

Microneedling for acne scars in Asian skin type: an effective low cost treatment modality

Sunil Dogra, MD, DNB, Savita Yadav, MD, & Rishu Sarangal, MD

Department of Dermatology, PGIMER, Chandigarh, India

Summary

Background Postacne scarring is disfiguring, both physically as well as psychologically. Over the past two decades, multiple modalities for treatment of acne scars have emerged and microneedling with dermaroller is one of them.

Objective To evaluate the efficacy and safety of microneedling treatment for atrophic facial acne scars.

Material and Methods Thirty-six patients (female – 26, male – 10) of postacne atrophic facial scars underwent five sittings of dermaroller under topical anesthesia at monthly intervals. Objective evaluation of improvement was performed by recording the acne scar assessment score at baseline and thereafter at every visit. Pre- and posttreatment photographs were compared, and improvement was graded on quartile score. Final assessment was performed 1 month after the last sitting. Patients were asked to grade the improvement in acne scars on visual analog scale (VAS, 0–10 point scale) at the end of study.

Results Of 36 patients, 30 completed the study. The age group ranged from 18 to 40 years, and all patients had skin phototype IV or V. There was a statistically significant decrease in mean acne scar assessment score from 11.73 ± 3.12 at baseline to 6.5 ± 2.71 after five sittings of dermaroller. Investigators' assessment based on photographic evaluation showed 50–75% improvement in majority of patients. The results on visual analog scale (VAS) analysis showed “good response” in 22 patients and “excellent response” in four patients, at the end of study. The procedure was well tolerated by most of the patients, and chief complications noted were postinflammatory hyperpigmentation in five patients and tram-trek scarring in two patients.

Conclusion Microneedling with dermaroller is a simple and cheap, means of treatment modality for acne scars remodulation with little downtime, satisfactory results and peculiar side effects in Asian skin type.

Keywords: acne scarring, microneedling, minimally invasive, treatment

Introduction

Acne is a very common problem affecting more than 90% of adolescent population, and it continues

into adulthood in 12–14% of cases.¹ Acne scarring is its permanent disfiguring sequel which can take varied morphological forms. Many therapeutic approaches have been used to treat acne scarring which include both invasive and noninvasive methods, but unfortunately even with the most expensive techniques it is difficult to achieve the goal of complete improvement. Thus, there is an ever increasing demand of less invasive, highly effective

Correspondence: S Dogra, Department of Dermatology, PGIMER, Chandigarh-160 012, India. E-mail: sundogra@hotmail.com

Accepted for publication April 19, 2014

and affordable therapeutic procedures to treat acne scars.

“Scar needling” as a means of new collagen deposition was first introduced by Orentreich and Orentreich in 1995 in the form of subcision.² Fernandes described percutaneous collagen induction (PCI) therapy performed with a self-designed microneedling device, as an alternative to lasers for skin rejuvenation.³ Multiple skin punctures were made with a drum-shaped device which had multiple fine protruding needles.³ Basic contention behind this technique was that the epidermis need not be damaged to make the skin smoother. He popularized this technique for combating photoaging, laxity and for skin rejuvenation.⁴ Later PCI technique has been used for the treatment of scars of varied etiology like acne, postburn, postvaricella etc.^{5–7} Microneedling with dermaroller is a simple and cheap procedure for atrophic scar remodulation. However, there is little published data about its efficacy and safety when used in patients with dark color Asian skin type.

This study provides both the qualitative and quantitative assessment of efficacy of microneedling treatment for postacne atrophic facial scars in pigmented skin and reviews the published literature.

Material and methods

The study included 36 adult patients with moderate to severe atrophic postacne facial scarring. Inclusion criteria were age more than 12 years, absence of active acne lesions while on or off treatment, off isotretinoin therapy for more than a month and voluntary participation. Exclusion criteria were active acne lesions while on treatment, keloidal tendency, collagen vascular disease, bleeding disorders, chronic corticosteroid or anticoagulant treatment, active bacterial or fungal or viral infection over face (patient included after adequate infection control), pregnancy and any invasive acne scar treatment performed in previous 3 months. Those having concomitant hypertrophic postacne facial scars were also included. Informed written consent was obtained from all the patients who were enrolled for the study after ethical approval. At baseline, assessment was performed to make note of patients' demographic parameters, treatment received for acne and scars, skin phototype, acne scar assessment score (Table 1),⁸ predominant type of scars and photographs were taken. The acne scar assessment score analyzed the scars based on number, severity and type; thus assessing the scars both qualitatively and quantitatively. We further graded the scars as mild (1–6),

