pISSN 0898-5901 | eISSN 1884-7269
Indexed in Scopus

Volume 29 - N. 3 - December 2022

Fractional treatment of rosacea by LBO 532 nm laser with "one shot" procedure: A preliminary study

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ABSTRACT

Rosacea is a chronic skin disease prevalently affecting the center of the face. The permanent erythema of skin face represents its typical sign. Further common features are face flushing, telangiectasias, and inflammatory presence of oedema, papules and pustules. The aim of this study was to investigate the use of LBO 532nm laser in the treatment of this disease. Ten subjects of both sex and middle age affected by rosacea in erithemato/teleangectatic stage were treated by a LBO 532nm laser single session. Discomfort evaluation during and after the treatment, one session results as well as incidence of the side effects were evaluated, with 6 months follow up. Positive results were obtained after only one session in total safety with minimal patients discomfort and without undesired effects during treatment. The study confirmed International literature data suggesting the use of laser and light devices as elective treatment of this disease. IPL, dye lasers and 532nm laser are the devices more used and the last seems to represent the gold standard for 1,2,3 phototypes. This clinical trial, with the limitations due to the small number of patients, indicated that "one session LBO 532nm laser treatment" represents an interesting and innovative approach in the therapy of the erythemato/telangectatic rosacea.

Key words: Rosacea; erythema; telangiectasias; LBO 532nm laser; vascular laser.

Running Head:
LBO 532nm laser and rosacea
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Introduction

Rosacea is a chronic skin disease prevalently affecting the center of the face (cheeks, chin, nose, and forehead) and the eyes.[1]

Its progress remains usually sub-acute, with good defined diagnostic signs, such flushing, persistent erythema, inflammatory papules/pustules, and telangiectasia.[2]

Epidemiologically, about 10% of the world people is affected, mainly in women of middle age and white skin, phototype 1-2-3. Rarely it involves the phototypes 4-5-6, where the prevalence is given by the types nodular and granulomatous.[3]

There are four different morphological types of rosacea: erithemato-telangectatic, papule-pustolar, phymatous and ocular[4] but in all the forms the characteristic sign is the persistent erythema of the face. Crisis of flashing are common (intermittent vasodilatation, acute-subacute).[5]

Rosacea can lead to embarrassment, low self-esteem, anxiety, depression, and stigmatization. Furthermore, it has an adverse impact on quality of life, social and psychological well-being.[6]

Recent studies have reported possible associations of rosacea with increased risk of cardiovascular, gastrointestinal, neurological, auto-immune, and psychiatric disorders along with an increased risk of cancer.[7]

Many authors think today that the causes of the rosacea are an abnormal congenital inflammation, micro-vasculopathies and infective/allergic factors, as the colonization by acari Demodex. Further causes could be genic predisposition and exogen factors.[8]

Current inflammatory pathways relevant to rosacea pathogenesis include dysregulation of immune (innate, adaptive, inflammasome) and neurocutaneous mechanisms.[9] Genetic susceptibility with modified immune reactivity is suggested by the association of rosacea with single nucleotide polymorphisms in genes associated with the major histocompatibility complex.[10]

Approved treatments for erythema include topical brimonidine and oxymetazoline; and for papules/pustules topical ivermectin, metronidazole, azelaic acid, and oral doxycycline 40 mg modified release. Laser and light-based therapies can be used for telangiectasia, erythema, and phyma, this often requiring also surgical correction.[11]

Moreover, it has been suggested to avoid high temperature, smog and long exposition at laptop monitor.[12]

Many laser and light devices were proposed in these last years: Q-swirched and long pulse Nd:YAG 1064nm laser,[13] 595 nm Pulsed Dye Laser (PDL),[14] intense Pulse Light (IPL) for the erythrosis treatment only[15,16] and KTP 532nm laser for the combined treatment of erythrosis and small telangiectasias.[17]

KTP laser, is a solid active medium laser emitting in the visible portion of the spectrum (its beam is an intense green light) produced by a special procedure.

