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Review Article

Surgical Scar Formation and *Vranavastu*: A Review of Hypertrophic Scarring, Keloids and Classical Perspectives

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Abstract

Scars are an expected result of skin repair after surgery, but some scars become raised, thick, itchy or painful. Hypertrophic scars stay within the original wound, whereas keloids grow beyond its edges and may return after treatment. Both arise from an altered wound-healing response involving prolonged inflammation, excess collagen and mechanical tension. This narrative review describes how surgical scars form, how hypertrophic scars differ from keloids, and how prevention and treatment are approached in current clinical practice. It also considers the Ayurvedic idea of Vranavastu, the lasting mark left after a wound has healed, alongside classical descriptions of wound features and scar-related care. These concepts offer a useful historical and clinical point of discussion, but they should not be treated as direct equivalents of modern pathological scar diagnoses. Evidence for Ayurveda-based treatment of established hypertrophic scars or keloids remains limited. Future studies should use clear diagnoses, validated scar scales, adequate follow-up and appropriate comparison groups.

Keywords: *surgical scar; hypertrophic scar; keloid; wound healing; Vranavastu; Ayurveda*

Introduction

A surgical incision heals through an organised sequence of clot formation, inflammation, tissue growth and remodelling. The repaired skin is not exactly the same as uninjured skin. A fine, flat line is common, but the scar can become raised and remain prominent. For some people it also causes itching, tenderness, pain, tightness or restricted movement. These changes can affect sleep, clothing choices, confidence and daily activity, especially when the scar is visible or crosses a joint.

Hypertrophic scars and keloids are the two main forms of raised pathological scarring. They share features, but their borders and natural course differ. Correctly distinguishing them matters because keloids are more likely to extend beyond the original wound and recur after simple removal. The classical Ayurvedic discussion of Vrana and the lasting wound mark, often discussed today under the term

Vranavastu, provides a separate lens through which to consider scar formation and its care. This review brings the two perspectives into conversation while keeping their different origins and methods clear.

Review approach

This is a narrative review. It draws on contemporary reviews, a recent clinical summary of hypertrophic scar and keloid management, a systematic review of keloid treatments, and published English translations or discussions of selected Suśruta passages. The search focused on wound healing, pathological scarring, prevention, treatment and Vranavastu. The material is summarised for clinical and academic discussion; it is not a systematic review and does not provide a formal grading of evidence.

How a surgical scar forms

Immediately after an incision, the body stops bleeding by forming a clot. In the inflammatory phase, immune cells remove damaged material and release signals that guide repair. Fibroblasts then produce collagen and other supporting material to bridge the wound. New small blood vessels supply the developing tissue, and the wound edges draw together. During remodelling, collagen is reorganised and some excess tissue is gradually removed. This process continues for months, so a scar may change in colour, firmness and height long after the skin surface has closed [1,2].

A raised scar develops when repair signals remain active for too long or collagen production and breakdown fall out of balance. Ongoing inflammation, infection, delayed closure, repeated injury and tension across the wound can contribute. The response also depends on the individual. A personal or family history of keloids, younger age, skin pigmentation and certain body sites are associated with greater risk, although none of these factors predicts the outcome in every person [2-4].

Mechanical tension deserves attention in surgery. A wound that is repeatedly stretched may receive signals that favour continued tissue growth. Incision placement along relaxed skin lines where feasible, careful handling of tissue, layered closure and measures that reduce tension can support orderly healing. Good wound care and prompt attention to infection or wound separation also help limit prolonged inflammation [1,2].

Hypertrophic scars and keloids

Feature	Hypertrophic scar	Keloid
Relation to wound	Raised but stays within the original incision or injury.	Extends beyond the original wound into nearby skin.
Typical course	Often appears within weeks; may flatten or soften gradually over time.	May appear months later and can continue to enlarge or persist.
Symptoms	May itch, feel tender or restrict movement, particularly over a joint.	Itching, pain and tenderness are common; recurrence after removal is a concern.
Management implication	May improve with time and non-surgical scar care; selected cases need procedures.	Usually needs a planned combination of treatments; excision alone has a high risk of recurrence.

The table gives broad patterns, not a substitute for examination. Some scars are difficult to classify by appearance alone. A clinician may consider the scar's history, growth beyond the incision, symptoms, site and response to earlier treatment. A scar that is changing unusually, ulcerating or bleeding needs assessment to exclude other conditions.

Clinical effects and assessment

Raised scars are not only a cosmetic issue. Itching and pain may be persistent, and a thick scar across a joint can limit movement. Assessment should document when the scar began, whether it is growing, symptoms, prior surgery or injury, family history, previous treatment and any wound complications. Examination should record the scar's dimensions,

height, colour, firmness, borders and relationship to the original incision. Photographs taken with consent and consistent lighting can help follow change over time.

Validated tools such as the Vancouver Scar Scale and Patient and Observer Scar Assessment Scale can support structured assessment. Patient-reported symptoms and the effect on function should be recorded alongside the clinician's observations [2]. This is particularly useful when judging whether an intervention has improved more than appearance alone.