Table 1 Acne scar assessment score⁸

Characteristics	1–10 Lesion	10–20 Lesion	>20 Lesion
Macular erythematous or pigmented	1	2	3
Mildly atrophic Dish-like			
Moderately atrophic dish-like	2	4	6
Punched out with shallow bases, small scars (<5 mm)			
Shallow but broad atrophic areas			
Punched out with deep but normal bases, small scars (<5 mm)	3	6	9
Punched out with deep abnormal bases, small scars (<5 mm)			
Linear or troughed dermal scarring			
Deep, broad atrophic areas			

moderate (7–12) and severe (13–18) based on total score.

Microneedling treatment was performed with dermaroller by the same investigator, monthly for five sittings. Thick layer of topical anesthetic mixture (lignocaine and prilocaine) under occlusion was applied over face and left for 1.5 h. Dermaroller used was drum-shaped roller studded with 192 fine microneedles (1.5 mm in length and 0.1 mm in diameter) in eight rows (Fig. 1). Small facial area was treated ($2 \times 2 \text{ cm}^2$) at a time, 16–20 passes made in different directions (horizontal, vertical, oblique) and end point was uniform pinpoint bleeding (Fig. 2) from the treated area. Serum ooze from the skin was cleaned with saline-soaked gauze and ice pack applied for 5–10 min. Topical antibiotics were not applied postprocedure and neither oral antibiotics prescribed. Patients were advised to take adequate sun protective measures and use sunscreen throughout the treatment period. Patients who developed active acne during study period were started on medical treatment and microneedling treatment restarted once active acne was controlled.

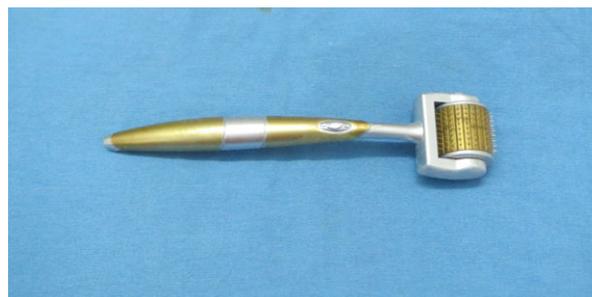


Figure 1 Dermaroller.



Figure 2 Uniform pin point bleeding postprocedure.

At every visit, clinical and photographic assessment was performed to look for efficacy and side effects. Final assessment was performed 1 month after the last microneedling treatment session by doing acne scar assessment scoring and investigators assessment of improvement based on quartile score (1: <25%, 2: 25–50%, 3: 50–75%, 4: >75% improvement). The improvement in acne scars was also assessed by patients at the end of treatment using 10-points VAS. The rating above 6 points on this scale was graded as “excellent response”, between 4 and 6 points as “good response” and below 4 points as “poor response”.²

Statistical analysis

Data were coded and entered using SPSS version 17 (SPSS, Inc., Chicago, IL, USA). Data were summarized using means standard deviations for quantitative variables and percentages for qualitative variables. Mean acne scar scores were computed for patients, both at the time of presentation and at end of the treatment period. Statistical significance of the difference in acne scar scores was estimated using two-tailed paired *t*-test at 5% significance level. Ninety-five percent (95%) confidence intervals of the mean difference in scar score were also computed. Clinical improvement in scar score was also analyzed by gender and initial severity status. $P \leq .05$ was considered statistically significant.

Results

Study included 26 female and 10 male patients. Age ranged between 18 and 40 years and mean age was 25.47 years. Of them, thirty patients (22 female and 8 males) completed the study. Of the six patients who did not complete the study, five dropped out because of

procedure related complications and one due to reasons unrelated to the study. Skin phototype by Fitzpatrick skin type was type IV in 14 patients and type V in 16 patients.

