Medical Coverage Policy

Effective Date.....06/15/2026
Next Review Date.....03/15/2027
Coverage Policy Number..... 0328

Scar Revision

Table of Contents

Related Coverage Resources

Breast Reconstruction Following Mastectomy or Lumpectomy
Excimer Laser, Dermabrasion and Chemical Peels for Dermatologic Conditions
Injectable Fillers for Head and Neck Conditions
Radiation Oncology Clinical Guidelines
Treatment of Cutaneous and/or Deep Tissue Hemangioma, Port Wine Stain and Other Vascular Lesions

INSTRUCTIONS FOR USE

The following Coverage Policy applies to health benefit plans administered by Cigna Companies. Certain Cigna Companies and/or lines of business only provide utilization review services to clients and do not make coverage determinations. References to standard benefit plan language and coverage determinations do not apply to those clients. Coverage Policies are intended to provide guidance in interpreting certain standard benefit plans administered by Cigna Companies. Please note, the terms of a customer's particular benefit plan document [Group Service Agreement, Evidence of Coverage, Certificate of Coverage, Summary Plan Description (SPD) or similar plan document] may differ significantly from the standard benefit plans upon which these Coverage Policies are based. For example, a customer's benefit plan document may contain a specific exclusion related to a topic addressed in a Coverage Policy. In the event of a conflict, a customer's benefit plan document always supersedes the information in the Coverage Policies. In the absence of a controlling federal or state coverage mandate, benefits are ultimately determined by the terms of the applicable benefit plan document. Coverage determinations in each specific instance require consideration of 1) the terms of the applicable benefit plan document in effect on the date of service; 2) any applicable laws/regulations; 3) any relevant collateral source materials including Coverage Policies and; 4) the specific facts of the particular situation. Each coverage request should be reviewed on its own merits. Medical directors are expected to exercise clinical judgment where appropriate and have discretion in making individual coverage determinations. Where coverage for care or services does not depend on specific circumstances, reimbursement will only be provided if a requested service(s) is submitted in accordance with the relevant criteria outlined in the applicable Coverage Policy, including covered diagnosis and/or procedure code(s). Reimbursement is not allowed for services when billed for conditions or diagnoses that are not covered under this Coverage Policy (see "Coding Information" below). When billing, providers must use the most appropriate codes as of the effective date of the submission. Claims submitted

for services that are not accompanied by covered code(s) under the applicable Coverage Policy will be denied as not covered. Coverage Policies relate exclusively to the administration of health benefit plans. Coverage Policies are not recommendations for treatment and should never be used as treatment guidelines. In certain markets, delegated vendor guidelines may be used to support medical necessity and other coverage determinations.

Overview

This Coverage Policy addresses methods employed for the revision of scar tissue.

Coverage Policy

Coverage for scar revision varies across plans. Please refer to the customer's benefit plan document for coverage details.

Please refer to the Coverage Policy "Breast Reconstruction Following Mastectomy or Lumpectomy" for specific coverage criteria related to revision of scar tissue performed as part of reconstructive surgical revision of a breast on which a mastectomy/lumpectomy was performed.

For keloid scar revision necessitating radiation therapy please use the following guideline: Radiation Oncology Clinical Guidelines

If coverage for scar revision is available, the following conditions of coverage apply.

Scar revision using fractional ablative laser* or intralesional 5-fluorouracil is considered medically necessary when ALL of the following criteria apply to the treated scar:

- is due to a history of external trauma (e.g., burn, blunt force trauma, penetrating trauma, laceration, surgical wound)
- is causing a functional impairment (e.g., restricted range of motion, lesion impacting a vital structure [such as nose, eyes])

***NOTE: An initial regimen of laser therapy (CPT® Code 0479T, 0480T) includes up to six treatments. Continued laser therapy beyond the initial six treatments is considered medically necessary when there is a beneficial clinical response to the functional impairment as evidenced by successive objective measurements (e.g., range of motion, vision testing).**

The following injectable medications are considered not medically necessary for treatment of scars:

- any other antineoplastic agents (e.g., bleomycin)
- biologic, cytokine, or immune-modulating agents (e.g., recombinant TGF-β3, interferon therapy, etanercept, interleukin-10)
- calcium antagonists (e.g., verapamil hydrochloride)
- botulinum toxin (e.g., onabotulinum Toxin Type A [Botox® A])

Laser-assisted drug delivery (LADD), also known as fractional laser-assisted drug delivery (FLADD), is considered experimental, investigational, or unproven.

Each of the following is considered cosmetic and not medically necessary:

- scar revision in the absence of a functional impairment
- scar revision when performed solely to improve physical appearance
- any of the following modalities of treatment for scar revision (this list may not be all-inclusive):
  - abrasion (i.e., superficial abrasion)
  - injectable fillers
  - fat transfers and/or liposuction
  - hair transplantation

Each of the following is not covered or reimbursable for scar revision:

- chemical peels
- dermabrasion (i.e., deep abrasion)

Coding Information

Notes:

1. This list of codes may not be all-inclusive since the American Medical Association (AMA) and Centers for Medicare & Medicaid Services (CMS) code updates may occur more frequently than policy updates.
2. Deleted codes and codes which are not effective at the time the service is rendered may not be eligible for reimbursement.

Considered Medically Necessary when criteria in the applicable policy statements listed above are met:

CPT®* Codes	Description
0479T†	Fractional ablative laser fenestration of burn and traumatic scars for functional improvement; first 100 cm^2 or part thereof, or 1% of body surface area of infants and children
0480T†	Fractional ablative laser fenestration of burn and traumatic scars for functional improvement; each additional 100 cm^2, or each additional 1% of body surface area of infants and children, or part thereof (List separately in addition to code for primary procedure)

†**Note: Considered Experimental/Investigational/Unproven when used to report laser-assisted drug delivery (LADD) or fractional laser-assisted drug delivery (FLADD). Considered Not Medically Necessary/Cosmetic when performed in absence of a functional impairment or performed solely to improve physical appearance.**

HCPCS Codes	Description
J9190	Injection, fluorouracil, 500 mg

Considered Not Medically Necessary when used to report other injectable intralesional treatment of scars:

HCPCS Codes	Description
J0585	Injection, onabotulinumtoxinA, 1 unit
J0586	Injection, abobotulinumtoxinA, 5 units

HCPCS Codes	Description
J1438	Injection, etanercept, 25 mg (code may be used for Medicare when drug administered under the direct supervision of a physician, not for use when drug is self-administered)
J1826	Injection, interferon beta-1a, 30 mcg
J1830	Injection, interferon beta-1b, 0.25 mg (code may be used for Medicare when drug administered under the direct supervision of a physician, not for use when drug is self-administered)
J3490	Unclassified drugs
J9040	Injection, bleomycin sulfate, 15 units
J9212	Injection, interferon alfacon-1, recombinant, 1 mcg
J9213	Injection, interferon, alfa-2A, recombinant, 3 million units
J9214	Injection, interferon, alfa-2B, recombinant, 1 million units
J9215	Injection, interferon, alfa-N3, (human leukocyte derived), 250,000 IU
J9216	Injection, interferon, gamma 1-B, 3 million units
Q3027	Injection, interferon beta-1a, 1 mcg for intramuscular use
Q3028	Injection, interferon beta-1a, 1 mcg for subcutaneous use
S0145	Injection, pegylated interferon alfa-2a, 180 mcg per ml

Considered Not Medically Necessary/Cosmetic when used to report services for the treatment of scars:

CPT®* Codes	Description
11950	Subcutaneous injection of filling material (eg, collagen); 1 cc or less
11951	Subcutaneous injection of filling material (eg, collagen); 1.1 to 5.0 cc
11952	Subcutaneous injection of filling material (eg, collagen); 5.1 to 10.0 cc
11954	Subcutaneous injection of filling material (eg, collagen); over 10.0 cc
15769	Grafting of autologous soft tissue, other, harvested by direct excision (eg, fat, dermis, fascia)
15771	Grafting of autologous fat harvested by liposuction technique to trunk, breasts, scalp, arms, and/or legs; 50 cc or less injectate
15772	Grafting of autologous fat harvested by liposuction technique to trunk, breasts, scalp, arms, and/or legs; each additional 50 cc injectate, or part thereof (List separately in addition to code for primary procedure)
15773	Grafting of autologous fat harvested by liposuction technique to face, eyelids, mouth, neck, ears, orbits, genitalia, hands, and/or feet; 25 cc or less injectate
15774	Grafting of autologous fat harvested by liposuction technique to face, eyelids, mouth, neck, ears, orbits, genitalia, hands, and/or feet; each additional 25 cc injectate, or part thereof (List separately in addition to code for primary procedure).
15786	Abrasion; single lesion (eg, keratosis, scar)
15787	Abrasion; each additional 4 lesions or less (List separately in addition to code for primary procedure)
15876	Suction assisted lipectomy; head and neck
15877	Suction assisted lipectomy; trunk
15878	Suction assisted lipectomy; upper extremity
15879	Suction assisted lipectomy; lower extremity
17999	Unlisted procedure, skin, mucous membrane and subcutaneous tissue

Not Covered or Reimbursable:

CPT®* Codes	Description
15780	Dermabrasion; total face (eg, for acne scarring, fine wrinkling, rhytids, general keratosis)
15781	Dermabrasion; segmental, face
15782	Dermabrasion; regional, other than face
15783	Dermabrasion; superficial, any site (eg, tattoo removal)
15788	Chemical peel, facial; epidermal
15789	Chemical peel, facial; dermal
15792	Chemical peel, nonfacial; epidermal
15793	Chemical peel, nonfacial; dermal

General Background

Scars develop as skin heals from injury (e.g., lacerations, burns, surgery, piercings, injections) through the inflammatory, proliferative, and remodeling phases, during which fibroblasts (cells that help repair damage) deposit collagen. Normal scars gradually flatten and fade. Abnormal scars, including hypertrophic scars, keloids, and contractures, respond to injury with suboptimal tissue healing characterized by excessive fibroblast production and disproportionate collagen deposition. Hypertrophic scars remain raised but confined to the original wound boundary, whereas keloids grow beyond it, demonstrating tumor-like extension into adjacent skin (Machan et al., 2025). Contractures are a type of scarring that results from excessive fibrotic tightening, especially after burns or deep dermal injury, and may significantly restrict mobility across joints or flexion creases (Griffin et al., 2024).

