

# Effect of Partial Massage Combined with Infrared Radiation on Pain and Functional Outcomes in Mild to Moderate Knee Osteoarthritis: A Pre–Post Interventional Study

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## Abstract

**Background:** Knee osteoarthritis (KOA) is a leading cause of chronic pain and disability. Non-pharmacological modalities such as therapeutic massage and infrared (IR) radiation are used in naturopathic practice to reduce pain and improve function, but short-course combined protocols require further evaluation.

**Objectives:** To evaluate the effect of partial massage combined with infrared radiation on pain and functional outcomes in subjects with mild to moderate knee osteoarthritis.

**Materials and Methods:** A single-group pre–post pilot study was conducted on 10 female participants (mean age  $52.9 \pm 5.4$  years) with mild to moderate KOA at GNCYMC&H, Mysore. Participants received partial massage with infrared radiation daily for 10 days. Outcomes were Visual Analogue Scale (VAS) for pain, Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), and Knee injury and Osteoarthritis Outcome Score (KOOS), assessed on Day 1 and Day 10. Data were analysed using Wilcoxon signed-rank and paired t-tests; effect sizes were expressed as Cohen's d.

**Results:** Highly significant improvements were observed in pain and WOMAC symptom scores. VAS decreased from  $4.10 \pm 0.74$  to  $2.20 \pm 0.63$  ( $\Delta -1.90$ ,  $p = 0.002$ ,  $d = -3.35$ ). WOMAC decreased from  $52.70 \pm 5.70$  to  $42.40 \pm 6.19$  ( $\Delta -10.30$ ,  $p = 0.002$ ,  $d = -5.83$ ). KOOS changed from  $62.00 \pm 8.18$  to  $55.50 \pm 7.40$  ( $\Delta -6.50$ ,  $p = 0.002$ ); interpretation of KOOS direction requires confirmation of the scoring convention used. All 10 participants improved on VAS and WOMAC.

**Conclusion:** Partial massage combined with infrared radiation over 10 days was associated with statistically significant and clinically meaningful reductions in pain and WOMAC symptom burden in

women with mild to moderate knee osteoarthritis. Larger controlled trials with standardised outcome scoring and range-of-motion measurement are warranted.

**Keywords:** Knee osteoarthritis; Partial massage; Infrared radiation; VAS; WOMAC; KOOS; Naturopathy; Pre–post study

## 1. Introduction

Osteoarthritis (OA) is a disease of movable joints characterised by cartilage degradation, bone remodelling, osteophyte formation, joint inflammation and loss of normal joint function [1,2]. The knee is the most frequently affected joint, accounting for a large proportion of the global OA burden. Knee OA (KOA) produces pain, stiffness and functional limitation, and is a major contributor to chronic disability, reduced quality of life and healthcare costs [3–5].

Risk factors include advancing age, female sex, obesity, previous joint injury, occupational loading and genetic predisposition [4,5]. Management aims to reduce pain, maintain function and delay or avoid surgical intervention. First-line approaches include education, exercise, weight management and topical or oral analgesics; however, interest in non-pharmacological physical modalities remains strong, particularly for patients seeking drug-sparing options [6].

Therapeutic massage may reduce muscle tension, improve local circulation and modulate pain perception. Infrared radiation provides superficial heating that can increase tissue temperature, promote vasodilation and facilitate relaxation and mobility. Combined use of partial (regional) massage with infrared radiation is practised in naturopathic and physical-medicine settings for musculoskeletal pain, yet short-course combined protocols specifically evaluated with validated KOA outcome measures remain limited. The present pilot study evaluated a 10-day protocol of partial massage with infrared radiation on pain and functional scores in subjects with mild to moderate knee osteoarthritis.

## 2. Aims and Objectives

Primary objective: To evaluate the effect of partial massage combined with infrared radiation on pain and knee-related function in subjects with mild to moderate knee osteoarthritis.

Secondary objectives: To assess changes in VAS pain, WOMAC and KOOS scores after 10 days of intervention; and to observe participant tolerance of the protocol.

## 3. Materials and Methods

### 3.1 Study design and setting

A single-group pre–post pilot study was conducted at Government Nature Cure and Yoga Medical College & Hospital (GNCYMC&H), Mysore, Karnataka, India.

### 3.2 Participants

Ten female participants (mean age  $52.9 \pm 5.4$  years; range 43–60) with clinically diagnosed mild to moderate knee osteoarthritis were enrolled after written informed consent. All completed the 10-day protocol.

Inclusion criteria: Mild to moderate KOA; ability to undergo partial massage and infrared application; willingness to provide informed consent.

