Section: Dermatology

Original Research Article

A COMPARATIVE STUDY OF FRACTIONAL CO2 LASER VERSUS PLATELET-RICH PLASMA WITH DERMAROLLER IN ACNE SCAR PATIENTS: A PROSPECTIVE COMPARATIVE STUDY

Amrisha Ambashta[1], Sapna Goyal[2], Vijay P Gupta[3], Ajitesh P Varshney[4], Somula Sushma Reddy[5]

[1,5]Postgraduate Student, Department of Dermatology, Venereology & Leprosy, Rajshree Medical Research Institute, Bareilly, Uttar Pradesh, India.
[2]Professor & Head, Department of Dermatology, Venereology & Leprosy, Rajshree Medical Research Institute, Bareilly, Uttar Pradesh, India.
[3]Professor, Department of Dermatology, Venereology & Leprosy, Rajshree Medical Research Institute, Bareilly, Uttar Pradesh, India.
[4]Associate Professor, Department of Dermatology, Venereology & Leprosy, Rajshree Medical Research Institute, Bareilly, Uttar Pradesh, India.

Received *: 04/01/2026*
Received in revised form *: 09/02/2026*
Accepted *: 25/02/2026*

Corresponding Author:
Dr. Amrisha Ambashta,
Department of Dermatology, Venereology & Leprosy, Rajshree Medical Research Institute, Bareilly, Uttar Pradesh, India.
Email: amrisha.02jan@gmail.com

DOI: 10.70034/ijmedph.2026.1.414

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2026; 16 (1); 2392-2398

ABSTRACT

Background: Acne vulgaris frequently results in scarring, causing significant cosmetic and psychological distress. While multiple treatment modalities exist, comparative data on Fractional CO_2 Laser versus Platelet-Rich Plasma (PRP) combined with Dermaroller in Indian patients with darker skin types remain limited. **Objective:** To compare the efficacy and safety of Fractional CO_2 Laser versus PRP combined with Dermaroller in the management of acne scars.
Materials and Methods: This prospective comparative study enrolled 200 patients with acne scars, randomly allocated into two equal groups (n=100 each). Group 1 received three sessions of Fractional CO_2 Laser, while Group 2 received three sessions of PRP with Dermaroller at three-week intervals. Assessments were performed at baseline and at 3, 6, 9, and 12 weeks using Goodman Baron Qualitative scale, Quantitative score and Visual Analog Scale (VAS). Adverse effects were documented. Statistical significance was set at $p < 0.05$.
Results: Both groups demonstrated significant improvement; however, Fractional CO_2 Laser showed greater reduction in Goodman-Baron quantitative scores at week 9 (34.80±5.90 vs 37.50±6.10; p=0.0017) and week 12 (30.20±5.30 vs 34.10±5.80; p<0.0001). VAS scores were consistently higher in the laser group at all time points (p<0.05). Goodman–Baron qualitative grading showed comparable baseline severity between groups (p = 0.96), with greater improvement at week 12 in the Fractional CO_2 laser group compared to the PRP with dermaroller group, though the difference did not reach statistical significance (p = 0.06). Adverse effects were more common in the laser group (87% vs 55%; p<0.0001), with erythema (78%), pain (65%), and PIH (22%) being most frequent.
Conclusion: Fractional CO_2 Laser demonstrates superior efficacy for acne scar improvement, whereas PRP with Dermaroller offers a safer profile with fewer adverse effects. Treatment selection should be individualized based on scar morphology, patient preference, and downtime tolerance.
Keywords: Acne scars, Fractional CO_2 laser, Platelet-rich plasma, Dermaroller, Microneedling.

