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From Vrana Shodhana to Wound-Bed Preparation: An Integrative Surgical Perspective on Ayurvedic Wound Management.**Dr. Sahil S. Shelake¹, Dr. Laxmi M. Narhare²**¹P.G. Scholar, Dept. of Shalyatantra, Yashwant Ayurvedic College, P.G.T. & R.C, Kodoli.²Professor, Dept. of Shalyatantra, Yashwant Ayurvedic College, P.G.T. & R.C, Kodoli.**ABSTRACT**

Wound management is a central component of surgical practice. Successful healing depends on tissue viability, adequate perfusion, control of contamination and infection, appropriate management of devitalized tissue, moisture balance, and correction of systemic factors that delay repair. Ayurveda describes a detailed surgical approach to Vrana through principles of Vrana Pariksha, Vrana Shodhana and Vrana Ropana.

Objective: To examine the conceptual relationship between classical Ayurvedic wound management and contemporary wound-bed preparation and to identify areas in which Ayurvedic procedures may be investigated using modern clinical research methods.

Methods: A narrative review was developed from classical Ayurvedic surgical concepts and selected contemporary literature on Ayurvedic wound research and wound-bed preparation.

Discussion: Vrana Shodhana may be understood as stage-oriented conditioning of an unhealthy wound, while Vrana Ropana represents the subsequent emphasis on tissue repair. Kshalana, Prakshalana, Avachurnana, Lepa and related local measures may be selected according to wound characteristics. These concepts should be correlated with, rather than declared identical to, modern debridement, cleansing, antimicrobial management or epithelialization.

Conclusion: A clinically useful integrative model is assessment → correction of barriers to healing → Shodhana when indicated → preparation of a healthy wound bed → Ropana-oriented care → objective monitoring. Future Shalya Tantra research should use standardized

interventions, validated wound-assessment tools, safety reporting and adequately designed controlled trials.

Keywords: *Vrana; Vrana Shodhana; Vrana Ropana; Shalya Tantra; wound-bed preparation; wound healing; Avachurnana; Kshalana.*

INTRODUCTION

Wounds are dynamic biological processes rather than static defects in the skin. Normal repair involves hemostasis, inflammation, proliferation and remodeling, while infection, ischemia, diabetes, malnutrition, smoking, age, medications and other systemic or local factors can disturb one or more phases of repair [1,2].

Classical Ayurvedic surgery gives substantial attention to Vrana and its management. The Sushruta tradition describes examination, stage-specific treatment and a broad therapeutic repertoire under Shashti Upakrama. Modern reviews of Ayurvedic wound literature document clinical work involving local applications, Avachurnana, Kshalana and other procedures, while emphasizing the need for stronger evidence and reproducible protocols [3,4].

Contemporary wound care has similarly moved from a dressing-centered approach toward structured wound assessment and wound-bed preparation. The Wound Bed Preparation 2021 paradigm emphasizes treatment of the cause, patient-centered concerns, assessment of healability, debridement when indicated, management of infection/inflammation and moisture balance [5]. This creates a useful opportunity for conceptual dialogue with Ayurvedic Shodhana and Ropana, provided that traditional and biomedical concepts are not treated as automatically equivalent.

AIM AND OBJECTIVES

Aim:

To critically discuss Vrana Shodhana and Vrana Ropana from an Ayurvedic surgical perspective and relate these principles to contemporary wound-bed preparation without assuming equivalence between traditional and biomedical terminology.

Objectives:

- To summarize the classical surgical framework of Vrana management.
- To describe the practical significance of Shodhana and Ropana as sequential treatment concepts.

- To compare selected Ayurvedic local procedures with contemporary wound-care principles.
- To identify objective outcomes suitable for future Shalya Tantra clinical trials.
- To outline research gaps that may improve scientific evaluation of Ayurvedic wound interventions.

3. Classical Framework of Vrana Management

The Sushruta tradition presents Vrana as a condition requiring examination and stage-appropriate management. The therapeutic repertoire is broad rather than limited to a single dressing. The choice of procedure depends on the nature of the wound, tissue condition, discharge, pain, inflammation and stage of healing.

