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ORIGINAL ARTICLE

A Comparative Study Between the Fractional CO₂ Laser and Carboxytherapy in Treatment Of Striae Distensae: A Clinical and Histopathological Study

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ABSTRACT

Background: Striae distensae (SD), usually known as stretch marks, defined as linear dermal scars associated with epidermal atrophy. It is prevalent in all races.

The aim of this study was to compare the efficacy and the safety of use of ablative fractional CO₂ laser therapy and carbon dioxide gas intradermal injection in treatment of striae distensae.

Methods: The present study included 20 patients diagnosed with striae distensae who had received any previous treatment for SD. There were three groups; each group composed of 10 patients: The first group was treated with ablative fractional CO₂ laser resurfacing 10,600 nm The treatment parameters in this study were: energy (30-40 mJ), pulse duration (1.4-1.8 ms), scanning area (20 mm x 5 mm), depth level (1-2) and density level (8-16) according to each patient condition and skin type. Stria of the second group was treated with intradermal injection of carbon dioxide gas. 4-mm punch biopsies were taken from patients before and after treatment by and results showed high percentage of excellent improvement with fractional CO₂ laser.

Results: Carbon dioxide laser showed significant higher percentage of excellent improvement after last session of treatment of SD, when compared with carbon dioxide injection.

Conclusions: Treatment with CO₂ laser showed significant higher frequency of striae with excellent improvement, with good improvement, when compared to treatment with CO₂ injection (carboxytherapy). Fractional CO₂ laser is promising tool in dermatology and in treatment of SD (safe and effective).

Keywords: striae distensae; fractional carbon dioxide laser; carboxytherapy; histopathology.

INTRODUCTION

Striae distensae (SD) is a usually cosmetic problem which appears during either puberty or pregnancy [1]. It is usually defined as stretch marks that are visible linear scars which develop in areas of dermal damage as a result of sever stretching of the skin. They are twice as common in females and are reported in the age group of 5–50 years [2]. Stretch marks are common and usually lead to cosmetic morbidity and psychological distress. However, despite several advances, no effective treatment has acceted [3].

The common sites affected include the abdomen and breasts for pregnancy-related striae, the outer thighs or lumbosacral regions in adolescent boys, and the buttocks, thighs, upper arms, and breasts in adolescent girls [4]. Stretch marks at first (early-stage), they are pink or red in color (striae rubra) but over time and with atrophic changes they become

white (striae alba). Immature stretch marks are flattened or slightly raised pink or red lesion (striae rubra) [5]. Many treatment methods have been reported with diffrent success [6].

Fractional Co₂ laser stimulates epidermal turnover and dermal collagen remodeling, which leads to important improvement in many types of scars. Fractional resurfacing laser has been approved by FDA for treatment of acne scars in 2006. It acts through ablation a fraction of the skin leaving regions of normal skin to repopulate the ablated columns [7]. Carboxytherapy defined as the transcutaneous administration of carbon dioxide for therapeutic goals. [8].

The aim of carboxytherapy in the treatment of stretch marks, apart from the thickening of dermis and more even arrangement of collagen fibers [9]. Neovascularization is the formation of new blood vessels network, which contributes to the change of

skin color within the stretch marks. This may lead to the formation of the network of new blood vessels in the skin, which directly influences its color [10]. The aim of this work was to compare the efficacy and safety between fractional CO₂ laser and carboxytherapy in treatment of striae distensae.

METHODS

A comparative study the collection of patients was carried out at the Outpatient Clinics of Dermatology, Venereology and Andrology Department, Faculty of Medicine, Zagazig University Hospitals in the period from October 2018 to October 2019. And the study done at private center under supervision of professors. It included 20 patients (16 females and 4 males) with striae distensae and 10 healthy individuals as control group for biopsy. Their ages ranged between 18 and 37 years. Informed written consents were taken from all patients before the study. The study had the approval of the Institutional Review Board (IRB) at Zagazig University (ZU-IRB # 2333).

The following steps were employed in order: 1. Careful history taking, 2. General examination, 3. Dermatological examination to assess skin type, stretch mark type and site of affection, 4. Assessment of treatment was done for each patient including physician, photography, patient assessment. Also, adverse effect assessment was done, 5. Digital photographs and finally 6. Pathology of selected cases: 4-mm punch biopsy skin samples were taken in Pathology Department, Faculty of Medicine, Zagazig University from the most atrophic site before treatment and 3 months after the last session by either fractional CO₂ laser or carboxytherapy. The excised skin was fixed in 10% formalin and embedded in paraffin.

Every biopsy was stained by three different stains (H&E, Masson Trichrome "for collagen" and Van Gieson stain "for elastic fibres") and they were examined by a pathologist to compare pre- and post-treatment histopathology and the histopathological changes were reported.

Protocol of treatment:

Patients were randomly divided into 3 groups; each group composed of 10 patients: The first group was treated with ablative fractional CO₂ laser resurfacing with wavelength of 10,600 nm (Geumcheon-gu, Seol, Korea) Figure (1).

The treatment parameters in this study were: energy (30-40 mJ), pulse duration (1.4-1.8 ms), scanning area (20 mm x 5 mm), depth level (1-2) and density level (8-16) according to each patient condition and skin type. The patients of group 1 treated by Fractional Co₂ laser received four laser treatments

at 4-week intervals based on each patient condition. The laser setting was changed by lowering (energy, pulse duration and density level) if any evidence of post-inflammatory hyperpigmentation, severe erythema or edema was observed after fractional CO₂ laser therapy.

