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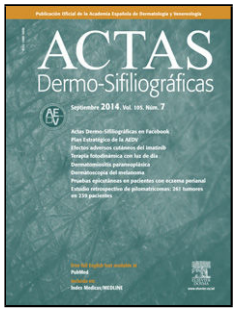

Stretch marks: systematic review of its therapeutic approach

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Stretch marks: systematic review of its therapeutic approach

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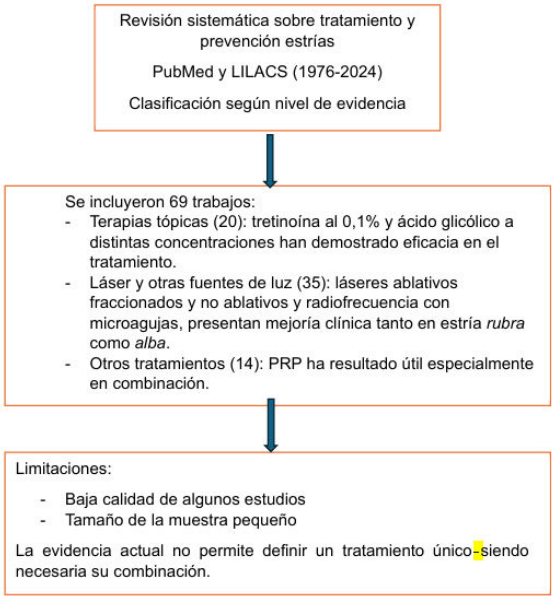
Graphical abstract



Abstract

Introduction. Stretch marks are common lesions that affect areas under stress, especially common in pregnant women and adolescents. Despite its prevalence, its treatment and prevention are a challenge in Dermatology.

Material and Methods. Systematic review of the literature published in PubMed and LILACS (1976-2024). The articles were classified according to their scientific evidence (level 1, randomized controlled studies; level 5, clinical cases).

Results. A total of 69 articles were evaluated: 20 on topical treatments, 35 on lasers and energy devices, and 14 on other therapies. Tretinoin at 0.1% and glycolic acid at different concentrations demonstrated clinical improvement, especially in recent stretch marks. Ablative and non-ablative lasers and

radiofrequency with microneedles presented good results. Other treatments, such as PRP, are useful in combination.
Conclusions. Current evidence does not allow defining a single treatment; some works are of low quality and with small samples. The combination of treatments helps to improve results.

Keywords:
Stretch Marks; Topics; Laser; PRP; Tretinoin; Radiofrequency

Introduction

Stretch marks are common cutaneous lesions associated with mechanical, hormonal, and genetic factors[1,2]. They present as red stretch marks (striae rubra) in early stages and white stretch marks (striae alba) in later stages. These lesions affect areas exposed to tension, such as the abdomen, thighs, and breasts, and are more prevalent in pregnant women, adolescents, and individuals with higher phototypes[3].

From a histologic standpoint, striae rubra demonstrate inflammation, collagen fiber thickening, and reduced elastic fibers[4,5], whereas striae alba show dermal atrophy and rupture with decreased vascularization.

Despite their high prevalence, their treatment and prevention remain a therapeutic challenge in Dermatology.

This study is based on the hypothesis that *at least one scientifically supported, effective therapeutic option may currently be identified for the treatment of striae*.

The endpoints of this study are:

1. To evaluate and synthesize the available evidence on the various therapeutic modalities used in the management of cutaneous striae.
2. To determine whether one or several options could be positioned as first-line therapy.
3. To provide a practical clinical guide and identify potential areas for future research.

Materials and Methods

We conducted a systematic review of the literature published in PubMed from January 1976 through February 2024 and LILACS from January 1986 through February 2024 was performed on the treatment and prevention of striae.

Search terms were selected according to MeSH and DeCS vocabularies and included: *"striae," "striae distensae," "stretch marks," "striae gravidarum," "striae rubrae," "striae albae,"* and *"treatment."*

Studies included clinical trials, cohort studies, controlled studies, and isolated case reports. Exclusion criteria were articles not published in English or Spanish, animal or in vitro studies, letters to the editor, narrative or systematic reviews, meta-analyses, and duplicate publications.

Each included study was assigned a level of evidence according to its scientific quality: Level 1 for randomized controlled trials, level 2 for randomized comparative studies, level 3 for nonrandomized comparative studies, level 4 for case series, and level 5 for isolated case reports.

Results

Included and excluded studies

A total of 364 records were identified in PubMed and 36 in LILACS. After screening titles and abstracts, a total of 325 articles were excluded for not meeting inclusion criteria. The full text of 69 articles was reviewed and categorized by therapeutic approach: (A) topical treatments (20 articles), (B) lasers and light-based therapy (35 articles), and
(C) other therapies (14 articles).

A) Results of Topical Treatments

1) Tretinoin (Table 1)

A vitamin A derivative, tretinoin promotes neoangiogenesis, collagen formation, and cellular differentiation. Most studies used a concentration of 0.1%. All reported significant clinical improvement except at 0.025%. A 12-week regimen was generally required to achieve results. Adverse effects were mild and rare, including local irritation and desquamation.

Of note, the study by Gamil[6] compared daily 0.05% tretinoin for 3 months with monthly platelet-rich plasma (PRP) injections. Greater improvement was observed in red vs white striae, with superior results and higher patient satisfaction in the PRP group.

2) Glycolic acid (Table 2)

An alpha-hydroxy acid involved in cellular repair, glycolic acid accelerates collagen regeneration through fibroblast stimulation and cytokine release by keratinocytes.

