Section: Dermatology

Original Research Article

A COMPARATIVE STUDY BETWEEN THE EFFICACY OF MICRONEEDLING VERSUS MICRONEEDLING WITH PLATELET-RICH PLASMA ON ATROPHIC FACIAL ACNE SCARS

Y Prathyusha[1], S. Dhanyasree[2], Chenna Subhashini[3], Ajay Kumar Gummalla[4]

[1]Associate Professor, Department of DVL, Gayatri Vidya Parishad Institute of Health Care and Medical Technology, Visakhapatnam, Andhra Pradesh, India.
[2]Associate Professor, Department of DVL, Dr YSR Government Medical College, Eluru, Andhra Pradesh, India.
[3]Associate Professor, Incharge HOD, Department of DVL, Government Medical College, Kadapa, Andhra Pradesh, India.
[4]Associate Professor, Department of DVL, Dr YSR Government Medical College, Vizianagaram, Andhra Pradesh, India

Received : 14/05/2024
Received in revised form : 11/05/2024
Accepted : 29/05/2024

Keywords:
Acne Scars, Dermaroller, Platelet Rich Plasma.

Corresponding Author:
Dr. Ajay Kumar Gummalla,
Email: akgummalla@gmail.com

DOI: 10.47009/jamp.2024.6.3.51

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

Int J Acad Med Pharm
2024; 6 (3); 242-247

Abstract

Background: Acne vulgaris is a persistent pilosebaceous follicular condition that affects over 90% of teenagers and can persist into adulthood in about 12-14% of cases. Severe inflammatory responses can cause texture changes in both the superficial and deep dermis, resulting in post-acne scars. The objectives are to study the effect of microneedling on atrophic facial acne scars, to compare this effect with the synergistic effect of microneedling and Platelet-rich plasma therapy. **Materials and Methods:** Study Design: Hospital-based observational comparative study. Study area: Department of Dermatology Venereology and Leprosy. Study Period: 1 year. Sample size: The study consisted of a total of 30 subjects. Study tools and Data collection procedure: Thirty patients with facial atrophic acne scars were offered four sittings of microneedling with platelet-rich plasma (PRP) treatment 4 weeks apart in one group (GROUP A) and with microneedling alone in another group (GROUP B). The patients were randomly assigned to each group. The patients were explained about the microneedling and PRP therapy, benefits, duration of the treatment, possible side effects and prognosis. Informed consent was taken. Digital photographs were taken. **Result:** The mean score of Goodman and Baron Quantitative grading at baseline for Group A was 13.27 and 14.73 for Group B, respectively. The mean score improved to 9.73 at 8 weeks and 7.00 at 16 weeks in Group A whereas, Group B showed an improvement of 10.87 at 8 weeks and 8.00 at 16 weeks, respectively. **Conclusion:** Our study concluded that Combining microneedling with topical autologous platelet-rich plasma is more effective than using a dermaroller alone for healing atrophic acne scars. Both operations are safe and well-tolerated by the patients.

INTRODUCTION

Acne vulgaris is a persistent pilosebaceous follicular condition that affects over 90% of teenagers and can persist into adulthood in about 12-14% of cases.[1,2] Severe inflammatory responses can cause texture changes in both the superficial and deep dermis, resulting in post-acne scars.[3] Jacob CI et al. presented a widely accepted classification system for atrophic acne scars. Atrophic acne scars come in three types: ice-pick, rolling, and boxcar.[4]

There are several treatment options for atrophic acne scars, including fillers, lasers, chemical peels, dermabrasion, TCA CROSS, microneedling, and radiofrequency.[5]

Microneedling involves repeatedly puncturing the skin with small needles, resulting in micro clefts that reach the dermis. This promotes wound healing, growth factor release, and collagen deposition in the upper dermis.[1] Microneedling with derma roller is a new therapeutic option for acne scars.[6]

A typical derma roller used for acne scars measures 0.5-3 mm in length and 0.1-0.25 mm in diameter.[7] Microneedling promotes the production of new collagen and elastin in the papillary dermis without harming the epidermis.[4,6] Platelet-rich plasma (PRP) is an autologous solution of plasma with 4-7 times the