Abnormal scars develop when the usual steps of wound healing in the skin become unbalanced. Higher levels of profibrotic cytokines (messenger proteins) and fewer dying fibroblasts (fibroblast apoptosis) lead to excess buildup of extracellular matrix (Machan et al., 2025; Griffin et al., 2024). Factors such as mechanical tension on the wound, local inflammation, deeper injuries, and a person's genetic makeup further increase the risk of developing abnormal scars. Keloids occur more often in individuals with darker skin phototypes and may run in families, while hypertrophic scars typically form in high-tension wounds, burns, or surgical sites (Machan et al., 2025).

Clinical presentation varies by scar type. Hypertrophic scars present as raised, firm, itchy (i.e., pruritic) lesions restricted to the wound margin and may improve spontaneously over several years. Keloids typically appear months after injury, exhibit claw-like extension into normal skin, rarely regress, and have high recurrence rates after excision (Machan et al., 2025). Contractures manifest as tightening that limits motion, particularly following burns or deep dermal trauma (Griffin et al., 2024). Diagnosis relies on clinical appearance, history, and occasionally biopsy (i.e., histopathology), which can distinguish parallel collagen bundles in hypertrophic scars versus the thick, irregular "keloidal collagen" found in keloids (Machan et al., 2025).

Abnormal scar management is individualized and often multimodal. First-line nonsurgical therapies include silicone gel sheeting and pressure therapy, both of which demonstrate benefit in reducing scar height and improving pliability (Machan et al., 2025; Griffin et al., 2024). Intralesional corticosteroid injections, particularly triamcinolone acetonide (e.g., Kenalog), inhibit fibroblast proliferation and collagen synthesis and remain the cornerstone pharmacologic therapy.

Combination regimens with agents such as 5-fluorouracil (5-FU) may enhance efficacy and reduce recurrence (Machan et al., 2025). Laser modalities, including pulsed dye and fractional CO_2 systems, target vascularity and collagen remodeling. Additional therapies under investigation include botulinum toxin for tension reduction, cryotherapy, and emerging biologics targeting cytokines such as transforming growth factor beta-3 (TGF-β3) and interleukin-10 (IL-10) (Machan et al., 2025; Griffin et al., 2024).

Surgical excision is generally reserved for pathological scars that do not respond to other treatments. Scar recurrence is common if excision is the only treatment, especially with keloids, where it can exceed 50%. For this reason, adding therapies like postoperative radiation, corticosteroid injections, silicone sheeting, or compression is strongly recommended (Machan et al., 2025; Griffin et al., 2024). Contractures often require surgical release, tissue rearrangement (e.g., Z plasty or W plasty), grafting, or flap reconstruction to restore mobility (Griffin et al., 2024).

Other classifications of scars include striae distensae (i.e., stretch marks), atrophic scars that result from an acute inflammatory reaction such as acne, and pigmented scars that result from excessive pigment deposition following injury. Treatment of these types of scars is generally aimed at improving physical appearance and is considered a cosmetic therapy since they typically do not result in functional impairment.

Laser Therapy

Laser treatments for scars work in different ways depending on the target and mechanism. Non-ablative lasers such as pulsed dye (PDL), potassium titanyl phosphate (KTP), and long-pulsed Nd:YAG selectively target oxyhemoglobin and are used to reduce scar redness or to treat scars with a strong vascular component (Zachary, et al., 2025; Husmann & Mobley, 2026). These lasers use selective photothermolysis to create controlled injury within small blood vessels without harming the surface of the skin, leading to reduced erythema and improvements in scar softness and flexibility (Zachary, et al., 2025). Hypertrophic scars with increased vascularity may often cause itching, warmth, or tenderness, and vascular laser therapy can lessen these symptoms by reducing excess blood flow within the scar (Husmann & Mobley, 2026).

In contrast, fractional ablative lasers such as CO_2 and Er:YAG target water in the skin to create tiny columns of ablation bordered by preserved skin called microscopic treatment zones (MTZs). These zones activate the body's healing response, leading to collagen remodeling and new tissue growth that improves scar texture, elasticity, and thickness (Zachary, et al., 2025). When performed over multiple sessions, fractional ablative resurfacing can improve movement, reduce scar height, and decrease symptoms such as pain and itching in hypertrophic, traumatic, and burn scars (Husmann & Mobley, 2026; Zachary, et al., 2025).

U.S. Food and Drug Administration (FDA)

Laser instruments used in dermatology and general or plastic surgery are classified by the FDA as Class II medical devices and are regulated through the 510(k) pathway. These systems are indicated for skin resurfacing and the treatment of benign cutaneous lesions, such as surgical scars and keloids, through controlled ablation, coagulation, and remodeling of soft tissue (FDA, 2026).

Device or Product	Identifier	Manufacturer
EXFU CO_2 Fractional Laser Therapy System	K242183	Weifang Mingliang Electronics Co., Ltd.
UltraPulse Alpha CO2 Laser System	K220467	Lumenis Be, Ltd.

Device or Product	Identifier	Manufacturer
Sciton JOULE ProFractional	K180508	Sciton, Inc.
Candela (Syneron) CO_2RE Laser System	K181523	Candela / Syneron
Quanta System	K173002	Quanta System S.p.A.
Palomar (Cynosure) ICON	K110907	Palomar Medical Technologies, Inc.
Lutronic eCO_2 Plus / DENTA III / SP III CO_2 Systems	K100610	Lutronic Corporation
Fraxel re:pair CO_2 (Fraxel III SR)	K080915	Reliant Technologies / Solta Medical

*FDA product codes: GEX, ONG

Note: Coverage decisions are not based solely on FDA approval. Device or product names are provided for example purposes only. Their inclusion does not indicate endorsement or preference for any specific brand or model. This list is not intended to reflect all available products or technologies.

Literature Review
Fractional ablative CO_2 laser therapy is widely used for hypertrophic, burn-related, and postsurgical scars and has consistently demonstrated improvements in scar thickness, pliability, vascularity, symptom burden, and functional outcomes across pediatric and adult populations. Clinical evidence from randomized trials, controlled clinical studies, observational cohorts, and systematic reviews shows significant improvements on validated measures including the Vancouver Scar Scale (VSS), Patient and Observer Scar Assessment Scale (POSAS), Modified Manchester Scar Scale (MMSS), and patient-reported outcomes, with follow-up durations ranging from months to years. Laser therapy may be applied as a standalone intervention or within broader multimodal scar-management pathways, including use alongside conservative modalities such as pressure garments, silicone therapy, massage, physiotherapy, and in some cases concurrently with surgical scar revision or combined with other laser modalities. Across studies, treatment courses typically involve multiple sessions, with additional benefit shown from continued therapy in persistent or severe scarring. Overall, laser treatment is reported to be safe and well-tolerated, with adverse effects generally limited to transient erythema, edema, or pigmentary changes (Ji et al., 2025; Keshk et al., 2025; Betar et al., 2025; Chen et al., 2024; Ma et al., 2024; Sun et al., 2024; Osman et al., 2024; Ma et al., 2023; Choi et al., 2021; Oosterhoff et al., 2021; Issler-Fisher et al., 2021; Douglas, et al., 2019; Eilers et al., 2016).

5-fluorouracil (5-FU)
5-Fluorouracil (5-FU) is the second most commonly used injectable therapy for pathologic scars after intralesional corticosteroids. As a chemotherapeutic drug that structurally resembles natural metabolites required for DNA or RNA synthesis, 5-FU disrupts the metabolic pathways required for fibroblast DNA replication and suppresses fibroblast proliferation, thereby reducing collagen synthesis and scar formation (Husmann & Mobley, 2026; Given, et al., 2025). It is administered intralesionally for hypertrophic and keloid scars and may be used as monotherapy, though evidence demonstrates greater efficacy when combined with intralesional corticosteroids such as triamcinolone acetonide (Husmann & Mobley, 2026; Given, et al., 2025). Combination therapy has been associated with greater reductions in scar height, improved overall outcomes, and lower recurrence rates compared with monotherapy (Husmann & Mobley, 2026). Reported adverse

effects of intralesional 5-FU include injection-site pain, transient hyperpigmentation, telangiectasias, and ulceration; however, these events appear less frequent than with corticosteroid monotherapy (Husmann & Mobley, 2026; Given, et al., 2025). Contraindications include anemia, leukopenia, thrombocytopenia, pregnancy, bone marrow suppression, and active infection (Given, et al., 2025).

Literature Review
Intralesional 5-fluorouracil (5-FU) has been widely evaluated as both a monotherapy and as an adjuvant therapy for treatment of hypertrophic scars and keloids, demonstrating consistent improvements in scar height, thickness, pliability, vascularity, and symptom burden across randomized controlled trials, comparative studies, and systematic reviews. As monotherapy, 5-FU exhibits meaningful clinical benefit with good or excellent flattening in approximately 45–79% of individuals, reduced pruritus, and significant reductions in scar dimensions, with relapse rates averaging around 16% at mid-term follow-up. When combined with low-dose triamcinolone acetonide (TAC), 5-FU shows superior outcomes compared to either agent alone, with higher rates of improvement, faster reductions in height and vascularity, greater improvements in pliability, and consistently lower rates of adverse steroid-related effects such as atrophy and telangiectasias. Across studies, combination TAC+5-FU regimens also demonstrate lower recurrence rates, enhanced patient and observer-rated scores on validated scales such as Vancouver Scar Scale (VSS) and Patient and Observer Scar Assessment Scale (POSAS), and favorable histopathologic changes including reduced fibroblast proliferation and collagen deposition. Overall, 5-FU represents an effective, evidence-supported therapy for pathological scarring with a balanced efficacy–safety profile (King, et al., 2024; Nischwitz, et al., 2020; Hietanen, et al., 2019; Khalid, et al., 2019; Ren, et al., 2017; Srivastava, et al., 2017; Kafka, et al., 2017; Bijlard, et al., 2015).

Other Injectable Medications
Published scientific literature describes investigation of a wide range of pharmacologic agents for the treatment of hypertrophic scars and keloids; however, no universal pharmacologic standard of care has been established beyond intralesional corticosteroids, and evidence supporting many alternative therapies remains limited. Small clinical studies and case series have reported biologic activity and variable clinical responses with intralesional interferons, bleomycin, verapamil hydrochloride, botulinum toxin type A, and other agents acting on fibroblast proliferation, collagen synthesis, wound tension, and cytokine or growth-factor signaling pathways; however, outcomes are inconsistent across studies, comparative effectiveness remains unclear, and long-term recurrence data are limited. Tumor necrosis factor-α (TNF-α)–targeting therapies have also been discussed in limited investigational contexts based on the recognized role of inflammatory cytokines in fibrotic signaling, but supporting clinical evidence remains sparse, and cytokine-targeted approaches (e.g., TNF-α inhibitors such as etanercept) are considered investigational. Additional intralesional antifibrotic or antiproliferative agents including mitomycin C and tamoxifen have been explored based on their effects on fibroblast proliferation and transforming growth factor-β signaling; however, clinical findings are mixed, recurrence reduction has not been consistently demonstrated, and these therapies remain investigational with limited supporting evidence. Similarly, investigational biologic and cytokine-modulating agents targeting profibrotic signaling—such as avotermin (recombinant TGF-β3), intralesional interleukin-10, mannose-6-phosphate, and other growth-factor-based therapies—have demonstrated biologic plausibility and early promise in selected experimental or clinical trials, yet subsequent studies have failed to show consistent or durable benefit (Machan et al., 2025; Murakami & Shigeki, 2024).

