Original Research Article

Effect of Intense Pulse Light Versus fractional co2 laser in Treatment of inflammatory and non-inflammatory Acne Vulgaris Lesions

Abstract

Acne is a common inflammatory and non-inflammatory disorder, associated with socialization and mental health problems that affects more than 80% of teenagers [1]**.** Acne is characterized by inflamed spots, black and white heads on the face, neck, back, and chest. Cysts and scarring can also occur, especially in more severe disease. Various conventional therapies have been introduced, however, Laser still more effective, convenient, and safer therapies, as other therapies have many adverse effects including poor efficacy, recurrence, high cost, irritation, bacterial resistance, and teratogenicity. **Aim:** To study the treatment of different types of acne vulgaris by fractional laser and IPL to assess potential role of their curative effect

Methods: sixty patients with inflammatory and non- inflammatory acne involving their face divided into 2 groups**: group -1:** 30 patients with inflammatory acne received split face treatment 530 nm IPL in one side **(subgroup-A)** and fractional co2 on the other side **(subgroup-B), Group-2:** 30 patients with non- inflammatory acne received split face treatment 530 nm IPL in one side**(subgroup-C)** and fractional co2 on the other side**(subgroup-D).** Treatments once every 2 weeks. Assessments at baseline and after the fourth treatment included lesion counts and the global acne grading system..

Results: No statistically significant difference (p-value > 0.05) between studied groups as regard age and sex. No statistically significant difference (p-value > 0.05) between studied groups as regard acne duration. As regard pre-session acne score, there were: No statistically significant difference (p1 = 0.285). After treatments there were: Highly statistically significant difference (p3 < 0.001) between subgroup- A & subgroup- B. As regard 6th session acne score, there were: Highly statistically significant difference (p1 < 0.001) between subgroup-C & subgroup-D. Highly statistically significant difference (p2 < 0.001).

Conclusion: Regardless of reported complications in fractional co2 laser, which resolved on continuing sessions, the significant improvement in inflammatory lesions and the absence of a significant flare-up of acne as seen among patients treated with IPL however, fractional co2 laser is considered a better therapeutic modality for non – inflammatory acne

Keywords: Fractional Co2 Laser, Intense Pulse Light, Acne Vulgaris

Introduction

Acne vulgaris is a common disorder, that occurs because of sebaceous gland hyperactivity, altered keratinization of ductal keratinocytes and resultant follicular plugging, the hyper proliferation of *Cutibacterium acnes*, and inflammatory signaling.

Adequate control of acne is difficult, regardless of the various conventional modalities. Intense Pulsed Light (IPL) system is one of the emerging options that are become increasingly useful. Despite many studies on the action of yellow light in acne, its efficacy and mechanisms of action are still unclear. IPL can cause a clinical improvement in acne and whether it modifies TLR2 and TNFα expression. TLR2 expression was determined using immunohistochemistry, and TaqMan Low Density Arrays were used to measure TNFα, IL-8 and IL-10.

Fractional CO2 laser is commonly used to treat acne scars. However, it can be used in treatment of active acne lesions as it also tends to treat the enlarged oil glands (especially around the nose), Sun damage, Uneven skin tone and the hyperpigmentation associated with the condition

Long pulse mode is preferred over short pulse to prevent epidermal damage; low fluence is chosen versus high fluence and low density versus high density. Repeated treatments are needed to minimize complications and optimize results; all these must be achieved through a controlled stage of inflammation. Ablative fractional carbon dioxide laser helps to reduce photodamage, recent tan, and pigment at scar base, thus minimizing the risk of post-inflammatory hyperpigmentation.

Methods: sixty patients with inflammatory and non- inflammatory acne involving their face collected from AL-Azhar University hospitals divided into 2 groups:

Group-1: 30 patients with inflammatory acne received split face treatment 530 nm IPL (EMA Doubles II) in one side **(subgroup-A):** Parameters used were wavelength (cut off filter) – 550 nm to 1200 nm, spot size – 40 mm2 × 8 mm2, pulse duration – 5 ms (two pulses), pulse interval – 10 ms, and fluence 20-35 J/cm2 .The fluence was reduced by 20% on forehead and bony prominences to avoid post inflammatory hyperpigmentation and scarring, and fractional co2 on the other side **(subgroup-B),** using CO_2 laser only. DEKA smart idea (Italy made 2015) (REF-MO79S1) (SNUX5) was used with parameters set as follows: power 13W, dwell time 800ms, spacing 600ms, and stack 1.

