KARA CLINICAL

RESEARCH & DEVELOPMENT DIVISION

MULTICENTER CLINICAL STUDY

Evaluation of Efficacy, Safety, and Tolerability

KARA AUREN PRO™

LED Phototherapy Mask for Face and Neck — Four Wavelengths

Protocol Code: KAP-RCT-2025-002

Design: Randomized, Double-Blind, Sham-Controlled Clinical Trial

Duration: 12 weeks | n = 220 subjects | 4 clinical sites

Principal Investigator: Multidisciplinary Dermatological Research Committee

Version 1.0 — Final Report

1. Executive Summary of the Study

1.1 General Product Description

The Kara Auren Pro™ device is a non-invasive LED phototherapy mask manufactured in flexible medical-grade silicone, designed for home use. Its construction allows quasi-direct contact between the LED diodes and the skin surface, optimizing photon transmission and minimizing light scattering. The system consists of a facial piece and a complementary cervical piece, addressing two anatomical zones with high visibility of aging signs.

The mask emits four controlled wavelengths, each with a specific chromophoric and biological target: red (630 nm) and near-infrared (830 nm) for collagen stimulation and deep tissue repair; blue (455-465 nm) with antimicrobial action against Cutibacterium acnes; yellow (585-595 nm) for reduction of erythema, superficial vascularization, and tone uniformity; and orange (~610 nm) for pore purification and improvement of microcirculation.

1.2 Primary Objective of the Clinical Study

To quantitatively and qualitatively evaluate the clinical efficacy, dermatological safety, and tolerability of the Kara Auren Pro™ device applied over 12 weeks in healthy adult subjects with visible signs of mild to moderate facial aging, photoaging, mild to moderate inflammatory acne lesions, and loss of skin luminosity, compared with a placebo group (sham mask with inert low-intensity imperceptible LEDs) and a standard cosmetic care control group.

1.3 Dermatological Hypothesis

Primary hypothesis (H1): The protocolized application of the Kara Auren Pro™ device for 12 weeks produces a statistically significant improvement ($p < 0.05$) in the parameters of facial luminosity, skin texture, depth of fine lines, number of inflammatory acne lesions, and user satisfaction, compared with the placebo group.

Secondary hypothesis (H2): The multispectral chromatic combination (Red/IR + Blue + Yellow + Orange) offers measurable complementary benefits superior to those obtained with a single wavelength, with an acceptable safety profile across the six Fitzpatrick phototypes when the intensity protocol is observed.

Null hypothesis (H0): No statistically significant differences exist between the treatment group, placebo group, and standard care control group in the dermatological parameters evaluated at the end of the study.

1.4 Expected Results

- **Improvement of facial luminosity:** 12-18% increase in L* value (CIELAB space) after 12 weeks.
- **Reduction of perioral and periorbital fine lines:** 15-22% decrease in mean depth (3D profilometry).
- **Reduction of inflammatory acne lesions:** 45-60% decrease in total count (acne sub-cohort).
- **Improvement of skin texture:** 18-25% increase in surface uniformity (VISIA analysis).
- **Reduction of baseline erythema:** 10-15% decrease in a* parameter (CIELAB).
- **Tolerability:** incidence of mild adverse events < 4%; absence of serious adverse events.
- **User satisfaction:** ≥ 88% report perceptible visible improvement (GAIS scale).

2. Objectives of the Study

2.1 Primary Objective

To evaluate the efficacy of the Kara Auren Pro™ device in improving the clinical signs of mild to moderate facial aging and inflammatory acne lesions, specifically in terms of skin luminosity, texture, depth of fine lines, acne lesion count, and erythema reduction, in an adult population aged 25 to 60 years, over a 12-week period of protocolized home use.

2.2 Secondary Objectives

- To evaluate acute (immediate post-application) and chronic (at 4, 8, and 12 weeks) skin tolerance of the device in each of the available chromatic modes.
- To measure the incidence, severity, and duration of local adverse events (persistent erythema, phototoxicity, pruritus, heat sensation, dryness).
- To evaluate objective changes in skin hydration (corneometry), transepidermal water loss (TEWL), and sebum production (sebumetry).
- To quantify the effect of the cervical piece on horizontal neck lines, cervical elasticity, and dermal tone.
- To compare efficacy between the six Fitzpatrick phototypes to validate the manufacturer's intensity protocol.
- To evaluate user-perceived satisfaction through validated scales (GAIS, FACE-Q, DLQI, 0-10 numeric scale).
- To determine the temporal response curve and the minimum effective time for visible results.

- To characterize the response of the sub-cohort with mild to moderate inflammatory acne (Blue + Yellow mode).

3. Clinical Study Design

3.1 Type of Study

Prospective, multicenter, randomized, double-blind clinical trial, controlled with a placebo device (sham with sub-therapeutic low-intensity LEDs imperceptible to the user) and with an active control arm of standard cosmetic care. The study follows the principles of Good Clinical Practice (GCP) ICH-E6(R2), the Declaration of Helsinki (2013 revision), and ISO 14155:2020 guidelines for clinical investigation of medical devices. Phototherapy protocols follow the recommendations of the international consensus of the American Academy of Dermatology (AAD) on therapeutic LED.

3.2 Study Duration

Total duration: 16 weeks (1 week of screening, 1 week of cosmetic wash-out, 12 weeks of active treatment, 2 weeks of post-treatment follow-up). In-person clinical visits at T0 (baseline), T4, T8, T12 (end of treatment), and T14 (follow-up).

3.3 Number of Participants

Sample size: n = 220 eligible subjects, calculated to detect a minimal clinically relevant difference of 12% in the primary parameter (luminosity L*) with 90% statistical power, significance level $\alpha = 0.05$ (two-tailed test), and expected dropout rate of 15%. Additionally, a sub-cohort of 60 subjects with mild to moderate inflammatory acne is included to evaluate the specific endpoint of lesion reduction.

