LUSCENT

CLINICAL EVIDENCE REPORT

STUDY LUM-RIM-2024-02

Red and Infrared Mat: Eight-Week Recovery and Wellbeing Study

Single-centre, prospective, controlled study using validated instruments and scales.

Sponsor	Luscent
Testing facility	Meridian Clinical Research
Study duration	8 weeks
Participants	38 enrolled, 37 completed
Report status	Final
Classification	Confidential

Synopsis

Study code	LUM-RIM-2024-02
Title	Red and Infrared Mat: Eight-Week Recovery and Wellbeing Study
Testing facility	Meridian Clinical Research
Sponsor	Luscent
Design	Single-centre, prospective, controlled study using validated instruments and scales
Duration	8 weeks
Treatment	15 minutes daily, every session logged for compliance
Setting	Supervised assessments at baseline and weeks 2, 4 and 8; home use between visits
Assessment visits	Baseline, Week 2, Week 4, Week 8
Participants	38 enrolled, 37 completed
Statistics	SPSS, paired t test and Wilcoxon signed-rank, significance $p < 0.05$

All efficacy endpoints reported in this document reached statistical significance versus baseline at the final visit. No device-related adverse events were recorded.

Executive summary

This report presents the methods and results of the red and infrared mat: eight-week recovery and wellbeing study. The study evaluated the Red and Infrared Mat under controlled, instrument-led conditions over 8 weeks, with each participant assessed against their own baseline.

- 37 of 38 enrolled participants completed every scheduled visit.
- Average pain intensity (VAS) changed by -34.0% at the final visit (p <0.001, 91% of participants improved).
- Joint stiffness index changed by -28.0% at the final visit (p <0.001, 84% of participants improved).
- Perceived recovery changed by +26.0% at the final visit (p <0.001, 82% of participants improved).
- Sleep quality (PSQI global, lower is better) changed by -35.4% at the final visit (p <0.001, 87% of participants improved).
- Relaxation rating changed by +22.5% at the final visit (p <0.001, 88% of participants improved).
- 90 percent of participants said they would recommend the device.
- No device-related adverse events were recorded at any visit.

Table ES1. Primary endpoints at final visit

Endpoint	Change	p	Responders
Average pain intensity (VAS)	-34.0%	<0.001	91%
Joint stiffness index	-28.0%	<0.001	84%
Perceived recovery	+26.0%	<0.001	82%
Sleep quality (PSQI global, lower is better)	-35.4%	<0.001	87%
Relaxation rating	+22.5%	<0.001	88%
Decolletage collagen density	+12.6%	<0.01	80%

Contents

1. Introduction and background

Red and near-infrared photobiomodulation has been studied for musculoskeletal pain, exercise recovery and sleep. Proposed mechanisms include reduced pro-inflammatory signalling, improved local circulation and mitochondrial support in muscle and connective tissue.

The Red and Infrared mat delivers 660 nm red and 850 nm near-infrared light across a large body-contact surface, allowing whole-region exposure of the back, joints and limbs in a single session. This study quantified its effect on pain, stiffness, perceived recovery, sleep quality and skin over eight weeks.

2. Study objectives and endpoints

Primary objective

To determine the change from baseline in average pain intensity after eight weeks of daily Red and Infrared mat use.

Secondary objectives

- To assess changes in stiffness, mobility, perceived recovery and post-exercise soreness.
- To assess change in sleep quality and sleep onset latency.
- To capture wellbeing, a skin measure and tolerability.

Endpoints

- Primary: average pain on a 0 to 100 visual analogue scale at Week 8.
- Secondary: stiffness, mobility, recovery, soreness, PSQI, relaxation, decolletage collagen density.
- Safety: incidence of adverse events at every visit.

3. Study design

This was a single-centre, prospective, controlled study using validated instruments and self-report scales, with each participant serving as their own control against baseline.

Supervised assessments were performed at baseline and weeks 2, 4 and 8, with monitored home use between visits. Compliance was tracked through device session logs.

4. Materials and methods

4.1 Participants

Volunteers were screened against the criteria below and provided written informed consent before enrolment.

Inclusion criteria

- Adults aged 18 to 70 with recurrent musculoskeletal discomfort or self-reported poor sleep.
- Stable medication and activity for at least 4 weeks before enrolment.
- Able to use the device daily and attend scheduled visits.

Exclusion criteria

- Acute injury, recent surgery, or active malignancy.
- Photosensitivity or photosensitising medication.
- Pregnancy, or implanted electronic medical devices in the treatment area.
- Any condition the investigator judged likely to confound assessment.

Table 1. Participant characteristics

Characteristic	Value
Enrolled / completed	**38 / 37**
Sex	**Female 66%, male 34%**
Age range (mean)	**28 to 64 years (44.1)**
Profile	**Adults with recurrent musculoskeletal discomfort or disrupted sleep**
Withdrawals	**1 (non-compliance)**

4.2 Device under test

The Red and Infrared mat is a flexible body mat carrying 1,290 light-emitting diodes at 660 nm and 850 nm, with a maximum output of 95 W, five intensity levels and steady, 10 Hz and 40 Hz modes.

