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Original Article

A comparative study of combined Microneedling Fractional Radiofrequency and Platelet-Rich Plasma versus Microneedling Fractional Radiofrequency alone in atrophic acne scars and effect of treatment on quality of life

在萎縮性痤瘡疤痕中的微針分段式射頻單獨或聯合高濃度血小板血漿治療的功效及其對生活質量影響的比較研究

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Microneedling Fractional Radiofrequency (MFR) is a newer, well-accepted modality for the treatment of atrophic acne scars while the role of Platelet rich plasma (PRP) remains to be investigated. The aim of this study was to compare the efficacy of combined MFR and PRP therapy (group A) with microneedling fractional radiofrequency alone (group B) in facial atrophic acne scars and effect of treatment on quality of life. Statistical comparison of end results between group A and B were found to be equally effective, based on GBS scale and Observer's scar assessment. However, overall scar assessment by patient and Dermatology Life Quality Index was better in patients of group A.

微針分段式射頻是治療萎縮性痤瘡疤痕的一種較新的廣為接受方式，而高濃度血小板血漿的作用則有待研究。這項研究的目的是比較聯合微針分段式射頻單獨和聯合高濃度血小板血漿療法(甲組)與單獨的微針分段式射頻治療(乙組)，在面部萎縮性痤瘡疤痕的療效以及其對生活質量的影響。根據古德曼和男爵的定量疤痕量表和觀察者的疤痕評估結果，發現甲乙組的最終結果的統計學比較為功效一樣。但是，患者的整體疤痕評估和皮膚病生活質量指數在甲組患者中較好。

Keywords: Atrophic acne scar, microneedling fractional radiofrequency, platelet rich plasma, post acne scars

關鍵詞：萎縮性痤瘡疤痕、微針分段式射頻、高濃度血小板血漿、痤瘡後疤痕

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Introduction

Acne vulgaris is a common dermatological condition among adolescents and delayed treatment often leads to scarring.[1-3] Scars can also be a consequence of severe inflammatory/nodulocystic acne and sometimes manipulation of superficial inflamed lesions by the patient. Depending on loss or hyper proliferation of collagen, acne scars can be divided in to atrophic and hypertrophic scars. Atrophic acne scars are more common than hypertrophic scars. On the basis of their width, depth and 3-dimensional architecture, atrophic scars have been sub-classified

into ice-pick scars (V-shaped epithelial tracts with a sharp margin that can extend deeper in the skin), boxcar scars (a round to oval scar with sharp vertical sides that can extend deeper in the skin), or rolling scars (irregular scars with a rolling or undulating shape that may reach up to 5 mm in diameter). Sometimes the three different types of atrophic scars can be seen in the same patient and it may be difficult to differentiate between them.[4] The management of acne scars includes various types of resurfacing (chemical peels, ablative and non-ablative LASER, dermabrasion/microdermabrasion, fractional photothermolysis) and surgical methods, such as dermal grafting, tissue augmenting agents, needling, subcision, punch excision, or punch elevation.[5]

Acne scar management requires a multimodal approach to deliver desirable results. The choice of therapy depends on factors like type of scar, skin type, and post procedure downtime and risk profile. To minimise downtime and risk associated with surgical and ablative procedures, various non-surgical modalities for scar reduction like MFR and PRP are becoming modalities of choice over past few years. MFR is a procedure in which an energy device allows penetration of tiny sterile needles through the skin and delivers radiofrequency (RF) energy to the dermis only. To avoid epidermal damage, the full length of the needle is insulated and only the tip of the needle delivers energy to the dermis at different levels depending on the depth of penetration. Compared to traditional microneedling, MFR has the benefit of radiofrequency energy added to the traditional microneedling procedure.[6]