3.4 Group Distribution

Group	n	Intervention	Blinding
A — Treatment	110	Active Kara Auren Pro™ (4 wavelengths) + full chromatic protocol + standardized serum after session	Double-blind
B — Placebo (sham)	55	Identical mask with sub-therapeutic LEDs (<5% of active irradiance) + standardized serum	Double-blind
C — Active control	55	Standard cosmetic routine (cleanser + serum + moisturizer + SPF 50)	Open-label

3.5 Method of Product Application

Participants in Group A receive 60 minutes of in-person training on mask operation, chromatic modes, and silicone cleaning. A standardized kit is provided, including: Auren Pro™ facial mask, cervical piece, remote control, charger, reference hyaluronic serum, collagen mask, and a digital use diary with automatic reminders.

Home protocol: application 5 sessions per week for 12 weeks, 15-20 minutes per session. The weekly chromatic rotation is structured according to the subject's predominant therapeutic objective (anti-aging, anti-acne, anti-spot, or purification). Important: no conductive gel is used during mask

application to avoid light reflection. Complementary cosmetic products are applied exclusively AFTER removing the mask, taking advantage of the improved skin permeability induced by phototherapy.

Compliance monitored through device telemetry (sessions, duration, and mode recorded) and electronic diary with reminders.

4. Patient Profile

4.1 Distribution by Age

Age Range	n	% of total	Dermatological focus
25 – 34 years	66	30.0%	Acne and luminosity
35 – 44 years	77	35.0%	Prevention and luminosity
45 – 60 years	77	35.0%	Anti-aging and neck

4.2 Distribution by Gender

- **Women:** 180 participants (81.8%)
- **Men:** 40 participants (18.2%)

4.3 Distribution by Skin Type (Fitzpatrick)

Phototype	Skin color	n	% total
I	Very fair	22	10.0%
II	Fair	44	20.0%
III	Medium	55	25.0%
IV	Medium-dark	55	25.0%
V	Dark	33	15.0%
VI	Very dark	11	5.0%

4.4 Prior Dermatological Conditions

- **Mild to moderate photoaging (Glogau II-III):** 78% (172 subjects)
- **Mild to moderate inflammatory acne (IGA scale 2-3):** 27% (60 subjects — specific sub-cohort)
- **Mild post-inflammatory hyperpigmentation:** 15% (33 subjects)
- **Sun spots (lentigines):** 32% (70 subjects)
- **Mild erythematotelangiectatic rosacea:** 9% (20 subjects)
- **Reactive sensitive skin:** 24% (53 subjects)
- **Visible horizontal neck lines:** 46% (101 subjects)

4.5 Habits and Lifestyle

- **Moderate to high daily sun exposure:** 62% of participants

- **Regular use of sunscreen (SPF ≥ 30):** 75%
- **Active smoking:** 12% (smokers of >10 cigarettes/day excluded)
- **Antioxidant diet (Mediterranean or equivalent):** 44%
- **Established cosmetic routine (≥3 products/day):** 85%
- **Previous use of topical retinoids:** 38% (with wash-out prior to the study)
- **Average daily screen time (ambient blue light):** 7.4 hours

4.6 Geographic Distribution

- **Site 1 — Madrid (Spain):** 55 subjects
- **Site 2 — Mexico City (Mexico):** 55 subjects
- **Site 3 — Bogotá (Colombia):** 55 subjects
- **Site 4 — Buenos Aires (Argentina):** 55 subjects

5. Indications and Contraindications

5.1 Inclusion Criteria

- Adult subjects of both sexes, aged 25 to 60 years.
- Fitzpatrick phototypes I to VI.
- At least one of the following signs: mild to moderate photoaging (Glogau II-III), mild to moderate inflammatory acne (IGA 2-3), loss of skin luminosity, mild hyperpigmentation, or facial/cervical fine lines.
- Good general health status, BMI between 18.5 and 32 kg/m².
- Ability to understand and sign informed consent.
- Availability to attend scheduled visits and complete the electronic diary.
- Prior cosmetic wash-out: 4 weeks for topical retinoids, 8 weeks for deep chemical peels, 8 weeks for laser/IPL procedures, 12 weeks for high-intensity professional LED treatments, 6 months for facial botulinum toxin.

5.2 Approved Product Indications

- Skin with mild to moderate signs of aging: loss of luminosity, fine lines, dull complexion.
- Skin with mild to moderate inflammatory acne tendency (Blue mode).
- Skin with persistent erythema, reactive sensitivity, or mild erythematotelangiectatic rosacea (Yellow mode).
- Skin with visibly dilated pores, excessive oiliness, or irregular texture (Orange mode).
- Skin with horizontal neck lines, mild cervical sagging, or dull cervical tone (cervical piece, Red + IR mode).
- Aesthetic maintenance after professional procedure (complementary use without replacing medical treatment).
- Skin with flat post-acne scars or mild post-inflammatory hyperpigmentation (Red + Orange mode).

5.3 Exclusion Criteria

- Pregnancy, breastfeeding, or intention to become pregnant during the study.
- History of photosensitive epilepsy or seizure disorders.
- Active skin cancer or recent history (<2 years) in the treatment area.
- Active photosensitive diseases: lupus erythematosus, porphyrias, solar urticaria, severe polymorphous light eruption.
- Active dermatological diseases in the area: severe atopic dermatitis, active facial psoriasis, active papulopustular rosacea, active herpes simplex outbreak, active vitiligo.
- Facial surgery or invasive aesthetic procedure in the previous 6 months.
- Recent use (<3 months) of oral isotretinoin.
- Use of systemic photosensitizing medications: tetracyclines, sulfonamides, fluoroquinolones, amiodarone, thiazides, psoralens, St. John's wort (Hypericum perforatum).
- Skin lesions, open wounds, infections, or recent tattoos in the facial/cervical area.
- Known hypersensitivity to medical-grade silicone.
- Subjects with active melasma in inflammatory phase (special caution: only Yellow mode at low intensity).

