
Combined Therapies for Medical / Aesthetic Procedures Using a Hybrid Laser and Pulsed-Light System

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ABSTRACT

Laser and light-based technologies have revolutionized dermatologic treatments, leading to a remarkable expansion of the aesthetic industry in the past decade. Increased clinical experience gained in the field has proven that in many cases, a combination of short wavelength light sources and near-mid infrared lasers can yield results surpassing those of any single treatment with stand-alone modality. In order to meet market demands and create new standards, Msq Ltd has introduced the Lovely II™ – the world's first medical aesthetic platform with both non-ablative and ablative applications. Lovely II incorporates different laser technologies (Nd:YAG, Q-Switched, Er:YAG), UV technologies (targeted phototherapy) and proprietary light energy optimization (LEO) pulsed-light source technologies all in a single platform. The system offers the broadest range of treatment possibilities found in any single platform currently on the market, by housing 9 interchangeable handpieces that provide high-quality treatment for a combination of over 60 clinical indications. Its unique scalable capabilities enable versatility and flexibility for safety concerns, offer therapeutic choices for clinician and patient alike, and reduce expenses without the need to rely on individual and expensive laser or light-based systems. In combination, the Lovely II handpieces provide four therapeutic categories: (i) monotherapy: single handpiece (LEO or laser); (ii) combined therapy: interchangeably and progressively using two or more different handpieces powered by different technologies (LEO AND laser) to treat a given skin irregularities; (iii) Bimodal therapy: interchangeably and progressively using two handpieces powered by the same technology (LEO OR laser) to treat a given skin irregularity; and (iv) light-activated drug therapy: the use of a light-based therapy along with topical agents.

INTRODUCTION

Over the past decade, advancements in laser and pulsed-light technologies have led to the rapid proliferation of minimally invasive procedures for the treatment of a growing variety of medical problems and aesthetic flaws. The keen demand for therapies to eliminate skin problems and abnormalities such as sun spots, unaesthetic blood vessels, wrinkles, acne outbreaks and many others has also led to accelerated growth in the number of procedures offered for each clinical indication.

Light-based therapy is following the same course of evolution as that of most emerging mass-market technologies. In just a few short years, light-based devices have made a dramatic and lasting impact on dermatologic treatments and have caused the significant step-change which has led to the remarkable expansion of the aesthetic industry. As the technology became safer, more effective and consequently more widespread, its increased use was accompanied by a similar increase in the level of anticipated results. Patients and practitioners alike have become accustomed to ongoing improvements in the safety, quality, duration and speed of such procedures and of their results, thus constantly raising the level of expectation and redefining excellence for both practitioners and manufacturers.

This growing demand from patients and their elevated expectation levels, along with the vast knowledge and experience gained by practitioners, have led to the emergence of new treatment modalities that

provide enhanced results. Widely referred to as Combination Therapies, these modalities require a set of single application or multi-application platform devices to achieve synergetic effects that can shorten the required patient participation time and improve results. Since the best cosmetic results normally require more than one technology, there are many benefits to be gained by administering the correct combination of technologies, applications and procedures.

THE HYBRID EVOLUTION

While laser and light-based systems are widely considered to be the gold standard for treatment of many cosmetic imperfections and medical indications, these systems also have their limitations. One of these limitations is the economical factor – i.e., the cost of the system, maintenance and storage space requirements. To address these concerns, equipment manufacturers moved to develop multiple devices within a single enclosure, creating scaleable and upgradeable hybrid systems that could treat multiple indications. The ultimate goal was to end up with a single workstation platform.

The single body workstation gave practitioners access to the equivalent of several standalone systems, and enabled them to begin using a combination of laser and pulsed-light handpieces to treat a single indication with synergetic effects or to provide full treatments by

addressing multiple aspects of a certain indication (e.g., treating acne and acne scars). In addition, many practitioners have discovered the benefits of combining light-based therapy with topical medication to further broaden the spectrum of possibilities and improve the outcome. The results are usually safer, faster, more effective treatments with a reduction in side effects – all leading to a significant boost in patient satisfaction.

