



EFFICACY OF MICRONEEDLING VERSUS FRACTIONAL CO₂ LASER IN TREATMENT OF ATROPHIC FACIAL ACNE SCAR: A RANDOMIZE CONTROL TRAIL

Mehak Mukhtar¹, Arfa Ikram^{2*}, Javeria Javed³, Amina Rahat⁴, Assad Ullah⁵

¹Emergency Satellite Hospital, Nahaqi Peshawar, Pakistan

^{2*}Department of Dermatologist, Lady Reading Hospital (LRH) Peshawar, Pakistan

³Department of Radiology, Khyber Teaching Hospital (KTH), MTI Peshawar

⁴Department of Food & Nutrition, College of Home Economics, University of Peshawar

⁵Department of Livestock Gombat Hospital, Kohat

***Corresponding author:** Arfa Ikram

*Department of Dermatologist, Lady Reading Hospital (LRH) Peshawar, Pakistan.

Email: arfaikram123@gmail.com

Abstract

Introduction: Post-acne scarring is very distressing for the patient and difficult for dermatologists to treat. Many treatments are available for treating post acne scars but optimized treatment does not still exist. Microneedling and CO₂ laser are both promising modalities in treatment of post acne scarring and have both resulted in clinical improvement.

Objectives: The main objective of the study is to evaluate the efficacy of fractional CO₂ laser in comparison with micro needling fractional radiofrequency in the management of post acne scars.

Material and methods: It was a randomized controlled trial conducted in dermatology unit of Lady Reading Hospital, Peshawar from 12th of October 2020 to 10th March, 2021. Total of 188 patients enrolled in the study, all suffering from atrophic facial acne scars having an age range between 16-40 years. The 188 patients were randomly divided into two groups by lottery method, each involved 94 patients; group A received micro needling radiofrequency, and group B included patients who were offered fractional CO₂ laser. Both groups statistically matched regarding age, gender, severity of acne scars. Efficacy was evaluated after 5 months of treatment and determined in terms of the percentage of number of lesions cleared from baseline. A clearance of more than 50% of lesions from baseline would be considered effective at 5th month follow up.

Results: Results exposed that, both group of patients displayed statistically significant percentage of improvement ($p < 0.05$). As per calculated sample size, a total of 188 patients i.e. 94 patients in each group were divided into two groups, A and B. Group with fractional CO₂ laser treatment showed 88.3% efficacy i.e. 83 patients showed improvement while those receiving microneedling therapy were 84% effective i.e. 79 patients showed more than 50% improvement in lesions from base line.

Conclusion: It is concluded that, our study highlights that the treatment of atrophic facial acne scars fractional CO₂ laser is more effective then micro needling radiofrequency sessions.

Keywords: Fractional Carbon dioxide laser, Micro-needling, Atrophic Facial Acne Scar, Randomized Control Trail.

Introduction

Acne vulgaris is the most inflammatory illness of pilosebaceous part occur in young persons and teenager which cause multiple troubling and hard to treat scars [1]. It is a common condition with prevalence as high as 80% among adolescents and persists to adulthood². Scarring can be a complication of untreated acne due to skin injury through the mechanism of heals of skin [2]. Two kinds found according to decrease or increase of collagen: atrophic plus hypertrophic [3]. Atrophic one occur due to decrease of collagen post inflammatory acne. There are three types-ice pick, rolling and boxcar [4]. Scarring occur after acne is considered worrying difficulty. Severe scarring is associated with psychological distress, particularly in young adults, and often results in decreased self-confidence and diminished quality of life [5]. Various treatment modalities are used for acne scars including not invasive and invasive procedures, noninvasive: (biochemical peels, retinoid topically, microdermabrasion) and small invasive: (lasers, small needle radio frequency apparatus) and invasive: (surgery for acne scar, laser for ablation), each technique with benefits and difficulties [1, 6]. Treatment of acne scarring is a common indication for ablative lasers, more improvement is seen after CO₂ laser than other techniques. The fractional devices, both ablative and non-ablative, have been used for traditionally [2,6].

