

Original Research Article

## In Chronic Knee Osteoarthritis Low Level Laser Therapy Combined With Exercise Is More Beneficial Than Exercise Alone in the Long Term: A Randomized Trial

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### ABSTRACT

**Background/Purpose:** Osteoarthritis (OA) of the knee is the most common joint disease in the elderly and is associated with significant physical disability. Low level laser therapy has been used previously as a therapeutic modality to control the pain in different musculoskeletal pathologies associated with joint disease. The aim of this investigation is to evaluate the effectiveness of low level laser therapy in combination with exercise in the long term to reduce pain, improve range of motion (ROM) and functionality in an osteoarthritis population.

**Methodology:** 220 subjects with chronic osteoarthritis of the knee are recruited, aged-matched and divided into 2 groups. Intervention: one group receives laser therapy and exercise and the second group receives placebo laser therapy and exercise. Laser therapy was performed twice a week for 6 weeks. Measurements of pain, knee range of motion, WOMAC and Lequesne Questionnaire were taken at the baseline, after 6 weeks of intervention and another 6 weeks of no interventions.

**Result:** The result of the study concluded that Low level laser therapy combined with exercise is more beneficial than placebo laser therapy with exercise in the long term. Hence Low level Laser therapy is used as an effective adjuvant treatment for patients with knee osteoarthritis.

**Key words:** Low level laser therapy, Exercise, Osteoarthritis

### INTRODUCTION

Osteoarthritis (OA) of the knee is the most common joint disease in the elderly and is associated with significant physical disability. <sup>[1,2]</sup> The treatment of knee OA is mainly aimed at alleviation of pain. Although non-steroidal anti-inflammatory drugs (NSAIDs) are widely used to treat the pain and stiffness associated with knee OA, the high incidence of serious upper gastrointestinal side effect with NSAIDs can limit their use. <sup>[3]</sup> To avoid or to reduce the side effects associated with NSAIDs, physical therapy agents such as ultrasound, transcutaneous electrical nerve stimulation

therapy and muscle strengthening exercises are frequently used. <sup>[4,5]</sup> Low-level laser therapy has been used to control pain in different musculoskeletal conditions. Despite its widespread use, the results of the experimental and clinical studies are conflicting. <sup>[6,7]</sup> The results of some placebo-controlled studies suggest that low-power laser treatment may be useful for reducing the pain in cervical osteoarthritis, medial and lateral epicondylitis. <sup>[8,9]</sup> On the other hand, a number of placebo controlled, randomized and double blind studies have not been able to demonstrate any significant or convincing clinically relevant effects

over placebo in the treatment of lateral epicondylitis, [10] rotator cuff tendinitis [11] and rheumatoid arthritis. [12] However, very few controlled clinical studies of low-level laser applied for the treatment of knee OA have been reported and the findings from these studies are also contradictory. [13,14] 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 OA. [15] In contrast, in a double blind, placebo controlled study Bülow et al. detected no difference between the actively and the placebo treated groups. [16,17] Since the results of low level laser therapy effectiveness studies in knee OA show considerable variation, and also no studies were found for the long term effects, we aimed to evaluate the effect of low level laser treatment in patients with knee OA for the long term in the present study.

#### **OBJECTIVES OF THE STUDY**

- ▶ To find out the effect of LASER therapy and exercise in the long term to reduce pain, improve knee range of motion, functionality and activity in subjects with knee osteoarthritis.
- ▶ To find out the effect of placebo LASER therapy and exercise in the long term to reduce pain, improve knee range of motion, functionality and activity in subjects with knee osteoarthritis.
- ▶ To compare the effects of LASER therapy and exercise group with placebo LASER therapy and exercise group in the long term to reduce pain, improve knee range of motion, functionality and activity in subjects with knee osteoarthritis.

#### **HYPOTHESIS OF THE STUDY**

- ▶ Null Hypothesis: There is no significance difference between LASER and exercise group over placebo LASER and exercise group in the long term to reduce pain, improve range of motion, functionality and activity in subjects with knee osteoarthritis.
- ▶ Alternate Hypothesis: There is a significance difference between LASER

and exercise group over placebo LASER and exercise group in the long term to reduce pain, improve range of motion, functionality and activity in subjects with knee osteoarthritis.

#### **MATERIAL & METHODOLOGY**

**Study Population:** C.M. Patel College of Physiotherapy with the Symptom of Unilateral Knee Pain during the period of Jan 2017 to Dec 2017.