At the beginning, a diode laser (810 nm) "pumps" energy to stimulate a crystal of Nd:YAG emitting a IR beam (1064 nm).

Subsequently a crystal of Potassium-Titanil-Phosphate (KTiOPo4) situated between the active medium and the semi reflective mirror in the Fabry-Perot chamber doubles the vibration frequency of the photons and so halving their wavelength and thus emitting the green ray of 532 nm.[18]

KTP laser has been introduced in medical field thanks to its great affinity for hemoglobin and oxy-hemoglobin, becoming very effective in vascular tissues.[19] Moreover, in contrast to Nd:YAG laser, in the red oral tissues it is absorbed at superficial tissue level avoiding deep tissue penetration, determining a very safe laser.[20]

One of the first uses of KTP in medical field was in Neurosurgery operations.[21] At the moment it is widely used in the vaporization of prostatic tumors[22,23] and in otolaryngological surgery of the larynx and epiglottis therapy of papillomatosis. tonsillectomies, nasopharynx tumors and ear-nose small bones operations.[24,25]

Even if it has also introduced to the large intestine surgery,[26] however its main use remains vascular surgery and treatment of superficial vascular surgery of the skin, thanks to its affinity for hemoglobin.[27]

Recently, a new type of 532nm laser with the replacement of KTP by a LBO (Lithium triborate LiB3O5) crystal was marketed, with the result of lasing time reduction and clinical outcomes improving without modifying the safety degree of patient[28] and several ex-vivo and in-vivo studies have demonstrated the higher efficiency of LBO 532nm laser when compared to KTP 532nm laser.[29,30]

The aim of this study was to investigate the effectiveness of LBO 532nm laser utilization in the treatment of Rosacea with one only session.

Material and Methods

Ten patients were enrolled in this study, seven women and three men, with age ranging from 35 to 65 years old and Fitzpatrick's phototype I - III.

All patients were tested with Wood lamp and Polarized lamp 10x to check the eventual presence of melanin deposits and to verify the microvascular distribution. This preliminary analysis was very important to establish the proper dosage of the laser energy.
Each of the patients presented face erythrosis and microvascular ectasia.
Inclusion criteria were: full medical therapy stopped from six months at least, previous laser therapy stopped from six months at least, no pregnancy and puerperium, negative clinic history regarding hypertrophic scars and keloids and other connective tissue diseases, photosensitizer drugs stopped from six month at least.
Laser LBO 532nm (LASEmaR® 500, EUFOTON®, Trieste, Italy) was used in one only session for the treatment of all the patients involved in the study.
Digital pictures of each patient were taken before and after the treatment: full pictures were performed with Canon Digital camera in 5 positions; in front, side right and left, perspective view right and left, background neutral.
Each patient signed the informed consent, and was clinically examined before the treatment.
They were utilized both a transdermic tool with variable spot caliber, from 0,5 to 2,0 mm (zoom) for single ectasia micro-vessels and a fractional scanner tool (Lightscan™) for the extended vascular tissue. The parameters were as follow: for the transdermic zoom, handpiece spot ranging from 0.5 mm to 1mm, depending by the deeply of the micro-vessel, 2,5 W power, T on 25 msec, T off 150 msec, 1 pulse; for the scanner fractional handpiece density Lightscan™, spot pixel 300 µm, 2 W power in CW, density 40%, spot area from 14x14 to16x16 mm, Teime Pixel from 20 to 25 msec.
In the erythrosis with much telangiectasias scanner was firstly used, followed by the photocoagulation of residual micro-vessels.
Use of cryogen agents and steroid drugs, both topically and systemically, was avoided during and after the treatment and skin protection from the sun as well as medical skin care at home were suggested.