In addition to the microinjury, the tip of the needle delivers radiofrequency energy to create radiofrequency thermal zones. Heat produced by the RF energy leads to stimulation of collagen and elastin helping in scar reduction and skin tightening.[7] Platelet-rich plasma (PRP) is blood plasma with concentrated platelets and has large reservoirs of growth factors required to initiate and stimulate tissue repair and regeneration. PRP efficacy in wound healing has motivated its use in the management of atrophic facial scars as monotherapy as well as in combination therapy with other available treatment modalities.[8-11]

Methods

Forty patients with acne scars were enrolled in the study between August 2017 to July 2018. This study was in accordance with declaration of Helsinki. The duration of the study was 12 months. A well informed consent was taken and baseline investigations were done. Patients were randomly divided into two groups. Group A was treated with a combination therapy of MFR and PRP while Group B was subjected to MFR alone. After gentle cleansing, the area of interest was anesthetised using a thick application of topical anaesthetic cream under occlusion for about 45-60 minutes. Group A patients underwent four sessions of microneedling fractional radiofrequency with intradermal PRP while group B patients offered four sessions of MFR alone, at monthly intervals. The final results were assessed one month after the fourth session.

The inclusion criteria were age group 18-45 years, skin type III-V, with atrophic acne scars (Grade 2-4) according to Goodman and Baron's classification system. The exclusion criteria were active acne, history of keloid, bleeding disorder, lignocaine hypersensitivity, pregnant or lactating, immune compromised status, and unrealistically high expectations.

Patients scars were scored using Goodman and Baron's quantitative and qualitative global acne scar grading system at baseline and at the end of the study.[12,13] Goodman and Barons qualitative scar (GBS) score, overall scar assessment by patient, observer's scar assessment score and Dermatology Life Quality Index was done at baseline and the end of the study. Strict photoprotection was advised and topical antibiotic and oral antibiotics were given (if required). Weekly follow-up was done to assess erythema, oedema and pain.

Micro needling fractional radiofrequency device

Microneedling fractional radiofrequency was done on targeted area. The parameters used are listed below. Over the forehead, bilateral temples and bony prominences, a 1.5 mm needle depth was kept. Over the cheeks, multiple passes were given with needle depth 3.5 mm for first pass, second pass with 2.5 mm, and third pass with 1.5 mm with minimal overlap. Energy was used according to needle depth. Higher energy (35-45W) for deeper penetration and lower energy (25-30W) for superficial penetration were used.

Parameters	Values
Mode	Bi-polar
Intensity/Energy	5-9 (25-45 W)
Pulse width	120-350 ms
Depth	1.5-3.5 mm
Passes	2-3
Interval between sessions	4 weeks

PRP preparation

For the preparation of PRP, a volume of 30 ml of whole blood was collected and separated into two sterile test tubes containing acid-citrate dextrose. First spin was done at 1500 rpm for 15 minutes. After discarding red cell sediments, second spin was performed at 3000 rpm for 10 minutes, which resulted in the dense layer of platelet at the bottom and clear fluid layer, platelet-poor plasma, on the top. The upper two-thirds of Platelet-poor plasma (PPP) was removed, leaving behind one third PPP solution and platelet pellet. With the help of sterile pipette the platelet pellet was gently mixed with remaining PPP to obtain our desired PRP volume. Prepared volume (2.5-3 ml) of PRP was injected intradermally on the targeted area using insulin syringe followed by MFR session.

For comparison of baseline and after the final fourth session results in a particular group, the Wilcoxon test was used as the data was not normally distributed and between both groups, after the fourth session, for comparison, the Mann-Whitney test was used.

Results

Forty patients were enrolled and completed in this study. There were 17 males and 23 females with mean age of 29.5 years. Of the Fitzpatrick skin types, 25 patients belonged to Type IV followed by 12 in Type V and three were Type III. The most common scar type noted was a combination of rolling, boxcar and ice pick scar in 21 patients followed by combination of ice pick and boxcar scars in 13 patients, rolling scar in three patients, combination of rolling and boxcar in two patients, rolling and ice pick scar in one patient. Family history of acne and acne scarring was positive in 17 patients and negative in the remaining 23 patients (Table1).

