

Original Research Article

Effect of microneedling by dermaroller on acne scars: an observational study at tertiary care hospital

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ABSTRACT

Background: Post acne facial scar is very distressing phenomenon. There are many treatment options like laser resurfacing, dermabrasion, microdermabrasion and non-ablative laser resurfacing but it may cause adverse effects and interference with the daily activities of the patient. Microneedling or dermaroller therapy is newer modality in management of acne scars with satisfactory improvement and no significant side effect. Objective of our study was to evaluate efficacy and safety of microneedling in the treatment of atrophic facial acne scars.

Methods: Twenty-eight patients of Fitzpatrick skin type IV to V having atrophic facial acne scars and fulfilling inclusion criteria were treated with multiple sittings of microneedling (dermaroller) treatment at monthly interval. Goodman and Baron's qualitative and quantitative acne scar grading system was used for assessment. Patients were evaluated clinically and by serial photography. Presence of any active infection, active acne, wounds, blisters, keloids, taking some medications like Accutane, antihypertensives, anticoagulants, systemic retinoids, topical retinoids, those undergoing cosmetic procedures, treatment with injecting fillers or ablative or non-ablative laser resurfacing, diabetes, collagen diseases and those who do not agree to participate in study were excluded.

Results: Any change in the grading of scars after the end of treatment and follow-up period was noted. Efficacy and improvement of dermaroller treatment was assessed by Goodman and Baron's global acne scarring system. Out of 18 patients (of total 28) with Goodman and Baron's qualitative grade-4, 16 (88.90%) patients reduced to grade-1. 21 out of 28 patients achieved 'excellent' response. Adverse effects were limited to transient erythema and post inflammatory hyperpigmentation.

Conclusions: Microneedling therapy seems to be simple, safe and efficacious for the management of atrophic facial acne scars.

Keywords: Dermaroller, Facial acne scars, Microneedling

INTRODUCTION

Scarring is a particularly distressing phenomenon particularly when it occurs on the face. Scars can arise on the face due to a number of causes, the commonest of which is acne vulgaris. Post-acne facial scarring is a psychologically devastating condition and the affected patient invariably suffers from low self-esteem and many other psychological ill-effects.¹ There is correlation between the severity of scars and delay between onset of

acne lesions and start of acne treatment.² Genetic factors also have an impact on predisposition to scarring, and type of scarring.^{3,4}

Acne scars are determined by severity of inflammation as judged by depth and duration. There are two basic types of scars depending on whether there is loss or gain of collagen (atrophic and hypertrophic scars respectively). Eighty to ninety percent of people with acne scars have atrophic scars. Remodelling of collagen, the last step in

tissue repair, is modulated by MMPs, which cause the damage, and tissue inhibitors of metalloproteases (TIMPs), which contain the damage. When the ratio of MMPs/TIMPs is low, atrophic scars occur and, conversely, when the ratio is high, hypertrophic scars occur.⁵

Atrophic scars are further classified into ice pick, boxcar, and rolling scars. Among them, the ice pick type represents 60-70% of total scars, the boxcar 20-30%, and rolling scars 15-25%. Sometimes all 3 different types of atrophic scars can be observed in the same patients and it can be very difficult to differentiate between them. For this reason, several classifications and scales have been proposed by other authors. Goodman and Baron proposed a qualitative scale and then presented a quantitative scale.⁶ There are some clinical studies in the world literature that have documented a favorable clinical and histopathological response in the skin after dermaroller treatment.¹⁰