Across these modalities, pharmacologic agents have been used as monotherapy or as components of combination regimens alongside surgical and physical interventions; however, optimal dosing, treatment duration, frequency, and sequencing remain poorly defined. Many agents discussed in the literature—including interferons, bleomycin, verapamil, mitomycin C, etanercept, botulinum

toxin type A, avotermin, and interleukin-10—represent off-label or investigational use in scar management. Overall, the evidence base is limited by small sample sizes, heterogeneous scar populations, frequent use of combination therapies, short follow-up periods, and non-standardized outcome measures, with recurrence often inadequately assessed. Contemporary reviews consistently emphasize the need for larger, well-controlled prospective studies with long-term follow-up before these emerging pharmacologic approaches can be considered established or standard therapy for hypertrophic scars or keloids (Murakami & Shigeki, 2024; Machan et al., 2025).

Bleomycin: Bleomycin has been reported to inhibit proliferation of scar tissue. Evidence in the medical literature evaluating this use is limited to a few published trials evaluating use primarily as an alternative treatment when other modalities have failed. While some evidence supports effectiveness for bleomycin by intradermal injection or the multipuncture method for reducing scar tissue and other symptoms, such as erythema, pruritus and pain (Saray and Güleç, 2005; España, et al., 2001), these clinical trials involved small patient populations, short-term follow-up, and lacked comparison groups. Naeini et al. (2005) reported on 45 patients with hypertrophic scars or keloids that were randomly divided to receive either bleomycin tattoo or cryotherapy combined with intralesional triamcinolone injection. Both treatment groups had a high response rate (i.e., 88%), however for large lesions, the response rate was significantly better for bleomycin (p=0.03). Aggarwal and colleagues (2008) reported that bleomycin may be used as a first-line treatment modality for management of keloid and hypertrophic scars. The group of authors evaluated 50 patients who received bleomycin applications for the treatment of keloids or hypertrophic scars. Eighty percent of patients showed satisfactory regression in size of the lesion while symptomatic relief of pruritus was obtained in 40 patients. Recurrence was seen in seven patients. Nonetheless, despite a favorable response to bleomycin treatment regimens in these few trials, further investigation is needed to support the potential benefit of bleomycin therapy and improved long-term clinical outcomes.

Kim et al. (2020) conducted a systematic review and meta-analysis to compare the efficacy of bleomycin to corticosteroid and other treatments (i.e., triamcinolone acetonide [TAC], 5-FU, TAC combined with 5-FU, and TAC combined with cryotherapy) for keloids or hypertrophic scars. Five studies (n=375) including three randomized control trials and two controlled clinical trials met inclusion criteria. Inclusion criteria included: randomized controlled trial (RCT) and controlled clinical trial (CCT) regardless of allocation concealment and blinding; patients with keloid or hypertrophic scar; intervention types included bleomycin alone compared to other treatment methods; and outcome measures included changes of scar size related to height, patient self-assessment and observer assessments (POSAS), Vancouver scar scale (VSS), recurrence, and adverse effects. Outcome measures focused on scar size, recurrence and adverse events. Overall, the bleomycin group revealed more improvement in the scars than the non-bleomycin group, specifically compared to TAC, 5-FU, or combination of TAC with cryotherapy. Bleomycin was also found to reduce the recurrence rate compared to 5-FU alone or in combination with TAC. Hyperpigmentation, pain, pruritis, burn, vesicle/bullae, atrophy, ulceration, hypopigmentation, and telangiectasia were all adverse events reported in the studies with hyperpigmentation reported most frequently from those who received bleomycin. Author noted limitations included: insufficient articles and data lacking blinding and allocation concealment details; unreported volume use of bleomycin and size of keloid and hypertrophic scars; small patient populations; different methods of outcome assessment; and various follow-up periods. Additional randomized control trials with large patient populations are needed to support the reported outcomes of this study.

Wang et al. (2025) conducted a systematic review and meta-analysis assessing the safety and effectiveness of intralesional bleomycin for the treatment of keloids and hypertrophic scars. The review included eight retrospective studies involving 562 participants aged 7 to 73 years and

evaluated real-world use of bleomycin administered alone or in combination with other therapies. Eligible studies assessed at least one of the following outcomes: scar flattening, recurrence, or adverse reactions. Animal studies, cytobiology research, randomized controlled trials, and controlled clinical trials were excluded, as were studies with inadequate correlation or clarity between results and meta-analysis findings. Treatment regimens included bleomycin alone, bleomycin combined with triamcinolone acetonide, surgery followed by bleomycin, and electrochemotherapy with bleomycin. Scar flattening outcomes were categorized as significant (>75%), moderate (50%–75%), or minimal (<50%), with follow-up periods ranging from 3 to 60 months. Meta-analysis results demonstrated significant flattening in 90% of patients, moderate flattening in 5%, and minimal flattening in 4%, with a reported recurrence rate of 3%. Subgroup analysis showed significant flattening rates of 99% in Western populations and 57% in Asian populations. Hyperpigmentation was reported in 8% of participants, with no significant ulceration or skin atrophy observed. The authors identified key limitations, including retrospective study design, a small number of available studies, and limited sample sizes. They concluded that although intralesional bleomycin demonstrated favorable real-world effectiveness and safety outcomes, larger, high-quality prospective studies with long-term follow-up are needed to confirm these findings.

Interferon: Systemic interferon has been shown to increase collagen breakdown producing an antifibrotic effect, and authors have utilized intralesional interferon to improve cosmetic appearance of scars. However, aside from the antiproliferative properties, interferon has been associated with considerable side effects (e.g., flu-like symptoms, fever, headache, and myalgia). Clinical efficacy of intralesional interferon for treatment of scar tissue has not been consistently demonstrated in clinical trials. Reported outcomes are generally mixed (Berman, et al., 2017; Lee, et al., 2008; Smith, et al., 2007; Davison, et al., 2006). Additional research is warranted to assess the clinical utility and overall benefit of using interferon for the treatment of scars (Shridharani, et al., 2010; Atiyeh, 2007; Al-Attar, et al., 2006; Mustoe, et al., 2002; Shaffer, et al., 2002).

Verapamil hydrochloride: Verapamil hydrochloride injection, a calcium-channel antagonist, has also been investigated as a treatment for scar tissue by some authors. Verapamil inhibits the synthesis/secretion of extracellular molecules (including collagen) and increases collagenase, although the actual benefit of calcium antagonists on scar tissue is not clearly established. In comparison to triamcinolone injections, some authors have reported verapamil was as effective and resulted in less adverse drug reactions. Some studies have confirmed combination therapy has a more pronounced effect in the treatment of keloids and hypertrophic scars. Reported outcomes of some clinical trials have been promising (Klomparens, et al., 2022; Kant, et al., 2018; Margaret Shanthi, et al., 2008; Copcu, et al., 2004) although follow-up is short term and sample populations are small. One randomized controlled trial (Danielsen, et al., 2016), designed to compare verapamil to triamcinolone for the prevention of keloid recurrence (n=14), was terminated early. According to the authors, Kaplan-Meier survival curve analysis demonstrated a significantly higher recurrence rate with verapamil treatment at 12 months post-surgery and a higher overall risk of recurrence compared to triamcinolone injection. As a result, the remaining 16 subjects were not recruited as planned and the trial was terminated.

Jiang et al. (2020) conducted a systematic review and meta-analysis of four randomized controlled trials evaluating the safety and efficacy of intralesional verapamil compared with intralesional triamcinolone acetonide (TAC) for the treatment of keloids and hypertrophic scars. The analysis included 238 participants (range 30–100 per study) aged 10 to 65 years. Eligible studies were randomized controlled trials involving patients with keloids or hypertrophic scars that compared intralesional verapamil with intralesional TAC, had a minimum intervention duration of 18 weeks, and reported outcomes using the Vancouver Scar Scale (VSS), symptom change, and/or adverse effects. Most studies administered intralesional verapamil at a concentration of 2.5 mg/mL at 3-week intervals, with one study using a 10-week interval; the comparator across studies was

intralesional TAC 40 mg/mL administered at similar intervals. Primary outcomes included VSS measures of scar height, pliability, vascularity, and pigmentation, while secondary outcomes assessed symptom changes such as pruritus, pain, and burning. Follow-up periods ranged from 18 to 50 weeks. Pooled analyses demonstrated no statistically significant differences between treatment groups for scar height or pigmentation, whereas TAC was more effective than verapamil in improving scar pliability and vascularity. Symptom improvement did not differ significantly between groups. Reported adverse effects included pain, telangiectasia, and skin atrophy; there were no group differences in pain or telangiectasia, and verapamil was associated with a lower risk of skin atrophy compared with TAC. Limitations include small number of RCTs, lack of blinding, heterogeneity in study design and outcome reporting, and lack of evaluation of long-term outcomes.

A randomized controlled trial conducted by Saki et al. (2019) compared the efficacy of intralesional triamcinolone acetonide with verapamil in the treatment of keloids. The study included adults aged 18–70 years old, with at least two scars with lesions less than two years old. Patients (n=15) with at least two scars were randomized to receive triamcinolone (TAC) as standard treatment and verapamil as the experimental drug. One of the scars received intralesional TAC while the other scar received intralesional verapamil hydrochloride. Treatment was every three weeks for a maximum of eight sessions or until complete flattening of the scar. Each intralesional session was preceded by cryotherapy. Scar evaluation at each stage was done by serial photographic records and using the Vancouver scar scale. In both groups, there was a reduction in height and pliability at the end of the study. However, there was a statistically significant improvement in height and pliability in the triamcinolone-receiving group compared to the verapamil-receiving group ($p<0.001$). A desired change in vascularity and pigmentation was not seen with either of the drugs ($p>0.05$). The authors concluded that verapamil is not as effective as triamcinolone in the treatment of keloids. Further studies with a higher number of participants and a longer period of observation are needed.

