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IP Indian Journal of Clinical and Experimental Dermatology

Journal homepage: https://ijced.org/

Original Research Article

A comparative study of efficacy and safety of microneedling fractional radiofrequency with and without subcision for facial acne scars

Ron Thomas[1]*, Yogesh Devaraj[1], Jithin Jayaraj[1], Mukunda Ranga Swaroop[1], Akshatha V Reddy[1], Nischitha Rudraiah[1]

[1]Dept. of Dermatology, Adichunchanagiri Institute of Medical Sciences, B G Nagara, Nagamangala taluk, Mandya, Karnataka, India

Abstract

Background: Severe acne causes scarring and disfigurement leading to considerable psychological and social distress. Various traditional modalities have been used for treatment, but have shown limited efficacy. Hence, there is a growing need for novel approach which is safer and more efficient with faster recovery time.

Aim and Objectives: To compare the efficacy and safety of Microneedling Fractional Radiofrequency (MNRF) with and without subcision in the treatment of acne scars.

Materials and Methods: Thirty patients aged between 18 and 40 years with acne scars were divided into two groups: Group A (treated with MNRF combined with subcision) and Group B (treated with MNRF alone). Each patient underwent four treatment sessions at monthly intervals. Clinical evaluation was performed using Goodman and Baron's qualitative and quantitative grading scales, along with patient satisfaction scoring, one month after the final treatment session.

Results: A total of 30 patients were enrolled in the study, with 15 patients assigned to each of the two groups. One month after the fourth treatment session, according to Goodman and Baron's qualitative grading 50% of patients in Group A showed acne scar reduction by three grades, whereas no such improvement was observed in Group B. Although scar improvement appeared greater in Group A, the difference was not statistically significant ($p = 0.464$). On Goodman and Baron's quantitative assessment, 40% of patients in Group A achieved a very good reduction in scars compared to 6.67% in Group B, ($P = 0.013$, which was statistically significant). Additionally, 40% of patients in Group A reported being very satisfied with the treatment, when compared to 13.3% in Group B. The mean satisfaction score was also higher in Group A.

Conclusion: MNRF with subcision was more efficacious and safer in the treatment of acne scars and patients receiving this, were more satisfied when compared to those receiving MNRF alone. Both groups tolerated the procedure well and there were no serious post procedure complications.

Keywords: Microneedling fractional radiofrequency, Subcision, Acne scars, Goodman and Baron's qualitative and quantitative grading system.

Received: 06-06-2025; **Accepted:** 15-07-2025; **Available Online**: 26-09-2025

1. Introduction

Acne vulgaris is the most frequent skin condition affecting 85% of adolescents and 10-12% of adults and scarring being most common sequelae.[1] Severe acne can cause permanent scarring and facial disfigurement leading to psychological abnormalities, social inhibition and embarrassment.[2]

Acne scars can be classified as either atrophic or hypertrophic. Atrophic scars—including ice-pick, rolling, and boxcar types—are more frequently seen on the face and develop due to destruction of collagen following inflammatory acne.[3] Its nature and the extent are directly dependent on the depth, severity of the inflammation and its duration. Several therapeutic methods like dermabrasion, chemical peel, punch techniques and fillers have been practiced but with limited efficacy.[4] Traditional ablative lasers can improve facial atrophic acne scarring, but long-term use of it has been hindered due to prolonged recovery time and associated complications like erythema, post inflammatory hyperpigmentation, hypopigmentation and

*Corresponding author: Ron Thomas
Email: ronthomas9595@gmail.com

https://doi.org/10.18231/j.ijced.68118.1758865977

scarring.[5] Hence, there is a need for safer and more effective treatment approaches that offer faster recovery.

