



Wound Bed Preparation

It's About TIME

Burn care is complex. It involves multisystem assessment, multidisciplinary care, and appropriate interventions. Only after the burn care professional is fairly certain the patient will survive the burn injury can treatment goals focus on burn wound closure. Inpatient hospital stays for burn patients range from a few days for small partial-thickness burns that heal on their own to several months for patients with large total body surface area burns and deep burns that often are exacerbated by other medical complications and require multiple surgeries to achieve wound closure.

Numerous advances have been made in burn wound management. Early excision and grafting have increased burn patient survival and recent technological advances such as bioengineered tissues have increased options for wound closure and better functional and cosmetic outcomes. Advanced wound care products include moist wound healing and sustained-release silver dressings and a wider selection of enzymatic debriding agents. Due to the chronicity of burn wound management, burn caregivers need to become familiar with these new dressing products and skin substitutes, not only in the acute care setting but also in the outpatient or community setting.

Wound bed preparation and the TIME principle incorporate debridement, infection treatment, and exudate management into a systematic approach to help restore the chronic wound bed environment onto a healing trajectory. The TIME system also can be applied to burn wound bed preparation to optimize the efficiency of advanced wound care and biotechnological therapies and reduce time to wound closure.

This is the eighth in a series of 12 articles that address wound bed preparation.



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Figure 1. Superficial burn.

The Problem — Dealing with the Complexity of Burn Wounds

Burn wound assessment. To properly classify a burn, clinicians must consider its type, severity, extent (total body surface area involved), and depth. The extent and depth of the burn are important in determining care requirements and expected survival.

Superficial burns, most commonly caused by sunburn, light contact with hot objects, or mild scalding by hot water or steam, involve only the epidermis. Initial symptoms include erythema and local pain from underlying edema. Typically, the skin is pink or light red with no blisters (see Figure 1). The area is painful to touch and usually heals without scarring in 3 to 5 days. If the lower extremities are involved, treatment for extensive sunburn includes slight elevation to decrease edema, application of a water-soluble lotion, and a mild analgesia for pain.

Partial-thickness burns, usually caused by minimal exposure to a hot liquid (splatters or splashes), steam (radiator scald), or a flash from fuel ignition, burning trash, or the like, may be superficial, mid-dermal, indeterminate, or deep. Superficial partial-thickness wounds involve the epidermis and the uppermost portion of the dermis and are characterized by blisters and a moist red or pink appearance (see Figure 2). With appropriate wound care and protection from infection, superficial partial-thickness burns usually heal within 1 to 2 weeks with minimal to no scarring. If the length of exposure to causative mechanisms is increased and/or the skin is exposed to higher temperature for a longer period of time, a deeper burn will result. Mid-dermal to indeterminate partial-thickness burns involve tissue destruction deeper into the mid-portion or lower portion of the dermis (see Figures 3 and 4). Healing times may range from greater than 2 weeks to 4 weeks or longer; these burns may require surgical closure.

Full-thickness burn injuries are caused by contact with concentrated chemicals or prolonged contact with high temperature liquids (>150° F), electrical contact, hot objects, flames, or ignited clothing, resulting in destruction of the epidermis, the dermis, and often subcutaneous fat, muscle or bone. The wound may appear charred, red, brown, black, or white (see Figure 5). Typically, the wound feels hard, dry, and leathery. A patient may feel pressure but exhibits a loss of



Figure 2. Superficial partial-thickness burn.



Figure 3. Mid-dermal partial-thickness burn.



Figure 4. Indeterminate to deep partial-thickness burn.

sensation in the full-thickness area. However, because partial-thickness burns and full-thickness burns are frequently concomitant, the report of pain may not be reliable in determining the depth of the burn injury.

The Solution - Incorporating the TIME Approach into Burn Wound Management

Initial care. Initial burn wound care includes removal of superficial debris such as soot, dirt, or grass using an antibacterial

solution. Standard protocol is to utilize an antimicrobial agent for coverage and prevention from bacteria growth within the burn wound. Typically, this has been achieved with silver sulfadiazine covered by a gauze dressing changed once or twice a day. Now clinicians also can address specific barriers to wound healing using the TIME approach (see Table 1).

T: Tissue non — viable or deficient. Wound debridement can be accomplished autolytically, chemically (enzymatic), mechanically, or surgically. The autolytic form is the most time-consuming; due to a greater risk of infection in burns, it is the least favored. Enzymatic debridement can be achieved using products such as GLADASE Papain-Urea Debriding Ointment in burn wounds that are not candidates for surgical debridement, as well as in conjunction with surgical debridement. Surgical debridement, the least time-consuming debridement method, is often necessary for deep partial-thickness and full-thickness to prevent infection and achieve ultimate burn wound closure.

I: Infection or inflammation. Burn wounds inevitably demonstrate some degree of bacterial contamination/infection during recovery. Although debriding necrotic tissue helps remove the environment that promotes bacterial growth, local antimicrobial coverage is often necessary. The emergence of resistant organisms and an increase in the virulence of organisms present additional challenges for healing the ever-changing burn wound, graft site, or skin substitute. The gold standard has been initial treatment with topical antimicrobials (ie, silver sulfadiazine, mafenide acetate, or silver nitrate). Over the last decade, newer technologies such as nanocrystalline silver dressings like ACTICOAT Burn Dressing have provided the burn caregiver with alternatives to the topical antimicrobials traditionally used in burn wound care.

