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

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ABSTRACT

Laser and light-based technology have revolutionized dermatologic treatments and caused a remarkable expansion of the aesthetic industry in the past decade. As more and more clinical experience gained in the field, it has proven that in many cases, combined short wavelengths light source and near-mid infrared lasers can yield results that surpass any single treatment with stand alone modality. In order to challenge market demand and create new standards, Msq Ltd has introduced the Lovely II™ - the world's first medical aesthetic platform with non-ablative and ablative applications. Lovely II incorporates different laser (Nd:YAG, Q-Switched, Er:YAG), UV (targeted phototherapy) and proprietary light energy optimization (LEO) pulsed-light source technologies all in a single platform. The system has the broadest range of treatment possibilities inherent 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 with respect to safety, therapeutic choices for clinician and patient alike, and reduce expenses without the need to rely on individual and expensive laser or light-based systems. Combining Lovely II handpieces provides 4 therapeutic categories: (i) monotherapy (single handpiece - LEO or laser); (ii) 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 irregularities; (iii) Bimodal therapy (The use of two handpieces powered by the same technology (LEO OR laser) interchangeably and progressively 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 penetration of minimally invasive procedures for the treatment of a growing variety of medical and aesthetic imperfections. The insatiable demand for therapies that will eliminate skin abnormalities such as sun spots, unaesthetic blood vessels, wrinkles, acne outbreaks and many other indications has also led to explosive growth in the number of procedures performed for each clinical indication.

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

This growing demand from patients with 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 the 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 manufactures 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 allowed practitioners access to the equivalent of several standalone systems, and to begin using a combination of laser and pulsed-light handpieces to treat a single indication with

synergetic effects or provide full treatments by addressing multiple elements 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 outcome. The results are usually, safer, faster, more effective treatments with reduction in side effects – all leading to a significant boost in patient satisfaction.

The many advantages to be enjoyed from combined therapy are unfortunately not yet available to everyone. Some manufactures continue to produce the single application systems that require the practitioner to either own multiple systems, or compromise on the results. Multiple systems require greater financial commitment as well as the space the systems and supplies consume. 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 vs. monotherapies.

LOVELY II – THE GOLD STANDARD IN COMBINED THERAPY

Through 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 9 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 in a simple Plug & Play procedure, with no need for reconfiguration or system downtime.

Lovely II's operation is designed to enable the operator rapid switching between applications with no system downtime or need for reconfiguration by seamless integration of the light, UV and laser handpieces. The system automatically identifies and configures the handpiece in use, eliminating the possibility of human error. Each handpiece is a user friendly, pistol-shaped design that 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= Neonidium 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

In order to skillfully use a single application system one must assume excellent diagnostic skills and 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 the Lovely II's spectral wavelengths for each application/handpiece and its endogenous chromophore.

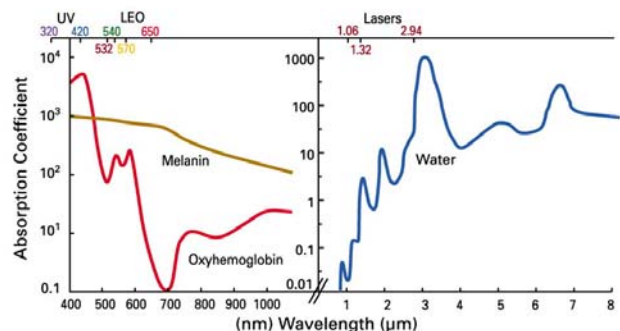


Fig. 2: AbsorptionCoefficient vs Handpieces' Wavelength

The wide spectrum of the Lovely II visible light (420-950nm) and laser (532, 1064, 1320, 2940nm) handpieces allow to treat numerous cosmetic conditions. When considering a given handpiece, one should realize that the dermis is structurally, functionally and optically different from epidermis. The penetration of light or laser energy depends on scattering and absorption by the epidermis and dermis as well as the light wavelength. Whereas visible light is absorbed mainly by hemoglobin and melanin, longer wavelengths allow for deeper beam penetration in 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 nonblue chromophores in dermis such as 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 desired remodeling for nonablative skin rejuvenation.

Hemoglobin and oxyhemoglobin strongly absorbs 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. By 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: by treating discrete chromophore in the dermis (melanin, oxyhemoglobin) or at the dermal-epidermal junction by using near infra-red lasers in the range of 1.06 -1.32µm. Conversely, because of the very strong absorption band of water at 2.94 µm, it can be used for precise skin ablation and remodeling.

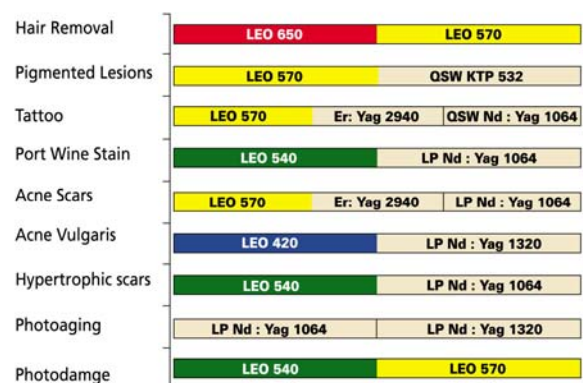
Improvement is in skin conditions resulting from sun damage, such as erythema, telangiectasia, and pigmentary changes can be achieved by targeting natural chromophores such as epidermal melanin and hemoglobin in blood vessels.

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 irregularity. 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 photoaged skin (skin rejuvenation).

Fig. 3 shows a partial spectrum of just 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 3 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 exhibited superb results in 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 for the

benefits of combined therapy using the Lovely II are the following cases:

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 treat initially (based on the lesion diagnosis, color, depth and location) superficial (short wavelength handpieces) lesions and continue to deeper epidermal-dermal lesions (near infrared laser). Perhaps the most popular of these procedures today is the combination of nonablative photorejuvenation treatment (pulsed light and laser), which is enjoying ever-growing demand.

The procedure is anticipated to continue to increase in demand as awareness grows among practitioners and patients as to the predictability and success of treating sun damaged skin with combined therapy. Using the full potential of the Lovely II, photofacials are no longer confined to skin rejuvenation and wrinkle reduction. Removal of unwanted facial hair, acne and acne scars, pigmented and vascular lesions and other cosmetic and aesthetic imperfections can now be treated easily and effectively, resulting in higher patient satisfaction. Fig. 4a-4d show various results achieved through combined therapy with 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 vs. 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 through more practitioners offering combination treatments and consumer demand for such services.

Fig 4b



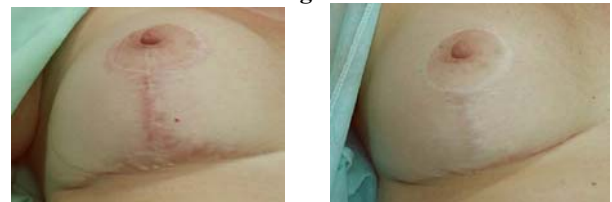
LEO 540 + 570nm handpieces

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 combined therapy can produce results that surpass any single treatment modality in most cases. 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 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 and unique system features that reduce the potential for risks or complications. The system is user's friendly and learning curve is short lasting. Using the Lovely II platform, many different combined therapy procedures are easily, safely and effectively made available to patients to ensure superior results.