

ERBIUM-YAG LASER ALONE VERSUS ERBIUM-YAG LASER WITH PLATELET RICH PLASMA IN TREATMENT OF ATROPHIC ACNE SCARS

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Aim of the work : To evaluate the efficacy of Erbium-YAG laser alone and in combination of platelet-rich plasma (PRP) in atrophic post acne scars.

Patients and Methods: This study was a prospective non randomized clinical trial. 50 patients were included in this study, examined and divided into two groups. Group A included 25 patients were subjected to 6 Erbium-YAG laser sessions over 6 months period while group B included 25 patients were subjected to 6 Erbium-YAG laser sessions plus 12 microneedling sessions with PRP over the same period. Evaluation was carried out through operating physicians, two blinded physicians as well as through patient's satisfaction.

Results: Both modalities of treatment showed improvement of acne scars but the improvement with combined Erbium-YAG laser and PRP was better than Er-YAG laser alone (*p value = 0.0158*) with less side effects and better patients' satisfaction (*p value = 0.022*).

Conclusion: We concluded that both modalities of treatment are effective and safe in treatment of acne scars but the combination of PRP plus laser was superior to laser alone with higher response and less side effects.

Key words: Acne scars; Erbium-YAG laser; platelet-rich plasma (PRP)

INTRODUCTION:

Acne is a common disorder affecting up to 80% of young adults and up to 5% of older adults. Multiple factors are implicated in the pathogenesis of acne including increased sebum production, abnormal follicular keratinization, colonization with *Propionibacterium acnes*, and a lymphocytic and neutrophilic inflammatory response¹. Acne scarring is an unfortunate complication of acne vulgaris occurring in 90% of patients. Acne scarring causes severe psychological depression, social withdrawal and poor self-esteem². Scarring usually results from severe inflammatory nodulocystic acne, but it may also be the consequence of superficial inflamed lesions or the squeezing or picking of

lesions with the fingernails. There are three general types of acne scars, depending on hyper proliferation or loss of collagen: hypertrophic scars, keloid scars or atrophic scars³. Atrophic scars are the most common; seen in almost 80% to 90% of patients, present clinically as indentations in the skin due to loss of collagen and destructive inflammation in the deep dermis with subsequent contraction. Different scoring and grading systems were proposed to evaluate acne scars. Goodman and Baron (2006) presented quantitative scoring based on the number, type of scar (atrophic, macular, boxcar, hypertrophic, and keloidal), and severity (mild, moderate, and severe)⁴. They also added a Qualitative Global Grading System, which was a simplified one⁵. Qualitative Global Scarring Score

takes into account the form, intensity, type, and evolution period of the scars ⁶. Fractional non ablative resurfacing employs a unique mechanism of action that repairs a fraction of skin at a time. The laser is used to resurface the epidermis and at the same time to heat the dermis to promote safely the formation of new collagen. The primary target is both the epidermis and dermis with the aim of creating small zones of micro-damage separated by zones of non-irradiated tissue that assist with the rapid healing process ⁷. Platelet-rich plasma (PRP) is an autologous concentration of human platelets in a small volume of plasma. It contains growth factors, especially epidermal growth factor, platelet-derived growth factor, transforming growth factor beta, and vascular endothelial growth factor ⁸. These factors are known to regulate various processes including cell migration, attachment, proliferation, and differentiation and to promote extracellular matrix production by binding to specific cell surface receptors ⁹. PRP has been used in many fields of medicine and surgery to promote wound healing and accelerate the formation of newly formed tissue in addition to the cosmetic applications in the rejuvenation and treatment of hair disorders ¹⁰. The goal of this study was to evaluate combination of PRP and Er-YAG laser because of the potential synergistic effect and the possible dampening of expected side effects. Therefore, this prospective non- randomized comparative clinical trial was conducted to compare the efficacy and safety of combining autologous PRP with Er-YAG laser in the treatment of atrophic acne scars with that of Er-YAG laser alone.