Results

The results on the patients were evaluated by the morphologic observation of the skin and also by using VAS (Visual Analog Scale) and PSS (Patient Satisfaction Scores), to analyze discomfort, ductility and procedure compliance.
A lidocaine 4% anesthetic cream (Asensil, Logofarma spa, Milano, Italy) was only used one hour before the treatment and majority of the patients didn't report any kind of pain during the procedure, only two of them referring to feel low pain. No relevant side effects were appreciated and only in two cases some crusts and little blisters, appeared in the site of the lesions after the intervention, disappeared 2 weeks after with total recovery, also stimulated by re-epithelializing cream.
It was noticed the complete absence of pigmentated lesion in the follow-up.
Seven patients (70%) reported excellent results, two patients (20%) good results while one (10%) was not satisfied of the treatment.
Follow up was positive 1 month after, 3 months after and 6 months after the treatment (Figure 1 to 5).
One only patient didn't show up at the last control.

Discussion

Laser and light-based therapies are currently state-of-the-art for the treatment of telangiectatic erythema, with a variety of devices targeting hemoglobin reported to be effective.[31]
The major chromophore in blood vessels is oxyhemoglobin: light and laser energy, after be absorbed by it, is converted to thermal energy which diffuses in the

Figure 1. Female 45y, single treatment with LBO 532nm fractional scanner and single beam laser for nose telangiectasias and rosacea. Pre and post 6 months.

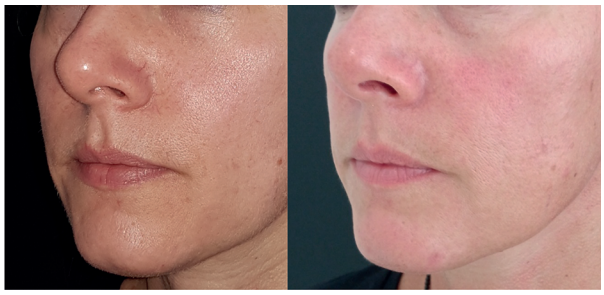

Figure 2. Close up: female 45y, single treatment with LBO 532nm fractional scanner and single beam laser for nose telangiectasias and rosacea. Pre and post 6 months.

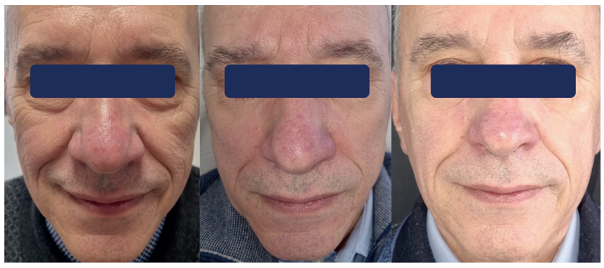

Figure 3. Male 60y, single treatment with LBO 532nm fractional scanner in single step. Pre, after 90 days and after 6 months.

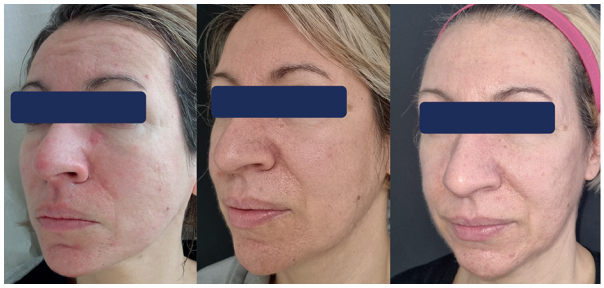

Figure 4. Female 50y, single treatment with LBO 532nm fractional scanner in single step. Pre, after 90 days and after 6 months.

