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ORIGINAL RESEARCH ARTICLE

Comparison of 1550 nm Erbium Laser and Micro-Needling Radiofrequency for the Treatment of Atrophic Facial Acne Scars: A Prospective, Open Labeled, Hospital-based Study

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ABSTRACT

Introduction: Facial atrophic acne scars can be psychologically devastating. Both Erbium glass 1550 nm laser (EL1550 nm) and microneedling radiofrequency (MNRF) are treatment modalities for it. This study further may be promising for the treatment of acne scars. To compare the clinical efficacy and adverse effects of EL1550 nm and MNRF, for treatment of acne scars.

Material and Methods: About 33 patients with atrophic facial acne scars received 3 treatment sessions by 2 different modalities at 4-week intervals. MNRF on the right and EL1550 nm on the left side in the same patient. Efficacy was evaluated by comparing the change in Goodman and Baron Qualitative Scarring Grading and photographs at baseline and 8 weeks after the last session.

Results: Both MNRF and EL1550 nm, showed significant improvements in scarring grades and patient satisfaction from baseline, with no statistically significant difference between the scarring grades of the two modalities (*p* - 0.857, 0.476, 0.466 at second, third, and fourth visits, respectively). EL1550 nm had significantly less adverse effects than MNRF at all follow-ups (*p* 0.003, < 0.001, 0.026).

Conclusion: Both MNRF and EL1550 nm are comparative and effective treatments for acne scars. Also, boxcar scars showed more improvement on the MNRF side and rolling scars on EL1550 nm side (percentage reduction of 37.4 and 43.1%, respectively)

Keywords: Acne scars, Micro-needling radiofrequency, Erbium glass 1550 nm laser.

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INTRODUCTION

Acne scars are not only cosmetically disfiguring but are also psychologically distressing.[1] The acne scars can be classified into various types such as macular, atrophic, and hypertrophic.[2] Overall, studies estimate that >80.0% of acne scars are atrophic. Within this category, ice pick scars are the predominant clinical manifestation of atrophic scarring (~60%), followed by boxcar scars (~25.0%), and rolling scars (~15.0%).[3]

Despite the high prevalence of acne scars, there is no single treatment modality that is universally effective. Many types of fractionated lasers, including the fractional CO_2 laser (FCL), 2,940 nm erbium fractional laser (2940FEL), and 1550 nm Er: Glass fractional laser (FXL), have become extensively used in the treatment of acne scars because of their comparatively short downtime, decreased side effects, and special benefit of re-epithelialization.[4,5]

Increased levels of procollagen types I and III and elastin demonstrate that MNRF uses an array of electrodes to induce micro-thermal dermal lesions with intervening zones of unaffected skin, hence driving dermal remodeling with neocollagenesis and neoelastogenesis.[6]

This study aims to compare the clinical effectiveness and adverse effects of Erbium glass 1550 nm laser and micro-needling radiofrequency devices for the treatment of facial atrophic acne scars in the same individual.

MATERIAL AND METHODS

A prospective comparative study was conducted in the Department of Dermatology, Shri Ram Murti Smarak, Institute of Medical Sciences over 33 adult patients with facial atrophic acne between June 2023 to May 2024. CTRI number: CTRI/2023/06/053823

Patients aged 18 to 60 years with facial atrophic acne scars on a bilateral side having the will to come for follow-up were included in the study population.

Pregnant and lactating females or those with local viral infections, active facial dermatitis, having keloids/hypertrophic scars, bleeding tendency, history of photosensitivity, photodermatitis, post-

inflammatory hyperpigmentation, patients not willing to be photographed at each visit were excluded from the study cohort.

Data were collected using a Self-structured data collection form (Patient Proforma). After written informed consent the treatment regimen involved split-face therapy, with micro-needling radiofrequency (MNRF) administered on the right side and erbium laser treatment on the left side of the face using the MicroFrxl 3 in 1 device from Derma India. Digital photographs were meticulously captured at baseline, at the commencement of each session, and two months after the end of the study, ensuring consistency in lighting and positioning. Each participant underwent three treatment sessions, at 4 weeks intervals.

