

Striae distensae (stretch marks)

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INTRODUCTION — Striae distensae are a common form of dermal scarring that appear on the skin as erythematous, violaceous, or hypopigmented linear striations. Synonyms include the terms striae, stretch marks, and striae atrophicans. Striae gravidarum are striae distensae occurring secondary to pregnancy.

There are two main types of striae distensae, **striae rubra** and **striae alba**. Striae rubra are the earliest presentation of striae distensae and are characterized by an erythematous to violaceous color ([picture 1A-C](#)). Over time, striae rubra evolve into striae alba, which appear hypopigmented, atrophic, and scar-like ([picture 2A-B](#)). Common locations for striae distensae are the abdomen, breasts, medial upper arms, hips, lower back, buttocks, and thighs.

Although typically asymptomatic, striae distensae may be disfiguring and psychologically distressing to patients. Various topical and procedural modalities have been employed for the treatment of striae distensae. (See '[Treatment](#)' below and '[Prevention](#)' below.)

The clinical features, diagnosis, and management of striae distensae will be reviewed here.

EPIDEMIOLOGY AND RISK FACTORS — Epidemiologic data on striae distensae in the general population are limited [[1-11](#)]. Reported incidences have ranged from as low as 11 percent in normal men to up to 88 percent in pregnant females [[5,11](#)]. Predisposing factors include pregnancy, adolescent age, drug exposure (eg, topical or systemic corticosteroids), underlying disease (eg, Cushing's syndrome), and surgery (eg, breast augmentation) [[12,13](#)]. A more extensive list of associated conditions is provided ([table 1](#)).

Studies specifically exploring risk factors for striae distensae secondary to pregnancy (striae gravidarum) suggest that striae gravidarum occur more frequently in women with a family history of striae gravidarum, higher prepregnancy body mass index (BMI), higher weight gain during pregnancy, higher birth weight and gestational age, multiple gestation pregnancies, polyhydramnios, or a lack of chronic diseases ([picture 3A-B](#)) [[3,5,6,14,15](#)]. Increased maternal age seems to protect against striae gravidarum, suggesting counterintuitive differences in stretching ability between older and younger skin [[16](#)]. In a series of 800 primiparas examined postpartum for striae gravidarum, 84 percent of 51 women under age 20 developed striae gravidarum compared with only 24 percent of 195 women age 30 or older (odds ratio 28.25, 95% CI 11.04-72.27) [[15](#)].

The findings of a study of 299 Caucasian women suggest that the distribution of striae distensae prior to pregnancy may be an indicator of risk for the development of striae gravidarum [[14](#)]. In the study, primiparous or multiparous women who reported striae distensae on the breasts prior to their most recent term delivery were more likely to report the development of striae gravidarum than patients who did not (71 versus 29 percent). In contrast, women who reported striae distensae on the thighs prior to pregnancy were less likely to report striae gravidarum than other women (23 versus 77 percent). An elevated risk for striae gravidarum is also proposed for women born prematurely [[17](#)]. Further study is necessary to confirm these findings.

PATHOGENESIS — The pathogenesis of striae distensae is not well understood and is likely multifactorial. Physical factors resulting in increased tension on the skin, intrinsic alterations in skin structure or function, and hormonal factors may be involved.

- **Physical factors** – A role for mechanical stress on the skin is suggested by the observation that striae often develop in sites experiencing rapid increases in girth (as occurs in pregnancy), rapid weight gain, pubertal growth spurts, and exercise-induced muscle hypertrophy.
- **Altered skin structure or function** – Striae distensae do not develop in all skin sites subjected to mechanical stress or in all individuals. Therefore, specific characteristics of skin in affected areas may influence development. Reduced migration and proliferation of fibroblasts [[18](#)] reduced procollagen and fibronectin gene expression [[19](#)], marked disruption of the elastic fiber network [[20](#)], and the emergence of thin, disorganized tropoelastin-rich fibrils [[20](#)] have been detected in biopsies of affected skin.

Genetic alterations in connective tissue may contribute to striae distensae. Striae distensae are a common finding in Marfan syndrome. (See "[Genetics, clinical features, and diagnosis of Marfan syndrome and related disorders](#)".)

- **Hormonal factors** – The common occurrence of striae distensae in pregnancy and Cushing's syndrome contributes to the theory that hormonal factors influence development of the condition ([picture 1B](#)). Potentially relevant observations include:
 - Increased expression of estrogen receptors, androgen receptors, and glucocorticoid receptors are present in striae distensae [[21](#)].
 - Serum cortisol elevation leads to alterations in collagen and elastic fibers through increased protein catabolism [[22](#)]. An example of this is seen in Cushing's syndrome, where increases in corticotrophin-releasing hormone (CRH), ACTH, and subsequent increases in cortisol levels lead to generalized protein breakdown, causing skin and muscle atrophy and loss of bone. Cortisol increases free amino acids in serum by inhibiting collagen formation, decreasing amino acid uptake by muscle, and inhibiting protein synthesis [[23](#)].
 - Lower serum levels of relaxin (a hormone that can decrease collagen production and increase collagen breakdown) are detected at 36 weeks gestation in women with striae gravidarum compared with women without this finding [[24](#)]. It is proposed that the resulting reduced elasticity of connective tissue contributes to greater risk for elastic fiber disruption and striae formation [[24](#)].

CLINICAL MANIFESTATIONS — Striae distensae may initially appear as edematous striations that evolve to the red-to-purple flat or atrophic plaques known as **striae rubra** ([picture 1A-C](#)). Striae rubra eventually progress to **striae alba**, hypopigmented scar-like depressions with fine wrinkling ([picture 2A-B](#)). This progression often occurs over the course of 6 to 10 months [25]. Striae alba persist indefinitely and may become more prominent with age as skin thins and loses additional elasticity. In patients with dark skin, striae distensae may also be dark gray to black (striae nigrae) or bluish (striae caerulea) [26,27].