Two major studies are noteworthy. Mazzarello et al.[7] compared glycolic acid 70% monthly for 6 months vs placebo in 40 patients with red and white striae. Clinical improvement was reported in texture and erythema, along with increased melanin detected by spectrophotometry. Ash et al.[8] compared glycolic acid 20% + tretinoin 0.05% vs a combination of glycolic acid 20%, L-ascorbic acid 10%, zinc sulfate 2%, and tyrosine 0.5% in 10 women with white striae, without significant differences across groups.

3) Cocoa Butter and Olive Oil:

Cocoa butter has emollient properties, as does olive oil, which is rich in vitamin E.

Studies[9–13] evaluated their usefulness in preventing striae in pregnant women vs placebo or other emollient creams. No significant differences were observed in any study.

4) Silicone Gel and Other Topical Agents:

Summarized in Table 3.

B) Results of Laser-Based Treatments

1) CO_2 Laser (Table 4)

Used in fractional mode, CO_2 lasers—due to their high affinity for water—create microscopic ablative and coagulative columns (*microthermal zones, MTZ*), with preserved tissue in between, promoting new collagen and elastin formation.

Most studies reported that fractional CO_2 laser improved dermal collagen regeneration, increased skin thickness, and enhanced clinical appearance. Adverse effects were mild and expected: post-inflammatory hyperpigmentation, erythema, and crusting.

Comparisons between fractional CO_2 and microneedling radiofrequency (MRF)—an energy-based device causing deep dermal thermal injury and growth factor release[14–16]—or microneedling alone[17,18]—showed variable results. MRF demonstrated clinically satisfactory outcomes, and in some studies, was superior to CO_2[16].

One study[19] compared fractional CO_2 laser with carboxytherapy (subcutaneous CO_2 infusion inducing stretching and low-grade inflammation) in 40 women with abdominal striae. Both treatments produced improvement, with no significant differences in efficacy or adverse events.

2) Nonablative Fractional Lasers (NAFL) (Table 5):

Due to lower water affinity, NAFL do not ablate epidermal layers. Tissue remodeling occurs by deep dermal heating, stimulating collagen and elastin regeneration without crust formation. NAFL are classified by wavelength (1450, 1540, 1550, 1064, 2940 nm), which determines penetration depth.

Five studies evaluated 1550- and 1565-nm Er:Glass lasers[20–24], 3 evaluated 1540-nm and 1450-nm diode lasers[25–27], 2 evaluated 2940-nm Er:YAG[28,29], and 1 evaluated 1064-nm Nd:YAG[30]. Although results varied, most reported partial improvement. One study[27] using diode lasers at different energies found no benefit vs control. Adverse effects were mild, with post-inflammatory hyperpigmentation—particularly in darker skin types—being the most common.

3) Vascular Lasers (Table 6)

Several studies evaluated pulsed dye laser (PDL), long-pulse 1064-nm Nd:YAG, or intense pulsed light (IPL), targeting hemoglobin due to their wavelengths.

Two studies assessed PDL. The first[31] showed modest improvement in red striae and no change in white striae. The second[32] demonstrated improvement in white striae (red striae not included), with better outcomes using larger spot sizes and higher energies (10 mm, 3 J).

Shokeir et al.[33] compared the outcomes of PDL vs IPL (565 nm). Although PDL showed slightly greater improvement, both light sources demonstrated clinically significant improvement in striae width, with greater effects in more recent (red) and smaller striae. Al Dhalimi et al.[34] compared 2 different IPL wavelengths (650 nm and 590 nm) for the management of striae rubra. Lower fluences were used at 590 nm (up to 14.5 J with 590 nm and up to 15.5 J with 650 nm) to avoid adverse effects. They achieved greater improvement with 590 nm, although with a higher rate of adverse events (erythema, pain, and post-inflammatory hyperpigmentation), since melanin acts as a competing chromophore for light devices with affinity for hemoglobin. Finally, Alexiades-Armenakas et al.[35] studied the 308-nm excimer lamp for the treatment of striae alba, demonstrating improvement vs the untreated side using colorimetric analysis. These favorable results progressively approached those of the control group during 6-month follow-up, suggesting that maintenance treatment would be necessary.

C) Other Treatments (Table 7):

1) Platelet-rich plasma (PRP)**,** which contains a high concentration of growth factors and cytokines, has also been used for this indication, generally in combination with other techniques.

Ibrahim et al.[36] used local PRP injections, microdermabrasion with aluminum oxide crystals (a resurfacing technique that theoretically improves the dermal matrix and promotes re-epithelialization), and the combination of both. They observed better results with both techniques than with 1 technique only.

Hodeib et al.[37] and Ahmed et al.[38] compared PRP with carboxytherapy, and PRP with carboxytherapy plus tripolar RF, respectively. In both studies, all groups improved, without significant differences across treatments. In Ahmed et al., PRP was more effective in striae rubra.

2) Subcision, a minimally invasive technique in which a cannula or blunt needle is introduced beneath the skin to break fibrous tracts that create surface depressions, was used alone or vs 0.1% tretinoin, or in combination with it, in the study by Luis-Montoya et al.[39]. No significant differences in efficacy were found across the 3 groups. However, subcision produced more adverse effects, including cutaneous necrosis in 3 patients.

3) One study employed combined UVB (296–315 nm) and UVA1 (360–370 nm)[40] for up to 10 sessions to repigment striae alba. More than half of patients achieved repigmentation, with hyperpigmentation as the most frequent adverse effect.

4) Finally, cold atmospheric plasma therapy involves applying an ionized gas directly to the skin. This plasma produces a combination of reactive oxygen and nitrogen species, along with electrons, ions, and free radicals, promoting collagen and elastin synthesis, improving blood circulation, and accelerating wound healing. Only 1 study with 23 participants applied it to striae[41], showing improvement in all evaluated scales from the first session, with mild adverse effects.