Mechanism of microneedling

Micropunctures are created using microneedles which produce controlled skin injury without actually damaging the epidermis. These microinjuries lead to minimal superficial bleeding and set up a wound healing cascade with release of various growth factors such as platelet derived growth factor (PGF), transforming growth factor alpha and beta (TGF- α and TGF- β), connective tissue activating protein, connective tissue growth factor, and fibroblast growth factor (FGF).⁷ The needles also breakdown the old hardened scar strands and allow it to revascularize. Neovascularization and neocollagenesis are initiated by migration and proliferation of fibroblasts and laying down of intercellular matrix.^{8,9} A fibronectin matrix forms after 5 days of injury that determines the deposition of collagen resulting in skin tightening persisting for 5-7 years in the form of collagen III. The depth of neocollagenesis has been found to be 5-600 μ m with a 1.5 mm length needle. Histological examination of the skin treated with 4 microneedling sessions 1 month apart shows up to 400% increase in collagen and elastin deposition at 6 months postoperatively, with a thickened stratum spinosum and normal rete ridges at 1 year postoperatively.¹⁰ Collagen fibre bundles appear to have a normal lattice pattern rather than parallel bundles as in scar tissue.¹¹

Objective

Objective of our study was to evaluate efficacy and safety of microneedling done by dermaroller in the treatment of atrophic facial acne scars.

METHODS

After approval of ethical committee, this prospective observational study was performed in department of dermatology, venereology and leprosy of Surat Municipal

Institute of Medical Education and Research on 28 patients suffering from localized or generalized acne scars with Fitzpatrick skin type IV to V from March 2019 to February 2020. Informed written consent was obtained from all patients who were enrolled for the study. Only patients with Grade 2 to Grade 4 acne scarring were recruited. Presence of any active infection, active acne on face, patients with open wounds, blisters, keloids on face, taking medications like Accutane, antihypertensives, anticoagulants or drugs causing photosensitivity, patients who used topical or systemic retinoids, those undergoing cosmetic procedures, those with treatment within the last 6 months or pending treatment within the subsequent 6 months with injecting fillers or ablative or non-ablative laser resurfacing, any disease that affects wound healing such as diabetes, collagen diseases and those who do not agree to participate in study were excluded.

Procedure

Microneedling by dermaroller was performed at monthly interval till satisfactory outcome was achieved or a maximum of six sittings whichever was earlier. A minimum of three treatment sessions were considered essential for inclusion for assessment. Patients were assessed with Goodman and Baron's qualitative and quantitative score. Area of interest was prepared by cleaning, applying local anesthetic (eutectic mixture of prilocaine and lignocaine) as a thick coating and left for 60 minutes under occlusion. Then, dermaroller with 192 needles in 8 rows, 0.25 mm diameter and 1.5 mm long needles was used in 4 directions (horizontal, vertical, both oblique directions) and repeated 4-10 times on treatment area. The endpoint for any treatment session was the presence of uniform bleeding points over the treated area. Skin was stretched perpendicular to the dermaroller movement in case of deep-seated scars. Saline pads were kept over the treated area, followed by application of topical antibiotic "fusidic acid" for 24 hours. After treatment, all patients were recommended to apply topical antibiotic cream for 2-3 days and to avoid sun exposure for at least 1 week, by using sunscreens with a sun protection factor (SPF) value of 30 or more during the day, also advised to avoid makeup and to swim.

Assessment

Patients were assessed and graded with Goodman and Baron's qualitative and quantitative score (which is mentioned in Tables 1 and 2) at 2 monthly interval and by taking serial photographs. Change in the severity or grading of scars was assessed in every visit. For subjective assessment, an improvement of scarring by two grades or more was labeled as 'excellent' response while a 'good' response meant an improvement by single grade. In those patients where the scar grading remained the same after completion of treatment irrespective of any visible change in facial scarring, response was labeled as 'poor'.

Table 1: Goodman and Baron’s qualitative score.

Grade	Characteristics
Grade-1	Macular involvement (erythematous, hyperpig/hypopig scars)
Grade-2	Mild (not obvious at ≥ 50 cm) (rolling)
Grade-3	Moderate (obvious at ≥ 50 cm, but flatten by stretching) (boxcar)
Grade-4	Severe (obvious at ≥ 50 cm, but does not flatten by stretching) (ice-pick)

Table 2: Goodman and Baron’s quantitative score.