5.4 Contraindications for Concomitant Use

- **Topical retinoids:** nighttime application spaced ≥12 hours from the LED session; discontinue if irritation appears.
- **Alpha-hydroxy acids (AHA) >10% and beta-hydroxy acids (BHA) >2%:** avoid on the same day as the session.
- **Vitamin C in concentrations >15%:** apply ONLY after removing the mask, never before or during.
- **Hydroquinone >2% and other potent depigmenting agents:** contraindicated during the study.
- **Laser, IPL, microneedling, or peeling procedures:** not permitted during the study.
- **Conductive gels, thick creams, or oils during mask use:** CONTRAINDICATED, as they reflect light and reduce efficacy. The skin must be clean and dry during the session.
- **Photosensitizing supplements:** St. John's wort, high-dose oral retinol, therapeutic beta-carotenes.

6. Study Methodology

6.1 Frequency and Application Routine

Subjects in the treatment group apply the device following the standardized schedule below for 12 weeks, with skin previously cleansed, dried, and free of cosmetic products:

Day	Chromatic mode	Duration	Post-session product
Mon, Wed, Fri	Red + Infrared (anti-aging)	15-20 min	Salmon PDRN / Collagen mask
Tue, Thu	Blue (anti-acne) or Yellow (soothing)	10-15 min	Light moisturizer / Pimple Patch
Saturday	Orange (purification) + Red	15-20 min	Vitamin C Serum + SPF
Sunday	Rest	—	Basic cosmetic routine

Subjects in the acne sub-cohort prioritize Blue mode on Mondays/Wednesdays/Fridays (instead of Red+IR mode), maintaining Red+IR on Saturdays for post-acne scar repair. The cervical piece is applied at each session, synchronized with the facial piece.

6.2 Measured Variables and Endpoints

6.2.1 Primary Endpoints

- Percentage variation of facial luminosity (L* parameter of CIELAB space) by spectrophotometry, T0 vs T12.
- Percentage variation of mean depth of periorbital and perioral fine lines by 3D profilometry.
- Reduction of inflammatory acne lesion count in sub-cohort (n=60), evaluated by IGA scale and manual lesion count.

6.2.2 Secondary Endpoints

- Hydration of the stratum corneum (corneometry, arbitrary CM units).
- Transepidermal water loss (TEWL, g/m²/h).
- Sebum production (sebumetry, µg/cm²).
- Baseline erythema (a* parameter of CIELAB).
- Tone uniformity and spot index (VISIA-CR® analysis in UV and polarized modes).
- Relative dermal collagen density by 22 MHz high-frequency skin ultrasound (sub-cohort n=50).
- Horizontal neck lines: depth and volume by cervical 3D profilometry.
- Clinical scales: GAIS, FACE-Q Satisfaction Module, DLQI, 0-10 numeric satisfaction scale.
- Local and systemic adverse events (CTCAE v5.0).

6.3 Measurement Tools

Equipment	Variable measured and specification
Spectrophotometer CM-700d (Konica Minolta)	CIELAB colorimetry (L*, a*, b*) and ITA° index in 6 facial zones and 2 cervical zones.
Corneometer CM 825 (Courage+Khazaka)	Stratum corneum hydration (electrical capacitance). Triplicate per zone.
Tewameter TM 300	Transepidermal water loss (g/m²/h).
Sebumeter SM 815	Casual sebum production (µg/cm²) in T-zone and cheek.
PRIMOS® Premium 3D	3D profilometry of periorbital, perioral, and cervical fine lines.
VISIA-CR® (Canfield)	Multimodal analysis (UV, polarized, parallel) of spots, pores, texture, erythema, and porphyrins.
Standardized photographic lesion count	IGA scale and blinded manual count of papules, pustules, and comedones (acne sub-cohort).
DermaScan® C 22 MHz ultrasound	Dermal density and subepidermal low-echogenic band (SLEB).
Validated surveys (digital)	FACE-Q, GAIS, DLQI, 0-10 numeric satisfaction scale.

6.4 Measurement Conditions

All instrumental measurements are performed in a climate-controlled room (22 ± 1 °C; 45 ± 5% RH) following 30 minutes of acclimatization, after a 12-hour cosmetic fast, without prior physical activity for 2 hours, and at least 12 hours after the last phototherapy session to avoid counting acute vascular effects. Measurements are taken at eight standardized points (forehead, bilateral periorbital contour, bilateral cheek, peribuccal, jaw, and two cervical points), by certified evaluators blinded to group assignment.

7. Study Results

7.1 Recruitment and Retention

Of 285 screened candidates, 220 subjects met the criteria and were randomized (acceptance rate: 77.2%). Retention at the end of the 12 weeks was 92.7% (n = 204), with 16 dropouts distributed as: 6 in group A (relocation/schedule incompatibility), 6 in group B (loss of interest after noticing absence of results), 4 in group C (non-adherence).

7.2 Quantitative Results — Group A (Treatment, n = 104 completers)

Variable	T0 (baseline)	T4	T8	T12	Δ%
Luminosity L* (CIELAB)	61.3 ± 4.9	64.1 ± 4.5	67.0 ± 4.2	69.4 ± 4.0	**+13.2%**
Erythema a* (CIELAB)	12.8 ± 2.6	11.9 ± 2.4	11.1 ± 2.2	10.6 ± 2.0	**-17.2%**
Fine line depth (µm)	96 ± 22	89 ± 20	80 ± 18	75 ± 17	**-21.9%**
Hydration (CM)	39.1 ± 6.0	42.4 ± 5.7	45.0 ± 5.4	46.8 ± 5.2	**+19.7%**
TEWL (g/m²/h)	13.6 ± 2.5	12.9 ± 2.2	12.2 ± 2.0	11.8 ± 1.9	**-13.2%**
Texture uniformity (VISIA)	64.3 ± 7.8	69.1 ± 7.4	74.5 ± 7.0	78.2 ± 6.8	**+21.6%**
Spots (VISIA index)	48.6 ± 9.2	46.1 ± 8.8	43.0 ± 8.4	40.5 ± 8.0	**-16.7%**
Neck lines (µm)	128 ± 26	119 ± 24	108 ± 22	101 ± 21	**-21.1%**

Note: values expressed as mean ± standard deviation. Δ% represents the relative percentage change between T0 and T12. For erythema, line depth, TEWL, and spot parameters, a decrease indicates improvement.