Discussion

In developing this work, it became evident that the scientific literature on the treatment of stretch marks is limited, as are the sample sizes and the strength of the conclusions that can be drawn from the highly variable results reported. The multitude of available options, with diverse mechanisms of action (collagen stimulation, increased skin elasticity, enhanced cellular proliferation, anti-inflammatory effects, emollient capacity, etc.), makes it difficult to recommend a single treatment.

Among topical therapies, tretinoin 0.1% and glycolic acid—both as 70% peeling and 20% daily application—stand out, as both have demonstrated improvement in the clinical appearance of striae. In studies comparing striae rubra and alba, more favorable responses were consistently seen in striae rubra, likely due to their more recent onset. Early interventions may minimize the structural epidermal and dermal changes that lead to persistent lesions. Nevertheless, in some studies, it is unclear how much of the benefit is due to massage during application rather than the topical agent *per se*.

Ablative and non-ablative lasers and MRF have demonstrated usefulness in treating all types of striae. Lasers or light sources targeting hemoglobin make more sense for striae rubra; however, studies evaluating both types of striae also demonstrated improvement in striae alba. Histologically, these devices increase dermal collagen and elastic fibers, helping regenerate the cutaneous surface.

Regarding PRP and similar techniques that stimulate cellular regeneration and collagen synthesis through growth factor release, their role continues to expand, particularly in combination therapies.

This review included several studies on combination treatments, including CO_2 + MRF[15,47]; CO_2 + PRP[57]; RF + PDL[66]; infrared light + RF[70]; RF + tretinoin[72]; subcision + tretinoin[39]; microneedling RF + 5-FU[73]; and microdermabrasion + PRP[36]. In most cases, combinations yielded better results than monotherapies.

Other reported combinations—such as fractional lasers with vascular lasers (eg, CO_2 + PDL[42] or IPL + erbium[43])—have also shown good outcomes, though they were not included here due to study selection criteria.

Based on level of evidence, the 3 treatments that may be considered most clinically relevant are fractional CO_2 laser, 0.1% tretinoin (especially for recent striae), and microneedling RF.

Overall, when treating a patient with stretch mark—and considering the findings of this review—the most reasonable approach is combination therapy (Figure 1). This must be done considering that, in striae rubra, treatments aimed at reducing pigmentation and erythema should be prioritized, in contrast with the recommendation of therapies with repigmenting potential that may be beneficial in striae alba. In addition, the potential adverse effects associated with certain treatments should be taken into consideration (notably the risk of post-inflammatory hyperpigmentation, which is more common in individuals with higher phototypes).

This study has the strength of its methodology and its broadened inclusion criteria, designed to synthesize clinically relevant information as comprehensively as possible. As relative limitations, we would include the fact that only the LILACS and PubMed databases were searched, as well as the suboptimal quality of most eligible studies, which generally included a small number of patients (with a mean of 39.84 subjects).

Conclusions

1. Multiple treatments exist for the management and prevention of stretch marks, with variable results. Tretinoin 0.1% has demonstrated benefit in most studies. Cocoa-butter and olive-oil creams have not proven effective in preventing striae. Fractional ablative and non-ablative lasers and MRF have shown benefit via dermal collagen remodeling. Vascular lasers have greater evidence in striae rubra.
2. Many analyzed studies are low quality, with small sample sizes, and comparative trials are scarce; therefore, a single first-line therapy cannot be recommended.
3. Current literature does not offer clear or unified treatment guidance; however, combination therapy appears reasonable to maximize effectiveness and minimize adverse effects.

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Figure 1. Proposed Treatment Algorithm.