Advent of Microneedling fractional radiofrequency (MNRF) has shown considerable improvement in acne scars recovery. Microneedles penetrate the skin with minimal damage to the epidermis and delivering radiofrequency energy directly into the dermis. This stimulates dermal remodelling by neocollagenogenesis and neoelastogenesis, leading to increased dermal thickening and overall skin rejuvenation.[5] MNRF offers a significant benefit over fractional lasers in terms of reaching desired depth, reducing downtime and less post inflammatory hyperpigmentation.[6]

Subcision is a minimally invasive modality for treating atrophic acne scar in which the scar levels are made free from the underneath connections and it decreases the connective tissue formation under the scar without causing any damage to the skin surface leading to elevation of the scar. Thus, though subcision effectively corrects rolling and depressed acne scar, as a standalone treatment it shows recurrence.[7,8] However, combining MNRF with subcision has led to considerable improvement of acne scars with good cosmetic results and skin rejuvenation.

Through this study, we intend to assess the efficacy and safety of MNRF alone versus combined treatment of MNRF and subcision in the treatment of moderate to severe facial acne scars.

2. Materials and Methods

Thirty patients belonging to age group (18-40 years) with facial acne scars attending Dermatology out-patient department, were randomly allocated to Group A (MNRF with subcision) and Group B (MNRF alone), using an online website- www.randomizer.org that generated the random sequence. Ethical clearance was secured from the Institutional Ethics Committee, and written informed consent was obtained from all participants prior to enrollment. Each patient's history was recorded using a structured questionnaire. A thorough dermatological assessment, focusing on facial acne scars, was conducted, and standardized photographs were taken before and after the procedure for comparison.

Patients aged 18 to 40 years with moderate to severe acne scars and Fitzpatrick skin types III to V, who consented to participate, were enrolled in the study. Patients with acne scars, who were unwilling and patients below 18 and above 40 years were not included in the study.

Patients were excluded from the study if they had undergone treatment with ablative or non-ablative lasers within the past 12 months, had a recent history of oral retinoid use, suffered from photosensitive conditions such as lupus erythematosus, had a history of active herpes infections or dermatomyositis. Also, Pregnant or breastfeeding mothers and patients with history of vitiligo, hypertrophic scar formation or keloid were not taken into the study.

2.1. Group A: MNRF with subcision treatment protocol

In this group patients underwent four sequential MNRF and subcision at an interval of four weeks between each session.

Before each session, EMLA cream (lignocaine 2.5% and prilocaine 2.5%) was applied to the target regions and left for 40 minutes. The treatment area was disinfected using povidone-iodine and 70% isopropyl alcohol under sterile precautions. Local anaesthesia (1% lidocaine with 1:100,000 epinephrine) was given to patients who experienced severe pain. Subcision was performed using an 18G needle inserted adjacent to each scar, bevel up and parallel to the skin, reaching the deep dermis. The needle was moved in a to-and-fro and fan-like motion to release fibrous bands in the dermal or subcutaneous plane. Larger scars were accessed from multiple entry points to ensure adequate release. After subcision, the needle site was compressed circumferentially to drain excess blood to minimize hematoma formation, though a small hematoma was permitted to support scar elevation. Hemostasis was achieved using pressure and ice application. This procedure was immediately followed by a session of MNRF in group A patients.

2.2. Microneedling fractional radiofrequency treatment protocol

Patients underwent four sequential MNRF (DERMA INDIA MR 16-2SB) treatment sessions four weeks apart. The device used for energy delivery uses a disposable tip equipped with 49 gold-coated non insulated microneedles, capable of delivering up to 50W of power. Needle depth was adjustable between 0.3 mm and 3 mm. Once the needles reached the preset depth, radiofrequency energy was emitted to selectively heat the dermis, minimizing damage to the epidermis. The time of needles being out was set at 300ms, with a 5ms delay between needle insertion and energy emission.

Before each treatment, EMLA cream (2.5% lignocaine and 2.5% prilocaine) was applied to affected areas and left for 40 minutes, followed by gentle cleansing. The treatment area was then disinfected with povidone-iodine and 70% isopropyl alcohol under sterile conditions, and protective eye shields were used. A single pass was performed per session. For patients with predominantly ice pick or mixed scars, a needle depth of 2.5 mm was used, reduced to 1.5 mm over the forehead, temples, and other bony areas. Disposable MNRF needles were used for every patient in each session.

