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" A comparative study of microneedling versus microneedling with topical Ascorbic Acid in the treatment of striae distensae"

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Abstract:

Background: Striae Distensae is a type of visible scar that develops in areas of dermal injury as a result of excessive skin stretching. Weight gain, pregnancy and long term systemic or topical steroid use are considered its most common causes.

Aim of the work: the aim of our study is to compare and evaluate the effectiveness of microneedling and microneedling combined with Ascorbic Acid in treating and improving the appearance of Striae distensae.

Patients and Methods: this study was conducted on 28 patients with striae distensae (rubra and alba), they were divided in to two groups: the first group was treated with microneedling only using dermapen device, while the second group was treated with microneedling combined with topical Ascorbic Acid. All patients received four sessions with one month interval and followed up for three months after the last session.

Results: our study revealed that both treatment modalities were safe and effective in treating and improving the appearance of Striae distensae, addition of topical Ascorbic Acid increases the treatment outcome with no serious side effects and results in significant patient satisfaction.

Conclusion: the current study concluded that the use of microneedling or microneedling combined with Ascorbic Acid in the treatment of Striae distensae both are promising therapeutic modalities with tolerated side effects.

Keywords: Ascorbic Acid, Microneedling, striae distensae.

INTRODUCTION

Striae distensae (SD) or so called stretch marks represents a common dermatological complaint, although they are not considered as a medical emergency, they are often associated with psychological morbidity with a negative impact on quality of life in affected patients [(1)].SD are most commonly found on the thighs, buttocks, and breasts in girls. They commonly appear on the lumbosacral area or theoutside surface of the thighs in boys. Stretch marks of pregnancy, also known as striae gravidarum (SG), appears in the third trimester on the belly, breasts or thighs. SG lesions are more common in young primigravidae and are linked to higher pregnancy weight, large for gestational age new born, and a higher risk of traumatic vaginal birth [(2)].

Many different risk factors were claimed to be the cause of SD development. The most common causes include pregnancy, rapid weight gain or loss, a growth spurt during puberty and positive family history are considered as leading causes of SD. Genetic causes including Marfan syndrome and Ehlers-Danlos syndrome, endocrinal abnormalities as Cushing disease, Iatrogenic causes as long term use of corticosteroids[3]. SD is caused by scarring of the skin or epidermal atrophy. The epidermis is thin with fewer dermal papillae and rete ridges, the dermis contains fewer extracellular matrix (ECM) components as collagen, fibronectin, fibrillin, and elastin [4].

SD comes in two forms: striae rubrae (SR) and striae alba (SA). The initial erythematous, stretched flat lesions that are aligned perpendicular to the direction of skin tension are known as the acute stage (SR) and they can cause mild itching. The chronic stage (SA) is described when SD have faded and appears atrophic, wrinkled and hypopigmented [5].

The main histopathological changes in SD include degranulation of the mast cells in association with mid-dermal elastolysis. There is also evident atrophy of the epidermis in association with flattening of the rete ridges. Dermis show thinning with a densely packed region of collagen and elastic fibers and reorganization of dermal ground substance [6].

Topical therapies, chemical peeling, microdermabrasion, radiofrequency, lasers and microneedling are various treatment modalities of SD. Although the therapeutic strategies for SD are numerous, yet no single modality has been so far more consistent and proved complete efficacy. Evaluation of a patient with striae should consider the striae stage (rubra or alba) and the skin type. Expectations must be realistic, and the optimal treatment modality should be carefully selected to avoid any complications or exaggeration of the problem [7].

Microneedling is a quick, low cost office technique that promotes collagen stimulation and medication distribution through the epidermis (Trans-epidermal drug delivery). Skin needling therapy is able to activate the elimination of damaged old collagen as well as stimulate additional collagen formation beneath the epidermis, also it helps many active substances to be introduced in to the skin as Ascorbic acid (AA)[8].

AA also stimulates collagen production in the dermis by increasing rate of fibroblast proliferation. It therefore seems that AA can cause improvement in the atrophic appearance of stretch marks [(9)]. It acts as an essential cofactor for the enzymes lysyl- hydroxylase and prolyl-hydroxylase, which are required for the post translational processing of collagen types I and III [(10)].