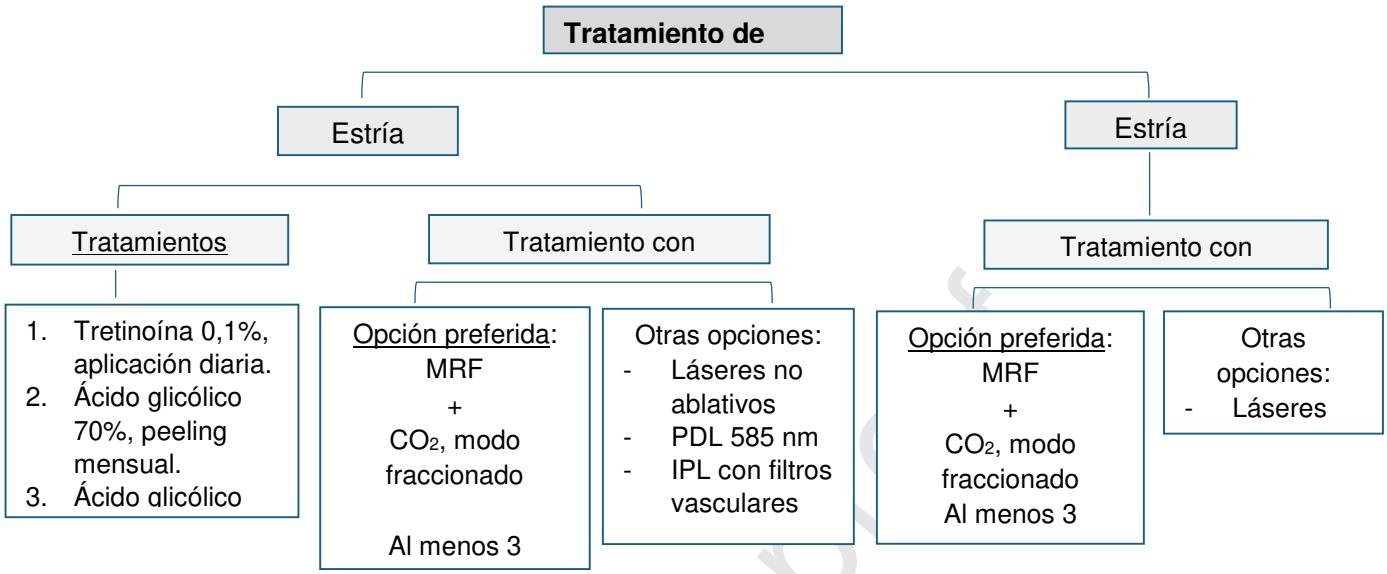

Table 1. Summary of Studies on the Treatment of Striae with Tretinoin

Authors	Treatment	Dose	Type of Striae	Location	N	Sex	Outcome	Adverse Effects	Study Type	Level of Evidence
Gamil HD et al.[6]	Platelet-rich plasma vs Tretinoin 0.05%	PRP every 3 months and daily tretinoin	Rubra and alba	N/S	30	F/M	Significant improvement in both groups. Tretinoin better for striae rubra.	Mild pain and bruising with PRP.	Randomized comparative	2
Asawaworarit P et al.[42]	Herbal extract cream vs Tretinoin 0.1%	Daily for 16 weeks	Alba	Hips	48	F/M	Significant improvement in both groups; no differences.	Irritant contact dermatitis in 4.55% (herbal cream) vs 72.3% (tretinoin).	Randomized comparative	2
Kang S et al.[43]	Tretinoin 0.1% vs Placebo	Daily for 6 months	Rubra	Multiple	22	F/M	Significant improvement in tretinoin group. No histologic differences.	N/R	Randomized comparative	2
Rangel O et al.[44]	Tretinoin 0.1% vs Placebo	Daily for 3 months	N/S	Abdomen	20	Pregnant F	Clinical improvement in tretinoin group	Erythema and scaling	Non-randomized comparative	3
Pribanich S et al.[45]	Tretinoin 0.025% vs Placebo	Daily for 7 months	N/S	Abdomen	11	Pregnant F	No differences	N/R	Randomized comparative	2
Elson ML et al.[46]	Tretinoin 0.1%	Daily for 12 weeks	N/S	Multiple	20	F/M	Clinical improvement	N/R	Case series	4
Listiawan MY et al.[47]	Tretinoin 0.1% vs Fractional RF microneedling + Fractional CO_2 laser	Daily tretinoin for 12 weeks; 3 laser sessions 4 weeks apart	Alba	Abdomen	22	F	No difference in length in either group. Significant improvement in width in laser group. Significant collagen increase in both groups.	Post-inflammatory hyperpigmentation in laser group; irritation in one tretinoin patient	Non-randomized comparative	3
Hexel D et al.[48]	Tretinoin 0.05% vs Dermabrasion	Weekly dermabrasion and daily tretinoin for 16 weeks	Rubra	Multiple	32	F	Significant improvement; no differences between groups	Pruritus, erythema, burning; no differences between groups	Randomized comparative	2

N, number of participants; F, female; M, male; N/R, not reported; N/S, not specified; PRP, platelet-rich plasma; RF, radiofrequency. Note: References outside the range [1–41] are included as supplementary data.

Table 2. Summary of Studies on the Treatment of Striae with Glycolic Acid, Cocoa Butter, and Olive Oil

Authors	Treatment	Dose	Type of Striae	Location	N	Sex	Outcome	Adverse Effects	Study Type	Level of Evidence
Mazzarello V et al.[7]	70% glycolic acid peel vs placebo	Once monthly for 6 months	Rubra and alba	Hips	40	F/M	Significant improvement in texture and erythema. No differences in control group.	N/R	Randomized controlled	2
Ash K et al.[8]	20% glycolic acid + 0.05% tretinoin vs 20% glycolic acid + 10% L-ascorbic acid, 2% zinc sulfate, and 0.5% tyrosine	Daily for 12 weeks	Alba	Multiple	10	F	Improvement in both treatment arms, no differences between groups. Greater elastin increase in tretinoin group.	Irritant dermatitis in 1 patient per group	Randomized controlled	2
Ud Din S et al.[49]	Silicone gel vs placebo	Daily for 6 weeks	N/S	Abdomen	20	F	Significant improvement with silicone gel; vascularization decreased significantly with placebo	N/R	Randomized controlled	1
Bodgan C et al.[50]	Punica granatum and Croton lechleri cream	Daily for 6 weeks	Alba	Hips	20	F	Improvement in both groups	N/R	Non-randomized comparative	3
García-Hernández JA et al.[51]	Hydroxyprolisilane C cream, rosehip oil, Centella asiatica triterpenes, and vitamin E vs placebo	At least twice daily until 1 month postpartum	N/S	Multiple	183	Pregnant women	Lower incidence and severity in treatment group	Erythema, xerosis, pruritus	Randomized controlled	1
Hajhashemi M et al.[52]	Aloe vera vs almond-oil cream vs emollient cream vs placebo	Twice daily from week 16 through delivery	N/S	Multiple	160	Pregnant women	Improvement in treatment group	N/R	Randomized controlled	1
Draelos ZD et al.[53]	Cream with onion extract, Centella asiatica, and hyaluronic acid vs placebo	Twice daily for 12 weeks	Rubra	Hips	—	F	Significant improvement in treatment group	N/R	Non-randomized controlled	3

N, number of participants; F, female; M, male; N/R, not reported; N/S, not specified. Note: References outside the range [1–41] are included as supplementary data.