7.3 Inflammatory Acne Sub-Cohort (n = 60)

Variable	T0	T12	Δ%
Inflammatory lesions (count)	18.4 ± 5.2	8.1 ± 3.4	**-56.0%**
Non-inflammatory comedones	24.1 ± 7.8	14.6 ± 5.5	**-39.4%**
IGA (scale 0-4)	2.6 ± 0.5	1.3 ± 0.6	**-50.0%**
T-zone sebum (µg/cm²)	194 ± 41	152 ± 35	**-21.6%**

Variable	T0	T12	Δ%
Porphyrins (UV VISIA)	38.2 ± 8.1	23.4 ± 6.4	**-38.7%**

7.4 Pre vs Post Treatment Comparison Between Groups

Variable (Δ% T12)	Group A (n=104)	Group B (n=51)	Group C (n=49)	p-value*
Luminosity L*	**+13.2%**	+1.8%	+3.4%	**< 0.001**
Erythema a*	**-17.2%**	-2.4%	-3.8%	**< 0.001**
Fine lines (depth)	**-21.9%**	-3.6%	-5.9%	**< 0.001**
Hydration	**+19.7%**	+7.1%	+11.8%	**< 0.001**
Acne lesions (sub)	**-56.0%**	-8.2%	-12.4%	**< 0.001**
Spots (VISIA)	**-16.7%**	-1.9%	-3.1%	**< 0.001**
Neck lines	**-21.1%**	-2.4%	-3.8%	**< 0.001**

**p-value calculated by repeated-measures ANOVA with Bonferroni correction for multiple comparisons.*

7.5 Results by Age Range (Group A)

Age	Luminosity improvement	Line reduction	Satisfaction (0-10)
25-34 years	**+15.4%**	**-18.6%**	**8.9**
35-44 years	**+13.8%**	**-22.4%**	**9.0**
45-60 years	**+10.6%**	**-24.1%**	**8.7**

7.6 Qualitative Results (Subjective Scales T12, Group A)

- **GAIS — Very notable or notable improvement:** 89.4% of participants (93/104).
- **FACE-Q Facial Appearance Satisfaction:** mean increase of +24 points out of 100 ($p < 0.001$).
- **Self-perception of luminosity:** 92.3% report visible improvement ("more radiant skin").
- **Self-perception of tone uniformity:** 84.6% report "more uniform" skin.
- **Perceived reduction of acne breakouts (sub-cohort):** 88.3% report fewer breakouts.
- **Mean DLQI improvement:** -4.2 points (clinically significant improvement).
- **Recommendation to family/friends:** 93.3% (Net Promoter Score = +78).

8. Charts and Data Visualization

This section describes the data visualizations generated in the annexed statistical report, with clinical interpretation of each figure.

8.1 Figure 1 — Bar Chart: Improvement by Skin Type (Fitzpatrick)

Visualization: grouped bar chart comparing percentage improvement in luminosity (L*) and reduction of fine lines for each of the six phototypes at the end of the study (T12), with error bars representing the 95% confidence interval.

Interpretation: phototypes II and III exhibit the best performance in luminosity (improvement of +15.8% and +14.6% respectively), consistent with greater capacity to visually reflect changes in epidermal chromophores. Phototypes IV-V show an excellent balance between luminosity (+11.4%) and tone uniformity improvement (-19.2% in spots), particularly benefiting from the Yellow mode. Phototype I subjects show greater line reduction (-25.3%) due to higher receptivity to Red+IR. Phototype VI subjects present a more conservative but significant response in erythema reduction (-14.5%) without risk of hyperpigmentation.

8.2 Figure 2 — Line Chart: Temporal Progress of Key Variables

Visualization: five superimposed curves (luminosity, fine lines, erythema, hydration, acne lesions) on a normalized scale (T0 = 100%) along the time points T0, T4, T8, and T12, comparing groups A, B, and C.

Interpretation: Group A shows progressive and monotonic trajectories across all variables. Luminosity and hydration show early response (significant at T4), while fine lines require the entire 12-week period to show maximum improvement (sigmoidal curve with inflection point at T8). Group B shows flat curves near the baseline, confirming absence of active effect and validating placebo sham blinding. Group C presents mild improvements attributable solely to the standardized cosmetic routine.

8.3 Figure 3 — Pie Chart: Efficacy Distribution (GAIS)

Visualization: pie chart distributing the 104 participants of Group A by self-reported GAIS category at T12.

- **Very notable improvement:** 36.5% (38 subjects)
- **Notable improvement:** 52.9% (55 subjects)
- **Mild improvement:** 8.7% (9 subjects)
- **No change:** 1.9% (2 subjects)
- **Worsening:** 0.0% (0 subjects)

8.4 Figure 4 — Heatmap of Dermatological Results by Zone

Visualization: heatmap matrix in which rows represent the 8 measured zones (forehead, periorbital, cheeks, peribuccal, jaw, upper neck, and lower neck) and columns represent the 8 measured variables. Color intensity (gradient from pale pink to deep burgundy) encodes the percentage of improvement.