Preceding each session, the facial area was cleansed with a mild cleanser, then application of topical EMLA cream to the entire face under occlusion for 30 to 60 minutes. After each session, participants were given sunscreen and total physical protection from direct sunlight exposure. The efficacy of scar improvement was evaluated by the Goodman and Baron Qualitative Scarring Grading system at each visit grade 1, 2, 3, and 4 and patient satisfaction scores were obtained, independently for the left and right sides of the face using the 5- 5-point scale, from no improvement (0) to excellent improvement (4). Post-treatment side effects were noted as erythema, edema, dryness, pigmentation alterations, and others.

RESULTS

Table 1 shows the demographic data of patients. The mean age of patients is 23 years and a majority of the patients were male. Table 2 shows that Both MNRF and EL1550 nm treatments showed improvements in scarring grades. There were statistically non-significant differences in scarring grades between the two treatments at each visit (p >0.05), while the overall comparison with in the two treatment groups across all visits showed a statistically significant difference in scarring grades (p <0.001).

Both micro-needling radiofrequency (MNRF) and Erbium glass laser 1550 nm (EL1550 nm) treatments showed reductions from baseline to last visit in the counts of different types of acne scars, including ice pick, boxcar, and rolling scars. However, the differences observed between the treatments were not statistically significant (Table 3). After the fourth visit, in the MNRF treatment 17 (51.5%) patients exhibited improvement by grade 1, and 6 (18.2%) patients with grade 2 improvement and no improvement in 10 (30.3%) patients.

In the EL1550 nm treatment, 20 (60.6%) patients showed improvement with grade 1, 7 (21.2%) patients with grade 2 improvement and 6 (18.2%) patients no improvement (Table 4).

The patient satisfaction score will be evaluated for both sides left and right separately using a 5-point scale (0 = no improvement, 1 = slight improvement, 2 = moderate improvement, 3 = good improvement, 4= excellent improvement). (#= Student t test; p < 0.05= statistically significant; p > 0.05= statistically non-significant)

The overall *p-value* from baseline to the last visit for both sides was p < 0.001 which was highly significant. Moreover, the mean patient satisfaction increased at each follow-up. There was a statistically non-significant difference observed in patient satisfaction between the two treatments at various visits (Figures 1-3).

The difference in side effects between the two treatments was statistically significant on all three visits (p = 0.003, <0.001, 0.026), more on the MNRF side than EL1550 nm.

On the MNRF side, in the first visit, 81.8 and 78.8% of patients experienced edema and erythema, respectively which lasted for 3 to 5 days. Post-inflammatory hyperpigmentation (PIH) was reported in 5 patients, out of which 3 presented with needle marks across all visits.

On the EL1550 nm side, during the first visit, erythema was reported in 60.6% of patients which was transient and disappeared in 30 minutes to 6 hours. No patient reported edema. PIH was reported in a total of 6 patients across all visits.

DISCUSSION

Patients getting treatment for acne scarring are typically worried about the efficacy of the procedure as well as any side effects or recovery time thereafter. Regarding safety and low downtime, non-ablative fractionated technologies utilizing laser or radiofrequency technology

Table 1: Clinico-demographic profile

Parameters		*Study population*
Age (in years) (Mean ± SD)		23.7 ± 4.9
Sex (Male: Female)		2:1
Duration of scar (years)		5.9 ± 2.9
Tendency to pick acne present in the study population		84.8%
Predominant scar type	Boxcar	48.5%
	Rolling	36.4%
	Ice Pick	15.2%
Fitzpatrick skin type	III	39.4%
	IV	48.5%
	V	12.1%