Post treatment, sites were gently wiped with betadine, and an ice pack was kept for 5 minutes to reduce discomfort and swelling. Patients were advised to apply a broad-spectrum sunscreen, use moisturizers, and avoid direct sun exposure for 48 hours. Any erythema was managed with a topical combination of steroid and antibiotic cream, while

post-procedure pain was relieved with NSAIDs for 2 to 5 days. Clinical photographs were taken before and after the session for documentation.

Group B: In this group patients underwent four sequential MNRF session alone four weeks apart.

2.3. Clinical evaluation

Improvement was assessed using Goodman and Baron's qualitative and quantitative grading systems during the initial visit and one month after the final treatment session (**Table 1,2**),[11] along with comparison of pre- and post-treatment photographs.

Additionally, patients were requested to rate their acne scar improvement one month after the last session using the following scoring system:

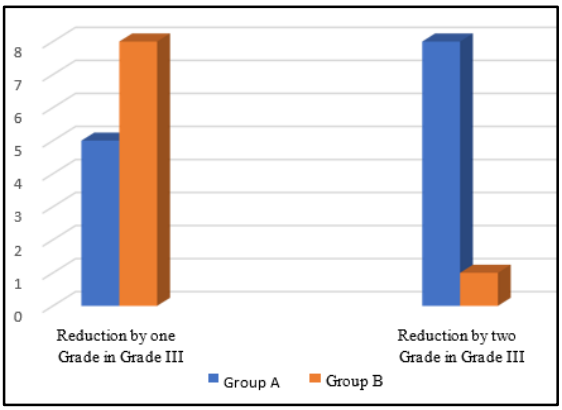
Patient satisfaction score: 5-point likert scale[15]

0- Not satisfied
1- Slightly satisfied
2- Satisfied
3- Very satisfied
4- Extremely satisfied

Any adverse events were recorded in detail at each treatment session and follow up visits.

3. Results

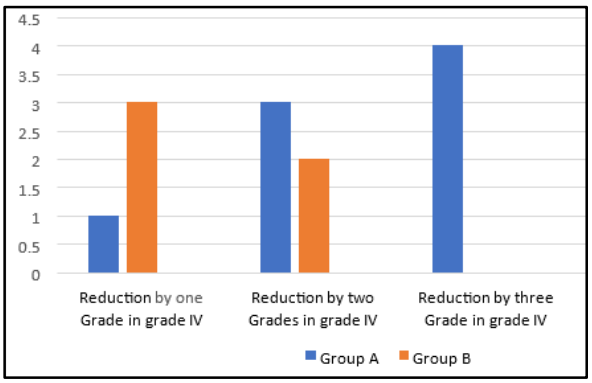
Basic characteristics of the patients in group A and B is given in **Table 3** and **5**. Goodman and Barons qualitative and quantitative assessment of group A and B is summarized in **Table 4** and **6**.



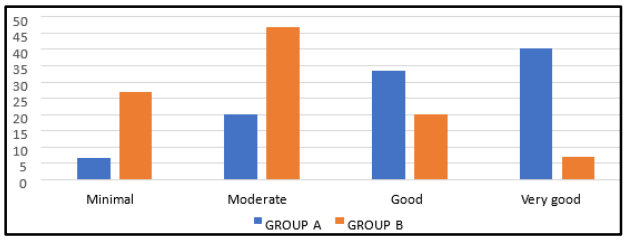
Graph 1: Goodman and Barons qualitative assessment in grade 3 acne scars

3.1. Comparison of results and group A and B

In our study, participants in both groups ranged in age from 18 to 35 years, with the majority in the 21–25year age group. The mean age was 24.30 ± 3.75 years in Group A and 24.4 ± 3.76 years in Group B. The male-to-female ratio was 1.14:1 in Group A and 1:2 in Group B. Most patients in Group A had Fitzpatrick skin type 3 (53.3%), whereas Fitzpatrick skin type 4 was predominant in Group B (86.7%).