Individually in each group, comparison of baseline (mean score) and after fourth session, the mean score of DLQI, Observers assessment, overall assessment by patient and qualitative GBS score showed statistically significant difference. This showed both the modalities were effective.

Estimation of improvement with Goodman and Baron's Global quantitative acne scarring system showed that 73% of group A (Figure 1a & 1b) and 62% of group B (Figure 2a & 2b) patients had good response. Twenty-seven percent of group A and 33% of group B patients had minimum response while 5% patient in group B had no improvement. There was a statistically significant difference as assessed by DLQI and overall scar assessment by the patient after the fourth session (mean score) between both groups. However, observer's scar assessment and qualitative GBS score did not show a significant difference, implying that both groups had the same impact i.e. both interventions were equally effective (Table 2).

Table 1. Patient demographic profile

		Group A (n=20)	Group B (n=20)
Gender			
	Male	45% (9)	40% (8)
	Female	55% (11)	60% (12)
Age Group (Years)			
	18 - 28	40% (8)	45% (9)
	28 - 38	50% (10)	45% (9)
	>38	10% (2)	10% (2)
Family history of acne/acne scar			
	Yes	45% (9)	40% (8)
	No	55% (11)	60% (12)
Skin type			
	I	–	–
	II	–	–
	III	5% (1)	10% (2)
	IV	60% (12)	65% (13)
	V	35% (7)	25% (5)
	VI	–	–
Scar type			
	Rolling	5% (1)	10% (2)
	Rolling +Boxcar	5% (1)	5% (1)
	Rolling + Ice pick	5% (1)	0% (0)
	Ice pick + Boxcar	30% (6)	35% (7)
	Rolling + Boxcar + Ice pick	55% (11)	50% (10)

Table 2. End results of individual group and comparison between group A and group B

Group	Total no of patients	Improvement in GBS after 4th session (Wilcoxon Test)			Overall scar assessment by patient (Mean) (Wilcoxon Test)			Observer's scar assessment (Mean) (Wilcoxon Test)			DLQI (Mean) (Wilcoxon Test)		
		Before	After 4 session	p value	Before	After 4 session	p value	Before	After 4 session	p value	Before	After 4 session	p value
Group A	20	3.55 (SD-0.604)	1.70 (SD-0.656)	P<0.001	7.78 (SD-0.595)	2.95 (SD-0.153)	P<0.001	16.95 (SD-1.191)	7.0 (SD-0.725)	P<0.001	16.95 (SD-1.395)	6.4 (SD-0.598)	P<0.001
Group B	20	3.65 (SD-0.489)	1.95 (SD-0.887)	P<0.001	7.70 (SD-0.57)	3.60 (SD-0.44)	P<0.001	17.0 (SD-0.918)	8.05 (SD-0.686)	P<0.001	17.1 (SD-1.165)	8.65 (SD-0.670)	P<0.001

Group A vs B Comparision (Mann Whitney test)	1:1 (Ratio)	GBS after 4th session P=0.5561 Statistically insignificant	Scar assessment by patient after 4th session P=0.0003 Statistically significant	Observers assessment after 4th session P=0.0648 Statistically insignificant	DLQI after 4th session P=0.0001 Statistically significant