At the baseline, mean acne scar assessment score of 30 patients was 11.73 ± 3.12 (range 7–17). Moderate and severe grade scarring was seen in 16 and 14 patients, respectively. Acne scars in all patients were of mixed type which included the rolling, shallow to deep box-car and ice-pick scarring. After 5 months (i.e. 1 month after the last sitting) mean acne scar assessment score decreased to 6.5 ± 2.71 (range 3–12; Fig. 3), the difference from baseline was statistically significant ($P < 0.05$). Figure 4 shows the acne scar assessment score at baseline and at the end of study in 30 patients. Mean acne scar score difference between baseline and end of study, in males and females was 5.88 ± 1.73 and 5.00 ± 1.57 , respectively, and the improvement was not significantly different between them. Mean acne scar score difference between baseline and end of study, in patients with moderate and severe grade scarring, was 4.56 ± 1.31 and 6.00 ± 1.66 , respectively. In terms of investigators assessment based on pre- and posttreatment photographs (Fig. 5), majority patients had 50–75% improvement and all had >25% improvement. In terms of patients’ assessment of the treatment based on VAS score, four patients (13.3%) reported “excellent response”, 20 patients (66.6%) stated “good response”, and six (20.0%) reported response as poor after having five sittings of dermaroller (Fig. 6).

Side effects were noted in 40% patients and in majority they were mild in nature (Table 2). Most common complaint was pain during the procedure, and postprocedure erythema and swelling which resolved spontaneously within 2–3 days of procedure. One patient dropped out from study because of intolerable pain even after 2 h application of topical local anesthetics, and he was not willing for facial nerve blocks. Other complications encountered during study were pigmentary complications in five patients and tram-trek-patterned scarring in two patients. Five patients developed postinflammatory hyperpigmentation (PIH; Fig. 7) after 2–3 sittings. Two patients had mild hyperpigmentation which improved gradually with strict compliance with photoprotection while three other had very severe hyperpigmentation leading to drop out from the study.

One patient developed severe tram-trek scarring (Fig. 8) over malar prominences after first sitting and was therefore excluded from the study. The tram-trek scars improved 20–30% with topical tretinoin 0.025%



Figure 3 Photograph of patients at baseline (a,c,e) and at the end of study (b,d,f) showing significant improvement.

gel after 3 months. Another patient developed mild tram-trek scarring over forehead and treatment was continued while applying comparatively lesser pressure while doing dermaroller at subsequent visits. Only one patient developed small area of ecchymosis which cleared spontaneously in next 2 weeks. There were no infection-related complications.

Discussion

There are numerous surgical as well as nonsurgical techniques available for acne scars remodeling. They range from simpler and cheaper chemical peels to

tedious and expensive lasers. Microneedling with dermaroller was initially introduced for skin rejuvenation, treatment of fine wrinkles and lax skin. However, later it found application in the management of scars of different etiology. During last few years, it has become a very popular procedure for acne scar treatment specifically. The technique involves puncturing the skin multiple times with small needles to breakdown the damaged collagen and for induction of new collagen deposition. The standard dermaroller used for acne scars is a drum-shaped roller studded with 192 fine microneedles in eight rows. Microneedles are available in different lengths (0.5–2.5 mm), and the diameter is 0.1 mm.