ISSN (O): 2687-5365; ISSN (P): 2753-6556

baseline concentration of human platelets. It is generated by centrifuging patients' blood and has been used to treat numerous dermatological diseases.[8] Platelet-derived growth factors promote cellular development, maturation, and differentiation, which can accelerate healing.[9] PRP has regenerating properties for keratinocytes, endothelial cells, erythrocytes, fibroblasts, and collagen.[10]

Microneedling enhances PRP absorption. PRP and skin are needling to produce growth factors that work together to improve wound healing.[11] While there are studies on the role of microneedling and platelet-rich plasma in atrophic acne scars, few Indian studies have compared the clinical efficacy and safety of combining microneedling with topical autologous platelet-rich plasma to microneedling alone. We conducted a study to compare the effectiveness and safety of microneedling with dermaroller and topical application of autologous platelet-rich plasma for treating face atrophic acne scars.

Objectives:

1. To study the effect of microneedling on atrophic facial acne scars.
2. To compare this effect with the synergistic effect of microneedling and Platelet-rich plasma therapy.

MATERIALS AND METHODS

Study Design: Hospital-based observational comparative study.

Study area: Department of Dermatology Venereology and Leprosy.

Study Period: 1 year.

Study population:

Sample size: The study consisted of a total of 30 subjects.

Sampling method: Simple random method.

Inclusion criteria

- Patients with atrophic facial acne scars.
- Aged 18-40yrs

Exclusion criteria

- Patients with atrophic facial acne scars due to other causes.
- Patients on oral isotretinoin treatment.
- Patients with active acne.
- Patients with recurrent herpes simplex
- Patients with a keloidal tendency
- Patients with blood coagulation disorders.

Ethical consideration: Institutional Ethical committee permission was taken before the commencement of the study.

Study tools and Data collection procedure: Thirty patients with facial atrophic acne scars were offered four sittings of microneedling with platelet-rich plasma (PRP) treatment 4 weeks apart in one group (GROUP A) and with microneedling alone in another group (GROUP B). The patients were randomly assigned to each group. The patients were explained about the microneedling and PRP therapy, benefits, duration of the treatment, possible side effects and prognosis. Informed consent was taken. Digital photographs were taken. At the end of the treatment duration, the scars were graded using the Goodman and Baron Quantitative grading system as used in the beginning, and photographs of the face were compared.

For PRP, 10 ml of autologous whole blood was collected into tubes containing acid citrate dextrose (ACD) and centrifuged at 1500 rpm for 15 minutes to get PRP at the top of the test tube. Then, the PRP was further centrifuged at 3000 rpm for 5 minutes at room temperature of 22°C to obtain a platelet count 4.5 times higher than the baseline (i.e. 8-9 lakhs/µl). Platelet-poor plasma (PPP) was partly removed and partly used to resuspend the platelets. Calcium chloride was added as an activator,0.3 ml of 10% Calcium chloride for 1 ml of PRP. Microneedles with 1.5 mm length and 192 needles on a roller drum were used for this study.

Assessments: Treatment efficacy during follow-up was determined by Goodman and Baron Quantitative Score,[12,13] as well as the percentage of acne scar counts of Icepick, Rolling scar, Boxcar scars and linear scars at follow-up were compared at baseline, 8 weeks, and 16 weeks.

Statistical analysis: After the completion of the study, the data obtained were analyzed statistically by using IBM SPSS version 24.0 software (student's T-test, Chi-square test, and significant figures). The Acne Score grades between the groups were compared with the baseline score by using the Man Whitney U test. A p-value of <0.05 was considered significant.

