Novel Laser Wavelength Combination of 589 and 1319 nm to Treat Moderate to Severe Acne

Steven D. Shapiro M.D.
Co-Director, Gardens Dermatology & Cosmetic Surgery Center, Palm Beach Gardens, Florida

Introduction

Devices from Lasers (i.e. Pulsed Dye Lasers) to Intense Pulsed Lights (IPL's) to Light Emitting Devices (LED's) have been used to treat Acne because of their suspected benefits against Propionibacterium acnes, anti-inflammatory effects, and reduction of scarring. Historically, devices have not combined the wavelength in the Pulsed Dye category (585 to 595 nm) along with a deeper penetrating wavelength (1319 nm) to suppress sebaceous gland activity in a quick, painless, and efficient manner.

Objective

To evaluate a novel solid-state combination 589/1319 nm laser with a spot size of 1 mm in a scanner to treat Acne resistant to oral and topical antibiotics.

Materials & Methods

Six patients have been treated in a pilot study to determine the tolerability and effective energies utilizing the 1319 nm wavelength first, immediately followed by the 589 nm wavelength for treatment of resistant Acne on the face.

Laser: 1319 nm (infrared) wavelength at 16 to 24 J/cm2, using a line exposure of either 10 spots or 5 spaced spots, followed by 589 nm (yellow) wavelength at 6 to 16 J/cm2, with same line exposure of either 10 adjacent spots or 5 spaced spots, at 6 week intervals.

Techniques: Immediately consecutive treatments with both wavelengths using the 1319 nm wavelength first for deeper penetration of the sebaceous glands followed by the 589 nm wavelength for more superficial benefits to reduce bacteria and inflammation plus stimulate collagen production in treating moderate Acne patients at 6 week intervals.

Patients: 18 to 54 years old with longstanding Acne resistant to topical and oral antibiotics. The laser therapy was chosen to avoid Isotretinoin in Isotretinoin eligible patients. Patients were moderate to severity.

Results

The consecutive treatments with both wavelengths was fast, efficient, and well tolerated by patients. Treatment energies were determined by patient's pain tolerance to achieve a pain free therapy. All patients had been treated previously with a traditional Pulsed Dye Laser (585 nm) but had a 3 month wash out period. All patients preferred the benefits of the combination 589/1319 nm wavelengths laser over the traditional Pulsed Dye Laser. Reduction in erythema and active acne lesions (pustules, papules, and cysts) were noted by clinician and staff. No side effects were seen by clinician and staff. The only side effect noted by a patient was superficial scabbing of active Acne lesions lasting up to 3 days which may have been resolving cystic lesions.

Conclusion

Pulsed Dye Lasers (585nm) have been used in treating Acne for years with the benefit of reducing P. acnes, inflammation, and scarring. Using a 589 nm wavelength laser has similar benefits for Acne. Combining 1319 nm before 589 nm to reduce activity of sebaceous glands appears to have a synergistic benefit clinically, as moderate Acne patients resistant to oral and topical antibiotics improved. Patients and clinical staff noted a reduction in active Acne lesions (pustules, papules, and cysts), inflammation (redness), and scarring.

Disclosure: ADVATx Laser is made by ADVALIGHT (Denmark)

Received: 8 July 2018 | Accepted: 13 July 2018

DOI: 10.1111/jocd.12742

ORIGINAL CONTRIBUTION

WILEY JCD Journal of Cosmetic Dermatology

Use of a novel 589-nm solid-state laser for treatment of facial erythema

Diana K. Cohen[1] MD, MS | Noelani E. Gonzalez[1] MD | Bradly S. Bloom[1,2] MD | David J. Goldberg[1,2] MD, JD

[1]Skin Laser & Surgical Specialists of NY and NJ, Hackensack, New Jersey,

[2]Icahn School of Medicine at Mt. Sinai, New York, New York,

Correspondence: Diana K. Cohen, MD, MS, Skin Laser & Surgical Specialists of NY and NJ, Hackensack, NJ (cohen.dianak@gmail.com).

Funding information
Advalight

Summary

Objective: To evaluate the efficacy and safety associated with use of a 589-nm solid-state laser for treatment of facial erythema.

Methods: A prospective, IRB-approved study was conducted. Participants who were interested in treatment for facial erythema were recruited. They received four monthly treatments with the 589-nm laser. Erythema of the right and left face was graded on a scale of 0-4, 4 being most severe, by both investigators and participants prior to each treatment and at follow-up. Safety was assessed by any reported side effects.

Results: Twenty-four participants enrolled in the study, 16 women (67%) and 8 men (33%), with an average age of 51.1 years. Investigator grades showed a statistically significant improvement in erythema of 31% for both the right and left face. Participant grades showed a statistically significant improvement in erythema of 23.2% for the right face and 22.8% for the left face. Side effects were limited to transient erythema posttreatment.

Conclusion: A 589-nm solid-state laser achieved a modest improvement in facial erythema when evaluating results 1 month after four monthly treatments. No major safety issues were reported.

KEYWORDS
erythema, vascular laser

1 | INTRODUCTION

Facial erythema is a common finding and frequently occurs in patients with rosacea. Estimates of rosacea prevalence in the population have ranged from 5.0% to 12.3%.[1,2] Rosacea can occur in any skin type but most commonly afflicts those with fair skin.[3] A survey of a cohort of patients with erythemotelangiectatic rosacea found that they experience a substantial negative impact of their disease on multiple quality of life instruments.[4] Patients with rosacea have also shown an increased propensity for anxiety and depression.[5]

A handful of treatments exist to improve facial erythema. The pulsed-dye laser (PDL) has been the standard of care for the treatment of facial erythema for the past few decades. While treatment with PDL is effective,[6,7] it requires additional resources to replenish the dye medium. Subpurpuric settings are often effective for treatment of facial erythema,[8,9] but even with these settings, purpura remains a risk. Newer topical treatments, such as oxymetazoline and brimonidine, have their role in temporary improvement of erythema, but must be applied daily and may cause side effects.[10,11]

A novel 589-nm solid-state laser (Advalight; Advatx, Copenhagen, Denmark) provides a wavelength similar to that of the PDL, and

This study was presented at the 2018 ASLMS Annual Meeting in Dallas, TX (CRM: 0003790).

TABLE 1 Erythema grading scale

0	No erythema/redness present, skin is clear
1	Mild
2	Moderate
3	Severe
4	Very severe

therefore can also target oxyhemoglobin and achieve a reasonable depth of penetration into the skin. In contrast to the PDL, the 589-nm solid-state laser requires no maintenance of dye or other medium. We conducted a single center prospective cohort study to determine the efficacy and safety of a new 589-nm solid-state laser for treatment of facial erythema.

2 | METHODS

This was an institutional review board-approved, single center, prospective cohort study. Twenty-four participants who fulfilled the inclusion criteria were identified, and informed consent was obtained. The participants underwent treatment and follow-up visits from May 2017 to February 2018 at Skin Laser & Surgery Specialists of NY and NJ. Eligible participants were age 18 years or older, in good health, Fitzpatrick Skin Types I-IV, and desired a reduction in facial erythema. Subjects were excluded if they were Fitzpatrick Skin Type V or VI, had been treated for facial erythema within the past 30 days, had a history of photosensitivity, or had been taking any anticoagulant medications.

All participants were treated with a 589-nm solid-state laser (ADVAtx; Advalight) at 10-15 J/cm^2, 46 ms, with use of a scanning handpiece. No cooling was used. The scanning handpiece consisted of a 1-mm spot size scanned in a circle, line, or square pattern of up to 10 × 10 spots, adjusted based upon the treatment region. The "touch" setting was used, placing spots directly next to one another, without overlap or extra space in between spots. Participants received four treatments occurring monthly, and then returned for a follow-up visit 1 month after the final treatment.

Photographs were taken with a Janus-II digital facial analysis system; all photographs were evaluated for erythema using an investigator-designed 5-point scale (Table 1). The right and left sides of the face were independently evaluated. Baseline photographs were obtained at the screening visit, and photographs were then obtained prior to and directly after each treatment. Final photographs were obtained at the follow-up visit. Evaluations were performed by both the investigator (a board-certified dermatologist or dermatology physician assistant) and the participant. Safety was assessed based upon participant-reported and/or investigator-reported side effects.