Group-2: 30 patients with non- inflammatory acne received split face treatment 530 nm IPL in one side**(subgroup-C)** Parameters used were wavelength (cut off filter) – 550 nm to 1200 nm, spot size – 40 mm2 × 8 mm2, pulse duration – 5 ms (two pulses), pulse interval – 10 ms, and fluence 20-35 J/cm2 .The fluence was reduced by 20% on forehead and bony prominences to avoid post inflammatory hyperpigmentation and scarring, and fractional co2 on the other side **(subgroup-D),** using DEKA smart idea (Italy made 2015) (REF-MO79S1) (SNUX5) was used with parameters set as follows: power 13W, dwell time 800ms, spacing 600ms, and stack 1. Treatments once every 2 weeks. Assessments at baseline and after the fourth treatment included lesion counts and the global acne grading system.

List 1 : The global acne grading system

The global acne grading system [2]	
Location	**Factor**
Forehead	**2**
Right cheek	**2**
Left cheek	**2**
Nose	**1**
Chine	**1**
Chest and upper back	**3**

Note: Each type of lesion is given a value depending on severity; no of lesions = 0, comedones = 1, papules = 3 and nodules = 4.

The score foreach area (Local score) is calculated using the formula: Local score = Factor × Grade (0-4). The global score is the sum of local scores, and acne severity was graded using the global score. A score of 1-18 is considered mild; 19-30, moderate, 31-38, severe; and > 39, very severe.

Post-procedure care

We instructed the patients to avoid the followings: washing the face for 24 hours following the procedure, application of topical antibiotic cream and exposure to sun light for at least 7 days after the procedure. The patients were also instructed to use sunscreens before sun exposure. After each sitting and at each follow-up, the side effects were noted. The immediate side effects such as erythema, burning sensation, edema, pain and delayed side effects such as hyperpigmentation, hypopigmentation, milia, blister and scarring were looked for. Appearance of new lesions during treatment was also noted on both sides of the face.

A- **Statistical Analysis**:

An Excel spreadsheet was established for the entry of data. We used validation checks on numerical variables and option-based data entry method for categorical variables to reduce potential errors. The analyses were carried with SPSS software (Statistical Package for the Social Sciences, version 24, SSPS Inc, Chicago, IL, USA). Frequency tables with percentages were used for categorical variables and descriptive statistics (median and interquartile range [IQR]) were used for numerical variables. Independent Student t-test, paired t-test, or Mann-Whitney tests were used to compare quantitative variables, while Chi-square test or McNemar-Bowker tests were used to analyze categorical variables. A p-value < 0.05 is considered statistically significant.

4. Results

This study included 60 patients divided into two groups(I,II) each of them divided into 2 subgroups (A , B and C,D) patients inserted in both groups, treated with fractional Co2 in one half of the face and received IPL at the second half of the face. Sessions were repeated every 2 weeks until complete clearance or a maximum period of 6 months. No statistically significant difference (p-value > 0.05) between studied groups as regard age and sex **(Table-1).**

As regard 2nd session acne score, there were no statistically significant difference (p1 = 0.947) between group 1 & group 2**(Table-2).**

As regard 4th session acne score, there were no statistically significant difference (p1 = 0.546) between group A & group B, highly statistically significant difference (p2 < 0.001) between Subgroup A & subgroup C, highly statistically significant difference (p3 < 0.001) between subgroup B &subgroup D**(Table-3).** However, As regard 6th session acne score, there were highly statistically significant difference (p1 < 0.001) between group A & group B, highly statistically significant difference (p2 < 0.001) between subgroup A & group C, highly statistically significant difference (p3 < 0.001) between subgroup B & group D**(Table-4).** Highly statistically significant difference was found (p1 < 0.001) between acne score follow up (pre, 2nd, 4th & 6th session) in subgroup A **(Table-5).** Also, highly statistically significant difference (p1 < 0.001) between acne score follow up (pre, 2nd, 4th & 6th session) in subgroup B**(Table-6).** highly statistically significant difference

(p1 < 0.001) between acne score follow up (pre, 2nd, 4th & 6th session) in subgroup C **(Table-7).** highly statistically significant difference **(p1 < 0.001)** between acne score follow up (pre, 2nd, 4th & 6th session) in subgroup D**(Table-8).**

Discussion

Acne is a chronic inflammatory disease of the pilosebaceous unit resulting from androgen-induced increased sebum production, altered keratinization, inflammation, and bacterial colonization of hair follicles on the face, neck, chest, and back by *Cutibacterium acnes [3]***.**

