

## Efficacy of microneedling with topical vitamin C in treatment of acne scars

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### Abstract

**Introduction:** Acne scars are largely preventable complications of acne. 95% of the scars occur over the face thus impacting the quality of life. Correction of scars is the priority for acne patients. There is no single treatment modality that has been shown to be universally effective. Microneedling is a relatively new minimally invasive procedure used as a collagen induction therapy for skin rejuvenation and facial scars.

**Aim of the work:** Evaluation of efficacy of microneedling with topical vitamin C in treatment of acne scars.

**Patients and Methods:** Ten patients with post acne atrophic facial scars attending the outpatient clinic of Dermatology in Sohag University Hospitals between June 2014 to September 2017 were offered six microneedling sessions plus topical vit. C (during the session of microneedling and daily topical application in between sessions) microneedling sessions were four weeks apart. They were evaluated monthly and one month after completion of sessions for both efficacy and safety of the procedure.

**Results:** The mean  $\pm$  SD of the patients' age in the study population were  $28.900 \pm 5.384$  years old nine females and one males with mean acne scars duration  $\pm$  SD  $11.900 \pm 5.506$  years, 90% of patients had psychological distress from their acne scars. At the end of study duration Out of the ten patients 6(60%) achieved one grade reduction in their Goodman and Baron qualitative grading score and 2 (20%) achieved two grade reduction. According to the quantitative ECCA " Echelle d'évaluation Clinique des cicatrices d'acné" score 80% of patients achieved reduction in their score with 27.5% improvement in the ECCA score. The mean ECCA score value of V scar started to decrease earlier than both U scar, and M scar. 40% of patients had excellent satisfaction and 60% had very good satisfaction. All treated patients, had adverse events of temporary erythema, edema, bleeding, or a serous ooze resolving with crusting or scabbing following each session of microneedling, bacterial infection not occurred in any of our patients.

**Conclusion:** Multiple minimally invasive sessions of skin microneedling with topical vitamin C during sessions and daily application is an effective treatment for post-acne atrophic scars with the advantage of being a relatively risk-free, in-office procedure with minimal patient recovery time.

**Key words:** Microneedling, Vitamen C, acne scar.

### Introduction

Acne vulgaris is a very common dermatological disease, it has a prevalence of over 90% among adolescents and persists into adulthood in approximately 12%–14%, of cases with psychological and social implications of high gravity <sup>(1)</sup>. Inflammatory acne lesions can result in permanent scars <sup>(2)</sup>. The prevalence and severity of acne scarring in the population has not been well studied, although in the available literature is

usually correlated to the severity of acne <sup>(3)</sup> nearly 1% of people had acne scar <sup>(4)</sup>.

There are two basic types of acne scar depending on whether there is a net loss or gain of collagen (atrophic and hypertrophic scars). Eighty to ninety percent of people with acne scars have scars associated with a loss of collagen (atrophic scars) compared to a minority who show hypertrophic scars and keloids <sup>(5)</sup>.

Severe scarring caused by acne is associated with substantial physical and psychological distress, particularly in adolescents<sup>(2)</sup>.

Despite high prevalence of acne scars, there is no single treatment modality that has been shown to be universally effective, posing a significant challenge for the treating physician. However, there are multiple methods for the treatment of acne scars available, each with both pros and cons<sup>(6)</sup>.

Microneedling is a relatively new minimally invasive procedure involving superficial and controlled puncturing of the skin by rolling with miniature fine needles<sup>(7)</sup>. Traditionally used as a collagen induction therapy for skin rejuvenation and facial scars specially acne scars<sup>(8)</sup>.

Micropunctures are created using microneedles which produce a 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- $\alpha$  and TGF- $\beta$ ), connective tissue activating protein, connective tissue growth factor, and fibroblast growth factor (FGF)<sup>(9)</sup>.

The needles also breakdown the old hardened scar strands and allow it to revascularize. Neovascularization and neocollagenesis is initiated by migration and proliferation of fibroblasts and laying down of intercellular matrix<sup>(10)</sup>.

