



IPL and LLLT technologies compared in the dry eye treatment

IPL

HOW IT WORKS FOR MGD

- Intense pulsed light (IPL) is a relatively novel treatment for DED due to MGD. The technique has been used in dermatology for over a decade for the treatment of rosacea, acne and skin lesions like benign cavernous hemangioma and telangiectasia.^{1,2} The technique uses a polychromatic light with a wavelength spectrum of 500–1200 nm which is directed to the skin and absorbed by chromophores such as melanin, hemoglobin and water with the development of heat, thus inducing blood vessels ablation.¹ Toyos and co-workers reported for the first time the concurrent improvement in DED symptoms in patients undergoing IPL to treat skin rosacea.³
- The potential role of IPL in the ophthalmology field dates back to 2002, when Toyos and colleagues registered ocular symptoms improvements in patients treated with IPL for facial skin rosacea.³ Further objective examination then confirmed its positive effects on MGD and DED.³
- The beneficial effect of IPL on vascular disorders has been extensively studied and reported.² Light energy absorbed by chromophores such as melanin, hemoglobin and water is transformed into heat causing the localized thrombosis and destruction of superficial blood vessels, thus removing a major source of inflammation from the eyelids and meibomian glands.⁴

IPL TECHNOLOGY RISKS / HANDICAPS

❑ *Treats only 50% of the pathology: only lower eyelids*

IPL flashes are placed for each eye **below the lower eyelid**, with slight overlapping applications - therefore, only indirect treatment. **The upper eyelids are not treated** since there is a risk of light penetration through the eyelid and absorption within the intraocular structures such as the pigmented iris tissue.⁵ On the other hand, if choosing to treat upper eyelids with IPL it is necessary to place a stainless steel plate with local anaesthesia. The operator must make sure that cornea, iris and sclera are not directly exposed to IPL fluence.

Several studies documented **the ocular complications** related to this procedure, which ranged from anterior uveitis to permanent iris atrophy and pupillary defects with long-lasting photophobia and pain.^{6,7,8}

Apart from the ocular complications secondary to the incorrect use of IPL, the procedure has been associated with minor and transient side effects such as pain, erythema, hypo- or hyperpigmentation, blistering and superficial crusts.

❑ *Many treatments are requested, at least 3 up to 5/6 for a partial solution:*

Most of IPL treatment protocols include 3 to 4 sessions, but the number of IPL sessions may vary depending on disease severity, patient characteristics and subjective satisfaction.

❑ *Very low certainty results from traditional IPL studies.*

In a recent article (March 2020) published by Cochrane Library, several studies published between 2015 - 2019 were evaluated on IPLs (New Zealand, China, Japan) and conclusions were “this systematic review finds a scarcity of evidence relating to the effectiveness and safety of IPL as a treatment for MGD.”¹⁷

WHY BETTER THAN TRADITIONAL IPL

- ❑ OPE® devices allow the regulation of wavelengths, pulse duration, pulse intervals and fluence, thus facilitating the treatment of a wide spectrum of conditions in different patients using **a tailored approach**.
- ❑ A **highly intuitive software** allows the operator to work at best and safely since the very first treatment, with automatic power adjustment and duration of each light impulse
- ❑ The interaction of OPE® technology with tissue is essentially thermal, and thanks to the embedded management software, it allows **to optimize heat emission**, stimulating the meibomian glands to resume normal functionality
- ❑ **No gel needed** : no risk to burn the treated skin thanks to the proprietary Patented cooling system
- ❑ Thermal spot stimulates the neurotransmitters which leads the meibomian glands to increase the lipid flow
- ❑ Thanks to spot dimensions (12 cm²) the periorbital area is **completely and deeply treated**

WHY OPE® TECHNOLOGY IS BETTER THAN PULSED LIGHT TECHNOLOGY IPL ?