Characteristics	Score		
A) Milder scarring (1 point each) Macular erythematous or pigmented Mildly atrophic dish-like	1 point	2 points	3 points
B) Moderate scarring (2 points each) Moderately atrophic, dish like Punched out with shallow bases small scars (<5 mm) Shallow but broad atrophic areas	2 points	4 points	6 points
C) Severe scarring (3 points each) Punched out with deep but normal bases, small scars (<5 mm) Punched out with deep abnormal bases, small scars (<5 mm) Linear or troughed dermal scarring Deep, broad atrophic areas	3 points	6 points	9 points
D) Hyperplastic Papular scars Keloidal/hypertrophic scars	2 points Area <5 mm 6 points	4 points Area 5-20 cm ² 12 points	6 points Area >20 cm ² 18 points

In data analysis, calculation of mean and standard deviation was carried out as well as paired t test was applied. For tables, graphs, Microsoft word and excel were used. Patients were also examined and noted for any adverse effects, both immediate and delayed.

RESULTS

The study included 28 patients of acne scars. Among them females (16) predominated over males (12) in the study. Age of the patients ranged from 19 to 34 years, with the mean age of 25.4 years.

Table 3: Demographic data of patients.

Age group in years	Male	Female	Total
19-24	2	2	4
25-30	4	6	10
31-34	6	8	14
Total	12	16	28

All patients completed the study and tolerated the procedure well. Majority of the patients had mixed types of atrophic acne scars, including ice pick, boxcar and rolling scars. Except for temporary erythema and post-inflammatory hyperpigmentation in 2 patients, no adverse effects were observed. No patient reported any interference in his/her daily activities in the immediate post-treatment period except mild crusting that persisted for one or two days. Patients were able to attend their

daily duties on the same day or the next day after the dermaroller sitting.

Table 4: Mean of Goodman and Baron’s quantitative score.

Month	Mean of Goodman and Baron’s quantitative score
Day 0	19.03
2nd month	13.82
4th month	8.17
6th month	3.9

Table 5: Mean of Goodman and Baron’s qualitative score.

Month	Mean of Goodman and Baron’s qualitative score
Day 0	3.56
2nd month	2.68
4th month	2.04
6th month	1.32

Both Goodman and Baron’s quantitative and qualitative score were decreased in all 28 patients. Mean of Goodman and Baron’s quantitative and qualitative score at day 0 was 19.03 and 3.56 respectively which significantly decreased to 3.90 and 1.32 at 6th month respectively (These findings are elaborated in Tables 4 and 5).

At the start of treatment, out of 28 patients 18 patients (64.2%) were presented with Goodman and Baron's qualitative grade-4 of which 16 (88.90%) patients reduced to Goodman and Baron's qualitative grade-1

(Figures 1a, 1b), 1 (5.55%) patient reduced to grade-2 (5.55%) and 1 patient (5.55%) to grade-3 at the end of treatment.

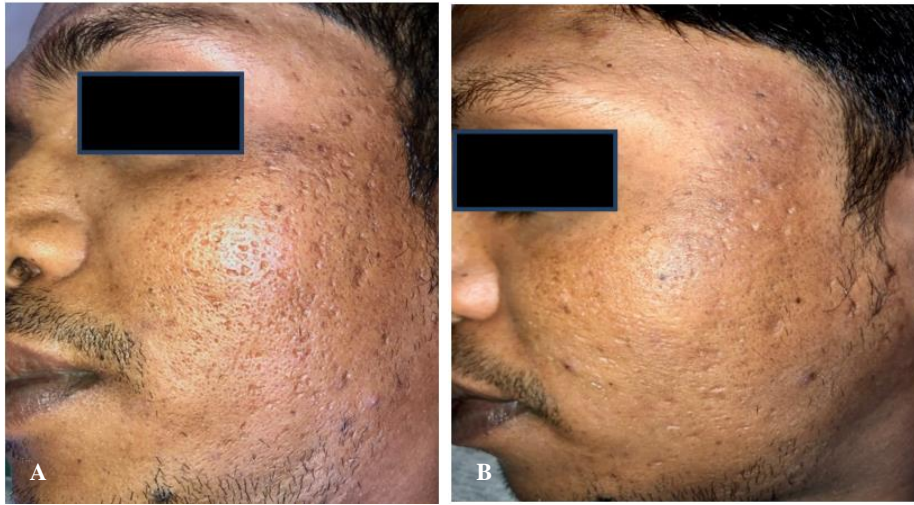


Figure 1: (a) Patient 1 having grade 4 acne scars and (b) improvement up to 2 grades after 3 months.