It is also widely used as a transdermal delivery system for therapeutic drugs<sup>(8)</sup>.

Vitamin C, the most plentiful antioxidant in human skin that is newly introduced as a topical agent for stimulation of collagen synthesis<sup>(11)</sup>. It was found to increases the mRNA

levels of collagens I and III, and their processing enzymes in humans and tissue inhibitor of matrix metalloproteinase 1 in the human dermis<sup>(12)</sup>, also to improve the clinical appearance of photoaged skin and to reduce facial wrinkles<sup>(12)</sup>.

The topical application of vitamin C partially restores the anatomical structure of the epidermal-dermal junction and increases the number of nutritive capillary loops in the papillary dermis close to the epidermal tissue in the aged skin<sup>(13)</sup>.

The numerous adverse effects and prolonged downtime associate energy based techniques make non energy based techniques like microneedling and topical agents are more suitable to wide range of acne scars sufferers<sup>(6)</sup>.

### **Aim of the work:**

Evaluation of efficacy of microneedling with topical vitamin C in treatment of acne scars.

### **Patients and Methods:**

**Design:** Cross sectional clinical study.

#### **Patients:**

Ten patients with post acne atrophic facial scars attending the outpatient clinic of Dermatology in Sohag University Hospitals between June 2014 to September 2017 were offered six microneedling sessions plus topical vit. C (during the session of microneedling and daily topical application in between sessions) microneedling sessions were four weeks apart. The study was approved by the institute of research and ethical committees at Sohag faculty of medicine. All the patients were informed verbally about the entire procedure, medication, possible complication and outcomes. An informed consent was signed from each participant. Patients were evaluated monthly and one month after completion of sessions for both efficacy and safety of the procedure. All patients were subjected to Medical

history and Clinical examination including patients evaluation by Goodman and Baron grading system for qualitative description of post acne scar<sup>(14)</sup> and Echellad'e valuation Clinique des cicatrices d'acne (ECCA) scale for numerical grading of acne scars<sup>(15)</sup>. This evaluation is repeated at each session.

Goodman and Baron qualitative description of post acne scars grade acne scars to four grads macular, mild, moderate and sever.

ECCA grading scales are based on semiquantitative, weighted assessments of 6 types of acne scars, namely, V-shaped atrophic scars (icepick), U-shaped atrophic scars (boxcar), M-shaped atrophic scars (rolling), hypertrophic inflammatory scars, keloid scars, and superficial elastolysis.

**• The procedure:**

The derma roller used is a plastic device with a 12-cm handle that holds a drum-shaped cylinder at the end, similar to a small paint roller, 2 cm in diameter and 2 cm in width. The surface of the cylinder holds 192 titanium needles in eight rows. Each 0.25 mm in diameter and 1.5 mm length sterilized by UV/ Gamma rays.

The area to be treated was anesthetized with topical anesthesia for 45 minutes to one hour. After preparation of the area with 1% Betadine solution.

A sterile single user derma roller was used for the treatment. The instrument was rolled in horizontal, vertical, and oblique directions for 10-20 times on the treatment area. After treatments, the bleeding was controlled with light pressure with sterile gauze and application of ice packs was then done to the treatment area. The face was cleaned with sterile normal saline. After each session immediate application of topical vit.C serum was done and also once daily application in between sessions.

application of fucidic acid ointment twice daily until the wounds were completely healed (between 5-7 days). There was mild to moderate facial erythema and or oedema for few days. The used vitamin C product was in the form of 17% concentration of L-Ascorbic Acid serum that was encapsulated in gelatinous capsules each contain 1 mg of the serum. This capsule form for topical application help to insure stability of the product and also insure use of equal dose in each application

**Outcome assessments:**

At each session and one month after completion of sessions all patients are assessed clinically by Goodman and Baron qualitative grading system and ECCA score. Photographic documentation using identical camera setting, lighting and patient. Patient satisfaction: was evaluated at the end of study and was graded as one of four categories represents the % of subjective improvement in the acne scars after treatment as compared with prior to treatment. [Excellent (100% - 76%), Very Good (51% - 75%), good (26% - 50%) and poor (0% - 25%)].