PATIENTS AND METHOD:

Patients:

This study was performed at the Outpatient Clinic of Dermatology, Venerology and Andrology department, South Valley University

on 50 patients complaining of atrophic post acne scars. Patients were recruited from June 2017 to August 2018 to compare the efficacy of fractional Erbium-YAG laser alone and with PRP in treatment of atrophic acne scars. The experimental design was approved by the Institutional Ethics and Research Committee of Faculty of Medicine, South Valley University, Egypt. Informed written consent was obtained from each participant before enrollment in the study. Patients with positive history of keloidal tendency, positive history of bleeding tendency, platelet disorder, positive history of major surgery in past 6 months, patients with any acute infection on face like, herpes, folliculitis, patients with HIV, HBsAg, patients with a history of systemic retinoid therapy within the last 6 months or patients with diabetes mellitus, collagen vascular disease or patients on immunosuppressive drugs were excluded from the study. Pregnant and lactating women were also excluded.

Methods:

Each participant was subjected to full medical history and clinical examination including general and local examination with diagnosis of scar type according to the predominant type (ice pick scars , boxcar scars or rolling scars) . Patients were graded prior to the treatment according to the qualitative scarring grading system of Goodman and Baron. ⁵

Treatment Protocol

50 patients were enrolled in this study and they were divided as follows:

1. Group A (25 patients) were subjected to 6 fractional non ablative Erbium-YAG laser (Fotona Xs Dynamics, Slovenia) sessions with 4 weeks interval.
2. Group B (25 patients) were subjected to 6 fractional non ablative Erbium-YAG laser (Fotona Xs Dynamics, Slovenia) sessions with 4 weeks interval between sessions in addition to 12 sessions of microneedling with PRP with 2 weeks interval between sessions.

Laser parameters were as follows: 5 passes in vertical, horizontal, and oblique directions were done over scar areas. Parameters for each setting were kept constant in all patients.

The 1st pass was done on all face with parameters: energy 600 mJ, with micro-short pulse mode (MSP), spot size 7 mm in diameter, frequency 5 Hz. The 2nd pass was done with the same parameters but to scars area only. The 3rd pass was done to scar area only with parameters: energy 1000 mJ, with short pulse mode (SP), spot size 7 mm in diameter, frequency 5 Hz. The 4th pass was done on scar area only with parameters: energy 1200 mJ, with short pulse mode (SP), spot size 7 mm in diameter, frequency 5 Hz. The 5th pass was done to scar area only with parameters: energy 1500 mJ, with Extra-long pulse mode (XLP), spot size 7 mm in diameter, frequency 5 Hz.

PRP preparation

10 ml of venous blood was obtained under sterile condition and then collected in sterile tubes containing Na Citrate 3.8%. Each tube was centrifuged at 2000 (rpm) for 7 minutes. The plasma and buffy coat were gently aspirated from each tube and transferred to a second tube (plain tube without anticoagulant). Further centrifugation was carried out at 4000 rpm for 7-10 minutes thus obtaining a two-part plasma: the uppermost part, consisting of platelet-poor plasma (PPP), and the lower part, consisting of PRP.

Injection was done via using of microneedling device (Derma roller, 540 needles, YMR microneedling roller system, China) with 1.5 mm depth. The derma roller device was applied over the skin with one hand while stretching the skin with the other hand so that the base of the scars could be reached. The device was moved back and forth in 4 directions (horizontally, vertically, and diagonally right and left) until uniform pinpoint bleeding was seen. Then the device was cleaned with alcohol after each session.

Outcome assessments

Clinical Assessment: Standardized high-resolution digital photographs using identical camera settings were obtained before the start of treatment, at 3 months after, and after end of treatment. The patients were evaluated using the pre-treatment & post-treatment photographs and clinically examined and graded according to the qualitative scarring grading system of Goodman and Baron with comparison between the pre-treatment and post-treatment grading for each patient to determine the degree of improvement.

Clinical improvement: two non-treating blinded physicians compared photographs using a four-point scale for assessment of clinical improvement of skin smoothness (grade 4, >75% = excellent improvement; grade 3, 51–75% = marked improvement; grade 2, 26–50% = moderate improvement; grade 1, 0–25% = minimal improvement).

Patient satisfaction: of the patients was also recorded on a four-point scale. Grade 4 highly satisfied, Grade 3 satisfied, Grade 2 neutral and Grade 1 dissatisfied.

RESULTS

This study included 50 patients complaining of atrophic post-acne scars. The age of the participants ranged between 18 and 38 years old with a mean of 26.68 ± 5.13 years old. 18 patients were males (36%) and 32 patients were females (64 %). The duration of their post-acne scars ranged between 1 and 8 years with a mean of (4.56 ± 1.92) with no statistically significant difference between the 2 groups regarding age, sex or duration of scarring (**Table 1**).

