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Original Article

Dermatology Section

Intense Pulsed light Versus 1,064 Long-Pulsed Neodymium: Yttrium–Aluminum– Garnet Laser in the Treatment of Facial Acne Vulgaris

ESSAM ELDEN MOHAMED[1], KHALED TAWFIK[2], MOHAMED ELSAIE[3]

ABSTRACT

Introduction: Laser and light-based procedures provide a good and safe modality for treatment of active acne lesions when used properly.

Aim: To compare the clinical efficacy of intense pulsed light (IPL) versus 1,064 long-pulsed Neodymium:Yttrium–Aluminum–Garnet (Nd: YAG) in treatment of facial acne vulgaris.

Materials and Methods: Seventy four patients recruited between June 2013 and August 2014 was enrolled in this controlled, single-blind, split-face clinical trial. All participants received 3 sessions of IPL on the right side of the face and 1,064-nm Nd:YAG on the left side of the face at 4-weeks intervals. Final assessment was made by comparison of the changes in the count of inflammatory acne lesions (inflammatory papules, pustules, nodules and cyst) and non-inflammatory acne lesions (Comedones) and the acne severity score between both therapies, based on standardized photography.

Results: At the final visit, the inflammatory acne lesions were reduced on the IPL and 1,064-nm Nd:YAG treated sides by 67.1% and 70.2% respectively ($p<0.05$ for each), while non inflammatory acne lesions were reduced by 18.3% and 19.3% respectively ($p>0.05$ for each). For both therapies, there was significant difference in the improvement on inflammatory acne lesions in comparison to non-inflammatory lesions ($p<0.05$ for each). There was no significant difference in the efficacy of the two therapies in reducing the percentage of both types of acne lesions count from baseline to the end of the study ($p>0.05$ for each).

Conclusion: Both IPL and 1,064-nm Nd:YAG laser are effective in treatment of inflammatory facial acne vulgaris. There is no significant difference between the effects of both therapies on facial acne lesions.

Keywords: Acne severity score, Comedones, Inflammatory acne lesions

INTRODUCTION

Several modalities have been used for treating acne; however newer therapeutic modalities such as light-based therapy have been developed to address the need for more efficacious and safer treatment. Acne is a chronic inflammatory disease of the pilosebaceous unit resulting from androgen-induced increased sebum production, altered keratinisation, inflammation, and bacterial colonization of hair follicles on the face, neck, chest, and back by *Propionibacterium acnes* [1]. There are several conventional medical treatments of acne, but poor efficacy (topical antibiotics), recurrence (topical antibiotics), high cost (systemic isotretinoin) and adverse drug reactions like irritation (topical retinoids), bacterial resistance (systemic antibiotic) and teratogenisity (systemic isotretinoin) were seen with these treatments [2]. There is obvious need for new, safe, and effective modalities in the acne treatment [2,3].

Several laser systems have been shown to destroy sebaceous glands, including near-infrared lasers and radiofrequency devices [4]. Light sources including blue lights and IPL are becoming regular additions to routine medical management to enhance the therapeutic response [5].

AIM

The aim of this prospective study was to compare the efficacy of 1,064-nm Nd:YAG laser with IPL in treatment of different types of acne.

MATERIALS AND METHODS

Study Design and Subjects

This study was designed as a prospective, split-face, randomized controlled trial. Written informed consent was obtained from all subjects prior to enrollment. Subjects were not allowed to use any systemic, topical or phototherapy based acne treatment during the course of this study. The exclusion criteria were pregnancy, prior acne therapy, including isotretinoin therapy within 6 months, systemic antibiotic therapy (for any indication) within 1 month, topical acne preparations or intralesional steroid injections within 1 month of starting laser treatment, presence of photosensitive disease, hypertrophic scars or keloids.

Participants in this study (n=74) were patients who presented with facial acne vulgaris (inflammatory and non-inflammatory) referred to the laser center of Al-Azhar University Hospital (Assiut) between June 2013 and August 2014, their mean ages were 22.8 years and ranged 18.5-32 years. The study was approved by the Ethical Committee of Al-Azhar University.

Methods

The right side of the face was treated with IPL while the left side of the face was treated with 1,064-nm Nd:YAG laser. The right side of the face was treated with 550 handpiece of IPL (Minislk-FT, DEKA – ITALY). Fluencies of 10–15 J/cm^2 and pulse width was 4 ms with 20 ms delay and patients received 2 passes at each treatment session.

Nd:YAG laser (SYNCHRO HP, DEKA – ITALY) was applied to the left side of the face. A fluence of 30-35 J, delay time 20 ms and spot size 15 were used. A topical lidocaine cream was applied on the face 30 min before the treatment and ice pack cooling was used before and immediately after the laser treatment. Sun screen with (SPF ≥ 50) was applied after each session on both sides.