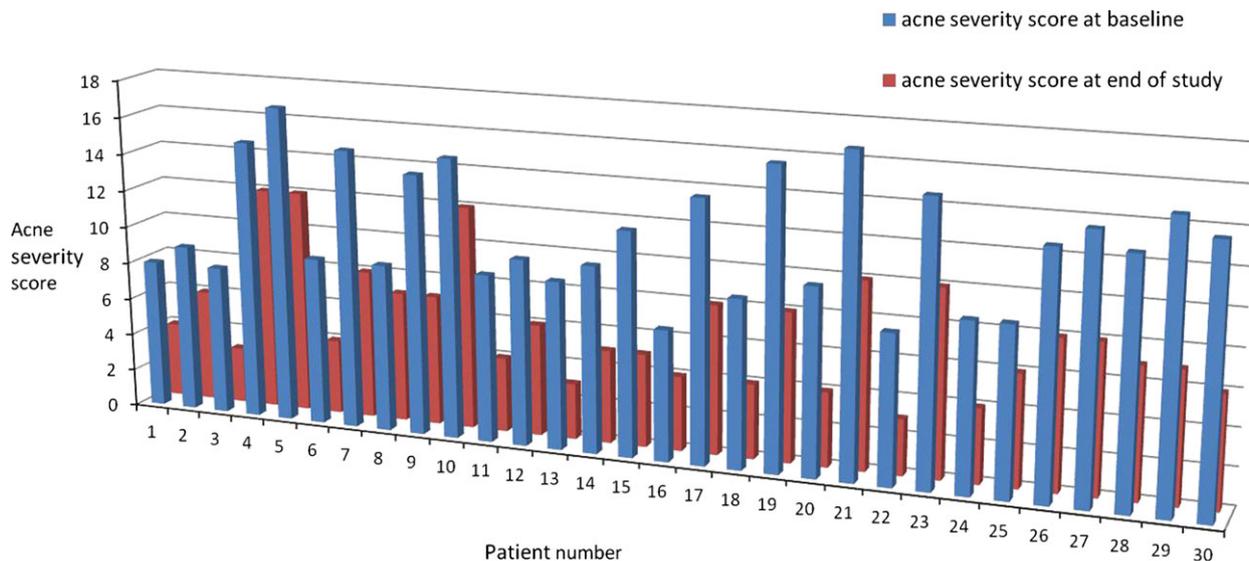


Figure 4 Acne scar assessment score at baseline and end of study.

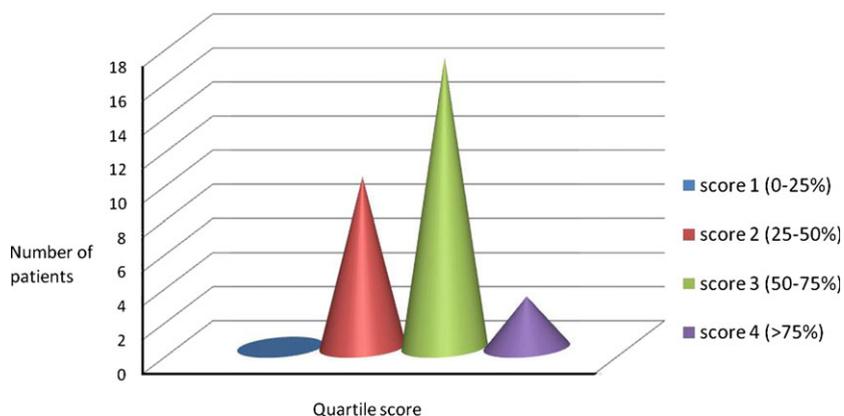


Figure 5 Investigators assessment of improvement based on quartile score.

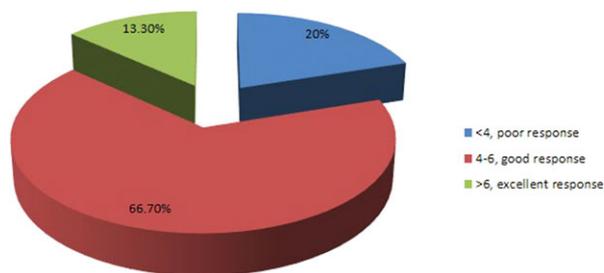


Figure 6 Patients assessment of response based on visual analog scale score.

Rolling of scarred skin with these microneedles, in various directions, lead to microtrauma to the superficial dermis without eroding the epidermis. Epidermis

Table 2 Complications following microneedling treatment

Complication	Of 36 total patients (%)
Pain	13 (36.1)
Hyperpigmentation	5 (13.8)
Tram-trek scarring	2 (5.6)
Ecchymosis	1 (2.8)

particularly stratum corneum remains intact except for the minute holes which heal rapidly. During procedure tiny wounds are created in the papillary dermis resulting in the release of growth factors, which stimulate the formation of new collagen. The effect of microneedling has also been explained on the basis of a



Figure 7 Severe postinflammatory hyperpigmentation.