Striae distensae usually occur in a symmetrical distribution. The striae are typically oriented along skin tension lines and are a few millimeters to 1 centimeter in diameter. Common locations for involvement are the abdomen, breasts, thighs, and buttocks [28]. The lower back, calves, medial upper arms, and hips are additional frequent locations. Striae gravidarum tend to develop in the second and third trimester of pregnancy and commonly occur on the abdomen, breast, or thighs ([picture 3A-B](#)). Patients with Cushing's syndrome may have particularly prominent and widely distributed striae. Striae distensae secondary to topical corticosteroid use often occur in intertriginous areas.

HISTOPATHOLOGY — The histopathologic findings of striae rubra and striae alba differ. Striae rubra exhibit flattening of the epidermis with loss of rete ridges. An inflammatory infiltrate with lymphocytes and histiocytes may be present in the dermis [29]. The centers of early striae rubra may also show a reduction in normal collagen, elastin, and fibrillin content in the dermis while thick, tortuous elastic fibers reside at the periphery [30,31]. Electron microscopy may demonstrate mast cell degranulation, macrophage activation, and elastolysis in the mid-dermis [29].

Striae alba exhibit histopathology similar to that of an atrophic scar, with epidermal atrophy, loss of rete ridges, and thin dermal collagen bundles arranged parallel to the skin surface [32,33].

DIAGNOSIS — The diagnosis of striae distensae usually can be made based upon visual examination. Linear, atrophic plaques in susceptible sites (eg, abdomen, breasts, buttocks, thighs) are characteristic. Skin biopsy is usually not necessary.

The evaluation of patients with striae distensae should include questions to determine the most likely cause for striae development. We routinely inquire about common causes, including pregnancy, rapid weight gain or loss, rapid growth, bodybuilding exercise, and medications (particularly topical or systemic corticosteroids).

Patients with associated systemic signs or symptoms may require further evaluation to rule out an underlying medical condition. As examples, supraclavicular fat pads, skin atrophy, wide purplish striae, and proximal muscle weakness suggest Cushing's syndrome, and an unusual distribution of striae distensae in a tall patient with arachnodactyly and aortic abnormalities should raise suspicion for Marfan syndrome. A list of additional conditions to consider during the patient evaluation is provided ([table 1](#)). (See "[Epidemiology and clinical manifestations of Cushing's syndrome](#)" and "[Genetics, clinical features, and diagnosis of Marfan syndrome and related disorders](#)".)

DIFFERENTIAL DIAGNOSIS — Striae are usually easily recognized based upon the characteristic linear configuration and distribution, which limits the differential diagnosis. The major disorder in the differential diagnosis is linear focal elastosis, also known as elastotic striae.

Linear focal elastosis is an uncommon disorder characterized by the development of multiple raised linear bands that are usually yellowish in color and horizontally arranged on the lower back ([picture 4](#)) [34]. Biopsy may demonstrate aggregated or fragmented elastic fibers [34,35]. The etiology and pathogenesis is unclear. Linear focal elastosis may represent an excessive regenerative process of elastic fibers, ie, a keloidal repair of striae distensae [35,36].

Occasionally, **anetoderma**, a disorder that presents with well-circumscribed, atrophic-appearing, depressed, wrinkled, flaccid, or pouch-like protrusions may enter the differential diagnosis ([picture 5](#)) [37]. Anetoderma lacks the long linear atrophic bands characteristic of striae distensae. Individual areas of anetoderma are typically 1 to 2 cm in diameter. Anetoderma may occur as a primary skin disease or as a result of a preceding inflammatory process.

In pregnant women, the development of erythematous, very pruritic papules or plaques within striae (particularly on the abdomen) should raise suspicion for pruritic urticarial papules and plaques of pregnancy (PUPPP) ([picture 6](#)). (See "[Dermatoses of pregnancy](#)", section on 'Polymorphic eruption of pregnancy'.)

TREATMENT — Striae distensae are non-life-threatening and asymptomatic. Therefore, treatment is not necessary for all patients.

For patients who desire treatment, treatment can be challenging. The goal of treatment is to reduce color or texture discrepancies between striae and adjacent normal skin. No therapeutic intervention induces complete resolution.

Multiple topical and procedural therapies are used for striae distensae. However, a paucity of high-quality trials and a lack of a reliable, validated, and widely accepted tools to assess striae severity and responses to treatment have precluded definitive guidelines for the best approach to treatment.

Our approach — Our approach to treatment is influenced by the clinical findings (striae rubra versus striae alba) and patient preferences regarding the mode of treatment. Our preferred interventions are pulsed dye lasers, fractional lasers, and topical retinoids, as these are among the most studied and most successful therapies.

For patients with striae rubra, we often utilize pulsed dye lasers for initial treatment because these lasers target hemoglobin and a reduction in erythema is cosmetically beneficial. [Topical tretinoin](#) is a useful alternative; however, adherence to several months of daily application is usually required and skin irritation is common. We have had the most success with topical retinoids in adolescent patients when started soon after the development of striae. Our patients with striae alba are often managed with fractional laser therapy because this treatment may improve skin texture and hypopigmentation. Some striae rubra may also respond to fractional lasers.

