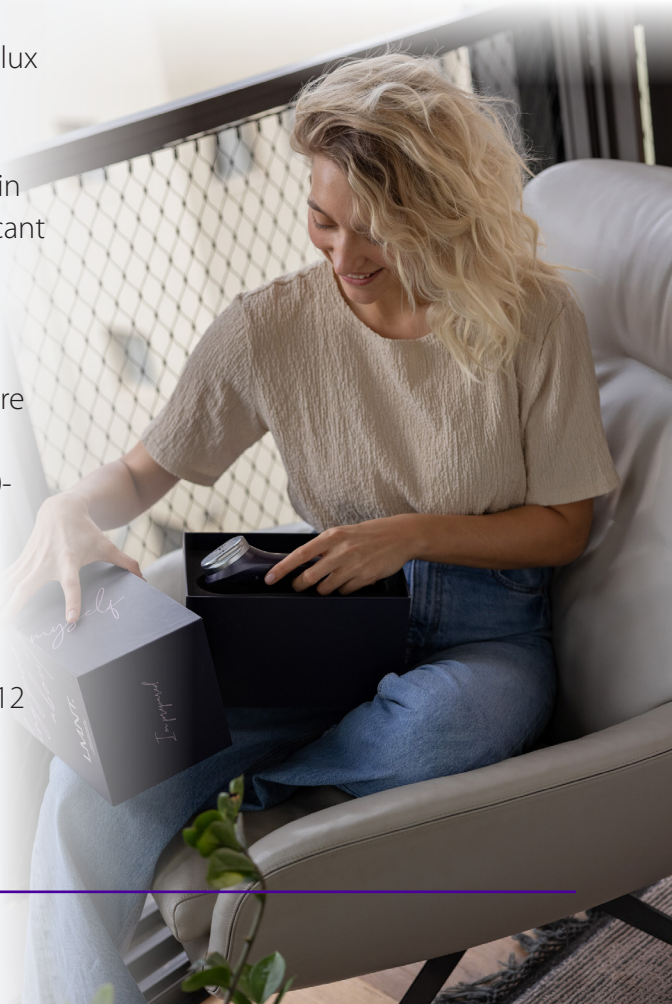
Clinical effects of 630 nm/830 nm LED phototherapy

Light-emitting diode (LED) treatment has long been recognized as a safe and effective means of achieving skin rejuvenation. Its rejuvenating impact is generally thought to be driven by photomodulatory effects, such as stimulation of fibroblast proliferation, synthesis of procollagen, extracellular matrix and fibroblastic growth factors, and acceleration of fibroblast-myoblast transformation and mast cell degranulation. Protocols integrating several wavelengths, maximize the favourable effects of each, to achieve an optimal balance of superficial and deep-layer responses.

In a split-face, randomized study assessing the impact of 633 nm LED light on aging skin, subjects underwent three weekly 20-min treatment sessions, for three weeks (Bhat, Birch et al. 2005). Five weeks after completion of treatment, 91% of subjects reported on visible skin improvements, with 64% reporting on reduced fine lines and wrinkles and softer and smoother skin, and 50% reporting on firmer skin. These ratings aligned with the blinded assessments of photos collected during the follow up period, which classified 59% as showing improvements in fine lines and wrinkles, skin tone and appearance. Changes in skin elasticity and hydration were not significant.

A prospective, randomized, double-blind trial comparing the effects of 660 nm LED therapy to those of polychromatic 411-777 nm white LED treatment in women with grade 3 lateral periocular wrinkles, found greater wrinkle volume decreases in the subjects treated with red light by week 12 post-treatment (Nam, Park et al. 2017). No significant changes in skin roughness were noted.

A 5-week 633 nm and 830 nm combination light regimen (Omnilux LED system) in 31 subjects with periorbital wrinkles or crow's feet and/or grade I-III photodamaged skin elicited significant improvements in profilometry measures, including decreased skin roughness metrics (Sq, Sa and Sp) by weeks 9 and 12 and significant decreases in maximum height of the profile (St) at week 12 after treatment initiation (Russell, Kellett et al. 2005). The therapy also led to a significant reduction in mean furrow density within 9 weeks of treatment initiation. In addition, photoaging scores were significantly improved, with approximately 50% of the treated patients showing a 25-50% improvement and 13% showing a 50-75% improvement by the end of the 12-week follow-up period. Periorbital wrinkle softening was reported by >80% of subjects at both the week 9 and week 12 assessment points. The majority of subjects reported on improvements in skin softness (65-84%), smoothness (68-81%) and firmness (~50%) at the week 6, 9 and 12 follow up visits.

