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## A study on assessing the effectiveness of cold laser Therapy and exercise with short wave diathermy and exercise in patients with chronic osteoarthritis knee –A comparative study

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### Abstract

The study wants to assess the effectiveness of cold laser therapy and short wave diathermy and exercises individually and also compare and assess the effectiveness of both cold laser therapy and exercise and short wave diathermy and exercise in chronic osteoarthritis of knee. Group A was cold laser therapy and exercise and Group B was short wave diathermy and exercise. 60 subjects were selected 30 in each group respectively were randomly selected. 12 days sessions with 4 weeks intervention. Cold laser therapy for 7 minutes and SWD for 20 minutes. Patients were evaluated with VAS, ROM and WOMAC score on before the start of 1st Session, 6th Session and by end of 12th Session. Result: at the end of 12<sup>th</sup> session both the groups were effective but Group A was more effective compared to Group B.

**Conclusion:** Statistically Group A is more significant than Group B.

**Keywords:** Cold Laser Therapy, Osteoarthritis Knee (OA), Visual Analog Scale (VAS), Western Ontario Mc Master Disability Scale (WOMAC), Range of Motion (ROM), Short Wave Diathermy (SWD)

### Introduction

Osteoarthritis is a chronic joint disease with a multi factorial aetiology involving Changes in the bone alignment, cartilage and structures necessary to joint stability <sup>[1]</sup>. The word ‘osteoarthritis’ is originated from the Greek word “osteo”, meaning “of the bone”, “arthro”, meaning “joint”, and “it is”, meaning inflammation <sup>[2]</sup>. The most commonly affected is the knee joint. This condition is characterized by joint pain, with or without swelling, reduced range of motion, reduction in strength of knee muscles and in more advanced stages stiffness, contractures, and muscle atrophy lead to severe disability of the joint and soft tissue deformation <sup>[3, 4]</sup>. Radiological findings remain the main stay of diagnosis of OA knee. X-ray findings shows more commonly the reduction in the medial joint space and osteophytes formation. Poor bone alignment, ligament injuries, and meniscal tears and internal derangement of knee lead to cartilage wear due to excessive impact and joint instability seem to be correlated with origin of this condition <sup>[3, 4]</sup>. It is among the most prevalent and disabling chronic conditions in the United States.

The prevalence increases with age, and by the age of 65, approximately 80 percent of the US population is affected. More than half of those with arthritis are under 65 years of age. Nearly 60% of Americans with arthritis are women <sup>[4]</sup>. In India the crude prevalence of clinically diagnosed knee OA was higher in the urban (5.5%) than those in the rural community (3.3%). After adjusting for age and sex distribution, the prevalence was higher in rural communities <sup>[5]</sup>. According to WHO osteoarthritis is the 4th most common cause of disability in women and 8th most common disability in men <sup>[6]</sup>. Risk factors increases with age (older than 50 years), especially in women. According to a number of published reports, anywhere from 6% to over 13% of men, but between 7% and 19% of women, over 45 years of age are affected, resulting in a 45% less risk of incidence in men <sup>[7]</sup>. Kellagren-Lawrence Classification: Knee Osteoarthritis.

**Grade I:** Unlikely narrowing of the joint space, possible osteophytes

**Grade II:** Small osteophytes, possible narrowing of the joint

**Grade III:** Multiple, moderately sized osteophytes, definite joint space Narrowing, some sclerotic areas, possible deformation of bone.

**Grade IV:** Multiple large osteophytes, severe joint space narrowing, marked sclerosis and definite bony end deformity [8].

In this study the researcher has taken grade 2 and grade 3 of kellegren – Lawrence (classification) samples. The samples are divided into two groups, Group A patients are treated with cold laser therapy and exercises and Group B patients are treated with short wave diathermy and exercises.

Cold laser therapy is called as low level laser therapy [9]. The therapeutic lasers were introduced in 1965 by Sinclair, Knoll and Mester through their research with human tissues. These therapeutic lasers work by supplying energy in to the body by non-thermal photons of light. The body is able to absorb this external energy on a cellular level and transform light energy into chemical energy, which the body uses to accelerate the normal healing rate of the tissues [10].