Graph 2: Goodman and Barons qualitative assessment in grade 4 acne scars



Graph 3: Goodman and Barons quantitative assessment

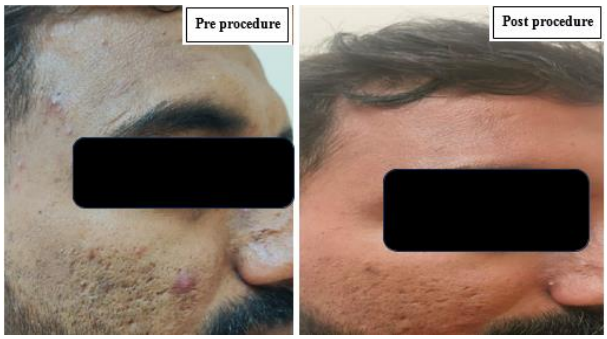


Figure 1: Pre and post procedure photographs of patients treated with mnrf with subcision

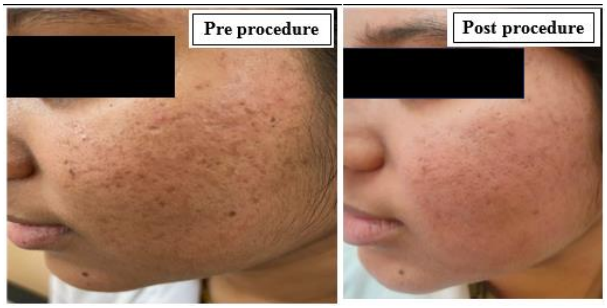


Figure 2: Pre and post procedure photographs of patients treated with mnrf alone

At the end of one month after final treatment session (total of 4 sessions one month apart), Goodman and Barons qualitative assessment of grade 3 acne scars, 2 patients (28.5%) in group A (MNRF with subcision) showed reduction by in acne scars when compared to 1 patient (11.1%) in group B (MNRF alone). Additionally, 71.4% of

patients in Group A had reduction by 1 grade in contrast to 88.88% of patients in Group B (**Graph 1**). For Grade IV acne scars 50% of the patients in Group A showed reduction by 3 grades and no patient showed reduction by 3 grades in group B. (**Graph 2**).

Based on Goodman and Baron's quantitative assessment, 6 patients (40%) in group A showed a very good reduction compared to only 1 patient (6.67%) in group B. Additionally, 5 patients (33.3%) in group A showed a good reduction compared to only 3 patients (20%) in group B (**Graph 3**). Patients receiving MNRF with subcision (Group A) had significant improvement in facial acne scars (P=0.013, which was found to be statisticaly significant).

In our study, Patients treated with MNRF with subcision were having a significantly higher mean percentage reduction (45.92%) of post acne scars when compared to patients who were treated with MNRF alone (36.10%).

In our study, 6 patients (40%) in Group A were very satisfied, when compared to 2 patients (13.3%) in Group B. The mean satisfaction score on the Likert scale was higher in group A (5.9) than in group B (4.7) with this difference being statistically significant (p=0.039)

Post procedure, almost all patients' experienced transient erythema, oedema and pain. And these side effects were mild and resolved within 24hrs. Post inflammatory hyperpigmentation was observed 2 patients (13.3%) in group A in contrast to 1 patient (6.67%) in group B which resolved eventually with the use of sunscreens and depigmenting creams.

Table 1: Goodman and baron's qualitative acne scar grading system

Grade or Type	**Number of lesions 1(1-10)**	**Number of lesions 2(11-20)**	**Number of lesions 3(>20)**
Milder scarring (1 point each)	1 point	2 points	3 points
Macular erythematous pigmented			
Mildly atrophic dish-like			
Moderate scarring (2 points each)	2 points	4 points	6 points
Moderately atrophic, dish like			
Punched out with shallow bases small scars (<5mm)			
Shallow but broad atrophic areas			
Severe scarring (3 points Each)	3 points	6 points	9 points
Punched out with deep but normal bases, small scars (<5mm)			
Punched out with deep but abnormal bases, small scars (<5mm)			
Linear or troughed dermal scarring			
Deep, broad atrophic areas			
Hyperplastic	2 points	4 points	6 points
Papular scars	Area<5mm	Area 5-20mm2	Area >20mm2
Keloidal/hypertrophic scars	6 points	12 points	18 points

Table 2: Assessment of improvement using goodman and baron's quantitative acne scars grading system[11]