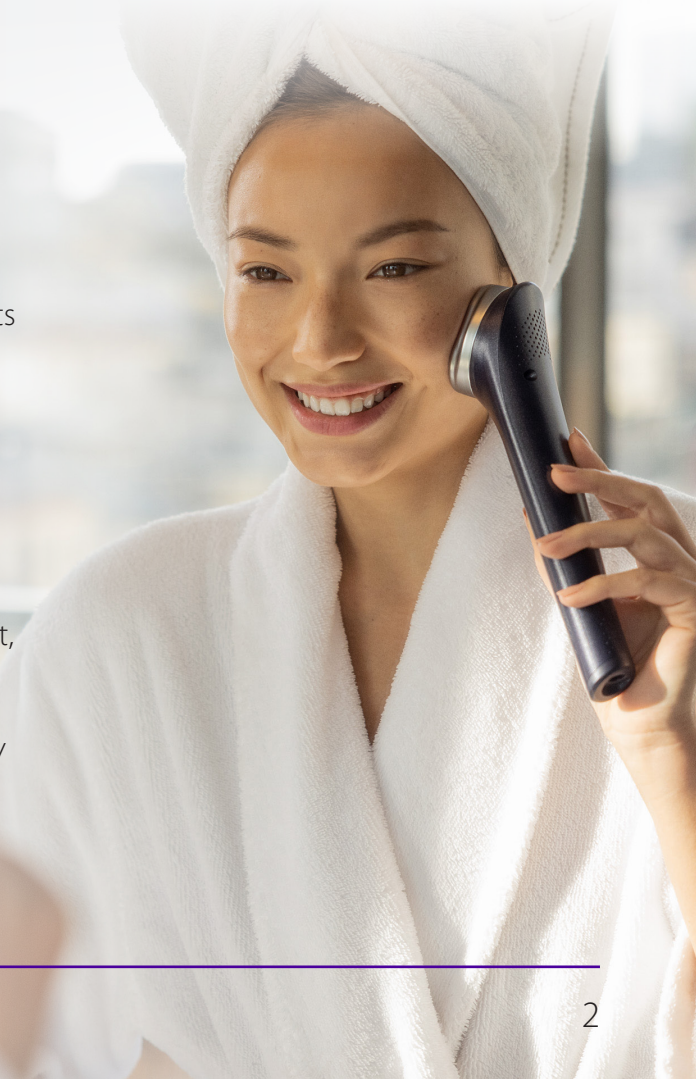


Similar outcomes of combined 633 nm and 830 nm LED treatment were reported by Goldberg et al. (Goldberg, Amin et al. 2006). In their prospective study, 36 subjects presenting with periorbital wrinkles or crow's feet and grade I-III photodamage, were treated with a combined 633 nm-830 nm LED regimen applied in 9 sessions over a 5 week period. Within 9-12 weeks of treatment, significant decreases in skin roughness metrics (Sq, Sa, Sp) and St were noted. While the treatment regimen had no significant impact on skin furrow depth, their mean density was significantly reduced by the week 9 session. Overall, 52% of the subjects showed a 25-50% improvement in photoaging scores by the end of the study, and 13% achieved 50-75% improvement. Most subjects (>80%) reported on periorbital wrinkle softening by at the weeks 9 and 12 follow up assessments and most reported on improvements in skin softness (65-85%), smoothness (68-81%) and firmness (48-52%) throughout the follow up period.

Similar subject ratings were reported by Baez and Reilly (Baez and Reilly 2007), who assessed the impact of combination 633 nm and 830 nm LED treatment (Omnilux) on typical signs of photoaging/damaged skin. Subjects (n=11) underwent 9 treatment sessions within a 5-week period and were followed up for 12 weeks. At the 12 weeks follow up session, the majority of subjects reported on improved skin tone (91%), smoothness (82%), softness (73%), clarity (64%) and firmness (55%). Improved elasticity was reported by 45% of subjects.

Prospective analysis of combination LED therapy in 19 subjects presenting with wrinkles or crow's feet in the periorbital region and grade I-III photodamage, found that 633nm-830 nm LED therapy, applied on alternating days at 2- day intervals, for 4 weeks, identified moderate responses in most subjects (Sadick 2008). At the end of the 12-week follow up period, 74% of subjects reported on visible changes in fine lines and wrinkles, 84% on improved skin tone, 79% on improved smoothness, 73% on improved clarity, 68% on improved firmness and 47% on improved elasticity. Overall treatment outcome was rated as good or excellent by 73% of subjects.

A prospective analysis of 830 nm-633nm mono vs. combination LED phototherapy data collected in a randomized, placebo-controlled, double-blinded, split-face study, found both the mono and combination regimens to be safe and effective (Lee, Park et al. 2007). When compared to the untreated side of the face and to sham-treated subjects, all three treatment protocols led to significant decreases in wrinkle severity. In parallel, a 36% improvement in skin roughness was noted 3 months post-treatment among subjects treated with the combination regimen, while maximal roughness improvements were 33% and 26% for the 830 nm-only and 633 nm-only cohorts, respectively. Skin elasticity improved significantly in all three treatment arms. A statistically significant decrease in melanin levels was only noted among subjects treated with 633 nm LED. All three regimens were associated with high proportions of subjects rating outcomes as good or excellent, while the majority of sham-treated subjects (10/14) reported on no change. Of note, at 12 weeks after completing treatment, >95% of subjects treated with 830 nm LED or the combination regimen reported on good to excellent results, while only 72% of the 633 nm LED-treated subjects ranked outcomes as good/excellent. Investigator assessments ranked wrinkle severity improvements much higher (mean >2) on the treated sides in all three treatment cohorts, while mean improvements of <0.5 points were reported in the sham cohort.