Prevention and current management

Reducing risk at the time of surgery

For a patient with a prior keloid or strong personal risk, the need for elective skin procedures should be discussed carefully. When surgery is needed, the team can consider incision placement, atraumatic technique, layered closure and steps to reduce tension. After the incision has closed, the patient should follow the surgeon's wound-care instructions and seek review if there is increasing redness, discharge, wound separation or persistent inflammation. Silicone gel or sheets are commonly used after the wound has fully closed, particularly for raised scars; they should not be placed on an open or infected wound unless directed by a clinician [1,2].

Treating an established scar

Treatment depends on the scar type, age, site, symptoms, skin sensitivity, prior response and the patient's goals. Silicone, pressure therapy in selected sites, and corticosteroid preparations or injections are among commonly used options. Intralesional corticosteroid injections can reduce thickness and symptoms, though repeat visits may be needed and side effects can occur. Other injectable medicines, cryotherapy and laser procedures may be considered by trained clinicians. Evidence and results vary, and no single method works for every scar [1,3,5].

Surgery can be useful for selected scars that restrict movement or remain troublesome, but a keloid should not usually be removed as a stand-alone treatment. Recurrence after excision alone is common. When surgery is chosen, it is generally combined with measures such as tension reduction and additional scar-directed treatment, planned by an appropriate specialist [1,2]. Radiation is reserved for selected cases and requires specialist risk-benefit assessment. Patients should avoid self-injection, unprescribed chemical applications and cutting or burning a scar at home.

Vranavastu and the classical perspective

In Suśruta's discussion of Vrana, the lasting mark of a wound after healing is recognised. A passage in Sūtrasthāna 21 explains that the site or mark remains even after the wound has healed and for as long as the body endures [6]. Later Ayurvedic writing commonly uses the word Vranavastu for this residual scar or wound site. In this sense, the concept highlights an important observation: closure of the wound does not always mean that the affected skin has returned to its former appearance or structure.

Suśruta's descriptions also attend to the wound's shape, depth, temperature, colour, firmness, discharge, pain and surrounding changes. Sūtrasthāna 22 describes raised (utsanna) and depressed (avasanna) wound features among signs of an abnormal or troubled wound [6]. Cikitsāsthāna 1 includes approaches to the appearance of healed wounds, including measures discussed for changing dark or pale scar colour [6]. These passages show that wound care included both healing and the visible condition of the site after healing.

This comparison needs care. Vranavastu is a classical concept about the persistent mark or site of a healed wound. Hypertrophic scar and keloid are modern clinical categories defined by clinical behaviour and tissue changes. The terms overlap at the broad level of scar formation, but they are not interchangeable diagnoses. Nor does a classical description establish the effectiveness of a present-day treatment for keloids.

Ayurveda and contemporary scar care: a cautious bridge

Ayurvedic texts describe wound management through assessment of the wound and selection of care according to its features and stage. Modern practice likewise emphasises wound condition, inflammation, tension, symptoms and scar behaviour. This shared attention to the healing process can guide research questions. It does not mean that traditional and biomedical explanations are the same, or that a

treatment is proven because it appears in a classical source.

A small open-label study of Manjistha lepa assessed scar colour and appearance in 30 people, but it excluded keloids and had no comparison group [7]. It therefore cannot show whether the intervention treats hypertrophic scars or keloids, nor establish comparative effectiveness or safety. Ayurvedic preparations intended for a closed surgical scar should be studied for formulation quality, skin irritation, infection risk and interaction with standard care. They should not be applied to a fresh, open, draining or infected incision without the treating clinician's advice.

For now, patients with a growing, painful, itchy or function-limiting scar should receive a clinical assessment. Where Ayurvedic care is considered, it is safest as a coordinated adjunct with transparent discussion of the evidence, ingredients and risks, while established scar treatments and necessary follow-up continue.

Gaps in evidence and research priorities

Scar studies often include different scar types, body sites, durations and treatment histories, making results hard to compare. Future trials should define hypertrophic scar and keloid separately, describe surgery and wound complications, and follow patients long enough to capture recurrence. Outcomes should combine scar height and area with pain, itch, function, patient satisfaction and adverse effects. Ayurvedic studies should specify the botanical identity, preparation, dose, application schedule and quality testing, and should use an appropriate control group and validated outcome measures. These steps would make the findings more useful to both Ayurvedic and surgical practice.

Conclusion

A surgical scar reflects the body's repair process, and a raised scar can result when inflammation, collagen production and wound tension remain poorly regulated. Hypertrophic scars stay within the original wound, while keloids grow beyond it and are more likely to recur. Prevention begins with sound surgical technique, reduced tension and attentive wound care; established scars may need a combination of treatments. The Ayurvedic idea of Vranavastu recognises that a wound's mark may persist after closure and offers a meaningful classical perspective on the healed wound. It should be read alongside, not substituted for, modern diagnosis. Current evidence does not yet establish Ayurvedic therapies as effective treatments for keloids, so careful clinical assessment and well-designed research remain essential.

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