The modality used is the Theralase TLC 1000 therapeutic laser system, a Class 3B medical laser system. The therapeutic laser system has a dual wavelength, i.e. the combination of super pulsed (905nm) and continuous wavelength (660nm). This system is in direct contact with the tissues in order to emit photons non-invasively into the tissues [11]. Short wave diathermy works with the principle of a high frequency current and refers to deep heat produced by the electric or magnetic fields which alternate at high frequencies (shortwave radio). The most widely used frequency is 27.12MHz. SWD can be given in two methods; one is the capacitive method and other is the inductive method. Here the subjects received capacitance method in the form of pad electrodes. Cross fire technique of placement of electrodes was used in this study [12].

Exercise is an integral component of conservative management for OA and is universally recommended by clinical guidelines, irrespective of patient age, joint involved, radiographic disease severity, pain intensity, functional levels, and co morbidities [13, 14].

A graded exercises program is devised with 10 repetitions with 3 sets on a daily basis.

1. Isometric quadriceps contraction in full extension held for five seconds: subjects on the long sitting position with the back supported and legs extended, with rolled up towel under one knee and contracts quadriceps by pushing into the floor against the towel.
2. Isotonic quadriceps contraction held in mid flexion of knee for five seconds: (subject sits in chair, lifts lower leg to partially extended position and holds.)
3. Isotonic hamstrings contraction: Subjects in supine lying or side lying and bends knee bringing foot towards body.
4. Isotonic quadriceps contraction with resistance band held for five seconds. These exercises helps to improve the strength of the quadriceps and hamstring muscles of knee joint.

### Materials and Methods

A randomised control trial with 60 subjects, 30 subjects in each group. The patients with osteoarthritis knee, were

referred from Kempegowda Institute of Medical Sciences, Department of Orthopaedic to Kempegowda Institute of Physiotherapy and were allocated to Short Wave Diathermy and Exercises. Other group of patients were allocated to Cold Laser Therapy and Exercises at Shree Sanjeevini Solutions, Cold Laser Clinic, and Malleswaram.

**Materials used:** TLC 1000 therapeutic laser device with cluster probe, Goggles for the therapist and the patient, Couch, Short Wave Diathermy with pad electrodes, Bed sheets, Towel roll, Universal goniometer, Pillow, Exercise band (red colour), Chair, Data collection /record sheet, Visual Analogous Scale, WOMAC- Western Ontario McMaster Osteoarthritis Index, Pen.

**Inclusion criteria:** Patients suffering with pain (tibiofemoral and patella femoral osteoarthritis) all, over the knee joint from more than 3 months, Age group between 50 – 65 years of age, Both gender, Grade 2 and grade 3 kellegren-lawrence classification: knee osteoarthritis.

**Exclusion Criteria :** Secondary Osteoarthritis knee, bilateral OA, Fixed flexion deformity, Pregnancy, Pacemaker, Benign or malignant tumours, Any subject currently undergoing any systemic medical or surgical or physical therapy for knee joint. Any skin infections. Open wounds. Uncontrolled diabetes. Metal implants, Swelling, Grade 1, 4 kellegren-lawrence classification: knee osteoarthritis. Fractures, subjects with extensor lag.

**Measurement Tools:** Intensity of pain, functional outcome and range of motion were the parameter considered for the study. The pain intensity was assessed using Visual Analog Scale (VAS), the functional outcome was assessed by using Western Ontario McMaster osteoarthritis Index (WOMAC) scale and range of motion by using universal goniometer.

Pain was assessed with VAS Scale. It consists, a vertical line of which at the bottom end of the scale are the words “No pain” corresponding to a VAS of 0. The words at the top end of the scale are “Worst pain possible” corresponding to a VAS of 10. The participant was instructed to place a line between the top and bottom ends of the line to indicate their level of pain.

Range of motion was assessed by universal goniometer. Subject was positioned in prone position and knee range of motion was assessed with fulcrum placed on the lateral epicondyle of femur and align the proximal arm with the lateral midline of femur using the greater trochanter for reference. Align the distal arm with the lateral of fibula using the lateral malleolus and fibular head.

WOMAC was used to assess pain, stiffness and physical function in subjects with OA knee.

WOMAC scale has 24 parameters under which the patient is assessed for pain, stiffness and physical function. Each sub group is scored On a 0-4 scale as:

- 0- None
- 1- slight
- 2-moderate
- 3-severe
- 4-extreme.