Clinical Outcome Assessments

Patient follow-up was scheduled at 4-week intervals during the treatment period (3 treatment sessions) and at 4-week interval after the final session. Standardized digital photographs were taken before the treatment and at every follow-up visit using identical camera settings (Olympus c-420 digital SLR camera 10MP). Evaluations included formal counts of inflammatory and non-inflammatory lesions as well as acne severity evaluations based on Cunliffe's grading [6]. Comedones were considered as non-inflammatory lesions. Erythematous papules, pustules, nodules and cysts were considered as inflammatory lesions. Adverse reactions were recorded at every follow-up visit.

STATISTICAL ANALYSIS

The statistical analysis was performed using SPSS, version 16.0 (SPSS Inc., Chicago, IL, USA). Results were expressed as simple percentage accompanied by qualitative description of comments. The significance of differences between the data of the studied groups and the mean and standard deviation values were use t-test. A p-value of 0.05 or less was considered significant.

RESULTS

The final study cohort was made up of 74 patients (23 males and 51 females) with acne vulgaris, with a mean age of 22.8 (range 18.5- 32 years). The mean duration of acne was 3.51 ±1.6 years (range 6 months to 8 years). Based on Fitzpatrick skin type, patients were classified as follows: 16 (21.6%) patients were grade III, 32(43.2%) patients were grade IV and 26 (35.1%) patients were grade V. According to acne severity, patients were divided into mild degree (n=21), moderate degree (n=34) and severe degree (n=19). Mean baseline acne grades of IPL and 1,064-nm Nd:YAG treated sides were 3.8 and 3.7, respectively. Statistically, there was no significant difference in acne severity between both sides (p>0.05). At the end of the study, in the IPL -treated side, acne grade was significantly decreased to 1.2 (68.4%) after treatment (p< 0.05) and in 1,064-nm Nd:YAG treated side, mean acne grade was significantly decreased to 0.9 (75.7%) after treatment (p< 0.05) [Table/Fig-1].

The mean ± SD percentage of improvement of inflammatory acne lesion in IPL and 1,064-nm Nd:YAG treated sites (67.1±12.3 and 70.2±11.3 respectively) were significantly higher than their mean of non-inflammatory acne lesion (14.2±10. 5 and 17.9± 5.2 respectively) (p<0.05 for each).

At the final visit, the mean inflammatory acne lesion counts (papules, pustules, nodules and cyst) were significantly reduced by both IPL and Nd-YAG (p<0.05 for each), whereas non inflammatory acne lesions (comedones) were insignificantly reduced (p>0.05 for each) [Table/Fig-2]. There was no significant difference was evident between the two therapies (p >0.05).

	IPL treated side	Nd:YAG treated side	p-value
Baseline	3.8±0.02	3.7±0.14	p > 0.05
After treatment	1.2±0.21	0.9 ±0.16	p > 0.05

[Table/Fig-1]: Mean Changes in acne severity for the two treatments at baseline and after treatment.
*Significant p < 0.05

Acne Lesions	Right side			Left side		
	Baseline	After treatment	%	Baseline	After treatment	%
Comedons	19.1± 11.3	14.2±10. 5	18.3	20.2±6.5	17.9± 5.2	19.3
Papules	19.6±3.1	4.8 ± 3.3*	75.5	19.1 ±12.2	4.2 ± 4.2*	78
Pustules	6.7 ± 2.4	1.09 ± 0.5*	83.7	7.3±1.2	1.1± 0.3*	84.9
Nodules	4.9 ± 0.8	0.7 ± 0.7*	85.7	4.2 ± 1.7	0.5 ± 0.9*	88.1
Cysts	10±0.01	0*	100	9±0.02	0*	100

[Table/Fig-2]: Mean percentage of improvement of different types of acne lesions for the two treatments.
*Significant p < 0.05

DISCUSSION

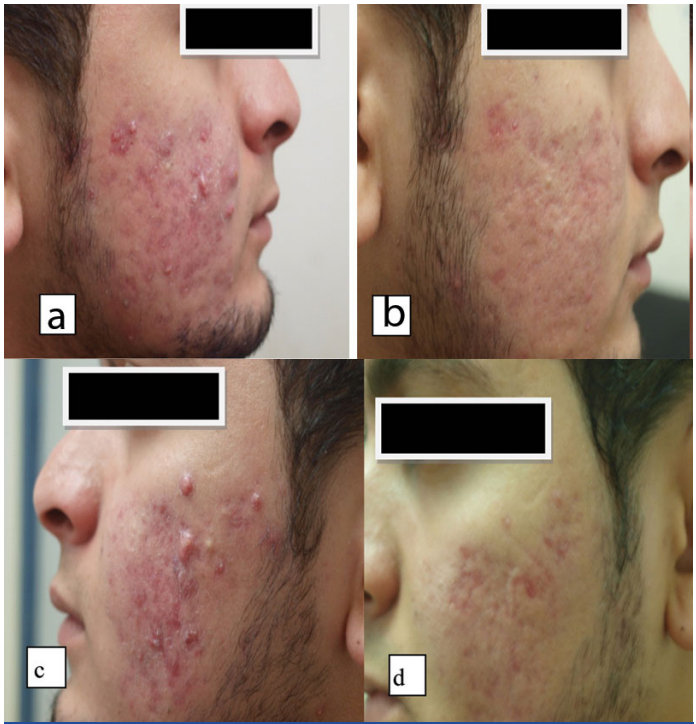
Lasers and light sources that have been developed to treat acne vulgaris fall into two classes either decreasing the levels of *P.acnes* or decreasing the function of the sebaceous unit as a whole [7]. [Table/Fig-3].