**Sample size:** 100 patients in each Group.

**Sample design:** Simple Random Sampling with single blinded placebo-controlled randomized clinical trial.

**Setting:** C. M. Patel College of physiotherapy, Gandhinagar.

**Study duration:** One year (Jan 2017 to Dec 2017)

**Inclusion criteria:** Both Male & Female patients aged between 40 years to 60 years with Chronic OA Knee (with symptoms for more than 3 months and less than 2 years); Kellgren- Lawrence Grade II & III radiographic classification). [15-17] Mild to Moderate functional score of WOMAC index (i.e.  $\leq 50$  out of 96) and diagnosed by orthopaedician were included in the study.

**Exclusion criteria:** Patients who had undergone knee surgery within 6 months, had metal implants, peripheral vascular disease, any local or systemic infections, fracture of femoral or tibial condyle, grade IV K-L Scale OA Knee, Mentally deficit patients were excluded from the study.

**Outcome measures;**

Pain Intensity 10 – cm Visual Analog Scale, Range of Motion: Universal Goniometer WOMAC index.(modified Pune version) and Lequesne questionnaire.

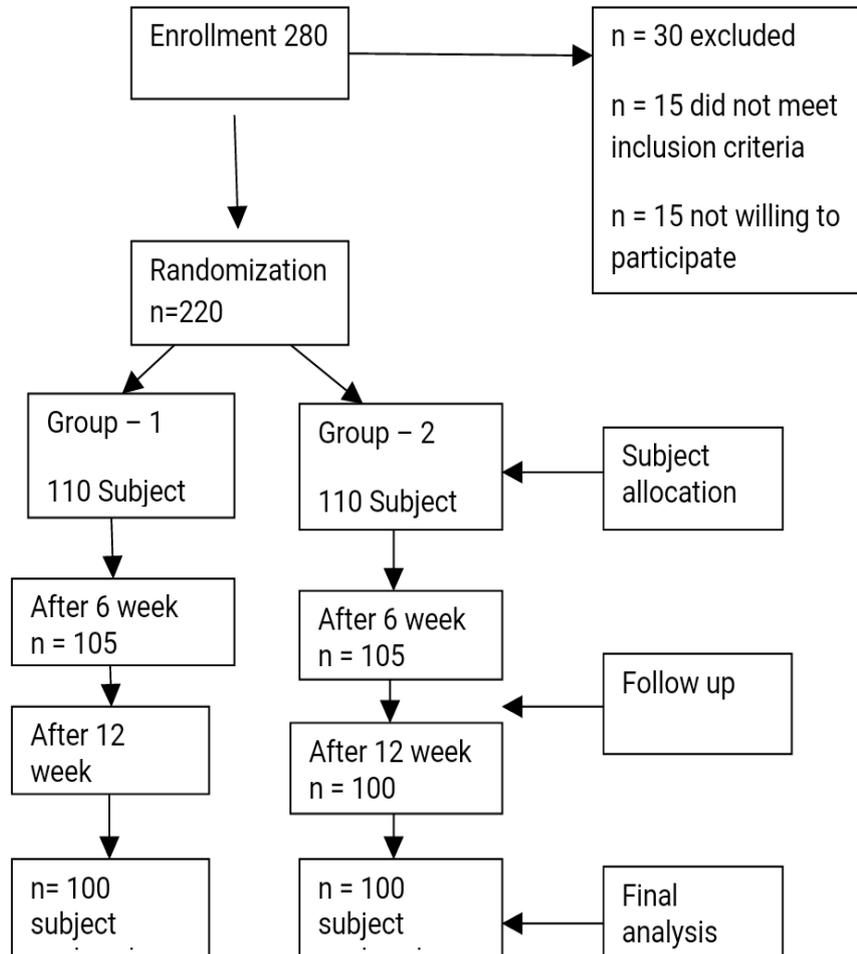
**Methodology:**

220 subjects with chronic osteoarthritis of the knee are recruited, aged-matched and divided into 2 groups. **Intervention:** one group receives laser therapy and exercise and the second group receives placebo laser therapy and exercise. Laser therapy was performed twice a week for 6 weeks. Measurements are taken at the baseline, after 6 weeks of intervention and another 6

weeks of no interventions. Data were analyzed using Levene's test of equality of variance between the group and ANOVA to

check variation of mean score within the group. Statistical package used SPSS-16.0 version.

### Study flow chart



## PROCEDURE

### EXPERIMENTAL GROUP:

- ▶ Subject were instructed to sit in long sitting position on the treatment table. The affected knee is exposed and Low level laser therapy (LLLT) dose of 3J/point is irradiated over five painful points examined clinically.
- ▶ 2 minutes at each point for 10 minutes per session for 12 sessions
- ▶ Total dosage: 15 J per session
- ▶ Wavelength: Infrared probe: 808 nm
- ▶ Power: Infrared probe: 200mW
- ▶ Beam area: 0.5 cm<sup>2</sup>
- ▶ CONTROL GROUP:  
received placebo low level laser therapy.