AIM OF THE WORK: is to evaluate and compare the efficacy and safety of microneedling and microneedling combined with topical AA in treating SD.

PATIENTS AND METHODS:

This study is a comparative study that included 28 patients with SD (rubra and alba). These patients were recruited from dermatology outpatient clinic at Port Said city under the supervision of the staff of dermatology department at Port Said University in the period from August 2021 to April 2022. All patients received complete information about steps of the treatment. Risks, benefits, potential complications were discussed and informed written consent was obtained from every patient. The approval from the research ethics committee of the Faculty of Medicine of Port Said University also was obtained.

Inclusion criteria: female patients suffering from SD (rubra and alba), with ages ranged from 15-35 and stable body weight in the last four months.

Exclusion criteria: patients who were already pregnant or lactating at the time of the study, patients with bleeding disorders or on anticoagulant therapy, patients using drugs that exacerbate the striae as systemic corticosteroids in the preceding two months or topical corticosteroid in the preceding one month, patients having active infection at the treating area, patients with keloidal tendency and patients using other forms of treatment for stria as topical tretinoin, emollients, glycolic acid peel and laser, because that might affect the result of our study.

All participants were subjected to thefollowing:

Full history taking: personal history, history of the current striae including (onset, course, duration, color and distribution), past history about any medical disorder and other skin disease, history of previous medications, drug allergy and family history.

General examination: To exclude any systemic or autoimmune diseases that cause stretch marks.

Local examination: Skin phototyping according to Fitzpatrick's skin types, examinationof the skin for keloid or hypertrophic scars, evaluation of the site and type of striae (rubra and alba).

Protocol of treatment: Patients enrolled in the study were divided in to two groups, the first group (14 patients) was treated by microneedling using dermapen (DR.Pen) while the second group of patients (14 patients) was treated by microneedling combined with topical application of AA (20 %).

Number of sessions: All patients received four sessions with one month interval.

Technique: (a) Anesthesia was done using application of topical anesthetic cream pridocaine® (lidocaine 2.5% and prilocaine 2.5%) that was applied for 30 minutes under occlusion, the affected area was cleaned by alcohol 70 %. **(b)** Microneedling of the affected area was done by dermapen (Dr.pen model: ultima A6 Wireless adjustable from 0.25 to 2.5 mm and have 5 speed) that was applied on the affected area as follows: inserting the sterilized needle (36 Titanium needle) into the derma pen tip, turning on using speed setting and adjusting speed on 5, needle depth of derma pen was adjusted to (2- 2.5mm) according to the site of the striae, passing vertically over the striae with dermapen in a stamping pattern until pin point bleeding appeared. Hemostasis was achieved by compressing normal saline soaked piece of gauge on the treated area. This was done in the first group, and the same was done in the second group but was accombined with topical application of 2:3 ml of AA 20% (the AA ampoules from BIOSKIN DERMOLIFE COSMETIC company - made in spain, each ampoule contains 5ml of pure AA 20%) superficially along the length of striae and rubbed gently to facilitate its absorption. **(c)** Photographs were taken using a consistent background, position, and lighting by Canon digital camera EOS 4000D (EF 18-55DC) at baseline, after four sessions and three months after the last session.

Clinical evaluation:

❶ Clinical improvement was evaluated by the average score of two blinded dermatologists. Assessment of patients by comparing photographs before and after treatment. The criteria for evaluations using a quartile grading scale were as follows: 0 = No improvement. 1 = Mild (percent improvement < or =25%). 2 = Moderate (percent improvement=26-50%). 3 = Good (percent improvement=51-75%). 4 = Excellent (percent improvement > or =76%) [(11)].

❷ SD appearance was assessed using the Manchester Scar Scale (MSS) score at baseline and three months after the last treatment session [(12)].

The parameters of MSS score:

Color	Finish	Contour	Distortion	Texture
Perfect=1	Matte=1	Flush with surrounding skin=1	none =1	normal =1
Slight mismatch=2	Shiny=2	slightly raised or indented= 2	mild=2	just palpable=2
Obvious mismatch=3		Hypertrophic = 3	moderate =3	firm =3
Gross mismatch=4		Keloid = 4	severe =4	hard =4

❸ Patient satisfaction score was rated using the following scale: a 5- point scale ranging from 0= Not satisfied, 1= slightly satisfied, 2= satisfied, 3= very satisfied and 4= extremely satisfied.