The many advantages of combined therapy are unfortunately not yet available to everyone. Some manufacturers continue to produce single application systems that require a practitioner either to own multiple systems or to compromise on the results. Multiple systems require greater financial commitment as well as the space required for the systems and supplies. Therefore, selecting the proper system is extremely important for practitioners who wish to enhance their practice with combined therapy and thus provide a broader range of procedures with superior results to those of monotherapies.

LOVELY II – THE GOLD STANDARD IN COMBINED THERAPY

Based upon our experience in the field of combined therapy, the Lovely II™ is the world's first multi-application non-ablative and ablative system that incorporates laser, UVB and proprietary LEO (Light Energy Optimization) pulsed-light source technologies all on a single platform. The system's unique scalable capabilities enable versatility and flexibility of therapeutic choices for clinician and patient alike, without the need to rely on expensive, single application laser or light-based systems.

Lovely II has the broadest range of treatment possibilities inherent in any single platform currently on the market. Its nine interchangeable handpieces provide high quality treatment for a combination of over 60 clinical indications – far more than any other system. Each handpiece can be added or removed from the system via a simple Plug & Play procedure, with no need for reconfiguration or system downtime.

Lovely II's operation is designed to enable the operator to switch rapidly between applications by seamless integration of the light, UV and laser handpieces, with no system downtime or need for reconfiguration. The system automatically identifies and configures the handpiece in use, eliminating the possibility of human error. Each handpiece has a user friendly, pistol-shaped design and connects to the system console through an umbilical cord containing wiring and cooling water tubes. The pulse widths and repetition rates (pulse per second) are preprogrammed according to the handpiece's intended application.

Fig 1: Lovely II Technology and Handpieces

	Handpiece (wavelength)	Applications
LEO	AC 420-950 nm	Acne
	VL 540-950 nm	Vascular Lesions
	PL 570-950 nm	Pigmented Lesions
	HR 650-950 nm	Hair Removal
UVB	UVB 300-380 nm	Psoriasis & Vitiligo
LASERS	LP 1064nm Nd:YAG Laser	Enlarged and deep leg veins; fine wrinkles
	QSW 1064/532nm Nd:YAG Laser	Dark / light ink tattoos; pigmented lesions
	LP 1320nm Nd:YAG Laser	Wrinkles; acne scars
	Er:YAG 2940nm Laser	Skin resurfacing

LEO=Light energy optimization; UVB=ultra violet B; LP=long pulse; QSW=quality switched; Nd:YAG= Neodidium Yttrium Aluminum Garnett; Er:YAG= Erbium Yttrium Aluminum Garnett; AC=acne clearance; VL=vascular lesion; PL=pigmented lesion; HR=hair removal

PHOTOBIOLOGY AND LIGHT-SKIN INTERACTION

Using a single application system requires excellent diagnostic skills and a broad understanding of photobiology and light-skin interaction. This understanding is important for each of the application handpieces used with the Lovely II system. The graph below depicts Lovely II's spectral wavelengths for each application/handpiece and its endogenous chromophore.

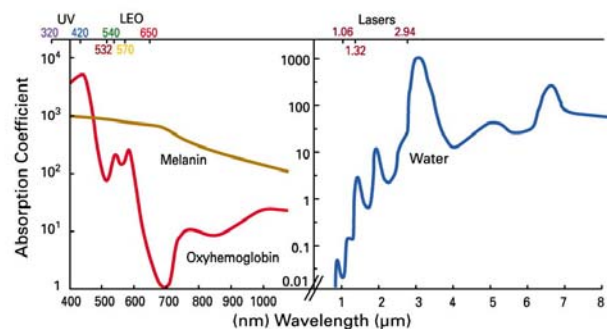


Fig. 2: Absorption Coefficient vs. Handpiece Wavelength

The wide spectrum of Lovely II's visible light (420-950nm) and laser (532, 1064, 1320, 2940nm) handpieces enables treatment of numerous cosmetic conditions. The decision to use a given handpiece must take into consideration that the dermis is structurally, functionally and optically different from the epidermis. The penetration of light or laser energy depends on scattering and absorption by the epidermis and dermis as well as on the light wavelength. Whereas visible light is absorbed mainly by hemoglobin and melanin, longer wavelengths allow for deeper beam penetration of the skin as a result of decreased scattering, where the primary chromophore is water. The wavelength-dependence of dermal light scattering accounts for "blue" skin color induced by non-blue chromophores in the dermis, including hemoglobin (veins), melanin (blue nevi), drug hyperpigmentation (minocycline), and carbon (blue-black tattoos).