Sushruta Chikitsa Sthana, Dvivraniya Chikitsitam, describes sixty Upakramas for Vrana. The classical list includes measures such as Alepa, Parisheka, Abhyanga, Sweda, Vimlapana, Upanaha, Pachana, Visravana, Chedana, Bhedana, Darana, Lekhana, Eshana, Aharana, Vyadhana, Seavana, Sandhana, Kashaya, Varti, Kalka, Sarpi, Taila, Rasakriya, Avachurnana, Dhupana, Utsadana, Avasadana, Kshara, Agnikarma, Bandha,

Patradana, Krimighna, Brimhana and other measures [6].

The same passage explicitly groups Kashaya, Varti, Kalka, Sarpi, Taila, Rasakriya and Avachurnana under Shodhana-Ropana measures. This is important because it demonstrates that classical wound management was organized around both cleansing/conditioning and healing rather than around one universal topical preparation [6].

4. Classical Shloka: Shashti Upakrama

तस्य व्रणस्य षष्टिरुपक्रमा भवन्ति ।

तद्यथा— अपतर्पणमालेपः परिषेकोऽभ्यङ्गः स्वेदो विम्लापनमुपनाहः पाचनं विस्रावणं स्नेहो वमनं विरेचनं छेदनं भेदनं दारणं लेखनमेषणमाहरणं व्यधनं विस्रावणं सीवनं सन्धानं पीडनं शोणितास्थापनं निर्वापणमुत्कारिका कषायो वर्तिः कल्कः सर्पिस्तैलं रसक्रियाऽवचूर्णनं व्रणधूपनमुत्सादनमवसादनं मृदुकर्म दारुणकर्म क्षारकर्मान्निकर्म कृष्णकर्म पाण्डुकर्म प्रतिसारणं रोमसञ्जनं लोमापहरणं बस्तिकर्मोत्तरबस्तिकर्म बन्धः पत्रदानं कृमिघ्नं बृंहणं विषघ्नं शिरोविरेचनं नस्यं कवलधारणं धूमो मधु सर्पिर्यन्त्रमाहारो रक्षाविधानमिति ॥८॥ [6]

Meaning: Sushruta describes a comprehensive set of sixty therapeutic measures for wounds, encompassing local applications, cleansing/conditioning, procedures, dressings, systemic measures and supportive care. The list illustrates a stage- and indication-dependent surgical approach rather than a single fixed treatment.

5. Vrana Shodhana: The Wound-Conditioning Principle

Vrana Shodhana may be understood as the process of making an unhealthy or contaminated wound more suitable for healing. In practical terms, this may include cleansing, management of excessive exudate, removal of unhealthy tissue, attention to local contamination and preparation of the wound environment.

A pharmacodynamic appraisal of wound-healing herbs in Sushruta Samhita identified 43 medicinal plants with Vrana-Shodhana activity, 48 with Vrana-Ropana activity and 62 with both categories [7]. This suggests that classical authors recognized different therapeutic functions during different stages of wound repair.

The concept should not be translated mechanically. A Shodhana drug should not automatically be labeled an antibiotic, and a classical Krimighna description should not be treated as proof of modern antimicrobial efficacy without microbiological evidence. Such claims require laboratory and clinical confirmation.

6. Vrana Ropana: The Healing-Oriented Principle

Once a wound has an adequately prepared bed, the therapeutic emphasis can shift toward repair and restoration. Vrana Ropana is therefore useful as a conceptual category for the healing phase. Clinically relevant endpoints include healthy granulation, epithelial advancement, reduction in wound dimensions, decreasing exudate and progressive restoration of tissue integrity.

Sushruta's Sutra Sthana 37 gives examples of preparations used for Ropana. One relevant verse states:

समङ्गा सोमसरला सोमवल्कः सचन्दनः ।

काकोल्यादिश्च कल्कः स्यात् प्रशस्तो व्रणरोपणे ॥२४॥ [8]

Meaning: A paste prepared from Samanga, Soma, Sarala, Somavalka, Chandana and the Kakolyadi group is described as highly suitable for wound healing. The verse demonstrates that classical Ropana care included defined local formulations rather than an undefined concept of healing.