STATSTICAL ANALYSIS:

Data were entered into the computer and analyzed using IBM SPSS software, version 20.0. (IBM Corp., Armonk, New York) number and percent were used to describe qualitative data. The normality of the distribution was assessed using the **Shapiro-Wilk test**. Quantitative data were described using range (minimum and maximum), mean, standard deviation, median, and interquartile range (IQR). The 5% level was used to determine the significance of the results. **The tests that were used:** **Chi-square test** for categorical data when comparing two groups. **Fisher's Exact or Monte Carlo** correction when more than 20% of the cells have an expected count of less than 5, chi-square must be corrected. **Student t-test** when comparing two groups under study with normally distributed quantitative variables, **Mann Whitney** test for comparing two groups under study using quantitative variables that have an irregular distribution.

RESULTS:

The present study was conducted on 28 female patients with SD, their ages ranged from 15 to 35 with Mean (22.68 ± 3.62 SD). The cause of striae was weight gain in 15 patients (53.6 %), weight loss in 3 patients (3.7 %), pregnancy in 7 patients (25.0%), systemic corticosteroid in 2 patients (7.1 %) and topical corticosteroid in 1 patient (3.6 %). The site of striae was on the abdomen in 8 patients (28.6 %), arms in 1 patient (3.6 %), back in 1 patient (3.6%), breast in 2 patients (7.1%), buttocks in 4 patients (14.3 %) , flanks in 4 patients (14.3 %), knee in 1 patient (3.6 %) and thighs in 7 patients (25.0 %). **Table (1).**

Table (1): distribution of the studied cases according to the demographic data

		All cases	
		N=28	
Age (years) (Mean± SD)		22.68	± 3.62
Causes		**N**	**%**
Weight gain		15	53.6 %
pregnancy		7	25.0 %
Weight loss		3	10.7%
Systemic steroid		2	7.1 %
Topical steroid		1	3.6 %
Types	Rubra	14	50.0%
	Alba	14	50.0%
Sites	Abdomen	8	28.6%
	Thigh	7	25.0%
	Buttocks	4	14.3%
	Flanks	4	14.3%
	Breast	2	7.1%
	Arms	1	3.6%
	knee	1	3.6 %
	Back	1	3.6%

Better improvement was achieved by combination of microneedling with AA, however there was no statistically significant difference between the two groups regarding the improvement score (quartile grading scale) that was evaluated by two blinded dermatologists. (P value =0.088) **Table (2)**

Table (2): Comparison between the two studied groups according to quartile grading scale that was evaluated by two blinded dermatologists.

Quartile grading scale	**Microneedling only (n= 14)**		**Microneedling with AA (n= 14)**		**2**	**MC_p**
	No.	**%**	**No.**	**%**		
Mild (<25%)	4	28.6	1	7.1	6.651	0.088
Moderate (26 – 50%)	6	42.9	2	14.3		
Good (51– 75%)	3	21.4	8	57.1		
Excellent (>76%)	1	7.1	3	21.4		

Comparing MSS after treatment to before treatment levels in each group revealed that MSS decreased significantly after treatment in the microneedling group and in the microneedling with AA group. (P value =0.001), better results were achieved by combination of microneedling with AA. However there was no statistically significant difference in improvement between both groups. (P value= 0.062). **Table (3)**

Table (3): Comparison between the two studied groups according to MSS .

MSS	Microneedling only (n= 14)	Microneedling with AA (n= 14)	U	p
before treatment				
Min. – Max.	12.0 – 15.0	12.0 – 15.0	92.50	0.804
Median (IQR)	13.0 (12.0 – 13.0)	13.0 (12.0 – 14.0)		
after treatment				
Min. – Max.	6.0 – 12.0	6.0 – 12.0	71.0	0.227
Median (IQR)	10.0 (7.0 – 11.0)	7.0 (7.0 – 8.0)		
Z (p_1)	**(0.001*)**	**(0.001*)**		
Improvement				
Min. – Max.	2.0 – 7.0	2.0 – 8.0	57.0	**0.062**
Median (IQR)	3.0(3.0 – 5.0)	5.0(5.0 – 6.0)		

The following table shows that there was statistically significant difference between the two groups regarding patient satisfaction score, Better satisfaction was significantly associated with treatment by microneedling combined with AA when compared to microneedling only. (P =0.025) **Table (4).**

Table (4): Comparison between the two studied groups according to patient satisfaction score.