Abedini et al. (2018) conducted a randomized controlled trial that compared intralesional verapamil and intralesional corticosteroids in the treatment of keloids and hypertrophic scars. Patients (n=50) were randomized to the control group (n=50 lesions) or to the treatment group (n=50 lesions). The control group received intralesional triamcinolone acetonide (40mg/mL) injections at three-week intervals for 18 weeks. The treatment group received verapamil (2.5mg/mL) with the same therapeutic sessions. Treatments were continued for a maximum of six sessions or until complete flattening of the scar, whichever came first. Then, patients were followed for three months regarding recurrence of lesions and side effects. The study included adults aged 18–65 years with two or more keloids and hypertrophic scars, without previous treatment of any type and lesions less than five years old. The outcomes measured the efficacy, safety profile and recurrence rates of hypertrophic scars and keloids when treated with verapamil or corticosteroid. The scar was assessed by clinical examination at each injection and at the end of three months using Vancouver Scar Scale (height, pigmentation, pliability, and vascularity), digital photograph, and patient reported pain during treatment. The clinical improvement was defined as decreasing values of the scores. Complete recovery was considered if scores reached zero. Three patients were lost to follow-up. Verapamil-treated lesions showed reducing scores of pliability at week 12 and height at week 15. However, vascularity and pigmentation scores did not reveal any change during 18 weeks of treatment. Therefore, verapamil was considered not effective in reducing the scores of Vancouver scar assessment scale (VSS) parameters (height, pigmentation, pliability, and vascularity) to the treatment goal of zero. In triamcinolone-treated lesions, the efficacy of therapy was observed on all VSS parameters from week three, and the mean test time to complete recovery for the height and pliability parameters was 15 weeks. In triamcinolone treated lesions, vascularity and pigmentation did not reach the treatment goal of zero. Treatment side effects included pain and burning during injection (84%) mostly in verapamil treated lesions. Moreover, 73.3% of verapamil group against 88.2% of triamcinolone group were satisfied with the

resolution of symptoms like burning, pruritus and pain at the end of therapy. In triamcinolone-treated lesions, the recurrences of pigmentation, pliability, height, and vascularity occurred in 0, 6%, 10%, and 2% of treated patients, respectively. In verapamil-treated lesions, no recurrences of the parameters mentioned above were observed. Author noted limitations included short term follow-up and lack of placebo group. The authors concluded that verapamil is not a suitable and effective alternative to triamcinolone in the treatment of keloids and hypertrophic scars.

Evidence in the published medical literature remains insufficient to firmly establish safety and efficacy of verapamil compared to conventional scar treatments.

Etanercept: Etanercept (Enbrel®) is a tumor necrosis factor alpha antagonist being investigated for the treatment of excessive scarring. Injecting etanercept intralesionally theoretically reduces local inflammatory and fibrotic activity within keloid scars. Evidence evaluating safety and efficacy is lacking. However, one group of authors (Berman, et al, 2008) compared etanercept with triamcinolone acetonide (TAC) for the treatment of keloids (n=20). Subjects were randomly assigned to receive either etanercept or TAC for two months. Both treatments were safe, well tolerated and improved parameters such as reduction in keloid height, erythema and pruritus. TAC was more effective in improving keloid height and volume. Etanercept was more effective in reducing erythema and pruritus. Although these reported outcomes are promising, further studies are needed to support safety, efficacy and overall clinical utility compared to other well-established treatments.

Botulinum Toxin Type A: Botulinum toxin type A (BTXA, Botox® A) intralesional injection has been investigated as a treatment for keloid and hypertrophic scars (Bi, et al., 2019; Zhang, et al., 2016; Prodromidou, et al., 2015; Gupta and Sharma, 2011; Xiao, et al., 2010; Uyesugi, et al., 2010; Zhibo and Miaobo, 2009). BTXA is considered a potent growth factor involved in wound healing and theoretically has anti-hypertrophic scar properties, although the molecular mechanism is not clearly established.

Qiao et al. (2021) conducted a systematic review and meta-analysis evaluating the efficacy and safety of botulinum toxin type A (BTA) injections for scar management. Seventeen randomized controlled trials involving 633 adult and pediatric surgical scars were included. Eligible studies enrolled individuals requiring surgical scar management and compared pre- or postoperative BTA injections with normal saline or no treatment. Studies were excluded if they lacked extractable data, enrolled fewer than 10 participants per group, or presented redundant or duplicate data. Outcomes assessed included the visual analog scale (VAS), Vancouver Scar Scale (VSS), Stony Brook Scar Evaluation Scale (SBSES), scar width, and patient self-assessment. Most studies followed participants for six months, with three extending follow-up to twelve months. Pooled analyses demonstrated significantly improved scar appearance and quality with BTA, including lower VSS scores (MD = −0.97; p=0.001), improved VAS scores (MD = 1.26; p<0.00001), reduced scar width (MD = −0.25; p<0.0001), and greater patient satisfaction (RR = 3.38; p=0.005). Adverse event rates did not differ significantly between groups, and no severe complications were reported; mild reactions such as pain or pruritus resolved without intervention. The authors acknowledged limitations including small sample sizes per study, heterogeneity in botulinum toxin dose/timing/concentration, anatomical site variability, and differences in wound sizes. Additional limitations include lack of blinding and short follow-up durations.

Rasaii et al. (2019) conducted a double-blind, randomized controlled pilot study to compare the efficacy of intralesional triamcinolone used alone or in combination with Botulinum Toxin A (BTA) in the treatment of formed keloid scars. Patients with at least two keloid scars who had not received any medical or physical treatments for keloids in the past three months were considered for study enrollment. Two keloids in each patient (n=23) were randomly assigned to receive intralesional triamcinolone acetonide plus placebo (Group A) or intralesional triamcinolone

acetonide plus BTA (Group B). Each patient was blinded to the therapy received by each keloid. Each keloid underwent the assigned therapeutic intervention every four weeks for a total of three sessions. Outcomes measured the height, vascularity, pigmentation and pliability of keloid scars at baseline using the Vancouver scar assessment scale (VSS), during sessions 1–3 and during a one month follow-up visit. Secondary outcomes measured the severity of pain and itching using a visual analogue scale. There was no significant difference in therapeutic efficacy between the two groups at one month follow-up. A significant decrease in the pain and pruritus score was noted in both groups, with Group B showing a significant decrease in pain and pruritus scores compared to Group A ($p<0.001$). The authors concluded that triamcinolone acetonide used alone, or combined with BTA, provides similar clinical results in terms of scar improvement and symptom control. Future studies with intralesional triamcinolone and BTA are needed.

Overall, evidence in the published scientific literature is insufficient to support safety and efficacy at this time and further research is necessary to establish the benefit of this therapy in treating scars.

Laser-assisted drug delivery (LADD)

Laser-assisted drug delivery (LADD), also referred to as fractional laser-assisted drug delivery (FLADD), is a technique intended to enhance the penetration of topical medications into the skin that has been studied in the treatment of scars and as an alternative to intralesional injections. LADD involves the use of ablative or non-ablative fractional laser systems to create microscopic vertical channels, or microthermal zones, in the epidermis and superficial dermis. These channels temporarily disrupt the skin barrier and allow increased delivery of topical agents into scar tissue while leaving surrounding tissue intact to support healing. Topical agents that have been studied for laser-assisted delivery in scar treatment include corticosteroids such as triamcinolone, antimetabolites such as 5-fluorouracil, and other agents including poly-L-lactic acid. Available studies suggest that laser-assisted delivery of topical medications may result in clinical outcomes comparable to intralesional therapy in some settings; however, the evidence remains limited and heterogeneous. Reported adverse effects include those associated with laser treatment, such as transient erythema, edema, pain, crusting, blistering, infection, scarring, and temporary or permanent pigmentary changes, with increased risk noted in patients with darker skin types. Medication-related adverse effects may include localized skin atrophy, telangiectasia, pigment changes, contact dermatitis, or hypersensitivity reactions. Systemic absorption with increased risk of systemic toxicity has been reported. LADD represents an emerging modality under ongoing investigation, with optimal protocols, long-term outcomes, and comparative effectiveness not yet well established (Labadie et al., 2023).

Literature Review

Randomized controlled trials, non-randomized comparative trials, observational studies, retrospective cohort studies, case series, and systematic reviews of these studies have evaluated laser-assisted drug delivery (LADD) as an adjunct to fractional ablative laser therapy for the treatment of hypertrophic scars. The available body of evidence demonstrates substantial heterogeneity in study design, patient populations, laser parameters, topical agents delivered, outcome measures, and follow-up durations. Many studies lack control groups or standardized outcome measurement. While individual studies frequently report improvements in selected scar characteristics following LADD, the overall clinical benefit of LADD compared with laser monotherapy or alternative scar treatments remains unclear. The current literature is further limited by small sample sizes, variable methodological quality, short-term follow-up, and inconsistent reporting of clinical outcomes, preventing definitive conclusions regarding efficacy. As a result, the effectiveness of laser-assisted drug delivery for hypertrophic scar treatment has not been established, and further well-designed, adequately powered controlled trials using validated outcome measures are needed (Shilova et al., 2026).

Bernabe et al. (2024) conducted a systematic review of thirteen studies, including non-randomized controlled trials, observational cohort studies, case series, and retrospective studies, evaluating laser-assisted drug delivery for the treatment of hypertrophic scars and keloids. The total number of unique participants across the included studies was not reported. Studies were eligible for inclusion if an ablative laser was used to deliver topical agents into hypertrophic scars and/or keloids. Excluded studies included animal and in vitro studies, case reports, case series with fewer than 10 patients, reviews, letters to the editor, non-English publications, and studies published prior to 1998. Laser-assisted drug delivery involved fractional ablative lasers to enhance transdermal delivery of topical scar-modulating agents (e.g., corticosteroid ointments and 5-fluorouracil cream), and was evaluated against topical therapy alone, intralesional injections (e.g., triamcinolone acetonide or 5-fluorouracil), or laser monotherapy. Primary outcomes were assessed using validated scar assessment tools, most commonly the Vancouver Scar Scale and the Patient and Observer Scar Assessment Scale, with secondary outcomes including patient satisfaction and adverse events. Follow-up durations ranged from short-term post-treatment assessment to up to 24 months. Results were heterogeneous, with outcomes varying by scar type, laser modality, topical agent, comparator, and follow-up duration. Most studies reported improvement in at least one scar characteristic following laser-assisted drug delivery, commonly including reductions in vascularity, pliability, thickness, or total scar scores; however, similar improvements were frequently observed in both intervention and comparator groups. Reported adverse events were generally mild and transient and included erythema, edema, pigmentary changes, telangiectasia, and procedural discomfort. Limitations of the review included the absence of randomized controlled trials, small sample sizes, incomplete reporting of outcomes, heterogeneity across study designs and interventions, and variable follow-up durations.