RESULTS

In my study, the most common Age group presented with Acne scars was 20 - 25 yrs (50%). [Table 1]

In the present study Group A: 15 patients (100%), Group B: 15 patients (100%) have the highest no. of Acne scars over the cheeks, followed by Acne scars over the jaw. Group A: 13 patients (86.7%), Group B: 14 patients (93.3%) and Acne scars over the forehead Group patients (13.3%), Group B: 9 patients (60 %). [Table 2]

Table 1: Age-wise distribution of patients

Group					Total
Group-A				Group-B	
Age Group	18-20	Count	1	0	1
		% within Age Group	100.0%	0.0%	100.0%
		% within Group	6.7%	0.0%	3.3%
	20-25	Count	8	7	15

ISSN (O): 2687-5365; ISSN (P): 2753-6556

		% within Age Group	53.3%	46.7%	100.0%
		% within Group	53.3%	46.7%	50.0%
	25-30	Count	3	5	8
		% within Age Group	37.5%	62.5%	100.0%
		% within Group	20.0%	33.3%	26.7%
	30-35	Count	3	3	6
		% within Age Group	50.0%	50.0%	100.0%
		% within Group	20.0%	20.0%	20.0%
Total		Count	15	15	30
		% within Age Group	50.0%	50.0%	100.0%
		% within Group	100.0%	100.0%	100.0%

Chi-Square value = 1.567, P Value = 0.667 (Not Sig.)

Table 2: Distribution of acne scars on the face

Site	GROUP A	GROUP B
Jaw	13	14
Forehead	2	9
Cheek	15	15

Table 3: Duration of scars

Group					Total
Group-A				Group-B	
Duration_Scar	<6 Months	Count	3	0	3
		% within Duration_Scar	100.0%	0.0%	100.0%
		% within Group	20.0%	0.0%	10.0%
	6 Months - 1 year	Count	2	2	4
		% within Duration_Scar	50.0%	50.0%	100.0%
		% within Group	13.3%	13.3%	13.3%
	1 Year - 2 Years	Count	8	5	13
		% within Duration_Scar	61.5%	38.5%	100.0%
		% within Group	53.3%	33.3%	43.3%
	> 2 Years	Count	2	8	10
		% within Duration_Scar	20.0%	80.0%	100.0%
		% within Group	13.3%	53.3%	33.3%
Total		Count	15	15	30
		% within Duration_Scar	50.0%	50.0%	100.0%
		% within Group	100.0%	100.0%	100.0%

Chi-Square value = 7.292, P Value = 0.063 (Not Sig.)

Table 4: Adverse effects

Adverse effects	Group-A	Group-B
Erythema	15	15
Burning sensation	1	1
Photosensitivity	6	4
Hyperpigmentation	1	1
Others (pain)	6	5

Table 5: Descriptive Statistics

N			Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Ice_Pick_0	Group-A	15	27.07	15.645	4.040	18.40	35.73	10	62
	Group-B	15	42.00	22.545	5.821	29.51	54.49	14	80
	Total	30	34.53	20.524	3.747	26.87	42.20	10	80
Ice_Pick_8_Wks	Group-A	15	20.87	13.964	3.605	13.13	28.60	7	48
	Group-B	15	32.93	20.834	5.379	21.40	44.47	7	72
	Total	30	26.90	18.475	3.373	20.00	33.80	7	72
Ice_Pick_16_Wks	Group-A	15	15.07	9.750	2.517	9.67	20.47	4	36
	Group-B	15	24.20	17.034	4.398	14.77	33.63	4	50
	Total	30	19.63	14.407	2.630	14.25	25.01	4	50
Rolling_Scar_0	Group-A	15	15.00	10.323	2.665	9.28	20.72	0	35
	Group-B	15	12.27	11.768	3.039	5.75	18.78	0	46
	Total	30	13.63	10.965	2.002	9.54	17.73	0	46
Rolling_Scar_8_Wks	Group-A	15	10.00	8.569	2.213	5.25	14.75	0	28
	Group-B	15	8.93	8.523	2.201	4.21	13.65	0	30
	Total	30	9.47	8.415	1.536	6.32	12.61	0	30
Rolling_Scar_16_Wks	Group-A	15	6.40	6.770	1.748	2.65	10.15	0	25
	Group-B	15	7.00	6.729	1.738	3.27	10.73	0	25
	Total	30	6.70	6.639	1.212	4.22	9.18	0	25