Patient satisfaction score	microneedling only (n= 14)		microneedling with AA (n= 14)		MC_p
	No.	%	No.	%	
Slightly satisfaction	4	28.6	0	0.0	**0.025***
Satisfied	6	42.9	3	21.4	
Very satisfied	4	28.6	8	57.1	
Extremely satisfied	0	0.0	3	21.4	

There was no statistically significant difference between the two groups regarding side effects after the treatment**. (**P value=0.337) **Table (5)**

Table (5): Comparison between the two studied groups according to side effect

Side Effect	Microneedling only (n= 14)		Microneedling with AA (n= 14)		2	MC p
	No.	%	No.	%		
No	10	71.4	11	78.6	3.549	0.337
Yes	4	28.6	3	21.4		
Burning sensation	0	0.0	2	14.3		
Hyperpigmentation	3	21.4	1	7.1		
Allergy from topical anesthesia	1	7.1	0	0.0		

The following table shows that there was no significant difference between SR and SA within each group regarding the score of improvement (quartile grading scale). **Table (6)**

Table (6): Comparison between alba and rubra groups within each group regard quartilegrading scale.

		Color				2	MC p
		SA		SR			
		No.	%	No.	%		
Quartile grading scale	**Microneedling only**						
	Mild (<25%)	3	42.9	1	14.3	2.328	0.630
	Moderate (26 – 50%)	3	42.9	3	42.9		
	Good (51– 75%)	1	14.3	2	28.6		
	Excellent (>76%)	0	0.0	1	14.3		
	Microneedling with AA						
	Mild (<25%)	0	0.0	1	14.3	3.447	0.440
	Moderate (26 –50%)	2	28.6	0	0.0		
	Good (51– 75%)	3	42.9	5	71.4		
	Excellent (>76%)	2	28.6	1	14.3		

There was no significant relation between patients with side effects and those without side effects regarding skin phototype in both groups. **Table (7)**

Table (7): comparison between patients with side effects and those without side effects regarding skin phototype in both groups.

Skin photo type In microneedling group	Side Effect				χ^2	MC_p
	No (n = 10)		Yes (n = 4)			
	No.	%	No.	%		
II	1	10.0	0	0.0	0.742	1.000
III	6	60.0	3	75.0		
IV	3	30.0	1	25.0		
Skin photo type In microneedling with AA group	**Side Effect**				χ^2	**MCp**
	No (n = 11)		**Yes (n = 3)**			
	No.	**%**	**No.**	**%**		
II	1	9.1	0	0.0	0.798	1.000
III	7	63.6	2	66.7		
IV	3	27.3	1	33.3		

The following table showed that improvement was correlated with short duration of striae. (P value =0.019) **Table (8)**

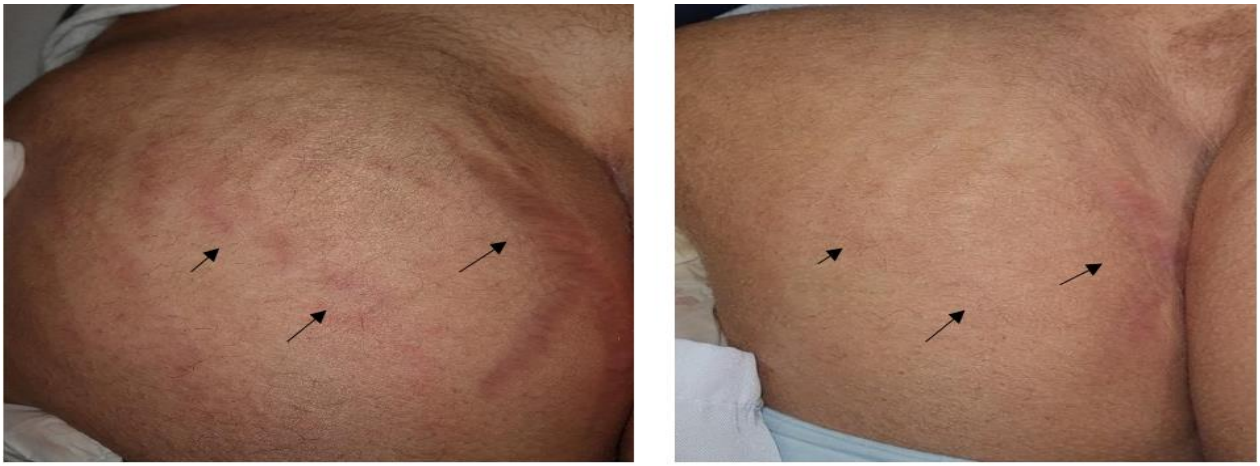
Table (8): correlation of improvement with age and duration of striae.