Another verse describes a medicated ghee for Ropana:

पृथक्पर्ण्यात्मगुप्ता च हरिद्रे मालती सिता ।

काकोल्यादिश्च योज्यः स्याद्भिषजा रोपणे घृते ॥२५॥ [8]

These verses are best used in research as evidence of the classical treatment framework; their modern mechanisms should be tested rather than assumed.

7. Kshalana, Prakshalana and Local Cleansing

Wound cleansing is a practical bridge between classical and contemporary wound management. Kshalana and Prakshalana involve local cleansing with appropriate liquids. Modern wound care similarly uses irrigation/cleansing to reduce surface contamination and remove loose debris.

The comparison must remain cautious. The composition, concentration, sterility and delivery method of a traditional Kashaya are not automatically equivalent to modern saline, antiseptic or antimicrobial solutions. Future research should document preparation method, physicochemical characteristics, microbial quality and local tolerance.

For an open wound, cleansing should never delay drainage of an abscess, surgical debridement of nonviable tissue, treatment of necrotizing infection, revascularization of ischemic tissue or other indicated surgical procedures.

8. Avachurnana and Lepa

Avachurnana is a classical local application involving medicated powder. Its potential research objectives may include control of exudate, local drug delivery and modification of the wound surface. However, particle size, dose, sterility, moisture interaction and frequency of application should be standardized before clinical comparison.

Lepa refers to local application of a medicinal preparation. Its effect is likely to depend on the formulation, stage of wound healing, thickness of application, contact time and dressing environment. These variables should be reported in clinical trials.

The 2023 systematic review of Ayurvedic wound literature specifically documented clinical research involving Lepa, Avachurnana, Kshalana and other procedures and recommended progression from existing positive observations toward multicentre trials [3].

9. Contemporary Wound-Bed Preparation

Modern wound-bed preparation is a holistic approach that considers the cause of the wound, patient-centered concerns and local factors affecting healing. The 2021 paradigm classifies wounds according to their healability and emphasizes debridement, infection/inflammation control and moisture management when appropriate [5]. A 2024 Delphi consensus extended

these concepts to resource-limited settings, with expert consensus around ten key concepts and 32 substatements [9].

This framework is relevant to Shalya Tantra because a wound should not be considered ready for a healing- focused dressing until major barriers have been identified and addressed.

The relationship can therefore be expressed as a conceptual sequence:

Patient and wound assessment → identify cause and barriers → Shodhana/bed preparation when indicated → reassessment of tissue viability → Ropana-oriented care → objective follow-up.

This is a conceptual parallel, not a claim that Shodhana and modern debridement are identical.

10. Debridement and the Surgical Boundary

Debridement is the removal of dead, damaged or infected tissue to improve the healing potential of viable tissue. Modern reviews emphasize that the method should be selected according to wound type, patient factors, pain, goals and clinical setting [10,11].

In Ayurveda, Shodhana may include procedures and medicinal approaches that aim to improve the wound condition. However, a classical topical intervention should never be substituted for indicated surgical source control. Abscess drainage, excision of necrotic tissue, treatment of necrotizing infection, vascular intervention and reconstruction remain surgical decisions.

This distinction is particularly important in diabetic foot wounds. Modern guidance emphasizes infection control, perfusion, off-loading, glycemic control, nutrition and appropriate debridement as components of wound optimization [12].

11. Wound Assessment and Objective Outcomes

A clinically useful wound assessment should document site, length, breadth, depth, wound-bed composition, granulation, slough, necrosis, exudate, odor, wound edges, periwound skin, edema, pain, perfusion and signs of infection.

Recommended research outcomes include:

- Percentage reduction in wound area.
- Change in wound depth.

- Percentage epithelialization.
- Granulation tissue score.
- Exudate amount and character.
- Pain score.
- Time to complete epithelialization.
- Infection resolution or microbiological outcome where appropriate.
- Adverse events and local tolerance.
- Recurrence and scar outcomes for longer follow-up.