Treatment results are unpredictable and vary from no improvement to significant improvement in patients treated with similar regimens. Thus, expectations for treatment outcome and potential adverse effects should be thoroughly discussed with patients prior to the initiation of treatment. In particular, patients with skin phototypes IV to VI ([table 2](#)) are at increased risk for dyspigmentation after laser treatment. Strict adherence to sun-protective measures is recommended after laser therapy to reduce risk for dyspigmentation.

In pregnant women, treatment of striae distensae is usually deferred until after delivery because of concerns regarding the effects of various therapies on the fetus. In particular, topical retinoid therapy is avoided during both pregnancy and breastfeeding. Data on the prevention of striae distensae in pregnant women is discussed separately. (See ['Prevention'](#) below.)

Pulsed dye lasers — The target chromophore of pulsed dye lasers is hemoglobin, a characteristic that is advantageous for reducing erythema in striae distensae. Pulsed dye lasers may also induce modest texture improvement, as evidenced by an increase in dermal collagen and elastin content [38]. (See ["Laser and light therapy for cutaneous vascular lesions"](#), section on ['Pulsed dye laser'](#).)

Data from uncontrolled and comparative studies suggest that treatment with a 585 nm or 595 nm pulsed dye laser can yield mild to moderate improvements in the appearance of striae distensae [38-43]. While striae rubra may be more likely to exhibit improvement after pulsed dye laser therapy than striae alba ([picture 7](#)) [39,41,43], both types of striae may improve after a series of treatments.

Pulsed dye laser therapy is usually performed every four to six weeks. Purpura lasting one to two weeks is a potential side effect. Whether pulsed dye laser doses either at high enough energy or short enough pulse durations to induce purpura are necessary to achieve improvement in striae remains to be seen. Additional potential side effects include postinflammatory hyperpigmentation, blistering, and rarely scarring. Treatment of patients with skin phototypes IV to VI ([table 2](#)) should be **avoided or performed with caution** because of risk for longstanding dyspigmentation.

Fractional lasers — Nonablative and ablative fractional lasers both may improve skin texture and dyspigmentation in striae distensae ([figure 1](#)). The efficacy of these therapies was compared in a trial in which women with post-pregnancy abdominal striae alba were given three treatments with a 1550 nm nonablative fractional laser on one randomly-selected side of the abdomen and three treatments with an ablative fractional CO₂ laser on the contralateral side [44]. Four weeks after the final treatment, photographic assessment revealed good or fair improvement in 8 of 22 sites (36 percent) treated with the nonablative fractional laser and 12 of 22 sites (55 percent) treated with the ablative fractional CO₂ laser. The difference in effect was not statistically significant. (See ["Nonablative skin resurfacing for skin rejuvenation"](#), section on ['Fractional lasers'](#) and ["Ablative laser resurfacing for skin rejuvenation"](#), section on ['Ablative fractional lasers'](#).)

In other disorders, ablative fractional laser therapy often yields more dramatic clinical effects than nonablative fractional laser therapy. Tissue remodelling resulting in increased epidermal thickness, dermal thickness, and collagen and elastin fiber deposition often occurs for months after fractional laser therapy [45-47]. A larger study with a longer follow-up period may have demonstrated a statistically significant difference between the two treatments. (See ["Ablative laser resurfacing for skin rejuvenation"](#), section on ['Ablative fractional lasers'](#).)

Downsides of ablative fractional laser therapy include a longer recovery period and greater potential for complications when compared with nonablative fractional laser therapy. However, ablative fractional laser therapy may require fewer treatments.

In general, we prefer to treat with nonablative fractional lasers to minimize risk for complications. This is particularly true when treating non-facial sites because risk for laser-induced dyspigmentation and scarring is elevated in non-facial skin. In addition, a shorter recovery period may be beneficial when treating large areas of skin.

Nonablative fractional lasers — Uncontrolled studies document modest to marked benefit in the appearance of striae distensae after nonablative fractional laser therapy ([picture 8A-B](#)). Although some degree of improvement appears to be common, very good or excellent responses seem to occur less frequently. Beneficial responses to 1540 nm, 1550 nm, and 1565 nm devices have been reported [45-52]. Treatment regimens vary.

Whether striae rubra or striae alba are more likely to respond to nonablative fractional laser resurfacing is unclear. Studies have reported responses to both types of striae distensae [47,48] as well more favorable responses in patients with striae alba [46]. In a prospective study of 22 women given two treatment sessions with a 1550 nm fractional laser for striae distensae secondary to pregnancy or weight gain, marked clinical improvement occurred in 6 patients (27 percent) one month after treatment, all of whom had striae alba [46]. Mild improvement was documented in the remaining 16 patients, all of whom presented with striae rubra. In contrast, striae rubra responded well to fractional laser therapy in a series of 10 patients given up to eight treatments with a fractionated 1550 nm fractional laser for new-onset striae distensae on the breast secondary to breast augmentation. Marked improvement in striae rubra was present in all patients four weeks after the final treatment [53].

The ideal regimen for nonablative fractional laser therapy for striae distensae is unknown. We typically administer a series of three to six once-monthly treatment sessions in an attempt to maximize efficacy. Treatment is administered in the office with topical anesthesia and forced air cooling for comfort. Energy and density settings should be reduced in patients with skin phototypes V or VI to minimize risk for postinflammatory hyperpigmentation.

Posttreatment sunburn-like erythema, edema, and rough desquamation occurs for one to two weeks after treatment on non-facial sites. Additional potential side effects include postinflammatory hyperpigmentation and prolonged erythema or edema. Dermatitis, impetigo, and purpura are rare complications [49].