Melanin has a wide absorption spectrum, which slowly decreases from ultraviolet to near infrared wavelengths (300-1000nm). Melanin is particularly concentrated in the 10-µm thick basal layer located typically 50-100 µm below the skin surface. However, melanin absorption is also significant in the visible and near infrared wavelengths. Subsequent heat conduction to subjacent dermal collagen has been shown to participate in the remodeling desired for nonablative skin rejuvenation.

Hemoglobin and oxyhemoglobin strongly absorb light in the blue, green and yellow portion of the electromagnetic spectrum (400-600nm). There are relatively broad peaks at 410, 540, 570nm, with smaller peaks at 920-940nm. Due to taking advantage of longer wavelength hemoglobin absorption bands, where tissue penetration is increased and melanin absorption reduced, less heating of the epidermis should occur and more incident light energy is transmitted to dermal blood vessels.

Laser interactions depend on optical properties of the skin, which are dynamic. In the near-mid infrared spectrum, where water absorption is weak and relatively deep penetration is allowed, the epidermis and superficial dermis can be selectively damaged by two basic mechanisms: (1) by treating discrete chromophores in the dermis (melanin, oxyhemoglobin), or (2) at the dermal-epidermal junction by using near infra-red lasers in the 1.06 - 1.32µm range. Conversely, because of the very strong absorption band of water at 2.94 µm, it can be used for precise skin ablation and remodeling.

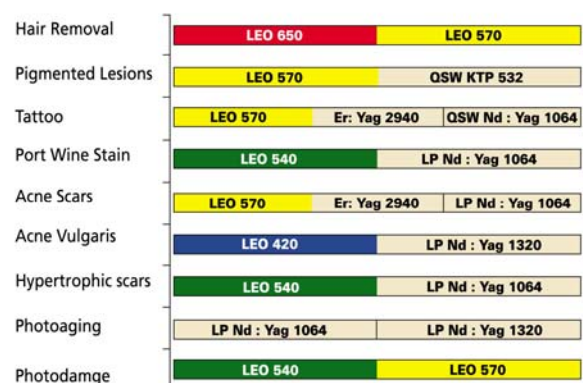
Improvement can be seen in skin conditions resulting from sun damage, such as erythema and telangiectasia, and pigmentary changes can be achieved by targeting natural chromophores, such as epidermal melanin and hemoglobin in blood vessels.

The spectrum of clinical possibilities when using the Lovely II platform can be classified into four major categories:

- **Monotherapy:** the use of a single handpiece (LEO or laser) to treat skin irregularities, e.g., solar lentigo, unwanted hair, telangiectasias, rosacea, black tattoo, mild to moderate inflammatory acne.
- **Combined therapy:** the use of two or more different handpieces powered by different technologies (LEO AND laser) interchangeably and progressively to treat a given skin irregularity (Type I & II photorejuvenation indications).
- **Bimodal therapy:** the use of two handpieces powered by the same technology (LEO OR laser) interchangeably and progressively to treat a given skin irregularity.
- **Light-activated drug therapy:** the use of a light-based therapy (LEO) along with topical agents (e.g. Levulan/Metvix) to treat indications such as actinic keratosis, and (off-label) acne and photo-aged skin (skin rejuvenation).

Fig. 3 shows a partial spectrum of some of the possible combined therapy procedures using more than a single handpiece. While the majority of combined therapy procedures involve dual applications (whether combined or bimodal therapy), in certain cases optimal results can be achieved through the use of three different handpieces, such as in the case of acne scars and traumatic tattoo (i.e., facial reconstruction post-trauma).