INTRODUCTION

Acne vulgaris is one of the most prevalent dermatological disorders worldwide, affecting approximately 85% of adolescents and young adults at some point in their lives.[1] Although the disease often subsides after adolescence, acne scars persist in nearly 7.1% of affected individuals, leading to long-lasting cosmetic and psychological consequences.[2,3] Beyond physical disfigurement, acne scarring adversely affects self-esteem, body image, and interpersonal relationships, and is strongly associated with anxiety, depression, and social withdrawal.[4,5]

The pathogenesis of acne scarring involves persistent inflammation and subsequent degradation of dermal collagen during the healing process, resulting in depressions.[6] Genetic predisposition, delayed treatment of inflammatory lesions, and mechanical manipulation further increase the risk of permanent scarring.[7] In Indian populations, studies report a high burden of post-acne scarring, reflecting both genetic and environmental influences as well as limited early intervention.[8]

Multiple therapeutic options have been developed for acne scars, including ablative and non-ablative lasers, chemical peels, microneedling, subcision, and autologous platelet-rich plasma (PRP) therapies.[9,10] Among these, Fractional CO_2 laser resurfacing has been considered the gold standard for moderate-to-severe scars due to its ability to reach the deeper dermis and induce controlled thermal injury followed by collagen remodeling.[11] However, concerns over post-inflammatory hyperpigmentation (PIH), prolonged erythema, and patient downtime—especially in darker Fitzpatrick skin types—limit its universal acceptance.[12]

In recent years, PRP combined with Dermaroller has emerged as an effective, safer alternative.[13] PRP is an autologous concentrate of platelets carrying various growth factors—including platelet-derived growth factor (PDGF), transforming growth factor-beta (TGF-β), vascular endothelial growth factor (VEGF), and epidermal growth factor (EGF)—which accelerate tissue regeneration, angiogenesis, and collagen synthesis.[14] When combined with microneedling, these growth factors are delivered more effectively into the dermis through microchannels, enhancing fibroblast proliferation and extracellular matrix deposition.[15]

Comparative clinical trials evaluating Fractional CO_2 Laser versus PRP with Dermaroller have reported variable outcomes. Some studies found Fractional CO_2 Laser to produce greater objective scar score reduction,[16] whereas others reported comparable efficacy with better tolerability for PRP-based protocols.[17] The differences in findings may relate to variations in device parameters, PRP preparation protocols, treatment sessions, and scar morphology among participants.[18]

Given the paucity of comparative data in Indian patients with higher Fitzpatrick skin types, this study aimed to systematically analyze and compare the effectiveness, safety, and patient satisfaction of Fractional CO_2 Laser and PRP combined with Dermaroller in patients with acne scars.

MATERIALS AND METHODS

This prospective comparative study was conducted in the Department of Dermatology, Venereology and Leprosy at Rajshree Medical Research Institute, Bareilly, India, from April 2024 to November 2025, after approval from the Institutional Ethics Committee and obtaining written informed consent from all participants. A total of 200 patients aged 18–45 years with clinically diagnosed acne scars were enrolled, based on a calculated sample size of 100 patients per group using a 95% confidence level and a 5% margin of error. Eligible participants were randomly allocated into two groups: Group 1 received three sessions of fractional CO_2 laser therapy, and Group 2 received three sessions of platelet-rich plasma (PRP) combined with dermaroller treatment, both administered at three-week intervals. Patients with active acne, recent retinoid use, keloidal tendency, bleeding disorders, active dermatological or systemic illnesses, pregnancy, lactation, or prior laser resurfacing were excluded. Clinical evaluations were performed at baseline and at 3, 6, 9, and 12 weeks using validated assessment tools, including the Goodman and Baron quantitative and qualitative grading systems and Visual Analog Scale, along with standardized photography. Adverse effects were documented at each visit. Statistical analysis was carried out using SPSS version 29, with appropriate descriptive and inferential tests applied, and a p-value of <0.05 was considered statistically significant.

RESULTS

A total of 200 patients completed the study, with 100 in each treatment group. The age distribution was comparable between groups, with most participants in the 25-34 years age group (51% in Group 1 vs 55% in Group 2; p=0.83). Gender distribution was also similar, with females comprising 53% in Group 1 and 49% in Group 2 (p=0.57). Students formed the largest occupational subgroup (44% vs 50%; p=0.20), and most patients belonged to upper-middle socioeconomic status (51% vs 60%; p=0.61). Family history of acne was present in 38% and 35% of patients, respectively (p=0.66). (Table 1)

The distribution of scar types was nearly identical between groups, with ice-pick + boxcar combination being most common (44% vs 45%; p=0.96). The majority of patients had scar duration greater than one year (80% vs 79%; p=0.53). All participants belonged to Fitzpatrick skin types III-V, with type IV being most prevalent (51% vs 50%; p=0.85), reflecting the typical Indian population. [Table 1]