Striae of the second group was treated with intradermal injection of CO₂ gas using 30G needle with flow 80 to 150 cc/minute. The clinical endpoint of injection is the appearance of an erythema and distension of injected skin. Each patient had 6 sessions with 2-week interval using carboxytherapy apparatus (Made in Egypt) Figure (2). The third group (a control group) included 10 patients for biopsy only (normal skin).

Clinical evaluation:

- Digital color photographs were taken using identical camera settings (Canon PowerShot S95, Tokyo, Japan). Quartile grading scale: as follows: excellent improvement greater than 75%; very good improvement of 50-74%; good improvement of 25-49% and poor improvement less than 25%.
- Patient satisfaction score was rated using the following scale; 0 = not satisfied, 1 = slightly satisfied, 2 = satisfied, 3 = very satisfied and 4 = extremely satisfied [11].

Side effects:

Any side effects as persistent erythema, hyperpigmentation, hypopigmentation or herpes simplex flare were recorded and assessed by participants and graded as mild, moderate and severe.

STATISTICAL ANALYSIS

Data using Statistical Package for the Social Sciences (SPSS version 20.0) (Statistical Package for the Social Sciences) software for analysis. the following tests were used to test differences for significance; difference and association of qualitative variable by Chi square test (X²). Differences between quantitative independent groups by t test. P value was set at <0.05 for significant results & <0.001 for high significant result.

RESULTS

This study was conducted in dermatology and Venereology outpatient clinic in Zagazig university hospitals on 20 patients (16 females and 4 males). The patient's age ranged from 18 to 37 years with mean 26.3 ± 4.32 years. The studied cases were classified into equal 2 groups Group I 10 patients treated with fractional Co₂ and Group II (10 patients treated with carboxy therapy). There were no statistical significance differences between the studied groups in age and sex distribution (Table 1).

Table (2) shows that there was a statistically significant increase in response among Group I compared to Group II where 50% of Group I had excellent response, 30% had good and only 20% had fair response while in Group II 20% had very good 20% had good, 60% had poor response with no cases had excellent response.

Table (3) shows that there was a statistically significant increase in patients' satisfaction among Group I compared to Group II where 60% of Group I were extremely satisfied, 20% were very satisfied, and only 20% were slightly satisfied while in Group II 20% were extremely satisfied, 20% were satisfied, 20% were slightly satisfied and 40% were unsatisfied.



Figure 1: Fractional Co2 Apparatus



Figure (2): carboxytherapy apparatus



Figure (3): 20 years old female with striae alba of abdomen treated by fractional CO₂ laser for 4 sessions showing excellent response.

Table (1): Demographic data of the studied groups

Variable	Group I (fractional Co2) (n=10)		Group II (Carboxy) (n=10)		t	P
Age: (years)						0.84
Mean ± Sd	26.5 ± 5.21		26.1 ± 3.47		0.20	NS
Range	18 - 37		18 - 30			
Variable	No	%	No	%	χ^2	P
Sex:						1
Male	2	20	2	20	0	NS
Female	8	80	8	80		

SD: Standard deviation t: Independent t test χ^2 :Chi square test NS: Non significant (P>0.05)

Table (2): Response to treatment among the studied groups

Variable	Group I (fractional Co2) (n=10)		Group II (Carboxy) (n=10)		χ^2	P
	No	%	No	%		
Response:					11.2	0.01*
Poor	0	0	6	60		
Good	2	20	2	20		
Very good	3	30	2	20		
Excellent	5	50	0	0		

χ^2 :chi square test *: Significant (P<0.05)

Table (3): Patient satisfaction among the studied groups

Variable	Group I (fractional Co2) (n=10)		Group II (Carboxy) (n=10)		χ^2	P
	No	%	No	%		
Satisfaction:					10	0.04*
Non satisfied	0	0	4	40		
Slightly satisfied	2	20	2	20		
Satisfied	0	0	2	20		
Very satisfied	2	20	2	20		
Extremely satisfied	6	60	0	0		

χ^2 :chi square test *: Significant (P<0.05)

DISCUSSION

Striae distensae (SD) is a cosmetic problem which develops during either puberty or pregnancy [1]. It is usually defined as stretch marks, they are visible linear scars which develop in areas of dermal damage due to sever stretching of the skin. They are twice as common in females and are reported in the age group of 5–50 years [2].

It is prevalent in all races. Striae are more common in females than in males. Incidences have ranged from 11% in normal men to up to 88% in pregnant females [12].

The aim of this study was to compare the efficacy and the safety of use of ablative fractional CO₂ laser therapy and carbon dioxide gas intradermal injection in treatment of striae distensae. This study contains 20 patients diagnosed with striae distensae who had received any previous treatment for SD.

Regarding clinical improvement, our results in group I were 5 patients (50%) excellently improved, 3 patients (30%) were very good improved, and 2 patients (20%) were good improved. The treatment parameters in this study were: single pass, energy (30–40 mJ), pulse duration (1.4–1.8 ms), scanning area (20 mm x 5 mm), depth level (1–2) and density level (8–16) according to each patient condition and skin type. All the patients received monthly treatment for four sessions.

Yang and Lee [13] study the fractional CO₂ laser on 22 patients with SD with the following parameters a pulse energy of 40–50mj and a spot density of 75–100 spots/ cm², using a scan area of 8X8 mm in a static mode.20 (90.9%) of the 22 patients showed clinical improvement of the 22.3 (13.6%) were good, 9 (40.9%) were fair, and 8 (36.4%)

were poorly improved; however, 2 (9.1%) did not show any improvement after the treatment.