Fig. 3: Potential Combined Therapy Procedures



IMPROVED RESULTS

Using the Lovely II system, practitioners around the world have already realized superb results with combined therapy across a broad range of clinical indications, as well as success in treating varying degrees of severity

within each indication. Among the examples of the benefits of combined therapy using Lovely II are the following:

1. **Hair Removal:** LEO handpieces (650-950; 570-950nm)
2. **Skin Rejuvenation + Remodeling:** Lasers (1064nm, 1320nm, 2940nm)
3. **Telangiectasias:** LEO (540nm) + laser (LP Nd:YAG 1064nm)
4. **Acne & Acne scars:** LEO (420nm) + laser (1320nm)
5. **Keloid:** LEO (540-950nm) + laser (LP Nd:YAG 1064nm)
6. **Traumatic Tattoo:** Laser (QSW 1064nm) + LEO (570-950nm)

Combined therapy and the use of different handpieces in various procedures helps refine the quality of the final results. It is advisable to first treat superficial lesions (based on the lesion diagnosis, color, depth and location) using short wavelength handpieces, and afterwards to continue on to deeper epidermal-dermal lesions using near infrared laser. Perhaps the most popular of these procedures today is the combination of nonablative photorejuvenation treatment (pulsed light and laser), now enjoying ever-growing demand.

Demand for this procedure is anticipated to continue to increase as awareness grows among practitioners and patients regarding the predictability and success of treating sun-damaged skin with combined therapy. Using the full potential of the Lovely II, photofacial treatments are no longer confined to skin rejuvenation and wrinkle reduction. Removal of unwanted facial hair, acne and acne scars, pigmented and vascular lesions, and treatment of other cosmetic and aesthetic imperfections can now be easy and effective, resulting in higher patient satisfaction. Figs. 4a-4d show various results achieved through combined therapy using the Lovely II system.

Fig 4a



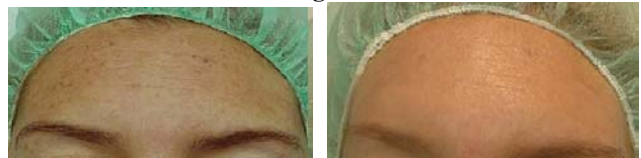
Laser LP Nd:YAG 1064nm + LEO 540nm handpieces

Today, combined therapy modalities and procedures are being researched by numerous equipment providers and

practitioners. Preliminary and ongoing clinical trials show improved outcomes in many cases compared to monotherapy, both in safety and efficacy.

As the full results of these studies become available over the next period, a surge in the popularity of combined therapy is expected, as more practitioners offer combination treatments and consumer demand for such services increases.

Fig 4b



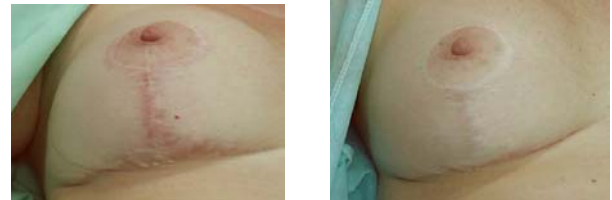
LEO 540 + 570nm handpieces

Fig 4c



LEO 540 + 570nm handpieces

Fig 4d



Laser LP Nd:YAG 1064nm + LEO 540nm handpieces

SUMMARY

Based upon our experience, it is clear that in most cases combined therapy can produce results surpassing any single treatment modality. Combined therapy, whether relying solely on a combination of light-based devices or a synergetic combination of light-based therapy and the use of topical agents, is proving to be effective for an expanding list of clinical indications. Practitioners are urged to gain access to a broad range of light-based devices or to use multi-application platform technology, which will result in overall superior results.

MSQ's Lovely II platform offers the broadest range of laser and light-based technology available on a single platform as well as unique system features that reduce the potential for risks or complications. The system is user-friendly, and its learning curve is short. With the Lovely II platform, many different combined therapy procedures can be easily, safely and effectively made available to patients to ensure superior results.