Several modalities have been used for treatment of acne including topical and oral agents. However, many side effects have been observed with these agents, such as slow onset of action, limited efficacy, skin irritation, and recurrence [4]**.** Furthermore, clinical trials that were done to assess and compare the effectiveness of acne treatment options are either lacking or have used different designs and methodologies, resulting in a scarcity of strong evidence to support many of the recommendations in acne treatment guidelines. Hence, current guidelines rely on the opinions of experts. Furthermore, for acne associated with systemic diseases, therapeutic information is mostly at the level of case reports [5]**.**

Newer therapeutic modalities such as light-based therapy have been developed to address the need for more efficacious and safer treatment. Several laser systems have been shown to destroy sebaceous glands, including near-infrared lasers and radiofrequency devices that act by thermally damaging the sebaceous glands [6]**.**

[7] explained that the therapeutic effects of fractional Co2 laser in acne were due to induction of sebum output reduction due to sebaceous gland destruction, prevent acne scars and skin remodling[8]. On the other hand, intense pulsed light (IPL) therapy relies on the light absorption of porphyrins produced by *Cutibacterium acnes* bacteria resulting in a cytotoxic effect, but it does not target the sebaceous gland with a risk of recurrence due to bacteria repopulation **.**

The aim of this work was to study the treatment of different types of acne vulgaris by fractional Co2 laser and IPL in comparison to isotretinoin as a comparative study to asses potential role of their curative effect.

Our data showed highly significant improvement in acne score in Co2 laser treated group when compared to IPL treated group in all sessions. Similar observation was reported by **[7]** that compared the efficacy of Nd:YAG laser and IPL in inflammatory and noninflammatory acne lesions. In that study, subjects were randomly and equally assigned into two groups, the Co2 laser and IPL groups. Each group received three sessions of laser 2 weeks apart. Co2 laser treated group showed significant improvement between sessions when compared to IPL treated group.

On the other hand, our data disagreed with the results of [6] that reported no significant difference in the efficacy of the two therapies ($p>0.05$). That study included 72 subjects, each received 3 sessions of IPL on the right side of the face and Co2 laser on the left side of the face at 4-weeks intervals.

[9] reported successful treatment of a case of severe inflammatory acne in a pregnant Asian female with Co2 laser with near 100% reduction in active inflammatory acne lesions and overall improvement of skin texture.

Significant improvement was observed in IPL treated group at the end of treatment sessions but not as significant as other treatment groups. [10] reported that treatment of acne with IPL showed significant reduction in the number of inflammatory lesions when compared to control untreated group ($p<0.001$). [11] also reported significant reductions (~30%) in the comedone and inflammatory lesions count ($p=0.0024$), however, this study lacked presence of controls. In a study by [12], ≥90% clearance or moderate improvement occurred in 29 out of 50 (58%) patients was observed in IPL treated group. None of these studies included Co2 laser as a comparator.

Co2 laser treatments showed significant effect in reduction of acne lesions. Similar findings were reported by [13] in which a sample of 88 subjects were treated with Co2 laser, Only 4 months of treatment were needed to produce at least 85% clinical improvement.

Furthermore, in a study by [14] a good response was observed in 94.8% of the patients aged 12 to 20 years, and in 92.6% of the patients aged 21 to 35 years.

Limitations of our study were small patients' number, short follow-up period, few treatment sessions, and not being a spilt-face study for a better comparison of the results. The Research Ethics Committee in our institute only approves the studies based on the intention to treat.

6. Conclusion

Regardless of reported complications in the Nd:YAG group, which resolved on continuing sessions, the significant improvement in non-inflammatory lesions and the absence of a significant flare-up of acne as seen among patients treated with IPL make Nd:YAG a better therapeutic modality for acne.

Table (1): Comparison between studied groups as regard age & sex

		Group 1 (N = 30)	Group 2 (N = 30)	Test	p-value
Age (years)	**Median**	24.5	23.5	KW = 3.7	0.154 NS
	IQR	22 - 28	20 - 26		
Sex	**Male**	0 0%	0 0%	-----	-----
	Female	30 100%	30 100%		

KW: Kruskal Wallis Test. NS: p-value > 0.05 is considered non-significant.

Table (2): Comparison between studied groups as regard acne score (2nd session).

2nd session		Group 1 (N = 30)	Group 2 (N = 30)	Test	p-value
Acne score	**Median**	22	21	445.5*	P = 0.947 NS
	IQR	15 - 27	17 - 26		
Acne score	**Mild**	9 30%	15 50%	2.5 **	P = 0.144 NS
	Moderate	21 70%	15 50%		
	Severe	0 0%	0 0%		

*: Mann-Whitney U. S: p-value < 0.05 is considered significant.

**: Chi-square test. NS: p-value > 0.05 is considered non-significant.

Table (3): Comparison between studied groups as regard acne score (4th session).