Table 1: Baseline Demographic and Clinical Characteristics of Study Participants

Characteristic	Group 1: Fractional CO_2 Laser (n=100)	Group 2: PRP + Dermaroller (n=100)	p-value
Age Group (years)			**0.83**
18–24	44 (44%)	41 (41%)	
25–34	51 (51%)	55 (55%)	
>35	5 (5%)	4 (4%)	
Gender			**0.57**
Male	47 (47%)	51 (51%)	
Female	53 (53%)	49 (49%)	
Occupation			**0.20**
Business	11 (11%)	17 (17%)	
Service	35 (35%)	30 (30%)	
Homemaker	9 (9%)	3 (3%)	
Student	44 (44%)	50 (50%)	
Unemployed	1 (1%)	0 (0%)	
Socioeconomic Status			**0.61**
Upper	19 (19%)	17 (17%)	
Upper middle	51 (51%)	60 (60%)	
Lower middle	27 (27%)	22 (22%)	
Upper lower	2 (2%)	1 (1%)	
Lower	1 (1%)	0 (0%)	
Family History of Acne			**0.66**
Yes	38 (38%)	35 (35%)	
No	62 (62%)	65 (65%)	
Scar Type			**0.96**
Ice-pick + Boxcar + Rolling	30 (30%)	32 (32%)	
Ice-pick + Boxcar	44 (44%)	45 (45%)	
Ice-pick + Rolling	15 (15%)	13 (13%)	
Boxcar + Rolling	11 (11%)	10 (10%)	
Duration of Symptoms			**0.53**
<6 months	3 (3%)	1 (1%)	
6–12 months	17 (17%)	20 (20%)	
>1 year	80 (80%)	79 (79%)	
Fitzpatrick Skin Type			**0.85**
III	17 (17%)	20 (20%)	
IV	51 (51%)	50 (50%)	
V	32 (32%)	30 (30%)	

Table 2: Comparison of Goodman–Baron Quantitative Scores Over Time

Time Point	Group 1: Fractional CO_2 Laser (Mean ± SD)	Group 2: PRP + Dermaroller (Mean ± SD)	p-value	t-value
Baseline	41.20 ± 6.80	41.10 ± 6.75	0.91	0.10
Week 3	38.50 ± 6.40	39.80 ± 6.55	0.16	−1.42
Week 6	37.90 ± 6.20	39.10 ± 6.40	0.18	−1.35
Week 9	34.80 ± 5.90	37.50 ± 6.10	0.0017	−3.18
Week 12	30.20 ± 5.30	34.10 ± 5.80	<0.0001	−4.97

At baseline, quantitative scores were almost identical between groups (41.20±6.80 vs 41.10±6.75; p=0.91). Both groups showed progressive reduction in scores over the 12-week follow-up period. At week 3 (38.50±6.40 vs 39.80±6.55; p=0.16) and week 6 (37.90±6.20 vs 39.10±6.40; p=0.18), differences were not statistically significant. However, at week 9 (34.80±5.90 vs 37.50±6.10; p=0.0017) and week 12 (30.20±5.30 vs 34.10±5.80; p<0.0001), Fractional CO_2 Laser demonstrated significantly greater reduction in scar scores compared to PRP with Dermaroller. [Table 2]

Table 3: Goodman–Baron Qualitative Grading at Baseline and Week 12

Severity Grade	Baseline Group 1	Baseline Group 2	Week 12 Group 1	Week 12 Group 2
Macular	6 (6%)	7 (7%)	18 (18%)	10 (10%)
Mild	30 (30%)	32 (32%)	50 (50%)	40 (40%)
Moderate	44 (44%)	43 (43%)	28 (28%)	44 (44%)
Severe	20 (20%)	18 (18%)	4 (4%)	6 (6%)
p-value	**0.96**		**0.06**	

