activates photo bio-modulation effects (anti-inflammatory and analgesic), promotes cellular metabolism and increases soft tissue healing (9, 10). There is less awareness about treatment of knee OA with LLLT among common citizens. Previously a few research studies have been organized about this technique on international level but in our country very limited literature is available on this modality. Therefore, the rational of this study was to find the potency of LLLT in alleviating knee pain and ameliorating knee ROM. The outcome of this trial would help to aware the fellow therapies and the patients about the advantages of LLLT on treating knee OA.

METHODOLOGY

A randomized controlled trial was conducted in Allied Hospital Faisalabad. Consecutive sampling technique was employed. Sample size was thirty four as calculated by online EPITOOL sample size calculator. Both male and female patients with age range of 45 to 65 years, at least 3 months of knee pain with unilateral knee OA, suffering from Kellgren-Lawrence grade 2 or 3 knee OA, numeric pain rating scale score more than 5 and Western Ontario McMaster Universities Osteoarthritis Index (WOMAC) score least of 25 were included in the study. The exclusion criterion was symptomatic hip osteoarthritis, any kind of knee surgery in the past 6 months, patients suffering from diabetes, cancer, neurological dysfunction or hypertension. The participants who met selection criteria were requested to participate in the study. Participants were divided randomly into group A and group B. Group A was experimental group and treated with Low Level Laser Therapy (LLLT) and conventional physiotherapy while group B was control group and treated with conventional physiotherapy alone. Low Level Laser Therapy: ASTAR Company Polaris HP L laser equipment with wavelength of 850 nm, power 100 mw, spot size of 1.0 mm and 6J/point energy for 60 seconds was utilized. Overall 8 points were exposed with total dose of 48J per session. Patients were treated in supine position. Arthritic knee was somewhat flexed upheld by the cushion or rolled towel. Hot pack covered by towel was placed on the affected knee for 20 minutes followed by laser therapy. Laser probe was placed on the influenced knee with complete skin contact at 8 points. These 8 points are distributed as: Three points medially, three points laterally and at the medial side of the bicep femoris muscle tendon and semitendinosus muscle tendon, two points were irradiated (11). Conventional Exercise Program: Isometric strengthening workout for quadriceps, ROM and active stretching training of muscles of hamstring and quadriceps, isometric activities of hamstring muscles and Active ankle pump. Extension practices for knee joint mainly include short arc terminal exercises. For the hip abductors, adductors and hip extensor muscles, static and dynamic strengthening exercises were performed. Non-weight bearing progressive resistance activities with weighted wristlets; plan was progressed to closed chain activities depending on the patient's discomfort. Isometric activities were performed with 6 second contractions and 2 seconds of rest

interval. Isotonic activities were begun as 10 reiteration with half of weight of 10 RM, 10 reiteration with 3/4th of this weight and 10 reiterations with entire 10 RM (12). Numeric Pain Rating Scale (NPRS), Western Ontario McMaster Universities Osteoarthritis Index (WOMAC) and goniometer were the tools used as outcome measure. All the participants received total nine sessions of treatment with frequency of three sessions per week for the period of three weeks. Measurements were calculated at the start of treatment and at the end of three weeks. SPSS version 25 was used for data analysis. The normality of data was assessed by Shapiro-Wilk test. The data was normal so parametric tests were used. The change of subjective and objective measurement overtime was depicted by paired samples t-test while the difference between the groups was measured by Independent samples t-test.