Exclusion criteria: Severe KOA requiring urgent surgical consideration; acute inflammatory arthritis; recent intra-articular injection or surgery; skin infection or contraindication to local heat or massage over the treatment area; inability to comply with the protocol.

### 3.3 Intervention

Participants received partial (regional) massage of the affected knee and periarticular soft tissues combined with infrared radiation, administered daily for 10 days under supervision according to institutional naturopathic practice. Session duration and intensity were adjusted for comfort. Concurrent conventional medication, if any, was continued as advised by the treating physician.

### 3.4 Outcome measures

Assessments were performed on Day 1 (pre-intervention) and Day 10 (post-intervention):

- Visual Analogue Scale (VAS) for pain (0–10; lower = less pain).
- Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC; lower scores indicate less pain, stiffness and functional difficulty).
- Knee injury and Osteoarthritis Outcome Score (KOOS). Standard KOOS scoring treats higher scores as better function; the direction of change observed in this dataset is discussed with appropriate caution.

Range-of-motion (ROM) was referenced in the study title; paired numeric ROM tables were not clearly available in the source data and are therefore not reported quantitatively.

### 3.5 Statistical analysis

Descriptive statistics (mean, SD, median, minimum, maximum) were calculated. Normality of difference scores was assessed with the Shapiro–Wilk test. Wilcoxon signed-rank test was the primary inferential test; paired t-tests are reported for completeness. Effect size was Cohen's  $d$  (paired). Two-tailed  $\alpha = 0.05$ . Analyses performed in Python (SciPy/NumPy).

## 4. Results

All 10 female participants completed the intervention (mean age  $52.9 \pm 5.4$  years).

### 4.1 Descriptive and inferential statistics

**Table 1. Descriptive statistics (n = 10)**

| Outcome  | Time | Mean  | SD   | Median | Min | Max |
|----------|------|-------|------|--------|-----|-----|
| KOOS     | Pre  | 62.00 | 8.18 | 60.5   | 52  | 76  |
|          | Post | 55.50 | 7.40 | 56.0   | 45  | 66  |
| WOMAC    | Pre  | 52.70 | 5.70 | 51.0   | 45  | 61  |
|          | Post | 42.40 | 6.19 | 40.5   | 36  | 52  |
| VAS Pain | Pre  | 4.10  | 0.74 | 4.0    | 3   | 5   |
|          | Post | 2.20  | 0.63 | 2.0    | 1   | 3   |

**Table 2. Change scores and inferential statistics (n = 10)**

| Outcome  | Mean $\Delta$ | SD $\Delta$ | Wilcoxon p | t-test p | Cohen's d | Direction                |
|----------|---------------|-------------|------------|----------|-----------|--------------------------|
| KOOS     | -6.50         | 3.21        | 0.002      | <0.001   | -2.03     | ↓ 10/10*                 |
| WOMAC    | -10.30        | 1.77        | 0.002      | <0.001   | -5.83     | ↓ 10/10<br>(improvement) |
| VAS Pain | -1.90         | 0.57        | 0.002      | <0.001   | -3.35     | ↓ 10/10<br>(improvement) |

\*Standard KOOS scoring treats higher scores as better function; the observed decrease should be interpreted with caution pending confirmation of the scoring convention used during data collection. WOMAC and VAS decreases indicate improvement.

### 4.2 Graphical representation

Figure 1 presents grouped mean  $\pm$  SD comparisons. Figure 2 shows individual outcome panels.

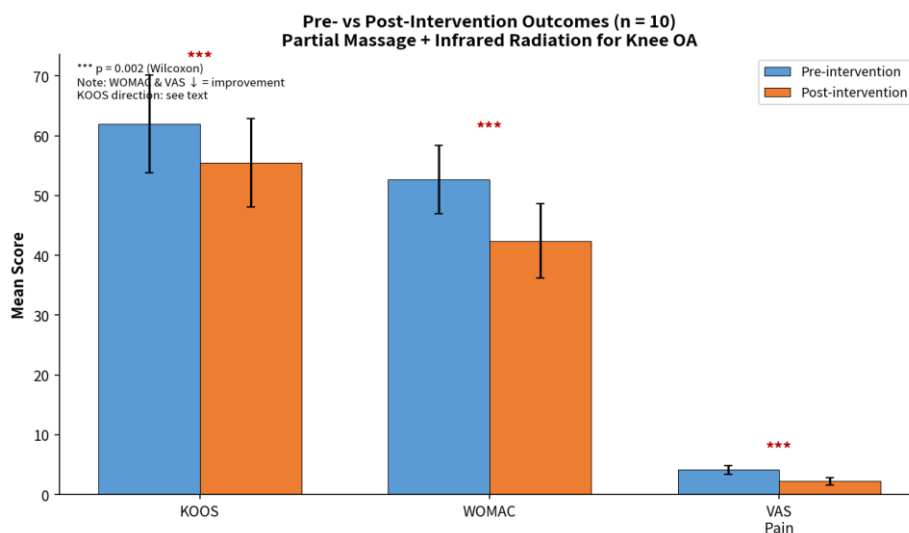


Figure 1. Mean pre- and post-intervention scores ( $\pm$  SD). \*\*\*  $p = 0.002$  (Wilcoxon). WOMAC and VAS decreases indicate improvement.