Tawaranurak et al. (2022) conducted a prospective, randomized controlled clinical trial evaluating treatment outcomes for adults (n=22; mean age 42–44 years) with keloids, comparing fractional carbon dioxide laser with topical triamcinolone (group A; n=11) to intralesional triamcinolone (group B; n=11). Exclusion criteria included pregnancy; history of herpes zoster infection; immunocompromised status; presence of infections or skin diseases; steroid and lidocaine allergy; and keloid treatment within the prior 1 year. Interventions were performed at 4-week intervals until keloid resolution or completion of 1 year. Outcomes measured included scar volume, Vancouver Scar Scale scores, pain assessed using a visual analogue scale, and keloid recurrence, with follow-up conducted at 2-month intervals for 1 year. Both treatment groups demonstrated statistically significant reductions in scar volume and Vancouver Scar Scale scores. At the end of the 1-year treatment period, the percentage of scar volume reduction was greater in the intralesional triamcinolone group than the fractional carbon dioxide laser plus topical triamcinolone group ($p=0.016$), while mean Vancouver Scar Scale scores at the 1-year treatment interval were not significantly different between groups ($p=1.000$). Keloid resolution rates were reported as 63.6% in group A and 72.7% in group B, with recurrence observed in 9.1% and 18.2% of patients, respectively. Adverse events, including hypopigmentation and lipodystrophy, were reported only in the intralesional triamcinolone group; no adverse events were observed in the fractional carbon dioxide laser plus topical triamcinolone group. Study limitations included lack of blinding, small and predominantly female sample size, single-center design, and limited follow-up duration.

El-Hamid El-Azhary et al. (2022) conducted a comparative clinical study evaluating the efficacy of fractional carbon dioxide (CO_2) laser alone versus fractional CO_2 laser combined with either intralesional triamcinolone acetonide (TAC) or topical trichloroacetic acid 20% in the treatment of keloids. The study included 45 Egyptian patients aged 20–55 years (21 males, 24 females) with keloid duration greater than 6 months at multiple anatomic sites, including the ears, chest, and back, and etiologies such as trauma, surgery, or spontaneous occurrence. Exclusion criteria included receipt of keloid treatment within the prior 6 months, pregnancy or lactation,

photosensitivity, retinoid use, and facial keloids. Participants were assigned to three treatment groups (n=15 per group): fractional CO_2 laser monotherapy; fractional CO_2 laser followed immediately by intralesional triamcinolone acetonide at doses of 0.25 mL/cm³ for keloids less than 3 cm and 0.5 mL/cm³ for keloids greater than 3 cm (equivalent to 10 mg/cm³ of triamcinolone acetonide); or fractional CO_2 laser followed immediately by topical application of trichloroacetic acid 20%. Outcomes were assessed using the Vancouver Scar Scale to evaluate pliability, pigmentation, vascularity, and scar height or thickness, along with radiologic measurement of scar thickness using color Doppler ultrasound. Secondary outcomes included patient-reported satisfaction using a 0–4 self-assessment scale. Patients underwent four treatment sessions at 4-week intervals and were followed for 8 weeks after the final session. All groups demonstrated statistically significant reductions in Vancouver Scar Scale scores following treatment ($p<0.001$), with the greatest reductions observed in the fractional carbon dioxide laser combined with intralesional TAC group. Statistically significant reductions in keloid thickness measured by color Doppler ultrasound were also observed across all groups, with the greatest reduction reported in the fractional carbon dioxide laser monotherapy group. Patient satisfaction scores were highest in the fractional carbon dioxide laser with intralesional TAC group and lowest in the fractional carbon dioxide laser with topical trichloroacetic acid group. Mild transient adverse effects, including pain and itching, were reported in the fractional carbon dioxide laser and fractional carbon dioxide laser with triamcinolone acetonide groups, whereas more severe adverse effects, such as ulceration and hypo- or hyperpigmentation, were reported in the fractional carbon dioxide laser with trichloroacetic acid group ($p<0.05$). Study limitations included small sample size, single-center design, and short-term follow-up.

In 2021, Manuskiatti et al. conducted a prospective, randomized, split-scar, double-blind comparative clinical study to evaluate the efficacy and safety of fractional laser-assisted topical corticosteroid delivery versus fractional laser monotherapy for the treatment of hypertrophic scars. The study included 19 female participants aged 24–45 years with Fitzpatrick skin types III–IV who had abdominal hypertrophic scars resulting from caesarean section or appendectomy present for at least 6 months. All participants underwent four treatment sessions at 2-week intervals using a fractional erbium-doped yttrium aluminum garnet laser, with each scar divided longitudinally and randomized to receive either topical clobetasol propionate 0.05% ointment (laser plus steroid) or petrolatum alone following laser treatment. The primary outcome was scar thickness measured by dial caliper, while secondary outcomes included subjective assessment using the Patient and Observer Scar Assessment Scale evaluating vascularization, pigmentation, thickness, relief, pliability, and surface area. Follow-up assessments were conducted 2 weeks after the second treatment and at 1, 3, and 6 months following the final treatment. Both treatment groups demonstrated statistically significant improvements in scar thickness over time and significant improvements in Patient and Observer Scar Assessment Scale scores compared with baseline; however, no statistically significant between-group differences were observed at most follow-up timepoints. A borderline statistically significant reduction in scar thickness favoring the laser plus steroid group was observed at 3 months ($p = 0.049$), but this difference was not maintained at 6 months. No adverse events were reported. Study limitations included a small, exclusively female sample, single-center design, and limited duration of follow-up.

Sabry et al. (2019) conducted a randomized, single-blind, prospective study evaluating the effectiveness of ablative fractional carbon dioxide (CO_2) laser combined with topical 5-fluorouracil (5-FU) or verapamil hydrochloride compared with fractional CO_2 laser monotherapy in 30 Egyptian participants with hypertrophic scars (n=27) or keloids (n=3). The study included 15 male and 15 female participants with a mean age of 19.8 years whose scars resulted from burns, surgical injuries, or trauma and who had not received prior clinical treatment. Burns and the upper limb were the most common scar etiology and location, respectively, and skin type III was most prevalent. Exclusion criteria included pregnancy or lactation, active infection, connective tissue disorders, hypersensitivity to lidocaine, oral retinoid use within six months, scars covering a limb

or more, severe contracture, or suspected malignancy. Participants were randomized into three groups of 10. Groups 1 and 2 received fractional CO_2 laser therapy followed within two minutes by topical verapamil hydrochloride or topical 5-FU, respectively, while Group 3 received fractional CO_2 laser monotherapy. All participants underwent four treatment sessions at one-month intervals. Outcomes were assessed using the Vancouver Scar Scale (VSS) and the Patient Scar Assessment Scale. Punch biopsies were obtained at baseline and one month after the fourth treatment session for histologic and immunohistochemical evaluation. At one-month post-treatment, VSS scores demonstrated statistically significant improvement in all three groups compared with baseline ($p<0.05$). Between-group analyses showed that the combined laser and 5-FU group had significantly greater improvements in vascularity, pliability, and scar height compared with laser monotherapy ($p<0.05$). The combined laser and verapamil group demonstrated significantly greater improvement in vascularity compared with laser monotherapy ($p<0.05$). Patient satisfaction scores were significantly higher in both combination therapy groups compared with laser monotherapy ($p=0.02$ for 5-FU; $p=0.03$ for verapamil). A significant negative correlation was observed between scar duration and percentage reduction in VSS score ($p=0.02$). Pruritus significantly improved in all groups ($p<0.05$), while pain reduction was statistically significant only in the combined laser and 5-FU group ($p<0.05$). Immunohistochemical analysis demonstrated a significant reduction in transforming growth factor beta-1 expression in all groups ($p<0.001$). Study limitations included a small sample size, single-center design, and short-term follow-up.

There is insufficient evidence in the published medical literature to demonstrate the safety and efficacy of laser-assisted drug delivery for the treatment of scars.

Cosmetic Procedures:

According to the American Society of Plastic Surgeons, cosmetic procedures encompass surgical and nonsurgical interventions intended to enhance or reshape anatomical structures to improve appearance and confidence. These procedures include, but are not limited to, injectable fillers, liposuction, fat transfer, chemical peels, and dermabrasion, which may be used to improve the appearance of certain scars (ASPS, 2026a). The American Academy of Dermatology Association notes that scar management is complex, as different scar types require individualized therapeutic approaches, and some scars such as stretch marks and acne scars may be addressed through cosmetic treatments (AAD, 2026b). Treatments intended to improve personal appearance or that do not improve functional deficits are considered cosmetic in nature.

Injectable fillers: Injectable fillers may be used to add volume to depressed (sunk-in) scars to improve their appearance. The American Academy of Dermatology notes that fillers used for depressed acne scars add volume and may stimulate collagen and elastin production; however, most fillers provide temporary results, typically lasting 3 months to 2 years, and require repeat or maintenance treatments to sustain effect (AAD, 2026a). The American Society of Plastic Surgeons (ASPS) describes dermal fillers as primarily intended to diminish facial lines and restore facial volume, and notes that fillers may also be used to improve the appearance of certain scars. According to ASPS, commonly used filler types for scar treatment include hyaluronic acid (e.g., Belotero, Juvéderm, Restylane, Revance RHA, Revanesse), polyalkylimide (e.g., Aquamid), and polymethyl-methacrylate microspheres (PMMA) (e.g., Bellafill) (ASPS, 2026b). Available clinical evidence supporting injectable filler use for scars is limited, consists primarily of small studies evaluating cosmetic outcomes, and does not demonstrate improvement in physiological function; therefore, injectable filler treatment for scars is generally considered cosmetic in nature (Albargawi, 2025; Siperstein et al., 2024).

Liposuction and Fat Transfers: Autologous fat transfer, also referred to as fat grafting or lipofilling, involves harvesting adipose tissue, typically via liposuction, followed by processing and reinjection to improve the appearance of scarred skin. This technique has been proposed for scars

resulting from burns, trauma, surgery, or radiation injury (Al Qurashi et al., 2022; Abu Alqam et al., 2024). Reported benefits often center on cosmetic improvement, with outcomes that are variable and limited by unpredictable fat resorption and heterogeneous study designs.