2.1 | Statistical analysis

An intention-to-treat analysis was performed. For subjects with missing data beyond baseline, the last observed value was carried forward. Repeated measure analysis of variance was performed to detect differences between time points for facial erythema. Significance was set at 0.05.

3 | RESULTS

Twenty-four participants, with varying degrees of erythema at baseline, were enrolled in the study. Participants were Fitzpatrick Types I-III. Of the 24 enrolled, 21 participants completed all treatments and follow-up visits (Figures 1 and 2). Three participants missed one or more visit(s) (1 missed a follow-up, 1 missed a treatment and follow-up, and 1 missed a treatment). Subject demographics are shown in Table 2. Mean age of the participants was 51.1 ± 13.1 years (range, 28-74). Sixteen participants were women (67%) and 8 men (33%).

There was an overall improvement in erythema as graded by both the investigators and the participants during the study (Figure 3). The average erythema score for all participants prior to the first treatment, as graded by the investigator, was 2.29 for both the left and the right face. The average score for both the left and right face improved to 1.58 (31.0% improvement) at the follow-up visit 1 month after the fourth and final treatment ($P < 0.05$). Participants graded their own erythema at an average of 2.15 for the right face, and 2.19 for the left face at baseline. At the final follow-up visit, the average score improved to 1.65 for the right face (23.2% improvement) ($P < 0.05$) and 1.69 (22.8% improvement) for the left face ($P < 0.05$).

Other than mild erythema posttreatment, there were no adverse events or other safety concerns that arose during or after treatments. There were no reported incidents of purpura.

4 | DISCUSSION

This study demonstrates that a novel 589-nm solid-state laser is safe and effective for treatment of facial erythema. Both investigators and participants saw an improvement in erythema after four treatments. Most improvement was realized after the first two treatments, with an incremental benefit seen after the third and fourth treatments (Figure 3). Our unblinded, prospective study is the first to demonstrate the clinical effects of a 589-nm solid-state laser.

Similar to the PDL (571, 585, 595 nm), which has been considered the standard of care for the treatment of facial erythema for the past several decades,[12] the 589 nm wavelength of light is located near the peak of 577 nm on the oxyhemoglobin absorption curve. The selective effects on oxyhemoglobin allow for the vasculature responsible for erythema to be damaged. The PDL has effectively been used for treatment of erythema and rosacea,[6–9] but there are drawbacks associated. The PDL requires replenishing of the dye medium, which adds cost and also creates periods of time where the laser cannot be used. The most recent generation of the PDL attempts to curb this issue by lengthening the lifetime of the dye medium. The PDL also has the potential to induce purpura, although nonpurpuric settings with longer pulse durations have proven effective for treatment of rosacea-associated erythema.[9]

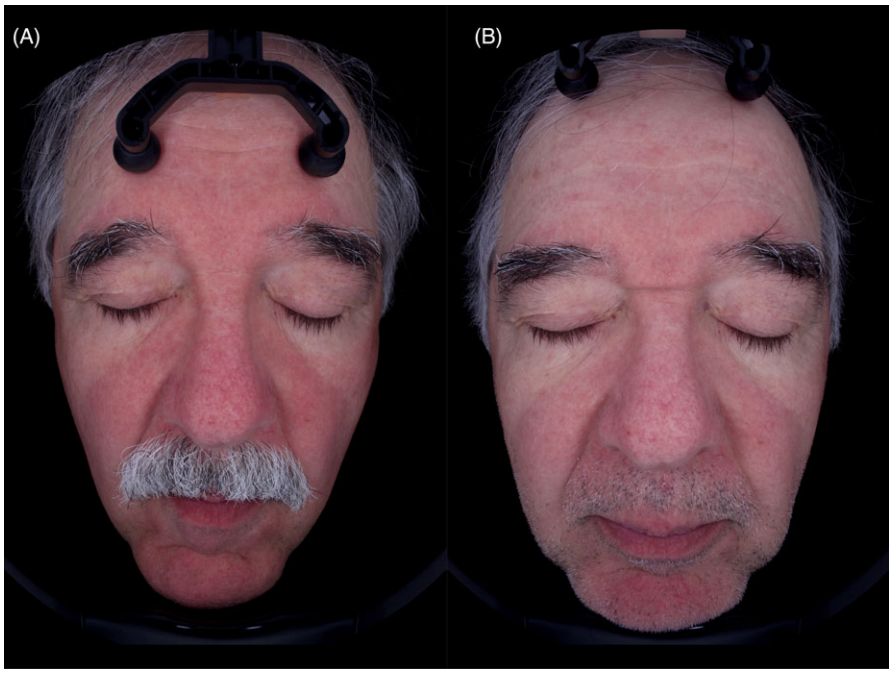


FIGURE 1 Participant treated with 589 nm at baseline (A) and at follow-up 1 month after four treatments (B)

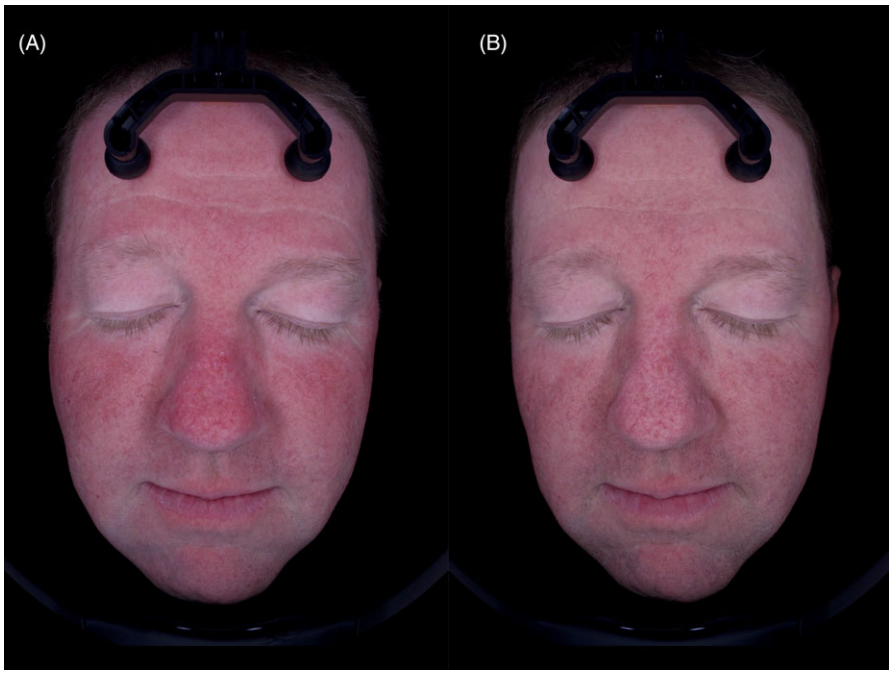


FIGURE 2 Participant treated with 589 nm at baseline (A) and at follow-up 1 month after four treatments (B)

The 589-nm laser, as previously stated, is a solid-state crystal laser that does not utilize consumables. It has is a quasi-continuous wave pulsing system, which delivers individual pulses of approximately 60 nanoseconds at a repetition rate of 12 kHz. The skin perceives these multiple pulses as a single pulse and therefore does not sense individual large energy spikes that would typically induce purpura. None of the patients in our study experienced any purpura.