- ▶ Dose of 0.1 J /point at 5 painful points for 2 min at each point for 10 min per session for 12 session.
  - ▶ The exercise program includes:
    - ▶ active range-of-motion exercises for the knee
    - ▶ strengthening exercises for the hip and knee
    - ▶ muscle stretching exercise for the lower limbs
    - ▶ riding a stationary bicycle for 10 minutes
- Each subject is treated 2 session in a week for 6 weeks duration. The time spent for each session is 30 minutes.

► **Inter group comparison**

► **Visual analog scale - comparison of pain intensity score between group 1 and 2**

Group	Pre test score	Levene's Test for Equality of Variance (p-value)	Post test score 6 weeks	Z-test	Percentage of improvement	Post test score 12 weeks	Z-test	Percentage of improvement
Group 1	6.621 (0.432)	3.227 (0.074)	5.112 (0.473)	-1.000	22.80%	2.963 (0.693)	-20.769	42.04%
Group2	6.544 (0.457)		5.180 (0.495)		20.84%	4.860 (0.595)		6.17%

► **Universal Goniometer score – comparison of range of motion between group1 and 2**

Group	Pre test score	Levene's Test for Equality of Variance (p-value)	Post test score 6 weeks	Z-test	Percentage of improvement	Post test score 12 weeks	Z-test	Percentage of improvement
Group 1	120.8 (5.281)	2.928 (0.089)	124.5 (4.867)	0.972	3.06%	126.5 (5.002)	5.374	1.61%
Group2	119.8 (4.295)		123.86 (4.431)		3.38%	123.16 (3.999)		0.56%

► **WOMAC index (modified pune version) – comparison of activity between group 1 and 2**

Group	Pre test score	Levene's Test for Equality of Variance (p-value)	Post test score 6 weeks	Z-test	Percentage of improvement	Post test score 12 weeks	Z-test	Percentage of improvement
Group 1	38.00 (4.725)	0.445 (0.506)	33.24 (4.706)	-1.237	12.52%	30.75 (4.622)	-3.787	7.50%
Group2	36.45 (4.363)		34.05 (4.556)		6.60%	33.25 (4.713)		2.34%

► **Lequesne questionnaire – comparison of functionality between group1 and 2.**

Group	Pre test score Mean (Standard deviation)	Levene's Test for Equality of Variance (p-value)	Post test score 6 weeks Mean (Standard deviation)	Z-test	Percentage of improvement	Post test score 12 weeks Mean (Standard deviation)	Z-test	Percentage of improvement
Group 1	17.40 (2.322)	2.721 (0.081)	12.93 (2.109)	-1.737	25.68%	9.60 (1.864)	-8.647	25.75%
Group2	16.00 (2.543)		13.50 (2.513)		15.62%	12.40 (2.648)		8.14%

► **Intra group comparison**

► **VISUAL ANALOG SCALE-Intra-group comparison at pre-test, 6<sup>th</sup> week and 12<sup>th</sup> week for group 1 and group 2**

Group	Pre test score Mean (Standard deviation)	Post test score 6 weeks Mean (Standard deviation)	Post test score 12 weeks Mean (Standard deviation)	Intra group comparison F- score (p-value)
Group 1	6.617 (0.4304)	5.112 (0.473)	2.963 (0.693)	111.1 (<0.001)
Group2	6.544 (0.4576)	5.180 (0.495)	4.860 (0.595)	305.6 (<0.001)

► **Post Hoc Tests Multiple Comparisons in group 1 – Bonferroni Test**

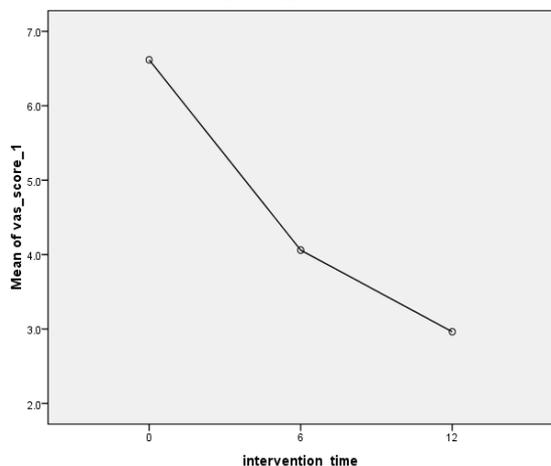
(I) intervention_time	(J) intervention_time	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
0	6	2.5570*	.0800	.000	2.364	2.750
	12	3.6540*	.0800	.000	3.461	3.847
6	0	-2.5570*	.0800	.000	-2.750	-2.364
	12	1.0970*	.0800	.000	.904	1.290
12	0	-3.6540*	.0800	.000	-3.847	-3.461
	6	-1.0970*	.0800	.000	-1.290	-.904

\*. The mean difference is significant at the 0.05 level.