According to the Fitzpatrick classification of skin photo types, 8 patients (16%) were type III, 35 patients (70 %) were type IV, and 7 patients (14 %) were of skin type V. The clinical types of acne scars were determined prior to treatment and classified according to the predominant type into Boxcar scars in 19 patients (38 %), ice pick scars in 17 patients (34 %) and rolling scars in 14 patients (28%).(**Table 2**).

Table 1. Comparison between the study groups regarding sociodemographic data

Parameter	Group A (N= 25)	Group B (N= 25)	P-value
Age (years) Mean± S.D. Median (Range)	26.68 ± 5.13 26 (19 – 38)	25.68 ± 5.34 25 (18 – 36)	0.503
Sex Male Female	8 (32%) 17 (68%)	10 (40%) 15 (60%)	0.556
Marital status Single Married Divorced	10 (40%) 13 (52%) 2 (8%)	11 (44%) 13 (52%) 1 (4%)	0.827
Duration of scarring Mean± S.D. Median (Range)	4.72 ± 1.69 5 (2 – 8)	4.56 ± 1.92 5 (1 – 8)	0.729

Table 2. Comparison between the study groups regarding skin photo type and duration of scars

Parameter	Group A (N= 25)	Group B (N= 25)	P-value
Skin phototype 3 4 5	4 (16%) 17 (68%) 4 (16%)	4 (16%) 18(72%) 3 (12%)	0.918
Duration of scarring Mean± S.D. Median (Range)	4.72±1.69 5 (2 – 8)	4.56±1.92 5 (1 – 8)	0.729
Predominant type of scarring Boxcar scar Ice pick scar Rolling scar	9 (36%) 10 (40%) 6 (24%)	10 (40%) 7 (28%) 8 (32%)	0.648

The severity of acne scars before treatment was graded according to Goodman and Baron's qualitative scar scale. And at baseline, , In group (A) patients were graded as follows ; 4 patients (16%) were mild , 13 patients (52%)

were moderate , 8 patients (32%) were sever. While in Group (B) patients were graded ; 5 patients(20%) were mild , 14 patients (56%) were moderate , 6 patients (24%) were sever. After 6 months of treatment, the patients were re-evaluated and assessed by the Goodman and Baron's qualitative scar scale and clinical improvement and patient satisfaction.

Acne scars showed a reduction of severity according to Goodman and Baron's qualitative scar scale. After treatment patients were graded as follows ; in Group (A) ; 2 patients (8%) were macular , 7 patients (28%) were mild , 11 patients (44%) were moderate , 5 patients (20%) were sever which denotes that there was a statistically significant improvement after treatment (*p value* = **0.002**). While in Group (B) ; 5 patients (20%) were macular , 11 patients (44%) were mild , 6 patients (24%) were moderate , 3 patients (12%) were sever which denotes that there was a statistically significant improvement after treatment(*p value* = **0.001**) and the difference between the post-treatment scores for the two groups was statistically significant (*P value* = **0.0009**). (Table 3,4).

Table 3. Comparison between pre and post treatment grade of acne scars of the 2 study groups according to Goodman and Baron's qualitative scar scale.

Parameter	Group A (N= 25)	Group B (N= 25)	P-value
Pre-treatment scaring grade			
Mild Moderate Severe	4 (16%) 13 (52%) 8 (32%)	5 (20%) 14(56%) 6 (24%)	0.805
Post-treatment scaring grade			
Macular Mild Moderate Severe	2 (8%) 7 (28%) 11 (44%) 5 (20%)	5 (20%) 11(44%) 6 (24%) 3 (12%)	0.0009

Table 4. Comparison between pre and post treatment grade of acne scars of each group according to Goodman and Baron’s qualitative scar scale.

Grade of acne scars	Pre-treatment	Post-treatment	P-value
Group A			
Macular	0 (0.0%)	2 (8%)	0.002
Mild	4 (16%)	7 (28%)	
Moderate	13 (52%)	11 (44%)	
Severe	8 (32%)	5 (20%)	
Group B			
Macular	0 (0.0%)	5 (20%)	<0.001
Mild	5 (20%)	11 (44%)	
Moderate	14 (56%)	6 (24%)	
Severe	6 (24%)	3 (12%)	