GBS - Goodman and Barons qualitative scar, DLQI - Dermatology Life Quality Index

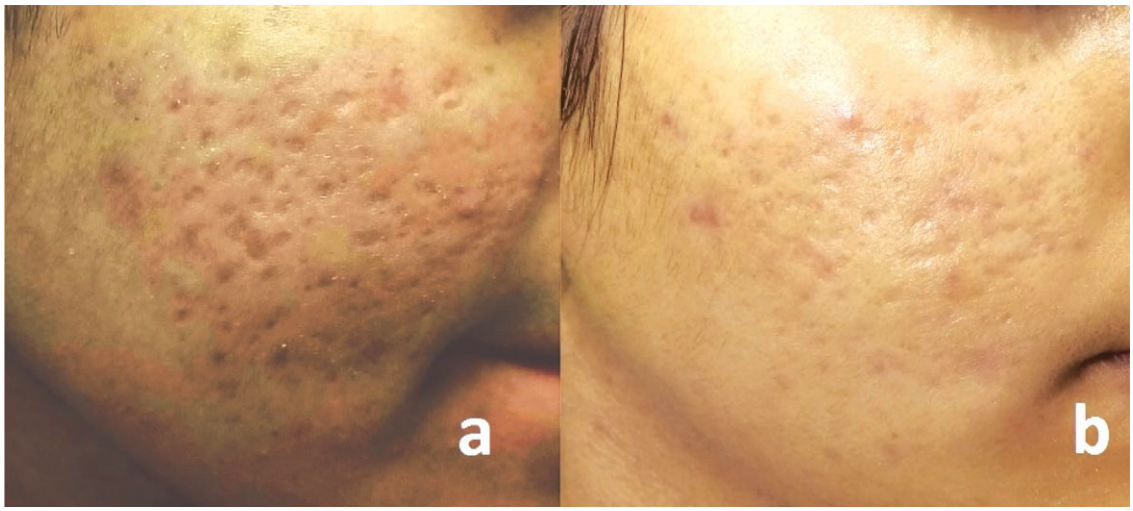

Figure 1. (a) Acne scar before MFR and PRP combination therapy. (b) Acne scar after 4 session of MFR and PRP combination therapy.

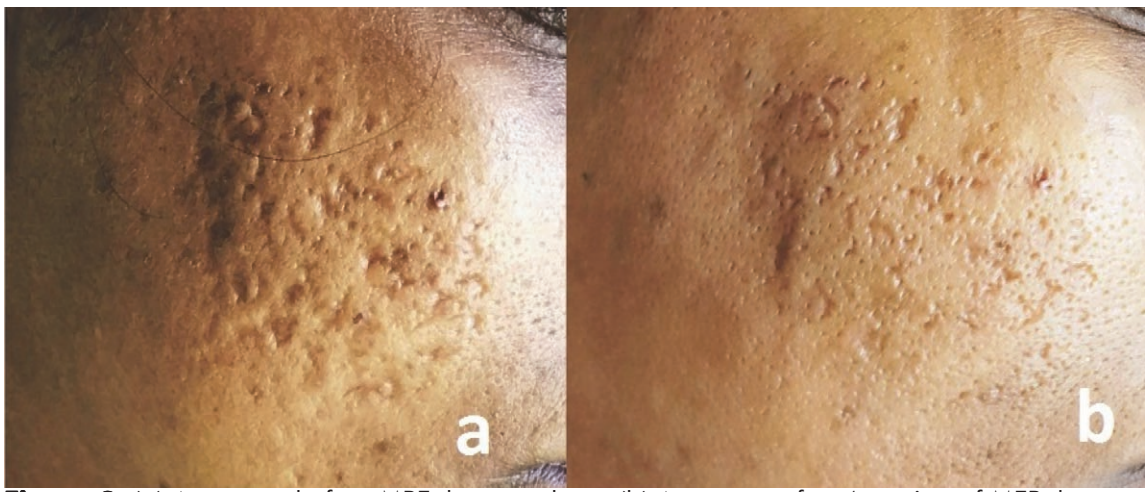

Figure 2. (a) Acne scar before MRF therapy alone. (b) Acne scar after 4 session of MFR therapy alone.