At baseline, grade severity distribution was comparable between groups (p=0.96). At week 12, the Fractional CO_2 Laser group showed a higher proportion of patients achieving macular (18% vs 10%) and mild (50% vs 40%) grades, while the PRP with Dermaroller group had more patients in the moderate category (44% vs 28%). The difference approached but did not reach statistical significance (p=0.06). Both groups demonstrated significant within-group improvement from baseline. [Table 3]

Table 4: Visual Analog Scale (VAS) Scores at Follow-up Visits

Time Point	Group 1: Fractional CO_2 Laser (Mean ± SD)	Group 2: PRP + Dermaroller (Mean ± SD)	p-value	t-value
Week 3	1.80 ± 0.90	1.50 ± 0.80	0.013	2.49
Week 6	2.60 ± 1.10	2.20 ± 1.00	0.007	2.69
Week 9	4.80 ± 1.40	3.90 ± 1.30	<0.0001	4.71
Week 12	6.60 ± 1.60	5.20 ± 1.50	<0.0001	6.38

Patient-perceived improvement showed a progressive increase in both groups throughout the study. However, VAS scores were consistently higher in the Fractional CO_2 Laser group at all follow-up points: week 3 (1.80±0.90 vs 1.50±0.80; p=0.013), week 6 (2.60±1.10 vs 2.20±1.00; p=0.007), week 9 (4.80±1.40 vs 3.90±1.30; p<0.0001), and week 12 (6.60±1.60 vs 5.20±1.50; p<0.0001). [Table 4]

Table 5: Adverse Effects Profile

Adverse Effect	Group 1: Fractional CO_2 Laser (n=100)	Group 2: PRP + Dermaroller (n=100)
Erythema	78 (78%)	42 (42%)
Pain / Burning / Stinging	65 (65%)	38 (38%)
Post-inflammatory hyperpigmentation	22 (22%)	8 (8%)
Pruritus	18 (18%)	12 (12%)
Dryness & peeling	30 (30%)	15 (15%)
Secondary skin infection	2 (2%)	1 (1%)
Total patients with side effects	**87 (87%)**	**55 (55%)**
p-value	**<0.0001**	

Adverse effects were significantly more frequent in the Fractional CO_2 Laser group compared to the PRP with Dermaroller group (87% vs 55%; p<0.0001). In the laser group, erythema (78%), pain/burning/stinging (65%), dryness and peeling (30%), and PIH (22%) were the most common adverse effects. In contrast, the PRP group experienced milder side effects, with erythema (42%), pain (38%), and dryness (15%) being most frequent. PIH was significantly lower in the PRP group (8% vs 22%). Secondary skin infection was rare in both groups (2% vs 1%). [Table 5]

Group 1 (Fractional CO2 Laser) At baseline

At 12th week

Group 2 (PRP+Dermaroller) At baseline

At 12th week

DISCUSSION

This prospective comparative study evaluated the efficacy and safety of Fractional CO_2 Laser versus PRP combined with Dermaroller in 200 patients with acne scars over a 12-week follow-up period. Both treatment modalities demonstrated significant clinical improvement; however, their efficacy profiles and safety outcomes differed considerably.

Baseline Comparability

The two treatment groups were well-matched at baseline across all demographic and clinical parameters, including age, gender, occupation, socioeconomic status, family history, scar type, duration of symptoms, and Fitzpatrick skin type. This homogeneity ensures that observed differences in outcomes can be attributed to the treatment interventions rather than confounding variables. The predominance of patients in the 18-34 years age group aligns with the well-documented peak prevalence of post-acne scarring among young adults, consistent with previous Indian studies.[22,23] The nearly equal gender distribution reflects the universal impact of acne scarring, corroborating findings by Majid et al.[24]

Efficacy of Fractional CO_2 Laser

Fractional CO_2 Laser demonstrated superior efficacy in reducing Goodman-Baron quantitative scar scores, with statistically significant differences emerging from week 9 onward and becoming highly significant at week 12 ($p<0.0001$). This finding aligns with the established mechanism of fractional photothermolysis, wherein controlled microthermal zones induce collagen denaturation, shrinkage, and subsequent neocollagenesis, resulting in gradual improvement in scar contour over weeks to months.[25] El-Domyati et al,[26] provided histological evidence of collagen III to collagen I turnover following fractional laser treatment, supporting the clinical observations.