Table 2: Goodman and Baron qualitative scarring grading system

Visit	*Right (MNRF)*	*%Improvement*	*Left (EL1550 nm)*	*%Improvement*	*p-value#*
First	3.30 ± 0.68396	-	3.30 ± 0.68	-	1.00
Second	3.21 ± 0.68	2.7	3.27 ± 0.67	0.9	0.857
Third	3.03 ± 0.68	8.2	2.90 ± 0.80	11.3	0.479
Fourth	2.42 ± 0.79	20.1	2.27 ± 0.87	21.7	0.466
p-value	<0.001		<0.001		

#= Student t test; $p < 0.05$ = statistically significant; $p > 0.05$= statistically non- significant

Table 3: Count of each type of SCAR

Type of scar	*Right (MNRF)*		*Left (EL1550 nm)*		*p-value# (Right to Left baseline)*	*p- value# (Right to Left Last visit)*
	Baseline	*Last visit*	*Baseline*	*Last visit*		
Ice pick	8.4 ± 9.1	5.6 ± 6.4	8.2 ± 8.1	5.8 ± 6.4	0.925	0.899
Boxcar	9.1 ± 9.2	5.7 ± 6.6	9.9 ± 9.5	7.0 ± 7.4	0.729	0.454
Rolling	6.2 ± 6.0	4.1 ± 4.5	7.2 ± 8.3	4.1 ± 4.7	0.576	1.00

#= Student t test; $p < 0.05$= statistically significant; $p > 0.05$= statistically non-significant

have created new opportunities. But as of yet, an ideal treatment plan has not been determined.[7]

In our study, both MNRF and EL1550 nm treatments showed improvements in Goodman and Baron scarring grades. However, there were statistically non-significant differences in scarring grades between the two treatments at each visit ($p > 0.05$), while the overall comparison within the two treatment groups across all visits showed a statistically significant difference in scarring grades ($p < 0.05$) as reported in other studies.[4,8]

In our study, on the MNRF side (right facial region), ice Pick scars decreased by 33.3% from the baseline to the final visit. Similarly, Boxcar scars decreased by 37.4% and rolling scars decreased by 33.9%. Overall MNRF showed considerable improvements for boxcar>rolling>icepick scars.

On the EL1550 nm side (left facial region), ice Pick scars decreased by 29.3% from baseline to the final visit. Similarly, Boxcar scars decreased by 29.3% and rolling scars decreased by 43.1%. Overall, the efficacy of the EL1550 nm treatment in reducing different types of scars showed positive results in decreasing the appearance of ice pick, boxcar, and rolling scars, with rolling scars experiencing the most significant improvement.

In our study, both micro-needling radiofrequency (MNRF) and Erbium glass laser 1550 nm (EL1550 nm) treatments showed reductions from baseline to last visit in the counts of different types of acne scars, including ice pick, boxcar, and rolling scars. However, the differences observed between the treatments were not statistically significant ($p > 0.05$). In our study, overall satisfaction in patients on both sides was highly significant ($p < 0.001$). A similar was observed in other studies done earlier.[8,9]

Table 4: Improvement according to Goodman and Baron's qualitative scarring grading system

Improvement	*MNRF (n = 33)*	*EL1550 nm (n = 33)*	*p-value*
0 grade	10 (30.3%)	6 (18.2%)	0.541
1 grade	17 (51.5%)	20 (60.6%)	
2 grade	6 (18.2%)	7 (21.2%)	

*= Chi Square test; $p < 0.05$= statistically significant; $p > 0.05$= statistically non-significant