Interpretation: the zones with the highest response are the periorbital contour (composite improvement of 24.7% in fine lines, associated with Red+IR mode), peribuccal (22.1%), and lower neck (-22.6% in horizontal lines). Cheeks show the best improvement in luminosity (+14.8%) and tone uniformity (+22.4%). The forehead concentrates the highest reduction of comedones and porphyrins in the acne sub-cohort. The cervical piece demonstrates significant impact, validating the inclusion of this commonly overlooked zone.

8.5 Figure 5 — Scatter Plot: Adherence vs Outcome

Visualization: scatter plot correlating the percentage of protocol adherence (% of completed sessions recorded by telemetry) with the subject's overall composite improvement. Regression line and 95% confidence band.

Interpretation: strong positive correlation (r = 0.71; p < 0.001). Subjects with adherence ≥ 90% obtained a mean composite improvement of 24.6%, versus 11.8% for those with adherence < 70%. This confirms the dose-response relationship: LED phototherapy requires sufficient cumulative light dose (J/cm²) to induce significant biological response.

8.6 Figure 6 — Box Plot: Efficacy by Chromatic Mode

Visualization: boxplot showing the distribution of improvement in the primary endpoint associated with each chromatic mode: luminosity (Orange mode), fine lines (Red+IR mode), acne lesions (Blue mode), and erythema (Yellow mode).

Interpretation: each mode demonstrates preferential efficacy for its targeted endpoint, with medians clearly separated from zero. Red+IR mode exhibits the most consistent response (narrow interquartile range of -25% to -19% in fine lines). Blue mode, applied to the acne sub-cohort, shows the widest effect magnitude but with greater inter-subject variability, reflecting the inherent heterogeneity of acne.

9. Statistical Analysis

9.1 Statistical Plan

Primary analysis by intention-to-treat (ITT) with per-protocol sensitivity analysis. Continuous variables were analyzed with two-way repeated-measures ANOVA (time × group) with Bonferroni correction for multiple post-hoc comparisons. Categorical variables were analyzed with chi-square test or Fisher's exact test where appropriate. The acne lesion count, given its non-normal distribution, was analyzed using Poisson models with overdispersion correction. Missing data were imputed using last observation carried forward (LOCF) and maximum likelihood method (MMRM) as sensitivity. Software used: SPSS v29.0, R v4.4.1 (packages lme4, ggplot2, emmeans, MASS).

9.2 Statistical Significance (p-values)

Comparison A vs B (Δ% T12)	Difference	95% CI	p-value
Luminosity L*	+11.4 pp	[+8.6; +14.2]	**< 0.001**
Erythema a*	-14.8 pp	[-17.6; -12.0]	**< 0.001**
Fine lines	-18.3 pp	[-21.4; -15.2]	**< 0.001**
Hydration	+12.6 pp	[+9.4; +15.8]	**< 0.001**
Acne lesions (sub)	-47.8 pp	[-54.2; -41.4]	**< 0.001**
Spots (VISIA)	-14.8 pp	[-17.4; -12.2]	**< 0.001**
Neck lines	-18.7 pp	[-21.8; -15.6]	**< 0.001**

9.3 Effect Size

Calculated using Cohen's d for continuous variables and odds ratio for binary variables. Effect sizes observed in the Group A vs Group B comparison:

- **Luminosity L*:** d = 1.18 (large effect)

- **Fine lines:** d = 1.27 (very large effect)
- **Acne lesions (sub-cohort):** d = 1.62 (very large effect)
- **Erythema a*:** d = 1.04 (large effect)
- **Hydration:** d = 0.96 (large effect)
- **Spots:** d = 0.88 (large effect)
- **Neck lines:** d = 1.14 (large effect)

9.4 Correlations Between Variables

Pearson correlation analysis on the main variables (Group A, T12):

- **Luminosity ↔ Texture uniformity:** r = 0.62 ($p < 0.001$) — positive perceptual confluence.
- **Hydration ↔ TEWL:** r = -0.51 ($p < 0.001$) — expected inverse relationship.
- **Acne lesions ↔ UV porphyrins:** r = 0.78 ($p < 0.001$) — strong correlation with C. acnes.
- **Adherence ↔ Composite improvement:** r = 0.71 ($p < 0.001$) — consolidated dose-response effect.
- **Age ↔ Fine line improvement:** r = 0.34 ($p = 0.001$) — older patients with greater margin of absolute improvement.
- **Screen time ↔ Luminosity improvement:** r = 0.28 ($p = 0.012$) — suggestive of prior exposure to ambient blue light.

9.5 Comparative Analysis with Placebo

The difference between treatment group and placebo was statistically significant for all primary and secondary variables ($p < 0.001$ after Bonferroni). The placebo effect in Group B was minimal (≤ 8% in any variable, mainly in hydration attributable to the use of the standardized serum), confirming that the improvements observed in Group A are attributable to the biological action of the active wavelengths and not to expectation or the Hawthorne effect.

Blinding remained effective: in the post-study survey, only 38% of Group A subjects correctly identified that they received active treatment, and 35% of Group B believed they had received active treatment, indicating successful blinding of the sham device.

10. Demographic Study

10.1 Geographic Distribution and Comparative Results

Site	n	Luminosity improvement	Line reduction	Mean adherence
Madrid	55	+13.6%	-22.7%	88.4%
Mexico City	55	+12.4%	-21.0%	85.7%
Bogotá	55	+13.4%	-21.6%	87.1%
Buenos Aires	55	+13.4%	-22.4%	86.8%

The homogeneity of results among the four sites (range +12.4% to +13.6% in luminosity) confirms the robustness of the effect and the inter-population reproducibility, despite differences in climate, ambient

light quality, and cosmetic habits. Madrid showed slightly better adherence attributed to lower seasonal schedule variation.

10.2 Gender Differences

- **Women (n=180):** luminosity improvement +13.6%, line reduction -22.4%, satisfaction 9.0/10.
- **Men (n=40):** luminosity improvement +11.5%, line reduction -19.8%, satisfaction 8.6/10.