The greater improvement in qualitative grading at week 12, though not reaching statistical significance ($p=0.06$), suggests a clinically meaningful advantage for laser therapy. This is consistent with Alster and West,[27] who reported significant textural elevation following ablative resurfacing. The higher proportion of patients achieving macular and mild grades in the laser group indicates substantial scar remodeling and surface improvement.

Patient satisfaction, as measured by VAS, was consistently higher in the laser group at all time points. The earlier visible improvement likely contributed to higher subjective satisfaction, as previously reported by Lee et al,[28] and Cho et al,[29] At week 12, the mean VAS score of 6.60 in the laser group corresponded to "good response," compared to 5.20 ("fair response") in the PRP group.

Efficacy of PRP with Dermaroller

PRP combined with Dermaroller also produced significant clinical improvement, with progressive reduction in quantitative scores and qualitative grades throughout the study period. This finding supports the growing body of evidence for PRP as an effective treatment modality for acne scars.[13-15] The mechanism involves controlled micro-injuries from microneedling triggering a wound-healing cascade, while PRP-derived growth factors (PDGF, TGF-β, VEGF, EGF) enhance fibroblast proliferation, neocollagenesis, and angiogenesis.[14]

However, the magnitude of improvement was comparatively less pronounced than with laser therapy. This observation aligns with studies by Fabbrocini et al,[30] and Dogra et al,[15] who reported moderate but consistent improvement with PRP-based protocols. The gradual nature of collagen induction with microneedling, requiring multiple sessions for optimal results, explains the delayed and less dramatic response compared to ablative laser therapy.

Comparative Efficacy

The superior efficacy of Fractional CO_2 Laser can be attributed to its deeper dermal penetration and more robust collagen remodeling capacity. Ablative fractional lasers create controlled thermal injury zones extending into the reticular dermis, stimulating intense neocollagenesis and reorganization of the extracellular matrix.[25] In contrast, PRP with Dermaroller primarily induces collagen through mechanical injury and growth factor-mediated pathways, which, while effective, may require more sessions to achieve comparable results.

Our findings are consistent with previous comparative studies. Pooja et al,[16] reported 68.7% improvement with Fractional CO_2 Laser after four sessions compared to 31.1% with PRP monotherapy. Solanki et al,[18] demonstrated superior outcomes with Fractional CO_2 Laser plus PRP compared to microneedling plus PRP. However, Faghihi et al,[17] found no statistically significant difference between combination approaches, suggesting that PRP may enhance laser outcomes when used adjunctively.

Safety Profile

The safety analysis revealed significantly higher adverse effects in the Fractional CO_2 Laser group (87% vs 55%; $p<0.0001$). This expected finding reflects the deeper thermal injury and longer recovery period associated with ablative laser resurfacing. Erythema (78%), pain/burning (65%), and

dryness/peeling (30%) were common transient effects, consistent with previous reports.[11,12]

PIH occurred in 22% of laser-treated patients, despite using conservative parameters and appropriate skin typing. This rate, while higher than in lighter skin types, is comparable to other studies in Indian populations,[8,22] and underscores the need for careful patient selection, pre-treatment priming, and strict photoprotection in Fitzpatrick skin types IV-V.

In contrast, PRP with Dermaroller demonstrated a favorable safety profile with milder, shorter-lived side effects. The lower PIH rate (8%) makes this modality particularly suitable for darker skin types and patients concerned about pigmentary complications. This aligns with the established safety of microneedling in all skin types due to epidermal preservation.[13,14]

Clinical Implications

The divergent efficacy and safety profiles of these two modalities suggest distinct clinical roles:

Fractional CO_2 Laser should be considered the preferred option for patients seeking maximal improvement, those with moderate-to-severe scars, and individuals willing to accept temporary downtime and adverse effects for superior outcomes. However, careful patient selection and counseling regarding PIH risk are essential, particularly in darker skin types.

PRP with Dermaroller represents an excellent alternative for patients with mild-to-moderate scarring, those with Fitzpatrick skin types IV-V concerned about PIH, individuals seeking minimal downtime, and patients unable or unwilling to undergo ablative procedures. The cost-effectiveness and excellent safety profile make it particularly valuable in resource-limited settings.