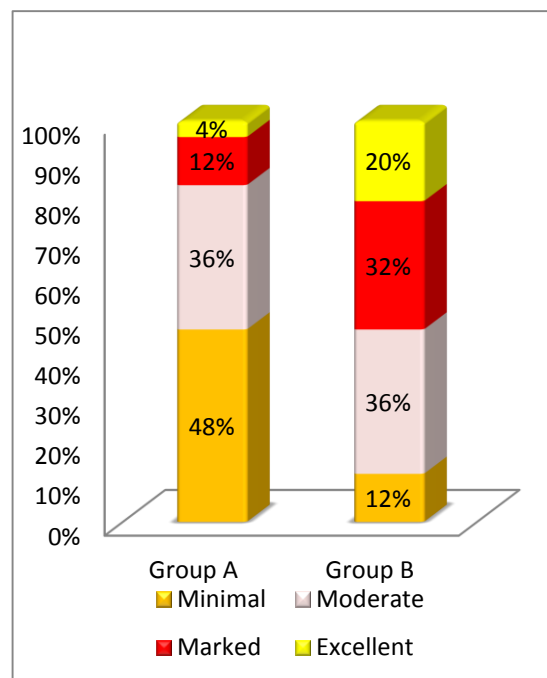
Regarding clinical improvement, Patients were evaluated according to four point scale for clinical improvement. Group (A) showed minimal improvement in 12 patients (48%) , moderate improvement in 9 patients (36%) , marked improvement in 3 patients (12%) and excellent improvement in 1 patient (4%).

The clinical improvement is better shown in pictures taken before and after treatment (**Picture 3**).

On the other hand, Group (B) showed excellent improvement in 5 patients (20%), marked improvement in 8 patients (32%), moderate improvement in 9 patients (36%) and minimal improvement in 3 patients (12%). The clinical improvement of combined treatment group is shown in pictures (**Picture 1,2**).

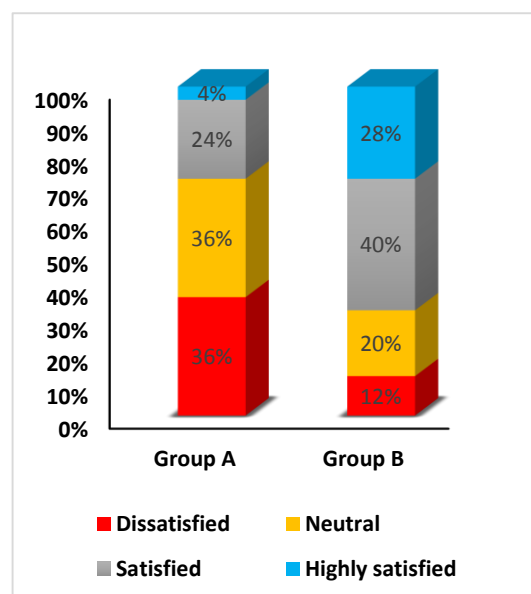
The overall improvement of group (B) was better than Group (A) with statistically significant difference (*p value = 0.0158*). (**Figure1**)

(Figure 1): Comparison between the study groups regarding clinical improvement

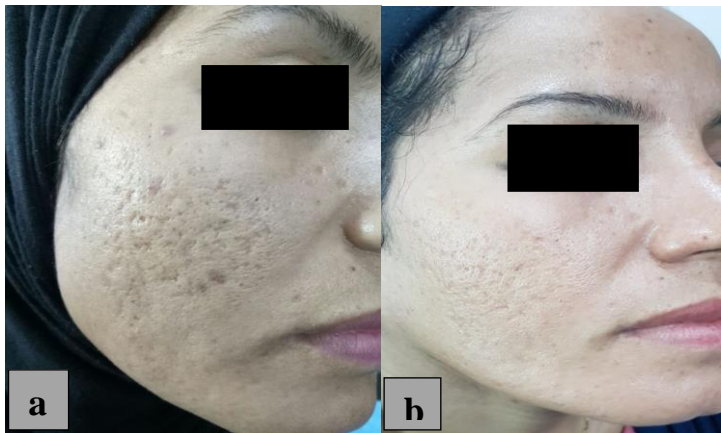


According to four point scale of patients’ satisfaction survey, Patients of the combined treatment group showed more satisfaction with statistically significant difference between the 2 groups. (*P value= 0.022*)(**Figure 2**)