Figure 2: (a) Patient 2 having grade 3 acne scars before treatment and (b) improvement after 3 sittings.

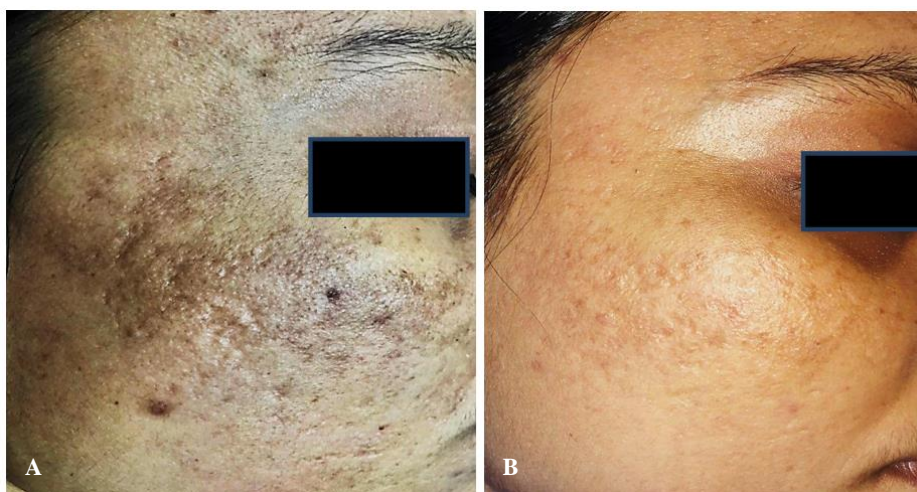


Figure 3: (a) Patient 3 having grade 3 acne scars before treatment and (b) improvement after 3 sittings.