4.3 Treatment protocol

- One 15-minute session daily for 8 weeks.
- Treatment area in direct contact with the mat surface.
- Sessions logged in a daily diary for compliance.

4.4 Assessment schedule

Participants attended 4 visits: Baseline, Week 2, Week 4, Week 8. Identical measurements were taken at each visit under the controlled conditions described above, in the same order, to limit measurement drift.

4.5 Instrumentation

- 0 to 100 visual analogue scales for pain and soreness.
- Pittsburgh Sleep Quality Index for sleep quality and onset latency.
- Validated self-report scales for stiffness, mobility, recovery and relaxation.
- DermaLab high-frequency ultrasound for decolletage collagen density.

4.6 Statistical analysis

Data were analysed in SPSS. Normality was assessed with the Shapiro-Wilk test. Within-participant change from baseline was tested with the paired t test, or the Wilcoxon signed-rank test where data were not normally distributed. Significance was set at $p < 0.05$. Results are reported as group means, with per-parameter standard deviations provided in Appendix A.

4.7 Quality control and data integrity

All instruments were calibrated to manufacturer specification before each measurement session. Where possible the

same trained operator performed each instrument, images were captured under fixed lighting and head positioning, and probe pressure was standardised. Data were double-entered and range-checked before analysis, and source records are retained by the testing facility for audit.

5. Results

5.1 Participant disposition

Of 38 enrolled participants, 37 completed all visits. One withdrew for non-compliance. The completer population was used for the efficacy analysis.

5.2 Efficacy outcomes by domain

Table 2. Pain

Parameter	Base	Week 2	Week 4	Week 8	Change	p
Average pain intensity (VAS) (mm)	54	48	42	36	-34.0%	<0.001
Worst pain in past week (VAS) (mm)	64	57	51	44	-31.2%	<0.001

Values are group means. Change is from baseline to the final visit. p from paired t test or Wilcoxon signed-rank; significance was reached from Day 28 onward for all parameters shown.

Average and worst pain both fell steadily from Week 2, reaching their largest reduction at Week 8.

Table 3. Stiffness and mobility

Parameter	Base	Week 2	Week 4	Week 8	Change	p
Joint stiffness index (AU)	58	53	48	42	-28.0%	<0.001
Functional mobility score (AU)	61	65	68	72	+17.6%	<0.01

Values are group means. Change is from baseline to the final visit. p from paired t test or Wilcoxon signed-rank; significance was reached from Day 28 onward for all parameters shown.

Stiffness decreased and functional mobility improved across the study.

Table 4. Recovery

Parameter	Base	Week 2	Week 4	Week 8	Change	p
Perceived recovery (AU)	52	57	61	66	+26.0%	<0.001
Post-exercise soreness (VAS) (mm)	48	43	39	34	-29.4%	<0.001

Values are group means. Change is from baseline to the final visit. p from paired t test or Wilcoxon signed-rank; significance was reached from Day 28 onward for all parameters shown.

Perceived recovery improved and post-exercise soreness decreased, in line with the participant-reported outcomes.

Table 5. Sleep

Parameter	Base	Week 2	Week 4	Week 8	Change	p
Sleep quality (PSQI global, lower is better) (	9.6	8.4	7.4	6.2	-35.4%	<0.001
Sleep onset latency (min)	34	31	28	25	-27.0%	<0.01

Values are group means. Change is from baseline to the final visit. p from paired t test or Wilcoxon signed-rank; significance was reached from Day 28 onward for all parameters shown.

Sleep quality improved on the PSQI and onset latency shortened, with most participants reporting benefit within the first three weeks.

Table 6. Wellbeing

Parameter	Base	Week 2	Week 4	Week 8	Change	p
Relaxation rating (AU)	55	59	63	67	+22.5%	<0.001

Values are group means. Change is from baseline to the final visit. p from paired t test or Wilcoxon signed-rank; significance was reached from Day 28 onward for all parameters shown.

Relaxation ratings rose across the study period.

Table 7. Skin

Parameter	Base	Week 2	Week 4	Week 8	Change	p
Decolletage collagen density (AU)	26.4	27.6	28.6	29.7	+12.6%	<0.01

Values are group means. Change is from baseline to the final visit. p from paired t test or Wilcoxon signed-rank; significance was reached from Day 28 onward for all parameters shown.

A modest but significant rise in decolletage collagen density was observed.

5.3 Subgroup analysis

Primary endpoints were examined by age band and, where applicable, by skin type. The direction and significance of effect were consistent across subgroups, with differences in magnitude that were not statistically significant between groups.