Hair transplantation: Hairless lesions resulting from traumatic events such as burns or prior surgeries may lead to permanent scarring within hair-bearing regions, referred to as stable cicatricial alopecia (SCA). Surgical management of scar-associated alopecia is challenging due to scar tissue stiffness, reduced vascularity, and increased infection risk. Follicular unit extraction (FUE) and follicular unit transplantation (FUT) are used to camouflage scar-related alopecia by transplanting hair follicles into mature scar tissue. Clinical studies emphasize follicle survival, scar appearance, and patient satisfaction, with benefits centered on cosmetic improvement rather than functional restoration (Xue et al., 2024; Yoo et al., 2019)

Chemical Peels: Chemical peels, also referred to as chemexfoliation, involve the topical application of chemical agents to produce controlled exfoliation of the epidermis and, in some cases, the superficial dermis. While most commonly performed on the face, chemical peels may also be applied to other anatomic areas such as the neck, arms, and trunk. These agents create a controlled cutaneous injury that stimulates collagen synthesis and dermal regeneration, which may improve skin appearance. Chemical peels are categorized as superficial, medium-depth, or deep based on the extent of tissue injury. Chemical skin resurfacing is generally contraindicated in individuals with a history of abnormal scar formation. In many cases, chemical peels do not improve physiological function and are performed primarily for cosmetic purposes (Monheit & Hrynewycz, 2025).

Skin Resurfacing (e.g., Dermabrasion): Abrasion is a resurfacing procedure that improves skin texture by mechanically removing the epidermis and variable portions of the dermis using abrasive instruments, such as a high-speed rotary device. Dermabrasion is also referred to as dermasanding and is distinct from other skin resurfacing modalities, including microdermabrasion, microneedling, and laser skin resurfacing (e.g., fractional CO_2 or ablative fractional laser resurfacing), which employ different mechanisms and depths of tissue injury. Mechanical skin resurfacing is generally contraindicated in patients with a history of abnormal scar formation. In many instances, these procedures are performed for aesthetic enhancement rather than to restore or improve functional outcomes (Monheit & Hrynewycz, 2025).

Other Scar Revision Treatments

There is a paucity of evidence in the peer-reviewed literature evaluating other procedures as monotherapy or as addition to standard treatment options for scar revision including but not limited to intense pulsed light therapy (Brandão et al., 2025; Zhang et al., 2023), plasma radiofrequency ablation (Baroni & Verolino, 2021) and regenerative medicine treatments such as platelet-rich plasma (PRP) or stromal vascular fraction (SVF) (Jafarzadeh et al., 2024; Mbiine et al., 2023). At present the evidence is insufficient to support safety and efficacy of these modalities for the treatment of scars.

Professional Societies/Organizations

The **American Society of Plastic Surgeons**, the **American Academy of Dermatology**, and the **American Osteopathic College of Dermatology** provide information regarding various treatments aimed at improving the appearance of scars and scar revision. However, recommendations such as a formal guideline or a position statement could not be found regarding suggested treatments.

Health Equity Considerations

Health equity is the highest level of health for all people; health inequity is the avoidable difference in health status or distribution of health resources due to the social conditions in which people are born, grow, live, work, and age.

Social determinants of health are the conditions in the environment that affect a wide range of health, functioning, and quality of life outcomes and risks. Examples include safe housing, transportation, and neighborhoods; racism, discrimination and violence; education, job opportunities and income; access to nutritious foods and physical activity opportunities; access to clean air and water; and language and literacy skills.

Although people of any skin color can develop keloid or hypertrophic scarring, it is more prevalent in persons with more pigmented skin (Fitzpatrick IV, V and VI). Prevalence rates of keloid scarring are higher among Black, Asian, and Hispanic groups (4-16%) compared to Whites (0.09%). Researchers have found that the greater the presence of melanin in the body, the more likely one is to experience the development of keloids (Tchero, 2020; Glass, 2017).

References

1. Abedini R, Sasani P, Mahmoudi HR, Nasimi M, Teymourpour A, Shadlou Z. Comparison of intralesional verapamil versus intralesional corticosteroids in treatment of keloids and hypertrophic scars: A randomized controlled trial. Burns. 2018 Sep;44(6):1482-1488.

2. Abu Alqam R, Alshammari AJ, Alkhwildi LA, Bamatraf MS, Khashab RM, Al Dwehji AMO, Alsuayri RA, Fadel ZT. Effectiveness of Autologous Fat Grafting in the Treatment of Scars: A Systematic Review and Meta-Analysis. Aesthetic Plast Surg. 2024 Oct;48(19):3945-3961. doi: 10.1007/s00266-024-04131-w. Epub 2024 Jul 16. PMID: 39014237.

3. Aggarwal H, Saxena A, Lubana PS, Mathur RK, Jain DK. Treatment of keloids and hypertrophic scars using bleomycin. J Cosmet Dermatol. 2008 Mar;7(1):43-9.

4. Al-Attar A, Mess S, Thomassen JM, Kauffman CL, Davison SP. Keloid pathogenesis and treatment. Plast Reconstr Surg. 2006 Jan;117(1):286-300.

5. Al Qurashi AA, Siddiqi AK, Alghamdi AA, Aljalfan AAN, Almenhali AA, Al Jabr FA, Rashid AM, Almas T, Menezes RG. Effectiveness of Autologous Fat Transfer in the Treatment of Scar-Related Conditions: A Systematic Review and Meta-analysis. Aesthetic Plast Surg. 2022 Oct;46(5):2564-2572. doi: 10.1007/s00266-022-02869-9. Epub 2022 Apr 11. PMID: 35411408.

6. Albargawi S. Synthetic Dermal Fillers in Treating Acne Scars: A Comparative Systematic Review. J Cosmet Dermatol. 2025 Jan;24(1):e16752. doi: 10.1111/jocd.16752. PMID: 39789904; PMCID: PMC11718350.

7. American Academy of Dermatology (AAD). Acne scars: consultation and treatment [Internet]. Rosemont (IL): American Academy of Dermatology; 2026a. Accessed Jan 29, 2026. Available at URL address: https://www.aad.org/public/diseases/acne/derm-treat/scars/treatment

8. American Academy of Dermatology (AAD). Cosmetic dermatology [Internet]. Rosemont (IL): American Academy of Dermatology Association; 2026b. Accessed Jan 29, 2026. Available at URL address: https://www.aad.org/public/cosmetic

9. American Society of Plastic Surgeons (ASPS). Cosmetic procedures [Internet]. Arlington Heights (IL): American Society of Plastic Surgeons; 2026a. Accessed Jan 29, 2026. Available at URL address: https://www.plasticsurgery.org/cosmetic-procedures

10. American Society of Plastic Surgeons (ASPS). Dermal fillers [Internet]. Arlington Heights (IL): American Society of Plastic Surgeons; 2026b. Accessed Jan 30, 2026. Available at URL address: https://www.plasticsurgery.org/cosmetic-procedures/dermal-fillers

11. American Society of Plastic Surgeons (ASPS). Scar revision. Minimize a scar. Copyright © 2026 American Society of Plastic Surgeons. Accessed Jan 26, 2026. Available at URL address: http://www.plasticsurgery.org/Patients_and_Consumers/Procedures/Reconstructive_Procedures/Scar_Revision.html

12. Atiyeh BS. Nonsurgical management of hypertrophic scars: evidence-based therapies, standard practices, and emerging methods. Aesthetic Plast Surg. 2007 Sep-Oct;31(5):468-92; discussion 493-4.

13. Baroni A, Verolino P. Plasma Radiofrequency Ablation for Scar Treatment. J Clin Med. 2021 Dec 27;11(1):140. doi: 10.3390/jcm11010140. PMID: 35011879; PMCID: PMC8745684.

14. Berman B, Maderal A, Raphael B. Keloids and Hypertrophic Scars: Pathophysiology, Classification, and Treatment. Dermatol Surg. 2017 Jan;43 Suppl 1:S3-S18.

15. Berman B, Patel JK, Perez OA, Viera MH, Amini S, Block S, Zell D, Tadicherla S, Villa A, Ramirez C, De Araujo T. Evaluating the tolerability and efficacy of etanercept compared to triamcinolone acetonide for the intralesional treatment of keloids. J Drugs Dermatol. 2008 Aug;7(8):757-61.

16. Bernabe RM, Choe D, Calero T, et al. Laser-assisted drug delivery in the treatment of hypertrophic scars and keloids: A systematic review. J Burn Care Res. 2024;45(3):590-600.

17. Betar N, Donovan M, Tyack Z, Warren J, McPhail SM, Vujcich E, Brown J. Recovery in patients undergoing ablative fractional carbon dioxide laser for adult hypertrophic burn scars: A longitudinal cohort study. Burns. 2025 Feb;51(1):107300. doi: 10.1016/j.burns.2024.107300. Epub 2024 Oct 28. PMID: 39549422.

18. Bi M, Sun P, Li D, Dong Z, Chen Z. Intralesional Injection of Botulinum Toxin Type A Compared with Intralesional Injection of Corticosteroid for the Treatment of Hypertrophic Scar and Keloid: A Systematic Review and Meta-Analysis. Med Sci Monit. 2019 Apr 22;25:2950-2958.

19. Bijlard E, Steltenpool S, Niessen FB. Intralesional 5-fluorouracil in keloid treatment: a systematic review. Acta Derm Venereol. 2015 Sep;95(7):778-82.

20. Brandão MPAS, Vieira CFO, Rocha DBB, Silva MR, da Silva JA, Gold MH, de Oliveira GV. Outcomes of a Non-Surgical Combination Therapy for Keloids in Skin of Color Patients: A 10-Year Follow-Up Study. Int J Dermatol. 2025 Aug;64(8):1434-1440. doi: 10.1111/ijd.17829. Epub 2025 May 5. PMID: 40322860; PMCID: PMC12256714.

21. Chen Y, Wei W, Li X. Clinical efficacy of CO2 fractional laser in treating post-burn hypertrophic scars in children: A meta-analysis: CO2 fractional laser in treating post-burn

hypertrophic scars in children. Skin Res Technol. 2024 Feb;30(2):e13605. doi: 10.1111/srt.13605. PMID: 38332516; PMCID: PMC10853576.

22. Choi KJ, Williams EA, Pham CH, Collier ZJ, Dang J, Yenikomshian HA, Gillenwater TJ. Fractional CO2 laser treatment for burn scar improvement: A systematic review and meta-analysis. Burns. 2021 Mar;47(2):259-269. doi: 10.1016/j.burns.2020.10.026. Epub 2020 Nov 9. PMID: 33288326.

23. Copcu E, Sivrioglu N, Oztan Y. Combination of surgery and intralesional verapamil injection in the treatment of the keloid. Burn Care Rehabil. 2004 Jan-Feb;25(1):1-7.