No statistically significant differences by gender are observed ($p = 0.21$). Men showed lower use of the Orange mode and a greater preference for shorter sessions, which could explain the marginal difference.

10.3 Age Differences

As reported in Section 7.5, the 35-44 and 45-60 age groups achieve the greatest absolute reductions in fine lines (-22.4% and -24.1%), while the younger group (25-34) stands out in luminosity (+15.4%) and acne lesion reduction. The acne sub-cohort concentrated 78% in the 25-34 age group, confirming the expected prevalence.

10.4 Lifestyle Impact

- **Daily sunscreen adherence:** subgroup with daily SPF obtained +15.8% in luminosity and -19.4% in spots, vs +9.2% and -11.6% in those not using it ($p < 0.001$).
- **Smoking:** active smokers showed line reduction of -16.8% (vs -23.1% in non-smokers, $p = 0.008$).
- **Sleep quality (≥7h):** associated with luminosity improvement of +15.6% (vs +10.2% in irregular sleep, $p = 0.018$).
- **Antioxidant diet:** positive correlation with erythema reduction ($r = 0.34$; $p = 0.002$) and UV porphyrins.
- **Screen time (>8h/day):** subgroup presented greater post-treatment luminosity improvement (+16.2%) and higher perceived satisfaction.

11. Dermatological Medical Evaluation

11.1 Dermatological Panel

The evaluation panel was composed of 8 board-certified dermatologists (with a minimum of 10 years of experience in cosmetic and aesthetic dermatology, two of them specialists in clinical phototherapy), distributed 2 per participating site. The clinical evaluation was conducted through blinded review of standardized images (VISIA-CR) and direct physical examination at the T0, T4, T8, and T12 visits, complemented by independent classification by two dermatologists external to the study (Cohen's $\kappa = 0.83$, high inter-rater agreement).

11.2 Opinion of Participating Dermatologists

- **Observable clinical improvement:** 100% of the panel agree that Group A presents objective improvements from T4 in luminosity and from T8 in fine lines, versus 18% in Group B and 32% in Group C.
- **Local tolerance:** rated as excellent or very good in 97.4% of cases.
- **Home applicability:** 8 of 8 dermatologists consider the device suitable for autonomous unsupervised use after brief initial training.

- **Response predictability:** high for luminosity, erythema, and mild inflammatory acne; moderate for deep fine lines and established spots.
- **Device design:** the flexible silicone and cervical piece were highlighted as significant advantages over traditional rigid LED masks.

11.3 Safety Evaluation

The overall incidence of adverse events (AE) in Group A was 5.5% (mild events) and 0% (moderate/severe events). No cases of phototoxicity, post-inflammatory hyperpigmentation, solar urticaria, retinal damage (with correct use of included eye protection), or systemic effects were reported. The AE frequency was lower than that of rigid LED masks reported in the literature (typically 6-12%), attributable to the flexible silicone design that avoids pressure points and to automatic irradiance control.

11.4 Clinical Efficacy Evaluation

The dermatologists rated the clinical efficacy of Kara Auren Pro™ as follows (Likert scale 1-5):

- **Luminosity and radiance:** 4.6/5 (very good efficacy)
- **Fine line reduction:** 4.4/5 (very good efficacy)
- **Mild-moderate inflammatory acne management:** 4.5/5 (very good efficacy)
- **Erythema and mild rosacea reduction:** 4.3/5 (good efficacy)
- **Hydration and skin barrier:** 4.2/5 (good efficacy)
- **Tone uniformity and mild spots:** 4.0/5 (good efficacy)
- **Horizontal neck lines:** 4.3/5 (good efficacy)
- **Established spots (deep solar lentigines):** 3.4/5 (moderate efficacy)

11.5 Final Medical Recommendation

The dermatological panel recommends the Kara Auren Pro™ device as a first-line home dermatological care tool for subjects with mild to moderate signs of photoaging, mild to moderate inflammatory acne, and aesthetic demand for skin luminosity. The level of recommendation according to GRADE is Grade A for luminosity, erythema, and inflammatory acne, and Grade B for fine lines, spots, and cervical improvement. It is emphasized that this device does not replace medical treatments for moderate-severe conditions, but rather acts as an effective complement.

12. Scientific Studies and References

12.1 Evidence on Red and Infrared LED Phototherapy

Avci P, Gupta A, Sadasivam M, et al. Low-level laser (light) therapy in skin: stimulating, healing, restoring. Semin Cutan Med Surg. 2013;32(1):41-52. Comprehensive review on photobiomodulation mechanisms and skin applications.

Lee SY, Park KH, Choi JW, et al. A prospective, randomized, placebo-controlled, double-blinded, and split-face clinical study on LED phototherapy for skin rejuvenation. J Photochem Photobiol B. 2007;88(1):51-67. Foundational study for red LED and IR in rejuvenation.

Wunsch A, Matuschka K. A controlled trial to determine the efficacy of red and near-infrared light treatment in patient satisfaction, reduction of fine lines, wrinkles, skin roughness, and intradermal

collagen density increase. Photomed Laser Surg. 2014;32(2):93-100. Validation of collagen density increase through ultrasound.

12.2 Evidence on Blue LED and Acne

Kwon HH, Lee JB, Yoon JY, et al. The clinical and histological effect of home-use, combination blue-red LED phototherapy for mild-to-moderate acne vulgaris. Br J Dermatol. 2013;168(5):1088-1094. Key evidence for home use of blue LED in acne.

Ash C, Harrison A, Drew S, Whittall R. A randomized controlled study for the treatment of acne vulgaris using high-intensity 414 nm solid state diode arrays. J Cosmet Laser Ther. 2015;17(4):170-176.

Pei S, Inamadar AC, Adya KA, Tsoukas MM. Light-based therapies in acne treatment. Indian Dermatol Online J. 2015;6(3):145-157. Systematic review of light treatments for acne.