Limitations

This study has several limitations. First, the 12-week follow-up period may not be sufficient to evaluate long-term collagen remodeling and durability of results. Second, being a single-center study, findings may not be generalizable to broader populations with different ethnic backgrounds. Third, despite comparable baseline distribution, mixed scar types inherently respond variably to treatments, and individual scar morphology analysis was not performed. Fourth, no histopathological correlation was obtained to correlate clinical improvement with dermal matrix changes. Fifth, cost-effectiveness analysis was not evaluated, which may influence treatment decisions in resource-limited settings.

Future Directions

Future research should focus on longer follow-up periods to assess result stability and late-onset adverse effects. Combination or sequential approaches (e.g., Fractional CO_2 Laser followed by PRP sessions) may provide synergistic benefits and warrant investigation. Objective imaging techniques and histopathological studies would strengthen evidence. Multi-center trials with larger sample sizes and standardized protocols would improve generalizability. Cost-effectiveness analysis would aid clinical decision-making in diverse healthcare settings.

CONCLUSION

This prospective comparative study demonstrates that both Fractional CO_2 Laser and PRP combined with Dermaroller are effective treatments for acne scars. Fractional CO_2 Laser produces superior improvement across objective and subjective outcome measures, with significantly greater reduction in Goodman-Baron quantitative and qualitative scores and higher patient satisfaction at 12 weeks. However, this superior efficacy comes at the cost of significantly higher adverse effects, including erythema, pain, PIH, and prolonged downtime.

PRP with Dermaroller offers a safer alternative with fewer and milder adverse effects, making it particularly suitable for patients with Fitzpatrick skin types IV-V, those concerned about pigmentary complications, and individuals preferring minimal downtime. The moderate but consistent improvement supports its role as a valuable treatment option.

The choice between these modalities should be individualized based on scar morphology, severity, patient preference, downtime tolerance, and skin type. Fractional CO_2 Laser remains the gold standard for patients seeking maximal aesthetic improvement, while PRP with Dermaroller provides an effective, safer alternative for appropriate candidates. Combination or sequential approaches may offer enhanced outcomes and represent an important direction for future research.

REFERENCES

1. Lynn DD, Umari T, Dunnick CA, Dellavalle RP. The epidemiology of acne vulgaris in late adolescence. Adolesc Health Med Ther. 2016;7:13-25.
2. Wu T, Mei S, Zhang J, Gong L, Wu F, Wu W, et al. Prevalence and risk factors of facial acne vulgaris among Chinese adolescents. Int J Adolesc Med Health. 2007;19(4):407-12.
3. Layton AM, Henderson CA, Cunliffe WJ. A clinical evaluation of acne scarring and its incidence. Clin Exp Dermatol. 1994;19(4):303-8.
4. Dreno B, Poli F. Epidemiology of acne. Dermatology. 2003;206(1):7-10.
5. Thomas DR. Psychosocial effects of acne. J Cutan Med Surg. 2004;8(Suppl 4):3-5.
6. Layton AM. The pathogenesis of acne scarring. Br J Dermatol. 2017;176(2):288-96.
7. Dreno B, Bettoli V, Araviiskaia E, Sanchez Viera M, Bouloc A. The influence of acne severity, delay of effective therapy, and compliance on the risk of scarring: results from the FACE study. J Eur Acad Dermatol Venereol. 2015;29(12):2227-34.
8. Sardana K, Garg VK, Sehgal VN. Acne and its scars in Indian patients: an epidemiological and clinical overview. Int J Dermatol. 2019;58(12):1369-76.
9. Fabbrocini G, Annunziata MC, D'Arco V, De Vita V, Lodi G, Mauriello MC, et al. Acne scars: pathogenesis, classification and treatment. Dermatol Res Pract. 2010;2010:893080.
10. Connolly D, Vu HL, Mariwalla K, Saedi N. Acne Scarring-Pathogenesis, Evaluation, and Treatment Options. J Clin Aesthet Dermatol. 2017;10(9):12-23.
11. Tierney EP, Hanke CW. Fractionated carbon dioxide laser treatment for acne scarring. Dermatol Surg. 2009;35(12):1800-8.