Ablative fractional lasers — Studies evaluating ablative fractional laser therapy for striae distensae are limited and primarily have included patients with striae alba. In a retrospective study of 27 women with striae alba (skin phototype IV) given a single treatment with a fractional CO₂ laser system, blinded assessors of clinical photographs noted marked or near-total improvement in striae distensae in 14 patients (59 percent) two months after treatment and lesser improvement in an additional nine patients [54]. A prospective study evaluating the effects of a novel fractional CO₂ device on striae distensae and other disorders found variable results. After three to four treatments, three of five patients had no improvement, one had moderate improvement, and one had advanced improvement [55]. Combination treatment with a pulsed dye laser and an ablative fractional CO₂ laser may be more beneficial for striae alba in some patients [56].

Fractional ablative laser therapy can be performed in an office setting with local anesthesia; however, some patients require the use of systemic anxiolytics and narcotic pain medication intraoperatively. For safety, treatment density should be much lower on non-facial sites as compared with facial sites, and it should be applied over four to eight passes to avoid overlap and skip areas. The authors routinely use 5 to 15 percent total density coverage when treating patients with skin phototypes I to IV, and use a lower density range for higher energy treatments and

patients with skin phototype V or VI ([table 2](#)). While treatment with fractional ablative lasers in patients with skin phototypes IV and higher is controversial due to the risk of pigmentary alteration and permanent scarring [[57,58](#)], laser experts may be able to safely treat these patients at very low density settings. (See "[Ablative laser resurfacing for skin rejuvenation](#)", section on 'Administration'.)

A total of one to three ablative fractional laser treatment sessions usually is sufficient. Because collagen remodelling may occur for several months after each treatment, treatments are usually given at four- to six-month intervals.

On non-facial sites, recovery involves approximately one week of serosanguineous discharge and crusting followed by an additional one to two weeks of desquamation and additional one to two months of erythema. Potential complications of ablative fractional laser therapy include prolonged erythema, infection, postinflammatory hyperpigmentation, and scarring. Local wound care, close clinical follow-up, aggressive sun protection, and antimicrobial and antiviral prophylaxis (where appropriate) can help reduce the risk of complications. (See "[Ablative laser resurfacing for skin rejuvenation](#)", section on 'Adverse effects'.)

Topical retinoids — Topical retinoid therapy is an alternative to laser therapy for striae rubra. The mechanism of topical retinoid therapy may relate to the affinity of these drugs for fibroblasts and the induction of collagen synthesis [[59-61](#)].

Efficacy of [topical tretinoin](#), a retinoid, was demonstrated in a randomized vehicle-controlled trial in which 26 patients with striae rubra were randomly assigned to once-nightly application of tretinoin 0.1% cream or vehicle to affected areas for 24 weeks [[60](#)]. Of the 10 patients in the tretinoin group who completed the trial, 4 had marked improvement, 4 had improvement, and 2 had no response after six months of treatment. In the vehicle group, none of 12 patients had marked improvement, 1 had improvement, and the remainder had no improvement or worsening. Of note, the common occurrence of retinoid-induced dermatitis could have influenced blinding of the trial.

Efficacy for striae rubra is also supported by a 16-week randomized open-label study that compared tretinoin 0.05% cream to superficial dermabrasion in 32 women with striae rubra [[62](#)] and a 12-week open-label study that associated treatment with tretinoin 0.1% cream and petrolatum with reductions in striae in 26 women with striae gravidarum who began treatment soon after delivery [[61](#)]. A randomized trial that found a failure of [topical tretinoin](#) to improve abdominal striae distensae utilized a lower concentration of tretinoin (0.025% cream) and did not restrict the study population to patients with striae rubra [[63](#)].

Typically, a very thin layer of tretinoin is applied once nightly to the affected areas for several months. We typically use tretinoin 0.1% cream. If there is concern for skin irritation, we use tretinoin 0.05% emollient cream. Initial improvement may be noted within the first two months of treatment [[60,64](#)]. Retinoid dermatitis characterized by erythema and scaling is a common side effect and may lead to postinflammatory hyperpigmentation, particularly in patients with skin phototypes IV to VI ([table 2](#)). Retinoid dermatitis usually can be managed with emollients. If necessary, the frequency of retinoid application can be temporarily decreased. Use of tretinoin or other topical retinoids is **not** recommended during pregnancy.

Examples of other topical retinoids include [adapalene](#) and [tazarotene](#). It is often assumed that other topical retinoids can be useful for striae distensae [[65](#)]; however, data on efficacy are lacking.

Other interventions — Other interventions that may improve striae distensae based upon limited evidence include superficial dermabrasion, phototherapy, chemical peels, intense pulsed light, radiofrequency devices, infrared lasers, and other therapies.

Superficial dermabrasion — Striae rubra may respond to superficial dermabrasion. A randomized open-label study of 32 women with narrow, early striae rubra (≤ 6 months old) compared the efficacy of 16 weekly sessions of superficial dermabrasion to daily application of [topical tretinoin](#) 0.05% cream for 16 weeks [[62](#)]. Both treatments demonstrated significant improvement of early striae rubra from baseline, and there was no significant difference in efficacy. Superficial dermabrasion had a lower incidence of side effects. Common side effects of superficial dermabrasion include scaling, pruritus, and erythema.

Phototherapy — Phototherapy may improve hypopigmentation in striae alba. A beneficial effect of this treatment is supported by a prospective uncontrolled study in which treatment of striae alba with up to 15 sessions with an ultraviolet B (UVB) range excimer laser was associated with 76 percent or greater darkening within striae in all patients after an average of eight treatments [[66](#)]. In addition, a study in which striae alba that were treated with an excimer laser in nine patients were compared with untreated striae alba in the same patients found a mean percentage pigment correction of 68 percent in treated areas relative to untreated areas [[67](#)]. Not all studies have yielded such favorable results. An uncontrolled study of 10 patients with striae alba given up to 10 treatment sessions with an excimer laser found greater than 50 percent repigmentation in only two patients [[68](#)]. Study protocol differences may have contributed to the variation in results.