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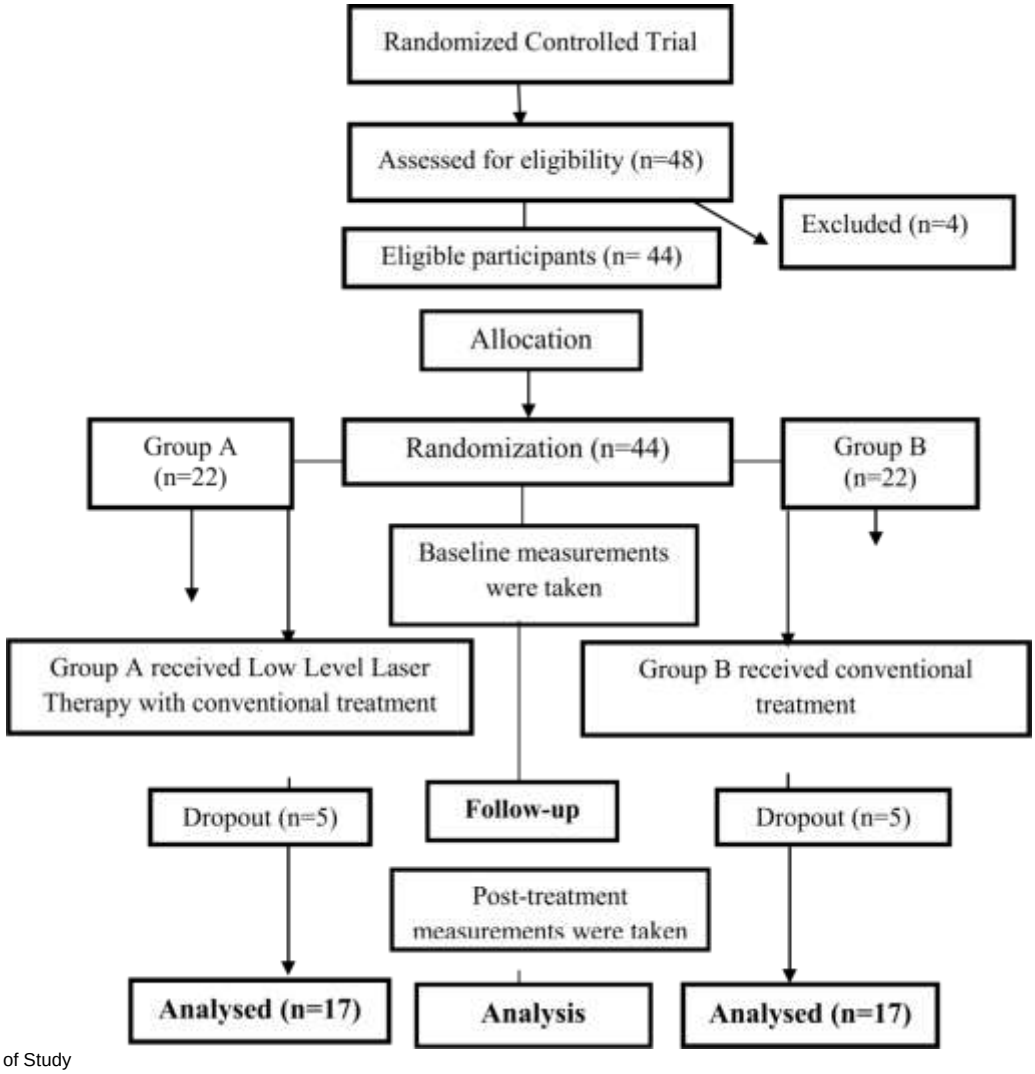

Consort Diagram of Study

RESULTS

Demographic data of the participants included age, height, weight and BMI. In group A minimum age was 48 years and maximum age of the participant was 58 years with the mean age of 52.82±3.02. Minimum height of the participant was 1.52m and maximum height was 1.80m with the mean height of 1.67±.09. Minimum weight of the participant was 54kg and maximum weight was 84kg with the mean weight of 69.88±8.86. Whereas minimum BMI of the participant was 25.14 and maximum BMI was 32.06 with mean BMI of 29.32±1.36. While in group B, minimum age of the participant was 49 years and maximum age was 60 years with the mean age of 3.02±3.29. Minimum height of the participant was 1.52m and maximum height was 1.78m with the mean height of 1.65±.09. Minimum weight of the participant was 58kg & maximum weight was 80kg with the mean weight of 68.23±7.50. Minimum BMI of the participant was 27.12 and maximum BMI was 31.52 with mean of 29.47±1.62. Results show that pre-treatment mean value of NPRS in group A was 7.29±.69 with p value of 0.574 while in group B pre-treatment mean value was 7.41±.50 with p value of 0.569. P value indicated that pretreatment there was no significant difference across the groups. In group A post treatment mean value of NPRS was 2.41±.61 with p value <0.001. Post treatment mean value of NPRS in group B was 5.23±.83 with p value <0.001. P value is less than selected α (0.05) which indicates that there was significant difference between both groups. This shows that pain was alleviated in both the groups but according to the mean difference, group A treated by LLLT and conventional exercises show more reduction in the pain as compared to group B.