M: Moisture imbalance. Burn wound edema is expected for the first 48 to 72 hours post burn as well as 24 to 72 hours post-operative grafting. Initially, excess exudate results from local tissue edema. In addition to elevating swollen extremities, consistent management requires the use of modern dressing materials such as EXUDRY Wound Dressing. A highly absorbent one-piece, multilayer sealed dressing, EXUDRY protects the healing burn wound, graft site, or skin substitute from friction, mechanical dislodgment, and shear forces. It can be used on all heavily exuding wounds, including burns, ulcers, pressure sores, skin grafts, donor sites, and fungating wounds.



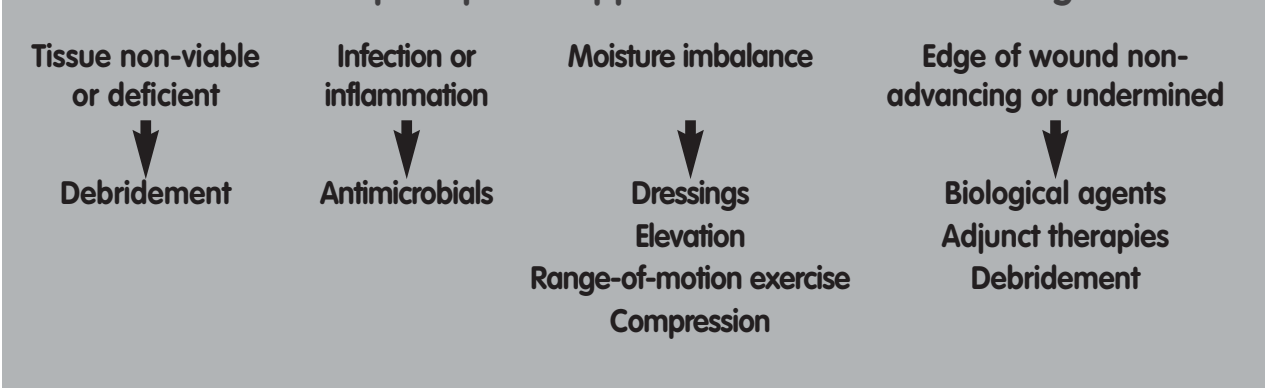
Figure 5. Full-thickness burn.

E: Edge of wound, non-advancing or undermined. Newer skin substitutes promote faster epithelialization than traditional treatment with silver sulfadiazine for partial-thickness burn injuries. These skin substitutes also offer the healthcare professional additional options for temporary wound closure when definitive autograft closure may not be possible, including allogenic (cadaver) skin, temporary synthetic and biologic covers, and permanent epidermal and dermal matrix and structural systems. One product is TRANSCYTE, a human fibroblast-derived temporary skin substitute consisting of a polymer membrane and human fibroblast cells cultured under aseptic conditions *in vitro* on a nylon mesh. As the fibroblasts proliferate within the nylon mesh, they secrete human dermal collagen, matrix proteins, and growth factors. TRANSCYTE is indicated for use as a temporary wound covering for surgically excised full-thickness and deep partial-thickness thermal burn wounds in patients requiring a skin cover before autograft placement. TRANSCYTE also is indicated for the treatment of mid-dermal to indeterminate depth burn wounds that typically require debridement and may heal without grafting.

Conclusion

Wound care professionals faced with the complexities of burn wound treatment can employ the TIME principles of wound bed management in the provision of care. Products featuring newer technologies complement this approach to chronic wound healing and enable the non-burn professional to provide optimal care to patients with these challenging injuries.





Table 1. The TIME principle as applied to burn wound management.



WOUND BED PREPARATION

Removing the barriers

TIME[±] - Principles of Wound Bed Preparation

Clinical Observations	Proposed Pathophysiology	WBP Clinical Actions	Effect of WBP Actions	Clinical Outcome	SOLUTIONS
T issue Non-viable or Deficient	Defective matrix and cell debris impair healing	Debridement (episodic or continuous): – Autolytic, sharp surgical, enzymatic, mechanical or biological – Biological agents	Restoration of wound base and functional extra-cellular matrix proteins	Viable wound base	GLADASE[®] Papain-Urea Debriding Ointment**  GLADASE[®] C Debriding, Deodorizing and Healing Ointment**
I nfection or Inflammation	High bacterial counts or prolonged inflammation: + Inflammatory cytokines + Protease activity - Growth factor activity	Remove infected foci Topical/systemic – Antimicrobials – Anti-inflammatories – Protease inhibition	Low bacterial counts or controlled inflammation: + Inflammatory cytokines + Protease activity - Growth factor activity	Bacterial balance and reduced inflammation	 ACTICOAT[®] [with SILCRYST Nanocrystals]†
M oisture Imbalance	Dessication slows epithelial cell migration Excessive fluid causes maceration of wound margin	Apply moisture balancing dressings Compression, negative pressure or other methods of removing fluid	Restored epithelial cell migration, dessication avoided Edema, excessive fluid controlled, maceration avoided	Moisture balance	 ALLEVYN[®]
E dge of Wound Non Advancing or Undermined	Non-migrating keratinocytes Non-responsive wound cells and abnormalities in protease activity	Reassess cause or consider corrective therapies: – Debridement – Skin grafts – Biological agents – Adjunctive therapies	Migrating keratinocytes and responsive wound cells Restoration of appropriate protease profile	Advancing epidermal margin	 DERMAGRAFT[®] Human Fibroblast-Derived Dermal Substitute**

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