Fractional Photothermolysis for the Treatment of Striae Distensae: Two Case Reports

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Striae distensae are difficult to treat. Several modalities have been used with moderate success. Fractional photothermolysis offers a novel treatment option for abdominal striae distensae. A 25-year-old white female patient (case 1) and a 39-year-old white female patient (case 2) with abdominal striae distensae were treated with fractional photothermolysis (1550-nm Fraxel SR laser). Multiple treatment sessions (2 for case 1 and 3 for case 2) were performed one month apart at 16 mJ and 125 microthermal zones for a total density of approximately 2000 microthermal zones/cm^2 for each treatment. Pretreatment and posttreatment clinical photographs (taken one month after the last treatment) and patient satisfaction ratings were used to assess treatment efficacy. An independent physician evaluator reported that a 50% clinical improvement in case 1 and a 45% clinical improvement in case 2 were achieved one month after the last treatment based on clinical photographs. Both patients measured their response rates as "significantly improved." Minimal to no side effects were noted. Clinical improvement continued at follow-up at 4 and 6 months. Fractional photothermolysis offers a new, safe, and effective treatment for abdominal striae distensae.

Striae distensae were described as a clinical entity hundreds of years ago, with the first histologic description appearing in the medical literature in 1889.[1] Striae are common cutaneous lesions that are cosmetically displeasing to many patients. They are characterized by wide linear bands of atrophic or wrinkled skin that occur in areas of dermal damage secondary to stretching. The distribution of striae is quite variable but typically involves the abdomen, buttocks, breasts, and skin flexures. Women develop striae more commonly than do men, with studies showing that 70% of adolescent females and 40% of adolescent males develop these lesions.[2] The etiology of striae is still controversial and is closely related to the variable clinical scenarios they accompany, including pregnancy, adrenocortical excess, changes in body habitus, obesity, and rapid weight gain.[1,2] Striae are seen in 90% of pregnant women and are due to a combination of hormonal factors along with increased lateral stress on connective tissue.[3]

Several studies have shown the pathogenesis of striae to be related to changes among the dermal extracellular matrix components, including fibrillin, collagen, and elastin, during stretching of the skin.[4] Different theories have been proposed defining what happens to these components during stretching, such as dermal collagen rupture, elastolysis, and mast cell degranulation leading to elastic fiber changes and disrupture of cross-linked collagen.[4-6]

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The treatment of striae distensae has been challenging, and various modalities have been studied. These include topical therapies such as tretinoin 0.1% alone or in combination with glycolic acid 20%, as well as the combination of glycolic acid 20% and L-ascorbic acid 10%.[7,8] Microdermabrasion has further been added to these treatment regimens to enhance the penetration of the topical therapies. These therapies have yielded variable cosmetic results by decreasing redness and size of striae rubrae but have had much less success in older, more atrophied striae albae.[9]

Both ablative and nonablative lasers have been used to treat striae distensae. Ablative lasers require significant downtime and have a higher side effect profile, including dyspigmentation and scarring. Nonablative lasers, such as the pulsed dye laser (PDL),[10,11] and light sources, such as UV[12] and intense pulsed light (IPL),[13] have yielded minimal improvement. At lower fluences (2–4 J/cm^2), the 585-nm flashlamp PDL has been reported to treat striae rubrae and increase the amount of collagen in the extracellular matrix of striae.[10,11] However, the 585-nm PDL had no apparent benefit in striae albae. In addition, side effects of PDLs have been reported with marked hyperpigmentation when they are used in darker skin types.[14] The use of IPL has been reported to show clinical and microscopic improvement in striae rubrae but has little effect on striae albae.[13] UV irradiation has been shown to repigment striae distensae (striae albae).[12] The improvement is due to an increase in melanin pigment, hypertrophy of melanocytes, and an increase in the number of melanocytes. However, this result is transient, and maintenance treatments are needed.