The improvement in appearance of acne scars following fractional CO₂ laser is due to the combination of processes of healing that initiates new collagen deposition after ablation and collagen remodeling initiated by the zone of coagulation surrounding the ablated area 7,8. CO₂ lasers produce significant improvement at the cost of long recovery times and post-inflammatory hyperpigmentation⁹. Micro needling fractional radiofrequency (MFR) is a recent procedure for managing scars and not lead to damage theepidermis¹⁰. MFR lead to formation radio frequent thermal regions with no epidermal damage¹¹. This study is aimed to compare between the efficacy of fractional CO₂ laser and micro needling radiofrequency for treatment of acne scars among Iraqi patients. Aim also includes performing subjective evaluation and assessment of clinical improvement of acne scar patients after treatment period for both therapeutic modalities based on photographic documentation.

Objectives

The main objective of the study is to compare the efficacy of microneedling versus fractional CO₂ laser in atrophic acne scar treatment.

Material and methods

Total sample size was 188 patients (94 patients in each group), using 46.66% efficacy of CO₂ laser and 26.67% efficacy of microneedling, 80% power of the test and 95% confidence level, using WHO software for sample size determination.

Inclusion criteria:

- Patients with grade 2 and 3 acne scars according to Goodman and Baron's quantitative and qualitative scale.
- Either gender males/females.
- Age range 16 to 40.
- No active acne.

Exclusion criteria:

- Patients with active acne.
- Patients with active herpes labialis or other local infection within the treatment area.
- Patients with keloidal tendency.

- Use of oral isotretinoin in last 6 months.
- Immunosuppression.
- Patients who lost follow-up after initial visits and patients not willing to participate in study.

Data collection

The statistical analysis was performed using SPSS 20 version. Mean and standard deviation was calculated for continuous variable like age and size of lesions at baseline. Frequencies and percentage were calculated for categorical variables like gender and efficacy. Efficacy was stratified with age, gender, no of lesions, size of lesions and duration of lesions to see effect modification Post-stratification chi square test was applied in which p value ≤ 0.05 was considered as significant. Moreover, comparison between both the groups are done with the help of chi-square test and cross tabulation in which p value ≤ 0.05 was considered as significant. Results were shown in the form of tables, bar and pie charts.

Results

All the 188 patients finished the study period of 4 monthly sessions and including the two month follow-ups. Patients in both groups were matched regarding age, gender, and severity of acne scar agreeing to Goodman besides Baron measure. The age range for all patients in the study was between 16-40 years with mean of (28 years), more than half of patients (57 in number) located in the age interval of 25-32 years, followed in frequency the age interval 16-24 years (34 patients) forming (22% and 13% each group), the another age interval belongs to was 33-40 years, with 40 patients found as shown in table no. 1. Regarding gender distribution in the study females (45 women) were found to form (22.3% and 25.5% from each group) out from all patients while 143 males (78% and 74% from each group) randomly were enrolled in the study as exposed in table no. 1. In Group A, the mean value of age of patient was 29.02 and in group B, 27.27 mean value of patients' age was observed (Table No 2). In Group A, the mean value of number of lesions was 16.649 and in group B, 17.6277 mean value of no of lesions was observed (Table No 3). In Group A, the mean value of duration of lesions was 13.348 and in group B, 15.702 mean value of duration of lesions was observed (Table No 4). According to patients' percentage improvement from the baseline, 109 patients out of 188, in which 52 (55.3%) patients from group B (CO₂) and 57 (60.6%) patients from group A (microneedling) showed 50% to 75% clearance of lesions. Similarly 31 patients (33%) from group B (CO₂) showed more than 75% clearance while 22 patients (23.4%) from group A showed excellent results (Table no. 5). The severity of scarring was also evaluated at baseline, 28 (15%) patients had mild grade i.e. grade 2, while 160 (85%) patients in the study had moderate to severe (grade 3) acne scar according to Goodman and Baron scale (Figure no. 4). On comparing the efficacy of all the two treatment modalities, based on mean percentage of improvement in Goodman and Baron quantitative grades, the efficacy of fractional CO₂ laser was significantly greater than that of Micro needling. (Figure no. 5). For patients in group A, the average Goodman and Baron scale baseline mean score and standard deviation was 2.52 ± 0.74 whereas, mean score after treatment was 2.67 ± 0.62 . For group B patients the average baseline average score was 2.57 ± 0.43 and the average final score was 2.04 ± 0.03 . The comparison of efficacy with baseline scores before treatment for group A and B were insignificant ($P=0.572$ greater than 0.05), whereas the final scores for both groups after treatment showed statistically significant ($P=0.001$ less than 0.05) (Table no. 6).