However, different results were obtained by Khater et al. [14] who showed clinical improvement in only 5 of 10 (50%) of the patients. One patient (10%) results were good, 4 (30%) were fair, one (10%) was poor and 5 (50%) did not show any improvement. This difference between results may be due to the parameters used in the study not high enough compared to our study. They used low parameters pulse energy of 16 mJ, 2 stacks, and 600 ms dwell time and a single pass was done.

Tehranchinia et al. [15] gave treatment sessions of fractional CO₂ laser to 30 patients with striae alba, with the following settings; intensity 10 J/cm², spot size 12 and 2 passes. Each patient received 2 treatment sessions with 4-week intervals. Demonstrated that 80% of patients had a poor or moderate improvement at 3-month follow up.

In our study, patient satisfaction score in group I (fractional CO₂ laser) revealed that six patients (60%) were extremely satisfied, two patients (20%) were very satisfied, two patients (20%) were slightly satisfied.

Also, similar results were obtained by El Taieb and Ibrahim [16] patients (16) (80%) were satisfied (20%) less satisfied they used 40 mJ energy, pulse width 4 ms. Scanning area (10mmX10mm) all the patients (20) received monthly treatment for five sessions.

Lee et al. [17] the results of 27 participants indicated that 22.2% of participants were very satisfied, 51.9% were satisfied, 18.1% were slightly satisfied, and 7.4% were unsatisfied after ablative 10,600-nm carbon dioxide fractional laser therapy, with lower parameters: pulse energy of 10 mJ, stacking 2 and a single pass.

In contrary to our study, Tehranchinia et al. [15] gave treatment sessions of fractional CO₂ laser to 30 patients with striae alba, with the following settings; intensity 10 J/cm², spot size 12 and 2 passes. Each patient received 2 treatment sessions with 4-week intervals. The results of study were 3 of the 30 participants (10%) were very satisfied, 3 (10%) were satisfied, one (3.3%) were slightly satisfied, and 21 (76.7%) were unsatisfied.

In our study, according to improvement in group II, 6 patients (60%) in group II were poor improved, 2 patients (20%) were good improved and 2 patients (20%) were very good improved and patient satisfaction score revealed that 2 patients (20%) were very satisfied, 2 patients (20%) were satisfied, 2 patients (20%) were slightly satisfied and 4 patients (40%) were non-satisfied.

In contrary to our study, Hodeib et al. [18] study contains 20 patients with striae alba. the patients

received treatment in the form of PRP injection in their right side (group A) and carboxytherapy session in their left side (group B) every 3-4 weeks for 4 sessions. In the group B treated by carboxytherapy The percentage of improvement ranged from 20% to 80% with a mean \pm SD of 48.5 \pm 18.45. The response of treatment (grading scale) was mild in 3 patients (15%), moderate in 12 patients (60%), marked in 3 patients (15%), and excellent in 2 patients (10%). Three patients (15%) were very satisfied, 7 patients (35%) were satisfied, 5 patients (25%) were slightly satisfied, and 5 patients (25%) were unsatisfied.

Abdelazim et al., [19] performed a clinical study (carboxy therapy versus PRP in striae distensae) including 30 patients with striae distensae divided into 2 groups: the carboxy group contains 15 patients receiving 6 sessions, the results were 40% excellent improvement, 20% marked improvement, 26.7% moderate improvement, 6.7% mild improvement and 6.7% no improvement.

In our study, 4 mm skin punch biopsy was taken from the striae in patients before treatment and after the end of treatment by either fractional CO₂ laser or carboxytherapy. Results from the biopsies which were taken from the striae before treatment with fractional CO₂ laser showed atrophic epidermis and flattened rete ridges. The dermis showed haphazardly arranged collagen bands with widening of the inter fibrillary spaces (H&E x 200 and Masson trichrome) and absence of elastic fiber (Van Gieson).

After treatment by fractional CO₂ laser, there were complete recovery with normal epidermis and rete ridges and parallel arrangement of the collagen bands and perivascular aggregate of inflammatory cells (H&E x 200 and Masson trichrome) and increased number of elastic fibers in between the collagen bands (Van Gieson).

After treatment by carboxytherapy, there were incomplete recovery with perivascular aggregates of inflammatory cells and near normal epidermis but collagen bands are still haphazardly arranged with widened inter fibrillary spaces (H&E x 200 and Masson trichrome) and few elastic fibers in between the collagen bands (Van Gieson).

Similar to our histopathological results. Yang and Lee [13] study the fractional CO₂ laser on 22 patients with SD with the following parameters a pulse energy of 40-50mj and a spot density of 75-100 spots/ cm², using a scan area of 8X8 mm in a static mode the epidermal thickness was increased and the amount of collagen bundles and elastic bundles were increased, in comparing to the pre treatment state.

Abdelazim et al., [19] performed a clinical study included 30 patients with striae distensae divided into 2 groups carboxy group (15) patients received 6 sessions. The results of biopsy highly significant increase in the epidermal thickness, and increase elastic fibres, collagen and improvement of colour of striae distensae.

In the present work, some complications were detected as hyperpigmentation occurs in 4 patients (40%) in group I versus 0% in group II. Pain occurs in 6 patients (60%) in group I and occurs in all cases in group II with different degrees; mild, moderate and severe. Erythema edema occurs in 5 patients (50%) in group I and 4 patients (40%) in group II and ecchymosis in 2 patients in group II and no patients in group I.