A 2023 randomized open-label trial of Jatyadi tulle, Madhughrita tulle and honey tulle in Shuddhavrana used the Bates-Jensen Wound Assessment Tool and assessed patients at baseline, day 5 and day 10 [13]. The study found significant within-group changes and comparable between-group outcomes, with no adverse drug events reported. This provides a practical model for objective evaluation of Ayurvedic wound interventions.

12. Evidence from Ayurvedic Clinical and Experimental Research

Clinical and experimental evidence is developing. A multicentric randomized controlled open-label trial evaluated topical Panchavalkala Kwatha and Jatyadi Taila aerosol sprays in diabetic and varicose ulcers against conventional treatment; 53 patients were randomized and wound assessment included the Bates-Jensen tool and photographic documentation [14]. The authors reported potentially comparable effects, while acknowledging the need for continued research.

Jatyadi Taila has also been evaluated experimentally. In a rat excision-wound model, topical Jatyadi Taila accelerated reduction in wound area compared with untreated controls and a modern topical comparator; biochemical and histopathological parameters were also assessed [15]. Another animal study evaluated standardized Jatyadi Ghrita and Jatyadi Taila in radiation-induced skin wounds and reported improvements in wound area, bacterial load and inflammatory/repair markers [16].

A 2025/2026 formulation-development study has further explored a quality-by-design nanoemulsion and hydrogel approach to Jatyadi Taila, illustrating how classical formulations may be subjected to modern pharmaceutical standardization [17].

These findings are encouraging but should not be interpreted as proof of clinical superiority. Animal, laboratory and small clinical studies generate evidence at different levels and require appropriate synthesis.

13. Honey as an Example of Translational Wound Research

Honey provides an instructive example because it has both a long traditional history and a modern evidence base. A 2024 systematic review and meta-analysis of honey dressings for chronic wounds included eight studies with 906 participants; it reported faster healing time and greater percentage wound healing, but rated the overall evidence as very low quality because of risk of bias, inconsistency and publication bias [18]. A

2013 systematic review similarly concluded that honey had potential wound-healing properties but highlighted methodological limitations [19].

The lesson for Ayurvedic research is methodological: traditional use can generate a clinically testable hypothesis, but the strength of a therapeutic claim depends on the quality of the evidence. The same standard should be applied to Madhu, Ghrita, Jatyadi formulations and other classical interventions.

14. Systemic Factors and Pathya

Local wound care cannot compensate for major systemic barriers to healing. Oxygenation, infection, diabetes, obesity, smoking, nutrition, age and medication exposure can all influence wound repair [1,2]. Contemporary wound-bed preparation therefore includes assessment of the patient as well as the wound [5].

From an Ayurvedic perspective, Pathya and systemic management can be incorporated into this patient- centered model. Research should record relevant comorbidities, nutritional status, glycemic control, anemia, smoking, vascular status and adherence rather than treating topical dressing as the sole determinant of outcome.

Recent evidence continues to emphasize the importance of metabolic and nutritional factors in diabetic wound healing [20,21]. A 2025 systematic review of dietary interventions in diabetes-related chronic wounds found low-quality evidence that nutrient supplementation may reduce wound dimensions, highlighting both the potential importance of nutrition and the need for stronger trials [22].

15. Proposed Integrative Shalya Tantra Algorithm

Step 1 — Patient assessment: Identify the cause, comorbidities, perfusion, infection and systemic barriers.

Step 2 — Wound assessment: Classify the wound as clean, contaminated, infected, necrotic, granulating or epithelializing.

Step 3 — Shodhana/bed preparation: Where indicated, use appropriate cleansing, drainage, removal of devitalized tissue and stage-appropriate local treatment.

Step 4 — Reassessment: Confirm viable tissue, acceptable exudate control and absence of untreated surgical source.

Step 5 — Ropana-oriented care: Select a standardized local intervention according to wound stage and patient factors.

Step 6 — Dressing and protection: Maintain an appropriate wound environment and protect newly formed tissue.

Step 7 — Objective follow-up: Record wound dimensions, granulation, epithelialization, pain, exudate, infection and adverse events.

Step 8 — Failure-to-heal review: Reassess ischemia, infection, pressure, diabetes, nutrition, foreign body, medication and diagnostic accuracy.

