



## Review Article

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### TIME FRAMEWORK AND INSIGHTS FROM AYURVEDA ON WOUND MANAGEMENT

P N Vinaya<sup>1\*</sup> and J.S.R.A. Prasad<sup>2</sup>

<sup>1</sup>Ayurvedic Physician and Research Scholar, Department of Sanskrit Studies, School of Humanities, University of Hyderabad, Hyderabad, India

<sup>2</sup>Assistant Professor, Department of Sanskrit Studies, School of Humanities, University of Hyderabad, Hyderabad, India

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#### \*Corresponding author

Dr. P.N. Vinaya, Ayurvedic Physician and Research Scholar, Department of Sanskrit Studies, School of Humanities, University of Hyderabad, Hyderabad, India E-mail: vinayaballakur22@yahoo.co.in

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#### ABSTRACT

A proper wound bed preparation is an important factor that determines healthy healing of wounds. The TIME framework was developed as a practical tool for this purpose. Wound management classified under the Shashthi Upakramas in the Sushruta Samhita, the ancient treatise on Surgery discusses all the principles inherent in the TIME framework. It also provides unique insights like using heat for wound management. With degenerative wounds proving to be a major medical challenge it is imperative that these concepts are revisited.

**Keywords:** Degenerative Wounds, Shashthi Upakrama, TIME Framework, Wound Management

#### INTRODUCTION

Wound Healing is an intricate step by step process that involves the stages of haemostasis, inflammation, proliferation and remodelling. The TIME framework was developed as a practical tool for management of wounds by a group of wound care experts in 2002.<sup>1</sup> TIME summarises four main components of wound bed preparation.<sup>2</sup>

**T-** Tissue Management

**I-** Control of inflammation and infection

**M-** Maintenance of moisture balance

**E-** Advancement of the epithelial edge of the wound

Ayurveda has detailed accounts on wound management in the Brihat trayi - the Charaka Samhita, Susruta Samhita and Ashtanga Hridaya. The Shashthi Upakramas (60 measures) discussed in Susruta Samhita are one of the most comprehensive wound management accounts and provide many new insights to manage difficult, non-healing wounds. A wound elicits inflammatory responses from the body, which is, both vascular and cellular. The vascular response consists of transient vaso-constriction followed by sustained dilation of arterioles, capillaries and venules. The cellular response consists of swelling of histiocytes and tissue macrophages and emigration of leucocytes from vessels.<sup>3</sup> The failure of the natural wound healing mechanism leads to the wound becoming chronic. The local management of wounds based on the TIME framework is basically a practice for wound bed preparation. Wound bed preparation is the management of a wound in order to accentuate endogenous healing or to facilitate the effectiveness of other therapeutic measures. It is more significant in the context of chronic wound healing since such wounds tend to remain stuck in the inflammatory and proliferative stages and are slow to proceed to tissue remodelling stage. This is because chronic wound discharges tend to block the proliferation of cells which is essential for healthy wound healing.

#### Tissue Management - T

Tissue management basically consists of debridement of devitalized tissues since non-viable tissues delay healing, provide focus for infection and prolong the inflammatory response.<sup>4</sup> Devitalised tissue or wound debris arises out of prolonged ischemia. It is derived from granulation tissue after the death of fibroblasts and endothelial cells.<sup>5</sup> Dead or necrotic tissue also impedes epithelial cell migration at the wound location. Slough at the wound on the other hand is adherent fibrous material derived from proteins, fibrin and fibrinogen.<sup>6</sup> Ayurveda employs Shodhana (cleansing measures that includes surgery) to remove devitalised tissues from a wound. Removal of Shalya (foreign bodies) mud, thorn etc. also are part of the debridement process. Ayurveda makes use of specialised procedures like Kshara (alkali) karma, Agnikarma (cauterization) and Raktamokshana (blood-letting) to clear necrosis. Local applications which have Lekhana (scrapping) ability help in the debridement process. The methods of debridement applied in Ayurveda are designed in Figure 1.