	MSS (Improvement)			
	microneedling only		Microneedling with AA	
	r_s	p	r_s	p
Age (years)	-0.184	0.530	0.057	0.848
Duration (years)	-0.614	0.019*	-0.329	0.250

Spearman coefficient, statistically significant at $p \leq 0.05$

Clinical photos for some of the study patients are shown in figures (1-5):

Figure (1): 24 years old female patient, skin photo type Ⅳ, presented with SR at the buttock of six months duration, the patient was treated with **microneedling by dermapen followed by topical application of AA** for four sessions with one month interval , and followed up for three months after the last session. (The case showed excellent response >76 %).



(a) (b)

Figure (1): (a) before the first session, (b) three months after the last session.

Figure (2): 20 years old female patient, skin phototype Ⅱ, presented with SA at the breast of two years duration, the patient treated with **microneedling by dermapen only,** for four sessions with one month interval, and followed up for three months after the last session. (The case showed good response 51-75%).

(a) (b)

Figure (2): (a) before the first session, (b) three months after the last session.

Figure (3): 30 years old female patient, skin phototype Ⅲ. Presented with SA at the buttocks of two years duration, the patient treated with **microneedling by dermapen followed by topical AA** for four sessions with one month interval and followed up for three months after last session. (The case showed excellent response >76%).

(a) (b)

Figure (3): (a) before the first session, (b) 3 months after the last session.

Figure (4): 22 years old female patient, skin phototype Ⅲ. Presented with SR at the thigh of one year duration, the patient was treated with **microneedling by dermapen followed by topical AA**, for four sessions with one month interval and followed up for three months after the last session. (The case showed excellent response >76%).

(a) (b)

Figure (4): (a) before the first session, (b) three months after the last session.

Figure(5): 17 years old female patient, skin phototype Ⅳ, presented with SR at the abdomen of 6 months duration, the patient was treated with **microneedling by dermapen only**, for four sessions with one month interval and followed up for three months after the last session. (The case showed good response 51-75%).

(a) **(b)**

Figure (5): (a) before the first session, (b) three months after the last session.

DISCUSSION

SD are frequent dermal scars with overlaying epidermal atrophy, they are not medically problematic, but they can be very upsetting for the person who has them [(4)]. There have been a variety of therapy approaches tried for striae, but no single "gold standard" modality has been identified. To get outcomes that are satisfactory, a combination of treatments is frequently needed [(13)].

Based on these facts we aimed to study the efficacy and safety of microneedling (using dermapen) in comparison to using dermapen followed by topical application of vitamin c (AA 20%) in the treatment of SD.

The study is conducted on 28 female patients with SD, whose ages range between (15:35). The patients are divided into two groups: first group is treated with microneedling by using dermapen, second group is treated with dermapen followed by topical application of AA, for four sessions with one month interval and followed up for three months after the last session. The most common site of lesion in our patients is the abdomen (28.6%), This is in agreement with the studies of **Hodeib et al., (2018)** [(14)] and **Saafan et al., (2022)** [(15)]. The most common possible cause of striae among our studied cases is weight gain (53.6%), This finding agrees with the studies done by **Abdelsamiea et al., (2021)** [(16)], **Salve et al., (2021)** [(17)] **and Saki et al., (2022)** [(18)].

In the current study as regard the improvement score (quartile grading scale), In the microneedling group 1 patient (7.1%) shows excellent improvement, 3 patients (21.4%) show good improvement. These results are in agreement with the results of **Khater et al. (2016) [19], Soliman et al., (2018) [20]**, regarding the improvement in the microneedling group, where they carried out studies to evaluate the effectiveness of microneedling therapy versus fractional co2 laser in treating SD.