Other lasers and light sources have been successful in treatment of facial erythema. A split-face study comparing 532-nm potassium-titanyl-phosphate (KTP) to 595-nm PDL showed equal and slightly greater improvement in facial telangiectasias and diffuse facial erythema for the KTP laser, although increased swelling and prolonged erythema was noted for the KTP side.[13] At 532 nm, KTP cannot achieved the depth of penetration as that of a 595-nm PDL

TABLE 2 Demographic data

Variable	Total (%)
All subjects	24 (100%)
Mean age, y ± SD	51.1 ± 13.1
Sex	
M	8 (33%)
F	16 (67%)

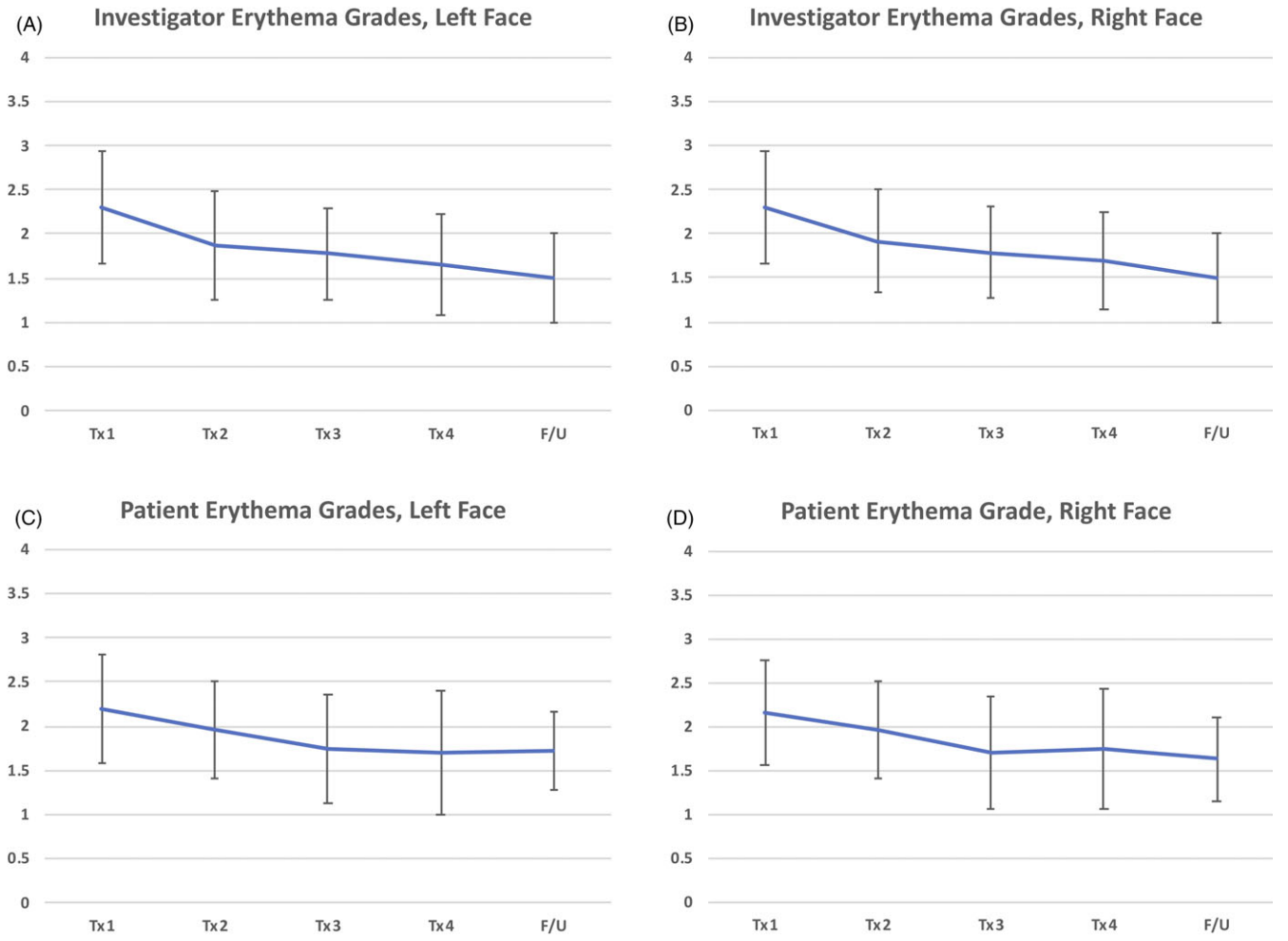


FIGURE 3 Mean erythema grades. A and B, Mean erythema grades for the left and right face, respectively, measured by investigators just prior to each treatment (Tx) and lastly at follow-up (F/U). C and D, Mean erythema grades for the left and right face, respectively, measured by participants just prior to each treatment (Tx) and lastly at follow-up (F/U). Error bars represent standard deviation

or 589-nm laser. Intense pulsed light (IPL) has also been shown in a split-face study to be equally effective as nonpurpuric PDL after two treatments.[14,15]

Newer topical alpha-adrenergic agonists achieve substantial improvement in facial erythema. Oxymetazoline and brimonidine tartrate exert vasoconstrictive action on vessels to treat erythema, and may also possess anti-inflammatory properties.[11] However, these medications require once daily application, and do not treat small caliber vessels and telangiectasias (vessels that lack smooth muscle). There are case reports linked to severe rebound erythema with brimonidine tatrate use,[15] and prolonged use of oxymetazoline may result in tachyphlaxis.[11]

There are a number of limitations to our study. These include a relatively small sample size, a single center study, and lack of a control group or comparison to the standard treatment (PDL). A future protocol may be improved by performing a split-face study comparing a 589-nm laser to PDL for the treatment of facial erythema. One of the strengths of this study is that both investigators and participants performed assessments.

5 | CONCLUSION

A 589-nm solid-state laser achieved a modest improvement in facial erythema as evaluated 1 month after four monthly treatment sessions. No major safety issues were reported. This laser presents an alternative to other vascular lasers that have unwanted side effects or may require routine maintenance to replenish the dye medium.

ACKNOWLEDGMENTS

We thank Advalight for a research grant to fund this study.

CONFLICT OF INTEREST

David J. Goldberg, MD, JD received a research grant from Advalight to conduct this study. Diana K. Cohen, MD, MS, Noelani E. Gonzalez, MD, and Bradley S. Bloom, MD have no significant interest with commercial supporters.

ORCID

Diana K. Cohen http://orcid.org/0000-0001-6706-8411

REFERENCES

1. Moustafa F, Hopkinson D, Huang KE, Feldman S. Prevalence of rosacea in community settings. *J Cutan Med Surg*. 2015;19(2):149-152.
2. Tan J, Schöfer H, Araviiskaia E, Audibert F, Kerrouche N, Berg M. Prevalence of rosacea in the general population of Germany and Russia – the RISE study. *J Eur Acad Dermatology Venereol*. 2016;30(3):428-434.
3. Gallo RL, Granstein RD, Kang S, et al. Rosacea comorbidities and future research: the 2017 update by the National Rosacea Society Expert Committee. *J Am Acad Dermatol*. 2018;78(1):167-170.
4. Zeichner JA, Eichenfield LF, Feldman SR, Kasteleter JS, Ferrusi IL. Quality of life in individuals with erythematotelangiectatic and papulopustular rosacea: findings from a web-based survey. *J Clin Aesthet Dermatol*. 2018;11(2):47-52.
5. Heisig M, Reich A. Psychosocial aspects of rosacea with a focus on anxiety and depression. *Clin Cosmet Investig Dermatol*. 2018;11:103-107.
6. Clark SM, Lanigan SW, Marks R. Laser treatment of erythema and telangiectasia associated with rosacea. *Lasers Med Sci*. 2002;17(1):26-33.
7. Tan SR, Tope WD. Pulsed dye laser treatment of rosacea improves erythema, symptomatology, and quality of life. *J Am Acad Dermatol*. 2004;51(4):592-599.
8. Jasim ZF, Woo WK, Handley JM. Long-pulsed (6-ms) pulsed dye laser treatment of rosacea-associated telangiectasia using subpurpuric clinical threshold. *Dermatologic Surg*. 2004;30(1):37-40.
9. Bernstein EF, Kligman A. Rosacea treatment using the new-generation, high-energy, 595 nm, long pulse-duration pulsed-dye laser. *Lasers Surg Med*. 2008;40(4):233-239.
10. Shanler SD, Ondo AL. Successful treatment of the erythema and flushing of rosacea using a topically applied selective α1-adrenergic receptor agonist, oxymetazoline. *Arch Dermatol*. 2007;143(11):1369-1371.
11. Moustafa FA, Sandoval LF, Feldman SR. Rosacea: new and emerging treatments. *Drugs*. 2014;74(13):1457-1465.
12. Goldman MP, Fitzpatrick RE, Ross EV, Kilmer SL, Weiss RA. *Lasers and Energy Devices for the Skin*, 2nd edn. Boca Raton, FL: Taylor & Francis Group, LLC; 2013.
13. Uebelhoer NS, Bogle MA, Stewart B, Arndt KA, Dover JS. A split-face comparison study of pulsed 532-nm KTP laser and 595-nm pulsed dye laser in the treatment of facial telangiectasias and diffuse telangiectatic facial erythema. *Dermatologic Surg*. 2007;33(4):441-448.
14. Handler MZ, Bloom BS, Goldberg DJ. IPL vs PDL in treatment of facial erythema: a split-face study. *J Cosmet Dermatol*. 2017;16(4):450-453.
15. Neuhaus IM, Zane L. Comparative efficacy of non-purpuric pulsed dye laser and intense pulsed light for erythema-totelangiectatic rosacea. *Dermatol Surg*. 2009;35:920-928.

