CHAPTER **37**

PERIOPERATIVE MANAGEMENT OF PAINFUL SCARS

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The risk of painful scar development is one every surgeon faces on a daily basis. It is possible, however, to minimize the risk of a patient developing a painful hypertrophic scar or keloid. It is important to understand the mechanisms of wound healing and scar formation. It is critical to identify high-risk patients preoperatively and make appropriate intraoperative decisions including incision placement and the use of injections, in order to try and prevent hypertrophic scars and keloid formation (1,2).

Scar formation is a natural part of the mechanism of wound healing. The phases of wound healing include inflammatory, proliferative, and remodeling. In the first or substrate, lag phase, inflammation occurs via specialized blood cells and proteins being recruited to the wound. After several minutes of initial vasoconstriction, vasodilation and erythema occur along with angiogenesis and capillary budding. Collagen is laid down in a random fashion by fibroblasts and this phase lasts for 3-4 days, approximately 10% of the healing process. The second phase, also known as granulation or proliferative phase, is marked by increased collagen and capillary bud formation until the wound contracts and epithelialization is complete. The phase accounts for 20% of healing and lasts 14-21 days. The final phase of wound healing is known as remodeling or maturation, and accounts for 70% of healing. This period is characterized by the random collagen fibers undergoing microscopic debridement via macrophage enzymatic breakdown. Wound contraction occurs toward the center of the wound. This phase can last 3 weeks until one year post injury (3).

Scars are a normal part of wound healing. When abnormal collagen deposition occurs, hypertrophic scars and keloids can arise. Excessive collagenation and decreased collagenase activity may contribute to fibrous proliferation. It is important to distinguish between these two, because onset and treatment may vary. A hypertrophic scar is an over abundance of collagen, which typical presents within a surgical incision, and appears around one month after surgery. There is less association with skin pigmentation. They are known to flatten spontaneously and regress with time. In contrast, a keloid is a fibroproliferative collagenous tumor, which has an association with skin pigmentation (3,4). Keloids characteristically extend outside the surgical incision. They can appear more than 3 months after the initial surgery, are typically elevated more than 4 mm and grow for years (5,6) (Figure 1).

As with everything else in medicine, it is important to keep a differential diagnosis in mind. Hypertrophic scars and keloids can present in unusual patterns. Be sure to take a good history and perform a good physical examination. Differential diagnosis can include sarcoidosis, scleroderma, and tumors including scar sarcoma. When in doubt, take a biopsy or refer to a dermatologist.

The major concerns with scarring are cosmetic in nature. Scarring can cause emotional damage to a patient, especially after an elective procedure. Depending on the location of the scar, the contracture can interfere with joint functioning. Scars can also cause pruritus, pain, and paresthesias (1).

Identifying high-risk patients is critical. Those patients predisposed to skin conditions such as acne and blisters are considered at higher risk for development of a painful scar. The Asian population is at an increased risk for hypertrophic scar formation and African Americans are predisposed for keloid formation. A recent study from Japan has shown a potential link to chromosomes in certain individuals for the potentiation of hypertrophic scar formation (1,7). Smoking can also increase the risk of postoperative complications in wound healing (1).

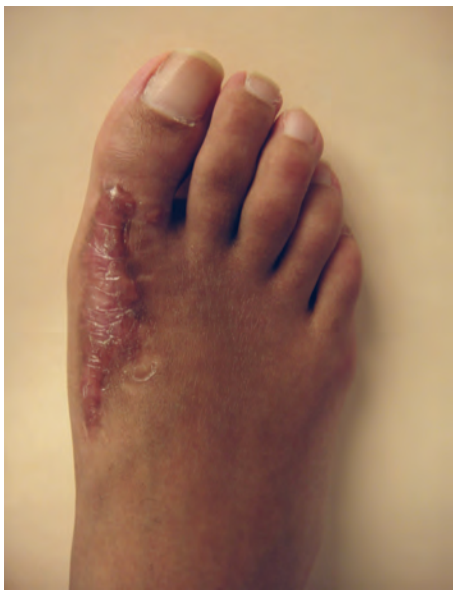

Figure 1. Painful keloid 5 months after a bunionectomy.