Figure 8 Tram-trek scarring.

demarcation current produced among cells when microneedles penetrate the skin, which triggers a cascade of production of growth factors that stimulate the healing phase.^{7,9} Thus after dermaroller treatment, skin barrier function remains undisturbed. The damaged superficial dermis and ruptured capillaries triggers a normal process of healing which includes three phases of inflammation, proliferation and tissue remodelling. This whole process of damage, inflammation and remodelling is known as PCI.^{7,9}

In our study, there was significant improvement in the mean acne scar assessment score at the end of study period. Both male and female patients exhibited

similar improvement. All grades of severity and types of atrophic acne scars showed improvement with maximum improvement in rolling type of scars. In terms of patients' assessment, majority patients reported the response as good. Two patients who had both atrophic and hypertrophic types of scars also showed improvement without any complication. Majid reported good to excellent response in 88.7% patients with atrophic facial scars when treated with microneedling.⁶ The study results showed that the severity of scars improved by two or more grade in 72.2% and 16.7% patients had improvement by single grade.⁶

There is limited published data on this technique in the management of acne scars (Table 3).^{6,7,9–13} Results of these studies may not be exactly comparable due to different total number of treatment sessions performed and different definitions and parameters used in assessment. In three studies, microneedling was performed to assess its efficacy and safety, while others are comparative studies. The most recent and largest study is by Fabbrocini *et al.*¹³ in which 60 patients were divided into three groups based on skin phototype. Total of three sittings were performed at monthly interval, and last assessment was performed 10 months after last sitting. Of 45 patients with skin phototype III–V, majority had significant improvement by the end of study. The authors did not report any pigmentary complications in their patients.

Glycolic acid peel has been combined with PCI to decrease pigmentary complications and to enhance efficacy.¹⁰ When PCI is combined with 20% trichloroacetic acid (TCA) peel, results are equivalent to deep phenol peel and nonablative fractional lasers.^{11,12}

Multiple sittings with dermaroller are generally required to get desired results. Time interval between two sittings varies from 4 to 8 weeks. In different studies, total numbers of treatment session performed varied from 2 to 6. It is not established yet if more number of sittings could result in still higher efficacy.

In our study, 40% of patients observed mild pain during procedure which was easily tolerable in most. Postprocedure erythema and edema subsided in 2–3 days. There were no infection-related complications. Topical or oral antibiotics were not prescribed in post-procedure period. We encountered PIH in five patients. The frequency of this complication was high as compared to previous studies.¹⁰ In our patients, it was primarily because of inadequate sun protection and probably because all our patients had skin phototype IV or V which is at higher risk for pigmentary complications. Reason behind insufficient sun protection was occupation (one patient was salesman), or

Table 3 Review of literature on microneedling for acne scars

No	Study	No of patients	Study design	Skin phototype	Result	Complications
1	Majid (2009) ⁶	32 acne scar patients (37 total)	Maximum 4 sittings performed at monthly interval, final assessment 2 month after last sitting	Not mentioned	Excellent response in majority with grade 2 and 3 scarring. Rolling, boxcar and ice-pick scar -all show improvement	1 patient had PIH
2	Fabbrocini et al. (2009) ⁷	32 acne scar patients (20-F, 12-M)	2 sittings at 8-week interval, last assessment at 16 week	Not mentioned	Rolling scar depth significantly reduced	None
3	Laheta et al. (2011) ⁹	30 patients divided in 2 groups (14-F, 16-M)	Group A- PCI Group B- 100% TCA cross Total 4 sessions performed at 4 weekly interval	II-1 III-15 IV-11	Mean improvement Group A- 68.3% Group B- 75.3%	Group A- 2 patients developed new acne lesions Group B- 50% had PIH
4.	Sharad (2011) ¹⁰	30 patients divided in 2 groups (22-F, 8-M)	Group A- PCI alone Group B- PCI + 35% GA peel (gap of 3 weeks between PCI and peel sessions)	III, IV, V-30	Mean improvement Group A- 31.33% Group B- 62%	Milia in 2 patients in both group A & B. PIH in 3 patients in group A
5	Leheta et al. (2012) ¹¹	24 patients divided in 2 groups	In both groups total 5 PCI sessions performed at 6 weekly interval Group A- deep phenol peel (once) Group B- PCI and 20% TCA peel performed for total of 4 sittings at 6 weekly intervals. Final assessment at 8 month	III-9 IV-11	75% and 69% improvement in scar severity score in group A and B, respectively	None significant in group B
6	Leheta et al. (2012) ¹²	39 patients divided into 3 equal groups (24-F, 15-M)	Group A- PCI +20% TCA Group B- nonablative fractional laser Group C-alternating treatment with above two modalities.	III-17 IV-22	59.79%, 61.83%, 78.27% improvement in Group A, B, C, respectively	None
7	Fabbrocini et al. (2012) ¹³	60 patients divided into 3 groups based on skin phototype (36-F, 24-M)	All treatments performed at 4-week interval, total 6 sessions 3 treatments at monthly interval Final assessment done 10 month after last sitting	I, II-10 III, IV, V-45 VI-5	Rolling scar and box-car scar showed significant improvement with PCI and laser, respectively Significant reduction in severity grade of acne scars. 31% reduction in degree of irregularity on silicone replicas	None