Grades	**Improvement status**
0-5	Minimal reduction in GSGS* scores
5-10	Moderate reduction in GSGS* scores
10-15	Good reduction in GSGS* scores
>15	Very good reduction in GSGS* scores

Table 3: Clinic demographic data of acne scar patients in group A

Mean age	24.30 ± 3.75
Gender	
Male	8(53.3 %)
Female	7(46.7 %)
Fitzpatrick skin type	
III	8(53.3 %)
IV	5(33.3 %)
V	2(13.3 %)
Mean scar duration	4.13±2.3

Table 4: Goodman and baron's qualitative and quantitative assessment of post treatment reduction of acne scars in group A

Goodman and baron's qualitative assessment				
Grade of acne scars (Group A)	**No of patients**	**Reduction by 1 Grade**	**Reduction by 2 Grades**	**Reduction by 3 Grades**
Grade III	7	5	2	0
Grade IV	8	1	3	4
Goodman and baron's quantitative assessment				
Group A	**Minimal reduction**	**Moderate reduction**	**Good reduction**	**Very good reduction**
	1 (6.6 %)	3 (20 %)	5 (33.3 %)	6 (40 %)

Table 5: Clinicodemographic data of acne scar patients in group B

Clinico demographic data of acne scar patients in group B	
Mean age	24.4±3.76
Gender	
Male	5 (33.3 %)
Female	10(66.7 %)
Fitzpatrick skin type	
III	2(33.3 %)
IV	13(86.7%)
V	0(0 %)
Mean scar duration	4.97±3.16

Table 6: Goodman and Baron's qualitative and quantitative assessment in group B

Goodman and baron's qualitative assessment				
Grade of acne scars (Group B)	**No of patients**	**Reduction by 1 grade**	**Reduction by 2 grades**	**Reduction by 3 grades**
Grade III	9	8	1	0
Grade IV	6	3	3	0
Goodman and baron's quantitative assessment				
Group B	**Minimal reduction**	**Moderate reduction**	**Good reduction**	**Very good reduction**
	4(26.6 %)	7(46.6 %)	3(20 %)	1(6.67%)

Table 7: Goodman and Baron's quantitative assessment of post treatment reduction of scars in present and previous studies

	Chandrashekaer BS et al[11]	**Navyadevi U et al[10]**	**Present Study**
Assessment scale	**Goodman and Baron's grading system**	**Goodman and Baron's grading system**	**Goodman and Baron's grading system**
Excellent/ Very Good / Grade 4 improvement/ Score 3	3%	17.5%	6.7%
Good/Marked Grade 3 improvement/ Score 2	9%	52.5%	20%
Moderate/ Fair/ Grade 2 improvement/ Score 1	58%	10%	46.6%

Table 8: Goodman and Baron's quantitative assessment of post treatment reduction of scars in present and previous studies

	Authors	
	Faghihi et al[13]	**Present study**
Assessment scale	**Quartile grading scale**	**Goodman and Barons grading system**
Excellent/ Very Good / Grade 4 improvement/Score 3	0%	40%
Good/Marked Grade 3 improvement/ Score 2	52%	33.3%
Moderate/Fair/ Grade 2 improvement/ Score 1	28%	20%
Minimal/ Mild/ Poor/ Grade 1 improvement/ Score 0	20%	6.6%

4. Discussion

A comparative study was carried on 30 patients with facial acne scars. Every patient in group A underwent 4 sessions of MNRF with subcision and group B received MNRF alone one month apart.

In Group A, most patients (46.7%) belonged to age group 21-25 years age group, with a mean age of 24.30 ± 3.75 years. In a similar study conducted by Faghihi et al reported that most patients (52%) belonged to 24-30 years age group with mean age of 30.08 ± 4.94.[13] The male-to-female ratio in our study was 1.14:1 with a male preponderance (53.3%), which was in contrast to study by Faghihi et al., which showed a female predominance (64%) with a male-to-female ratio of 1:1.8.[13] Majority of the patients 8 (53.35%) had Fitzpatrick skin type III, followed by 5 patients (33.3%) with Fitzpatrick skin type IV and 2 patients (13.3%) with skin type V. Similarly, Faghihi et al reported that 16 patients (64%) had Fitzpatrick skin type III, 5 patients (20%) had type II and 4 patients (16%) had type IV skin type.[13]