How to cite this article: Cohen DK, Gonzalez NE, Bloom BS, Goldberg DJ. Use of a novel 589-nm solid-state laser for treatment of facial erythema. *J Cosmet Dermatol*. 2018;17:770–774. https://doi.org/10.1111/jocd.12742

Received: 21 February 2019 | Accepted: 17 June 2019

DOI: 10.1111/jocd.13068

ORIGINAL CONTRIBUTION

JCD Journal of Cosmetic Dermatology WILEY

Treatment of acne scarring with a novel dual-wavelength laser

Michael H. Gold MD[1] | April Wilson RN, BSN, CCRP[1] | Serge R. Mordon PhD[2]

[1]Tennessee Clinical Research Center, Nashville, TN, USA

[2]University Lille, Inserm, CHU Lille, U1189-ONCO-THAI – Image Assisted Laser Therapy for Oncology, Lille, France

Correspondence
Serge Mordon, University Lille, Inserm, CHU Lille, U1189 - ONCO-THAI - Image Assisted Laser Therapy for Oncology, Avenue Oscar Lambret 59037 Lille cedex, France.
Email: serge.mordon@inserm.fr

Funding information
Advalight, San Diego, CA, USA

Abstract

Background: Facial acne scarring is a prevalent disease with both physical and psychosocial sequelae.

Aims: This study aims to evaluate an innovative solid state dual wavelength 1,319 and 589 nm laser, which does not require consumable dye, for the treatment of acne scars.

Patients/methods: A total of 12 patients (11 female, 1 man - Fitzpatrick skin phototypes II & III) with acne scar for more than one year, were treated with 1,319 nm and subsequently by 589 nm, all having four-sessions, one every other week. A full face was covered in approximately 30 minutes. Acne scars were scored by one physician evaluator using the ECCA grading scale before, 2 weeks after each treatment and 1 month and 6 months after the 4th treatment. Safety was measured by recording subject discomfort scores and adverse effects.

Results: 12 subjects were enrolled into the study, 10 completed all 4 treatments and 2 were lost to follow up. Fluence used was 28 J/cm² ± 2.4 J/cm² at 1,319 nm and 16 ± 2.9 J/cm² at 589 nm. At baseline, mean ECCA score was 98 ± 23. This score was reduced to 88 ± 30 ($p<0.02$), after one session, to 68 ± 21 ($p<0.01$) after 2 sessions, to 58 ± 17 ($p<0.01$) after 3 sessions to reach 58 ± 15 ($p<0.01$) 1 month after the 4th and finally 66 ± 11 ($p<0.01$) at 6 month follow up. This observation corresponds respectively to 14%, 33 %, 42 %, 40% and 30% reduction of the ECCA score. Only one patient (ECCA score: 120) did not improve after 3 sessions. Slight to moderate erythema was sometimes observed without dryness or bruising. No or minimal burning or stinging was reported. No crust was observed.

Conclusion: Improvement in scarring was noted in almost all patients with minimal discomfort and minimal downtime. Combining both minimal side effects with effective acne scar reduction, this laser appears to be highly effective. Long-term evaluation remains necessary to confirm the efficacy of this new laser.

KEYWORDS
acne, ECCA, near-infrared laser, scarring, yellow laser

1 | INTRODUCTION

Facial acne scarring is a prevalent disease with both physical and psychosocial sequelae.[1] The treatment of acne scarring with lasers and light-based and energy-based technologies has become an integral component of the therapeutic arsenal. Evaluation of the literature examining acne scar treatment with lasers, revealed that clinical outcomes are dependent on various patient factors, including atrophic acne scar subtype, patient skin type, treatment modality, and side-effect profile.[2]

There are two types of acne scars. Raised acne scars occur when the body produces too much collagen and form a visible bump. Depressed acne scars happen when the body produces too little collagen which causes depressions or pits as the skin heals.[3]

During acne scarring, changes in microvasculature and tissue structure are observed. Baran et al, using the optical microangiography (OMAG) technique, were able to image microvasculature up to capillary level and to visualize the remodeled vessels around the acne lesion.[4] Consequently, vascular lasers are used to treat these vessels and to reduce raised acne scars.[5] The 585-nm flashlamp-pumped pulsed dye laser was shown to be effective in improving the clinical appearance of erythematous and hypertrophic facial acne scars.[6]

For depressed scars, lasers able to induce collagen production are also proposed.[7] Usually, lasers emitting in the infrared are used.[8,9] Nonablative lasers generally have a decreased risk of complications from therapy compared with ablative and have become more popular for treating acne scars. There are several types of nonablative lasers available including a 1450-nm diode laser, 1320-nm or 1064-nm Nd:YAG lasers, and a 1540-nm erbium glass laser. Nonablative lasers spare the epidermis and instead cause a controlled thermal injury to the dermis, promoting collagen production.

The superiority of combining a vascular laser with a nonablative laser has been already demonstrated.[5] Patel et al showed that in the combination of 585/1064-nm had a significantly greater treatment effect than long-pulse Nd:YAG laser treatment alone according to ECCA scores.

This clinical study aims to evaluate an innovative solid-state dual-wavelength 1319- and 589-nm laser, which does not require consumable dye, for the treatment of acne scars.

2 | MATERIALS AND METHODS

A total of 12 patients (11 female, 1 male—Fitzpatrick skin phototypes II & III) with acne scar for more than 1 year, were treated with 1319 nm and subsequently by 589 nm, all having four sessions, one every other week. Follow-up was performed 1 month and 6 months after the 4th treatment.

The treatment was performed with the ADVATx laser (Advalight). This laser combines two laser modules and emits at 589 nm and 1319 m. For this study, the lesions were treated first by the 1319-nm wavelength and subsequently by 589 nm. For each wavelength, spot size was 1 mm using a 5 × 5 mm square scan pattern, with spots touching. Pulse duration varied from 40-65 ms for both wavelengths. A full face was covered in approximately 30 minutes. This study was submitted and approved by an AAHRPP accredited IRB (Chesapeake IRB) and was executed under GCP/ICH guidelines. Prior to any study-related activities, and per protocol, all subjects were properly consented utilizing an IRB approved ICF that embodied all required basic elements (21CFR50.25).

ECCA grading scale was used for quantitative evaluation.[10] The ECCA grading scale is a tool designed to help dermatologists to assess the severity of acne scars and to standardize the discussions about the treatments of scars. This scale is based on semiquantitative, weighted assessments of six types of acne scars: V-shaped atrophic, U-shaped atrophic, M-shaped atrophic, hypertrophic inflammatory, keloid scars, and superficial elastolysis.

Acne scars were scored by one physician evaluator before, 2 weeks after each treatment and 1 month and 6 months after the 4th treatment. Safety was measured by recording subject discomfort scores and adverse effects.

Standardized digital photographs were obtained pre- and post-laser treatment and at all follow-up visits. Digital images were captured utilizing standardized conditions and settings on a stereotactic high-resolution system (Canfield Scientific).

Degrees of improvement are presented according to subtype as percentage improvements (0%-100%) from baseline. In addition, ECCA scores were calculated to compare treatment-associated changes.

Statistical analyses were performed using the Wilcoxon signed-rank test. Data are expressed as means ± standard deviations, and $P < 0.05$ was considered significant.

3 | RESULTS

Of the 12 enrolled subjects, 10 completed all four treatments and were eligible for final evaluation at 6-month follow-up.

Mean fluence used was 28 J/cm^2 ± 2.4 J/cm^2 at 1319 nm and 16 ± 2.9 J/cm^2 at 589 nm.