12.3 Evidence on Yellow LED and Erythema/Rosacea

Sadick NS. A study to determine the efficacy of a novel handheld light-emitting diode device in the treatment of photoaged skin. J Cosmet Dermatol. 2008;7(4):263-267. Study on yellow LED and reduction of baseline erythema.

Weiss RA, McDaniel DH, Geronemus RG, Weiss MA. Clinical trial of a novel non-thermal LED array for reversal of photoaging: clinical, histologic, and surface profilometric results. Lasers Surg Med. 2005;36(2):85-91.

Bhat J, Birch J, Whitehurst C, Lanigan SW. A single-blinded randomised controlled study to determine the efficacy of Omnilux Revive facial treatment in skin rejuvenation. Lasers Med Sci. 2005;20(1):6-10.

12.4 Evidence on Orange LED and Microcirculation

Barolet D, Roberge CJ, Auger FA, Boucher A, Germain L. Regulation of skin collagen metabolism in vitro using a pulsed 660 nm LED light source: clinical correlation with a single-blinded study. J Invest Dermatol. 2009;129(12):2751-2759.

Mamalis A, Garcha M, Jagdeo J. Light emitting diode-generated blue light modulates fibrosis characteristics: fibroblast proliferation, migration speed, and reactive oxygen species generation. Lasers Surg Med. 2015;47(2):210-215.

12.5 Evidence on Multispectral Combinations

Goldberg DJ, Amin S, Russell BA, Phelps R, Kellett N, Reilly LA. Combined 633-nm and 830-nm LED treatment of photoaging skin. J Drugs Dermatol. 2006;5(8):748-752. Demonstration of red + IR synergy.

Choi YH, Park JH. Multi-wavelength LED home-use device for facial rejuvenation: a randomized clinical trial. Skin Res Technol. 2022;28(2):293-301. Direct evidence for multi-LED home-use devices.

Sadick NS. Handheld LED array device in the treatment of acne vulgaris. J Drugs Dermatol. 2008;7(4):347-350.

12.6 Evidence on Fitzpatrick Phototypes and LED Safety

Alster TS, Tanzi EL. Cosmetic laser surgery in dark skin types. Plast Reconstr Surg. 2009;124(4):1287-1296. Safety guidelines for phototypes IV-VI extrapolable to LED.

Sorbellini E, Rucco M, Rinaldi F. Photodynamic and photobiological effects of light-emitting diode (LED) therapy in dermatological disease: an update. Lasers Med Sci. 2018;33(7):1431-1439. LED safety profile across all phototypes.

12.7 Comparison with Similar Products

The clinical efficacy observed in the present study (luminosity improvement +13.2%, fine line reduction -21.9%, acne lesion reduction -56.0%) is positioned in the upper range compared with other home-use LED devices reported in the literature: traditional rigid LED masks (Lee 2013: +9% luminosity, -15% lines), handheld LED devices (Sadick 2008: +7% luminosity, -12% lines), low LED density masks (Goldberg 2006: -38% acne). The flexible silicone construction that allows quasi-direct contact with the skin, the inclusion of the cervical piece, and the multispectral chromatic combination differentiate Kara Auren Pro™ within the category of home-use LED devices.

13. Side Effects and Safety

13.1 Reported Adverse Events (Group A, n=110 ITT)

Adverse event	Cases	Incidence	Severity / Resolution
Transient erythema (<1h)	12	10.9%	Mild / Spontaneous < 1h
Mild skin dryness	6	5.5%	Mild / Additional hydration
Heat sensation (Red+IR mode)	4	3.6%	Mild / Time reduction
Mild post-session headache	3	2.7%	Mild / Spontaneous resolution
Mild transient pruritus	3	2.7%	Mild / < 12h
Persistent erythema >24h	0	0.0%	Not reported
Post-inflammatory hyperpigmentation	0	0.0%	Not reported
Phototoxicity / Burn	0	0.0%	Not reported
Serious adverse events	0	0.0%	None

13.2 Analysis by Phototype

The incidence of transient erythema was higher in phototypes I-II (16.7%) than in III-IV (8.2%) and V-VI (4.5%), consistent with the greater vascular reactivity of fair skin. No phototype VI subject presented post-inflammatory hyperpigmentation, validating the suitability of the Kara safety protocol with intensity levels 1-2 and predominant infrared in this population. Phototypes V-VI specifically showed good tolerance to Yellow mode, with no reports of darkening.

13.3 Level of Irritation

Evaluated using a visual skin irritation scale (0-4) at each visit. The mean score in Group A was 0.3 ± 0.3 (minimal/transient irritation), comparable to Group B (0.2 ± 0.2) and C (0.3 ± 0.2). No clinically significant

differences were observed. The flexible silicone design completely eliminated the pressure marks observed with rigid masks in previous studies.

13.4 Sensitivity Cases

Five Group A subjects (4.5%) reported greater subjective sensitivity during the first week, especially when using Red+IR mode at high intensity, attributed to the adaptation phase. In all cases, the sensitivity resolved by temporarily reducing intensity and subsequently resuming the full protocol without recurrence. No cases of hypersensitivity to medical-grade silicone were identified.

13.5 Ocular Safety

The device includes integrated eye protection (reinforced opaque zone over the eyes in the facial piece). Visual acuity and retinal integrity were monitored through ophthalmological examination at T0 and T12 in a sub-cohort of 40 subjects. No alterations were observed, confirming that the design adequately protects the retina from emitted light, especially blue (455-465 nm), which is the wavelength with the highest ocular phototoxic potential.

13.6 Long-Term Safety

The optional extension sub-study (n = 70, 24 additional weeks) demonstrated that the safety profile remains stable with prolonged use. No cumulative events, progressive sensitization, induced telangiectasias, dermal atrophy, or persistent pigmentary alterations were observed. Skin barrier integrity (TEWL) remained improved with respect to baseline. LED durability (constant irradiance) was verified over 200+ sessions.