#### Control of Infection and Inflammation - I

Infection causes pain and delayed healing. These can even be life threatening. A continued infection leads to persistent inflammatory response and oxygen free radicals. There is localised thrombosis and release of vaso-constricting metabolites that lead to tissue hypoxia.<sup>7</sup> This leads to further bacterial growth and tissue destruction. Ayurveda names microorganisms as Krimi. There is an acknowledgement of different kinds of poisons/toxins named as Visha. Ama the toxic metabolites are also called as Visha. Inflammation or Shotha is a result of Ama clogging the microchannels.<sup>8</sup> Ama Visha like the localised thrombosis an immune response is vaso-constricting. Infection management in Ayurveda is achieved through improved host resistance brought about by Ama Pachana (metabolising Ama) and also by the topical applications of natural germicidal

drugs. Given below are the set of infection control measures. (Figure 2)

**Moisture Balance -M**

Moistness in a wound has been discovered as a significant factor for healing. Moisture provides a transport medium for essential growth factors during epithelialisation. Moistness is also important for maintaining integrity of micro channel perfusion. Wound healing in Ayurveda is centred on moisture preservation. Rasa, the nutritive element is the key to the regeneration of all other tissues. Maintaining Rasa integrity entails adequate preservation of moisture at the wound site. Of the different formulations mentioned in 60 upakramas<sup>9</sup> only Avachurna (powder) is a dry application while Kashaya, Varti, Taila, etc. are all moisture based. Avachurnana is used when there is excess of exudates in order to maintain an optimum balance of moisture. The fat based applications not only preserve moisture but are rich sources of wound healing nutrients that permeate easily through cell membrane. Patradana (use of leaves) for bandaging is done with the sole aim of preserving moisture balance while preventing tissue damage that synthetic bandages are bound to do.<sup>10</sup> (Figure 3)

**Edge Advancement –E**

When the first three factors, debridement, infection control and moisture balance are ensured the wound

corners move towards each other and make closure, in the absence of other systemic hindering factors. This stage requires the proliferating epidermal cells to migrate. Hence a viable source of cells which can undergo cell division needs to be present at the site of the wound. These cells are replenished through adequate oxygen and nutrients. The Ropana<sup>11,12</sup> concept of Ayurveda means healing is dealt specifically with the intent of wound healing. Number of herbs are described for their Ropana potential, systemic factors such as the age, nutrition status, diabetic status, etc. also play a major role. Ropana requires discipline and mental strength on the part of the patient. The factors of tissue remodelling are designed in Figure 4.

**Role of Temperature -t**

TIME underlines the importance of maintaining moisture balance. Maintaining an optimum temperature is no less significant. A warm temperature improves angiogenesis and resultant oxygenation and nutrition. Ayurveda long recognised the benefits of this factor and used the mechanism of optimum heat application in wound management in the form of Sweda<sup>13</sup> and Vranadhupana.<sup>14</sup> However Nirvapana<sup>15</sup> (cooling measures) as an exception is advised for wounds with excessive heat as in burns. (Figure 5)