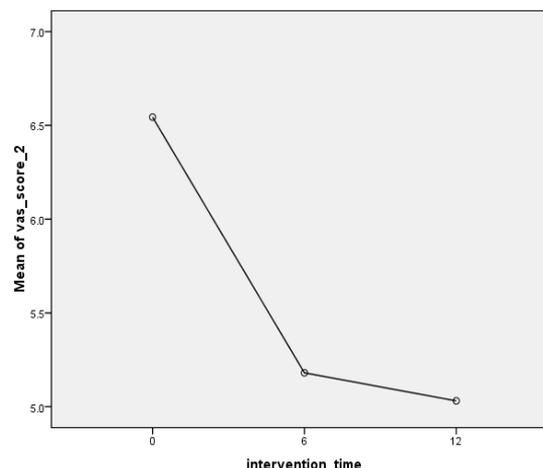
► **Post Hoc Tests - Multiple Comparisons in group 2 - Bonferroni test**

(I) intervention_time	(J) intervention_time	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
0	6	1.3635*	.0674	.000	1.201	1.526
	12	1.5130*	.0674	.000	1.351	1.675
6	0	-1.3635*	.0674	.000	-1.526	-1.201
	12	.1495	.0674	.082	-.013	.312
12	0	-1.5130*	.0674	.000	-1.675	-1.351
	6	-.1495	.0674	.082	-.312	.013

► **Graphical representation of mean score for VAS at pretest, 6th week and 12<sup>th</sup> week for group1**



► **Graphical representation of mean score for VAS at pretest, 6th week and 12<sup>th</sup> week for group 2**



► **Range of motion-Intra-group comparison at pre-test, 6<sup>th</sup> week and 12<sup>th</sup> week for group 1 and group 2**

Group	Pre test score Mean (Standard deviation)	Post test score 6 weeks Mean (Standard deviation)	Post test score 12 weeks Mean (Standard deviation)	Intra group comparison F- score (p-value)
Group 1	120.8 (5.281)	124.5 (4.867)	126.5 (5.002)	30.111 (< 0.001)
Group2	119.8 (4.295)	123.86 (4.431)	123.16 (3.999)	16.640 (< 0.001)

► **Post Hoc Tests - Multiple Comparisons in group1 – Bonferroni Test**

(I) intervention_time	(J) intervention_time	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
0	6	-3.400*	.713	.000	-5.12	-1.68
	12	-5.480*	.713	.000	-7.20	-3.76
6	0	3.400*	.713	.000	1.68	5.12
	12	-2.080*	.713	.011	-3.80	-.36
12	0	5.480*	.713	.000	3.76	7.20
	6	2.080*	.713	.011	.36	3.80

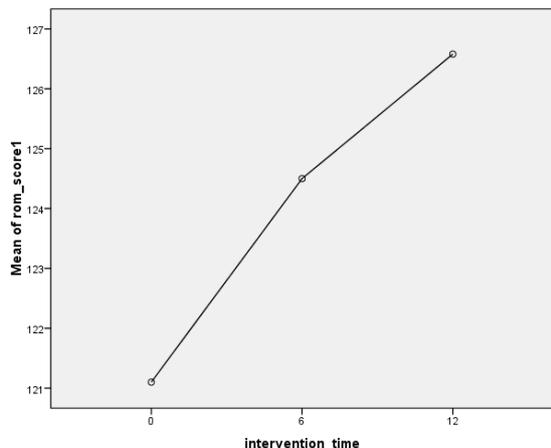
\*. The mean difference is significant at the 0.05 level.

► **Post Hoc Tests - Multiple Comparisons in group 2 - Bonferroni Test**

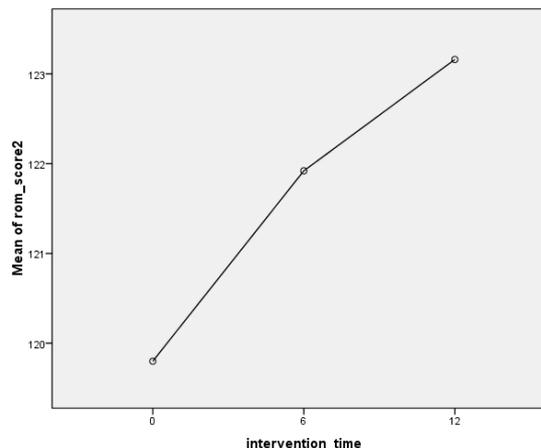
(I) intervention_time	(J) intervention_time	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
0	6	-2.120*	.589	.001	-3.54	-.70
	12	-3.360*	.589	.000	-4.78	-1.94
6	0	2.120*	.589	.001	.70	3.54
	12	-1.240	.589	.108	-2.66	.18
12	0	3.360*	.589	.000	1.94	4.78
	6	1.240	.589	.108	-.18	2.66

\*. The mean difference is significant at the 0.05 level.