When beneficial, the effects of excimer laser therapy appear to diminish over time [[67](#)], suggesting that maintenance therapy may be necessary to maintain the response to treatment. Excimer laser therapy does not improve the atrophy and abnormal skin texture of striae distensae.

Other forms of phototherapy may be useful. In a small uncontrolled study, targeted narrowband UVB/UVA1 therapy improved hypopigmentation in striae alba [[69](#)].

Potential side effects of phototherapy include erythema, burning, and hyperpigmentation of adjacent skin. Adverse effects of UVB phototherapy are reviewed in greater detail separately. (See "[UVB therapy \(broadband and narrowband\)](#)", section on 'Short- and long-term adverse effects'.)

Chemical peels — Superficial chemical peels may improve striae distensae by increasing collagen synthesis [[70-72](#)]. A prospective, non-randomized study ($n = 40$) that compared the effect of six once-monthly 70% glycolic acid chemical peels on striae distensae on the left thigh to placebo on the right thigh showed a significant decrease in furrow width and hemoglobin levels by spectrophotometry in those with striae rubrae [[73](#)]. Participants with striae alba also demonstrated a similar decrease in furrow width as well as an increase in melanin levels by spectrophotometry. No significant differences in these parameters were demonstrated in the placebo-treated areas.

Potential side effects of superficial chemical peels include, erythema, scaling, and postinflammatory hyperpigmentation. Caution should be taken when applying high concentrations of glycolic acid or other chemical peels, especially in patients with skin phototypes IV to VI ([table 2](#)) because of the risk for postinflammatory pigmentary alteration.

Intense pulsed light — Intense pulsed light (IPL) may be an alternative to pulsed dye laser therapy for striae rubra. A comparative study in which 20 patients with striae rubra (16 patients) or striae alba (4 patients) received five sessions of pulsed dye laser therapy on one side of the body and IPL therapy on the contralateral side found clinical improvement in striae width and skin texture with both treatments [39]. In comparison to striae alba, striae rubra demonstrated better clinical responses to both therapies. Histologic evaluation of striae revealed increases in collagen after both therapies. However, a statistically significant increase in collagen I expression was detected with pulsed dye laser therapy, but not IPL therapy. (See "[Nonablative skin resurfacing for skin rejuvenation](#)", section on '[Intense pulsed light](#)'.)

Although the response of striae alba to IPL was less than the response of striae rubra in the comparative study, striae alba seem to respond to IPL treatment [39]. An uncontrolled study of 15 women with striae alba also found benefit [74]. After five IPL treatments, all of the women demonstrated clinical and microscopic improvement.

Potential side effects of intense pulsed light include erythema, blistering, dyspigmentation, and scarring.

Radiofrequency devices — Noninvasive radiofrequency devices have been used alone or in combination with other modalities to induce dermal remodeling and subtle tightening of the skin, leading to improvement in striae distensae [75-81]. As monotherapy, clinical efficacy is modest overall and the durability of effect is unclear. (See "[Nonablative skin resurfacing for skin rejuvenation](#)", section on '[Radiofrequency](#)'.)

Radiofrequency devices have been combined with other therapies in attempts to augment the response to treatment. In small uncontrolled studies, combined use of radiofrequency devices with pulsed dye laser treatment [77] or autologous platelet-rich plasma [79,80] has been reported to be of benefit. In a prospective study of 30 patients with striae distensae, combination therapy with a fractionated microneedle radiofrequency device and fractional CO₂ laser demonstrated a trend towards greater improvement compared with improvement from either treatment as monotherapy [81]. Radiofrequency energy combined with a pulsed magnetic field appeared to improve striae distensae in an uncontrolled study with 16 patients [78].

Radiofrequency devices do not induce epidermal injury and treatment is generally well tolerated.

Infrared lasers — The 1064 nm neodymium-doped yttrium aluminium garnet (Nd:YAG) laser can be used to target vascular structures and also may induce modest dermal collagen remodelling [82,83], features that may be useful for the treatment of striae rubra. An uncontrolled study in which 20 adults with striae rubra were given an average of 3.45 treatments with a 1064 nm long-pulsed Nd:YAG laser found excellent (>70 percent) improvement in the appearance of striae rubra in 8 patients and good (30 to 70 percent) improvement in an additional 8 patients [25]. Treatment was well tolerated, complicated only by mild transient erythema and edema. (See "[Nonablative skin resurfacing for skin rejuvenation](#)", section on '[Infrared lasers and light devices](#)'.)

Treatment with other nonablative infrared lasers has been attempted, such as the 1320 nm Nd:YAG and 1450 nm diode lasers. However, these devices yielded poor clinical outcomes and an unacceptably high incidence of postinflammatory pigmentation [84].

Other — Limited data suggest that regimens incorporating 20% glycolic acid [70], topical silicone or non-silicone gels applied with massage [85], sand abrasion and [trichloroacetic acid](#) [71], succinylated atelocollagen [86], or a product containing onion extract and *Centella asiatica* [87] may be beneficial for the treatment of striae distensae. Further study is necessary to clarify the role of these treatments. Our clinical experience suggests that the 532 nm potassium titanyl phosphate (KTP) laser may also be of benefit for the treatment of striae rubra.