**Sampling technique:** Randomized sampling technique was used for this study. 60 subjects were selected for the study, 30 subjects in each group based on the inclusion and exclusion criteria. Both the groups were treated for 3 sessions per week

for 4 weeks and total of 12 Treatment sessions.60 Subjects were divided into two groups which are Group A and Group B. Each group consisted of 30 subjects.

**Group A:** treated with cold laser therapy and exercises. Brief explanation about the procedure and harmful effects of laser was given to the patient. The therapist set the dosage of 60mW with energy density of 3.6J/cm<sup>2</sup> for 7 points with 60seconds for each point around the knee joint. With supine lying patient was treated with laser 3 points medially, 3 points laterally of knee joint and patient is positioned in side lying or prone lying according to the comfort of patient, for 1 point in the posterior part of midline of popliteal fossa.

**Group B:** treated with SWD and exercises. A brief explanation about treatment procedure and thermal effect of the SWD was given to patient. Patient in supine position was treated with the pad electrodes in a cross fire technique with the duration of 10 minutes for medial and lateral part of the knee and 10 minutes for anterior and posterior part of knee joint with 4 cm spacing with continuous SWD. The intensity (dosage) of the SWD is given according to subject’s tolerance but all subjects were generally advised that to feel comfortable warmth.

A graded exercises program is devised with 10 repetitions with 3 sets on a daily basis.

1. Isometric quadriceps contraction in full extension held for five seconds: subjects on the long sitting position with the back supported and legs extended, with rolled up towel under one knee and contracts quadriceps by pushing into the floor against the towel.
2. Isotonic quadriceps contraction held in mid flexion of knee for five seconds: (subject sits in chair, lifts lower leg to partially extended position and holds.)
3. Isotonic hamstrings contraction: Subjects lies in front or side and bends knee bringing foot towards body.
4. Isotonic quadriceps contraction with resistance band held for five seconds. These exercises helps to improve the strength of the quadriceps and hamstring

**Results**

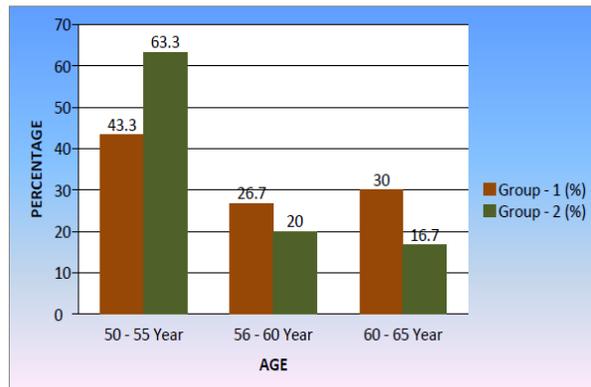
All the analysis was done by using SPSS 16.0 software. Following are the statistical analysis

1. Descriptive statistics were used to calculate Mean, SD
2. In both Group, Patients who received Cold Laser Therapy and Exercises in Osteoarthritis of Knee. (Group A). And patients who received Short Wave Diathermy and Exercises in Osteoarthritis Knee (Group B). Effectiveness of treatment were calculated by Repeated measure ANOVA.
3. Paired t-test was used to compare the effectiveness of Cold Laser Therapy, Exercise and Short Wave Diathermy, Exercises in Osteoarthritis Knee.

**Section I**

**Table 1:** Frequency and Percentage distribution of age for Group-A and Group – B N=30

Age	Group – 1		Group – 2	
	Frequency	Percentage	Frequency	Percentage
50 - 55 Year	13	43.3	19	63.3
56 - 60 Year	8	26.7	6	20
60 - 65 Year	9	30	5	16.7
	30	100	30	100



**Fig 1:** Percentage Distribution of Age for Group-A and Group- B

Above table shows Frequency and Percentage of age for Group-A and Group – B. Overall 50 to 65 year age group clients were participated in the study. Majority of 43.3% of participants were belongs to the age group 50-55 years and 26.7% participants were belongs to 56-60 years and 30% were belongs to 60 – 65 years in Group-A and in Group- B Majority of 63.3% of participants were belongs to the age group of 50-55 years, 20% belongs to 56-60% and remaining 16.7% were belongs to 60 – 65 years.