Table 3. Summary of Studies on the Treatment of Striae with Silicone Gels and Other Topical Therapies

Authors	Treatment	Dose	Type of Striae	Location	N	Sex	Outcome	Adverse Effects	Study Type	Level of Evidence
Sobhi MR et al.[14]	Fractional CO_2 vs MRF	5 sessions, 4 weeks apart, 2 passes/session	N/S	Multiple	17	F	No significant differences	Post-inflammatory hyperpigmentation with CO_2	Non-randomized comparative	3
Seong GH et al.[15]	Fractional CO_2 vs CO_2 + MRF vs MRF	3 sessions, 4 weeks apart, 1 pass/session	N/S	Abdomen	19	F (phototypes III–IV)	Significant improvement in the combined group	Hyperpigmentation and pruritus in combined and CO_2 groups	Randomized comparative	2
Khater MH et al.[16]	Fractional CO_2 vs MRF	3 sessions, 4 weeks apart	Rubra and alba	Abdomen and thighs	20	F (phototypes III–IV)	Clinical improvement; increased collagen, elastic fibers, and epidermal thickness in 90% with microneedling vs 50% with CO_2	Post-inflammatory hyperpigmentation in CO_2 group	Non-randomized comparative	3
Soliman M et al.[17]	Fractional CO_2 vs microneedling (dermaroller)	3 sessions, 4 weeks apart	N/S	Multiple	33	F/M	Greater satisfaction and effectiveness with CO_2	Post-inflammatory hyperpigmentation in CO_2 group	Non-randomized comparative	3
Saki N et al.[18]	Fractional CO_2 vs microneedling	4 sessions, 4 weeks apart	N/S	N/S	40	F/M	Reduction in striae width with no group differences	Not reported	Randomized comparative	2
Elmorsy EH et al.[19]	Fractional CO_2 vs carboxytherapy	CO_2: 6 sessions, 4 weeks apart; Carboxy: 6 sessions, 2 weeks apart	Rubra and alba	Abdomen	40	F	Improvement with both therapies; no significant differences	CO_2: erythema, crusts, pain, PIH; Carboxy: erythema, bruising, tingling	Randomized comparative	2
Crocco EI et al.[54]	Fractional CO_2 vs control	4 sessions with increasing intensity (80–110 mJ/MTZ), 4 weeks apart	Alba	Abdomen	13	F	Significant increase in collagen fibers and epidermal thickness; non-significant increase in elastic fibers	Erythema, edema, crusting	Controlled comparative	1
Cho SB et al.[55]	Fractional CO_2	2 sessions, 4 weeks apart	Alba	Thighs	1	F	Clinical improvement	None	Case report	5
Nouri K et al.[56]	CO_2 vs PDL 585 nm vs control	Single session; assessment at 4 and 20 weeks	N/S	Abdomen	4	F (phototypes IV & VI)	PDL: No improvement in phototype IV; worsening hyperpigmentation in VI. CO_2: persistent erythema in IV, hyperpigmentation in VI	Hyperpigmentation	Controlled comparative	1

Authors	Treatment	Dose	Type of Striae	Location	N	Sex	Outcome	Adverse Effects	Study Type	Level of Evidence
Preclaro IA et al.[57]	CO_2 + PRP vs CO_2 + placebo	4 sessions, 4 weeks apart; combined group: CO_2 followed by PRP	N/S	Abdomen	16	F	Clinical and subjective improvement in CO_2 + PRP; no significant differences	Not reported	Controlled comparative	1
Shin JU et al.[58]	CO_2 vs CO_2 + (succinylated atelocollagen or placebo) vs collagen or placebo	3 sessions, 4 weeks apart; follow-up 1 month after completion	Alba	N/S	14	F	Significant differences between collagen and placebo in irradiated groups; and between collagen and placebo without CO_2; epidermal thickening in all groups	Pruritus, erythema; one case of psoriasis	Controlled comparative	1

N, number of participants; F, female; M, male; N/R, not reported; N/S, not specified. Note: References outside the range [1–41] are included as supplementary data.

Table 4. Summary of Studies on the Treatment of Striae Using CO_2 Lasers

Authors	Treatment	Dose	Type of Striae	Location	N	Sex	Outcome	Adverse Effects	Study Type	Level of Evidence
Kim BJ et al.[20]	NAFL 1550 nm vs control	1 session; evaluation at 4 and 8 weeks	Alba	Thighs	6	F	Improvement in erythema, pigmentation, and partial elasticity; increased epidermal thickness, collagen, and elastic fibers histologically	Pain, hyperpigmentation	Non-randomized comparative	3
Stotland et al.[21]	NAFL 1550 nm	6 sessions, 2–3 weeks apart	Alba	Abdomen, thighs, buttocks	20	F	26–50% improvement in 63%; < 25% improvement in dyschromia in 50%; 26–50% texture improvement in 50%	Not reported	Case series	4
de Angelis F et al.[25]	NAFL 1540 nm	2–4 sessions, 4–6 weeks apart; 2–3 passes; long-term evaluation	Rubra and alba	Multiple	51	F/M	50% improvement at 6 months; increased dermal collagen/elastin; no recurrence at 18–24 months	Erythema, edema, PIH	Case series	4