PREVENTION — Interventions for the prevention of striae distensae are usually discussed in the context of pregnancy given the common and expected occurrence of striae distensae in pregnant women. Although many women use a wide variety of creams, lotions, and ointments in attempts to reduce risk for striae development, strong evidence to confirm efficacy of any of these interventions is lacking [88,89].

A 2012 systematic review of randomized trials that included trials assessing olive oil; cocoa butter; a product containing [hyaluronic acid](#), vitamins A and E, allantoin, and calcium pantothenate; a product containing *Centella asiatica* extract, alpha tocopherol, and collagen-elastin hydrolysates; and a product containing vitamin E, essential free fatty acids, panthenol, hyaluronic acid, elastin, and menthol found no high-quality evidence to support the use of these topical preparations to prevent striae distensae during pregnancy [88]. In addition, a subsequent randomized trial (n = 360) comparing use of olive oil or a cream containing [lanolin](#), stearin, triethanolamine, almond oil, and bivox [glycerin](#) amidine to no treatment found that neither intervention was effective for prevention [90].

Many "belly band" garments to support the abdomen are marketed to pregnant women. However, there are no published studies demonstrating whether peripartum or postpartum use is effective in preventing or treating striae distensae.

Topical retinoids may be beneficial for the treatment of early striae distensae, but due to fetal safety concerns, should not be used for prevention or treatment during pregnancy. (See '[Topical retinoids](#)' above.)

SUMMARY AND RECOMMENDATIONS

- Striae distensae (stretch marks) are a common form of dermal scarring that usually appear as linear erythematous, violaceous, or hypopigmented striations. Predisposing factors include pregnancy, adolescence, drug exposure (eg, topical or systemic corticosteroids), underlying disease (eg, Cushing's syndrome or Marfan syndrome), and surgery (eg, breast augmentation). (See '[Epidemiology and risk factors](#)' above.)
- The pathogenesis of striae distensae is not well understood. Mechanical forces on the skin, intrinsic alterations in skin structure or function, and hormonal factors may play a role. (See '[Pathogenesis](#)' above.)
- The two main clinical presentations of striae distensae are striae rubra and striae alba. Striae rubra precede striae alba and are characterized by an erythematous to violaceous color. Striae rubra eventually evolve into the hypopigmented, scar-like, and atrophic plaques known as striae alba. Common sites for striae distensae are the abdomen, breasts, medial upper arms, hips, lower back, buttocks, and thighs. (See '[Clinical manifestations](#)' above.)

- The diagnosis of striae distensae can usually be made easily during the physical examination. A biopsy usually is not necessary. The major disorder in the differential diagnosis is linear focal elastosis. (See ['Diagnosis'](#) above and ['Differential diagnosis'](#) above.)
- Treatment of striae distensae is optional. A paucity of high-quality trials has led to uncertainty about the best approach to therapy. (See ['Treatment'](#) above.)
- For patients with striae rubra who desire treatment, we suggest pulsed dye laser therapy as an initial treatment ([Grade 2C](#)). Topical retinoid therapy is an alternative mode of treatment. (See ['Pulsed dye lasers'](#) above and ['Topical retinoids'](#) above.)
- For patients with striae alba, we suggest fractional laser therapy as initial treatment ([Grade 2C](#)). Treatment options include nonablative and ablative fractional lasers. Nonablative fractional lasers are often preferred over ablative fractional lasers due to lower risk of complications and shorter recovery times. However, nonablative fractional laser therapy may require more treatments.

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GRAPHICS

Striae distensae (stretch marks)



Erythematous linear plaques on the abdomen consistent with the striae rubra form of striae distensae.

Graphic 101441 Version 1.0

Striae in Cushing's disease



Lower abdominal and thigh striae in a female patient with Cushing's syndrome.

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Graphic 67682 Version 4.0

Striae distensae (stretch marks)