Regarding the complications of fractional CO₂ therapy, Yang and Lee [13] found that PIH developed in 8 patients (81.8%) after fractional CO₂ laser sessions. They used also high fluency: Parameters used were pulse energy of 40-50 mJ and a spot density of 75-100 spots/cm².

In the study done by Lee et al. [17] no patients developed PIH after fractional CO₂ laser. The cause of that they did only one session and with lower parameters; pulse energy of 10 mJ, stacking 2 and a single pass.

Regarding the complications of carboxytherapy, Brandi et al. [20] observed similar side effects of carboxytherapy, including crackling, ecchymosis (25% of patients) and. Pain at site of injection. (70% of patients)

Hodeib et al., [18] found that carboxytherapy is associated ecchymosis in 45% (resolved with 3-4 days) and pain in 45% temporary and limited to time of injection.

Podgorna et al. [21] found that carboxytherapy is associated with pain/discomfort in all cases.

CONCLUSIONS

Fractional CO₂ laser showed significant higher percentage of excellent improvement (A clinical and Histopathological) with high degree of patients satisfaction after last session of treatment of SD, when compared with carbon dioxide injection (Carboxytherapy). Fractional CO₂ laser is promising tool in dermatology and in treating SD (safe and effective).

Conflict of Interest: None

Financial Disclosure: None declared

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SUPPLEMENTARY TABLES AND FIGURES

Table (4s): Duration and skin type of the studied groups

Variable		Group I (fractional Co2) (n=10)		Group II (Carboxy) (n=10)		MW	P
Duration: (month)	<i>Mean ± Sd</i>	2.2 ± 1.21		1.73 ± 1.26		0.85	0.40
	<i>Median</i>	2.5		2			
	<i>Range</i>	3 month – 48		4 month – 48			
Variable		No	%	No	%	χ ²	P
Skin type	<i>II</i>	6	60	4	40	1.4	0.50
	<i>III</i>	3	30	3	30		
	<i>IV</i>	1	10	3	30		

SD: Standard deviation MW: Mann Whitney test χ²:Chi square test NS: Non significant (P>0.05)

Table (5s): Clinical data of disease among the studied groups

Variable		Group I (fractional Co2) (n=10)		Group II (Carboxy) (n=10)		χ ²	P
		No	%	No	%		
Site:	<i>Abdomen</i>	5	50	6	60	0.29	0.96
	<i>Arm</i>	1	10	1	10		
	<i>Buttock Thigh</i>	1	10	2	20		
		3	30	1	10		
Cause:	<i>Pregnancy</i>	5	50	6	60	0.29	0.87
	<i>Weight gain</i>	2	20	2	20		
	<i>Weight loss</i>	3	30	2	20		
Stria type:	<i>Alba</i>	8	80	8	80	0	1
	<i>Rubra</i>	2	20	2	20		

χ²:Chi square test NS: Non significant (P>0.05)

Table (6s): Number of sessions and Side effects of ttt among the studied groups

Variable		Group I (fractional Co2) (n=10)		Group II (Carboxy) (n=10)		χ ²	P
		No	%	No	%		
Side effect:	<i>Pain & itching</i>	1	10	4	40	7.91	0.04*
	<i>Pain, erythema & edema</i>	5	50	4	40		
	<i>Pain & ecchymosis</i>	0	0	2	20		
	<i>Hyperpigmentation</i>	4	40	0	0		
Pain degree:	(n=6)					6.04	0.04*
	<i>Mild</i>	4	66.7	2	20		
	<i>Moderate</i>	2	33.3	2	20		
<i>Sever</i>	0	0	6	60			
Sessions number:		4		6		--	--

SD: Standard deviation t: Independent t test χ²:chi square test **: Highly Significant (P<0.01)

Table (7s): Relation between demographic data & response in Group I

Variable		Good (n=2)		V.Good (n=3)		Excellent (n=5)		F	P
Age: (years)	<i>Mean ± SD</i>	28 ± 1.41		23.67 ± 5.13		27.6 ± 6.23		0.58	0.59
	<i>Range</i>	27 - 29		18 - 28		21 - 37			
Variable		No	%	No	%	No	%	χ ²	P
Sex:	<i>Male</i>	1	50	0	0	1	20	1.88	0.39
	<i>Female</i>	1	50	3	100	4	80		

SD: Stander deviation, F: ANOVA test, χ²: Chai square test. NS: Non significant (P>0.05)

Table (8s): Relation between duration and skin type and response in Group I

Variable		Good (n=2)		V.Good (n=3)		Excellent (n=5)		KW	P
Duration (years)	Mean ± SD	3 ± 0		2.53 ± 1.26		1.02 ± 0.87		3.69	0.04*
	Median (Range)	3		3 (8m – 48)		1.5 (4m-24m)			
Variable		No	%	No	%	No	%	χ ²	P
Skin type:	II	0	0	1	33.3	5	100	10	0.04*
	III	1	50	2	66.7	0	0		
	IV	1	50	0	0	0	0		

SD: Stander deviation, KW: Kruskal Wallis test, χ²: Chai square test. NS: Non significant (P>0.05)