Figure (2): Comparison between the study groups regarding patient satisfaction



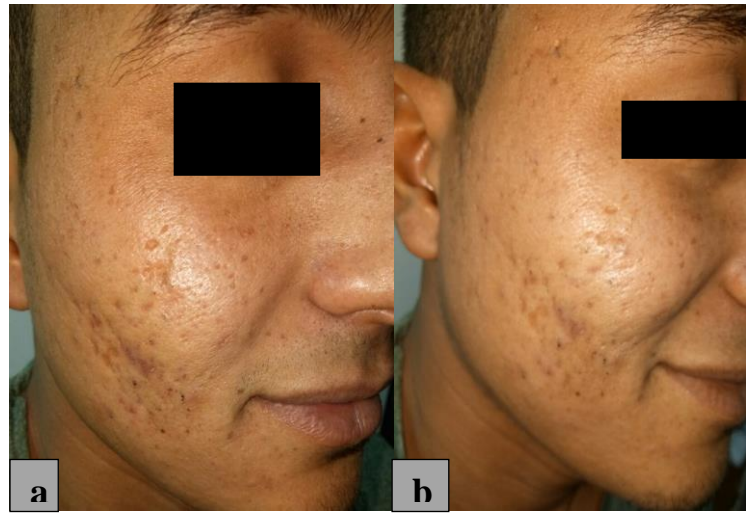
Follow Up for all patients was carried out after 1 week of each session for early complications. The degree of facial erythema was evaluated through the Clinician Erythema Assessment Scale (CEA)¹¹, which was graded as clear, almost clear, mild, and moderate. Other adverse effects including post-inflammatory hyperpigmentation, acneiform eruption were observed and recorded. There was no statistically significant difference between the 2 groups regarding the adverse effects.



Picture 1: shows right side of the face of female patient of group (B);(a) before and (b) after treatment with combined laser &PRP sessions.



Picture 2: shows right side of the face of female patient of group (B);(a) before and (b) after treatment with combined laser &PRP sessions.



Picture 3: shows Left side of the face of male patient of group (A); (a) before and (b) after treatment with laser sessions only.

DISCUSSION

Acne scarring is a consequence of impaired resolution due to damage of sebaceous follicles during active inflammation. Acne scarring causes low self-esteem and significant psychological depression to the affected patients. There is no standard treatment option for the treatment of acne scars however; various therapeutic modalities are used with variable clinical success and complications¹².

In this study, 50 patients with atrophic post acne scars were included, non-randomly divided into two groups; 25 patients were subjected to Six fractional non ablative Erbium-YAG laser sessions with four weeks interval between sessions, 25 patients were subjected to Six fractional non ablative Erbium-YAG laser sessions with four weeks interval between sessions in addition to twelve sessions of microneedling with platelet rich plasma with two weeks interval between sessions.

Our results showed that all patients in the current study showed improvement regardless of treatment modality, although significantly better clinical results were observed with combined treatment with fractional Er:YAG laser and microneedling with PRP than fractional Er:YAG laser alone . Our results showed statistically significant clinical improvement in (Group A) receiving fractional Er:YAG laser alone.

There was also a statistically significant reduction in the severity of acne scars in all patients after treatment. Acne scars showed a reduction of severity according to Goodman and Baron's qualitative scar scale with statistically significant improvement after treatment in group A. And statistically significant improvement after treatment in group B and the difference between the post-treatment scores for the two groups was statistically significant.

These findings were in agreement with Gokalp, who demonstrated that atrophic scars had a significantly better response to non-ablative fractional laser treatment¹³.

Additionally, our results also agreed with Yang et al. who found that the improvement in acne scars after the fractional Er:Glass laser 1550-nm treatment was more significant than the control side¹⁴.

Our PRP results were supported by Asif et al. who concluded that PRP has efficacy in the management of atrophic acne scars. It can be combined with microneedling to enhance the final clinical outcomes in comparison with microneedling alone¹⁵.

Recently, Ibrahim et al. performed a study that agreed with our results. The study concluded that both microneedling and microneedling in combined with PRP showed satisfactory results¹⁶.

On the other hand, our results did not agree with those Chan et al., who used ablative fractional laser for the treatment of acne scars and skin rejuvenation in Asian patients¹⁷.

Also our study was in disagreement with Kim et al. who used intradermal radiofrequency combined with autologous PRP in the treatment of striae distensae; it was administered to the participants once every 4 weeks. Most of the participants did not show satisfactory changes¹⁸.

CONCLUSION

In conclusion, the current study introduces the combination of microneedling with PRP and

Erbium-Yag laser as an effective and safe modality in the treatment of atrophic acne scars with short downtime and good tolerability.

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