Authors	Treatment	Dose	Type of Striae	Location	N	Sex	Outcome	Adverse Effects	Study Type	Level of Evidence
Park KK et al.[22]	NAFL 1550 nm vs control	3 sessions, 4 weeks apart	N/S	Abdomen	17	F (phototypes IV–VI)	Significant clinical improvement of striae and DLQI vs control	Pruritus, scaling, erythema; no PIH	Controlled comparative	1
Katz TM et al.[23]	NAFL 1550 nm	3–5 sessions, 4 weeks apart	Rubra	Thighs and breasts	2	F	Clinical improvement	Erythema, edema	Case series	4
Clementoni MT et al.[24]	NAFL 1565 nm	3 sessions, 4–5 weeks apart	N/S	Multiple	12	F/M	Clinical improvement; reduced depression and discoloration	Transient erythema, edema	Case series	4
Oliveira Alves R et al.[26]	NAFL 1540 nm	3–6 sessions	Rubra	Arms, thighs	4	F/M	Improvement after 3rd session	Transient erythema, edema	Case series	4
Tay YK et al.[27]	NAFL 1450 nm (6 mm, 40 ms; 4, 8, 12 J) vs control	3 sessions, 6 weeks apart	Rubra and alba	Multiple	11	F/M (phototypes IV–VI)	No improvement vs control	Session erythema; PIH (64%)	Controlled comparative	1
Meningaud JP et al.[28]	NAFL 2940 nm	6 sessions, 4 weeks apart	N/S	N/S	20	F/M	Increased skin thickness, elasticity, and skin quality	Erythema during session	Case series	4
Wanitphakdeedecha R et al.[29]	NAFL 2940 nm	2 sessions, 4 weeks apart; 400 mJ SP + 2.2 J/cm² smooth	N/S	Multiple	29	F/M	Significant improvement in both groups; no differences in roughness, smoothness, surface	Transient PIH in dark phototypes	Randomized comparative	2
Kaewkes A et al.[30]	Fractional picosecond laser 1064 nm	4 sessions, 4 weeks apart	Alba	Abdomen	20	F (phototypes IV–V)	Significant texture improvement at 1 and 6 months; increased melanin at 1-month follow-up	PIH (2 cases)	Case series	4
Tang Z et al.[59]	NAFL 1565 nm vs MRF	3 sessions, 6 weeks apart	Alba	Abdomen	14	F	MRF significantly more effective clinically; both effective overall; no difference in satisfaction or melanin; more	Significantly more pain with MRF	Non-randomized comparative	3

Authors	Treatment	Dose	Type of Striae	Location	N	Sex	Outcome	Adverse Effects	Study Type	Level of Evidence
							neocollagenesis with MRF			
Gungor S et al.[60]	1064 nm Nd:YAG LP vs 2940 nm Er:YAG	3 sessions, 4 weeks apart	Rubra and alba	Abdomen, arm (1), lumbar (2)	20	F	No clinical improvement in alba, though histologic changes present; neither treatment useful clinically	No complications with 1064 nm; erythema and PIH with 2940 nm	Non-randomized comparative	3
Cao Y et al.[61]	Beta-glucan vs vehicle vs NAFL 1565 nm + vehicle vs NAFL 1565 nm + beta-glucan	3 sessions, 4 weeks apart; topicals twice daily × 12 weeks	Alba	Abdomen	64	F	Greater improvement with NAFL than beta-glucan; histology also favored NAFL	Not reported	Controlled comparative	1
Zaleski-Larson LA et al.[62]	Picosecond NAFL 1064/532 nm vs NAFL 1565 nm	3 sessions, 3 weeks apart	Alba	Abdomen	20	F	Significant texture improvement with both; no density differences; picosecond laser less painful and faster healing	Erythema, pain	Non-randomized comparative	3
Naspolini AP et al.[63]	1340 nm NAFL vs microneedling	5 sessions, 4 weeks apart	Alba	Abdomen	20	F (phototype III–IV)	Improvement without significant group differences; increased collagen/elastin in both	Erythema, pruritus; NAFL also caused PIH and crusting	Non-randomized comparative	3
Gauglitz GG et al.[64]	NAFL 2940 nm vs PDL	5 sessions, 4 weeks apart	Rubra	Axillae	2	M	Improvement in texture and color on Er:YAG side	PIH (1)	Case series	4

N, number of participants; F, female; M, male; N/R, not reported; N/S, not specified; MRF, microneedling radiofrequency; PDL, pulsed dye laser. Note: References outside the range [1–41] are included as supplementary data.

Table 5. Summary of Studies on the Treatment of Striae Using Non-Ablative Fractional Lasers (NAFL)

Authors	Treatment	Type of Striae	Location	N	Sex	Outcome	Adverse Effects	Study Type	Level of Evidence
Jiménez GP et al.[31]	PDL 585 nm vs control	Rubra and alba	Multiple	20	F/M	Limited benefit in red striae; no change in white striae	Post-inflammatory hyperpigmentation in 1 phototype VI patient	Controlled comparative	1
McDaniel DH et al.[32]	PDL 585 nm vs control	Alba	Abdomen, thighs, breasts	39	F	Improvement with all parameters; best effectiveness with 3 J, 10-mm spot	N/R	Case series	4
Al Dhalimi MA et al.[34]	IPL 650 nm vs 590 nm	Rubra	N/S	20	F/M	Significant reduction with both; 590 nm more effective	Transient erythema and pain; PIH (2), more with 590 nm	Non-randomized comparative	3
Alexiades-Armenakas MR et al.[35]	Excimer 308 nm	Alba	Face, trunk, extremities	31	F/M	Colorimetric correction increased proportionally to number of sessions (> 9)	N/R	Controlled comparative	1
Shokeir H et al.[33]	PDL 585 nm vs IPL 565 nm	Rubra and alba	Multiple	20	F/M	Significant improvement with both; better response in red striae	Transient erythema, pain, pruritus; PIH	Non-randomized comparative	3
Elsaie ML et al.[65]	Nd:YAG 1064 nm LP (10 ms) 75 vs 100 J/cm²	Rubra and alba	Trunk, back, shoulders	45	F/M	Significant improvement with 100 J/cm² in both types; no differences between fluences in rubra	Pain	Non-randomized comparative	3
Suh DH et al.[66]	Non-ablative RF + PDL	Rubra and alba	Abdomen	37	F/M	Subjective improvement and increased elasticity in most patients	Transient purpura (6); transient PIH (1)	Case series	4

N, number of participants; F, female; M, male; N/R, not reported; N/S, not specified; MRF, microneedling radiofrequency; LP, long pulse; PDL, pulsed dye laser. Note: References outside the range [1–41] are included as supplementary data.