Fractional photothermolysis is a novel concept using arrays of microscopic thermal damage patterns to stimulate a therapeutic response.[15] It has recently shown efficacy in the treatment of several dermatologic conditions, such as acne scars,[16] melasma,[17] hypertrophic surgical scars,[18] poikiloderma of Civatte,[19] photodamage,[20] and fine rhytides.[21] In addition, it has been shown to cause tissue and collagen remodeling.[22] Fractional photothermolysis uses a 1550-nm erbium-doped laser that creates a variable density of 100- to 160-µm–wide columns of thermal damage and can penetrate from 300 to 1200 µm depending on the energy setting. Patients are typically treated with 8 passes with a variable per-pass density, leading to a total density of 5% to 35% coverage per treatment. Unlike traditional lasers, which cause confluent heating of areas of skin chromophores, fractional photothermolysis creates hundreds to thousands of microthermal zones (MTZs) and spares the tissue between each MTZ.[15] This allows for approximately 15% to 20% of the skin surface area to be treated at one time. By delivering fractionated MTZs of heat into the deep dermis, with the surrounding tissue remaining intact, healing occurs from the epidermal cells adjacent to the MTZs.[22] Continuity of the epidermal basal layer has been shown to occur 24 hours after fractional photothermolysis, with complete epidermal closure within 7 days.[22] Using this treatment allows for rapid healing, little downtime, and a minimal side effect profile. Here we report the cases of 2 female patients with Fitzpatrick skin type III to IV and abdominal striae secondary to pregnancy who were treated with 2 or 3 treatments of fractional photothermolysis one month apart. Significant improvement was seen based on clinical photographs assessed by an independent physician evaluator as well as by patient ratings.

CASE REPORTS

Case 1

A 25-year-old woman with Fitzpatrick skin type III had delivered a baby 8 months prior to her clinical visit. Her physical examination revealed hypopigmented linear atrophic plaques on bilateral sides of her lower abdomen (Figure 1A). Each plaque had a wrinkled, paper-thin appearance. She had no significant past medical history, and she denied using any topical medication on the area other than emollients. In addition, she did not have any history of laser treatments to her striae. The patient underwent 2 treatments with the 1550-nm Fraxel SR laser one month apart. Photographs were taken one month after the second treatment at the follow-up visit (Figure 1B).

Case 2

A 39-year-old woman with Fitzpatrick skin type III presented to our clinic with a 16-year history of striae. Her physical examination revealed hypopigmented linear atrophic plaques on bilateral sides of her lower abdomen (Figure 2A). Each plaque had a wrinkled, paper-thin appearance. She had no significant medical history, and she denied using any topical medication on the area other than emollients. In addition, she did not have any history of laser treatments to her striae. The patient underwent 3 treatments with the 1550-nm Fraxel SR laser one month apart. Photographs were taken one month after the third treatment at the follow-up visit (Figure 2B).

Treatment

Prior to treatment, each patient had lidocaine 30% applied to her abdominal striae for one hour. The treatment area was cleansed thoroughly with mild cleanser. A water-soluble tint was then applied to the treatment area to highlight the contours of the skin and allow the laser to track the treatment area. Treatment was performed for both patients at an energy setting of 16 mJ and a density of 125 MTZ. Eight passes were delivered with