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Box_Sccar_0	Group-A	15	19.27	11.603	2.996	12.84	25.69	3	42
	Group-B	15	23.60	8.862	2.288	18.69	28.51	0	36
	Total	30	21.43	10.381	1.895	17.56	25.31	0	42
Box_Sccar_8_Wks	Group-A	15	12.00	8.460	2.184	7.32	16.68	2	34
	Group-B	15	15.80	7.262	1.875	11.78	19.82	0	28
	Total	30	13.90	7.984	1.458	10.92	16.88	0	34
Box_Sccar_16_Wks	Group-A	15	7.13	5.012	1.294	4.36	9.91	1	18
	Group-B	15	9.27	4.949	1.278	6.53	12.01	0	19
	Total	30	8.20	5.013	.915	6.33	10.07	0	19
Linear_Scar_0	Group-A	15	4.00	6.949	1.794	.15	7.85	0	20
	Group-B	15	2.33	4.639	1.198	-.24	4.90	0	15
	Total	30	3.17	5.867	1.071	.98	5.36	0	20
Linear_Scar_8_Wks	Group-A	15	2.80	5.281	1.363	-.12	5.72	0	16
	Group-B	15	1.67	3.352	.866	-.19	3.52	0	11

Total		**30**	**2.23**	**4.384**	**.800**	**.60**	**3.87**	**0**	**16**
Linear_Scar_16_Wks	Group-A	15	1.93	3.595	.928	-.06	3.92	0	12
	Group-B	15	1.33	2.664	.688	-.14	2.81	0	9
	Total	30	1.63	3.124	.570	.47	2.80	0	12
Grade_scar_0	Group-A	15	13.27	4.978	1.285	10.51	16.02	5	24
	Group-B	15	14.73	3.283	.848	12.92	16.55	8	18
	Total	30	14.00	4.210	.769	12.43	15.57	5	24
Grade_scar_8_Wks	Group-A	15	9.73	3.595	.928	7.74	11.72	3	16
	Group-B	15	10.87	3.248	.839	9.07	12.67	6	16
	Total	30	10.30	3.415	.624	9.02	11.58	3	16
Grade_scar_16_Wks	Group-A	15	7.00	3.946	1.019	4.81	9.19	3	14
	Group-B	15	8.00	3.586	.926	6.01	9.99	3	16
	Total	30	7.50	3.739	.683	6.10	8.90	3	16

Source of Variables	**Mann-Whitney U**	**Wilcoxon W**	**Z-value**	**P Value**
Ice_Pick_0	72.500	192.500	-1.664	0.096 (Not Sig.)
Ice_Pick_8_Wks	75.500	195.500	-1.538	0.124 (Not Sig.)
Ice_Pick_16_Wks	81.500	201.500	-1.287	0.198 (Not Sig.)
Rolling_Scar_0	91.500	211.500	-0.873	0.383 (Not Sig.)
Rolling_Scar_8_Wks	106.000	226.000	-0.270	0.787 (Not Sig.)
Rolling_Scar_16_Wks	103.500	223.500	-0.375	0.708 (Not Sig.)
Box_Sccar_0	82.500	202.500	-1.245	0.213 (Not Sig.)
Box_Sccar_8_Wks	78.000	198.000	-1.434	0.152 (Not Sig.)
Box_Sccar_16_Wks	82.000	202.000	-1.275	0.202 (Not Sig.)
Linear_Scar_0	102.500	222.500	-0.512	0.609 (Not Sig.)
Linear_Scar_8_Wks	103.500	223.500	-0.460	0.645 (Not Sig.)
Linear_Scar_16_Wks	105.000	225.000	-0.384	0.701 (Not Sig.)
Grade_scar_0	82.000	202.000	-1.270	0.204 (Not Sig.)
Grade_scar_8_Wks	86.500	206.500	-1.089	0.276 (Not Sig.)
Grade_scar_16_Wks	94.000	214.000	-0.773	0.439 (Not Sig.)

In the present study, a greater number of patients were found to have acne scars of duration 1 year – to 2 years. [Table 3]

In the present study, Group A 15 patients (100%), and Group B 15 patients (100%) were found to have erythema as the common adverse effect followed by Burning, Photosensitivity, and Hyperpigmentation. [Table 4]

Percentage of improvement in Ice Pick scars:

- Group A at 8 wks found to be 22.91%, and at 16 wks was 44.33%.
- Group B at 8wks found to be 21.59%, and at 16 wks was 42.38%.