Safety assessment: adverse effects and recovery times were recorded at each treatment visits and follow up visit (bleeding, erythema, oedema, scaling and crusting, dyschromia and aggravation of inflammatory acne) before starting session, after each session and one month after the last session.

**Inclusion criteria:**

Facial acne scars and age greater than 18 years.

**Exclusion criteria:**

Active inflammatory acne, active infection in the treatment area (e.g., herpes simplex and verrucae), melanoma or lesions suspected of malignancy, isotretinoin use in the past year, dermatoses (e.g., eczema and psoriasis), sunburn, anticoagulant

therapy and systemic disease (diabetes, hypertension, collagen diseases or

bleeding tendency).

## **Results**

The mean $\pm$ SD of the patients' age in the study population were  $28.900 \pm 5.384$  years old nine females and one male with mean acne scars duration  $\pm$  SD  $11.900 \pm 5.506$  years, 90% of patients had psychological distress from their acne scars. Before starting sessions 10%, 50% and 40% of patients were grade 2,3 and 4 Goodman and Baron grading system respectively and the mean $\pm$ SD of their ECCA score was  $92.50 \pm 29.36$ .

- One month after completion of sessions 60% of patients showed one grade reduction in their score and 20% showed two grades reduction in their Goodman and Baron score. The improvement began after the 2nd session.

The mean value of ECCA score started to decrease after 2<sup>nd</sup> session, and after 4<sup>th</sup> session there was significant difference in ECCA score compared to baseline with highly significant improvement by the end of the study ( $p$  value=0.001) with 27.5% percent of improvement table 1.

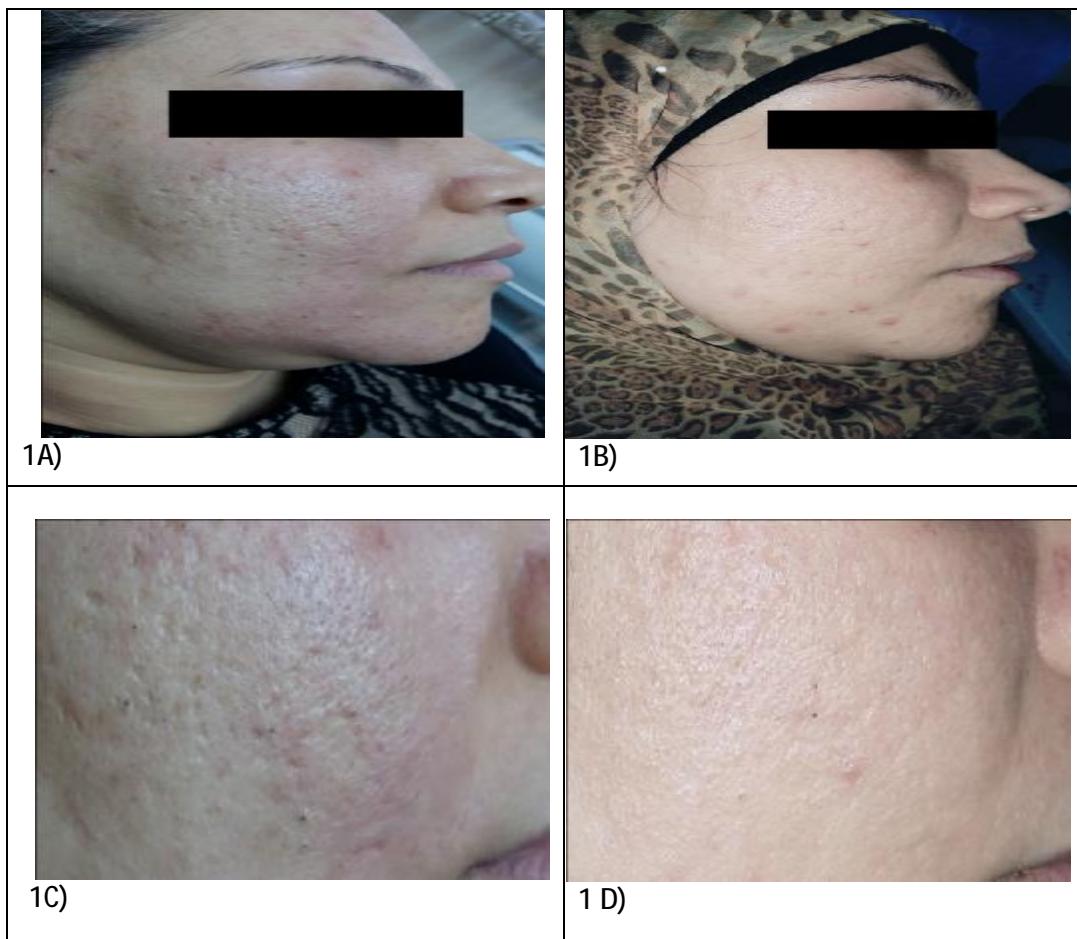
**Table 1: Changes in ECCA score in each group after each session**