At baseline, mean ECCA score was 98 ± 23. This score was reduced after each session to 88 ± 30 ($P < 0.02$), to 68 ± 21 ($P < 0.01$) after two sessions, to 58 ± 17 ($P < 0.01$) after three sessions to reach 58 ± 15 ($P < 0.01$) 1 month after the 4th, and finally 66 ± 11 ($P < 0.01$) at 6-month follow-up.

This observation corresponds, respectively, to 14%, 33%, 42%, 40%, and 30% reduction of the ECCA score. Only one patient (initial ECCA score: 120) did not improve after three sessions (Figure 1).

Slight-to-moderate erythema was sometimes observed without dryness or bruising. No or minimal burning or stinging was reported. No crust was observed.

Figures 2 and 3 show the results obtained after four treatments at 1-month and 6-month follow-up.

4 | DISCUSSION

Numerous ablative laser resurfacing techniques have been described for the treatment of acne scarring, with significant downtime for healing and the risk of infection.

The use of lasers in a noninvasive manner has been reported for the treatment of acne scars by numerous studies with significantly less drawbacks. For example, Alster et al have showed that nonablative long-pulsed 1320-nm Nd:YAG offers clinical improvement for patients with atrophic scarring without significant side effects

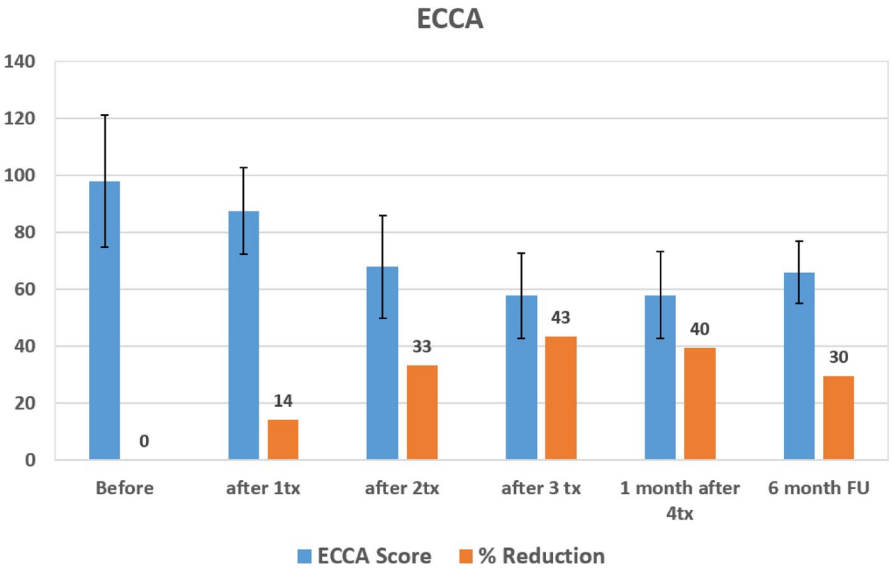


FIGURE 1 ECCA scores obtained after treatment, first by the 1319 nm (28 J/cm^2) and subsequently by 589 nm (16 cm^2). Data obtained on 10 patients

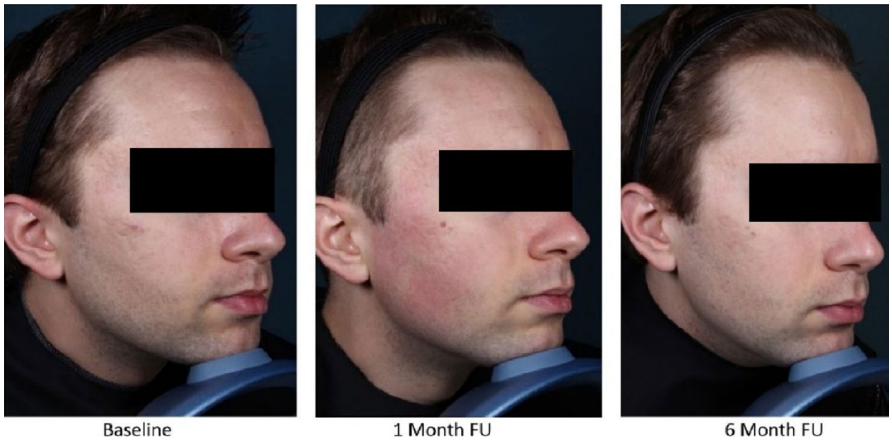


FIGURE 2 Patient # 003 after four treatments at 1-mo and 6-mo follow-up

FIGURE 3 Patient # 009 after four treatments at 1-mo and 6-mo follow-up

or complications.[11] Similarly, Alster et al[6] showed that a flashlamp-pumped pulsed dye laser could improve the appearance of atrophic or erythematous facial acne scars.

The fact that the treatment of acne scarring could be improved even further by using two different wavelengths has been showed in only a limited number of studies.

Lee et al[12] compared the effectiveness of PDL and Nd:YAG laser, both of which were used frequently in daily practice, for the treatment of atrophic acne scarring in a split-face manner. In terms of the treatment of these challenging scar types, ice-pick scars tended to respond better to PDL, while deep boxcar scars tended to benefit more from the Nd:YAG laser.

The combination of an infrared laser to a yellow laser for acne scarring treatment has been also proposed. Patel et al[5] showed that numerical differences in ECCA scores, acquired before and after treatment, confirmed that combined 585/1064-nm laser treatment was superior (66.7 vs 45.1, 32.3% improvement) to long-pulse Nd:YAG laser treatment in overall treatment efficacy.

Similarly, Glaich et al demonstrated that the combination of the 595-nm pulsed dye laser and the 1450-nm diode lasers was a safe and effective treatment option for patients with acne scarring. Patients reported an improvement of their acne scarring even if the goal of the study was treatment of inflammatory facial acne vulgaris. Dermal heating caused by the 1450-nm diode laser causes remodeling of dermal collagen. Additionally, low fluences of the pulsed dye laser can stimulate procollagen production secondary to nonlethal heating of dermal perivascular tissues.[13]

The present study confirms these previous observations. Acne scars treated first by the 1319 nm and subsequently by 589 nm are statistically improved at least 6 months after follow-up.

The main advantage of the laser used in this study is its innovative solid-state yellow technology which requires no maintenance compared with a PDL laser and its reduced footprint.

5 | CONCLUSION

There are many different treatments for acne scarring and each modality has a role in treating acne scars. The patient's expectations and ability to tolerate and recover from a procedure should be accounted for in order to obtain the best outcome. This clinical study using a new laser combining two wavelengths in a laser requiring a low maintenance and a small footprint should be now considered in the dermatologist's armamentarium to treat acne scars.

ORCID

Michael H. Gold https://orcid.org/0000-0002-5183-5433
Serge R. Mordon https://orcid.org/0000-0002-1208-7153

