



# Fractionated CO<sub>2</sub> Laser in the Treatment of Striae Alba in Darker Skinned Patients - A Prospective Study

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## Abstract

**Introduction:** In recent years, the positive effect of fractional CO<sub>2</sub> laser on increasing collagen fibers, and consequently its effect on treating striae has been suggested. The present study aims to assess the effectiveness of CO<sub>2</sub> fractional laser 10600-nm in the treatment of striae alba.

**Methods:** In this prospective clinical trial, 2 treatment sessions of fractional CO<sub>2</sub> laser with 4-week interval was given to 30 patients with striae alba. Cutaneous resonance running time (CRRT) was measured at baseline and at week 4 and 3 months after the last session of laser therapy. The level of improvement was assessed by 2 independent dermatologists and patients after 3 months of follow up.

**Results:** 16.7% of patients had moderate improvement, 63.3% had minimal improvement, and 20% had no improvement. A statistical significant difference was found in median CRRT during the study ( $P < 0.0001$ ). The median CRRT levels were significantly higher in week 4 and 3 months after the last treatment compared to the baseline (both  $P < 0.001$ ). Likewise, a significant increase was observed in median CRRT level from week 4 till the end of study ( $P < 0.001$ ). Evaluation of participant satisfaction revealed that 10% were very satisfied, 10% satisfied, 3.3% slightly satisfied, and 76.7% unsatisfied.

**Conclusion:** Striae alba remain a challenging condition to treat. The treatment of striae alba with CO<sub>2</sub> fractional laser results in minimal improvement with mild side effects.

**Keywords:** Non-ablative laser; Stretch mark; Fractional laser; Striae.

## Introduction

Striae distensae (alba) is a relatively common skin disorder. It manifests as linear dermal atrophic scars and can cause significant distress to the affected individuals.<sup>1-4</sup> Striae distensae involves the skin which is susceptible to constant and dynamic stretching. Enlargement of the different parts of the body imposes progressive stress and stretch on the connective tissue. They often emerge on different parts of athletes' body, on the breasts and abdomen of pregnant women, in teenagers during the peak of their growth, and in over weighted people.<sup>5-8</sup>

Etiologic factors of striae have not been completely revealed. Skin stretch may result in explosive degranulation of mast cells with consequent destruction of elastin and collagen fibers.<sup>9</sup> Cushing syndrome or long term administration of topical/oral corticosteroids may cause the developing of striae.<sup>5,10-13</sup> Genetic susceptibility can definitely have a major role as well; however, the precise mechanism has not completely elucidated. Tung et al performed some accurate genome analysis and

demonstrated the collapse of elastic microfibrils as the etiology of some cases of striae distensae.<sup>14</sup>

Currently, even with the major progresses in topical medications and invention of different therapeutic devices, complete treatment of these skin lesions has remained an unachievable target.<sup>15</sup> Development of stretch marks may be prevented by avoidance of brisk weight gain or loss; particularly in high-risk groups e.g. adolescents, athletes, and pregnant women.<sup>16</sup> Application of topical retinols, fruit acids, vitamin C, and other medicaments have been recommended for the treatment of striae rubra in its early stages, but all have moderate efficacy.<sup>17,18</sup> Topical tretinoin improve the appearance of striae rubra significantly<sup>19-22</sup>; however, it is contraindicated in breastfeeding or pregnant women due to its probable teratogenic side effects.<sup>23,24</sup>

Several studies have reported the improvement of the clinical appearance of striae with 585-nm pulsed dye laser (PDL) via enhancement of the extracellular matrix collagen.<sup>25-28</sup> In addition, it has a modest efficacy in decreasing the erythema of striae rubra; however, it has

no obvious advantage in striae alba.<sup>29-32</sup> More recently, there has been evidence that indicates the benefits of both fractionated non-ablative and ablative lasers in increasing collagen fibers, and improving the appearance of striae alba. Our study aimed to assess the effectiveness a fractionated CO<sub>2</sub> in the treatment of striae alba, especially in darker skin types.

### Patients and Methods

In a prospective clinical trial, 30 patients with striae alba who were referred to our dermatology clinic were included in the study. The inclusion criteria consisted of striae for at least 1 year, skin type III to V, and informed consent to attend the study. The exclusion criteria included pregnancy or breast feeding, history of using immunosuppressive drugs, history of keloid formation, any treatment of striae in the last 6 months, and history of collagen or elastin disorders. Baseline characteristics (gender, age) and medical history (etiology of striae, skin type, and location of striae) were collected from the recorded hospital files. Photography was initially performed using canon SX-200 camera from standardized anterior position for each patient. Two photographs were taken of the striae of each patient, including one from the far view and another from up close view at baseline and also at the end of study period.

At baseline, cutaneous resonance running time (CRRT) was measured by a reviscometer (multi-probe adaptor system MPA5). This assessment was repeated at week 4 and 3 months after the last session of laser therapy. Prior to the treatment, local anesthesia was applied with a 2% lidocaine cream for 30 minutes. The lidocaine cream was wiped off, and the patients were treated with the fractionated 10600 nm CO<sub>2</sub> laser (Ultra Pulse, Lumenis Ltd, Yokneam, Israel) at the following settings: Deep Fx:2, intensity:10 J/cm<sup>2</sup>, spot size: 12, and 2 passes. After the treatment, zinc oxide cream was applied to the treated areas. Each patient received 2 treatment sessions with 4-week intervals.

Patients were then followed-up for 3 months after the last treatment, and skin elasticity was measured again. Any side effects including erythema, burns, keloids and hyperpigmentation were recorded and scored as mild, moderate and severe. The appearance of any unintended complication was considered as a criterion for excluding. The level of improvement was assessed by 2 independent dermatologists by comparing photographs taken 3 months after the last treatment with baseline photographs. The level of patient satisfaction was also categorized as unchanged, good, moderate, excellent, and very excellent in each session and after 3 months of treatment.