Also our study is in agreement with the study of **Mohamed Ali et al., (2017) [21]** who found that microneedling significantly improves the SD in their study which included 30 patients that were divided into two groups, the first group was treated with microneedling and the second group was treated with microdermabrasion.

AA is a water-soluble micronutrient, it stimulates collagen production in the dermis by increasing rate of fibroblast proliferation. It therefore seems that AA can cause improvement in the atrophic appearance of stretch marks **[9].** Microneedling promotes collagen stimulation and medication distribution through the epidermis, it helps many active substances to be introduced into the skin as AA **[8]**.

In our study, regarding the improvement score , in the microneedling combined with topical AA group , 3 patients (21.4 %) show excellent improvement , 8 patients (57.1 %) show good improvement, thus we noticed that combining microneedling with AA leads to more improvement than using microneedling only. However, there is no statistically significant difference between the two groups regarding the improvement score.

The results of the current study is in agreement with the study of **Abdelsamiea et al., (2021) [16],** who compared the efficacy of microneedling with and without Vitamin C versus fractional co2 laser in treating SD , where 25 patients were enrolled in the study and received three treatment sessions with one month interval . There was no statistically significant difference between the three treatment modalities according to the improvement score that was evaluated by two blinded dermatologists, but there was highly statistically significant difference according to the histopathological evaluation where the highest rate of collagen and elastin induction was induced by microneedling with vitamin C followed by fractional CO2 LASER then microneedling only.

Despite improvement, the results of our study are in disagreement with **Saafan et al., (2022) [15],** who carried out a study evaluating the effectiveness of

dermapen versus dermapen combined with topical AA in treatment of Stretch Marks in 45 patients for three sessions with four weeks interval, and there was statistically significant difference between the two treatment modalities regarding the improvement score. This may be due to increased number of participants in the study done by **Saafan et al** and also may be due to using the dermapen by different technique, as in our study we use stamping technique while in their study they rolled at least 20 passes in the same area in different ways.

As regard patient satisfaction score, in our study there is statistically significant difference between the two groups where the patients are more satisfied in the group treated with microneedling combined with AA. This is in agreement with the studies of **Casabona et al (2017) [22] and Saafan et al., (2022) [15]**. And is in disagreement with the study of **Abdelsamiea et al., (2021) [16],** as in their study there was no significant difference in patient satisfaction score between the studied groups.

In our study, there is no statistically significant difference between SR and SA regarding the improvement score in both groups. This came in agreement with the study done by **Abdel-Motaleb et al., (2022) [23],** who carried out a study to compare the efficacy of microneedling with topical application of platelet-rich plasma (PRP) versus microneedling alone in the treatment of SD in 40 patients that were divided in to two groups, group 1 was treated with microneedling only and group 2 was treated by microneedling with topical PRP, and the results in group 1 showed no statistically significant difference between SR and SA regarding the improvement score.

Also, our results are in disagreement with the study of **Mohamed Ali et al., (2017) [21]**, as in their studies there was significant relation between score of improvement and the color of striae, where improvement was better in cases with SR. This contrast may be due to different distribution of the studied patients.

Both treatment modalities were generally well tolerated, there was no significant long lasting adverse effects except transient burning sensation that resolve within hours and post inflammatory hyperpigmentation that was treated by bleaching cream for 1 month.

CONCLUSION

We can conclude that the use of microneedling (dermapen) and microneedling combined with topical AA may be safe, effective, and a viable therapeutic option

for the treatment of SD. These treatments are widely accessible, low cost, have minimal tolerated side effects, essentially no downtime and are efficient in treating both forms of striae.

RECOMMENDATIONS & LIMITATIONS

1-This study recommends microneedling (dermapen) either alone or combined with topical AA as an effective and safe modalities for treatment of SD. **2-** More than four sessions are also recommended as higher improvement is achieved after multiple sessions in both techniques. **3-**Further comparative studies between microneedling and other treatment modalities is also recommended. **4-** Due to small sample size in the study, there was no statistically significant difference in the improvement scores between the two groups. However, the microneedling with AA group showed better improvement than microneedling only group.

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