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# The use of NDYAG laser combined with pulsed light in the treatment of rosacea

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ABSTRACT

Rosacea is a chronic inflammatory skin disease with a complex pathogenesis that mainly affects the central part of the face, with a global incidence of 5.46%. The present study was performed on a group of 68 patients with rosacea 1 and 2 subtypes, patients between 34-63 years old. The treatments were performed using a Cutera Xeo laser, using 2 types of probes: NdYag 1064nm for telangiectasias and LimeLight 520-1100nm for diffuse facial erythema, papules, and pustules, having an 10x30mm window. For patients with diffuse facial erythema, etc., the optimal number of sessions was between 3 and 6 with or without anesthetic cream, using energies between 14-19J / cm. The average recovery time was 5 days. Registered effects included bruises, pustules, burning sensation, transient stinging, and hypopigmentation. For patients with telangiectasia, the optimal number of sessions was two, performed at an average interval of once per month/ monthly.

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## Introduction

Rosacea is a chronic inflammatory disease of the skin with a complex pathogenesis that mainly affects the central part of the face [1]. The term "rosacea" was introduced in the 19th century by Thomas Bateman [2]. The disease affects both sexes and can be found at any age, but frequently, the debut of the disease occurs after the age of 30 years.

In women, there was an increased incidence of erythematotelangiectatic and papulopustular rosacea, in which the debut was recorded after the age of 40 [3]. The incidence of the disease according to the latest reported statistical data is between 0.09 and 22.41%, with an average of 5.46% amongst world populations [4;5], reaching up to 10% among the Caucasian population [6]. The disease is also more common for Fitzpatrick III and IV phototypes, and lower for V and VI phototypes [6]. From a clinical point of view, the disease is manifested by facial erythema (transient or persistent), telangiectasia, edema, papules and pustules, burning sensation, stinging, pain or itching; patients may show one or more signs and symptoms [7]. There are also cases in which patients are completely asymptomatic, the disease having only facial skin signs [8]. The disease has a sinusoidal evolution, with periods of remission and exacerbation. It is important to emphasize the role of Demodex Folliculorum in the appearance of Rosacea, because its number is increased in confirmed patients compared to patients without rosacea, questioning whether its multiplication directly or indirectly produces rosacea, or alternatively whether rosacea is favorable ground for its multiplication. Studies show that Demodex Folliculorum can be present and multiplied without producing rosacea, only spinulosis, including areas other than the central facial area. Sometimes its presence and associated endosymbiont bacteria, described in the literature, can produce rosacea or demodeciosis with inflammatory elements, objectified through spectrometric bacteriological methods, imagistic- ex: VISIA dermoscopy [9-12].

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Rosacea was classified into 4 main subtypes: erythemothelothelectectic (subtype 1), papulopustular (subtype 2), phytomatous (subtype 3), and ocular (subtype 4), granulomatous rosacea being considered a variant/type of rosacea rather than a subtype. Since 2017, the classification of rosacea is based on phenotypes and for the diagnosis of rosacea, at least one diagnosis or two major phenotypes are required [6].

*The diagnostic phenotypes for rosacea are:*

- Persistent erythema of the central face area that worsens with some triggers
- Phytomatic changes (most commonly rhinophyma)

*The major phenotypes for rosacea are:*

- Transient facial erythema of the central face
- Inflammatory papules and pustules
- Telangiectasias
- Ocular changes: blepharitis, keratitis, conjunctivitis, ocular telangiectasias

*Minor phenotypes for rosacea are:*

- Burning sensation
- Stings
- Edema
- Dryness [13].

Also, a particular type of rosacea is the secondary one, induced by the prolonged use of cutaneous dermatocorticoids or calcineurin inhibitors [14-17].

## Materials and Methods

The present study is based on 68 patients, with the age between 34-63 years with a prevalence of women (76%). The inclusion criteria were: patients with rosacea subtypes 1 and 2. Exclusion criteria were: patients with rosacea subtypes 3 and 4.

The treatments were performed with the Cutera Xeo laser, using 2 probes: NdYag 1064 nm and LimeLight 520-1100 nm, with a 10x30 mm window. The protocol used in the study was:

- for telangiectasia (cuperosic stage of the disease), NdYag treatment was applied, 1 session every 1-2 months. The working parameters were: 3 mm spot, time 15-25 ms, energy 110-130 J / cm2.
- for diffuse facial erythema, papules, and pustules, the LimeLight probe was applied, 1 session of 3-4 weeks, program A (vascular) and an energy of 15-19 J / cm2.

Since the two conditions usually exist simultaneously, the following steps have been followed: LimeLight sessions were done every 3-4 weeks, followed by the 2 NdYag sessions.