Table 6. Summary of Studies on the Treatment of Striae Using Vascular Laser and Other Energy-Based Devices

Authors	Treatment	Dose	Type of Striae	Location	N	Sex	Outcome	Adverse Effects	Study Type	Level of Evidence
Suwanchinda A et al.[41]	Cold atmospheric pressure plasma (CAP)	5 sessions, every 15 days	N/S	N/S	23	F/M	Significant improvement after 1 session	Crusting and superficial wounds	Controlled comparative	1
Ahmed NA et al.[38]	Carboxytherapy vs PRP vs Tripolar RF	5 weekly sessions	Rubra and alba	Trunk and lower limbs	45	F	Improvement in all groups, no significant differences	Pain and ecchymosis (PRP); erythema (RF)	Randomized comparative	2

Authors	Treatment	Dose	Type of Striae	Location	N	Sex	Outcome	Adverse Effects	Study Type	Level of Evidence
Hodeib AA et al.[37]	Carboxytherapy vs PRP	4 sessions every 3–4 weeks	Alba	Multiple	20	F/M	Improvement, no significant inter-group differences	Mild ecchymosis and pain	Non-randomized comparative	3
Manuskiatti W et al.[67]	Tripolar RF	6 weekly sessions	Rubra and alba	Abdomen and thighs	17	F	Improvement; no differences in texture 1 and 6 weeks after therapy	N/R	Case series	4
Ibrahim ZAE et al.[36]	PRP vs microdermabrasion vs PRP + microdermabrasion	6 sessions every 15 days	Rubra and alba	Multiple	68	F/M	PRP and PRP + microdermabrasion superior to microdermabrasion alone	Pain, ecchymosis; worsening with PRP in 3 cases	Randomized comparative	2
Ferreira ACR et al.[68]	Galvanopuncture vs microdermabrasion vs control	10 weekly sessions	Alba	Buttocks	48	F	Improvement without significant inter-group differences	Pain	Randomized controlled	1
Nassar A et al.[69]	Microneedling vs microdermabrasion + sonophoresis	Biweekly or monthly sessions	Rubra and alba	Thighs and legs	40	F	Significant improvement with microneedling	Transient erythema and PIH	Non-randomized comparative	3
Harmelin Y et al.[70]	Bipolar RF vs IR-enhanced bipolar RF vs IR+RF vs control	3 monthly sessions	N/S	Abdomen	22	F/M	No differences among active treatments or control	Transient pain related to RF	Controlled comparative	1
Montesi G et al.[71]	Bipolar RF	6–8 sessions, every 2 weeks	N/S	Abdomen, buttocks, scapulohumeral region	30	N/S	Improvement from second session onward	Transient ecchymosis; blisters (2)	Case series	4
Tian T et al.[72]	RF vs tretinoin vs combination vs control	RF: 3 sessions every 3 months; tretinoin daily ×1 week	Rubra and alba	Abdomen	18	F	Significant improvement with combined treatment	Mild pain, erythema, edema (RF-related)	Controlled comparative	1
Luis-Montoya P et al.[39]	Subcision vs tretinoin 0.1% vs combination	N/S	Alba	N/S	14	N/S	Reduction in width and clinical improvement in all 3 groups; no significant inter-group differences	Necrosis (3) with subcision	Non-randomized comparative	3
Sadick NS et al.[40]	Narrowband UVB/UVA1	10 sessions, twice weekly	Alba	N/S	14	F/M	> 51% repigmentation > 50% hyperpigmentation	Erythema, hyperpigmentation	Case series	4

Authors	Treatment	Dose	Type of Striae	Location	N	Sex	Outcome	Adverse Effects	Study Type	Level of Evidence
Costa DC de O et al.[73]	Microneedling + 5-FU vs 5-FU vs microneedling	1 session, evaluated at 180 days	Alba	Buttocks	18	F/M, phototype III–V	Partial improvement	PIH with all treatments	Randomized comparative	2
Lima EVA de A et al.[74]	Fractional microneedling RF	One session, 60-day follow-up	N/S	N/S	8	F	Partial improvement; high patient satisfaction	Transient PIH in 6 patients	Case series	4

PDL, pulsed dye laser; IPL, intense pulsed light; RF, radiofrequency; N, number of participants; F, female; M, male; N/R, not reported; N/S, not specified. Note: References outside the range [1–41] are included as supplementary data.

Table 7. Summary of studies on the treatment of striae with other therapies.

Authors	Treatment	Dose	Type of Striae	Location	N	Sex	Outcome	Adverse Effects	Study Type	Level of Evidence
Suwanchinda A, et al.[41]	Cold atmospheric pressure plasma (CAP)	5 sessions, 15 days apart	N/E	N/E	23	M/H	Significant improvement after one session	Scabs and superficial wounds	Controlled comparative	1
Ahmed NA, et al.[38]	Carboxytherapy vs PRP vs Tripolar RF	5 weekly sessions	Rubra and alba	Trunk and lower limbs	45	M	All groups improved with no significant differences	Pain and bruising (PRP), erythema (RF)	Randomized comparative	2
Hodeib AA, et al.[37]	Carboxytherapy vs PRP	4 sessions, 3–4 weeks apart	Alba	Multiple	20	M/H	Improvement without significant differences	Mild bruising and pain	Non-randomized comparative	3
Manuskiatti W, et al.[67]	Tripolar RF	6 weekly sessions	Rubra and alba	Abdomen and thighs	17	M	Improvement; no texture difference at 1 and 6 weeks	N/R	Case series	4
Ibrahim ZAE, et al.[36]	PRP vs Microdermabrasion vs PRP + microdermabrasion	6 sessions, 15 days apart	Rubra and alba	Multiple	68	M/H	Improvement with PRP and combination vs microdermabrasion alone	Pain, bruising; worsening with PRP (3 cases)	Randomized comparative	2
Ferreira ACR, et al.[68]	Galvanopuncture vs microdermabrasion vs Control	10 weekly sessions	Alba	Gluteal region	48	M	Improvement with no significant differences	Pain	Randomized controlled	1