► Graphical representation of mean score for ROM at pretest, 6th week and 12<sup>th</sup> week for group 1



► Graphical representation of mean score for ROM at pretest, 6th week and 12<sup>th</sup> week for group 2



► Womac-Intra-group comparison at pre-test, 6<sup>th</sup> week and 12<sup>th</sup> week for group 1 and group 2

Group	Pre test score Mean (Standard deviation)	Post test score 6 weeks Mean (Standard deviation)	Post test score 12 weeks Mean (Standard deviation)	Intra group comparison F- score (p-value)
Group 1	38.00 (4.725)	33.24 (4.706)	30.75 (4.622)	116.024 (0.000)
Group2	36.45 (4.363)	34.05 (4.556)	33.25 (4.713)	13.419 (0.000)

► Post Hoc Tests Multiple Comparisons in group 1 – Bonferroni Test

(I) intervention_time	(J) intervention_time	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
0	6	6.750*	.623	.000	5.25	8.25
	12	9.150*	.623	.000	7.65	10.65
6	0	-6.750*	.623	.000	-8.25	-5.25
	12	2.400*	.623	.000	.90	3.90
12	0	-9.150*	.623	.000	-10.65	-7.65
	6	-2.400*	.623	.000	-3.90	-.90

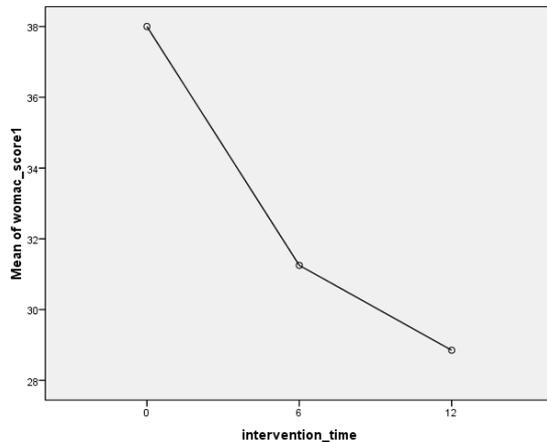
\*. The mean difference is significant at the 0.05 level.

► Post Hoc Tests Multiple Comparisons in group 2 – Bonferroni

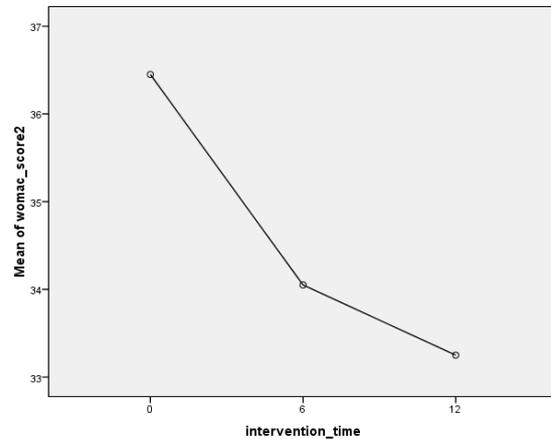
(I) intervention_time	(J) intervention_time	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
0	6	2.400*	.643	.001	.85	3.95
	12	3.200*	.643	.000	1.65	4.75
6	0	-2.400*	.643	.001	-3.95	-.85
	12	.800	.643	.643	-.75	2.35
12	0	-3.200*	.643	.000	-4.75	-1.65
	6	-.800	.643	.643	-2.35	.75

\*. The mean difference is significant at the 0.05 level.

▶ Graphical representation of mean score for WOMAC at pretest, 6th week and 12th week for group 1



▶ Graphical representation of mean score for WOMAC at pre-test, 6th week and 12th week for group 2



▶ Lequesne questionnaire-Intra-group comparison at pre-test, 6th week and 12th week for group 1 and group 2

Group	Pre test score Mean (Standard deviation)	Post test score 6 weeks Mean (Standard deviation)	Post test score 12 weeks Mean (Standard deviation)	Intra group comparison F- score (p-value)
Group 1	17.40 (2.322)	12.93 (2.109)	9.60 (1.864)	156.670 (0.000)
Group 2	16.00 (2.543)	13.50 (2.513)	12.40 (2.648)	44.307 (0.000)

▶ Post Hoc Tests Multiple Comparisons in group 1 – Bonferroni Test

(I) intervention_time	(J) intervention_time	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
0	6	5.550*	.322	.000	4.77	6.33
	12	3.900*	.322	.000	3.12	4.68
6	0	-5.550*	.322	.000	-6.33	-4.77
	12	-1.650*	.322	.000	-2.43	-.87
12	0	-3.900*	.322	.000	-4.68	-3.12
	6	1.650*	.322	.000	.87	2.43