Table-I: Pairwise comparison of NPRS (Paired samples t- test)

	Group A (LLLT and Conventional Physiotherapy) Mean		Group B (Conventional Physiotherapy alone) Mean	
Pre-treatment NPRS	7.29		7.41	
Post-treatment NPRS	2.41		5.23	
	Mean Difference	p-value	Mean Difference	p-value
Pre-treatment NPRS – Post-treatment NPRS	4.88	< 0.001	2.17	< 0.001

Table- II: Pairwise comparison of WOMAC (Paired samples t- test)

	Group A (LLLT and Conventional Physiotherapy) Mean		Group B (Conventional Physiotherapy alone) Mean	
Pre-treatment WOMAC	75.70		77.05	
Post-treatment WOMAC	34.11		60.52	
	Mean Difference	p-value	Mean Difference	p-value
Pre-treatment WOMAC– Post-treatment WOMAC	41.58	< 0.01	16.52	< 0.01

Table-III: Pairwise comparison of knee flexion ROM (Paired samples t-test)

	Group A (LLLT and Conventional Physiotherapy) Mean		Group B (Conventional Physiotherapy alone) Mean	
Pre-treatment knee flexionROM	102.00		101.17	
Post-treatment knee flexionROM	120.82		105.94	
	Mean Difference	p-value	Mean Difference	p-value
Pre-treatment knee flexion ROM – Post-treatment knee flexion ROM	18.82	< 0.001	4.76	< 0.001

Table- IV: Within group comparison of knee extension ROM (Paired Samples t-test)

	Group A (LLLT and Conventional Physiotherapy) Mean		Group B (Conventional Physiotherapy alone) Mean	
Pre-treatment knee extension ROM	3.88		4.05	
Post-treatment knee extension ROM	1.23		3.35	
	Mean Difference	p-value	Mean Difference	p-value
Pre-treatment knee extension ROM – Post-treatment kneeextension ROM	2.64	< 0.001	0.70	< 0.001

DISCUSSION

This clinical trial reveals that both LLLT and conventional exercises are helpful in improving knee symptoms but LLLT combined with conventional exercises is more beneficial as compared to exercise alone. Many research studies have been conducted by different researchers to evaluate the outcome of LLLT among the knee OA patients. Most of the research studies support the role of LLLT in alleviating knee pain and increasing knee range of motion in knee osteoarthritis patients and there is also availability of researches that does not advocates the efficacy of LLLT. A double blinded placebo controlled RCT was conducted by Fukuda, et al. (2011) from July 2008 to February 2010 to investigate short term effects of LLLT among patients suffering from knee OA. Forty seven subjects were randomly divided into two groups. Group 1: This group was treated by active laser. Group 2: This group was treated with inactive (placebo) laser. Results of the assessment revealed that short term application of LLLT was beneficial in improving knee pain and function among knee OA patients (13). Current study also evaluates the effects of LLLT within 3 weeks' time period. Conclusion shows that treatment with short term application of LLLT is beneficial in alleviating pain and functional improvement in patients with knee OA. Alfredo, et al. (2017) conducted an experimental double blinded randomized controlled trial to observe the long term effects of LLLT on patients with knee OA. Forty subjects were recruited in the trial and divided among active laser and placebo group. These researchers first conducted a RCT to find short term (8 weeks) effects of LLLT on knee OA patients. Same subjects were included in this study and follow up was taken after 3 and 6 months. Results of the trial indicates that the short term advantageous effects of LLLT obtained after 8 weeks were stable and maintained after 6 months. Patients in active laser group also consumed less amount of Paracetamol as compared to placebo group (14). Results of this study also conclude that treatment with short term application of LLLT is beneficial in alleviating pain and enhancing functional status in patients with knee OA. A Kholvadia et al conducted a descriptive interventional study to explore the effectiveness of LLLT and exercise program on patients suffering from knee OA. Total 120 participants were recruited into 3 groups. Group A was instructed to follow exercise protocol for knee OA. Group 2 was treated by active LLLT and combination of exercise and LLLT was received by group 3. Knee circumference, pain, knee ROM and knee functionality were outcome measures for this study. All groups got 12 sessions of treatment. After 4 weeks results showed that outcome parameters were improved in all three groups but active LLLT was more beneficial in short term pain relieving and combination of LLLT and consecutive exercise protocol for knee OA seems to be more fruitful in long term pain alleviation and improvement in knee functionality (15). This randomized trial also determines that LLLT combined with conventional exercises is more advantageous in alleviating pain and enhancing function in patients with knee osteoarthritis. Most of the evidence from last 5 years falls in support of the results of this trial. This proves that LLLT is beneficial for treating OA of knee.

CONCLUSION

This study concluded that low level laser therapy had beneficial effects on pain and function in patients with knee osteoarthritis than conventional physiotherapy alone.

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