GA, Glycolic Acid; PIH, Postinflammatory hyperpigmentation; PCI, Percutaneous collagen induction.

hobby (hockey player), or excessive sweating leading to wash off of sunscreen. So, though epidermis is not damaged significantly in PCI, yet pigmentary complications can occur and all measures should be taken to prevent it. Tram-trek-patterned scarring was seen as worst side effect in our study which led to one drop out from the study. There is one previous similar report and it is thought to be due to larger needling device or strong pressure exerted while doing the procedure.¹⁴

The limitations of our study were lack of control group, lack of blinded evaluator, and subjective way of evaluating acne scars.

In conclusion, our study emphasizes the satisfactory results and less down time of simple microneedling technique in acne scars, while exercising caution for side effects. Future focus of studies should be to evaluate optimum number and frequency of microneedling sessions, means of preventing pigmentary complications especially in dark skin type and optimizing results by combining with other treatment modalities for acne scarring.

References

- Ghods SZ, Orawa H, Zouboulis CC. Prevalence, severity, and severity risk factors of acne in high school pupils: a community-based study. *J Invest Dermatol* 2009; **129**: 2136–41.
- Orentreich DS, Orentreich N. Subcutaneous incisionless (subcision) surgery for the correction of depressed scars and wrinkles. *Dermatol Surg* 1995; **21**: 543–9.
- Fernandes D. Percutaneous collagen induction: an alternative to laser resurfacing. *Aesthet Surg J* 2002; **22**: 307–9.
- Fernandes D, Signorini M. Combating photoaging with percutaneous collagen induction. *Clin Dermatol* 2008; **26**: 192–9.
- Aust MC, Knobloch K, Reimers K et al. Percutaneous collagen induction therapy: an alternative treatment for burn scars. *Burns* 2010; **36**: 836–43.
- Majid I. Microneedling therapy in atrophic facial scars: an objective assessment. *J Cutan Aesthet Surg* 2009; **2**: 26–30.
- Fabbrocini G, Fardella N, Monfrecola A et al. Acne scarring treatment using skin needling. *Clin Exp Dermatol* 2009; **34**: 874–83.
- Peterson JD, Palm MD, Kiripolsky MG et al. Evaluation of the effect of fractional laser with radiofrequency and fractionated radiofrequency on the improvement of acne scars. *Dermatol Surg* 2011; **37**: 1260–7.
- Leheta T, Tawdy AE, Abdel Hay R et al. Percutaneous collagen induction versus full-concentration trichloroacetic acid in the treatment of atrophic acne scars. *Dermatol Surg* 2011; **37**: 207–16.
- Sharad J. Combination of microneedling and glycolic acid peels for the treatment of acne scars in dark skin. *J Cosmet Dermatol* 2011; **10**: 317–23.
- Leheta TM, Abdel Hay RM, El Garem YF. Deep peeling using phenol versus percutaneous collagen induction combined with trichloroacetic acid 20% in atrophic post-acne scars; a randomized controlled trial. *J Dermatolog Treat* 2014; **25**: 130–6.
- Leheta TM, Abdel Hay RM, Hegazy RA et al. Do combined alternating sessions of 1540 nm nonablative fractional laser and percutaneous collagen induction with trichloroacetic acid 20% show better results than each individual modality in the treatment of atrophic acne scars? A randomized controlled trial. *J Dermatolog Treat* 2014; **25**: 137–41.
- Fabbrocini G, De Vita V, Monfrecola A et al. Percutaneous collagen induction: an effective and safe treatment for post-acne scarring in different skin phototypes. *J Dermatolog Treat* 2014; **25**: 147–52.
- Pahwa M, Pahwa P, Zaheer A. “Tram-Trek” effect after treatment of acne scars using microneedling device. *Dermatol Surg* 2012; **38**: 1107–8.