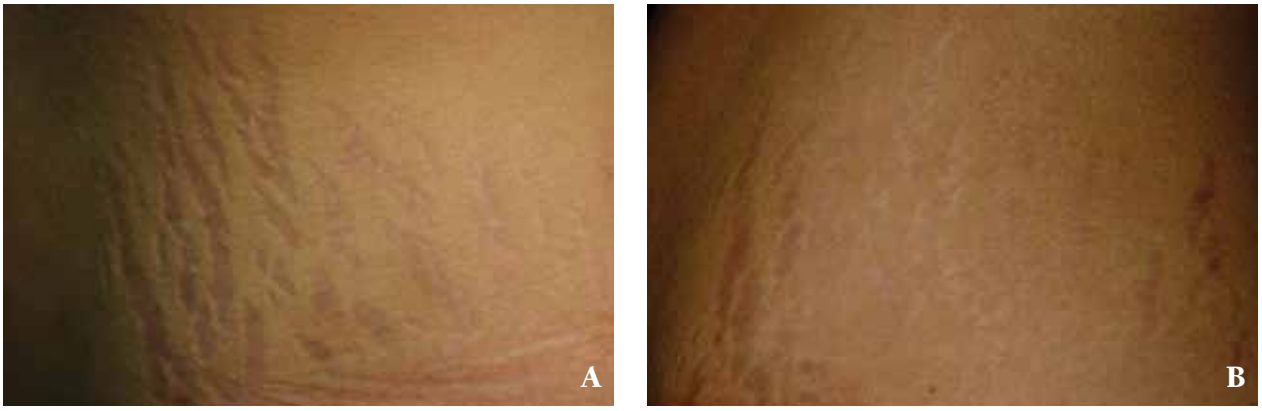

Figure 1. A 25-year-old woman with Fitzpatrick skin type III with striae distensae on the lower abdomen before (A) and one month after (B) the second of 2 treatments with fractional photothermolysis.

appropriate overlap for an overall density of approximately 2000 MTZ/cm^2. The treatment was repeated one month later.

For both patients, postoperative pain assessment was 4 to 5 on a scale of 0 to 10, where 0 represents no pain and 10 represents the worst pain. Erythema and mild edema were noted after both treatment sessions, which resolved in 1 to 2 days. Erythema and edema were then replaced by a mild bronzing and minimal peeling that lasted for 2 to 3 days. The patients returned one month after their last treatments, and photographs were taken (Figures 1B and 2B). Based on clinical photographs, an independent physician evaluator assessed a 50% improvement in the striae in case 1 and a 45% improvement in the striae in case 2. In addition, each patient was extremely satisfied with the results and reported "significant improvement." Clinical improvement continued at follow-up at 4 and 6 months.

COMMENT

Striae distensae present a real cosmetic concern for both men and women, and there are several different therapeutic modalities for their treatment, including topical tretinoin,[7,8] UV light,[12] IPL,[13] PDL,[9-11] and other nonablative lasers.[23] Our clinical experience has shown that successful treatment of striae is difficult to achieve, with no single modality working better than another. Although striae are thought to be a result of collagen disruption and breakdown during stretching of the dermis, few modalities target the atrophic plaque and irregular surface texture. Until recently, numerous treatments have focused on decreasing the erythema of striae rubrae or increasing the pigmentation of striae albae with minimal effect on collagen remodeling.

The frequent mode of treatment is laser therapy, and the 585-nm PDL has been the most common laser used to treat striae distensae.[9-11] The 585-nm PDL has been shown to decrease the erythema of striae rubrae, with minimal tissue remodeling. McDaniel et al[10] showed clinical improvement of striae using a 10-mm spot size and low fluence of 3.0 J/cm^2. Although the wavelength of the 585-nm PDL corresponds to the absorption peak of hemoglobin, their results did show improvement in