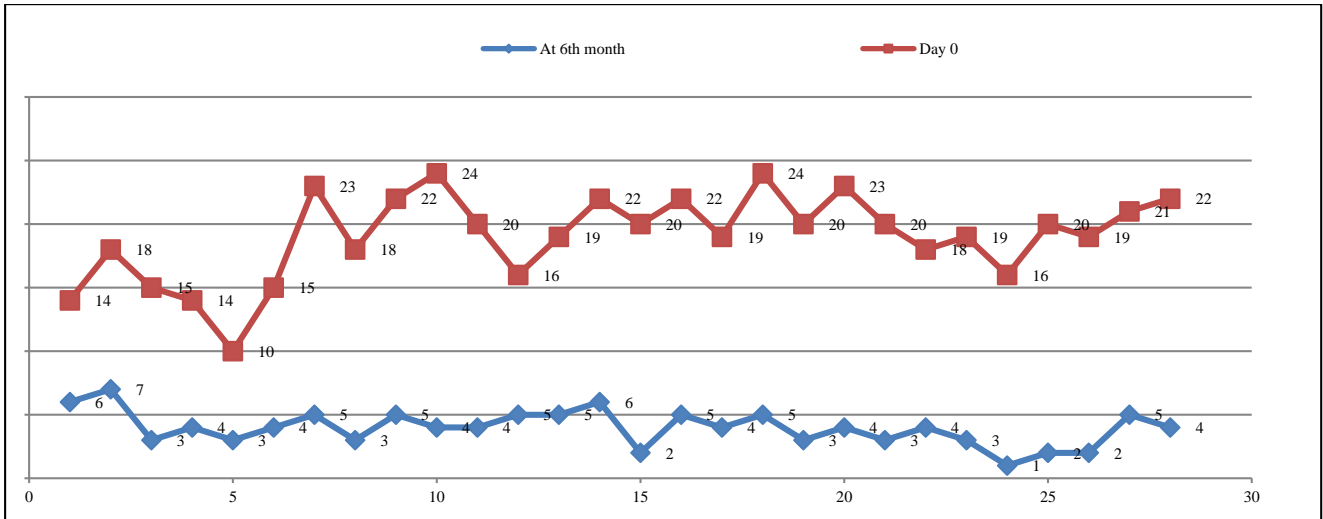


Figure 4: Patient-wise decrease in Goodman and Baron's quantitative score.

Table 6: Assessment of pre and post treatment grading.

Pre-treatment acne scar grade	No. of patients	Post-treatment scar reduction by 3 grades (%)	Post-treatment scar reduction by 2 grades (%)	Post-treatment scar reduction by 1 grade (%)	No Post-treatment scar reduction (%)
Grade 4	18	88.90	5.55	5.55	0
Grade 3	9	0	44.44	55.55	0
Grade 2	1	0	0	100	0

Table 7: Subjective assessment as response of patients.

Grade of Acne scar	No of patients	excellent response	Good response	Poor response
4	18	17	1	0
3	9	4	5	0
2	1	0	1	0
1	0	0	0	0

Remaining 9 (32.1%) patients were presented with Goodman and Baron's qualitative grade-3 out of which 4 patients (44.44%) showed reduction to grade-1 and 5 patients (55.56%) showed reduction to grade-2 (shown in Figures 2a, 2b, 3a, 3b).

Only 1 (3.7%) patient was at Goodman and Baron's qualitative grade-2 at the time of treatment, which decreased to grade-1 at 6th month.

As mentioned in Figure 4, Goodman and Baron's quantitative score has shown significant reduction in all 28 patients within the duration of 6 months.

Correlating the response with the morphological type of scarring present, we found a good to excellent response in rolling and boxcar scars while pitted scars showed only moderate improvement. However, contrary to expectations, definite improvement was observed in pitted scars and deep boxcar scars as well.

DISCUSSION

There are various modalities of treatment for acne scars like laser skin resurfacing, chemical peeling, dermabrasion, microdermabrasion, fillers, radiofrequency, electrodesiccation, punch excision, collagen induction therapy, platelet rich plasma therapy etc.

Ablative lasers such as Er:YAG lasers or CO₂ lasers produce significant improvement and have the efficacy of 25-90% for treatment of acne scars. But they are associated with erythema for more than 3 months, dyspigmentation, scarring and have long recovery times.¹²⁻¹⁴ Recently, newer techniques such as microneedling fractional radiofrequency (MFR) has been shown to be clinically efficient in managing acne scars without causing direct damage to the epidermis.^{15,16}

Non-ablative lasers such as 1064 nm Nd:YAG and 1450 nm diode lasers have an efficacy of 40-50% after a series

of treatments, with effect only on shallow box scars with no significant epidermal improvement.^{14,17}

Platelet rich plasma (PRP) is a newer modality that may be beneficial in the treatment of atrophic acne scars by providing various growth factors which aid in quick wound healing. Though mild, it is also associated with adverse effects like transient pain, edema, erythema, hyperpigmentation etc.¹⁸

Ramesh et al treated facial acne scars of 30 subjects with a matrix tunable radiofrequency device pretreated with oral antibiotics, topical tretinoin and subcision. The visual analog scale of improvement in scars ranged from 10-50% at end of 2 months to 20-70% at the end of 6 months.¹⁹

Gold et al, conducted a study where in 13 patients with mild to moderate acne scars were treated with bipolar fractional radiofrequency and concluded that fractional bipolar radiofrequency is safe and an effective treatment for acne scars with 67-92% patients satisfied with the results.¹⁵

Gulanikar et al treated 30 patients of acne scars by PRP injections on monthly basis for 6 sittings. Out of them, 50% patients with grade 2 and 3 acne scars showed improvement at the end of treatment.¹⁸