16. Proposed Research Design for Future Studies

Future Shalya Tantra wound studies should define the intervention precisely. A minimum protocol should include botanical identity where applicable, plant part, authentication, formulation method, batch number, dose/quantity, particle size for powders, application frequency, dressing method and storage conditions.

A useful primary endpoint is percentage change in wound area over a prespecified period. Secondary outcomes may include epithelialization time, granulation score, exudate, pain, infection, quality of life, recurrence and adverse events.

Randomization, allocation concealment where feasible, standardized wound photography, blinded outcome assessment where possible and transparent reporting should be used. The trial should also define rescue treatment and criteria for withdrawal if the wound deteriorates. This approach would transform classical wound-care concepts into reproducible clinical interventions without compromising patient safety.

DISCUSSION

The most useful point of convergence between Ayurveda and modern wound care is not the substitution of one dressing for another but the principle of treating the wound according to its condition. Classical Shodhana and Ropana provide a sequential therapeutic framework, while contemporary wound-bed preparation provides a structured method for identifying the cause of nonhealing and optimizing tissue conditions.

Important differences must remain visible. Ayurvedic concepts arise from a distinct theoretical system. Therefore, a scientifically strong paper should use terms such as “conceptual parallel,” “possible correlation” and “testable hypothesis” rather than claiming direct equivalence.

The current evidence also suggests that the next phase of Ayurvedic wound research should prioritize standardized interventions and objective outcomes. Small uncontrolled case reports may be valuable for hypothesis generation, but they cannot establish comparative efficacy. Larger controlled trials and multicentre studies are required to determine which classical interventions provide clinically meaningful benefit.

The integration should therefore be evidence-informed rather than merely terminological: classical principles can generate hypotheses, modern clinical methods can test them, and safety remains the first surgical requirement.

Limitations

This is a narrative review rather than a systematic review or meta-analysis. The contemporary literature was selected to illustrate major research directions and was not intended to provide an exhaustive database search. Classical Sanskrit passages were checked against accessible digital editions, but the final manuscript should be cross-checked with the exact printed edition of Sushruta Samhita used by the author's institution before journal submission.

The conceptual comparisons presented here should not be interpreted as proof that Ayurvedic procedures and modern biomedical interventions are equivalent. Further pharmacological, microbiological and clinical research is required.

CONCLUSION

Vrana Shodhana and Vrana Ropana provide a clinically relevant, stage-based framework within Ayurvedic surgery. Shodhana can be discussed alongside the broader modern concept

of wound-bed preparation, while Ropana can be investigated through measurable indicators such as granulation, wound-area reduction and epithelialization.

A safe and scientifically useful model is: assess the patient and wound → correct barriers to healing → perform Shodhana when indicated → establish a viable wound bed → provide stage-appropriate Ropana- oriented care → monitor objectively.

The future of Shalya Tantra wound research lies in combining classical knowledge with rigorous clinical methodology, standardized formulations, validated outcome measures and transparent safety reporting. This approach can preserve the identity of Ayurvedic surgical principles while generating evidence that is clinically interpretable and scientifically reproducible.

20. Tables for Journal Use

Ayurvedic concept		Primary objective	Contemporary conceptual
Vrana Pariksha		Characterization of wound	Structured wound assessment
Kshalana /		Local cleansing	Irrigation/cleansing
Avachurnana		Local powder application	Topical dressing intervention
Shodhana		Improving unhealthy wound	Wound-bed preparation
Ropana		Supporting tissue	Granulation/epithelialization
Pathya and systemic care		Support of host factors	Nutrition, glycemic and risk-factor optimization
Domain	Baseline	Follow-up	Suggested endpoint
Wound size	Length × breadth/depth	Serial	% area reduction
Wound bed	Granulation/slough/necrosi	Each review	Change in tissue
Exudate	Amount/type	Each review	Reduction
Epithelializatio	Present/absent or %	Serial	Time to completion
Pain	Numeric rating scale	Serial	Change in score
Infection	Clinical ± microbiology	As indicated	Resolution/no new infection
Safety	Baseline	Every visit	Adverse-event

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