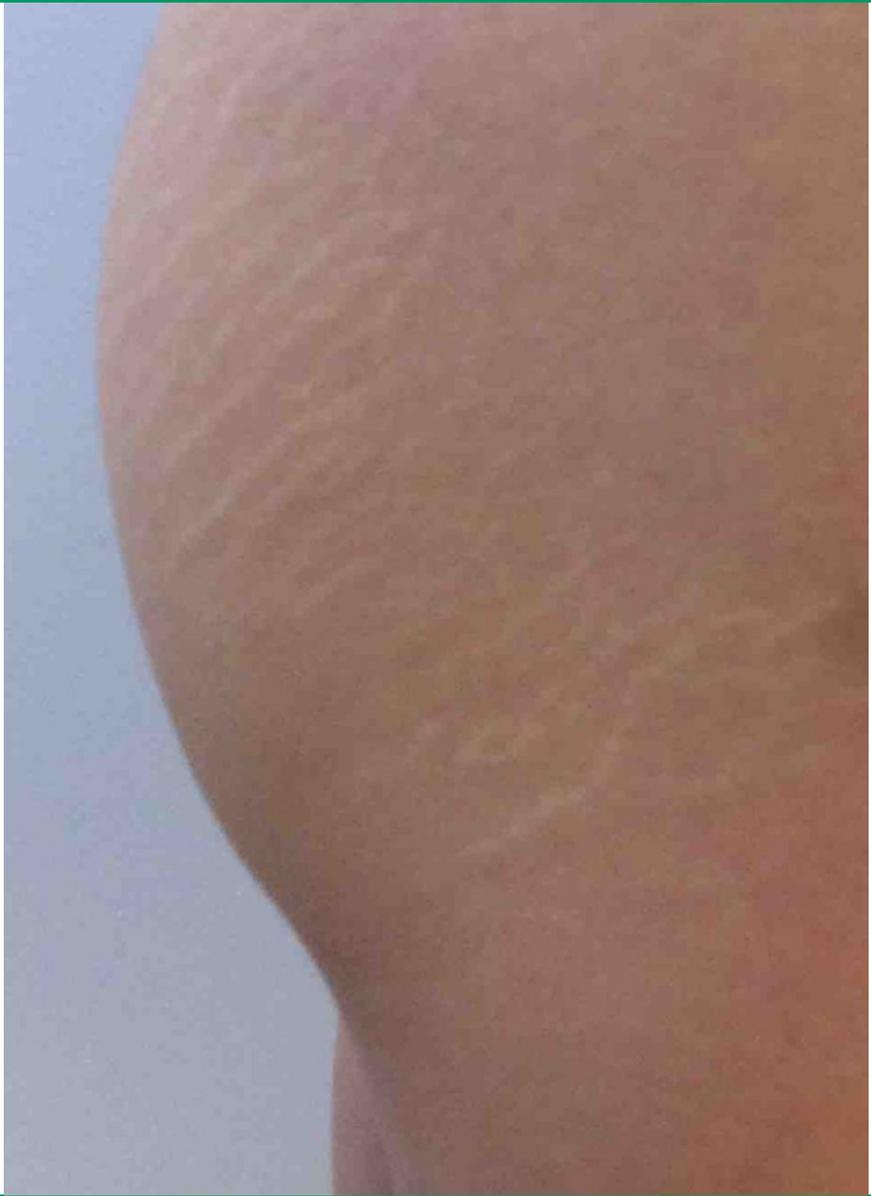


Erythematous, linear, atrophic plaques on the thigh.

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Graphic 101442 Version 1.0

Striae distensae (stretch marks)



Hypopigmented, linear, atrophic plaques on the buttocks.

Graphic 101443 Version 1.0

Striae distensae (stretch marks)



Multiple hypopigmented, linear, atrophic plaques on the shoulder and upper arm.

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Conditions associated with striae distensae

General
Family history (genetic)
Obesity
Sudden weight gain or loss
Bodybuilding exercise
Smoking
Adolescents during or after growth spurt
Medical conditions
Marfan syndrome
Cushing's syndrome
Anorexia nervosa
Typhoid fever
Rheumatic fever
Chronic liver disease
Medications
Systemic and topical corticosteroids
Human immunodeficiency virus (HIV) therapy
Chemotherapy
Tuberculosis therapy
Contraceptives
Neuroleptics
Surgery
Breast augmentation
Tissue expanders
Tension-requiring skin sutures
Organ transplantation
Cardiac surgery
Pregnancy
Family history
Younger age
Higher birthweight
Increased gestational age
Weight gained
Pre-pregnancy body mass index (BMI)
Lack of chronic diseases
Polyhydramnios
Pre-pregnancy presence of breast striae (but not thigh striae)

Prepared with information from the following sources:

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Striae distensae (stretch marks)



Striae distensae on the abdomen after pregnancy.

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Striae distensae (stretch marks)



Post-pregnancy striae distensae on the abdomen.

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Linear focal elastosis



Linear, yellowish plaques horizontally arranged on the lower back.

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Graphic 101454 Version 1.0

Anetoderma



Multiple circumscribed, wrinkled lesions are present on the chest.

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Graphic 67581 Version 3.0

Pruritic urticarial papules and plaques of pregnancy (PUPPP)

Erythematous plaques in the distribution of striae are present. Note the sparing of the periumbilical skin.

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Graphic 81605 Version 5.0

Fitzpatrick skin phototypes

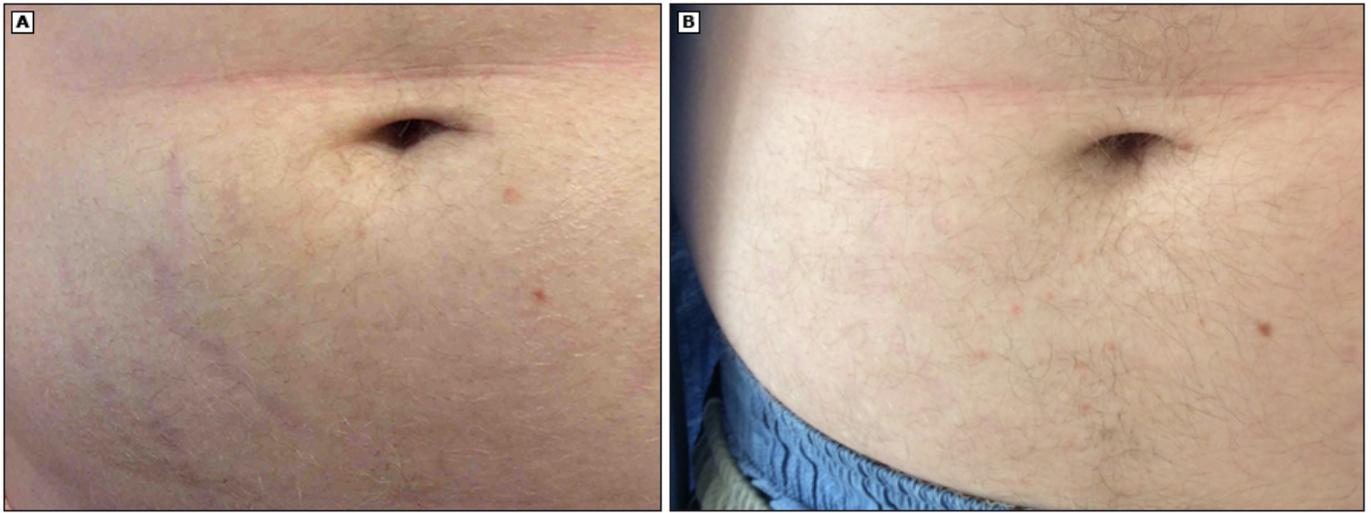
Skin type	Unexposed skin color	Reaction to sun exposure*
I	White	Always burns, never tans
II	White	Always burns, minimal tan
III	White to olive	Burns minimally, gradually tans
IV	Light brown	Burns minimally, tans well
V	Brown	Very rarely burns, tans profusely
VI	Dark brown to black	Never burns, tans deeply

Note: Slight variations on the definitions of the phototypes appear in the literature.