REFERENCES

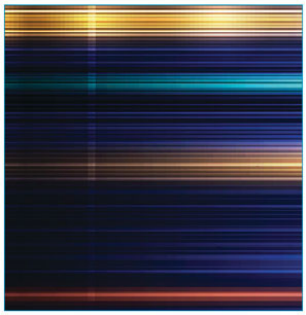
1. Abdel Hay R, Shalaby K, Zaher H, et al. Interventions for acne scars. *Cochrane Database Syst Rev*. 2016;4:CD011946.
2. Sadick NS, Cardona A. Laser treatment for facial acne scars: a review. *J Cosmet Laser Ther*. 2018;20(7–8):424-435.
3. Fabbrocini G, Annunziata MC, D'Arco V, et al. Acne scars: pathogenesis, classification and treatment. *Dermatol Res Pract*. 2010;2010:893080.
4. Baran U, Li Y, Choi WJ, Kalkan G, Wang RK. High resolution imaging of acne lesion development and scarring in human facial skin using OCT-based microangiography. *Lasers Surg Med*. 2015;47(3):231-238.
5. Patel N, Clement M. Selective nonablative treatment of acne scarring with 585 nm flashlamp pulsed dye laser. *Dermatol Surg*. 2002;28(10):942-945;discussion 945.
6. Alster TS, McMeekin TO. Improvement of facial acne scars by the 585 nm flashlamp-pumped pulsed dye laser. *J Am Acad Dermatol*. 1996;35(1):79-81.
7. Konda S, Potter K, Ren VZ, Wang AL, Srinivasan A, Chilukuri S. Techniques for optimizing surgical scars, part 1: wound healing and depressed/atrophic scars. *Skinmed*. 2017;15(4):271-276.
8. Cohen BE, Brauer JA, Geronemus RG. Acne scarring: a review of available therapeutic lasers. *Lasers Surg Med*. 2016;48(2):95-115.
9. Politi Y, Levi A, Snast I, Ad ED, Lapidoth M. Integrated cooling-vacuum-assisted non-fractional 1540-nm erbium: glass laser: a new modality for the simultaneous effective treatment of acne lesions and scars. *J Drugs Dermatol*. 2018;17(11):1173-1176.
10. Dreno B, Khammari A, Orain N, et al. ECCA grading scale: an original validated acne scar grading scale for clinical practice in dermatology. *Dermatology*. 2007;214(1):46-51.
11. Tanzi EL, Alster TS. Comparison of a 1450-nm diode laser and a 1320-nm Nd:YAG laser in the treatment of atrophic facial scars: a prospective clinical and histologic study. *Dermatol Surg*. 2004;30(2 Pt 1):152-157.
12. Lee DH, Choi YS, Min SU, Yoon MY, Suh DH. Comparison of a 585-nm pulsed dye laser and a 1064-nm Nd:YAG laser for the treatment of acne scars: a randomized split-face clinical study. *J Am Acad Dermatol*. 2009;60(5):801-807.
13. Glaich AS, Friedman PM, Jih MH, Goldberg LH. Treatment of inflammatory facial acne vulgaris with combination 595-nm pulsed-dye laser with dynamic-cooling-device and 1450-nm diode laser. *Lasers Surg Med*. 2006;38(3):177-180.

How to cite this article: Gold MH, Wilson A, Mordon SR. Treatment of acne scarring with a novel dual-wavelength laser. *J Cosmet Dermatol*. 2019;18:1290–1293. https://doi.org/10.1111/jocd.13068

Treatment of Moderate-to-severe Facial Acne Vulgaris with Solid-state Fractional 589/1,319-nm Laser

JCAD Online Editor | March 1, 2019

J Clin Aesthet Dermatol. 2019;12(3):28–31



by Alison Kang, MD; Alexis Lyons, MD; Jennifer Herrmann, MD; and Ronald Moy, MD

Drs. Kang and Herrmann are with the Division of Dermatology, Harbor-UCLA Medical Center in Torrance, California. Drs. Lyons, Herrmann, and Moy are with Moy-Fincher-Chipps Facial Plastics and Dermatology in Beverly Hills, California. Dr. Moy is with the Department of Dermatology, Keck School of Medicine at the University of Southern California in Los Angeles, California.

FUNDING: No funding was received for this study.

DISCLOSURES: The authors have no conflicts of interest relevant to the content of this article.

ABSTRACT: *Objective.* The objectives of this study were to evaluate the efficacy, safety and patient satisfaction of a unique combination of wavelengths 589nm and 1,319nm for the treatment of facial acne vulgaris.

Design. This was a small, randomized, prospective, split-face, single-blinded study of patients with moderate-to-severe acne vulgaris.

*Setting.*The study took place at a single outpatient center study in Torrance, California.

Participants. Nine patients underwent four treatment sessions at 2- to 3-week intervals. Each patient received one pass with the 1,319nm laser followed by one pass with the 589nm laser only to the randomized treatment side of the face.

Measurements. A blinded, board-certified dermatologist reviewed photographs and counted acne lesions on treated and nontreated sides.

Results. Of the nine patients, eight were Fitzpatrick Skin Type IV. At the final visit, inflammatory acne lesions were reduced by 2.5 (-23.1%) on the treatment side and increased by 1.1 (+11.1%) on the control side. No patients experienced bruising, edema, hyperpigmentation or scarring. At the conclusion of the study, 77.8 percent of the patients reported overall satisfaction.

Conclusion. This unique combination of lasers appears to be safe in patients with Fitzpatrick Skin Type IV, and might be useful in treating moderate-to-severe acne vulgaris.

KEYWORDS: Acne, acne vulgaris, active acne, acne scarring, laser

Introduction

Acne vulgaris is the most common skin condition in the United States, affecting up to 50 million Americans each year.[1] Although most prevalent during the teenage years, acne often persists into adulthood and is more common in women than men.[2] Acne affects all skin colors and can cause negative self-image, lower self-esteem, and feelings of isolation, anxiety, and depression.[3] Scarring is a common complication of acne and has been reported in up to 95 percent of patients with acne.[4]

Standard medical treatments for acne include topical medications such as benzoyl peroxide, antibiotics, retinoids, and salicylic acid, as well as oral medications such as antibiotics, contraceptive pills, spironolactone, and isotretinoin.[5–7] Treatments are individualized depending on acne severity, type, and etiology. Recently, there has been increasing recognition of laser- and light-based therapies for the treatment of active acne and resultant scarring.[8,9] Lasers studied include the 1,540-nm erbium:glass laser, 1,550-nm fractionated erbium:glass laser, pulsed-dye laser (PDL), q-switched 1,064-nm neodymium-doped yttrium aluminium garnet (Nd:YAG) laser, fractional 1,320-nm Nd:YAG laser, 1,450-nm diode laser, and 532-nm potassium titanyl phosphate laser.[8,9] In addition, the 1,450-nm diode laser has been shown to reduce sebum production.[10]

To date, few studies have investigated laser combinations, including PDL combined with either a 1,064-nm Nd:YAG or a 1,450-nm diode laser.[11–13] The device investigated in this study is a unique, solid-state laser with both 589-nm and 1,319-nm wavelengths. The 589-nm wavelength targets the superficial cutaneous microvasculature and might reduce acne-associated erythema,[14–16] while the 1,319-nm wavelength is absorbed primarily by water, generating thermal energy nonspecifically, leading to dermal collagen remodelling.[21] Studies evaluating the 1,320-nm wavelength have demonstrated histologic improvement in epidermal and dermal thickening as well as acne scar improvement.[17–24] In addition, the 1,319-nm wavelength might also target the sebaceous gland directly, leading to reduced sebum production.[25]

The primary objective of this study was to evaluate the efficacy of a unique combination of the 589-nm and 1,319-nm wavelengths for the treatment of facial acne vulgaris. The secondary objectives of this study were to assess the safety of this combination of lasers in patients with Fitzpatrick Skin Type IV and to evaluate overall patient satisfaction.

Materials and Methods

A randomized, prospective, split-face, single-blinded study was performed at a single center in Torrance, California. Participants were at least 16 years of age, with Fitzpatrick Skin Types I to IV and moderate-to-severe inflammatory acne, and were required to provide informed assent/consent. Informed consent was provided by a legal guardian for participants under the age of 18 years. Exclusion criteria included the initiation of new topical or oral acne therapy within the previous three months, history of oral retinoid therapy, history of other laser treatments, dermabrasion, or other methods to treat scars, and pregnancy. This small study was performed in accordance with the 2013 revision of the Declaration of Helsinki. Informed assent/consent was obtained from all individual participants included in the study. Photo consent was obtained from participants. Moderate-to-severe acne was defined for our study as having at least four inflammatory papules or pustules on each half of the face.

Each patient was randomized to receive treatment on either the left or the right side of the face. Out of nine total participants, five (55.6%) patients were randomized to receive treatment on the left half of the face and four (44.4%) were randomized to receive treatment on the right half of the face. Patients underwent four treatment sessions at 2- to 3-week intervals. Each patient received one pass with the 1,319-nm laser followed by one pass with the 589-nm laser only to the randomized treatment side of the face. Laser settings were chosen based on patient skin type and tolerability ranging from 16 to 19mJ/cm^2 for the 1,319-nm setting and 14 to 17mJ/cm^2 for the 589-nm setting. Commercially available ice packs and cooling gel were used for improved patient comfort during the treatment with the 589-nm laser. Photographs were taken at each visit prior to the treatment. Patients were followed for up to 5.4 weeks after their final treatment, and final post-treatment photographs were obtained. A poststudy patient survey was conducted to assess subjective perceived improvement of four metrics: skin texture, redness, oiliness, and scarring. In addition, patients were asked to report any experienced discomfort and their overall satisfaction. At the conclusion of all laser treatments, a blinded board-certified dermatologist reviewed photographs and counted acne lesions on treated and nontreated sides.