Percentage of improvement in Rolling scars:

- Group A at 8 wks found to be 33.33%, and at 16 wks was 57.33%.
- Group B at 8wks found to be 27.17%, and at 16 wks was 42.93%.

Percentage of improvement in Boxcar scars:

- Group A at 8 wks found to be 37.72%, and at 16 wks was 62.98%.
- Group B at 8 wks found to be 33.05%, and at 16 wks was 60.73%.

Percentage of improvement in Linear scars:

- Group A at 8 wks found to be 30%, and at 16 wks was 51.67%.
- Group B at 8 wks found to be 28.57%, and at 16 wks was 42.86%.

Overall Percentage of improvement in Acne scars:

- Group A found to have a 26.63% improvement at 8 wks and a 47.24% improvement at 16 wks.
- Group B was found to have a 26.24% improvement at 8 weeks and a 45.70% Improvement at 16 weeks.

DISCUSSION

Atrophic acne scarring, a consequence of acne vulgaris, can cause emotional and social anguish.[14]

ISSN (O): 2687-5365; ISSN (P): 2753-6556

There are various therapies available for atrophic scars, including chemical peeling, subcision, dermabrasion, microneedling, fillers, and ablative/nonablative lasers, each with limitations.[15] New treatments have emerged in recent years to address these restrictions. Newer treatments, such as microneedling, collagen induction therapy, and platelet-rich plasma therapy, are effective possibilities.[11-16]

In the present study, we used Goodman and Baron's quantitative acne scar grading system,[12] of classification for acne scars. The grading system was based on lesion counting (1 point for several lesions <10, 2 points between 11 to 20 and 3 points >20) and severity (1 point for mild atrophic scarring, 2 points for moderate atrophic scarring, 3 points for severe atrophic scarring, and 4 points for hyperplastic scarring). The lesion counting score was then multiplied by the lesion severity score. The final score depended on the addition of points assigned to each respective category and reflected disease severity, ranging from a minimum of 0 to a maximum of 84. Although complicated, it helped us in objective assessment in a systematic way.

The expression of matrix metalloproteinases induced by microneedling is speculated in the reduction of hyperpigmentation. In addition, the hyperproliferation of keratinocytes is downregulated by microneedling in acne patients because it overall balances out the cell equilibrium.[17] In a study by Chandrashekar et al, quantitative assessment using Goodman and Baron's score showed moderate improvement in 58% of the patients, minimal in 29%, good improvement in 9%, and very good improvement in 3% of the patients.[18]

In a study done by Gita Faghihi et al,[19] Sixteen patients underwent split-face therapy with ablative fractional carbon dioxide laser combined with intradermal platelet-rich plasma therapy on one side of their face and the other half with ablative fractional carbon dioxide laser with intradermal normal saline. Scars were graded according to the Goodman and Baron quantitative scale. Overall clinical improvement of acne scars was greater on the fractional carbon laser combined with platelet-rich plasma-treated side, but the difference was not statistically significant either one month after the first treatment session (P = 0.15) or four months after the second (P = 0.23).

In a study done by Imran Majid20, thirty-seven patients of atrophic facial scarring were offered multiple sittings of micro-needling treatment, and their scars were evaluated and graded clinically by Goodman and Baron quantitative grading and by serial photography at the start as well as at two months after the completion of the treatment protocol. Out of these 36 patients, 34 achieved a reduction in the severity of their scarring by one or two grades (88.7%). Excellent response was seen in rolling or boxcar scars, while moderate response was seen in pitted scars.

In a study by Jiang-Ting Zhu et al,[21] PRP combined with erbium fractional laser therapy was used for the treatment of 22 patients and followed up for 1-3 months with serial photographs. On the quartile grading scale, the clinical improvement at four weeks after the first treatment was 2.77±0.39, corresponding to a moderate grade of improvement. 68% of the total participants demonstrated excellent or marked improvement after the first treatment, while 90.9% demonstrated excellent or marked improvement after the third time.

In a study by Simran Chawla,[22] thirty patients with post-acne atrophic facial scars were treated with micro-needling with PRP on one side and micro-needling with vitamin C on another side of the face with four sittings of treatment at an interval of 4 weeks between sessions. Grading was done on the Goodman and Baron Qualitative scale. Out of 30 patients, 23 achieved a reduction in scarring by one or two grades. Excellent response was seen in five patients (18.5%) with PRP compared to two patients (7%) who received treatment with vitamin C according to the clinical assessment.