The treatments were performed exclusively between October and May of the same year. For maintenance, we recommend 1-2 sessions of LimeLight annually during winter. Post-procedure, all patients received recommendations to use a mixture of cream with a protection factor of at least 50% during the entire length of treatment, to avoid exposure to excessive heat such as sauna, sun, or solarium exposure, and to avoid alcohol consumption.

## Results

For patients with diffuse facial erythema, papules, etc., the optimal number of sessions with the LimeLight probe was 4, at intervals of 3-4 weeks. The maximum number of sessions was 6, the fewest 3. Most treatments were performed without anesthetic cream though some patients wanted to use the cream. The degree of discomfort during the procedure was medium, and the treatments were started from energies of 14-15 J/cm2 and increased progressively, from session to session, to energies of 18-19 J/cm2. The average recovery time was 5 days, during which the patient presented with severe edema. As side effects, there were small bruises, small pustules, burning sensation, and transient stinging. As complications, in 3 patients there were observed areas of hyperpigmentation, partially remitted. We did not record any post-procedure scars. Although after the first sequence of LimeLight procedure, many patients said they would stop treatment, ultimately all patients completed the treatment.

For patients with telangiectasia, the optimal number of sessions was 2, performed on average monthly. Telangiectasia disappeared completely after these 2 sessions. As for complications, in two cases there were small excavations in the nose, instead of blood vessels, almost imperceptible but permanent. As an advantage, however, a reduction in the volume of the nose was observed. The area of predilection treated was that of the nose, followed by the chin and only in a few cases by the zygomatic areas. It did not require recovery time and the treatment was well tolerated by all patients. No local anesthesia was required.

## Discussions

It is known that rosacea has negative effects on quality of life, including psychosocial well-being in people with mild, moderate, or severe erythema. However, this impact on self-perception and emotional, social, and general well-being is significantly higher in people with severe erythema [18]. Thus, we paid special attention to improving the quality of life of these patients [19]. In this case, the end results were very positive, with an excellent aesthetic result and with complete remission of the symptoms in most cases. The degree of satisfaction of the patients was very good, with the return to normal of their self-confidence and well-being.

Rosacea treatment is not standardized; we are still seeking optimal treatment protocols. One of the usual therapeutic approaches for rosacea is based on reducing inflammation, using various drugs and substances such as doxycycline [20], metronidazole [21], topical azelaic acid [22], sodium sulfacetamide [23] and calcineurin inhibitors, [24], ivermectin, pimecrolimus, retinoids, permethrin, benzoyl peroxide, erythromycin, and dapsone [25]. Utilization of serine protease inhibitors is considered an emerging therapy for rosacea [26]. Isotretinoin has also been used in patients with papulopustular subtype rosacea [27]. But this approach is useful only in the early stages, with the improvement of symptoms, though with suboptimal aesthetic results and in most cases with a non-negligible toxicity for the body, with gastrointestinal disorders or increased photosensitivity.

Recently, photodynamic therapy (PDT) has increasingly gained ground [28,29], sometimes in association with other treatments such as methyl ester aminolevulinate (MAL) [30]. Furthermore, an in vitro study performed on mouse skin showed that the most effective wavelengths are 630 nm and 940 nm, which decrease some mediators of rosacea inflammation, such as cathelicidin (LL-37), TLR2 and kallikreins (KLKs) [31]. Photodynamic therapy also interacts with the skin microbiome [32]. Research is currently continuing on the effectiveness of blue and red light on the skin's microflora in patients with rosacea and acne patients [33].

Different types of lasers with wavelengths between 400-1400 nm are used to treat diffuse facial erythema. Thus, in addition to intensely pulsed light that involves a wide spectrum of wavelengths, 595 nm colored pulse lasers (PDL) are also used. Furthermore, the use of intensely pulsed light at a wavelength of 560 nm is as effective as the PDL laser in the treatment of facial erythema, but with much lower side effects than the PDL laser and with a shorter recovery time [32], this being the main consideration for using a laser with intense pulsed light and not a PDL. Most people who present with rosacea are active people who cannot afford long periods of recovery. [34].

For the treatment of telangiectasias, the range of lasers used is larger. However, the principle underlying their functioning in the case of vascular lesions is the same, namely the absorption of energy by hemoglobin [35]. Thus, the lasers used to treat telangiectasia are: 1064 nm Neodymium-doped, yttrium – aluminum – garnet (Nd-YAG), 532 nm Potassium-Titanium-Phosphate (KTP), 595 nm PDL, dual wavelength long-pulsed 775 nm alexandrite/ 1,064 nm neodymium: yttrium-aluminum (LPAN) [36]. The most used lasers, however, remain by far NdYag 1064 nm and PDL 595 nm.