« It's a technology in which wavelengths and energy of the emitted light are exploited at 100% in respect of the metabolism of cells exposed to it. The absence of contact surfaces has raised considerably the safety margins for the Patient. »

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LLLT® / LIGHT MODULATION®

HOW IT WORKS FOR MGD

- ❑ Photomodulation consists in using light sources at different wavelengths to stimulate specific biological patterns in order to achieve a therapeutic effect. LLLT® produces a photochemical cascade, inducing changes in components along the mitochondrial respiratory chain, leading to faster electron transfer and, hence, to an increase in **adenosine triphosphate production (ATP)**.⁹⁻¹⁰
- ❑ The ability of LLLT® to activate fibroblasts and enhance collagen synthesis is the basis for the efficacy of skin rejuvenation treatments.¹¹ At the eyelid skin level, this effect could contrast the natural tendency of the skin to lose rigidity and elasticity with aging, a process that could lead to poor apposition of the lid margins and incomplete blinks, resulting in reduced meibum secretion and increased tear evaporation.
- ❑ **Antimicrobial Effect**
Another potential mechanism of action of LLLT® is the reduction of bacteria and parasitic growth on the eyelids and eyelashes. *Demodex folliculorum*, an ectoparasite living in hair follicles and sebaceous glands, retains a commensal relationship with *Bacillus olerinus* and together they play a role in the etiology of blepharitis and MGD.¹²
- ❑ **Anti-Inflammatory Effect**
Inflammation plays a key role both in the pathogenesis and in the progression of DED as confirmed by the elevated levels of cytokines, matrix metalloproteinases and chemokines found in the tears of patients with DED compared to healthy controls.¹³⁻¹⁴⁻¹⁸
- ❑ **Anti-Oxidative Effect**
Above the several factors contributing to the pathogenesis of DED, it is important to cite the role of reactive oxidative species such as superoxide anions and hydroxyl radicals released by neutrophils and inflammatory cells.¹⁵ The effect of LLLT® on oxidative stress follows a biphasic dose response: at low doses, it produces an increase in reactive oxidative species together with an antimicrobial effect, whereas at higher doses it shows the reduction of reactive oxidative species levels, thus diminishing oxidative stress and inflammation.¹⁶ Mitochondria play a key role with cytochrome C oxidase complex being proposed as the primary photoreceptor, yielding an increase in adenosine triphosphate production and the induction of transcription factors. Together, these effects lead to cellular stimulation and cytokines modulation.¹⁰

LLLT[®]/LIGHT MODULATION[®]

HOW TO OPTIMIZE MGD TREATMENT

The most important worldwide spokesman of IPL technology for dry eye disease, **Rolando Toyos MD**, writes scientific papers and states during International Congresses the importance of Low Level Light Therapy (LLLT), proposing this technology as a fundamental evolution for Meibomian Gland Dysfunction treatment.

OphthalmologyTimes > Ophthalmology > Drug Therapy - Ophthalmology

Red light technology increases tear break-up time in dry eye patients

More than 90% of subjects report improvement in symptoms in study

November 15, 2015

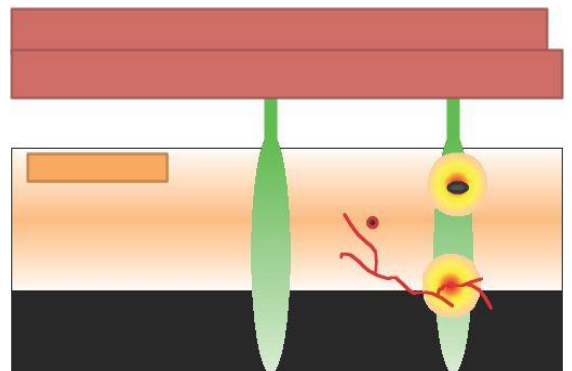
By Lynda Charters, Rolando Toyos MD

Ophthalmology Times
CUTTING-EDGE ADVANCEMENTS

Take-home message: Treatment with red light technology resulted in a significant improvement in the tear break-up time in the vast majority of patients. This may be a future light treatment for the improvement of dry eye disease in patients with meibomian gland dysfunction.