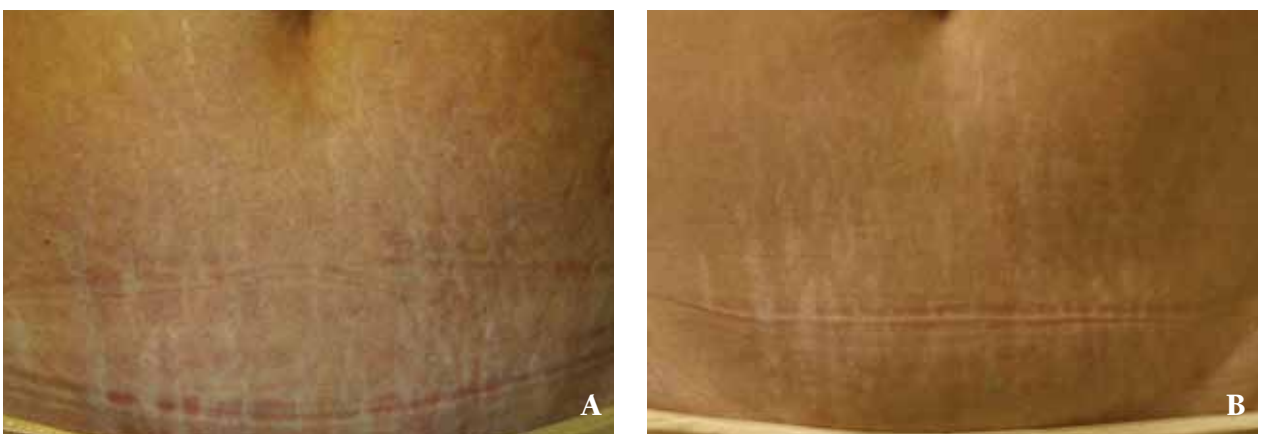

Figure 2. A 39-year-old woman with Fitzpatrick skin type III with striae distensae on the lower abdomen before (A) and one month after (B) the third of 3 treatments with fractional photothermolysis.

the surface patterns and texture of striae. Histologically, the striae regained a normal elastin content when compared with that of normal skin. A study by Jiménez et al[9] showed that the 585-nm PDL at low fluences had a beneficial effect on reducing the degree of erythema in striae rubrae with no clinical change in striae albae. In addition, the total collagen per gram of dry weight of sampled tissue slightly increased in the striae treated with the PDL versus those of controls. Thus, the nonablative heating effect of the dermis with the 585-nm PDL in the dermis did contribute to tissue remodeling. However, this laser has been reported to cause hyperpigmentation in darker skin types and is limited in this patient population.[9]

In this report, we present 2 female patients with abdominal striae distensae who were treated with fractional photothermolysis using the 1550-nm erbium-doped laser and experienced significant clinical improvement. Multiple treatment sessions were performed one month apart at 16 mJ and 125 MTZ for a total density of approximately 2000 MTZ/cm^2 for each treatment. Fractional photothermolysis has been shown to increase collagen production and tissue remodeling.[22] Histologic evidence of increased collagen III production has been shown with immunohistochemistry staining 7 days after a single fractional photothermolysis treatment.[22] We think it is this process that accounts for the significant improvement in the atrophic nature and surface texture of the abdominal striae.

Few reports of fractional laser treatments for striae distensae exist. In 2005, Fisher et al[24] presented a report of 20 patients treated with fractional resurfacing for striae. They used lower energies and higher densities than we used in our patients. The treatments at low energies and consisting of 4 or 5 treatment sessions were effective. Our cases demonstrate that, at higher fluences (16 mJ), fewer treatments may be required to achieve similar results. The deeper penetration of microthermal damage at higher energies may be the reason behind the dramatic results.

Minimal to no side effects were noted in our case reports. These included erythema and edema lasting 24 to 48 hours, followed by minimal peeling. There was no incidence of hyperpigmentation. These side effects are consistent with those reported by Fisher et al.[25] The 1550-nm wavelength of fractional photothermolysis targets water, not melanin. Thus, unlike the PDL, which carries a risk of hyperpigmentation in darker skin types, fractional photothermolysis for the treatment of striae can be used on darker skin types with the appropriate settings.

SUMMARY

Based on these case reports, fractional photothermolysis offers a new and effective modality for the treatment of striae distensae, with few side effects and little downtime. The use of higher energies, resulting in deeper penetration and more collagen induction, may require fewer treatments for adequate results. Further studies with an increased number of patients, more treatment sessions, and longer follow-up to assess optimal treatment settings and long-term results are needed. In addition, histologic and clinical correlation of treatment response should be studied. We await additional trials looking at the treatment of striae distensae with fractional photothermolysis and, perhaps, combination modalities as well.

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