In last few years microneedling therapy is becoming popular for managing post-acne scars. The treatment is performed as an outdoor procedure after application of a local anaesthetic cream. This procedure stimulates collagen production by injuring the skin through hundreds of punctures. It causes reorganization of old collagen fibers and laying down of new collagen, elastin, and capillaries leading to the effect of skin tightening. This leads to the thickening of the skin and smoothing of wrinkles and scars.¹⁰

Certain adverse events are also known with the procedure, the common ones being potential erythema, irritation, post-inflammatory hyperpigmentation which are temporary. Aggravation of acne, reactivation of herpes, systemic hypersensitivity, allergic granulomatous reactions, local infections following the use of a non-sterile instrument can occur.²⁰ Allergic contact dermatitis to materials used in the needles has also been observed.²¹ Tram-track effect after two sessions of microneedling has been reported in a patient with acne scars who developed regularly placed linear papular scars over bony prominences of the face.²² This can be avoided by using less pressure and smaller needles over these areas.

There is correlation between the severity of scars and delay between onset of acne lesions and start of acne treatment.² Apart from nodulocystic lesions, superficial forms of acne can also lead to scarring when the treatment is delayed. This finding is also supported by Chandrashekar et al.²³

We have analysed the efficacy of dermaroller, both in different types of scars and different grades of scars. Mean age was 25.4 years in our study which is similar to the study done by Hassan et al (25.07%).²⁴ We noted female preponderance which was comparable to the study done by Pandey et al.²⁵

79.5% mean improvement was found in our study. This was similar to the finding in study done by Dogra et al who noted 50-75% mean improvement.²⁶

The severity of scars improved by two or more grades in 21 (75%) of our patients and in another seven (25%) patients we could achieve reduction in scars by a single grade. While Chandrashekar et al noted that out of 31 patients with grade 3 and grade 4 acne scars, 80.64% showed improvement by 2 grades and 19.35% showed improvement by 1 grade.²³ Thus, on an overall basis, good to excellent response was achieved in all patients. Excellent response was seen in rolling or boxcar scars, while moderate response was seen in pitted scars. Study done by Chandrashekar et al also reported similar response.²³

Singh et al also noted better efficacy of microneedling in rolling and boxcar scars.²⁰

88.7% patients showed good to excellent response in study done by Imran Majid. While Pandey et al noted excellent response in 77% patients.²⁵

Except for temporary erythema and post inflammatory hyperpigmentation in 2 patients, no adverse effect was observed in our study. Doddaballapur also noted only erythema as an adverse effect of microneedling.²⁷ Microneedling is relatively safe to use in Indian skin because it rarely leads to hyperpigmentation unlike other ablative and resurfacing procedures. Relatively small sample size was limitation of our study.

CONCLUSION

Acne surgery involves the use of appropriate surgical interventions for treatment of active acne as well as improving cosmetic outcomes in post acne scarring. In active acne, surgical intervention is used as an adjunctive to medical therapy.

The treatment of post acne scars involves a multimodal approach as different types of scars may exist in an individual. Each scar and each patient must be evaluated and treated accordingly. The main goal of treatment is to achieve maximal improvement with minimal adverse effect. For superficial scars, noninvasive or minimally invasive techniques such as microdermabrasion, superficial chemical peels or the newer nonablative lasers, are better treatment options. For deeper scars, a combined approach with subcision, punch excision techniques in conjunction with resurfacing procedures, are essential to achieve optimum results. Many

complications can be prevented by thorough preoperative evaluation, sound surgical technique, and careful follow-up care. Good patient rapport and effective communication with patients are invaluable. There are certain advantages with dermaroller or microneedling therapy over laser resurfacing; former does not lead to any epidermal injury as is seen with lasers, there is minimal downtime associated with the procedure unlike ablative laser resurfacing and the treatment is far cheaper as compared to lasers. It is an office procedure which does not need any extensive special training or expensive instruments. That is why it is becoming popular day by day.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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