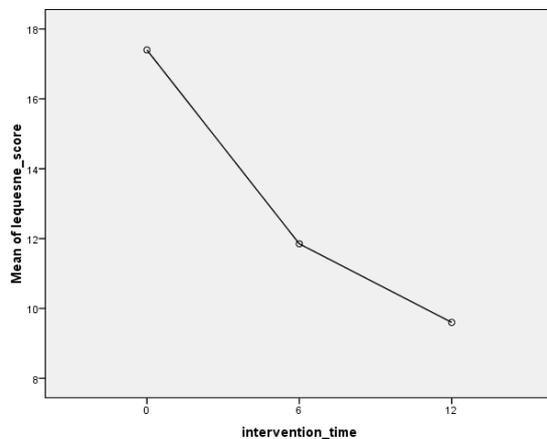
\*. The mean difference is significant at the 0.05 level.

▶ Post Hoc Tests Multiple Comparisons in group 2 – Bonferroni Test

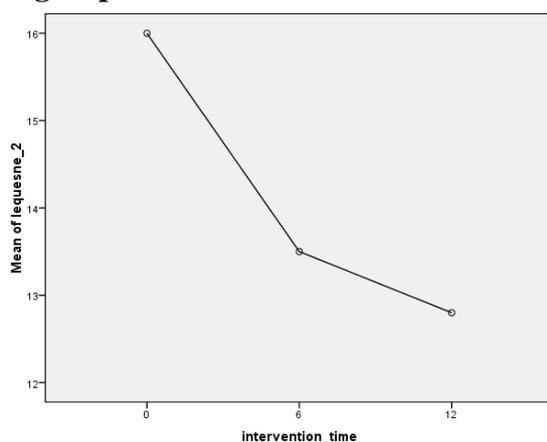
(I) intervention_time	(J) intervention_time	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
0	6	2.500*	.357	.000	1.64	3.36
	12	3.200*	.357	.000	2.34	4.06
6	0	-2.500*	.357	.000	-3.36	-1.64
	12	.700	.357	.153	-.16	1.56
12	0	-3.200*	.357	.000	-4.06	-2.34
	6	-.700	.357	.153	-1.56	.16

\*. The mean difference is significant at the 0.05 level.

► **Graphical representation of mean score for lequesne questionnaire at pre-test, 6<sup>th</sup> week and 12<sup>th</sup> week for group 1**



► **Graphical representation of mean score for lequesne questionnaire at pre-test, 6<sup>th</sup> week and 12<sup>th</sup> week for group 2**



**RESULTS**

**Inter-Group Analysis**

**Test for Homogeneity**

It was calculated by Levene's Test for Equality of Variance, the p-value obtained was > 0.05 at pre-test level between both groups in case of VAS, ROM, WOMAC and Lequesne, thereby suggesting no significant difference in pretest scores between both groups at baseline level, hence showing sample homogeneity.

**Inter group analysis - VAS - comparison of pain intensity score between group 1 and 2**

The calculated Z-test value was obtained as -1.000 (i.e. > -1.96, not significant at 95% CL), thereby suggesting no significant mean difference between the mean VAS score between two groups for post-test after 6 weeks suggesting no significant difference between both groups in terms of improvement after 6 weeks. Z-test value was obtained as -20.769 (i.e. < -1.96, significant at 95% CL), thereby suggesting significant mean difference between the mean VAS score between two groups for post-test after 12 weeks, suggesting long term effect of treatment (laser + exercise) in group 1. Percentage of improvement was seen more in group 1.

**Inter group analysis - Universal Goniometer score – comparison of range of motion between group1 and 2**

The calculated Z-test value was obtained as 0.972 (i.e. < -1.96, not significant at 95% CL), thereby suggesting no significant mean difference in the mean ROM score between two groups for post-test after 6 weeks suggesting no significant difference between both groups in terms of improvement after 6 weeks. Not much variation was observed in percentage of improvement between both the groups after 6 weeks of post test analysis. However, Z-test value was obtained as 5.374 (i.e. > 1.96, significant at 95% CL), thereby suggesting significant mean difference between the mean ROM score between two groups for post-test after 12 weeks, suggesting long term effect of treatment (laser + exercise) in group 1. Percentage of improvement was seen more in group 1.

**Inter group analysis - WOMAC index (modified pune version) – comparison of activity between group 1 and 2**

The calculated Z-test value was obtained as -1.237 (i.e. > -1.96, not significant at 95% CL), thereby suggesting no significant mean difference in the mean WOMAC score between two groups for post-test after 6 weeks suggesting no significant difference between both groups in terms of improvement after 6 weeks. Z-test value was obtained as -3.787 (i.e. < -

1.96, significant at 95% CL), thereby suggesting significant mean difference between the mean WOMAC score between two groups for post-test after 12 weeks, suggesting long term effect of treatment (laser + exercise) in group 1. Percentage of improvement was seen more in group 1.