In our study, majority of the patients (80%) had less than 5 years of acne scar duration and 4.13±2.3 years was the mean scar duration.[13]

One month after the fourth and final session, Goodman and Baron's qualitative assessment of patients with grade III acne scars revealed that 2 patients (28.5%) showed an improvement of 2 grades, while 5 patients (71.4%) showed grade 1 reduction in acne scars. Among those with grade IV acne scars, 4 patients (50%) showed a 3-grade improvement, 3 patients (37.5%) showed a 2-grade improvement, and 1 patient (12.5%) improved by 1 grade. However, no comparable studies were available to support or contrast these findings.

In the current study, one month after the final (fourth) session, based on Goodman and Baron's quantitative assessment of acne scars, 40 % of patients showed very good reduction, 33.3 % of patients showed good reduction, 20% of patients showed moderate reduction and 6.7 % showed minimal reduction. In a similar study conducted by Faghihi et al. using the Quartile grading assessment scale reported good, moderate and minimal improvement in 32%, 48% and 20% of the patients respectively.[13]

In our study, one month after last session (4th session), 6 patients (40%) were very satisfied, 20% were satisfied with the treatment. Meanwhile, 1 patient (6.6%) was slightly satisfied, and 5 patients (33.3%) were neutral in their opinion. However, there are no similar studies done to compare with our study observation. The mean of patient satisfaction Likert score was 5.9. In a similar study done by Faghihi et al. the patient satisfaction VAS score was 6±2.2.[13]

Most of the patients following the procedure experienced transient erythema, edema and pain which subsided in 24hrs which is in accordance with observation by Faghihi et al. and in the present study 2 patients (13.3%) developed PIH following the procedure which got healed with sunscreen and depigmenting creams. However, there was no permanent complications.[13]

In group B, most of the patients (7 patients, 46.7%) belonged to the age group 21-25 years, with mean age of 24.20 ± 3.89 years. In a study conducted by Navyadevi U et al mean age of the study group was 27.05 ± 5.154 years, with 20 years being the minimum age and a 40 years was the limit.[9] A Female preponderance (66.7%) was observed with male to female ratio being 1:2 which was comparable with study done by Faghihi et al in which majority of the patients were females (64%).[13] Majority of the patients 13(86.7%) in group B belonged to Fitzpatrick skin type IV, then Fitzpatrick skin type III with 2 patients (13.3%) which was in accordance to the study conducted by Faghihi et al reported 16 patients (64%) belonged to type III skin type, 5 patients (20%) of type II and 4 patients (16%) of type IV skin type.[13] Most of the patients in group B (9, 60%) had less than 5 years scar duration with mean scar duration of 4.97 ± 3.16 years which is almost similar to study done by Navyadevi U in which mean scar duration is 4.33±1.774 years.[9]

One month after the final session, according to Goodman and Barons qualitative assessment of patients with grade III acne scars, 1 patient (11.1%) showed 2 grade reduction in acne scars and 8 patients (88.8%) showed reduction by 1 grade. The findings were not in accordance with study done by Chandrashekar BS et al. wherein 2 grade reduction was shown by 80.64% and 1 grade reduction was shown by 19.35%. In study done by Navyadevi et al majority patients with grade IV and grade III scars shown improvement to grade II scars.[9,11]

One month after the last session, based on Goodman and Barons quantitative assessment 1 patient (6.67 %) showed very good reduction which was higher than that reported by Chandrashekar BS et al (3%) but lower than that observed by Navyadevi U et al (17.5%). Good improvement was observed in 3 (20%) patients, which is significantly lower compared to the findings of Navyadevi et al (52.5%) and was higher than study conducted by Chandrashekar BS et al (9%). Moderate reduction was observed in 7 (46.6 %) patients which was significantly higher compared to study done by Navyadevi et al (10%).[9,11] (**Table 7**).