In an experimental, analytical study done by Deshmukh et al,[23] Forty patients underwent Split face therapy in which the right side of the face was the study side where autologous PRP was injected into each scar after performing subcision. The left side of the face was the control side, where only Subcision was performed. The analysis was performed using the Wilcoxon signed-Rank test and Mann-Whitney tests in SPSS software. Greater improvement (32.08%) was seen with Platelet-rich plasma & subcision in post-acne scars as compared to subcision alone (8.33%). Rolling scars responded well (39.27%), followed by box scars (33.88%). Overall clinical improvement of acne scars was greater with platelet-rich plasma and subcision.

In a comparative study done by Nofal and Eman et al,[24] forty-five patients with atrophic acne scars were randomly assigned to 3 equal groups; Group A patients received an intradermal injection of PRP, Group B received chemical reconstruction of skin scars with TCA 100%, and Group C was treated by combined skin needling and PRP. Each patient underwent three sessions at a 2-week interval. All the patients completed the study. The three groups showed statistically highly significant improvement in the degree of acne scars after treatment ($p < .001$). No major adverse effects were found in the studied groups. The three modalities showed promising efficacy and safety in the treatment of atrophic acne scars.

In a study done by Gawdat, Heba I,[25] thirty patients were randomly divided into two groups. Both underwent split-face therapy. Group 1 was administered Fractional Ablative Carbon Dioxide Laser (FCL) followed by Intradermal Autologous Platelet Rich Plasma (PRP) on one side and FCL followed by Intradermal saline on the other side. In group 2, one cheek was treated with FCL, followed by Intradermal PRP, and the other received FCL

ISSN (O): 2687-5365; ISSN (P): 2753-6556

followed by topical PRP. Each patient received three monthly sessions. The final assessment took place at six months. Results showed that Combined PRP and FCL-treated areas had a significantly better response than FCL-treated areas, but there were no significant differences in Intradermal and topical PRP–treated areas in a degree of response.

In the present study, Thirty patients with facial atrophic acne scars were randomly allotted into two groups of 15 patients each. One group was treated with microneedling and platelet-rich plasma, and another group was treated with microneedling alone. Acne scar counts and digital photographs were taken at baseline, 8 weeks, and 16 weeks. Goodman and Baron's Quantitative scale was used to grade the improvement. The mean score of Goodman and Baron Quantitative grading at baseline for Group A was 13.27 and 14.73 for Group B, respectively. The mean score improved to 9.73 at 8 weeks and 7.00 at 16 weeks in Group A whereas, Group B showed an improvement of 10.87 at 8 weeks and 8.00 at 16 weeks, respectively. On comparing the clinical improvement of patients on subsequent follow-up among both groups, we found no statistically significant difference in grades of scar between groups at baseline, first, and second follow-up. However, an improvement was found concerning percentages of improvement in individual acne scar counts.

CONCLUSION

Our study concluded that combining microneedling with topical autologous platelet-rich plasma is more effective than using a dermaroller alone for healing atrophic acne scars. Both operations are safe and well-tolerated by the patients.