#### **Inter group analysis - Lequesne questionnaire – comparison of functionality between group1 and 2.**

The calculated Z-test value was obtained as -1.737 (i.e. > -1.96, not significant at 95% CL), thereby suggesting no significant mean difference in the mean score between two groups for post-test after 6 weeks suggesting no significant difference between both groups in terms of improvement after 6 weeks. Z-test value was obtained as -8.647 (i.e. < -1.96, significant at 95% CL), thereby suggesting significant mean difference between the mean score between two groups for post-test after 12 weeks, suggesting long term effect of treatment (laser + exercise) in group 1. Percentage of improvement was seen more in group 1.

#### **Intra-group Analysis**

##### **Visual Analog Scale - Intra-group comparison at pre-test, 6<sup>th</sup> week and 12<sup>th</sup> week.**

###### **Group 1**

The mean VAS score for group 1 at pre-test, post test 6<sup>th</sup> week and 12<sup>th</sup> week was obtained as 6.617, 5.112 and 2.963, respectively. Intra group comparison was done by ANOVA to check the variation of mean scores within the group at each stage (i.e. pre-test and post test). The value of F-score obtained through ANOVA was highly significant at p-value < 0.001, suggesting within the group variation as significant statistically.

###### **Group 2**

The mean VAS score for group 2 at pre-test, post test 6<sup>th</sup> week and 12<sup>th</sup> week was obtained as 6.544, 5.180 and 4.860, respectively. Intra group comparison was done by ANOVA to check the variation of mean scores within the group at each stage (i.e. pre-test and post test). The value of F-

score obtained through ANOVA was highly significant at p-value < 0.001, suggesting within the group variation as significant statistically.

#### **Post hoc analysis - Bonferroni Test**

This test is based on multiple comparisons and compares each stage (pre-test, post test 6 weeks, post test 12 weeks) separately with another to see which stage shows more variation.

##### **Group 1**

The pre-test, post test 6 weeks and post test 12 weeks showed significant variation from each other with the contributing significant p-value as < 0.001.

##### **Group 2**

Here, the pre-test value differed significantly with post test 6 weeks and 12 weeks but no significant difference was seen between the scores of post test 6 weeks and post test 12 weeks, suggesting no long term effect of treatment (placebo laser + exercise) in group 2. So most of overall variation within the group was thought to have contributed by the significant difference between pre-test and post test 6 weeks and pre-test and post test 12 weeks scores, whereas no significant difference (p value > 0.05) was obtained between the post test 6 weeks and 12 weeks scores.

##### **Range of motion-Intra-group comparison at pre-test, 6<sup>th</sup> week and 12<sup>th</sup> week**

###### **Group 1**

The mean ROM score for group 1 at pre-test, post test 6<sup>th</sup> week and 12<sup>th</sup> week was obtained as 120.8, 124.5 and 126.5, respectively. Intra group comparison was done by ANOVA to check the variation of mean scores within the group at each stage (i.e. pre-test and post test). The value of F-score obtained through ANOVA was highly significant at p-value < 0.001, suggesting within the group variation as significant statistically

###### **Group 2**

The mean ROM score for group 2 at pre-test, post test 6<sup>th</sup> week and 12<sup>th</sup> week was obtained as 119.8, 123.86 and 123.16, respectively. Intra group comparison was done by ANOVA to check the variation of

mean scores within the group at each stage (i.e. pre-test and post test). The value of F-score obtained through ANOVA was highly significant at  $p$ -value  $< 0.001$ , suggesting within the group variation as significant statistically

#### **Post hoc analysis - Bonferroni Test**

##### **Group 1**

The pre-test, post test 6 weeks and post test 12 weeks showed significant variation from each other with significant  $p$ -value as  $< 0.001$ .the significant difference in mean scores of post test 6 weeks and 12 weeks showed long term effect of the treatment (laser + exercise) in group 1

##### **Group 2**

Here, the pre-test value differ significantly with post test 6 weeks and 12 weeks but no significant difference was seen between the scores of post test 6 weeks and post test 12 weeks, suggesting no long term effect of treatment ( placebo laser + exercise) in group 2. So most of overall variation within the group was thought to have contributed by the significant difference between pre-test and post test 6 weeks and pre-test and post test 12 weeks scores, whereas no significant difference ( $p$  value  $> 0.05$ ) was obtained between the post test 6 weeks and 12 weeks scores.

