Sense and Nonsense of Scar Creams and Gels

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Abstract. The wish to prevent or improve scars, whether they are of surgical or traumatic origin, has led to the development of scar creams and gels that are said to influence the aesthetic appearance of a scar. In this article the literature on results of the topical application of various scar creams and gels is reviewed. It is concluded that no single modality has been proven to manage hypertrophic scarring except maybe silicone and BAPN. Further research into the physiology and pharmacophysiology of scar tissue is needed. With respect to scars, it still applies that even “plastic surgeons can’t erase without a trace.”

Key words: Scar—Wound healing—Topical treatment—Plastic surgery—Silicone

Although a scar may have an important social meaning in some cultures, most Westerners regard it negatively. An often-heard remark in plastic surgery practice is the patient’s wish to be operated on “without scars.” Once a scar is present, improvement may be sought. This has led to the development of scar creams and gels that are said to improve the aesthetic appearance of a scar. In this article we review the literature on scar creams after the (patho-) physiology of scar formation is discussed.

Physiology of Wound Healing and Scar Formation

Wound healing is a complex sequence of events, beginning with tissue injury, mediated by inflammation, and ending long after reepithelialization is complete [17, 49]. Three phases are discussed: (1) inflammatory phase, (2) fibroplastic phase, and (3) remodeling phase.

Inflammatory Phase

Subsequent to initial tissue injury, exudate from cut vessels and transudate from dilated, noninjured vessels, made more permeable by histamine, bradykinins, and prostaglandins, together form a watery wound fluid which fills all spaces in the wound. This fluid is high in fibrinogen, thereby coagulating the wound. For healing to commence, two prerequisite events must then occur. First, the wound must be decontaminated (phagocytosis), and second, a new blood supply must become available (neovascularization). In this, the macrophage is vital as appraiser of damage, as a phagocytic agent, and probably also as initiator of vascular regeneration. Furthermore, its role in recruiting fibroblasts to start rebuilding is significantly related to the final amount of scar tissue produced.

Fibroplastic Phase

To achieve coalescence and wound closure, epithelialization, wound contraction, and collagen production occur simultaneously during this phase. Fibroblasts begin to migrate into the wound via a fibrin mesh created previously in the wound fluid milieu, while inflammation goes on. These fibroblasts, containing the contractile proteins actin and myosin, line up end to end and exert tension on the wound edges, in effect shrinking the defect. Further, fibroblasts start intense synthesis of collagen.
By crosslinking, bundle orientation, and remodeling of this collagen, the tensile strength of the wound increases.

Remodeling Phase

Although often wounds are thought to be healed as soon as reepithelialization is complete, numerous changes continue to occur long after the wound is covered by epidermis. The dense supply of capillaries regresses further while collagen synthesis and collagen lysis continue. Collagen bundles thereby become denser and organize parallel to the surface of the wound and in the direction of wound stress. This remodeling process continues from six months to two years after injury.

Pathophysiology of Wound Healing and Scar Formation

An immature scar has three special properties: (1) if allowed to relax, it contracts rapidly; (2) if subjected to continuous tension, it stretches slowly; and (3) if stretched intermittently, it remains immature and may become hypertrophic. Cosmetic deformities such as scar contracture, stretching, or hypertrophy result from disproportionate wound contraction by lined-up fibroblasts during the fibroplastic phase and unbalanced collagen synthesis and lysis during the remodeling phase of immature scars.

Contracted scars have become sufficiently shorter than the initial injury, thereby restricting the range of movement of the skin or joint. The deformation potential is more or less proportional to the extent of the scar. Scars are called "stretched" in cases where continuous traction across the breadth of the scar has caused it to widen. Tight elastic skin is a feature of youth while laxity comes with age. Consequently, scar stretching often is encountered in young patients. Scars also stretch when tension is strong enough to overcome contraction, e.g., in herniation of abdominal wounds in obese patients.

One speaks of scar hypertrophy in cases where the scar becomes elevated but remains within the boundaries of the initial injury. The collagen bundles usually run parallel to the skin surface. A keloid is a nonencapsulated mass of hyperplastic scar tissue escaping the boundaries of the original wound to invade normal surrounding skin. It is produced by deposition of excessive amounts of irregularly distributed bands of collagen over a prolonged period of time.

Finally, depressed scars should be mentioned separately for they represent a deficit of subcutaneous tissue in combination with centripetal contraction resulting in a scar surface that lies deep within the surrounding normal skin. Since physical properties of the skin vary from individual to individual among different age groups, in different sites, and in different directions, site and orientation of the wound influence the final outcome of wound healing and scar maturing.

Scar Prevention

From the above we can conclude that a preferred scar is one that has matured rapidly without contracture or increase in width, and without forming more collagen than is necessary for its strength. To achieve this one has to pay attention to certain physical properties of skin. These are viscoelasticity, tension, and extensibility.

Viscoelasticity or creep allows the skin to stretch in response to a constant pulling force and stress relaxation is the corollary to creep. As the skin is stretched for a given distance and that distance is kept constant, the force required to maintain the stretch gradually decreases.

Tension inherent in skin in a relaxed position is partially a function of the internal pull of the elastic fibers. Collagen fibers have no power of retraction.

Extensibility refers to the ability of skin to return from its extended or stretched state to its relaxed state. This allows the skin to adapt to movement. Because of these physical properties, skin has certain forms of appearance. Creases, for instance, are usually formed at right angles to the direction of muscle pull, while the relaxed skin tension lines (sometimes mistakenly called Langer's lines) correspond with the axis of minimal extensibility. Cleavage lines often run across natural creases and flexion lines and are also a function of skin extensibility [27].

Apart from skin properties, age, race, and localization of the tissue injury influence wound healing and scar formation. Furthermore, crushed wound edges, nonviable tissues, hematoma, infection, and redundant sutures all are stimuli for fibroplasia. By choosing proper cleavage lines for surgical incisions and avoiding high-risk areas and wound conditions, one may prevent significant scar deformities.

Scar-Improving Therapies

To improve scar appearance, many therapies as well as camouflage techniques have been and still are used (Table 1). Use of multiple treatment methods usually indicates that none of the methods is entirely satisfactory. This was illustrated by Snyderman [44] when he consulted three colleagues.