Results

TABLE 1. Baseline demographics

Age, median 23 years	
Sex, n (%)	
Male	1 (11.1)
Female	8 (88.9)
Race, n (%)	
Asian	4 (44.4)
Hispanic	4 (44.4)
White	1 (11.1)
Fitzpatrick skin type, n (%)	
II	1 (11.1)
IV	8 (88.9)

A total of nine patients who fulfilled the inclusion criteria were enrolled in and completed the study. No participants dropped out or failed to follow up appropriately for study visits. There were seven (77.8%) women and two (22.2%) men between the ages of 17 and 40 years (median age: 23 years). One (11.1%) patient had a Fitzpatrick Skin Type II and eight (88.9%) patients had Fitzpatrick Skin Type IV. The demographic characteristics of the nine patients are summarized in Table 1.

Average baseline inflammatory acne lesion count was 11.1 on the treatment side and 10.3 on the control side. Reduction in acne lesion count was noted in 57.1 percent of patients after the first treatment session. However, between the first and second treatments, these improvements were not sustained, with some patients experiencing an increase in acne lesions. After the second treatment, 40 percent of patients experienced a reduction in acne lesions counts. After the third and fourth treatments, 57.1 and 85.7 percent of the patients showed improvement, respectively. At the final visit, inflammatory acne lesions were reduced by 2.5 (-23.1%) on the treatment side and increased by 1.1 (+11.1%) on the control side. Two patients experienced increased acne counts on both sides of the face. Representative photographs of patients treated in the study are shown in Figures 1A–B and 2A–B. The efficacy of the laser treatments was noted to be sustained for up to 5.4 weeks following the final treatment session, which was the longest follow-up period in this study. All nine patients completed the survey at the completion of the study; 77.8 percent of patients reported overall satisfaction with the results of the laser treatments. Patients were asked to rate their degree of improvement on a linear scale, with 0=no improvement and 10=very significant improvement. Average and median scores were 4.9 and 7 points, respectively, for subjective evaluation of response to treatment. Specifically, patients reported an improvement in skin texture (6/9, 66.7%), scarring (4/9, 44.4%), redness (6/9, 66.7%), and oiliness (7/9, 77.8%). Finally, patients were asked to rate their level of discomfort during the laser treatments from the following choices: none, mild, moderate, or severe. One patient reported none, five patients reported mild discomfort, and three patients reported moderate discomfort. No patients reported severe discomfort. All patients developed transient post-treatment erythema that resolved completely within 24 hours. No patients experienced bruising, edema, hyperpigmentation, or scarring.

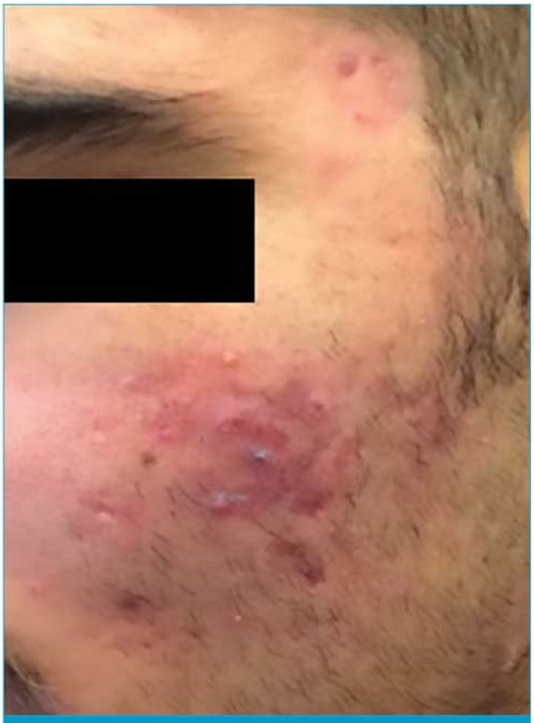


FIGURE 1A. Photograph at baseline

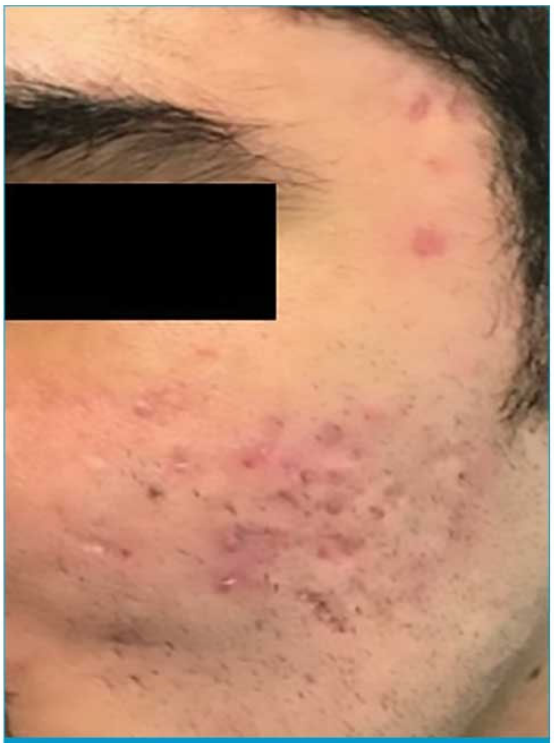


FIGURE 1B. Improvement in inflammatory acne and erythema following three sessions

FIGURE 2A. Photograph at baseline

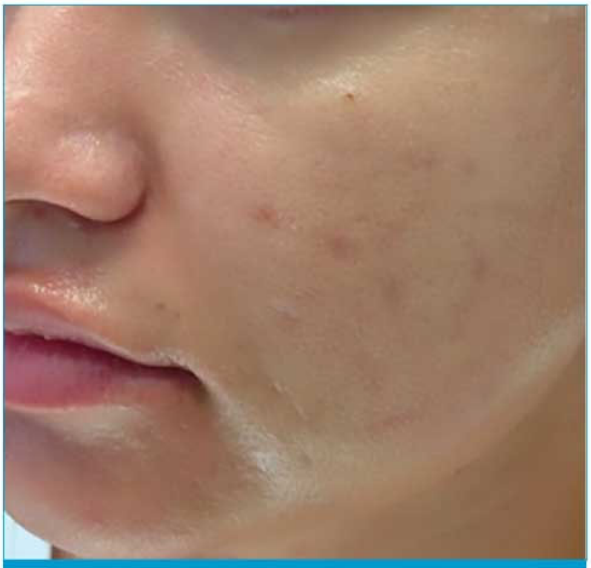


FIGURE 2B. Photograph following completion of four laser treatments

Discussion

Recently, laser- and light-based therapies have emerged as popular options for the management of active acne and acne scarring. These modalities can be used as adjunct therapy to conventional acne treatments or as monotherapy.[26] Laser therapy is advantageous because it is an in-office treatment, which ensures patient adherence to therapy. In addition, it offers no systemic side effects that might complicate treatment when using oral acne medications. Although many different lasers have been studied for the treatment of acne, only a few studies to date have have evaluated a combination of lasers, which include PDL with either a 1,064-nm Nd:YAG or a 1,450-nm diode laser.[11–13]

Our research is unique in that it studied a novel, solid-state laser with both 589-nm and 1,319-nm wavelengths available in the single device. To our knowledge, no similar combination of wavelengths has been studied previously. We found that more than half of our patients had temporarily reduced acne lesion counts after only one session, and 85.7 percent of the patients showed improvement after four sessions, which was sustained through the follow-up period (5.4 weeks). These results might be due to effects on the sebaceous gland. The 1,319-nm wavelength might target the sebaceous gland directly and reduce sebum production, similar to the sebum reducing effects that have been observed in the 1,450-nm diode laser.[10] However, further studies are necessary to assess the effects of the 1,319-nm wavelength on sebaceous gland activity and sebum production. In addition, 66.7 percent of the patients reported an improvement in redness. This might be explained by the 589-nm wavelength, which has been shown in other studies to improve acne-associated erythema.[14–16] Improvement in erythema in a representative patient can be seen in Figures 1A–B.