Out of 94 patients offered CO₂ laser 90 responded were improved and satisfied while 4 were not. Whereas patients offered micro needling 81 responded improvement while 13 not. Both the results are significant with p-value less than 0.05. (Table no. 7). Association between level of stratification of efficacy with respect to gender was also observed. Results showed statically significance relation of stratification of efficacy with respect to male ($P=0.05$) whereas statically insignificance relation of stratification of efficacy with respect to female ($P=0.234$) (Table no. 8). Association between level of stratification of efficacy with respect to age was also observed. Patients with the age 25-32 had greater

participation followed by 33-40 years and 16-24 years. P value was greater than 0.05 which indicate the acceptance of null hypothesis that is there is no significance association of age on the stratification of efficacy level in both the groups. (Table no. 9) . Stratification of efficacy with respect to number of lesions also been analysed in the table no. 10. In group A, 11-20 number of lesions were more stratified followed by more than 20 and 0 to 10 while two, eight and three patients were not satisfied with the 0-10, 11-20 and more than 20 respectively. Whereas in case of group B, 11-20 number of lesions were more satisfied followed by more than 20 and 0 to 10 while only and three patients were not satisfied with the 11-20 and more than 20 respectively. P-value calculated separately for both the treatments and found significant in both groups (p-value = 0.03 for microneedling and p-value = 0.05 for CO₂) (Table no. 10) . Stratification of efficacy with respect to duration of lesions been analysed in the table no. 11. In group A, efficacy was 29 in 11-20 weeks and more than 20 weeks both while efficacy was 23 in category of less than 10 weeks. Whereas in case of group B, efficacy was 35 in category of 11-20 weeks followed by more than 20 weeks (29) and less than 10 weeks (26). The P-value of overall stratification of efficacy of both treatment with respect to duration of lesions was observed to be insignificant i.e., 0.303 greater than 0.01. (Table no. 11)

Table no.1: Descriptive statistics of patients' gender and age.

Characteristics		No. of patients (%)		
		Group A (n=94)	Group B (n=94)	Total (n=188)
Gender	Male	73 (77.7)	70 (74.5)	143
	Female	21 (22.3)	24 (25.5)	45
Age	16-24	21 (22.3)	30 (31.9)	51
	25-32	57 (60.6)	57 (60.6)	114
	33-40	16 (17.0)	7 (7.4)	23