Intense pulsed light sources use a flash lamp to emit a non-coherent, non laser, pulsed, broad spectrum of light with different wavelengths (in the ranges of 400-1200nm) depending on their cut-off filters [8,9]. IPL is a FDA-approved phototherapy for the treatment of a variety of conditions such as acne and hirsutism. It utilizes the principle of selective photothermolysis [8].

In the present study, patients were subjected to three sessions of IPL on the right side of the face and 1,064-nm Nd:YAG laser on the left side of the face 9 [Table/Fig-4], the results of the study in the right side of the face (treated with IPL) showed that significant improvement in the inflammatory lesions by penetrating deeper into the skin where it may directly target sebaceous glands and exert anti-inflammatory properties by influencing cytokine release

Type of light source	Wavelength	Mechanism
IPL	400-1200	Bacetricidal on *P. Acne* Antinflammatory effect Alter sebaceous gland function
ND Yag	1064	Antinflammatory effect Alter sebaceous gland functions
PDL	585	Antinflammatory effect Alter sebaceous gland functions
Infrared lasers	1320,1450,1540	Alter sebaceous gland function
Blue light & red light	415;660	Bactericidal effect on *P. Acne*

[Table/Fig-3]: Mechanism of light and laser devices in acne.



[Table/Fig-4]: A 28 year-old man with acne: (a and b) right side of the face (a) before treatment, (b) 4 weeks after 3 IPL treatment sessions. (c and d) left side of the face before treatment (c) before treatment, (d) 4 weeks after 3 Nd-YAG treatment sessions. Clinical improvements were observed on both sides.

from macrophages; while non-inflammatory lesions showed insignificant improvement.

Several studies have reported significant effect of IPL on acne lesion with variable percentages. Elman and Lask [9], treated 19 patients with IPL and showed that 85% of the individuals had a >50% improvement in their acne vulgaris lesions following twice weekly therapy for 4 weeks. Mohanan et al., reported that, IPL was offered to seven patients, 87.5% patients expressed satisfaction with the procedure [10]. No adverse effects were noted.

There are a variety of mechanisms postulated to explain the effect of IPL systems on acne vulgaris, e.g. because of its thermal impact on hyper functioning and enlarged sebaceous glands, IPL could cause a marked decrease in acne lesions count and severity [11,12]. The effect of IPL on acne lesions may be through its effect on small vessels supplying the sebaceous glands associated with inflammation of acne [13]. Ali et al., reported that, intense pulsed light upregulates TGF-β1/Smad3 signaling in perilesional skin obtained from patients with mild-to-moderate inflammatory acne vulgaris [14].

Similar to IPL, the left side of the face (treated with 1,064-nm Nd:YAG laser), showed significant reduction in inflammatory lesions and insignificant reduction of non inflammatory lesions since it has not affected cytokine release by macrophages. Ballin and Uebelhoer, reported that, the low fluence 1,064-nm Nd:YAG laser is a safe, effective, and well-tolerated alternative for patients with acne and who have contraindications to the use of systemic anti-acne therapies [15].

Chun and Calderhead, reported that marked reduction in active acne was observed during treatments with 1,064-nm Nd:YAG laser [16]. The mechanism of long-pulsed Nd:YAG laser on acne patients is not clear. A possible inference from previous studies is that it could be due to damaging sebaceous glands and inducing collagen production in the dermis [17,18].

After reviewing the published data through a detailed PubMed database search, we found no reports comparing 1,064-nm Nd:YAG and IPL in treatment of acne lesions. In our study, there was no statistically significant difference between the two therapies indicating that they share similar mode of action on acne lesions.

CONCLUSION

In conclusion 1,064-nm Nd:YAG and IPL are effective in treatment of acne lesion with minimal side effects, and provide alternatives for patients in which topical or systemic medicines have failed or contraindicated. Therefore, newer therapeutic modalities such as light-based therapy have been developed to address the need for acne treatment. Treatment with IPL and NdYAG sources may offer improvements in inflammatory acne and acne scarring, with more limited benefit for noninflammatory (comedonal) acne.

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PARTICULARS OF CONTRIBUTORS:
1. Assistant Professor, Department of Dermatology and Andrology, Al-Azhar University, Assiut, Egypt.
2. Assistant Professor, Department of Dermatology and Andrology, Al-Azhar University, Assiut, Egypt.
3. Assistant Professor, Department of Dermatology, National Research Centre, Cairo, Egypt.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Mohamed Elsaie,
15 Tarablos Street, Nasr City 11371, Cairo, Egypt.
E-mail: egydoc77@yahoo.com

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