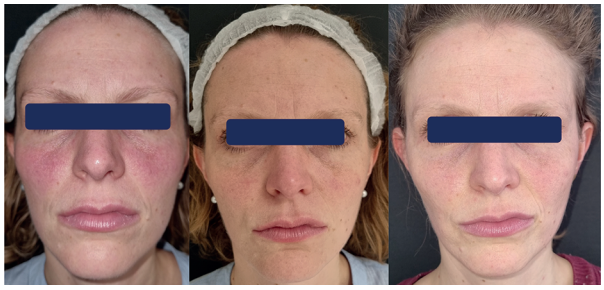

Figure 5. Female 35y, single treatment with LBO 532nm fractional scanner in single step. Pre, after 90 days and after 6 months.

blood vessel, so causing photocoagulation, mechanical injury, and finally thrombosis and occlusion.[32]

595nm Pulsed Dye Laser (PDL) have circular or oval spot sizes that are ideal for the treatment of dermal vessels; their main disadvantage is the development of post-treatment purpura, a rash of purple spots on the skin caused by internal bleeding from small blood vessels.[32]

Unlike lasers that use selective photothermolysis, Intense Pulsed Light (IPL) devices emit non-coherent light at a wavelength ranging from 500 to 1200nm.

Cut-off filters allow for selective tissue damage depending on the absorption spectra of the tissue. Longer wavelengths are effective for the treatment of deeper vessels, whereas shorter wavelengths target more superficial vessels. However, because the shorter wavelengths can interact with melanin, their use should be avoided in dark skin types.[33]

The use of KTP 532nm laser is limited to light skin types due to its high melanin absorption, which can lead to epidermal damage with post-inflammatory hyper-pigmentation. Based on its short wavelength, the KTP laser is best used to treat superficial telangiectasias.[34]

Previous studies have shown that 1064nm Nd:YAG lasers used at longer pulse widths can be used to treat vascular lesions. Nd:YAG lasers can penetrate deeply and enable treatment of deeper vessels. Because of lower melanin absorption with Nd:YAG lasers, there is less concern for epidermal damage, and they may be more safely used to treat patients with darker skin. Compared to other lasers, the risk for post-inflammatory hyper-pigmentation is very low.[35]

However, although stationary (single-pass) Nd:YAG laser treatment can cause side effects such as pain, burns and vesiculation, a multi-pass ("in motion") technique can limit such side effects and ensure homogeneity of treatment. Use of this this method enables gradual increase of temperature, monitoring of skin reactions, and discontinuation or modification of treatment at any time, thus minimizing the typical side effects associated with the traditional method.[36]

In this study it was decided to use a new laser, Lithium Triborate Laser (LBO), which utilizes a diode pumped Nd:YAG laser light emitted through an LBO instead of a KTP crystal, so resulting in a higher-powered 532 nm wavelength green light laser while still using the same 70-degree deflecting, side firing, silica fiber delivery system. LBOO 532nm laser offered an 88% more collimated beam and smaller spot size, resulting in much

higher irradiance or power density with a beam divergence of 8 versus 15 degrees. The primary aim for this upgrade was to reduce lasing time and improve clinical outcomes while demonstrating the same degree of safety for patients.[28]
These characteristics allowed to treat rosacea in one single session, with good results both by a clinical point of view and low patients discomfort.
Absence of side effects and complication also at 6 months follow-up confirmed the good effectiveness of this new laser device.

Conclusions

Even if with the limitations due to the low number of patients involved in this clinical trial, "LBO 532nm laser one session" may be considered an interesting and innovative approach for the treatment of erythemato/telangectasic rosacea.
Further studies with a larger number of patients will have to confirm the results of this preliminary work.

Acknowledgments: Authors thank Dr. Francesco Marangoni, CEO of Eufoton, for his availability in the study.

Conflict of interest: The Authors declare no conflict of interest.

Availability of data and materials: All data generated or analyzed during this study are included in this published article.

Ethics approval and consent to participate: The study is conformed with the Helsinki Declaration of 1964, as revised in 2013, concerning human and animal rights. All patients participating in this study signed a written informed consent form for participating in this study.

Informed consent: Written informed consent was obtained from a legally authorized representative(s) for anonymized patient information to be published in this article.

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