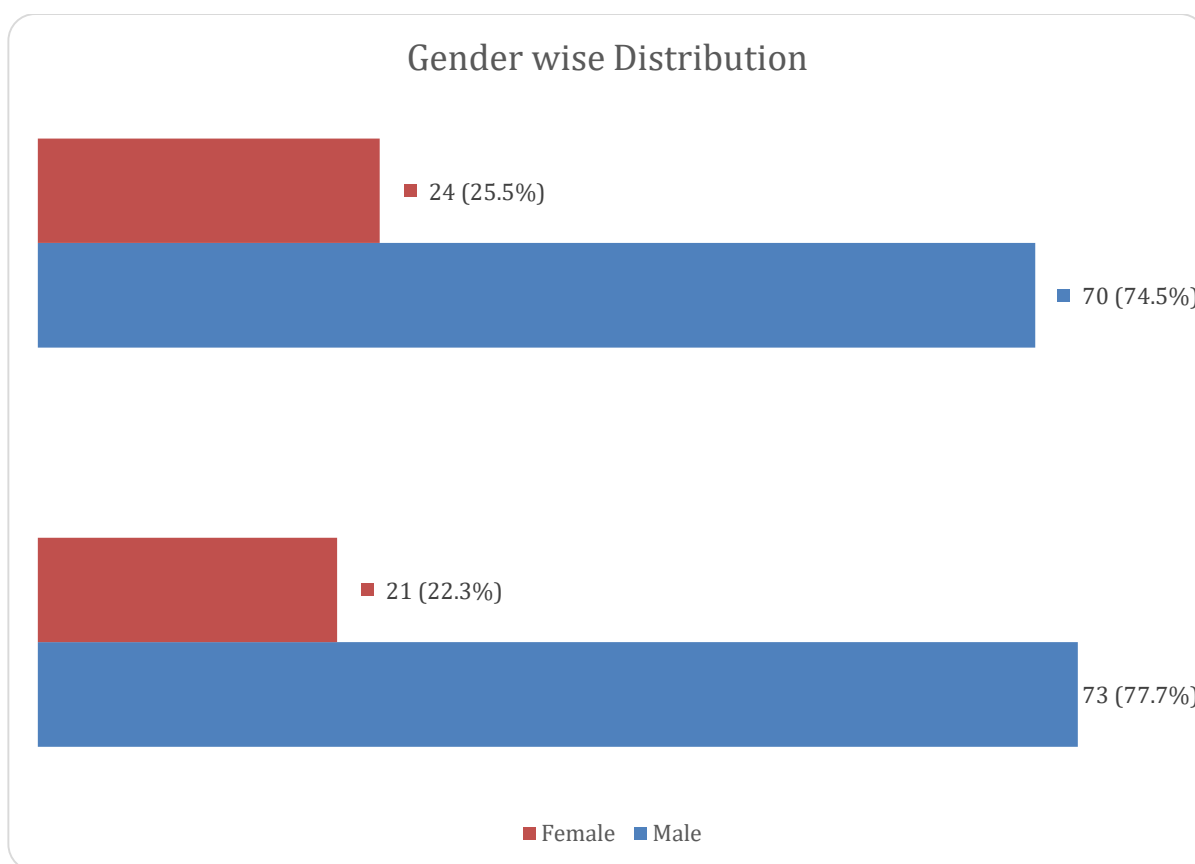


Figure no 1: Gender wise distribution

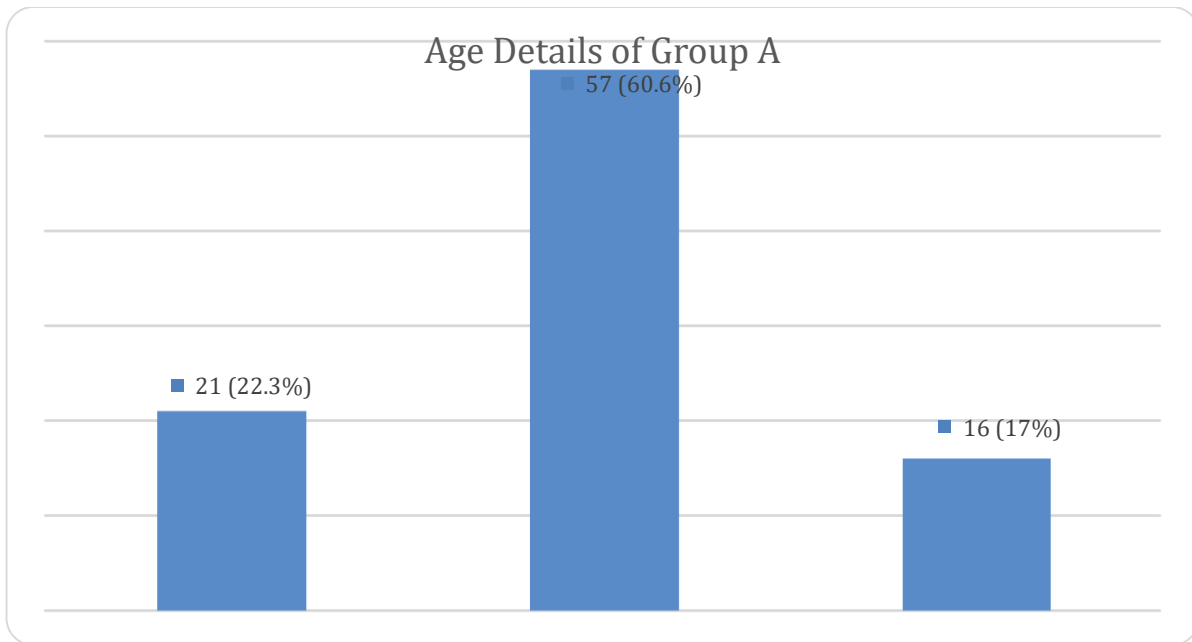


Figure no 2: Patients' age details of group a

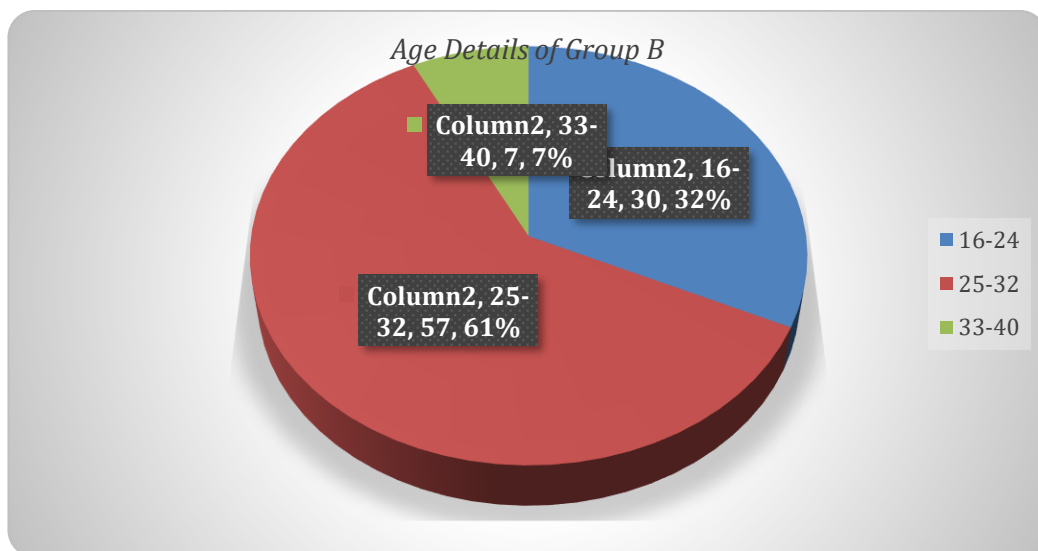


Figure no 3: Patients' age details in group b

Table no. 2: Descriptive statistics of age of pateints in both groups (n=188)

Age	Group A		Group B	
	n	Mean	n	Mean
	94	29.02	94	27.27
		5.576		5.153
		16		17
		40		40

Table no. 3: Descriptive statistics of number of lesion in both groups (n=188)

Number of Lesions	Group A		Group B	
	n	Mean	n	Mean
	94	16.6489	94	17.6277
		4.6343		3.90749
		7		8
		27		26

Table no. 4: Descriptive statistics of duration of leision in both groups (n=188)

Duration of Lesions	Group A		Group B		
	n	Mean	Standard Deviation	Minimum	Maximum
	94	13.348	6.23237	7	32
	94	15.702	5.88205	4	28

Table no.5: Patients' assessments percentage improvement from baseline

Improvement in Percentage from Baseline	Microneedling	CO ₂	Total	p-value
poor < 24%	4 (4.3%)	2 (2.1%)	6 (3.2%)	0.003
Satisfactory 25-49%	11(11.7%)	9 (9.6%)	20 (10.6%)	
Good 50-75%	57 (60.6%)	52 (55.3%)	109 (58%)	
excellent > 75%	22 (23.4%)	31 (33%)	53 (28.2%)	
Total	94(100%)	94 (100%)	188 (100%)	