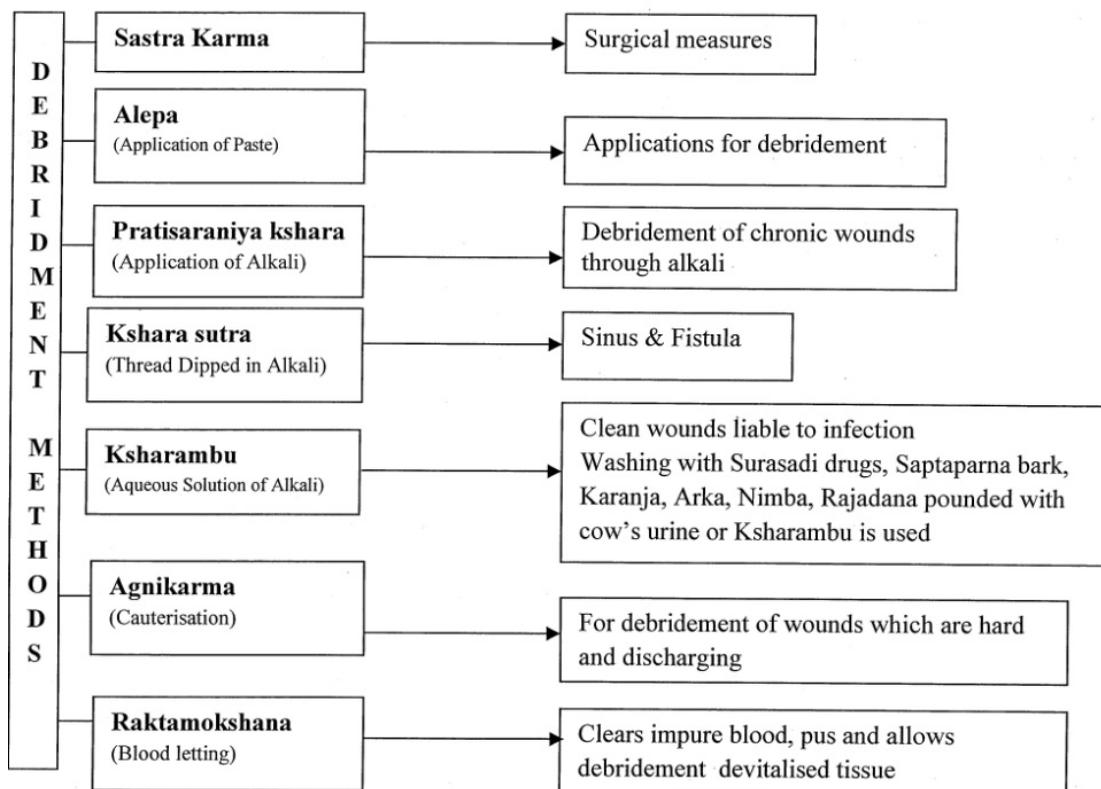


Figure 1: Debridement of De-Vitalized Tissue

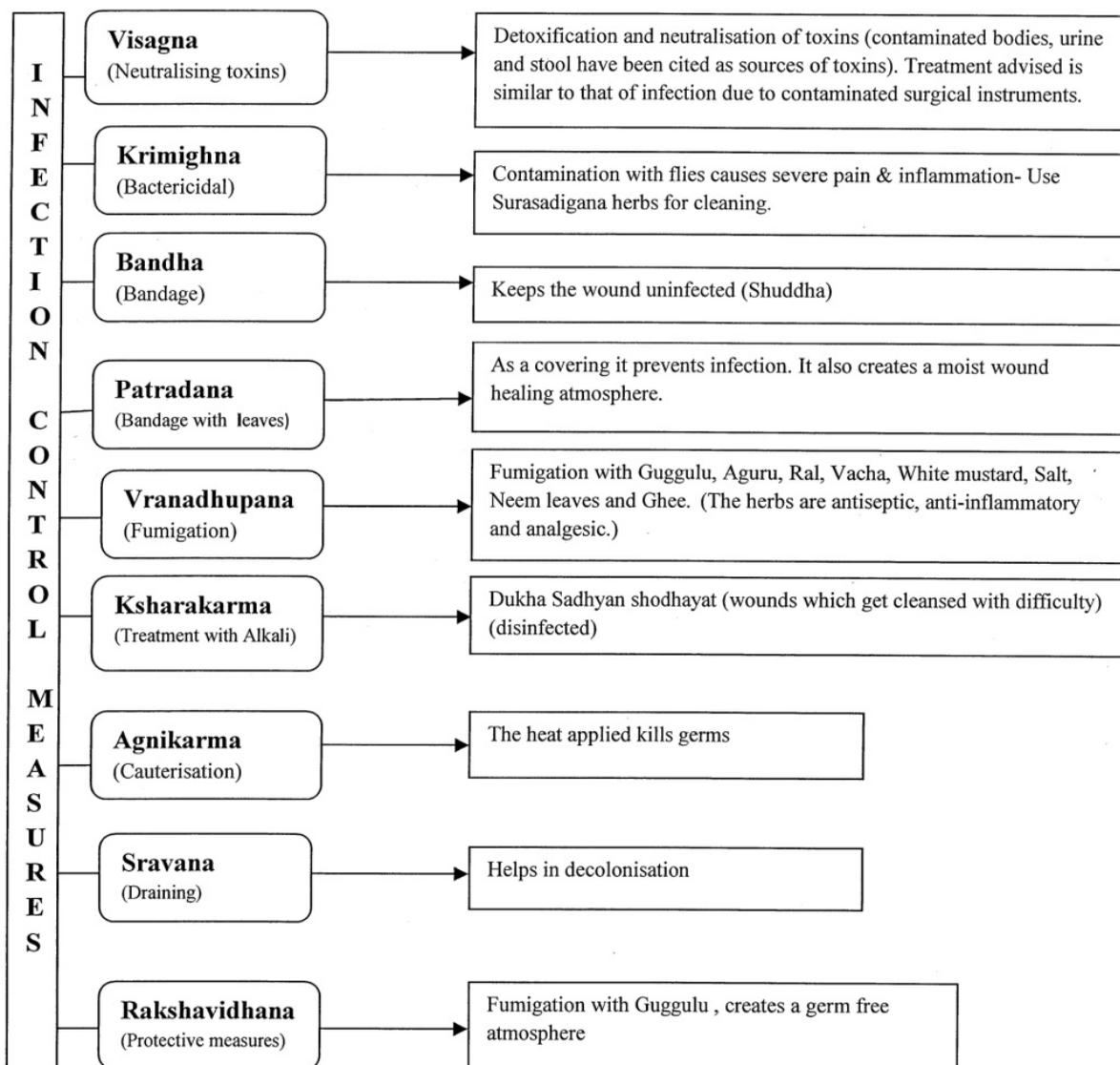


Figure 2: Infection Control for Wounds

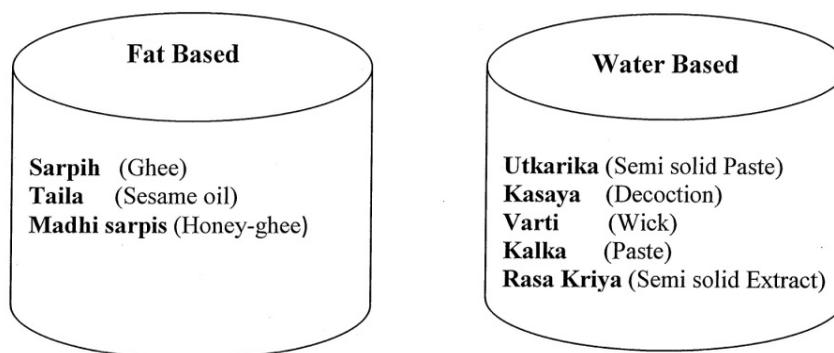


Figure 3: Pharmacological Formulations that Provide Moist Wound Healing

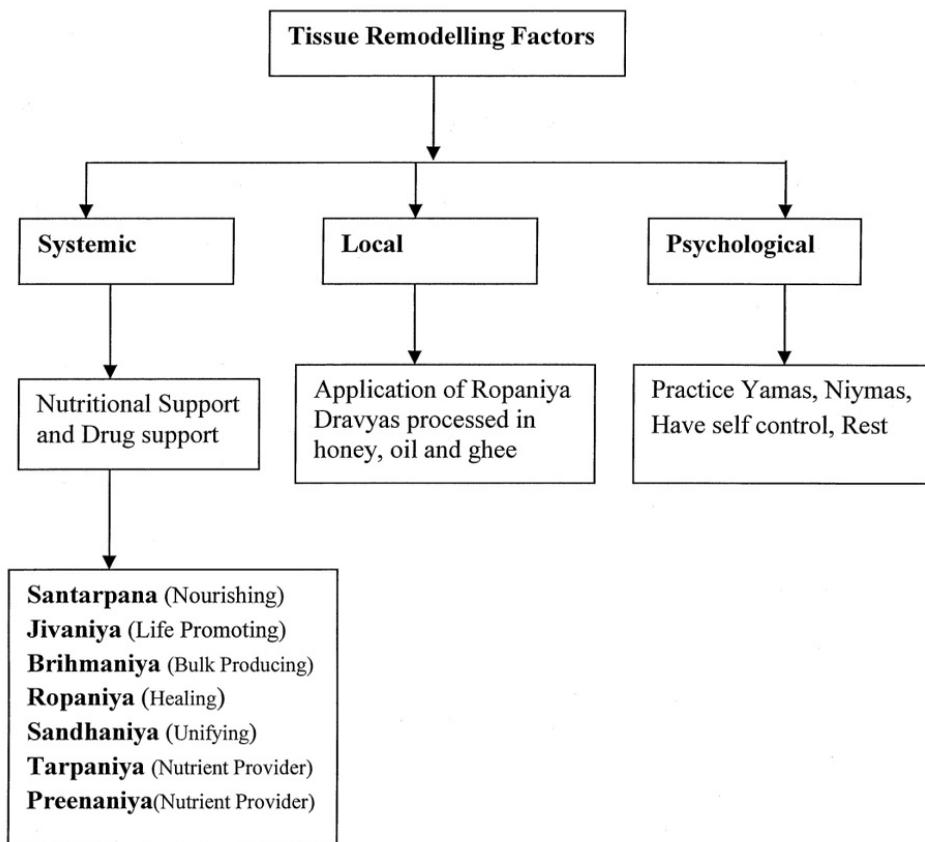


Figure 4: Edge Advancement

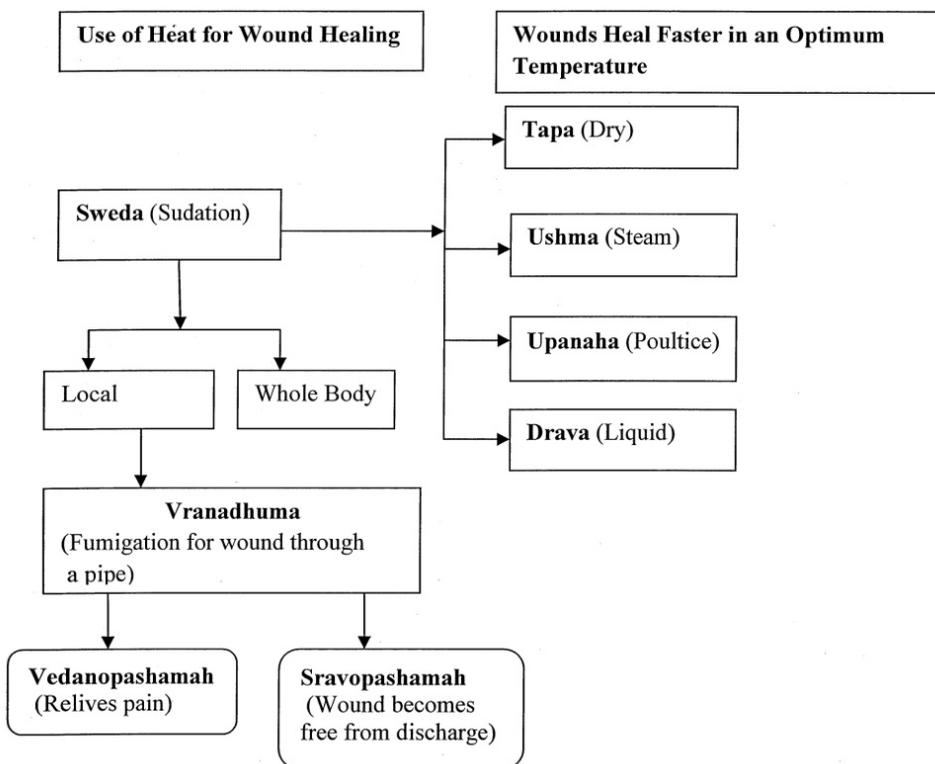


Figure 5: Temperature as a factor in Wound Healing

## CONCLUSION

The TIME set of factors have contributed an algorithmic frame work for wound bed preparation. Wound bed preparation is not dependent entirely on local conditions. Systemic factors play an equal role. The Shasti upakramas of Ayurveda have provided a detailed and feasible management for wounds. Ayurveda advocates that all wounds must follow the dictum of Shodhana (cleansing) and Ropana (healing) not only because these concepts are textually evident but also because they are practically effective as stated by Sushruta. Shodhana precedes Ropana. In a larger sense, Shodhana refers to purging the system of toxins and as a local measure constitutes debridement, exudate management, infection and inflammation control. Additionally inflammatory stage of wounds need to be managed with systemic Shodhana procedures like Vamana (induced emesis), Virechana (induced purgation), and Vasti (enemas). Conceptually there is no dichotomy between the TIME framework and the principles behind the Shashthi upakramas. The variation lies only with respect to the manner of application.

T- } The Shodana Set of Principles  
 I- }  
 M- } The Ropana Set of Principles  
 E- }

Unique wound management techniques from the Shashthi Upakramas like the use of heat, use of natural material like leaves for bandaging and adjunct measures like Krishnakarma (blackening), Pandukarma (whitening), Romasanjanana (repilation) and Lomapaharana (depilation) for near tissue replacement and remodelling could also be incorporated with TIME for better results in chronic and degenerative wounds. The use of conventional antiseptics which damage tissues but nevertheless continue to be prescribed for use at the proliferation and edge advancement stage needs to be re-examined. The fat based anointments and emulsions which are a rich source of vitamins, natural steroids and

wound healing phyto-chemicals needs to be explored especially in non-healing wounds. The TIME concept could be extended further with insights from Ayurveda for developing best practices for Wound management.

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