All data analyses were performed using the statistical software SPSS 16.0.0. (SPSS Inc. Chicago, IL, USA). *P* values less than 0.05 were considered statistically significant. All tests were 2-sided. Continuous variables were reported as mean ± standard deviation (SD) or as

medians with total and inter quartile ranges (25th-75th percentiles). Categorical data were summarized as number (percentage). The normality of continuous variables was assessed using the Shapiro-Wilk's *W*-test. Friedman test was used to evaluate the differences in CRRT values. For pair-wise comparisons, Wilcoxon signed-rank tests with Bonferroni corrections were conducted.

### Results

Thirty patients with striae alba (27 females and 3 males) were included in this study. Baseline demographics and clinical characteristics of the patients are summarized in Table 1.

Three months after the last treatment, 5 of the 30 participants (16.7%) had moderate improvement, 19 (63.3%) had minimal improvement, and 6 (20%) had no improvement (Figure 1). None of the participants showed worsening of their striae alba during the course of study. Evaluation of overall participant satisfaction 3 months after the treatment revealed that 3 of the 30 participants (10%) were very satisfied, 3 (10%) were satisfied, one (3.3%) was slightly satisfied, and 21 (76.7%) were unsatisfied.

A statistical significant difference was detected in median CRRT levels during the study ( $P < 0.0001$ , Friedman test). The median CRRT levels were significantly higher in fourth week and 3 months after the last treatment compared to the baseline (both  $P < 0.001$ , Wilcoxon signed-rank test). Furthermore, a significant increase was observed in median CRRT level from week 4 till the end of study ( $P < 0.001$ , Wilcoxon signed-rank test).

After the first laser session, mild-to-moderate post-treatment erythema was detected in approximately half of the patients and resolved during 2–10 days after treatment.

Also, post-therapy erythema was observed in 8 patients (26.6%) after the second sessions of laser therapy, which

**Table 1.** Baseline Demographics and Clinical Characteristics of the Patients With Striae Alba

Variable	
Sex	
Female	27 (90%)
Male	3 (10%)
Age, years	
Mean ± SD	33.63±8.26
Median (range)	33 (21-45)
Fitzpatrick's skin type	
3	16 (53.3)
4	14 (46.7)
Cause of striae alba	
Weight change	16 (53.3)
Pregnancy	13 (43.3)
Corticosteroid use	1 (3.3)

Data are expressed as no. (%) unless otherwise stated.



**Figure 1.** Steria Alba on the Arm (A) at Baseline and (B) 3 months After the Last Treatment by Fractional CO<sub>2</sub> Laser (2 sessions) With 4-Week Interval.

disappeared within 1 week. Adverse events such as burns and post-inflammatory hyperpigmentation (PIH) were observed in 5 patients (17%) after the first session of laser therapy and resolved within 2 weeks. Additionally, transient PIH had developed in 3 patients (10%) after the second sessions.

### Discussion

As previously described, laser treatments are now the most effective techniques for treating striae alba. Since the appearance of striae alba is the last stage of striae, response to various treatments is not ideal. In this regard, different laser-based treatments were tested in treating this condition, but the impact of laser fractional CO<sub>2</sub> (10 600 nm) therapy was not assessed previously in darker skin patients. In this context, our study showed that almost two-thirds of treated patients had a mild response within 3 months of treatment, while 46.7% had a moderate response and 20% suffered from unchanged clinical condition. In addition, within the first 4 weeks, only 40% experienced mild response. Although adverse effects were reported in patients, these complications were all mild and self-limited. Regarding patients' satisfaction, only 20% had partial or complete satisfaction of the treatment method.

In previous studies, different response levels were achieved. In a study by Naein and Soghrati, fractional photothermolysis with a fractional CO<sub>2</sub> laser for treatment of striae alba was more effective than conventional local methods.<sup>33</sup> In another study by Yang and Lee, both nonablative fractional and ablative CO<sub>2</sub> fractional lasers showed significant clinical and histopathologic improvement of striae when compared to the pretreatment area; however, both treatments did not statistically differ.<sup>34</sup> Alexiades-Armenakas et al also indicated that following treatment with the 308-nm excimer laser, the percentage of pigment correction increased in direct correlation with the number of treatment sessions.<sup>35</sup> In a recent study, Wang et al compared the safety and efficacy of a 1540-nm

and 1410-nm non-ablative fractional laser in treatment of striae, histologically and clinically. Both methods resulted in clinical and histological improvement. However, no significant difference was observed between these lasers.<sup>36</sup> In another study by Ostovari et al, the mexameter-based data analysis showed that the excimer laser had poor efficacy in the repigmentation of the striae lesions.<sup>37</sup> Malekzad et al similarly reported poor results after 8 sessions of treatment with 1540-nm non-ablative fractional laser.<sup>38</sup>

In this study, the 3 months follow up photos demonstrated 80% of patients had a poor or moderate improvement. It is possible that further treatment sessions are required to achieve considerable improvement. In particular it seems that concomitant laser fractional CO<sub>2</sub> 10600 nm treatment with additional topical treatments and other lasers may enhance the improvement rate. Moreover, striae alba continues to be a challenging condition to treat despite great advances in laser surgery.

### Conclusion

Striae alba remain a challenging condition to treat. The treatment of striae alba with CO<sub>2</sub> fractional laser results in minimal improvement with mild side effects.

### Conflict of Interests

The authors declare that they have no conflict of interest.

### Ethical Considerations

All subjects gave an informed consent to join this study. The study has been approved by the Skin Research Center, Shahid Beheshti University of Medical Sciences.

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