Low level light therapy using visible light emitted by LEDs (discovered by NASA), is used also in facial rejuvenation, according to Dr. Toyos. When applied to skin, this therapy increases fibroblast activity by raising the cellular adenosine triphosphate (ATP), which enhances elastin and collagen production, he explained.


Chronic dry eye symptoms include inflammation of the eyelid margins and inspissation of the Meibomian glands. These observations raised the question whether light therapy can be used to treat Meibomian gland dysfunction. The investigators theorized that this therapy applied close to the eyelid should result in increased cellular ATP activity in the cells of the Meibomian gland, including improving the Meibomian gland function.



LLLT[®]/LIGHT MODULATION[®]

HOW TO OPTIMIZE MGD TREATMENT

Worldwide opinion leaders in Ophthalmic Surgery are using our proprietary LLLT[®] / Light Modulation[®] technology like **Dr. Karl Stonecipher (USA), Prof. Rohit Shetty (INDIA), Prof. Jorge Alio (SPAIN), Dr. Lucio Buratto (ITALY)** and others.

 Open Access Full Text Article

ORIGINAL RESEARCH

Combined low level light therapy and intense pulsed light therapy for the treatment of meibomian gland dysfunction

This article was published in the following Dove Press journal:
Clinical Ophthalmology

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Purpose: To evaluate the effects of combined intense pulsed light therapy (IPL) and low-level light therapy (LLLT) on clinical measures of dry eye related to severe meibomian gland disease (MGD) in subjects unresponsive to previous medical management.

Patients and Methods: This was a retrospective chart review of patients treated by 4 physicians at 3 centers. All patients were documented treatment failures with traditional pharmaceutical therapy. They all had their MGD evaluated before treatment using a grading scale (0–4), tear breakup time in seconds and the Ocular Surface Disease Index (OSDI) questionnaire. To be included, all patients had to have had a short course of adjunct pharmaceutical or device-related therapy, along with a combined IPL/LLLT treatment. As well, a second MGD evaluation with the same three measures had to have been conducted 1–3 months post treatment.

Results: A total of 460 eyes of 230 patients were identified for inclusion in the data set. Mean OSDI scores were significantly lower after treatment; 70.4% of patients had pretreatment OSDI scores indicative of dry eye; this dropped to 29.1% of patients after treatment. A 1-step or greater reduction in MGD grading was observed in 70% of eyes, with 28% of eyes having a 2-step or greater reduction. Tear breakup time was ≤6 seconds in 86.7% of eyes pretreatment, dropping to 33.9% of eyes after treatment. There were no ocular or facial adverse events or side effects related to the combined light treatment.

Conclusion: The use of combined IPL/LLLT for the treatment of severe MGD appears to be beneficial in patients who have failed topical and/or systemic therapy.

Keywords: LLLT, low level light therapy, IPL, intense pulsed light, meibomian gland dysfunction, ocular surface disease index

LLLT[®]/LIGHT MODULATION[®] TO TREAT MGD AND OTHER OCULAR SURFACE PATHOLOGIES

Using **only** the LIGHT MODULATION[®] / LLLT[®] technology it is possible to treat and **resolve** MGD from level 1 to level 4 of the PULT MEIBOSCALE but also to treat other pathologies of the eye surface.

- **Low-Level Light Therapy in the Treatment of Meibomian Gland Dysfunction** - Heiko Pult - ARVO Annual Meeting Abstract, June 2020
- **Messung der Hauttemperatur nach Intense Pulse Light (IPL)-Anwendung sowie Low-Level-Light-Therapie (LLLT)** - Heiko Pult - die KONTAKTLINSE 4/2020
- **Low Level Light therapy for the treatment of recalcitrant chalazia : a sample case summary** - Karl Stonecipher - Clinical Ophthalmology 2019:13 1727-1733
- **Eye surgery and dry eye** - Lucio Buratto - EyeDoctor, July/August 2019
- **Dry eye in patient with clinical history of chronic blepharitis and chalaziosis** - Lucio Buratto - EyeDoctor, March/April 2018

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