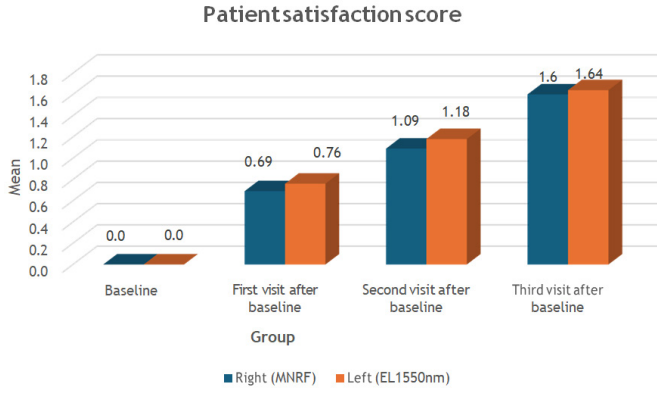

Figure 1: Comparison of patient satisfaction score at follow-up visits

Among the adverse effects, the edema & erythema subsided in 3 to 5 days on the MNRF side whereas the erythema lasted for 30 minutes to 6 hours on the side of EL1550 nm. The PIH decreased but didn't disappear completely on both sides. Similarly reported in various studies.[9-12]

Due to the split face design of this study, features such as skin type and post-treatment care could not have an impact on the comparison of the adverse effects of

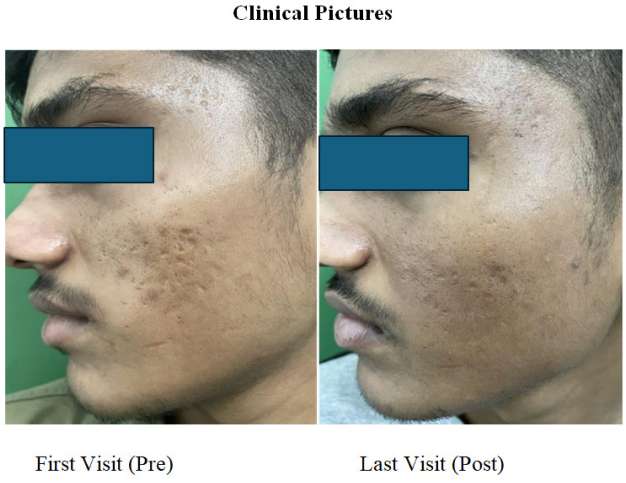

Figure 2: Erbium glass 1550 nm pre and post (left side)

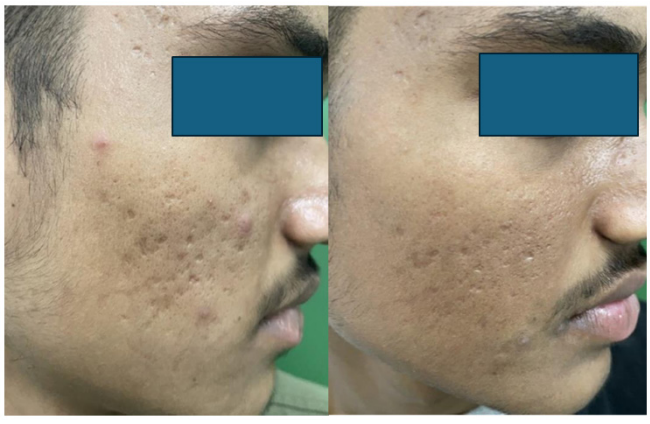

Figure 3: Microneedling radiofrequency pre and post (right side)

the two devices. It appears, nonetheless, that numerous therapy sessions are necessary to attain a level of clinical improvement that is adequate. While many studies have shown that acne scars become less noticeable after using MNRF and EL1550 nm devices, these two modalities have not been compared on the same patient.

CONCLUSION

This study has concluded that patients with Fitzpatrick skin types III to IV who have atrophic acne scars can be safely and effectively treated using the MNRF and EL1550 nm. The majority of patients expressed high satisfaction with the treatment's outcome. When treating atrophic acne scars, both devices worked similarly well. The treatment's side effects were minor to momentary. We noticed that there was slightly less downtime for the EL1550 nm laser, than the MNRF, but both modalities were well tolerated. In addition, boxcar scars showed more improvement on the MNRF side and rolling scars on EL1550 nm side. Therefore, dermatologists should consider the scar type of acne scar to select the treatment options.

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