It is noteworthy that treatment with this combination of laser wavelengths was generally well-tolerated and led to high patient satisfaction. Future studies that investigate the optimal frequency of treatments and assess duration and long-term efficacy are warranted. Furthermore, it would be interesting to study the role of this laser as an adjunct therapy to conventional acne treatments or in combination with chemical peels.

Limitations. This study is limited by its small sample size, modest improvement, and short follow-up times to assess duration and long-term efficacy.

Conclusion

This unique combination lasers appears to be safe in Fitzpatrick Skin Type IV patients and might be useful in treating moderate-to-severe acne vulgaris.

References

1. Bickers DR, Lim HW, Margolis D et al. The burden of skin diseases: 2004 a joint project of the American Academy of Dermatology Association and the Society for Investigative Dermatology. *J Am Acad Dermatol.* 2006;55(3):490–500.
2. Collier CN, Harper JC, Cafardi JA, et al. The prevalence of acne in adults 20 years and older. *J Am Acad Dermatol.* 2008;58(1):56–59.
3. Dalgard F, Gieler U, Holm J, et al. Self-esteem and body satisfaction among late adolescents with acne: results from a population survey. *J Am Acad Dermatol.* 2008;59(5):746–751.
4. Layton AM, Henderson CA, Cunliffe WJ. A clinical evaluation of acne scarring and its incidence. *Clin Exp Dermatol.* 1994;19(4):303–308.
5. Arowojolu AO, Gallo MF, Lopez LM, et al. Combined oral contraceptive pills for treatment of acne. *Cochrane Database Syst Rev.* 2012;(7):CD004425.
6. Bhate K, Williams HC. What's new in acne? An analysis of systematic reviews published in 2011–2012. *Clin Exp Dermatol.* 2014;39(3):273–277.
7. Zaenglein AL, Pathy AL, Schlosser BJ, et al. Guidelines of care for the management of acne vulgaris. *J Am Acad Dermatol.* 2016;74(5): 945–973.e33.
8. Wiznia LE, Stevenson ML, Nagler AR. Laser treatments of active acne. *Lasers Med Sci.* 2017;32(7):1647 –1658.
9. Barbaric J, Abbott R, Posadzki P, et al. Light therapies for acne. *Cochrane Database Syst Rev.* 2016; (9):CD007917.
10. Laubach HJ, Astner S, Watanabe K, et al. Effects of a 1,450 nm diode laser on facial sebum excretion. *Lasers Surg Med.* 2009;41(2):110–115.
11. Glaich AS, Friedman PM, Jih MH, et al. Treatment of inflammatory facial acne vulgaris with combination 595-nm pulsed-dye laser with dynamic-cooling-device and 1,450-nm diode laser. *Lasers Surg Med.* 2006;38 (3):177–180.
12. Jung JY, Choi YS, Yoon MY, et al. Comparison of a pulsed dye laser and a combined 585/1,064-nm laser in the treatment of acne vulgaris. *Dermatol Surg.* 2009;35(8):1181–1187.
13. Salah el din MM, Samy NA, Salem AE. Comparison of pulsed dye laser versus combined pulsed dye laser and Nd: YAG laser in the treatment of inflammatory acne vulgaris. *J Cosmet Laser Ther.* 2017;19(3):149–159.
14. Yoon HJ, Lee DH, Kim SO, et al. Acne erythema improvement by long-pulsed 595-nm pulsed-dye laser treatment: a pilot study. *J Dermatolog Treat.* 2008;19(1):38–44.

15. Leheta TM. Role of the 585-nm pulsed dye laser in the treatment of acne in comparison with other topical therapeutic modalities. *J Cosmet Laser Ther.* 2009;11(2):118–124.
16. Park KY, Ko EJ, Seo SJ, et al. Comparison of fractional, nonablative, 1550-nm laser and 595-nm pulsed dye laser for the treatment of facial erythema resulting from acne: a split-face, evaluator-blinded, randomized pilot study. *J Cosmet Laser Ther.* 2014;16(3):120–123.
17. Bellew SG, Lee C, Weiss MA, et al. Improvement of atrophic acne scars with a 1,320 nm Nd:YAG laser: retrospective study. *Dermatol Surg.* 2005;31(9 Pt 2):1218–1221.
18. Bhatia AC, Dover JS, Arndt KA, et al. Patient satisfaction and reported long-term therapeutic efficacy associated with 1,320 nm Nd:YAG laser treatment of acne scarring and photoaging. *Dermatol Surg.* 2006;32 (3):346–352.
19. Chan HH, Lam LK, Wong DS, et al. Use of 1,320 nm Nd:YAG laser for wrinkle reduction and the treatment of atrophic acne scarring in Asians. *Lasers Surg Med.* 2004;34(2):98–103.
20. Rogachefsky AS, Hussain M, Goldberg DJ. Atrophic and a mixed pattern of acne scars improved with a 1320-nm Nd:YAG laser. *Dermatol Surg.* 2003;29(9):904–908.
21. Sadick NS, Schecter AK. A preliminary study of utilization of the 1320-nm Nd:YAG laser for the treatment of acne scarring. *Dermatol Surg.* 2004;30(7):995–1000.
22. Goldberg DJ. Non-ablative subsurface remodeling: clinical and histologic evaluation of a 1320-nm Nd:YAG laser. *J Cutan Laser Ther.* 1999;1(3): 153–157.
23. Goldberg DJ. Full-face nonablative dermal remodeling with a 1320 nm Nd:YAG laser. *Dermatol Surg.* 2000;26 (10):915–918.
24. Tanzi EL, Alster TS. Comparison of a 1450-nm diode laser and a 1320-nm Nd:YAG laser in the treatment of atrophic facial scars: a prospective clinical and histologic study. *Dermatol Surg.* 2004;30(2 Pt 1):152–157.
25. Orringer JS, Kang S, Maier L, et al. A randomized, controlled, split-face clinical trial of 1320-nm Nd:YAG laser therapy in the treatment of acne vulgaris. *J Am Acad Dermatol.* 2007;56(3): 432–438.
26. Thiboutot D, Gollnick H, Bettoli V, et al. New insights into the management of acne: An update from the global alliance to improve outcomes in acne group. *J Am Acad Dermatol.* 2009;60(5 Suppl):S1–S50.

Tags: Acne, acne scarring, Acne Vulgaris, active acne, laser

Category: Acne, Current Issue, Lasers, Original Research, Scars

Comments are closed.

« Safety and Efficacy of Aminolevulinic Acid 10% Topical Gel versus Aminolevulinic Acid 20% Topical Solution Followed by Blue-light Photodynamic Therapy for the Treatment of Actinic Keratosis on the Face and Scalp: A Randomized, Double-blind Study
Facial Lift and Patient Satisfaction Following Treatment with Absorbable Suspension Sutures: 12-Month Data from a Prospective, Masked, Controlled Clinical Study »

Official Journal of ACOS

AMERICAN CUTANEOUS ONCOLOGY SOCIETY™

SUBSCRIBE

Author and Copyright Forms

Download **AUTHOR FORM**

Download **COPYRIGHT FORM**

Follow Us

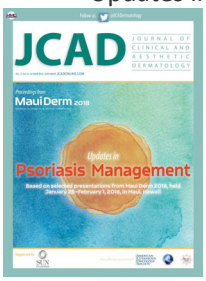
E-Editions & Supplements

Current JCAD E-Edition

March 2019 issue 

October 2018 Supplement

Updates in Psoriasis Management: Based on selected presentations from Maui Derm 2018



June 2018 Supplement

Facial Rejuvenation and Acne Scar Treatment with Polymethylmethacrylate-collagen Gel Alone and in Combination with Other Modalities

May 2018 Supplement

Maui Derm for Dermatologists: Selected Abstracts from the 2018 Meeting

January 2018 Supplement

The Importance of Skin Barrier Maintenance and Repair

Past Issues

Past Issues Select Month

Complete Journal Archives

PubMed Central

Vol.1, No. 1 to Current Issue Available via Pubmed Central. Click here to access.

Download the JCAD App!