Once preoperative evaluation is complete, intraoperative management of scar prevention commences. Incision placement is important because it aids in preventing unnecessary trauma or surgery to surrounding tissues. The incision should be placed within the relaxed skin tension lines, and throughout the surgery maintenance of minimal wound tension should be observed. Linear scar contraction occurs from both ends of the scar towards the center. The long axis of the anticipated scar should be oriented parallel to the axis of the motion of the underlying joint. Layered anatomic dissection is also encouraged. The use of suture material should also be considered. The use of finer suture, as well as, nonabsorbable suture has been shown to decrease foreign body reactions and scar formation because of less soft tissue inflammation (8). An intraoperative technique to diminish formation of a painful scar is the utilization of injectables. Corticosteroids such as Dexamethasone, Triamcinolone, and Methylprednisolone have been shown to reduce scar formation via anti-inflammatory response and decreasing proliferation of fibroblasts by induction of cell apoptosis. At the Podiatry Institute, a peri-incisional infiltration of 11 ccs of 0.5% Marcaine plain and 1cc Decadron 4 mg/mL is commonly administered after layered skin closure with Vicryl and the application of Steri-strips (8-10).

Postoperative management is equally important. Continued reduction of wound tension is carried out via the application of steri-strips, paper tape, and pressure dressings. Mobilization should be decreased in order to limit contracture, especially over joints. Maintain moisture to the surgical site by applying lotion daily once steri-strips have been discontinued (8).

If a painful hypertrophic scar or keloid develops, it is important to recognize it early in order to begin prompt treatment. The patient can aid the physician by describing the scar via the Cosmetic Scale, with 0 being the worst, and 10 the best, which can be documented in the chart for continued analysis of improvement of the scar throughout the course of treatment. The Vancouver Scar Scale and Patient and Observer Scar Assessment Scale can also be useful in monitoring progression of treatment as pain, itching, height of scar, vascularity, pigmentation, pliability, and pain relief are recorded (11).

In the current literature, there is no one correct treatment to combat painful scars. The following algorithm was created as a guideline for postoperative management of hypertrophic scars and keloids. First line treatment includes physical modalities, corticosteroids, and topicals. The second line of defense includes the use of radiation, lasers, and surgical excision. Physical modalities can include steri-strips (3M Nexcare), paper tape, silicone sheeting (EpiDerm, ScarAway), and pressure dressing (EpiFoam), which are all relatively inexpensive and disposable (8,12,13). As previously mentioned, steroid injections with Dexamethasone and Triamcinolone can be employed every 4-8 weeks (10). Typical technique is an intradermal injection with a 3 cc syringe, 25 gauge needle, and 2 ccs 0.5% Marcaine plain with 0.5 ccs Decadron versus Kenalog 10 (40) mg/mL. Other injectables include Fluorouracil 50 mg/mL every 2-3 weeks and Verapamil 2.5 mg/mL every 4 weeks. Topical steroids (Aristocort, Westcort), gel onion extract (Mederma), vitamin E (Acetate), Retinoids (Tretinoin, Isotretinoin), and Imiquimod 5% (Aldara) are all applied daily (12-14).

The use of cryosurgery for 2-10 sessions every 25 days is indicated for painful scarring. The use of lasers has been indicated 2 months postoperatively to suppress fibroblasts. A variety of laser exist on the market, including Laser-Assisted Skin Healing (LASH), Resurfacing lasers, Pulsed Dye Laser (Ultra, Versa) (15-17). Most podiatrists do not have a laser in the office, so consider a dermatology consult. Surgical excision of the scar is also an option. Care must be taken however, because there is a very high recurrence rate with excision. Simple elliptical, biaxial serial, rotational flap, and skin grafts are all viable options (18). Nonabsorbable and finer sutures, such as 4-0 or 5-0 Prolene, that are less tissue reactive should be utilized. Consider consulting a plastic surgeon.

The newest treatment options include the Moist Exposed Burn Ointment (MEBO), which has been shown to increase moisture and keratinocyte maturation (19). Calcipotriol, a synthetic Vitamin D derivative, has anti-inflammatory properties and decreases proliferation of fibroblasts (20). BioCorneum, is a newer FDA approved topical combining silicone gel, steroid, and SPF 30 (1). Botulinum Toxin A is being used as an injectable and has been shown to decrease skin tension (1,9). Human Mesenchymal Stem cells have been shown to increase wound tensile strength, however the mechanism of action is unclear (1,9). Recombinant Human Transforming Growth Factor - 3 (Avotermin) decreases connective tissue formation and research has shown there is significant potential to reduce scarring. All of the newer treatment modalities require further long-term follow up (1,9).

In conclusion, it is critical to obtain an accurate and complete history and physical examination by performing a thorough preoperative assessment. It is also important to explain to patients that once a skin incision is made, the wound can never go back to the way it was prior to surgery. Wound healing and scarring can be unpredictable, so the patient should have realistic expectations about the possibility of developing a painful hypertrophic scar or

keloid. If a postoperative scar should occur, treat it as early as possible. Although there is no one correct way to treat scars, the above-mentioned algorithm is useful. The perioperative management of scars should start when the patient agrees to surgery and should continue post-operatively with topicals, injectables, lasers, and surgery.

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