Group			Mean	SD	Paired T Test	P Value
Microneedling with Vit c	Pair 1	ECCA at 1 <sup>st</sup> session	92.500	29.36	1.000	0.343
		ECCA at 2 <sup>nd</sup> session	92.500	29.36		
	Pair 2	ECCA at 1 <sup>st</sup> session	92.500	29.36	1.406	0.193
		ECCA at 3 <sup>rd</sup> session	91.000	28.75		
	Pair 3	ECCA at 1 <sup>st</sup> session	92.500	29.36	2.806	0.02
		ECCA at 4 <sup>th</sup> session	85.000	31.53		
	Pair 4	ECCA at 1 <sup>st</sup> session	92.500	29.36	4.943	<0.001
		ECCA at 5 <sup>th</sup> session	78.500	35.12		
	Pair 5	ECCA at 1 <sup>st</sup> session	92.500	29.36	3.939	<0.001
		ECCA at 6 <sup>th</sup> session	71.000	34.46		
	Pair 6	ECCA at 1 <sup>st</sup> session	92.500	29.36		
		ECCA at 1 month after TTT	67.000	36.68		

### **P value significant if <0.05**

The mean value of V scar ECCA score started to decrease after 2<sup>nd</sup> session, U scar and M scar started to decrease after 3<sup>rd</sup> session up to 1 month after TTT. The difference between V scar score was significant at 5<sup>th</sup>&6<sup>th</sup> session and after TTT, also difference between U scar score was significant at 6<sup>th</sup> session and after TTT.

All treated patients, had adverse events of temporary erythema, edema, bleeding, or a serous ooze resolving with crusting or scabbing following each session of microneedling, bacterial infection not occurred in any of our patients.



**Figure 1:** received microneedling vit. C, right side of the face A) before treatment B) one month after six sessions C) close view before treatment D) close view after treatment.

## Discussion

Although a lot of studies done to evaluate efficacy of microneedling either alone or in conjunction with other modalities of acne scar therapy, the challenge to compare our results to previous was due to heterogeneity in their sample size, study design and patient demographics. In addition, different scar grading scales have been used by different studies.

Our study population size was nearly equal to that conducted by Leheta et al.<sup>(16)</sup>, Sharad.<sup>(17)</sup>, El-Domyati et al.<sup>(18)</sup>, Gadkari and Nayak.<sup>(19)</sup>, Leheta et al.<sup>(20)</sup> to evaluate efficacy of microneedling compared to or in conjunction with other treatments of acne scars.

For microneedling we used the standard dermaroller device similar to that used in studies by Majid.<sup>(21)</sup>,