Table (9s): Relation between disease clinical data and response in Group I

Variable		Good (n=2)		V.Good (n=3)		Excellent (n=5)		χ ²	P
		No	%	No	%	No	%		
Site:	Abdomen	0	0	0	0	5	100	14.44	0.03*
	Arm	0	0	1	33.3	0	0		
	Buttock	1	50	0	0	0	0		
	Thigh	1	50	2	66.7	0	0		
Cause:	Pregnancy	0	0	1	33.3	4	80	4.68	0.32
	Weight gain	1	50	1	33.3	0	0		
	Weight loss	1	50	1	33.3	1	20		
Stria type:	Alba	1	50	2	66.7	5	100	2.71	0.26
	Rubra	1	50	1	33.3	0	0		

χ²: Chai square test. NS: Non significant (P>0.05) *: Significant (P<0.05)

Table (10s): Relation between satisfaction and response in Group I

Variable		Good (n=2)		V.Good (n=3)		Excellent (n=5)		χ ²	P
		No	%	No	%	No	%		
Satisfaction:	Slightly satisfied	2	100	0	0	0	0	15.5	0.004**
	Very satisfied	0	0	2	66.7	0	0		
	Extremely satisfied	0	0	1	33.3	5	100		

χ²: Chai square test. **: Highly Significant (P<0.01)

Table (11s): Relation between side effect and response in Group I

Variable		Good (n=2)		V.Good (n=3)		Excellent (n=5)		χ ²	P
		No	%	No	%	No	%		
Side effect:	Pain & itching	0	0	0	0	1	20	4.33	0.36
	Pain, Erythema & Edema	2	100	2	66.7	1	20		
	Hyperpigmentation	0	0	1	33.3	3	60		
Pain degree:	Mild	1	50	2	66.7	1	20	1.5	0.47
	Moderate	1	50	0	0	1	20		

χ²: Chai square test. NS: Non significant (P>0.05)

Table (12s): Relation between satisfaction & side effect in Group I

Variable		Slightly satisfied (n=2)		Very satisfied (n=2)		Extremely satisfied (n=6)		χ ²	P
		No	%	No	%	No	%		
Side effect:	Pain & itching	0	0	0	0	1	16.7	3	0.56
	Pain, Erythema & Edema	2	100	1	50	2	33.3		
	Hyperpigmentation	0	0	1	50	3	50		
Pain degree:	Mild	1	50	1	50	2	33.3	0.75	0.68
	Moderate	1	50	0	0	1	16.7		

χ²: Chai square test. *: Significant (P<0.05)

Table (13s): Relation between demographic data and response in Group II

Variable		Poor (n=6)		Good (n=2)		Very good (n=2)		F	P
Age: (years)	<i>Mean ± SD</i>	25.5 ± 3.94		27.5 ± 0.71		26.5 ± 4.95		0.22	0.81 NS
	<i>Range</i>	18 - 29		27 - 28		23 - 30			
Variable		No	%	No	%	No	%	χ ²	P
Sex:	<i>Male</i>	1	16.7	1	50	0	0	1.67	0.44 NS
	<i>Female</i>	5	83.3	1	50	2	100		

SD: Stander deviation, F: ANOVA test, χ²: Chai square test. NS: Non significant (P>0.05)

Table (14s): Relation between duration, skin type and response in Group II

Variable		Poor (n=6)		Good (n=2)		Very good (n=2)		KW	P
Duration (years)	<i>Mean ± SD</i>	2.39 ± 1.26		0.67 ± 0.47		1.84 ± 1.46		2.84	0.13 NS
	<i>Median (Range)</i>	2.5 (1 - 4)		0.67 (4m - 1)		1.84 (8m - 3)			
Variable		No	%	No	%	No	%	χ ²	P
Skin type:	<i>II</i>	3	50	1	50	0	0	2.78	0.60 NS
	<i>III</i>	2	33.3	0	0	1	50		
	<i>IV</i>	1	16.7	1	50	1	50		

SD: Stander deviation, KW: Kruskal Wallis test, χ²: Chai square test. NS: Non significant (P>0.05)

Table (15s): Relation between clinical data of diseases and response in Group II

Variable		Poor (n=6)		Good (n=2)		Very good (n=2)		χ ²	P
		No	%	No	%	No	%		
Site:	<i>Abdomen</i>	3	50	1	50	2	100	3.33	0.77 NS
	<i>Arm</i>	1	0	0	0	0	0		
	<i>Buttock</i>	1	0	0	0	0	0		
	<i>Thigh</i>	1	50	1	50	0	0		
Cause:	<i>Pregnancy</i>	3	50	1	50	2	100	3.34	0.50 NS
	<i>Weight gain</i>	1	16.7	1	50	0	0		
	<i>Weight loss</i>	2	33.3	0	0	0	0		
Stria type:	<i>Alba</i>	5	100	1	50	2	100	1.67	0.44 NS
	<i>Rubra</i>	1	0	1	50	0	0		

χ²: Chai square test. NS: Non significant (P>0.05)

Table (16s): Relation between satisfaction and response in Group II

Variable		Poor (n=6)		Good (n=2)		Very good (n=2)		χ ²	P
		No	%	No	%	No	%		
Satisfaction:	<i>Unsatisfied</i>	4	66.7	0	0	0	0	20	0.003**
	<i>Slightly satisfied</i>	2	33.3	0	0	0	0		
	<i>Satisfied</i>	0	0	2	100	0	0		
	<i>Very satisfied</i>	0	0	0	0	2	100		

χ²: Chai square test. **: Highly significant (P<0.01)