* After the first one hour of sun exposure on untanned skin on the first day of spring.

Graphic 60541 Version 4.0

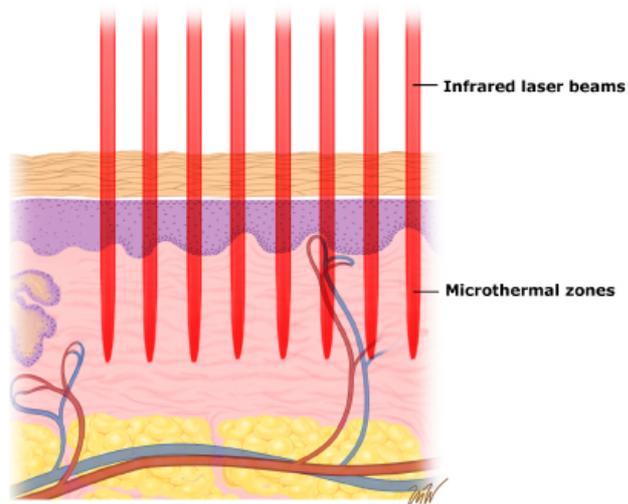
Treatment of striae distensae with a 595 nm pulsed dye laser



Striae distensae before (A) and after (B) pulsed dye laser treatment.

Graphic 101447 Version 1.0

Fractionated photothermolysis



Fractional photothermolysis involves the delivery of narrow columns of infrared light to the target tissue. In skin, this leads to microscopic columns of thermally damaged tissue (microthermal zones).

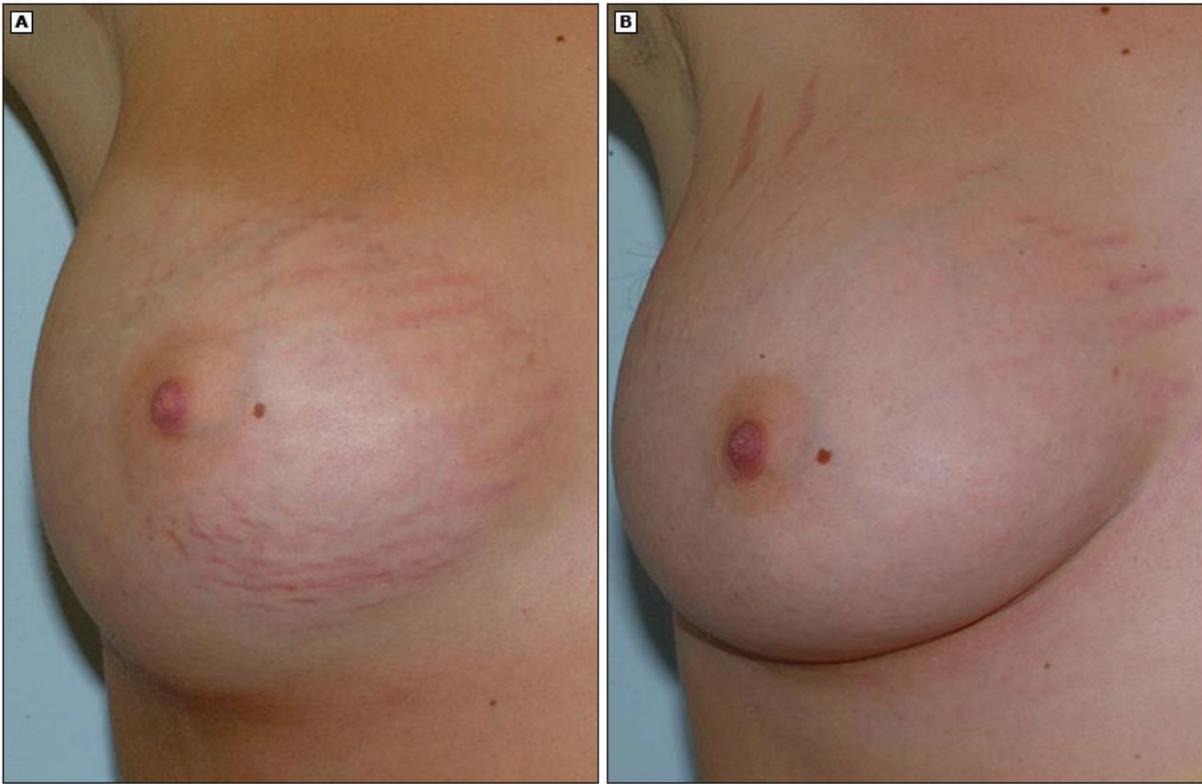
Graphic 53757 Version 3.0

Treatment of striae distensae with a nonablative fractional laser



Striae distensae before (A) and after (B) nonablative fractional resurfacing.

Graphic 101448 Version 1.0

Treatment of striae distensae with a nonablative fractional laser

Striae alba before (A) and after (B) nonablative fractional resurfacing. Note the advancing striae at the edge of the treated area (B).

Courtesy of Nuno Osório, MD.

Graphic 101449 Version 1.0