As far as the approach order of rosacea lesions, all authors prefer to use in the first stage intense pulsed light (IPL) followed by the use of NdYag or PDL lasers to close telangiectasia [25], an approach that we have used in our clinic. NdYag lasers have the advantages over PDL of less pain production, shorter recovery time, and fewer complications, yet with results that are comparatively the same [25], and thus, the basis for choosing the NdYag laser and not a PDL in the treatment of telangiectasia. The efficiency of NdYaG lasers can be increased by combining it with topical substances based on retinoic acid (some authors find this increases potency up to 47%) or vitamin C or D [37-39]. In recent years, radiofrequency devices have been used to treat telangiectasia, but thus far, results are not promising, with radiofrequency tending to be overrated as a good-for-everything technique [40].

Recently, Botox has been introduced as a therapeutic method in the treatment of rosacea: it seems its actions take place through the nervous system by lowering local vascularity, but the mode of action and efficacy are yet to be fully evaluated [41].

The factors that lead to the appearance of rosacea are not fully elucidated. Some innate or acquired immune dysfunctions are often associated with several neurovascular dysfunctions, with a genetic component underlying the appearance of rosacea [42]. These dysfunctions are directly or indirectly associated Demodex Folliculorum (DF) (through its own bacteria endosymbiosis, or other bacteria unrelated to DF such as Staphylococcus), epidermidis, ultraviolet (UV) radiation, extreme temperatures, stress, congestive foods, and the presence of metabolic syndrome or diabetes mellitus [38-41]. DF has been shown to have Bacillus bacteria endosymbionts such as Bacillus Oleronius, Bacillus Pumilus, Bacilus simplex, Cereus or Corynebacterium kroppenstedtii [44-46].

DF, either directly or through its endosymbionts, can trigger the cascade of immunologically active peptides by interacting directly or indirectly with various structures, including receiver type. It has also been found that some skin receptors exhibit enhanced receptivity, such as Toll-like receptor (TLR) 2, nucleotide-binding oligomerization domain (NOD)-like receptor, and transient vanilloid receptor potential (TRPV4). Activation of these receptors causes the production of immune peptides (eg, LL-37) and various cytokines and chemokines, which induce a variety of inflammatory reactions [47]. The TLR2 receptor can also activate kappa B nuclear transcription factor (NF-kB), further accentuating inflammation [48]. Implicitly, they will also cause neurovascular changes. Mast cells also participate in the appearance of rosacea by increasing inflammation, angiogenesis, and fibrosis [49]. More recently, rosacea and other skin diseases such as psoriasis and atopic dermatitis have been linked to intestinal dysbiosis, although the role of the association of

Helicobacter pylori infection or SIBO-small intestinal bacterial overgrowth is still debated [50]. However, the cascade of inflammatory reactions and triggers is much wider. Thus, keratinocytes will release cathelicidin, vascular endothelial growth factor and endothelin-1, endothelial cells will release nitric oxide, mast cells will release cathelicidin and matrix metalloproteinases, macrophages will release interferon-gamma, tumor necrosis factor, matrix metalloproteinase and interleukin-26 and in addition, all these factors can communicate directly with the cutaneous nervous system through active neurovascular neuropeptides. The consequences of these many pathophysiological changes over the long term are: vasodilation, glandular hyperplasia, and fibrosis. The presence of rosacea may contraindicate or limit the indications for some dermato-cosmetic treatments such as chemical peels or hyaluronic acid treatments [51-53]. It may also limit the use of other types of lasers for various dermatological conditions that induce local vasodilation; in these cases, the order of treatment must be analyzed [54-55].

## Conclusions

Rosacea is a dermatological condition with multifactorial etiology. Its clinical forms require complex treatments on the one hand, combined, both topical and systemic but also by using NdYag laser devices and intense pulsed light; on the other hand, the treatments are adapted to the particularities and comorbidities associated with rosacea in our patients.

This paper presents the results of the treatments performed, with the help of a Cutera Xeo laser, using 2 probes: NdYag 1064 nm and LimeLight 520-1100 nm, with a window of 10x30 mm. The maximum number of sessions was 6, the minimum was 3. Most treatments were made without anesthetic cream though some patients wanted anesthetic cream. The degree of discomfort during the procedure was medium, and treatments were started from energies of 14-15 J / cm2 and increased progressively, from session to session, to energies of 18-19 J / cm2. The average recovery time was 5 days, during which the patient presented severe edema. As side effects, there were small bruises, small pustules, burning sensation, and transient stinging. As complications there were registered, in 3 patients, areas of hyperpigmentation which partially remitted. We did not observe post-procedure scars. Rosacea treatment remains to be individualized according to the needs and status of patients.

## Conflict of interest disclosure

There are no known conflicts of interest in the publication of this article. The manuscript was read and approved by all authors.

## Compliance with ethical standards

Any aspect of the work covered in this manuscript has been conducted with the ethical approval of all relevant bodies and that such approvals are acknowledged within the manuscript.

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