Table (17s): Relation between side effects and response in Group II

Variable		Poor (n=6)		Good (n=2)		Very good (n=2)		χ^2	P
		No	%	No	%	No	%		
Side effect:	<i>Pain & itching</i>	2	33.3	1	50	1	50	1.67	0.80
	<i>Pain, Erythema & Edema</i>	2	33.3	1	50	1	50		
	<i>Pain & ecchymosis</i>	2	33.3	0	0	0	0		
Pain degree:	<i>Mild</i>	2	33.3	0	0	0	0	4.44	0.35
	<i>Moderate</i>	0	0	1	50	1	50		
	<i>Sever</i>	4	66.7	1	50	1	50		

χ^2 : Chai square test. NS: Non significant (P>0.05)

Table (18s): Relation between side effects and satisfaction in Group II

Variable		Unsatisfied (n=4)		Slightly satisfied (n=2)		Satisfied (n=2)		Very satisfied (n=2)		χ^2	P
		No	%	No	%	No	%	No	%		
Side effect:	<i>Pain & itching</i>	2	50	0	0	1	50	1	50	10	0.12
	<i>Pain, Erythema & Edema</i>	2	50	0	0	1	50	1	50		
	<i>Pain & ecchymosis</i>	0	0	2	100	0	0	0	0		
Pain degree:	<i>Mild</i>	2	50	0	0	0	0	0	0	6.67	0.35
	<i>Moderate</i>	0	0	0	0	1	50	1	50		
	<i>Sever</i>	2	50	2	100	1	50	1	50		

χ^2 : Chai square test. NS: Non significant (P>0.05)



Before treatment



After treatment

Figure (8s): 23 years old female patient with striae alba of the buttocks treated by carboxytherapy for 6 sessions showing very good response

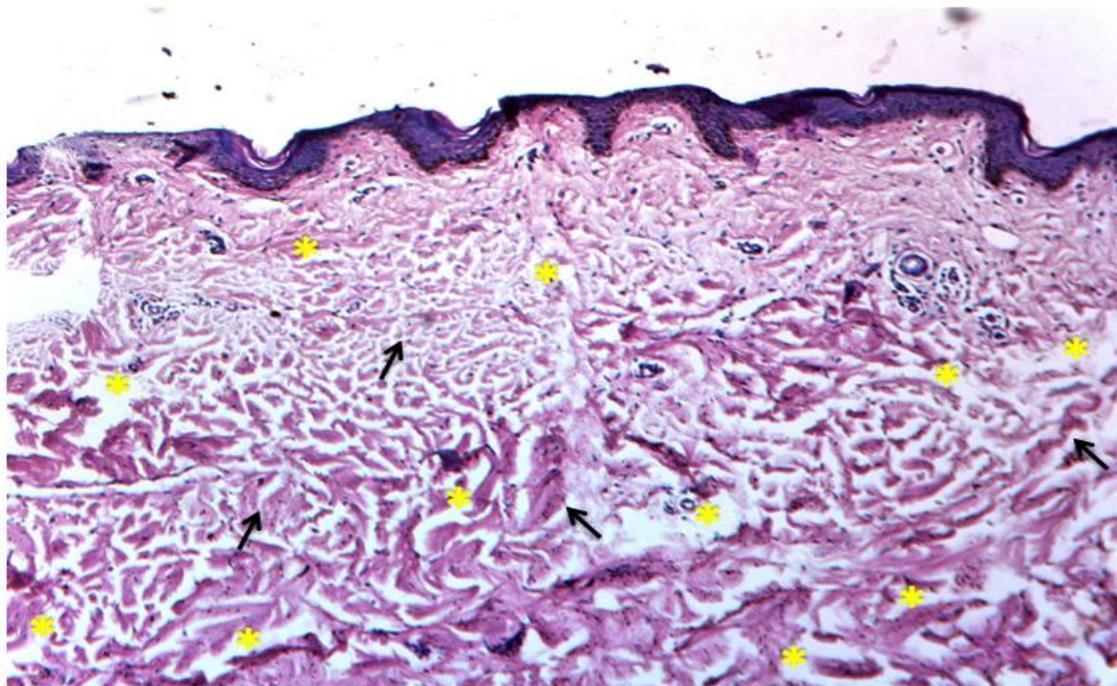


Figure (9s): Punch biopsy from a patient with stria of buttocks before treatment by carboxytherapy showing thin epidermis and flattened rete ridges. The dermis showed haphazardly arrangement of collagen bands ↑ with widening of inter-fibrillary spaces (H&E original magnification x 200).

