Intense Pulsed Light (IPL) from Dermatology to Ophthalmology

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Abstract

Intense pulsed light (IPL) therapy emits light that is converted to heat-inducing ablation applied to vascular structures. This process of photothermolysis selectively destroys blood vessels and has been used for the destruction of telangiectasias. Other mechanisms of action include mild local warming that has been used to decrease inflammation.

IPL emits pulsed light at a 500 – 1200 nm wavelength. Longer wavelengths (1000 nm) penetrate more deeply and can be used for telangiectasias situated deeper in the dermis and large vessels. Lower cut off filters (500 to 600 nm) effectively treat smaller calibre vessels but interact more readily with epidermal and dermal melanin. The micro pulses allow the epidermis cells and smaller vessels to cool down between pulses. At the same time, the heat is retained in the larger vessels, resulting in selective thermal damage.

IPL is used to treat facial skin damage, including wrinkles, coarseness, laxity, and dyspigmentation because it increases collagen synthesis. IPL is used in rosacea because it ablates the abnormal vessels (erythema and telangiectasia) and improves the dermal connective tissue disorganization and elastosis by collagen remodelling.

Over the past 20 years, there has been rapid development and proliferation of the technology, with application in multiple fields of medicine, mainly for Dermatology. The first IPL device obtained regulatory approval from the Food and Drug Administration (FDA) in the USA in 1995 for treating lower extremity telangiectasias. These devices were first developed to treat benign vascular lesions. In 1997, Raulin et al successfully treated patients with telangiectasias of the face and legs and published cases of permanent hair removal supporting the efficacy and safety of this technique. Since then, the systems have proliferated thanks to their low cost and versatility in various conditions. Several studies also show the effectiveness of the IPL in treating symptoms associated with skin ageing, and hyperpigmentation, getting the remodelling of the dermis.
In 2003, Mark et al published data that supported the use of IPL to reduce the blood flow and resolve telangiectasia and erythema associated with rosacea. Many studies have pointed to the efficacy and applicability of IPL, confirming similar or superior efficacy compared to laser systems versatility (they act on different chromophores, as melanin, and haemoglobin), safety, and reasonable costs. Current IPL devices have calibration systems, integrated cooling, and tuning resulting versatile. IPL devices are very popular in many medical offices.

Rosacea

Ocular rosacea is estimated to occur in up to three-quarters of patients with rosacea. It frequently produces a foreign-body sensation, dryness, burning, itching, redness, photophobia, tearing, and blurred vision. There are many treatment options for rosacea, including IPL. IPL benefits rosacea, improving the dysfunction of the meibomian glands, clearing telangiectasia, and reducing erythema. IPL emits polychromatic light in millisecond pulse duration for delivering selective energy to target blood vessels, which is essential for rosacea treatment. In addition, a local increase in the temperature during the treatment affects the blood flow in the treated area and improves metabolism. As a result, residues of tissue catabolism products are reduced, which may also indirectly influence the reduction of oedema or bags under the eyes.

Dry Eye

IPL is being used to treat dry eye disease (DED) related to meibomian gland dysfunction (MGD), one of the options. MGD is the leading cause of evaporative dry eye, and when DED and MGD occur as comorbidities increase disease severity and have a significant adverse impact on patients’ life quality. In 2009, Toyos treated patients with rosacea with IPL, improving their dry eye symptoms. This discovery has led to the commercial development and promotion of IPL devices that are specific for dry eye treatment. Currently, the two main devices are the M22 Optima device (Lumenis Ltd, US) and the E>Eye device (E-Swin, France). The mechanisms of IPL in DED can be related to 1) improving the inflammatory state of the ocular surface and the meibomian glands, 2) neurotrophic effect, improving the state of the cornea by acting on the parasympathetic nerve fibers, 3) thrombotic effect on the micro vascularization of the eyelids, reducing the presence of telangiectasia, 4) photomodulatory effect based on fibroblasts regeneration and collagen synthesis and 5) antimicrobial effect by acting directly on Demodex or indirectly as a vector on bacterial proliferation especially Bacillus Olerinus.

For the treatment of MGD, IPL is applied to multiple locations (typically six) across the face, under the inferior eyelids, nasally and temporally. Typically, three or four IPL sessions are applied over approximately three to four months. The results are promising, decreasing DED symptomatology and clinical signs by approximately 90%. Nevertheless, evidence is scarce for few clinical trials. IPL is safe and does not damage eye structures; the biggest concern is the local effect on the skin.

In conclusion, IPL therapy is clinically effective and safe with great results as a non-invasive technique. Today, IPL is one of the new treatments for dry eye disease and meibomian gland dysfunction, showing great results. We believe that the research will continue to advance to clarify the mechanism of action of IPL better and help us improve the technology adapting it to its use in Dermatology and Ophthalmology. We will improve the results, surely combining it with other therapies such as artificial tears, anti-inflammatories, eyelid massage or even new technologies such as Radiofrequency.

Conflict of interest Disclosures

C. Vergés is a consultant to MDS. The authors have no other relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict.

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