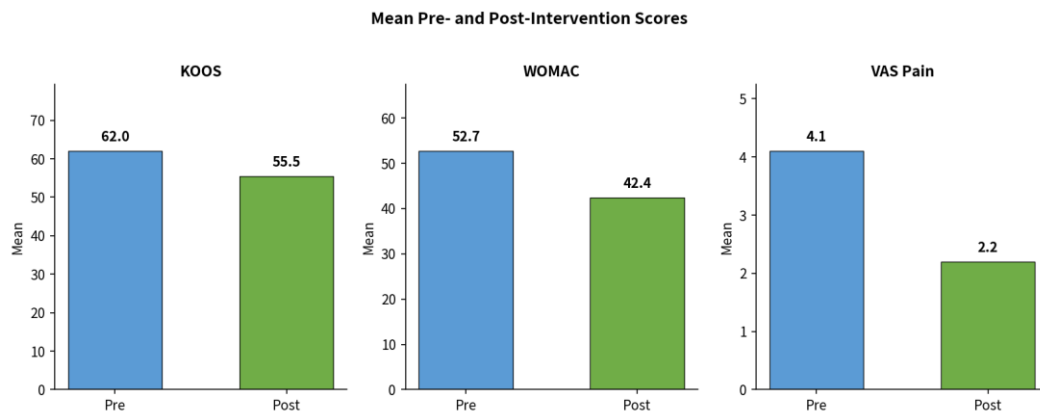


Figure 2. Mean pre- and post-intervention scores for KOOS, WOMAC and VAS pain.

### 4.3 Summary of key findings

VAS pain: Mean reduction  $-1.90$  (SD  $0.57$ );  $p = 0.002$ ;  $d = -3.35$ ; 10/10 improved.

WOMAC: Mean reduction  $-10.30$  (SD  $1.77$ );  $p = 0.002$ ;  $d = -5.83$ ; 10/10 improved.

KOOS: Mean change  $-6.50$  (SD  $3.21$ );  $p = 0.002$ ;  $d = -2.03$ ; direction of clinical interpretation depends on scoring convention (see Discussion).

## 5. Discussion

In this single-group pre–post pilot study, a 10-day protocol of partial massage combined with infrared radiation was associated with highly significant reductions in VAS pain and WOMAC scores, with extremely large effect sizes. All participants improved on these measures. The findings support the potential of this non-pharmacological combination as a short-course adjunct for mild to moderate knee osteoarthritis.

Massage may reduce periarticular muscle tension, improve local circulation and influence pain-gate and central modulatory mechanisms. Infrared radiation provides superficial heating that can increase tissue extensibility, promote vasodilation and facilitate comfort during and after soft-tissue work. Together, these modalities align with guideline emphasis on non-pharmacological physical approaches for KOA [6].

An important interpretive caveat concerns KOOS. Under standard KOOS scoring, higher scores indicate better knee-related health. The observed mean decrease would therefore suggest worsening if standard scoring was applied, which conflicts with the clear improvements on VAS and WOMAC. Possible explanations include reverse scoring during data entry, use of a raw symptom subscale, or data-handling inconsistency. Until the scoring convention is confirmed, KOOS findings should be interpreted cautiously; the primary clinical signals in this study are the VAS and WOMAC improvements.

Limitations include the small sample ( $n = 10$ ), single-sex cohort, absence of a control or sham group, short duration, single-centre design, lack of blinding, and absence of clearly tabulated paired range-of-motion data despite the study title. Causal attribution cannot be established. Larger randomised controlled trials with standardised outcome definitions, goniometric ROM, longer follow-up and mixed-sex samples are needed.

## 6. Conclusion

Within the limitations of this single-group pre–post study, partial massage combined with infrared radiation over 10 days was associated with statistically significant and clinically meaningful reductions in pain (VAS) and osteoarthritis symptom burden (WOMAC) in women with mild to moderate knee osteoarthritis. The protocol was well tolerated. These preliminary findings support further evaluation of this naturopathic physical modality as a non-pharmacological adjunct in KOA care.

## Declarations

Conflict of interest: The author declares that there is no conflict of interest.

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Ethics: Written informed consent was obtained from all participants. The study was conducted as a student dissertation under institutional supervision.

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