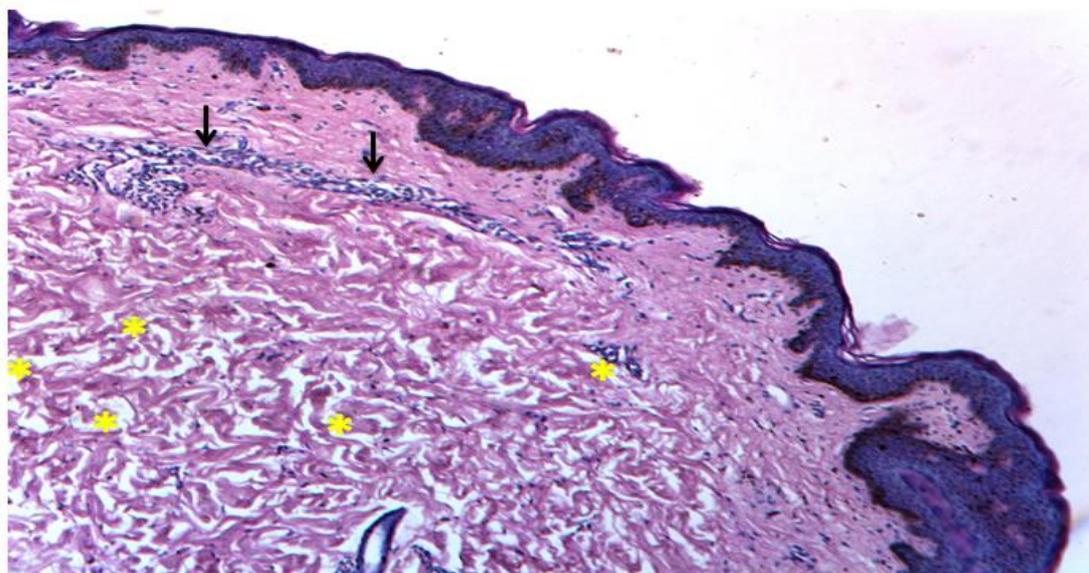


Figure (10s): Punch biopsy from same patient after treatment with carboxytherapy showing perivascular aggregates of inflammatory cells ↑ with normal epidermis but collagen bands are still haphazardly arrangement with widened inter-fibrillary spaces * (H&E x 200)

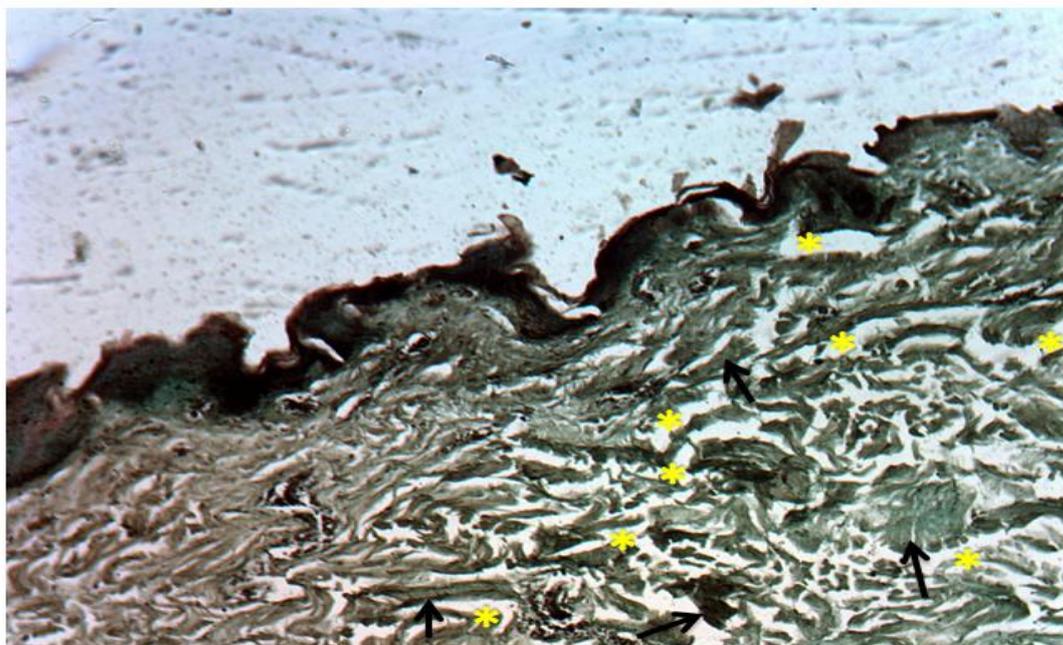


Figure (11s): Punch biopsy from same patient before treatment by carboxytherapy showing thin haphazard all arrangement of collagen bands ↑ with wide intra-fibrillary space *(Masson trichrome original magnification).