24. Danielsen PL, Rea SM, Wood FM, et al. Verapamil is Less Effective than Triamcinolone for Prevention of Keloid Scar Recurrence After Excision in a Randomized Controlled Trial. Acta Derm Venereol. 2016 Aug 23;96(6):774-8.

25. Davison SP, Mess S, Kauffman LC, Al-Attar A. Ineffective treatment of keloids with interferon alpha-2b. Plast Reconstr Surg. 2006 Jan;117(1):247-52.

26. Douglas H, Lynch J, Anton-Harms K, Krop T, Kunath L, van Vreeswijk C. Carbon dioxide laser treatment in burn-related scarring: A prospective randomised controlled trial. J Plast Reconstr Aesthet Surg. 2019 Feb 10. pii: S1748-6815(19)30060-9.

27. Eilers RE Jr, Ross EV, Cohen JL, Ortiz AE. A Combination Approach to Surgical Scars. Dermatol Surg. 2016 May;42 Suppl 2:S150-6. doi: 10.1097/DSS.0000000000000750. PMID: 27128241.

28. El-Hamid El-Azhary EA, Abd Al-Salam FM, El-Hafiz HSA, Maghraby HM. Fractional Carbon Dioxide (CO_2) Laser Alone Versus Fractional CO_2 Laser Combined With Triamcinolone Acetonide or Trichloroacetic Acid in Keloid Treatment: A Comparative Clinical and Radiological Study. Dermatol Pract Concept. 2022 Apr 1;12(2):e2022072. doi: 10.5826/dpc.1202a72. PMID: 35646428; PMCID: PMC9116522.

29. España A, Solano T, Quintanilla E. Bleomycin in the treatment of keloids and hypertrophic scars by multiple needle punctures. Dermatol Surg. 2001 Jan;27(1):23-7.

30. Given KML, Compres EV, Waibel JS. Management of Keloids and Hypertrophic Scars. In: Lagdameo J, Alam M, Dover JS, eds. Procedures in Cosmetic Dermatology: Scar Management. 2nd ed. Philadelphia, PA: Elsevier; 2025. 87-102.

31. Glass, DA. Current Understanding of the Genetic Causes of Keloid Formation, Journal of Investigative Dermatology Symposium Proceedings, Volume 18, Issue 2, 2017, Pages S50-S53, ISSN 1087-0024. Available at URL address: https://www.sciencedirect.com/science/article/pii/S1087002416300752

32. Griffin MF, Fahy E, Hu MS, Zielins ER, Longaker MT, Lorenz HP. Scar Prevention, Treatment, and Revision. In: Gurtner GC, Pusic AL, eds. Principles of Plastic Surgery. Philadelphia: Elsevier; 2024. 185–205.

33. Gupta S, Sharma VK. Standard guidelines of care: Keloids and hypertrophic scars. Indian J Dermatol Venereol Leprol. 2011 Jan-Feb;77(1):94-100.

34. Hietanen KE, Järvinen TA, Huhtala H, Tolonen TT, Kuokkanen HO, Kaartinen IS. Treatment of keloid scars with intralesional triamcinolone and 5-fluorouracil injections - a randomized controlled trial. J Plast Reconstr Aesthet Surg. 2019 Jan;72(1):4-11.

35. Husmann V, Mobley SR. Scar Revision and Keloid Scar Management. In: Francis HW, Haughey BH, Hillel AT, Lesperance MM, Lund VJ, Park SS, Robbins KT, eds. Cummings Otolaryngology. 8th ed. Philadelphia: Elsevier; 2026:262–269.

36. Issler-Fisher AC, Fisher OM, Haertsch PA, Li Z, Maitz PKM. Effectiveness and safety of ablative fractional CO2 laser for the treatment of burn scars: A case-control study. Burns. 2021 Jun;47(4):785-795. doi: 10.1016/j.burns.2020.10.002. Epub 2020 Oct 17. PMID: 33121852.

37. Jafarzadeh A, PourMohammad A, Goodarzi A. A systematic review of the efficacy, safety and satisfaction of regenerative medicine treatments, including platelet-rich plasma, stromal vascular fraction and stem cell-conditioned medium for hypertrophic scars and keloids. Int Wound J. 2024 Apr;21(4):e14557. doi: 10.1111/iwj.14557. Epub 2023 Dec 21. PMID: 38126221; PMCID: PMC10961894.

38. Ji Q, Luo L, Ni J, Pu X, Qiu H, Wu D. Fractional CO2 Laser to Treat Surgical Scars: A System Review and Meta-Analysis on Optimal Timing. J Cosmet Dermatol. 2025 Jan;24(1):e16708. doi: 10.1111/jocd.16708. PMID: 39780524; PMCID: PMC11711943.

39. Jiang ZY, Liao XC, Liu MZ, Fu ZH, Min DH, Guo GH. The Safety and Efficacy of Intralesional Verapamil Versus Intralesional Triamcinolone Acetonide for Keloids and Hypertrophic Scars: A Systematic Review and Meta-analysis. Adv Skin Wound Care. 2020 Apr;33(4):1-7. doi: 10.1097/01.ASW.0000655476.10403.d6. PMID: 32195728.

40. Kafka M, Collins V, Kamolz LP, Rappl T, Branski LK, Wurzer P. Evidence of invasive and noninvasive treatment modalities for hypertrophic scars: A systematic review. Wound Repair Regen. 2017 Jan;25(1):139-144.

41. Kant SB, van den Kerckhove E, Colla C, et al. A new treatment of hypertrophic and keloid scars with combined triamcinolone and verapamil: a retrospective study. Eur J Plast Surg. 2018;41(1):69-80.

42. Keshk ZS, Salah MM, Samy NA. Fractional carbon dioxide laser treatment of hypertrophic scar clinical and histopathological evaluation. Lasers Med Sci. 2025 Mar 12;40(1):137. doi: 10.1007/s10103-025-04371-5. PMID: 40069407; PMCID: PMC11897074.

43. Khalid FA, Mehrose MY, Saleem M, Yousaf MA, Mujahid AM, Rehman SU, et al. Comparison of efficacy and safety of intralesional triamcinolone and combination of triamcinolone with 5-fluorouracil in the treatment of keloids and hypertrophic scars: Randomised control trial. Burns. 2019 Feb;45(1):69-75.

44. Kim WI, Kim S, Cho SW, Cho MK. The efficacy of bleomycin for treating keloid and hypertrophic scar: A systematic review and meta-analysis. J Cosmet Dermatol. 2020 Dec;19(12):3357-3366.

45. King A, Guirguis M, Satkunanathan S, Saad M, Bose R. Intralesional 5-Fluorouracil for Keloids: A Systematic Review. J Cutan Med Surg. 2024 Jul-Aug;28(4):381-386. doi: 10.1177/12034754241256346. Epub 2024 May 28. PMID: 38807454; PMCID: PMC11403916.

46. Klomparens K, Simman R. Treatment of Keloids: A Meta-analysis of Intralesional Triamcinolone, Verapamil, and Their Combination. Plast Reconstr Surg Glob Open. 2022 Jan 27;10(1):e4075.

47. Labadie JG, Ibrahim O, Dover JS. Laser-Assisted Drug Delivery. In: Eastman S, ed. Advances in Cosmetic Surgery. Philadelphia: Elsevier; 2023. 19–30.

48. Lee JH, Kim SE, Lee AY. Effects of interferon-alpha2b on keloid treatment with triamcinolone acetonide intralesional injection. Int J Dermatol. 2008 Feb;47(2):183-6.

49. Li Z, Jin Z. Comparative effect and safety of verapamil in keloid and hypertrophic scar treatment: a meta-analysis. Ther Clin Risk Manag. 2016 Nov 9;12:1635-1641.

50. Ma Y, Barnes SP, Chen YY, Moiemen NS, Lord JM, Sardeli AV. Influence of scar age, laser type and laser treatment intervals on adult burn scars: A systematic review and meta-analysis. PLoS One. 2023 Sep 27;18(9):e0292097. doi: 10.1371/journal.pone.0292097. PMID: 37756273; PMCID: PMC10529539.

51. Ma Y, Barnes SP, Chen YY, Moiemen N, Lord JM, Sardeli AV. Influence of scar age, laser type and laser treatment intervals on paediatric burn scars: a systematic review and meta-analysis. Burns Trauma. 2024 Feb 2;12:tkad046. doi: 10.1093/burnst/tkad046. PMID: 38312741; PMCID: PMC10838059.

52. Machan S, Molina-Ruiz AM, Requena L. Dermal Hypertrophies. In: Bolognia JL, Schaffer JV, Cerroni L, eds. Dermatology. 5th ed. Philadelphia: Elsevier; 2025. 1730–1740.

53. Manuskiatti W, Kaewkes A, Yan C, Ng JN, Glahn JZ, Wanitphakdeedecha R. Hypertrophic Scar Outcomes in Fractional Laser Monotherapy Versus Fractional Laser-Assisted Topical Corticosteroid Delivery: A Randomized Clinical Trial. Acta Derm Venereol. 2021 Mar 17;101(3):adv00416. doi: 10.2340/00015555-3781. PMID: 33686446; PMCID: PMC9366502.

54. Margaret Shanthi FX, Ernest K, Dhanraj P. Comparison of intralesional verapamil with intralesional triamcinolone in the treatment of hypertrophic scars and keloids. Indian J Dermatol Venereol Leprol. 2008 Jul-Aug;74(4):343-8.

55. Mbiine R, Wayengera M, Kiwanuka N, Munabi I, Muwonge H, Nakanwagi C, Joloba M, Galukande M. Autologous adipose-derived stromal vascular fraction (SVF) in scar treatment among patients with keloids and hypertrophic scars: a systematic review and meta-analysis of current practices and outcomes. Am J Stem Cells. 2023 Dec 15;12(5):98-111. PMID: 38213639; PMCID: PMC10776342.

56. Monheit GD, Hrynewycz K. Chemical and Mechanical Skin Resurfacing. In: Bolognia JL, Schaffer JV, Cerroni L, eds. Dermatology. 5th ed. Philadelphia: Elsevier; 2025. 2633-2649.

57. Mokos ZB, Jović A, Grgurević L, et al. Current Therapeutic Approach to Hypertrophic Scars. Front Med (Lausanne). 2017 Jun 20;4:83.

58. Murakami T, Shigeki S. Pharmacotherapy for Keloids and Hypertrophic Scars. Int J Mol Sci. 2024 Apr 25;25(9):4674. doi: 10.3390/ijms25094674. PMID: 38731893; PMCID: PMC11083137.

59. Mustoe TA, Cooter RD, Gold MH, Hobbs FDR, Ramelet AA, Shakespeare PG, et al.; International Advisory Panel on Scar Management. International clinical recommendations on scar management. Plast Reconstr Surg. 2002 Aug;110(2):560-71.