Discussion

Acne scarring is the result of deep trauma caused due to inflammatory acne. Although scars can occur with any grade of acne, they are more commonly associated with nodulocystic acne.[14,15] Atrophic acne scars are the most common type of scars associated with acne. The atrophic scars can further be subdivided into ice pick scars, rolling scars, deep soft scars, and boxcar scars. Various treatment modalities are available for atrophic acne scars which may be used alone or in combination with each other. These include chemical peels, microdermabrasion, and tissue augmentation with fillers, ablative/non-ablative laser skin resurfacing, needling, microneedling fractional radiofrequency and PRP therapy.[4,15]

Amongst the ablative lasers, CO_2 and Er:YAG lasers are most commonly used. They have high efficacy but are associated with erythema which could persist for months, as well as post inflammatory pigmentation and scarring. The 1064 nm Nd YAG and 1450 nm diode non-ablative lasers are commonly used. Microneedling Fractional Radiofrequency is a relatively newer treatment

modality which causes electrocoagulation selectively in dermis, avoiding any epidermal damage and thus minimal chances of post inflammatory pigmentation and scarring.[16,17] Insulated needles are used to prevent electrothermal damage from occurring anywhere in the dermis but at the very tip of the needle and never in the epidermis. This causes increased collagen synthesis due to release of growth factors and relative sparing of epidermis and adnexal structures which contributes to rapid healing.[18]

In a study conducted by Gold et al, 13 patients with mild to moderate acne scarring were treated with fractional bipolar radiofrequency. Of these, 67-92% patients were satisfied with results. Similar results with improvement in 70% of patients were found in a study of 30 patients with mild to moderate acne scar treated with fractional radiofrequency by Cho et al,[6,19] In a study by Zhu et al which combined Erbium fractional laser and PRP showed, 91% patients were satisfied with the results.[20] In a split face study, use of microneedling along with platelet-rich plasma application in acne scars treatment by Fabbrocini et al, showed that the combined the use of microneedling and PRP was more effective than microneedling alone.[21] Nofal et al in their study of 45 patients with acne scars showed superior results with combination of microneedling and PRP compared to monotherapy with 100% trichloroacetic acid and PRP.[22]

In contrast to study done by Goulden et al, female outnumbered males (1.3:1) in our study.[23] This may be because females have greater cosmetic concerns and are more willing to undergo treatment. In comparison to study done by Porwal et al,[24] the mean age of patients in our study was 29.5 years (47.5%) with the majority of cases between 28-38 years. In the study by Majid, patients were aged between 13 to 34 years, with the mean age of 22.4 years.[25]

In our study, most of the patients were suffering from combination of ice pick, boxcar, and rolling scars (52.5%) followed by a combination of ice pick and boxcar scars. Study done by Jacob et al. showed ice pick (60-70%) was commonest followed the boxcar scars (20%-30%) and rolling scars (15-25%).[4] Estimation of improvement with Goodman and Baron's Global quantitative Acne Scarring System,[12] 73% of the group A and 62% of group B patients showed a good improvement of acne scars. Study done by Porwal et al showed 59% improvement among patient treated with combined dermaroller and PRP while 43% improvement among patients treated with dermaroller alone.[24]

A simple, self-explanatory questionnaire [Dermatology Life Quality Index (DLQI) questionnaire][26] was given to the all patient to compare the effect of acne scars on quality of life before and after taking treatment. The final score was the summation of score of each question. The possible maximum possible score was 30 and minimum score was 0. Higher scores suggested maximum effects on patient's quality of life. Comparing the DLQI at baseline and after the completion of the fourth session, there was positive impact of treatment results on quality of life on patients in both the group. Hayashi et al. and Hazarika and Rajaprabha observed a negative impact of acne scar on patient's quality of life.[27,28]

Comparing the side effect profile in both groups, not much difference was observed. Post-procedural erythema and oedema, lasting for 2-4 days, were seen in both groups. Oedema was more in group A and can be explained by simultaneous use of PRP. One patient of group B developed post inflammatory hyperpigmentation which resolved within four weeks, which is less than reported by Garg and Baveja.[29]

Conclusion

Objective assessments of results were similar between combination of MFR with PRP and MFR alone but combination of MFR and PRP had statistically significant positive impact on patient's quality of life.

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