Chawla.<sup>(22)</sup>, Dogra et al.<sup>(23)</sup>, Leheta et al.<sup>(20)</sup>, El-Domyati et al.<sup>(18)</sup>, Nofal et al.<sup>(24)</sup>. Number of sessions was six sessions one every four weeks near to the average study durations and sessions intervals done by Majid.<sup>(21)</sup>, Dogra et al.<sup>(23)</sup>, Leheta et al.<sup>(20)</sup>, El-Domyati et al.<sup>(18)</sup>, and more than that done by Chawla.<sup>(22)</sup>, Nofal et al.<sup>(24)</sup>. For patients evaluation our study differ from all previous studies in combining subjective Goodman and Baron qualitative grading system as used by Majid.<sup>(21)</sup>, Chawla.<sup>(22)</sup>, Nofal et al.<sup>(24)</sup> and objective numerical grading system Echelle d'Evaluation clinique des Cicatrices d'acné' classification (ECCA) scale that used only by Sharad.<sup>(17)</sup> and patient satisfaction that used by Leheta et al.<sup>(20)</sup>, Nofal et al.<sup>(24)</sup>.

This study is the first study that uses vit. C daily with microneedling session to treat acne scars in a form of L-ascorbic acid serum as recommended by studies done by **Pinnell et al.** <sup>(25)</sup> and in concentration 17% that recommended by study of **Matsuda et al.** <sup>(26)</sup> to affect dermal collagen and daily application in between sessions to insure continuous dermal collagenesis.

The only other study that used vit. C 15% with microneedling was **Chawla.** <sup>(22)</sup> that used vit. C only during sessions without daily application and compared this with microneedling with PRP.

As regard the Goodman and Baron qualitative grading system, reduction started after the 2<sup>nd</sup> session and by the end of sessions 20% showed two grades reduction in their score, 60% of patients showed one grade reduction in their score and 20% had poor response, our results were better than the group of microneedling and vit. C of **Chawla.** <sup>(22)</sup>, in which 7% of patients showed two grades reduction in their score 56% showed one grade reduction in their score and 37% had poor response. This can be attributed to continuous daily application of vit. C and in higher concentration that insure persistent dermal reserve of vit. C to stimulate fibroblast, also our results were better than that recorded by **Chawla.** <sup>(22)</sup>, **Nofal et al.** <sup>(24)</sup> who used microneedling in combination with PRP.

As regard the ECCA score in this group; it showed improvement in 80% of patients by the end of the study. The ECCA score began to decrease after the 2<sup>nd</sup> session with a mean score $\pm$ sd (91.00 $\pm$ 28.57) as compared to the base

### **Conclusion:**

Multiple minimally invasive sessions of skin microneedling with topical vitamin C during sessions and daily application are an effective treatment

line (92.5 $\pm$ 29.36) and by the end of the study it was (67.00 $\pm$ 36.68) with highly significant improvement by 25.5 points as compared to base line. The percent of improvement in the ECCA score in this group at the end of study was 27.5%.

This result was slightly lower than that recorded by **Sharad.** <sup>(17)</sup>, who used ECCA score to evaluate microneedling with glycolic acid peel but didn't comment on types of scars. The mean value of V scar score started to decrease after 2<sup>nd</sup> session, U and M scar started to decrease after 3<sup>rd</sup> session, by the end of the study improvement of the V and U scar scores were significant.

The improvement in types of scars in our study was in agree with the finding in a systematic review of treatments for acne scarring by Non-energy based techniques which done by **Kravvas et al.** <sup>(6)</sup> that noted that rolling scars have the highest rates of treatment failure.

As regard patient satisfaction, 40% of patients had excellent satisfaction and 60% had very good satisfaction this was better than patients satisfaction recorded by **Leheta et al.** <sup>(20)</sup>, **Nofal et al.** <sup>(24)</sup> in their studies microneedling was in combination with peeling and PRP respectively.

### **As regard adverse effects of the procedures:**

Treated patients with skin needling alone, had adverse events of cause temporary erythema, edema, bleeding, or a serous ooze resolving with crusting or scabbing, the same result was reported by **Fabbrocini et al.** <sup>(27)</sup>, **Majid.** <sup>(21)</sup>, **Fabbrocini et al.** <sup>(10)</sup>, **Leheta et al.** <sup>(27)</sup>, **Sherad.** <sup>(17)</sup>, **Alam et al.** <sup>(28)</sup>, **Dogra et al.** <sup>(23)</sup>.

for post-acne atrophic scars with the advantage of being a relatively risk-free, in-office procedure with minimal patient recovery time.

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