**Table 2:** Percentage distribution of Mean age for Group-A and Group-B N=30

	Mean Age
Group – A	52.83
Group – B	54.36



**Fig 2:** Pie chart showing Percentage Distribution of Mean Age for Group-A and Group- B

**Table 3:** Frequency and Percentage of Distribution of Gender for Group-A and Group-B N=30

Gender	Group – A		Group – B	
	Frequency	Percentage	Frequency	Percentage
Male	14	46.7	15	50
Female	16	53.3	15	50
	30	100	30	100

Interpretation: Above table shows Frequency and Percentage of distribution of gender for Group - A and Group – B 46.7% male and 53.3% female were participated in Group-A and 50% male, 50% female were participated in Group-B.

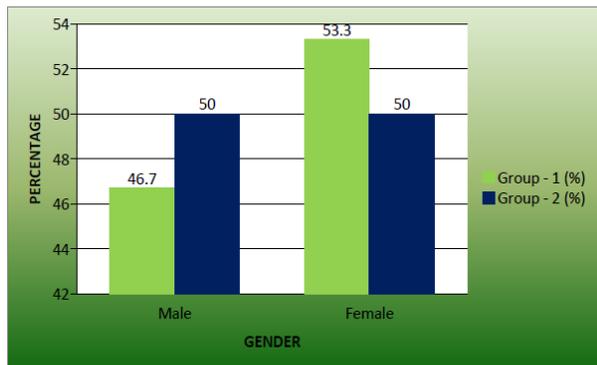


Fig 3: Percentage Distribution of Gender for Group-A and Group-B

Section 2

Table 4: Paired 't' Test for comparison between Group -A and Group -B with VAS score Value

VAS	Group - 1 Mean	Group - 2 Mean	Mean Difference	Paired 't' Test	p' Value
1st Session	6.83	7.4	0.57	2.538	0.017
6th Session	5.23	6.23	1.5	2.35	0.02
12th Session	3.56	4.13	0.57	2.79	0.009

\*Significant at  $P < 0.05$

Interpretation

Above table shows for comparison of Group -A and Group -B with VAS score Value. Group -A client shows more improvement than Group -B. On the 1st Session,  $t=2.538$ , 6th Session,  $t=2.35$ , 12th Session  $t=2.79$  values are significant at  $P < 0.05$ . It means there is a comparative difference between Group -A and Group -B

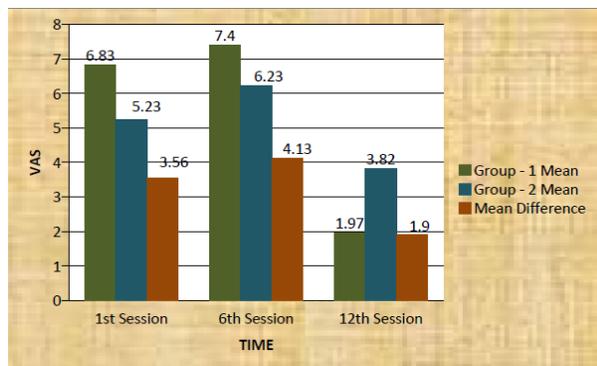


Fig 4: Comparison between Group -A and Group -B with VAS score Value

Table 5: Paired 't' Test for comparison between Group -A and Group -B with WOMAC score Value

WOMAC	Group - 1 Mean	Group - 2 Mean	Mean Difference	Paired 't' Test	p' Value
1st Session	54.07	57.83	3.77	1.618	0.117
6th Session	42.96	45.83	2.87	2.572	0.017
12th Session	29.7	35.1	5.4	2.951	0.006

\*Significant at  $P < 0.05$

Interpretation

Above table shows for comparison of Group -A and Group -B with WOMAC score Value. Group -A client shows more improvement than Group -B. On the 6th Session  $t=2.572$ , 12th Session  $t=2.951$  values are significant at  $P < 0.05$ . It means there is a comparative difference between Group -A and Group -B.

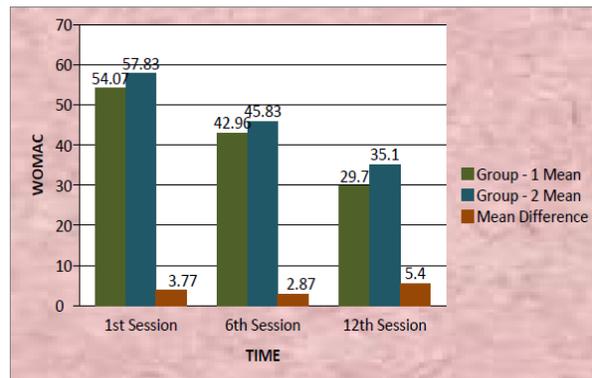


Fig 5: Comparison between Group -A and Group -B with WOMAC score Value

Table 6: Paired 't' Test for comparison between Group -A and Group -B with ROM score Value