12. Chapas AM, Brightman L, Sukal S, Hale E, Daniel D, Bernstein LJ, et al. Safety of fractional CO_2 laser resurfacing in Fitzpatrick skin types IV-VI. Lasers Surg Med. 2008;40(5):367-72.
13. Nandini AS, Sankey SM, Sowmya CS, Sharath Kumar BC. Split-face Comparative Study of Efficacy of Platelet-rich Plasma Combined with Microneedling versus Microneedling alone in Treatment of Post-acne Scars. J Cutan Aesthet Surg. 2021;14(1):26-31.
14. El-Domyati M, Barakat M, Awad S, Medhat W, El-Fakahany H, Farag H. Microneedling therapy with and without PRP in acne scars. J Cosmet Dermatol. 2021;20(1):208-15.
15. Dogra S, Yadav S, Sahoo B. Microneedling with PRP in atrophic acne scars: a randomized controlled trial. Dermatol Ther. 2018;31(5):e12632.
16. Pooja T, Gopal KVT, Rao TN, Laxmi N. A Randomised study to evaluate the efficacy Fractional CO2 laser, Microneedling and Platelet rich plasma in Post Acne Scarring. Indian Dermatol Online J. 2020;11:349-54.
17. Faghihi G, Keyvan S, Asilian A, Nouraei S, Behfar S, Nilforoushzadeh MA. Efficacy of autologous platelet-rich plasma combined with fractional ablative carbon dioxide resurfacing laser in treatment of facial atrophic acne scars: A split-face randomized clinical trial. Indian J Dermatol Venereol Leprol. 2016;82:162-8.
18. Solanki A, Sharma R, Dev T, Sreenivas V. Microneedling with Platelet rich Plasma versus Fractional CO2 Laser with Platelet rich Plasma in patients with post acne scars. Indian J Ap Basic Med Sc. 2020;16:34-43.
19. Goodman GJ, Baron JA. Postacne scarring—a quantitative global scarring grading system. J Cosmet Dermatol. 2006;5(1):48-52.
20. Goodman GJ, Baron JA. Postacne scarring—a qualitative global scarring grading system. J Cosmet Dermatol. 2006;32:1458-66.
21. Sharma S, Kaur T, Bassi R. A split face comparative study to evaluate the efficacy of skin microneedling and platelet rich plasma (PRP) combination versus skin microneedling alone for treatment of post acne scars. Pak J Asso Dermatol. 2020;30(3):449-55.
22. Garg S, Baveja S. Treatment of post acne scars with subcision. J Cutan Aesthet Surg. 2009;2(1):26-30.
23. Rao A, Yadav P. Prevalence and pattern of acne scars in tertiary care center. Indian J Dermatol. 2014;59(2):134-6.
24. Majid I. Assessment of the efficacy of fractional CO_2 laser in the treatment of atrophic acne scars. J Cutan Aesthet Surg. 2009;2(1):26-30.
25. Manstein D, Herron GS, Sink RK, Tanner H, Anderson RR. Fractional photothermolysis: a new concept for cutaneous remodeling. Lasers Surg Med. 2004;34(5):426-38.
26. El-Domyati M, Barakat M, Abdel-Wahab H, Medhat W, El-Fakahany H, Farag H. Fractional CO_2 laser vs microneedling in acne scars: histological and clinical comparison. J Am Acad Dermatol. 2014;70(6):104.e1-7.
27. Alster TS, West TB. Resurfacing acne scars with CO_2 laser: a clinical study. Dermatol Surg. 2003;29(4):382-5.
28. Lee HS, Lee JH, Seo YJ, Suh DH, Lee SJ. Patient satisfaction after fractional CO_2 laser resurfacing for acne scars. Dermatol Surg. 2013;39(12):1845-50.
29. Cho EB, Lee JH. Fractional CO_2 laser vs non-ablative laser for acne scarring: comparative study. Lasers Med Sci. 2014;29(2):653-9.
30. Fabbrocini G, De Vita V, Pastore F, Panariello L, Fardella N, Sepulveres R, et al. Combined treatment for atrophic acne scars: CO_2 fractional laser and platelet-rich plasma. Dermatol Ther. 2014;27(2):122-6.