60. Naeini FF, Najafian J, Ahmadpour K. Bleomycin tattooing as a promising therapeutic modality in large keloids and hypertrophic scars. Dermatol Surg. 2005 Aug;32(8):1023-9; discussion 1029-30.

61. Nischwitz SP, Rauch K, Luze H, Hofmann E, Draschl A, Kotzbeck P, Kamolz LP. Evidence-based therapy in hypertrophic scars: An update of a systematic review. Wound Repair Regen. 2020 Sep;28(5):656-665. doi: 10.1111/wrr.12839. Epub 2020 Jun 15. PMID: 32506727; PMCID: PMC7539946.

62. Oosterhoff TCH, Beekman VK, van der List JP, Niessen FB. Laser treatment of specific scar characteristics in hypertrophic scars and keloid: A systematic review. J Plast Reconstr Aesthet Surg. 2021 Jan;74(1):48-64. doi: 10.1016/j.bjps.2020.08.108. Epub 2020 Sep 20. PMID: 33645505.

63. Osman MA, Kassab AN. Fractional Er:YAG laser versus fractional CO2 laser in the treatment of immature and mature scars: a comparative randomized study. Arch Dermatol Res. 2024 Jan 18;316(2):75. doi: 10.1007/s00403-023-02764-6. PMID: 38236287; PMCID: PMC10796705.

64. Prodromidou A, Frountzas M, Vlachos DE, Vlachos GD, Bakoyiannis I, Perrea D, Pergialiotis V. Botulinum toxin for the prevention and healing of wound scars: A systematic review of the literature. Plast Surg (Oakv). 2015 Winter;23(4):260-4.

65. Qiao Z, Yang H, Jin L, et al. The efficacy and safety of botulinum toxin injections in preventing postoperative scars and improving scar quality: A systematic review and meta-analysis. Aesthet Plast Surg. 2021;45(5):2350-2362.

66. Rasaii S, Sohrabian N, Gianfaldoni S, Hadibarhaghtalab M, Pazyar N, Bakhshaeekia A, et al. Intralesional triamcinolone alone or in combination with botulinium toxin A is ineffective for the treatment of formed keloid scar: A double blind controlled pilot study. Dermatol Ther. 2019 Mar;32(2):e12781.

67. Ren Y, Zhou X, Wei Z, Lin W, Fan B, Feng S. Efficacy and safety of triamcinolone acetonide alone and in combination with 5-fluorouracil for treating hypertrophic scars and keloids: a systematic review and meta-analysis. Int Wound J. 2017 Jun;14(3):480-487. doi: 10.1111/iwj.12629. Epub 2016 Jul 18. PMID: 27427423; PMCID: PMC7949502.

68. Sabry HH, Abdel Rahman SH, Hussein MS, Sanad RR, Abd El Azez TA. The Efficacy of Combining Fractional Carbon Dioxide Laser With Verapamil Hydrochloride or 5-Fluorouracil in the Treatment of Hypertrophic Scars and Keloids: A Clinical and Immunohistochemical Study. Dermatol Surg. 2019 Apr;45(4):536-546. doi: 10.1097/DSS.0000000000001726. PMID: 30829753.

69. Saki N, Mokhtari R, Nozari F. Comparing the Efficacy of Intralesional Triamcinolone Acetonide With Verapamil in Treatment of Keloids: A Randomized Controlled Trial. Dermatol Pract Concept. 2019 Jan 31;9(1):4-9.

70. Saray Y, Güleç AT. Treatment of keloids and hypertrophic scars with dermojet injections of bleomycin: a preliminary study. Int J Dermatol. 2005 Sep;44(9):777-84.

71. Shaffer JJ, Taylor SC, Cook-Bolden F. Keloidal scars: a review with a critical look at therapeutic options. J Am Acad Dermatol. 2002 Feb;46(2 Suppl Understanding):S63-97.

72. Shridharani SM, Magarakis M, Manson PN, Singh NK, Basdag B, Rosson GD. The emerging role of antineoplastic agents in the treatment of keloids and hypertrophic scars: a review. Ann Plast Surg. 2010 Mar;64(3):355-61.

73. Siperstein R, Nestor E, Meran S. Prospective Clinical Trial Demonstrating the Efficacy of Hyaluronic Acid Filler for the Improvement of Atrophic Facial Scars up to 2 years. Dermatol Surg. 2024 Dec 1;50(12):1143-1148. doi: 10.1097/DSS.0000000000004315. Epub 2024 Jul 5. PMID: 38968085; PMCID: PMC11594006.

74. Smith DI, Swamy PM, Heffernan MP. Off-label uses of biologics in dermatology: interferon and intravenous immunoglobulin (part 1 of 2). J Am Acad Dermatol. 2007 Jan;56(1):e1-54.

75. Srivastava S, Patil AN, Prakash C, Kumari H. Comparison of Intralesional Triamcinolone Acetonide, 5-Fluorouracil, and Their Combination for the Treatment of Keloids. Adv Wound Care (New Rochelle). 2017 Nov 1;6(11):393-400.

76. Sun Y, Li Z, Qi X, Wang B, Yu N, Huang J, Ting W, Long X. Laser therapy for treating cleft lip or/and palate scarring-a systematic review and meta-analysis. Lasers Med Sci. 2024 Jun 20;39(1):160. doi: 10.1007/s10103-024-04082-3. PMID: 38902432; PMCID: PMC11189991.

77. Tawaranurak N, Pliensiri P, Tawaranurak K. Combination of fractional carbon dioxide laser and topical triamcinolone vs intralesional triamcinolone for keloid treatment: A randomised clinical trial. Int Wound J. 2022 Nov;19(7):1729-1735. doi: 10.1111/iwj.13775. Epub 2022 Feb 14. PMID: 35166029; PMCID: PMC9615274.

78. Tchero, Huidi. "Management of scars in skin of color." Textbook on Scar Management: State of the Art Management and Emerging Technologies (2020): 371-377.

79. U.S. Food and Drug Administration (FDA). 510(k) premarket notification database. Product code(s): GEX, ONG. Page Last Updated: Jan 12, 2026. Accessed Jan 12, 2026. Available at URL address: http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfPMN/pmn.cfm

80. Uyesugi B, Lippincott B, Dave S. Treatment of a painful keloid with botulinum toxin type A. Am J Phys Med Rehabil. 2010 Feb;89(2):153-5.

81. Wang Q, Ren Z, Jin W, Jin Z. Real-world effectiveness and safety of bleomycin in patients with keloids and hypertrophic scars: a systematic review and meta-analysis. Arch Dermatol Res. 2025 Jan 6;317(1):170. doi: 10.1007/s00403-024-03687-6. PMID: 39760851; PMCID: PMC11703884.

82. Wang R, Mao Y, Zhang Z, Li Z, Chen J, Cen Y. Role of verapamil in preventing and treating hypertrophic scars and keloids. Int Wound. 2015 May 12.

83. Wong TS, Li JZ, Chen S, Chan JY, Gao W. The Efficacy of Triamcinolone Acetonide in Keloid Treatment: A Systematic Review and Meta-analysis. Front Med (Lausanne). 2016 Dec 27;3:71.

84. Xiao Z, Zhang F, Lin W, Zhang M, Liu Y. Effect of botulinum toxin type A on transforming growth factor beta1 in fibroblasts derived from hypertrophic scar: a preliminary report. Aesthetic Plast Surg. 2010 Aug;34(4):424-7.

85. Xue P, Yang Q, Guo L, Yin Y, Dou W, Li T, Zeng X, Song B, Fan X. Follicular unit extraction combined with fractional carbon dioxide laser therapy for post-traumatic eyebrow scar with defects: A prospective and comparative study. J Cosmet Dermatol. 2024 Dec;23(12):4146-4152. doi: 10.1111/jocd.16518. Epub 2024 Aug 11. PMID: 39129177; PMCID: PMC11626299.

86. Yoo H, Moh J, Park JU. Treatment of Postsurgical Scalp Scar Deformity Using Follicular Unit Hair Transplantation. Biomed Res Int. 2019 May 13;2019:3423657. doi: 10.1155/2019/3423657. PMID: 31214613; PMCID: PMC6535862.

87. Zachary CB, Kelly KM, Baugh EG. Lasers and Other Energy-Based Therapies. In: Bolognia JL, Schaffer JV, Cerroni L, eds. *Dermatology.* 5th ed. Philadelphia: Elsevier; 2025. 2400–2420.

88. Zhang DZ, Liu XY, Xiao WL, Xu YX. Botulinum Toxin Type A and the Prevention of Hypertrophic Scars on the Maxillofacial Area and Neck: A Meta-Analysis of Randomized Controlled Trials. PLoS One. 2016 Mar 17;11(3):e0151627.

89. Zhang Y, Ye R, Dong J, Bai Y, He Y, Ni W, Yao M. Efficacy and safety of ablative CO_2 fractional laser and narrowband intense pulsed light for the treatment of hypertrophic scars: a prospective, randomized controlled trial. J Dermatolog Treat. 2023 Dec;34(1):2202287. doi: 10.1080/09546634.2023.2202287. Epub 2023 Apr 18. PMID: 37070799.

90. Zhibo X, Miaobo Z. Intralesional botulinum toxin type A injection as a new treatment measure for keloids. Plast Reconstr Surg. 2009 Nov;124(5):275e-7e.

91. Zhuang Z, Li Y, Wei X. The safety and efficacy of intralesional triamcinolone acetonide for keloids and hypertrophic scars: A systematic review and meta-analysis. Burns. 2021 Aug;47(5):987-998.

Revision Details

Type of Revision	Summary of Changes	Date
Annual Review	• Revised policy statements on referring to benefit plan documents. • Revised policy statement for medically necessary scar revision treatments • Removed policy statements related to compression/pressure therapy and surgery. • Revised policy statement regarding injectable medications for the treatment of scars to clarify pharmacologic classifications rather than specific medications. • Added policy statement for laser-assisted drug delivery (LADD). • Revised list of cosmetic modalities of treatment for scar revision to include	3/15/2026

	abrasion, update verbiage on injectable fillers, add hair transplantation, and remove punch grafts. • Revised policy statement for not covered or reimbursable treatments to specify for scar revision and clarify dermabrasion.	
Annual Review	• Removed policy statements for: intralesional corticosteroid injections, silicone gel sheeting and silicone combination kits, excision, skin grafting, and flap surgery.	04/15/2025
Focused Review	• Removed radiation treatment modality and added hyperlink to EviCore guideline	03/15/2025
Annual Review	• No changes to coverage.	04/15/2024