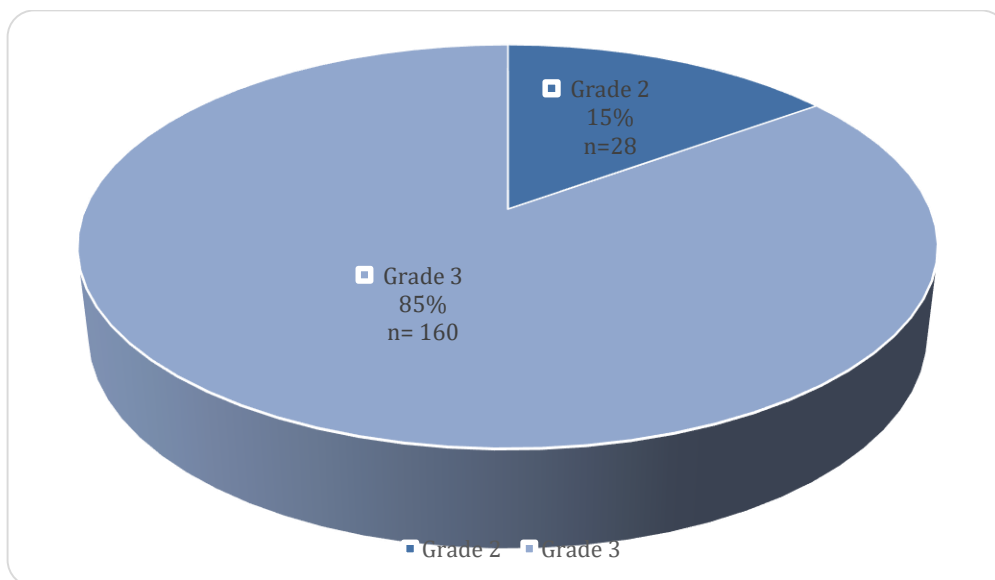


Figure no.4: Goodman and baron scale

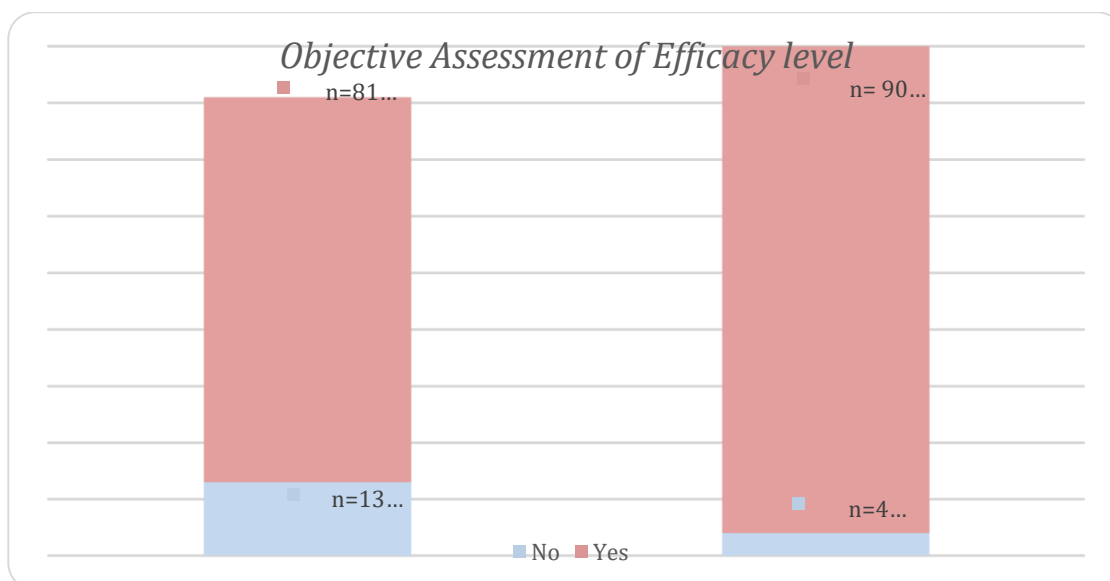


Figure no. 5: Physician (objective) assessment of efficacy level; improvement in goodman and baron grade from baseline



Figure no. 6: Results of co2 laser



Figure no. 7: Results of microneedling

Table no.6: Comparison of efficacy of all treatments based on goodman & baron quantitative grading

Study Group	Baseline average score	After treatment average score
A (Micro needling)	2.52±0.74	2.67±0.62
B (CO2 laser)	2.57±0.43	2.04±0.03
Efficacy P value	0.572	<0.001

Table no.7: Stratification of efficacy with respect to treatment.

Treatment	Efficacy		% within Treatment		P – value
	Yes	No	Yes	No	
Micro needling	81	13	86.2%	13.8%	0.02
CO2 laser	90	4	95.7%	4.3%	
Total	171	17	91.0%	9.0%	

Table no.8: Stratification of efficacy with respect to gender in both treatments.

Gender	Efficacy Group A		Efficacy Group B		P - value
	Yes	No	Yes	No	
Male	63	10	67	3	0.050
Female	18	3	23	1	0.234
Total	81	13	90	4	

Table no.9: Stratification of efficacy with respect to age in both treatments.

Age	Efficacy Group A		Efficacy Group B		P - value
	Yes	No	Yes	No	
16-24 years	19	2	30	0	0.163
25-32 years	49	8	54	3	
33-40 years	13	3	6	1	
Total	81	13	90	4	

Table no.10: Stratification of efficacy with respect to no. of lesions in both treatments.

Number of Lesions	Efficacy Group A		Efficacy Group B	
	Yes	No	Yes	No
0-10	1	2	9	0
11-20	59	8	61	1
More than 20	18	3	20	3
Total	81	13	90	4
P – value	0.03		0.05	

Table no.11: Stratification of Efficacy with respect to Duration of lesions in both treatments.