ROM	Group - 1 Mean	Group - 2 Mean	Mean Difference	Paired 't' Test	p' Value
1st Session	117.4	113.4	4.07	2.37	0.024
6th Session	119.4	114.5	4.83	2.974	0.006
12th Session	121.3	116.2	5.167	3.018	0.005

\*Significant at  $P < 0.05$

Interpretation: Above table shows for comparison of Group -A and Group -B with ROM score Value. Group -A client shows more improvement than Group -B. On the 1<sup>ST</sup> Session  $t=2.37$ , 6<sup>TH</sup> Session  $t=2.974$ , 12<sup>th</sup> Session  $t=3.018$  values are significant at  $P < 0.05$ . It means there is a comparative difference between Group -A and Group -B.

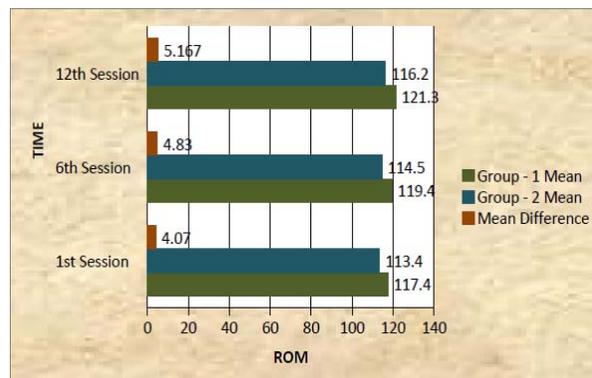


Fig 6: Comparison between Group -A and Group -B with Range of motion score Value

Testing Hypothesis: By statistical analysis we found that there is statistically significant difference in pain, functional ability and knee range of motion with both short wave diathermy and exercises and cold laser therapy and exercises in subjects with osteoarthritis knee. Hence null hypothesis is rejected and Alternative Hypothesis is accepted.

Discussion

Osteoarthritis (OA) of the knee is characterized by degeneration of the articular cartilage, morphologic changes to the subchondral bone, and damage to the surrounding soft tissue.

The study comprising of 60 subjects of chronic OA knee patients were divided into Group A and Group B respectively, each group consisting of 30 subjects. Group A, cold laser therapy and excises consisting of 30 subjects, in which 14 males (46.7%) and 16 females (53.3%)

Group B, short wave diathermy consisting 30 subjects, in which there were 15 males (50.0%) and 15 females (50%). There were 13 subjects (43.3%) in Group A and 19 subjects (63.3%) in Group B with their age group between 50 to 55 years. The age group between 56-60 years has 08(26.7%) subjects in Group A and 06(20%) subjects in Group B. The age group between 60-65 years has 09(30%) subjects in group A and 05(16.7%) subjects in group B. The mean age in cold laser therapy and exercise was 53 years and the age in short wave diathermy and exercise was 54 years.

The comparison b/w Group A and Group B, the VAS score p value of 1<sup>st</sup> session  $p=0.017$ , at 6th session  $p=0.02$  and at 12th session  $p=0.009$ , where p value was found to be significant at the end of 12th session ( $p<0.05$ )

The comparison b/w Group A and Group B, the WOMAC score p value of 1st session  $p=0.117$ , at 6th session  $p=0.017$  and at 12th session  $p=0.006$ , where p value was found to be significant at the end of 12th session ( $p<0.05$ ) The comparison b/w Group A and Group B, the range of motion p value of 1st session  $p=0.024$ , at 6th session  $p=0.006$  and at 12th session  $p=0.005$ , where p value was found to be significant at the end of 12th session ( $p<0.05$ ).

The study implies that both cold laser therapy and exercise and short wave diathermy and exercises are effective but Group A cold laser therapy and exercises are found to be more effective than Group B.

### Conclusion

Since the mean score of visual analogue scale, WOMAC questionnaire and range of motion showed improvement in both the groups. But Group A; cold laser therapy and exercises showed better improvement when compared with Group B; short wave diathermy and exercises.

Hence, cold laser therapy and exercises are the better line of treatment than short wave diathermy and exercises in treating chronic osteoarthritis of knee joint.

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