In the present study, one month after last session (4th session), 2 patients (13.3%) were very satisfied with the treatment outcome. Results of our study observation was significantly lower when compared to findings of Cho et al and Navyadevi et al. Mean Likert score was 4.8 in study by faghihi et al.[9,12,13]

All the patients following the procedure experienced transient erythema, edema and pain which subsided in 24 hours which was consistant with studies done by Navyadevi

U et al, Chandrashekar BS et al and Faghihi et al. One patient complained of Post-inflammatory hyperpigmentation and post-treatment erythema was observed in all patients.[9,12,13]

4.1. Comparison of results of group A AND B

One month after final treatment session (total of 4 sessions one month apart), Goodman and Barons qualitative assessment of grade 3 acne scars, 2 patients (28.5%) in group A (MNRF with subcision) showed 2 grade reduction when compared to 1 patient (11.1%) in group B. Also, 71.4% of patients in Group A showed 1 grade reduction in acne scars in contrast to 88.88% of patients in Group B. For Grade IV acne scars 50% of patients in Group A (MNRF with subcision) showed reduction by 3 grades when compared to none of the patients in Group B (MNRF alone). Overall, the clinical improvement in facial acne scars was better in patients treated with a combination of MNRF with subcision compared to those who received MNRF alone. However, this difference was not statistically significant (P = 0.464). No prior studies were available for comparison with our study.

At the end of one month after last treatment session, based on Goodman and Baron's quantitative assessment, 6 patients (40%) showed very good reduction in group A compared to only 1 patient (6.67%) in group B and 5 patients (33.3%) in group A showed a good reduction compared to only 3 patients (20%) in group B. In the similar study conducted by Faghihi et al using the quartile grading assessment scale, reported good response in 52% of patients who received MNRF with subcision compared to 32% of patients who received MNRF alone. Acne scar improvement was better in patients treated with MNRF with subcision compared to patients treated with MNRF alone (P = 0.013, which was statistically significant).[13] (**Table 8**).

One month after the final session (4th session), patients treated with MNRF with subcision were having a significantly higher mean percentage reduction (45.92%) of post acne scars when compared to patients who were treated with MNRF alone (36.10%) and this difference was found to be statistically significant (p-value = 0.012). In a similar study conducted by Faghihi et al, clinical assessment showed statistically significant improvement in the group receiving MNRF with subcision compared to MNRF alone (P=0.009).[13] This observation suggests that combining MNRF with subcision yielded better results in reducing post acne scars.

After one month following the final treatment session, 6 patients (40%) who received MNRF with subcision were very satisfied with the results compared to 2 patients (13.3%) in group B receiving MNRF alone. The mean satisfaction score on the Likert scale was higher in group A (5.9) than in group B (4.7) with P = 0.039, which was statistically significant. This suggests that patients treated with MNRF combined with subcision were more satisfied with their results than those who underwent MNRF alone. Our findings were in accordance with the study conducted by Faghihi et al. (P = 0.001).[13]

Almost all patients reported temporary pain, erythema and mild edema after the procedure, which was consistent with the findings of study done by Faghihi et al. PIH was seen in 2 patients (13.3%) in group A and 1 patient (6.67%) in group B, which resolved subsequently with the use of topical sunscreen and depigmenting agents. In a similar study by Faghihi et al. in MNRF group, one patient experienced transient PIH which resolved subsequently and also one patient developed transient submandibular lymphadenopathy which got resolved in 3 days.[13-15]

5. Limitations of the Study

Smaller sample size, shorter follow ups and absence of post-procedural histopathological analysis were the limitations of the study.

6. Conclusion

Our study suggested that combining MNRF with subcision is more efficacious in the treatment of facial atrophic acne scars compared to using MNRF laser alone.

All of the patients tolerated the procedure well and there were no serious procedure related complications.

Patients who underwent the combined treatment of MNRF and subcision reported higher satisfaction with their treatment outcomes when compared to those who received MNRF alone.

7. Source of Funding

None.

8. Conflicts of Interest

None.

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Cite this article: Thomas R, Devaraj Y, Jayaraj J, Swaroop MR, Reddy AV, Rudraiah N. A comparative study of efficacy and safety of microneedling fractional radiofrequency with and without subcision for facial acne scars. *IP Indian J Clin Exp Dermatol*. 2025;11(3):301-308.