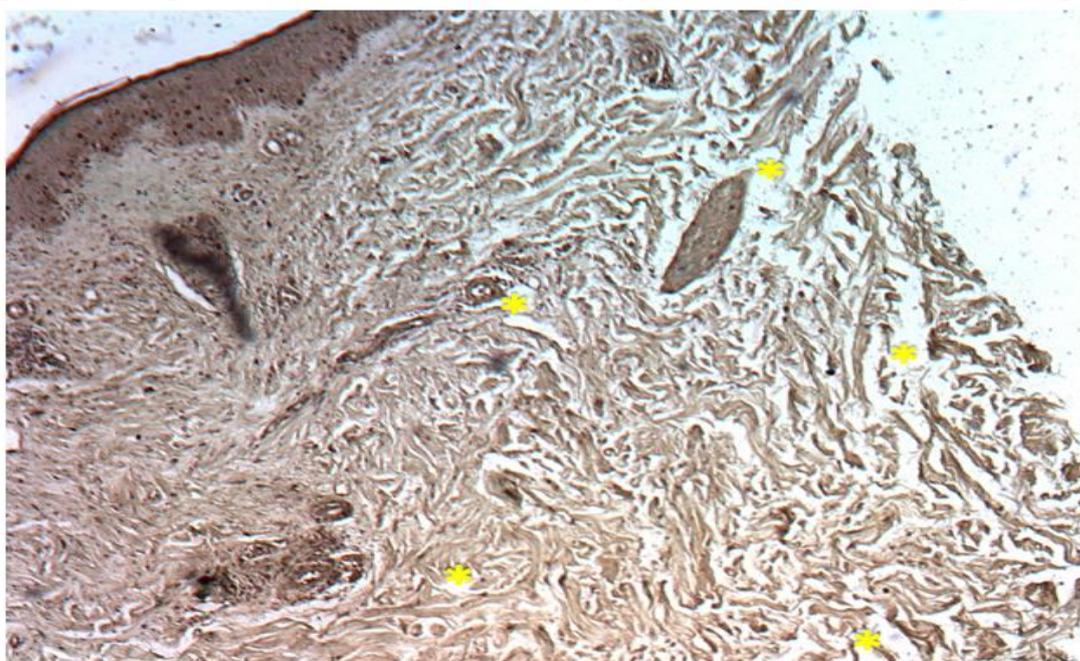


Figure (12s): Punch biopsy from same patient after treatment with carboxytherapy showing increased collagen bands but still haphazardly arrangement with wide inter-fibrillary space * (Masson trichrome original magnification x 200).

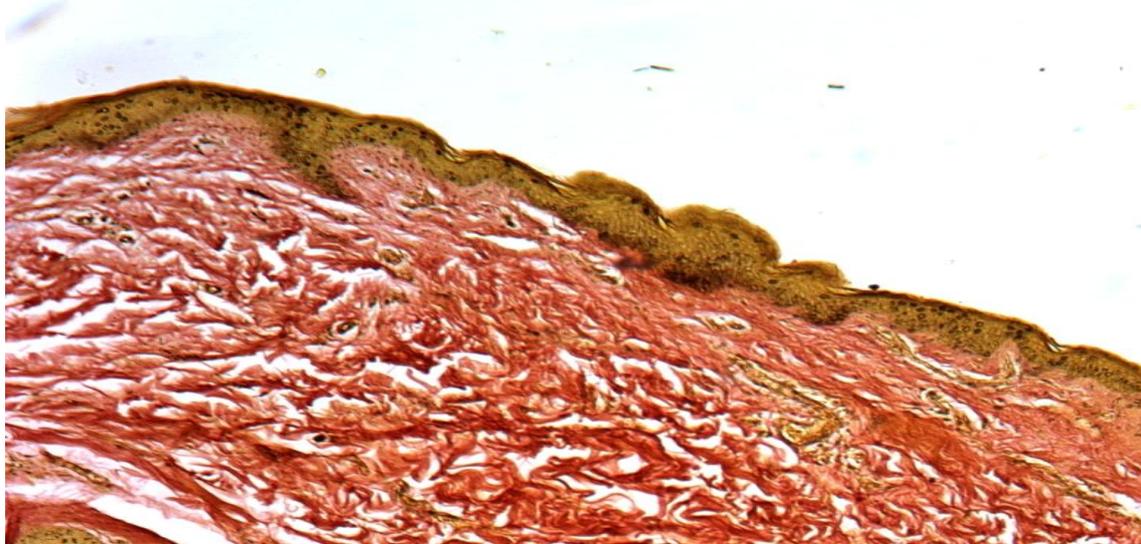


Figure (13s): Punch biopsy from same patient before treatment by carboxytherapy that there is absence of elastic fibers (Van Gieson, original magnification x 200)

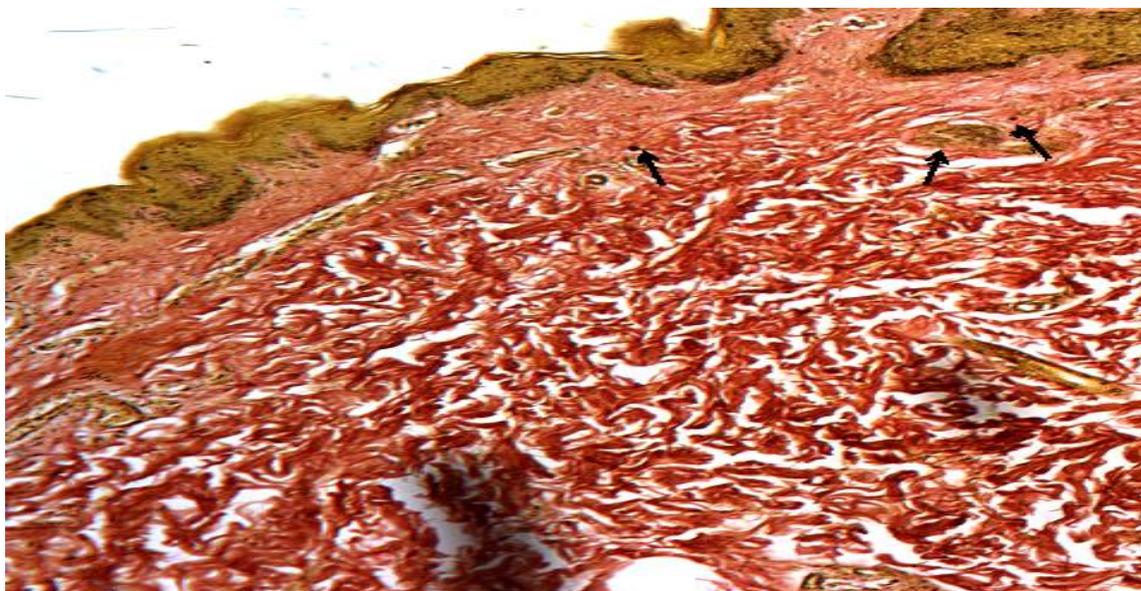


Figure (14s): Punch biopsy from same patient after treatment with carboxytherapy showing few elastic fibers ↑in between the collagen bands (Van Gieson stain x 200)