Authors	Treatment	Dose	Type of Striae	Location	N	Sex	Outcome	Adverse Effects	Study Type	Level of Evidence
Nassar A, et al.[69]	Microneedling vs microdermabrasion + Sonophoresis	Biweekly or monthly sessions	Rubra and alba	Thighs and legs	40	M	Significant improvement with microneedling	Transient erythema and PIH	Non-randomized comparative	3
Harmelin Y, et al.[70]	Bipolar RF vs Enhanced bipolar RF + IR light vs IR+RF vs Control	3 monthly sessions	N/E	Abdomen	22	M/H	No differences between treatments and control	RF-related transient pain	Controlled comparative	1
Montesi G, et al.[71]	Bipolar RF	6–8 sessions, 2 weeks apart	N/E	Abdomen, gluteal region, scapulohumeral area	30	N/E	Improvement from 2nd session onwards	Transient bruising, blisters (2)	Case series	4
Tian T, et al.[72]	RF vs Tretinoin vs Combination vs Control	RF: 3 sessions every 3 months; Tretinoin: daily × 1 week	Rubra and alba	Abdomen	18	M	Significant improvement with combination therapy	RF-related mild pain, erythema, edema	Controlled comparative	1
Luis-Montoya P, et al.[39]	Subcision vs Tretinoin 0.1% vs Combination	N/E	Alba	N/E	14	N/E	Reduced width and clinical improvement in all groups	Necrosis (3) with subcision	Non-randomized comparative	3
Sadick NS, et al.[40]	Narrowband UVB/UVA1	10 sessions, twice weekly	Alba	N/E	14	M/H	Repigmentation in > 51% Hyperpigmentation in > 50%	Erythema, hyperpigmentation	Case series	4
Costa DC de O, et al.[73]	Microneedling + 5-FU vs 5-FU vs microneedling	1 session, 180-day follow-up	Alba	Gluteal region	18	M/H (phototype III–V)	Partial improvement	Hyperpigmentation in all groups	Randomized comparative	2
Lima EVA de A, et al.[74]	Fractional RF with microneedles	1 session, 60-day follow-up	N/E	—	8	M	Partial improvement; high patient satisfaction	Transient hyperpigmentation in 6 patients	Case series	4

PRP, platelet-rich plasma; RF, radiofrequency; N, number of participants; F, female; M, male; N/R, not reported; N/S, not specified.
Note: References outside the range [1–41] are included as supplementary data.

TRADUCCIÓN DE LA FIGURA

Tratamiento de estrías

Estría ribra

Estría alba

Tratamientos tópicos

Tratamiento con dispositivos

Tretinoína 0,1%, aplicación diaria

Ácido glicólico 70%, peeling mensual.

Ácido glicólico 70%, aplicación diaria

Opción preferida:

MRF

Treatment of striae
Striae rubra
Striae alba

Topical therapies

Device-based treatments

Tretinoin 0.1%, daily application

Glycolic acid 70%, monthly peeling

Glycolic acid 20%, daily application

Preferred option:

MRF
CO2, modo fraccionado

Al menos 3 sesiones, separadas 4 semanas

Otras opciones:

Láseres no ablativos

PDL 585 nm

IPL con filtros vasculares

Opción preferida:

MRF

CO2, modo fraccionado

Al menos 3 sesiones, separadas 4 semanas

Otras opciones:

Láseres no ablativos

CO_2, fractional mode
At least 3 sessions, spaced 4 weeks apart

Other options:
Non-ablative lasers
PDL 585 nm
IPL with vascular filters

Preferred option:
MRF
CO_2, fractional mode
At least 3 sessions, spaced 4 weeks apart

Other options:
Non-ablative lasers

TRADUCCIÓN DEL GRAPHICAL ABSTRACT

Revisión sistemática sobre tratamiento y prevención estrías PubMed y LILACS (1976-2024)

Clasificación según nivel de evidencia

Se incluyeron 69 trabajos:

Terapias tópicas (20): tretinoína al 0,1% y ácido glicólico a distintas concentraciones han demostrado eficacia en el tratamiento.

Láser y otras fuentes de luz (35): láseres ablativos fraccionados y no ablativos y radiofrecuencia con microagujas, presentan mejoría clínica tanto en estría rubra como alba.

Otros tratamientos (14): PRP ha resultado útil especialmente en combinación.

Systematic review on the treatment and prevention of striae PubMed and LILACS (1976–2024)

Classification according to level of evidence

A total of 69 studies were included:
Topical therapies (20): 0.1% tretinoin and glycolic acid at various concentrations have demonstrated efficacy in treatment.
Lasers and other light sources (35): fractional ablative and non-ablative lasers, as well as microneedling radiofrequency, show clinical improvement in both striae rubra and alba.
Other treatments (14): PRP has been especially useful when combined with other modalities.

Limitaciones:

Baja calidad de algunos estudios

Tamaño de la muestra pequeño

La evidencia actual no permite definir un tratamiento único siendo necesaria su combinación.

Limitations:
Low quality of some studies
Small sample sizes
Current evidence does not allow the definition of a single optimal treatment, making combination therapy necessary.