#### **Womac-Intra-group comparison at pre-test, 6<sup>th</sup> week and 12<sup>th</sup> week**

##### **Group 1**

The mean WOMAC score for group 1 at pre-test, post test 6<sup>th</sup> week and 12<sup>th</sup> week was obtained as 38, 33.24 and 30.75, respectively. Intra group comparison was done by ANOVA to check the variation of mean scores within the group at each stage (i.e. pre-test and post test). The value of F-score obtained through ANOVA was highly significant at  $p$ -value  $< 0.001$ , suggesting within the group variation as significant statistically.

##### **Group 2**

The mean WOMAC score for group 1 at pre-test, post test 6<sup>th</sup> week and 12<sup>th</sup> week was obtained as 36.45, 34.05 and 33.25, respectively. Intra group comparison was done by ANOVA to check the variation

of mean scores within the group at each stage (i.e. pre-test and post test). The value of F-score obtained through ANOVA was highly significant at  $p$ -value  $< 0.001$ , suggesting significant variation within the group.

#### **Post hoc analysis - Bonferroni Test**

##### **Group 1**

The pre-test, post test 6 weeks and post test 12 weeks showed significant variation from each other with significant  $p$ -value as  $< 0.001$ .the significant difference in mean scores of post test 6 weeks and 12 weeks showed long term effect of the treatment (laser + exercise) in group 1

##### **Group 2**

The pre-test score differ significantly with post test 6 weeks and 12 weeks but no significant difference was seen between the scores of post test 6 weeks and post test 12 weeks, suggesting no long term effect of treatment (placebo laser + exercise) in group 2. So most of overall variation within the group was thought to have contributed by the significant difference between pre-test and post test 6 weeks and pre-test and post test 12 weeks scores, whereas no significant difference ( $p$ -value  $> 0.05$ ) was obtained between the post test 6 weeks and 12 weeks scores.

#### **Lequesne questionnaire-Intra-group comparison at pre-test, 6<sup>th</sup> week and 12<sup>th</sup> week**

##### **Group 1**

The mean score for group 1 at pre-test, post test 6<sup>th</sup> week and 12<sup>th</sup> week was obtained as 17.40, 12.93 and 9.60, respectively. Intra group comparison was done by ANOVA to check the variation of mean scores within the group at each stage (i.e. pre-test and post test). The value of F-score obtained through ANOVA was highly significant at  $p$ -value  $< 0.001$ , suggesting within the group variation as significant statistically.

##### **Group 2**

The mean WOMAC score for group 1 at pre-test, post test 6<sup>th</sup> week and 12<sup>th</sup> week was obtained as 16, 13.50 and 12.40, respectively. Intra group comparison was

done by ANOVA to check the variation of mean scores within the group at each stage (i.e. pre-test and post test). The value of F-score obtained through ANOVA was highly significant at p-value < 0.001, suggesting significant variation within the group.

#### **Post hoc analysis - Bonferroni Test Group 1**

The pre-test, post test 6 weeks and post test 12 weeks showed significant variation from each other with significant p-value as < 0.001. The significant difference in mean scores of post test 6 weeks and 12 weeks showed long term effect of the treatment (laser + exercise) in group 1

#### **Group 2**

The pre-test score differ significantly with post test 6 weeks and 12 weeks but no significant difference was seen between the scores of post test 6 weeks and post test 12 weeks, suggesting no long term effect of treatment ( placebo laser + exercise) in group 2. So most of overall variation within the group was thought to have contributed by the significant difference between pre-test and post test 6 weeks and pre-test and post test 12 weeks scores, whereas no significant difference (p-value > 0.05) was obtained between the post test 6 weeks and 12 weeks scores.

### **DISCUSSION**

This was a placebo-controlled single-blinded clinical trial with random distribution that had the aim of evaluating the effect of LLLT along with conservative exercise for pain alleviation and functional improvement among patients with knee OA.

The calculated z-test, shows there is no significant difference between both groups in terms of reduction in pain, improvement in range, functionality and activity at the end of sixth week. However there is more significant improvement seen in experimental group at the end of twelve weeks. This suggest that LASER group have long term effects as compared with placebo laser group.

The exact effects from using LLLT remain uncertain. Some explanations can be

found in different experimental studies, which suggest that LLLT has an anti-inflammatory, analgesic and reparative effect. In a meta-analysis, Brosseau *et al* [18] stated that the reduction in 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. [19,20] Through LLLT, there is an improvement in local circulation, which leads to reduced edema and improved tissue oxygenation, which consequently may result in pain alleviation

### **CONCLUSION**

The result of the study concluded that Low level laser therapy combined with exercise is more beneficial than placebo laser therapy with exercise in the long term. Hence Low level Laser therapy is used as an effective adjuvant treatment for patients with knee osteoarthritis.

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