Duration of Lesions	Efficacy Group A		Efficacy Group B		P - value
	Yes	No	Yes	No	
Less than 10 weeks	23	4	26	1	0.303
11-20 weeks	29	7	35	2	
More than 20 weeks	29	2	29	1	
Total	81	13	90	4	

Discussion

Acne is the most usual skin disorders practiced by adults & adolescents [6,7]. Moderate to severe acne formation accompany by inflammation which lead to losing of fat and dermal collagen and formation of atrophic scar [8]. Results of the general characteristics of patients in the present study presented that the age range for all patients was between 16-40 years with the greater participation of 25 to 32 years. This age distribution Was approved by other study, patients with long period of scar due to

acne not found management till age 30 – 40 years old this scar become deteriorated [8]. This also agreed by another study showed that the atrophic component of the scar is emphasized by premature facial capacity changes and understated laxity of skin after age 30 or 40 years. Gender was another factor related to the general characteristics of acne scar that was studied in this work, as these results revealed, men were more frequently presented to the dermatologist with acne scar than female. These results met in line with a comparable gender distribution by many other authors:16in the United Kingdom, 2 in Saudi Arabia,13 in Egyptand17 in the United States, all reported an overall prevalence rates more in females than males in all age group [9]. Acne scar is hard full to treat in all types of skin, in darker skin people isa greater challenge as a results of hyperpigmentation after inflammation andhigh danger of scarring [10]. The treatment of a patient with acne scars is challenging specially inpatients with darker skin types due to the higher risk of pigmentary alteration. In the present study, assessment of improvement after the full period of treatment for each modality of therapy by Goodman besides Baron gauge and Quartile grading scale exposed that, both groups of patients displayed statistically significant percentage of improvement (P value <0.05) and patients in group B benefited more than those in group A. These results were sustained by another study about the efficacy of fractional CO₂ laser in management of scars after acne, fractional CO₂ laser may actively correct atrophic scarring, which is a common sequel from loss of collagen and elastic fibers after inflammatory processes [9, 10] . Fractional laser therapy falls somewhere in between no ablative and ablative approaches. It is capable of producing 26%–50% improvement without side effects [7,9] . Many comparative studies of efficacy and safety of fractional CO₂ laser with other treatment modalities in the treatment of post acne scars have be conducted in the past few years2,8,13.This study results about the superior effectiveness of fractional CO₂ laser on post acne scars was reinforced by very recent study, Babu and his colleagues at 2019 found that, the good degree ofimprovement after CO₂ laser resurfacing was attributed to its mode of action which incorporate tissue removal, prompt collagen shrinkage, and remodeling of dermal collagen. Columns of miniscule ablated epidermis and dermis after treatment with fractional CO₂ laser may lead to visible epidermal healing as confirmed by clinical improvement of scar and skin texture1 .Likewise, enforcement came from Saeed and Alsaiari, 2018, signifying that, good or excellent response mean positive (75%) of group inside study, so that fractional CO₂ laser used for management of atrophic acne scars resurfacing as monotherapy seems to be effective, and without significant side effects, even in darker-skinned patients [12]. In a comparative manner to fractional CO₂ laser, the efficacy of micro needling radiofrequency in post acne scars have been evaluated inthe present study, it was found to be effective in alleviating the post acne scar according to Goodman and Baron scale, while Quartile grading scale for the assessment of the percentage of improvement showed that good-excellent degree of improvement from baseline after completing micro needling radiofrequency sessions was identified in (33.3%) in group A (although both assessing scales found a statistically lower results among patients of group B than that registered among patients in group A). These results were confirmed by study of Chawla,2014 indicating that micro needling treatment is a new treatment for post acne scars it is simple and cheap 20. Management by the MFR apparatus can be organized by changing the deepness. With accepted adverse effect like mild erythema and hyperpigmentation after inflammation 21 . Another support came from a previous study by Elawar and Dahan,2018, as they observed a significant improvement in acne scars among all patients in the study, all of patients were reported.

Conclusion

It is concluded that, our study highlights the significant reduced acne scar scores by both fractional CO₂ laser reappearing besides micro needling radiofrequency, however, a better reduction of acne scars noticed by fractional CO₂ laser sessions in comparison to micro needling radiofrequency. On comparing the efficacy of all the two treatment modalities, based on mean percentage of improvement in Goodman and Baron quantitative grades, the efficacy of fractional CO₂ laser was significantly greater than that of Micro needling.

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