REFERENCES

1. Fabbrocini F, Annunziatia MC, Monfrecolo G. Acne scars: Pathogenesis, Classification and treatment. Dermatol Res Prac. 2010.
2. Lauermann FT, Duquia RP, Almeida HL, de Souza PRM, Breunig JDA. Acne scars in 18-year-old male adolescents: a population-based study of prevalence and associated factors. An Bras Dermatol 2016; 91: 291-5.
3. El-Domyati M, Barakat M, Awad S, Medhat W, El-Fakahany H, Farag H. Microneedling Therapy for Atrophic Acne Scars: An Objective Evaluation. J Clin Aesthet Dermatol 2015; 8:36-42.
4. Jacob CI, Dover JS, Kaminer MS. Acne scarring: a classification system and review of treatment options 2001; 19: 109-17.
5. Connoly D, Vu HL, Mariwalla K, Saedi N. Acne Scarring: Pathogenesis, Evaluation and Treatment Options. J Clin Aesthet Dermatol 2017; 10: 12-23.
6. Doddaballapur S. Microneedling with Dermaroller. J Cutan Aesthet Surg 2009; 2: 110-11.
7. Singh A, Yadav S. Microneedling: Advances and Widening Horizons. Indian Dermatology Online Journal 2016; 7: 244-47.
8. Leo MS, Kumar AS, Kirit R, konathan R, Sivamani RK. A systematic review of the use of platelet-rich plasma in aesthetic dermatology. J Cosmet Dermatol 2015; 14: 315-23.
9. Saeed M, Elethawi A, Al-Ani Z, Abdullah R. Application of fractional microneedling radio-frequency and autologous platelet in managing facial Acne scars. Br J Med Med Res. 2016; 14: 1-18.
10. Chawla S. Split face comparative study of microneedling with PRP versus microneedling with vitamin C in treating atrophic post acne scars. J Cutan Aesthet Surg 2014; 7: 209-12.
11. Fabbrocini G, De Vita V, Pastore F, Panariello L, Fardella N, Sepulveres R, et al. Combined use of skin needling and platelet-rich plasma in acne scarring treatment. Cosmet Dermatol 2011; 24: 177-83.
12. Goodman GJ, Baron JA. Post acne scarring: A qualitative global scarring grading system. Dermatol Surg 2006; 32 (12): 1458-66.
13. Goodman GJ, Baron JA. Post acne scarring: A quantitative global scarring grading system. J Cosmet Dermatol 2006; 5: 48-52.
14. Cotterill JA, Cunliffe WJ. Suicide in dermatologic patients. Br J Dermatol 1997; 137: 246-50.
15. Ibrahim ZA, El-Ashmawy AA, Shora OA. The therapeutic effect of microneedling and autologous platelet-rich plasma in the treatment of atrophic scars: A randomized study. J Cosmet Dermatol 2017; 1–12.
16. Yaseen U, Shah S, Bashir A. Combination of platelet-rich plasma and microneedling in the management of atrophic acne scars. Int J Res Dermatol 2017; 3 (3): 346-50.
17. Liebl H, Kloth LC. Skin cell proliferation is stimulated by microneedles. J Am Coll Clin Wound Spec 2012;4:2-6.
18. Chandrashekar BS, Sriram R, Mysore R, Bhaskar S, Shetty A. Evaluation of microneedling fractional radiofrequency device for treatment of acne scars. J Cutan Aesthet Surg 2014;7:93-7.
19. 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 the treatment of facial atrophic acne scars: A split-face randomized clinical trial. Indian J Dermatol Venereol Leprol 2016;82:162-8.
20. Imran Majid.Microneedling Therapy in Atrophic Facial Scars: An Objective Assessment Journal of Cutaneous and Aesthetic Surgery - Jan-Jun 2009, Volume 2, Issue 1
21. Jiang-Ting Zhu, Min Xuan et al. The efficacy of autologous platelet-rich plasma combined with erbium fractional laser therapy for facial acne scars or acne. Molecular Medicine Reports 8: 233-237, 2013
22. Chawla S. Split face a comparative study of microneedling with PRP versus microneedling with vitamin C in treating atrophic post-acne scars. J Cutan Aesthet Surg 2014;7:209-12
23. Deshmukh NS, Belgaumkar VA. Platelet-rich plasma augments subcision in atrophic acne scars: a split-face comparative study. Dermatologic Surgery. 2019;45(1):90-8.
24. Nofal E, Helmy A, Nofal A, Alakad R, Nasr M. Platelet-rich plasma versus CROSS technique with 100% trichloroacetic acid versus combined skin needling and platelet-rich plasma in the treatment of atrophic acne scars: a comparative study. Dermatologic Surgery. 2014 Aug 1;40(8):864-73.
25. Gawdat HI, Hegazy RA, Fawzy MM, Fathy M. Autologous platelet-rich plasma: topical versus intradermal after fractional ablative carbon dioxide laser treatment of atrophic acne scars. Dermatologic Surgery. 2014 Feb;40(2):152-61.

ISSN (O): 2687-5365; ISSN (P): 2753-6556