In a similar split-face prospective study involving 24 subjects with photoaging skin, LED-based phototherapy was applied twice weekly, for 8 weeks, to the left side of the face only, using a home-use device (LG Pra.L Derma LED Mask®) that integrates 60 red LEDs (637 nm) and 60 infrared LEDs (854 nm) (Ng, Wanitphakdeedecha et al. 2020). Most of the subjects had Fitzpatrick skin type V. When compared to baseline and untreated skin, treated sides showed increased skin elasticity 6-8 weeks following treatment. By 8 weeks post-treatment, skin smoothness and texture, assessed using the Visioscan VC 98 system, were significantly improved as compared to baseline. No significant differences in wrinkle status and skin roughness were noted between cohorts and between baseline and post-treatment measurements. At the end of the 8-week follow-up period, 83% of the subjects reported on good to excellent improvements on the treated side, while only 26% of subjects gave similar ratings to the untreated control side.

In all studies, adverse effects were extremely rare. When reported, they were all mild and self-limiting (<24 h).

LED low-level light therapy has been shown to be safe and effective in rejuvenating aging skin. Synergistic effects have been observed when integrating multiple wavelengths in treatment regimens. The enhanced outcomes achieved with combination protocols are attributed to the multifaceted impacts they have on cells of the epidermal and dermal layers, as well as on blood flow.

First Author	630 nm, 830 nm or combination	System	Fluence/ Radiance	Schedule	Indication	Outcome
Bhat et al.	630 nm	Omnilux Revive	630 nm: 96 J/cm2	Three times/week, 3 weeks 20-min sessions	Aging skin	Reduced fine lines/ wrinkles Softer, smoother, firmer skin Improved tone
Nam, CH et al.	640-680 nm	SKIN LABS	640-680 nm: 5.17 J	10 min daily, 12 weeks	Lateral periocular wrinkles	Reduced wrinkle volume
Baez F and Reilly LR	Combination – alternate days	Omnilux LED and Omnilux Plus	830 nm: 55 mW/cm2 (66 J/cm2) 633 nm: 105 mW/ cm2 (126 J/cm2)	830: Day 1, 3, 5, 15, 22, 29 633: Day 8, 10, 12 20 min exposures each	Photoaging skin	Improved skin tone, smoothness, clarity, firmness, elasticity
Goldberg DJ et al.	Combination – alternate days	Omnilux Revive and Omnilux Plus	830 nm: 55 mW/cm2 (66 J/cm2) 633 nm: 105 mW/ cm2 (126 J/cm2)	830: Day 1, 3, 5, 15, 22, 29 633: Day 8, 10, 12 20 min exposures each	Photoaging skin	Improved skin roughness (Sq, Sa, Sp) Improved St Reduced furrow density Improved skin softness, smoothness, firmness

First Author	630 nm, 830 nm or combination	System	Fluence/ Radiance	Schedule	Indication	Outcome
Lee SY et al.	Mono or combination-same-day sequential	Omnilux Plus and Omnilux Revive	830 nm: 55 mW/cm2 (66 J/cm2) 633 nm: 105 mW/cm2 (126 J/cm2)	Two times/week, 4 weeks 20-min sessions	Aging skin	Mono and Combination treatment: Reduced wrinkle severity Improved skin roughness, elasticity Combination: Greatest improvement in skin roughness 633 nm only: Reduced melanin 830 nm only: Highest subject satisfaction
Ng JN et al.	Combination - Simultaneous application	LG Pra.L Derma LED Mask®	25 mW/cm2	Twice weekly (9 min each), 8 weeks	Photoaging skin	Improved skin elasticity, smoothness, texture
Russell, BA et al.	Combination – sequential	Omnilux	830 nm: 55 mW/cm2 (66 J/cm2) 633 nm: 105 mW/cm2 (126 J/cm2)	830: Day 1, 3, 5, 15, 22, 29 633: Day 8, 10, 12 20 min exposures each	Facial rhytids	Improved skin roughness (Sq, Sa, Sp) Improved St Reduced furrow density Improved skin softness, smoothness, firmness
Sadick NS	Combination – alternate days	Omnilux	830 nm: 55 mW/cm2 (66 J/cm2) 633 nm: 70 mW/cm2 (126 J/cm2)	2-day intervals between 830 nm (20 min) exposure and 633 nm (30 min) exposure	Photoaging skin	Improved fine lines/ wrinkles Improved skin tone, smoothness, clarity, firmness, elasticity

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