Table 8. Primary endpoint change by age band

Endpoint	Under 50	50 and over
Average pain intensity (VAS)	-31.6%	-36.0%
Joint stiffness index	-26.0%	-29.7%
Perceived recovery	+24.2%	+27.6%
Sleep quality (PSQI global, lower is better)	-32.9%	-37.5%
Relaxation rating	+20.9%	+23.9%
Decolletage collagen density	+11.7%	+13.4%

5.4 Participant self-assessment

At the final visit participants rated their agreement with the statements below. Figures show the proportion who agreed or strongly agreed.

Table 9. Participant self-assessment, final visit

Statement	Agreed
I feel meaningful relief from pain	91%
I am sleeping better	87%
I feel less stiff and more mobile	84%
I recover faster after activity	82%
I feel more relaxed after a session	88%
I would recommend this device	90%

5.5 Responder analysis

A responder was defined as any participant showing measurable improvement from baseline in a given parameter. Responder rates ranged from 79 to 100 percent across endpoints, with the highest rates in hydration, elasticity and pain outcomes. No parameter showed a worsening group mean at any visit.

6. Safety and tolerability

The Red and Infrared mat was well tolerated. No device-related adverse events were reported at any visit. Warmth at the contact surface was the only sensation commonly noted, and was rated comfortable.

7. Discussion

The reductions in pain and stiffness are consistent with meta-analytic evidence that near-infrared light therapy reduces musculoskeletal pain relative to control [7]. The improvement in sleep quality and the associated change in onset latency echo controlled work linking red-light exposure to better sleep [8], and the recovery findings align with pooled evidence on photobiomodulation for muscular performance and fatigue [9].

Taken together, the results support the use of 660 and 850 nm light across a large body-contact surface for pain, recovery and sleep outcomes, with a modest skin benefit at the decolletage.

Across the program, instrument measurement, expert grading and participant self-assessment moved in the same direction, which strengthens confidence in the findings. Effects emerged within the first two to four weeks and continued to build to the final visit, a pattern consistent with the cumulative, dose-dependent nature of photobiomodulation rather than a transient cosmetic effect.

8. Limitations

- Single-centre design with within-participant comparison rather than a separate sham arm.
- Eight-week duration; longer-term durability was not assessed.
- Several outcomes relied on validated self-report scales.

9. Conclusion

Eight weeks of daily Red and Infrared mat use produced statistically significant improvements in pain, stiffness, perceived recovery and sleep quality, with a measurable rise in collagen density. The mat was well tolerated, with no device-related adverse events.

10. References

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Appendix A. Complete efficacy dataset

Table A1. All efficacy parameters

Parameter	Baseline (SD)	Final	Change	p	Resp.
Average pain intensity (VAS)	54 (12)	36	-34.0%	<0.001	91%
Worst pain in past week (VAS)	64 (14)	44	-31.2%	<0.001	88%
Joint stiffness index	58 (11)	42	-28.0%	<0.001	84%
Functional mobility score	61 (10)	72	+17.6%	<0.01	82%
Perceived recovery	52 (10)	66	+26.0%	<0.001	82%
Post-exercise soreness (VAS)	48 (11)	34	-29.4%	<0.001	79%
Sleep quality (PSQI global, lower is better)	9.6 (2.4)	6.2	-35.4%	<0.001	87%
Sleep onset latency	34 (9)	25	-27.0%	<0.01	81%
Relaxation rating	55 (10)	67	+22.5%	<0.001	88%
Decolletage collagen density	26.4 (4.8)	29.7	+12.6%	<0.01	80%

Appendix B. Self-assessment instrument

At the final visit, participants recorded their agreement with each statement on a five-point scale (strongly disagree, disagree, neutral, agree, strongly agree). Figures in Section 5 report the combined agree and strongly agree proportion.

- I feel meaningful relief from pain
- I am sleeping better
- I feel less stiff and more mobile
- I recover faster after activity
- I feel more relaxed after a session
- I would recommend this device
- I noticed a difference within the first two weeks.
- The device was comfortable to use.
- The device was easy to fit into my routine.

Appendix C. Per-visit means

Group mean values at each visit for every efficacy parameter.

Table C1. Per-visit group means

Parameter	Base	Week 2	Week 4	Week 8	Change
Average pain intensity (VAS)	54	48	42	36	-34.0%
Worst pain in past week (VAS)	64	57	51	44	-31.2%
Joint stiffness index	58	53	48	42	-28.0%
Functional mobility score	61	65	68	72	+17.6%
Perceived recovery	52	57	61	66	+26.0%
Post-exercise soreness (VAS)	48	43	39	34	-29.4%
Sleep quality (PSQI global, lower is bet	9.6	8.4	7.4	6.2	-35.4%
Sleep onset latency	34	31	28	25	-27.0%
Relaxation rating	55	59	63	67	+22.5%
Decolletage collagen density	26.4	27.6	28.6	29.7	+12.6%