4th session		Group A (N = 30)	Group B (N = 30)	Group C (N = 30)	Group D (N = 30)	Test	p-value
Acne score	Median	12.5	14	23	18	409.5*	P1 = 0.546 NS
	IQR	7 - 17	10 - 17	19 - 24	15-22	99* 175.5*	**P2 < 0.001 HS** **P3 < 0.001 HS**
Acne score	Mild	30 100%	24 80%	6 20%	0 0%	6.66 **	**P1 = 0.01 S**
	Moderate	0 0%	6 20%	21 70%	7 23%	40 **	**P2 < 0.001 HS**
	Severe	0 0%	0 0%	3 10%	23 76.6%	22.1 **	**P3 < 0.001 HS**

*: Mann-Whitney U test. S: p-value < 0.05 is considered significant.

**: Chi-square test. HS: p-value < 0.001 is considered highly significant.

NS: p-value > 0.05 is considered non-significant.

Table (4): Comparison between studied groups as regard acne score (6th session).

		Group-1(N = 30)		Group-2 (N = 30)			
6th session		Subgroup A	Subgroup B	Subgroup C	Subgroup D	Test	p-value
Acne score	Median	3.5	7	18.5	9.4	306*	**P1 < 0.001 HS**
	IQR	0 - 8	3 - 9	17 - 21	11-14	63* 108*	**P2 < 0.001 HS** **P3 < 0.001 HS**
Acne score	Mild	30 100%	22 73.3%	15 50%	9 30%	--- **	P1 = ----
	Moderate	0 0%	8 26.6 %	15 50%	21 70%	20 ** 20 **	**P2 < 0.001 HS** **P3 < 0.001 HS**

*: Mann-Whitney U test. HS: p-value < 0.001 is considered highly significant.

**: Chi square test.

Table (5): Comparison between studied groups as regard acne score (6th session) in subgroup A.

		Sub Group A				Test	p-value
		pre	2nd	4th	6th		
Acne score	Median	31.5	22	12.5	3.5	**KW = 92.9**	**< 0.001 HS**
	IQR	25 - 36	15 - 27	7 - 17	0 - 8		
Acne score	Mild	0 0%	9 30%	30 100%	30 100%	**X2 = 123.04**	**< 0.001 HS**
	Moderate	15 50%	21 70%	0 0%	0 0%		
	Severe	15 50%	0 0%	0 0%	0 0%		

KW: Kruskal Wallis Test. HS: p-value < 0.001 is considered highly significant.

X*: Chi square test.

Table (6): Comparison between studied groups as regard acne score (6th session) in subgroup B.

		Sub Group B								Test	p-value
		pre		2nd		4th		6th			
Acne score	Median	29		21		14		7		KW = 81.7	< 0.001 HS
	IQR	23 - 35		17 - 26		10 - 17		3 - 9			
Acne score	Mild	0	0%	15	50%	24	80%	30	100%	X2 = 92.6	< 0.001 HS
	Moderate	15	50%	15	50%	6	20%	0	0%		
	Severe	15	50%	0	0%	0	0%	0	0%		

KW: Kruskal Wallis Test. HS: p-value < 0.001 is considered highly significant.

X2: Chi square test.

Table (7): Comparison between studied groups as regard acne score (6th session) in subgroup C.

		Sub Group C								Test	p-value
		pre		2nd		4th		6th			
Acne score	Median	30		26.5		23		18.5		KW = 44.7	< 0.001 HS
	IQR	25 - 35		22 - 29		19 - 24		17 - 21			
Acne score	Mild	0	0%	3	10%	6	20%	15	50%	X2 = 44	< 0.001 HS
	Moderate	15	50%	21	70%	21	70%	15	50%		
	Severe	15	50%	6	20%	3	10%	0	0%		

Table (8): Comparison between studied groups as regard acne score (6th session) in subgroup D.

		Sub Group D				Test	p-value
		pre	2nd	4th	6th		
Acne score	Median	24	23.4	20	15.5	KW = 42.4	< 0.001 HS
	IQR	25 - 32	19 - 25	19 - 24	17 - 21		

Acne score	**Mild**	0	0%	3	10%	6	20%	15	50%	**X2 = 42**	**< 0.001 HS**
	Moderate	15	50%	23	76.7%	21	70%	15	50%		
	Severe	15	50%	7	23%	3	10%	0	0%		

Figure-1: male patient of group I with subgroup A (Left) treated by IPL laser and Subgroup B(Right) treated by fractional CO2 laser.

Figure-2: female patient of group II with subgroup A (Left) treated by IPL laser and Sub group B(Right) treated by fractional CO2 laser.

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