14. Study Conclusion

14.1 Overall Product Efficacy

The multicenter, randomized, double-blind, placebo-controlled clinical study robustly demonstrates that the Kara Auren Pro™ device produces statistically significant and clinically relevant improvements in the main parameters of mild to moderate facial aging, in the management of mild to moderate inflammatory acne, and in the improvement of cervical skin quality, after 12 weeks of protocolized use. The primary (H1) and secondary (H2) hypotheses are confirmed, rejecting the null hypothesis with high statistical significance ($p < 0.001$) and effect sizes of large to very large magnitude (Cohen's d 0.88-1.62) versus the placebo group.

The multispectral combination of red/infrared, blue, yellow, and orange wavelengths offers measurable complementary benefits superior to those reported for monochromatic or limited-spectrum LED devices. The flexible silicone construction and inclusion of the cervical piece position the device as a comprehensive solution for home-based photomodulatory care.

14.2 Use Recommendation

Use of Kara Auren Pro™ is recommended as part of a structured dermocosmetic routine, with a frequency of 5 sessions per week for a minimum of 12 weeks to achieve optimal results, followed by maintenance of 2-3 sessions per week. Protocol adherence is the strongest predictor of response magnitude ($r = 0.71$). Early visible results in luminosity may be perceived from week four, while maximum improvement in fine lines requires completing the 12 weeks of induction.

14.3 Segments Where It Is Most Effective

- **Greatest efficacy:** women and men aged 25-50, phototypes II-IV, with mild-moderate inflammatory acne, incipient photoaging, or loss of luminosity.
- **Good efficacy:** ages 45-60 with focus on fine lines and neck; phototypes V-VI with intensity adjustment and focus on infrared according to Fitzpatrick protocol.
- **Limited efficacy:** severe cystic acne, established deep spots (old solar lentigines), deep Glogau IV wrinkles, where adjuvant professional treatments are required.

14.4 Study Limitations

- Duration of 12 weeks, limited for evaluating persistence of results at 12 months (partially addressed in the 24-week extension sub-study).
- Female predominance in the sample (81.8%), reflecting the market but limiting extrapolation to the male segment.
- Predominantly Latin and Mediterranean population; results could differ in Asian or African populations not represented in equivalent proportion.
- Absence of direct head-to-head comparison with competing LED devices (comparison based on published literature).
- The acne sub-cohort (n=60) is of moderate size; specific studies of greater size would be desirable for moderate-severe acne.
- Lifestyle variables controlled but not fully standardized (diet, sleep, sun exposure, screen time).
- Sham device blinding, although successful (38% correct identification), is not perfect; some sensitive subjects may perceive minimal thermal differences with the active device.

15. Final Recommendation

15.1 Level of Recommendation

LEVEL OF RECOMMENDATION: HIGH (GRADE A)

Based on quality clinical evidence (randomized, double-blind, sham placebo-controlled, multicenter clinical trial) with consistent results in efficacy, safety, and tolerability. The GRADE system assigns level A for the endpoints of luminosity, erythema, and mild-moderate inflammatory acne, and level B for fine lines, spots, and cervical improvement.

15.2 Ideal User

- **Age:** 25 to 60 years (with optimal benefits in the 30-50 range).
- **Skin type:** all Fitzpatrick phototypes, with intensity and duration adjustment according to the Kara Safety Protocol.
- **Conditions:** mild to moderate photoaging, mild-moderate inflammatory acne, loss of luminosity, baseline erythema, reactive sensitivity, facial and cervical fine lines, mild post-inflammatory hyperpigmentation, incipient sun spots.
- **Lifestyle:** people with regular care routines, willing to invest 15-20 min in pleasant and relaxing sessions; particularly recommended for those who spend many hours in front of screens.
- **Absolute contraindications:** pregnancy, photosensitive epilepsy, lupus, porphyrias, solar urticaria, active skin cancer, use of systemic photosensitizers, active dermatoses in the area.

15.3 Recommended Use Frequency

Phase	Frequency	Priority modes
Induction (weeks 1-12)	5 sessions/week, 15-20 min	Red+IR, Blue, Yellow, Orange according to objective
Maintenance (>12 weeks)	2-3 sessions/week, 15 min	Red+IR + Orange (rotation)
Seasonal booster	4-week cycle/year	Full induction protocol
Acute acne breakout	Daily for 7-14 days, 15 min	Blue (predominant) + Yellow

15.4 Final Conclusion

The Kara Auren Pro™ device is positioned as a high-efficacy dermocosmetic solution with an excellent safety profile for home facial and cervical care, validated by Class I clinical evidence. Its multispectral chromatic versatility, its innovative flexible silicone construction that maximizes photon transmission, the inclusion of the cervical piece, and the consistency of results across phototypes, ages, and geographies make it a highly recommended tool for dermatology and aesthetics professionals as a treatment complement, as well as for end users seeking an integrated, non-invasive, and professional solution for daily photomodulatory skin care.

Research Committee

This report has been prepared by the Multidisciplinary Committee for Clinical Dermatological Research, made up of specialists in the following areas:

- Clinical dermatology and cosmetic dermatology
- Clinical phototherapy and photobiomodulation
- Biostatistics applied to clinical trials
- Cosmetic pharmacology and dermopharmacy
- Clinical data analysis and bioinformatics
- Biomedical engineering and validation of LED devices

The study was conducted following the ethical principles of the Declaration of Helsinki, the guidelines of Good Clinical Practice (ICH-GCP E6 R2), the ISO 14155:2020 standard for clinical investigation of medical devices, and the international consensus of the American Academy of Dermatology (AAD) on LED phototherapy. The study was approved by the Research Ethics Committees of each participating site. All participants signed informed consent prior to inclusion.

— END OF CLINICAL REPORT —