

# Soft Tissue Principles to Minimize Scarring

## An Overview



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### KEYWORDS

• Scar • Scarring • Scar treatment • Scar revision • Ointment • Silicone • Laser • Dermabrasion

### KEY POINTS

- Patient factors include skin type, medical conditions, ethnicity, medications, and soft tissue healing. Patient perception plays a role in the scar result.
- Preoperative planning, intraoperative tissue handling, and suture techniques are vitally important to optimize wound healing and minimize scarring.
- Postoperative use of ointments, taping, silicone, and sun protective products as well as adjunctive procedures (dermabrasion, scar revision, and laser therapy) can assist in the final overall scar appearance.

### INTRODUCTION

Scarring is an inevitable consequence of surgery. Facial scars, due to their public visibility, can be very disconcerting to patients. They can have significant morbidity, ranging from functional problems to psychological sequelae.<sup>1</sup> Important principles and management techniques can be used that can minimize scarring to improve both patient functional outcome and satisfaction. The purpose of this article is to give a broad and practical overview of clinical measures to reduce facial scarring.

### SCARRING IN RELATION TO WOUND HEALING

Scars form when the deep reticular layer of the dermis is violated. As a part of the healing

process, the body forms new collagen fibers resulting in a scar. Four phases of wound healing occur following a surgical incision. They are coagulation and hemostasis, inflammation, proliferation, and remodeling. A scar is formed primarily during the latter 2 phases. During proliferation, fibroblasts migrate into the wound to begin the process of making new collagen, which will eventually become a scar. New collagen is primarily type III collagen and is replaced with type I over time. As the scar gets stronger with time, wound strength approaches 70% of its original strength at 6 weeks but will never surpass 80% of its original skin strength. Remodeling is the last stage of wound healing in conjunction with contraction, which may last as long as 1 to 2 years.

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Neither Dr D.B. Hom nor Dr J.L. Welshhans have anything to disclose.

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Within the extracellular matrix, the fibrin-rich matrix during the inflammatory phase transforms to a collagen-rich extracellular matrix during the proliferative phase. During the remodeling phase, collagen deposition and cross-linking occur, forming an organized collagen fiber network, which later undergoes wound contraction as fibroblasts transform into myofibroblast. The collagen breakdown is controlled by matrix metalloproteinases.<sup>2</sup> In addition, dermal extracellular matrix transformation occurs with fibronectin followed by hyaluronan (4–6 days) and then with proteoglycans deposition (7–10 days).

Any factors that delay wound healing will increase risk for scarring. Thus, measures to optimize dermal wound healing will result in reduced scar formation. Factors to ensure proper wound healing include (1) adequate nutrition, (2) sufficient blood supply, (3) proper wound management, (4) wound pressure relief, and (5) minimizing bacterial contamination.

## RELEVANT ANATOMY

### *Skin Structure and Skin Condition*

The skin consists of several layers: epidermis, papillary dermis, reticular dermis, and hypodermis (**Fig. 1**). The adnexal structures in the dermis (ie, hair follicles, apocrine and sebaceous glands) serve as progenitor cell sources for epithelialization.<sup>3</sup> When injury occurs in the deep reticular layer of the dermis that is allowed to heal by secondary intention, more scarring usually occurs. Incisions through thicker skin tend to scar more than thin skin. Especially in thick sebaceous skin, incisions tend to scar easier.

### FACIAL AREAS PRONE TO SCARRING

Convex surfaces of the face, such as the chin, cheek, forehead, and nasal tip, are more prone to hypertrophic, widened scars compared with other regions of the face.

Also, areas in close proximity to mobile regions of the face have an increased risk to have widened scars due to the continuous pull on the incision. In this instance, taping the incision for several months after suture is removed may help reduce pulling on the incision as it matures, resulting in a less widened scar.

## PATIENT FACTORS

### *Medical Conditions*

Several medical conditions and medications can predispose a surgical patient to scarring (**Box 1**). Patients with hyperplastic joints have increased elastin in the dermis and are more prone to scarring.<sup>4</sup> Surgeons should consider checking for signs of hyperelasticity by asking the patient to bend his thumb to his forearm or to touch his

tongue to his nose (**Fig. 2**). An additional patient factor that can contribute to scarring is age. In younger patients, the remodeling phase of the scar is more prolonged, resulting in increased erythema and hypertrophy. Remodeling becomes more adultlike after puberty.<sup>4</sup> Any condition that increases the propensity for a prolonged inflammatory reaction during wound healing, such as an infection or a foreign body reaction, increases the probability of more scarring. Other medical problems, such as diabetes, collagen vascular disease, hypothyroidism, immunocompromised states, and diseases with delayed healing, have an increased risk for scarring.

Patients with poor nutritional status who have decreased wound healing are more prone to scar. Specific nutritional deficiencies known to delay healing are vitamin C deficiency, which is necessary for the hydroxylation of lysine and proline for collagen cross-linking. Zinc and copper are also required for collagen cross-linking, and vitamin K is necessary for clotting and prothrombin production. As a result, deficiencies in these vitamins impede healing.

Patients with a history of previous radiation have poor wound healing and scarring. Radiation affects wound healing by causing obliterative endarteritis, excessive fibrosis, and an aberration of normal cellular replication. A total radiation dose greater than 50 Gy is consistently associated with poor wound healing.<sup>5</sup> Patients who smoke are also more likely to heal poorly and have a higher risk for scarring due to the vasoconstrictive effects of nicotine. Medications, such as corticosteroids and chemotherapy agents, also slow down healing and increase risk for scarring.

### *Type of Skin Injury*

Planned, sterile surgical wounds will have less scarring compared with traumatic wounds. Traumatic wounds heal with more scarring due to a heightened inflammatory response from foreign bodies and bacteria inoculation. Infected wounds ( $>10^5$  microorganisms per gram of tissue) induce a longer inflammatory phase of wound healing, and therefore, heal with more scarring. In addition, burn-inflicted trauma is more likely to result in scar hypertrophy.

Topographically, scars can be classified into several types, as seen in **Fig. 3**. Linear wounds that are perpendicular to the relaxed skin tension line (RSTL) make scars more apparent.<sup>4</sup>

### *Ethnicity*

Ethnicity plays a role in scar formation. Patients with Fitzpatrick skin types IVtoVI are at increased

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