Special Considerations in Wound Bed Preparation 2011: An Update

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R. Gary Sibbald BSc MD MEd FRCPC(Med, Derm) MACP FAAD MAPWCA, Professor, Public Health Sciences and Medicine; Director, International Interprofessional Wound Care Course and Masters of Science in Community Health; Dalla Lana School of Public Health, University of Toronto, Toronto, Ontario, Canada

Laurie Goodman BA RN MHScN, Director, and Mississauga Halton Wound Care Initiative, Toronto Regional Wound Clinics, Toronto, Ontario, Canada

Kevin Y. Woo PhD RN FAPWCA, Assistant Professor, Faculty of Health Sciences, School of Nursing, Queen's University, Kingston; Wound Care Consultant, West Park Health Centre, Toronto, Ontario, Canada

Diane L. Krasner PhD RN CWCN CWS MAPWCA FAAN, Clinical Nurse Specialist/Wound, Ostomy, Continence Nurse, Rest Haven–York; Wound and Skin Care Consultant, York, Pennsylvania, USA

Hiske Smart MA RN PG Dip (UK) IIWCC (Canada), Clinical Nurse Specialist and IIWCC Course Coordinator – South Africa, Division of Community Health, Department of Interdisciplinary Health Sciences, Stellenbosch University, Stellenbosch, South Africa

Local Wound Care

5. Assess and monitor the wound history and physical examination

Documentation of a detailed patient and wound assessment is a legal requirement from both an organizational and professional standards perspective. Specific details about the wound history and physical appearance will facilitate communication within the patient's circle of care. This includes the type of wound and its history, the patient-centred plan of care and targeted patient-specific goals.[57] The details of the wound assessment should be communicated to other professionals when referrals are made. Whether a wound is healable, nonhealable or maintenance, an individualized care plan is made to identify specific interventions and outcomes that the patient and interprofessional team agree upon and modify based on a new holistic interprofessional assessment.

Using a framework allows consistent documentation of a wound. When a framework is used to assess a wound over time, clinicians can identify if a wound is improving, stalled or deteriorating. One example of such a framework is the mnemonic MEASURE[58] – the wound location plus MEASURE is described:

- **M**easure size – the longest length and the widest width at right angles.
- **E**xudate amount (none, scant, moderate, heavy) and characteristics (serous, sanguineous, pustular or combinations).
- **A**ppearance (base: necrotic [black], fibrin [firm yellow], slough [soft yellow] or granulation tissue [pink and healthy vs. red and friable = easy bleeding, unhealthy]).
- **S**uffering (pain).
- **U**ndermining (measure in centimetres and use hands of clock to document: 12 o'clock, 6 o'clock and so on).
- **R**e-evaluate.
- **E**dge (hyperkeratotic, macerated, normal).

There are several new electronic technologies available for wound assessment, but they may be costly for clinicians and healthcare systems. Novel camera systems accurately calculate the length, width, depth and surface of exposed wound areas. Limitations include undermined areas or sinuses that are not measureable using this technology, requiring supplementation by visual clinical inspection and probing. Wound assessment devices differ markedly from computer-based documentation systems that capture multiple data points and assessments about wound parameters inputted by skilled clinicians.

6. Gently cleanse wounds with low-toxicity solutions: saline, water and acetic acid (0.5–1.0%). Do not irrigate wounds where you cannot see where the solution is going or cannot retrieve (or aspirate) the irrigating solution

The standard of care for wound cleansing is to use solutions that are gentle and the least cytotoxic to the wound: saline, water and acetic acid (0.5–1.0%). Research has shown that certain solutions can be cytotoxic to healing cells, such as fibroblasts, in vitro.[59]

In an analysis of Cochrane Reviews prior to 2008, the authors concluded: "There is not strong evidence that cleansing wounds per se increases healing or reduces infection." The Cochrane Collaboration updated evidence reviews on wound cleansing for PUs in 2011 and concluded there is "no good evidence to support use of any particular wound cleansing solution or technique for PUs."[60] A specific type of solution for wound cleansing in adults was the subject of an additional evidence review in 2010. The authors concluded that there was no evidence to indicate that using tap water to cleanse an acute wound increases infection rates. In addition, there was no strong evidence demonstrating that cleansing of wounds at all decreases healing infection or

Gulnaz Tariq RN BSN PG Dip (Pak), Wound Care Specialist, Sheikh Khalifa Medical City; IIWCC Course Coordinator – Abu Dhabi, Abu Dhabi, United Arab Emirates

Elizabeth A. Ayello PhD RN ACNS-BC CWON MAPWCA FAAN, Faculty, Excelsior College School of Nursing, Albany; President, Ayello, Harris and Associates, Inc., Copake, New York, USA

Robert E. Burrell PhD MSc, Professor and Chair, Department of Biomedical Engineering, Faculties of Engineering and Medicine and Dentistry; Professor and Canada Research Chair, Nanostructured Biomaterials Chemical and Materials Engineering, Faculty of Engineering, University of Alberta, Edmonton, Alberta, Canada

David H. Keast, MD MSc BSc(Hon) DipEd CCFP FCFP, Centre Director, Aging, Rehabilitation and Geriatric Care Research Centre, Lawson Health Research Institute, London, Ontario, Canada

Dieter Mayer MD FEBVS FAPWCA, Head of Wound Care, Senior Vascular Consultant, Clinic for Cardiovascular Surgery, University Hospital of Zurich, Zurich, Switzerland

Linda Norton BScOT OT Reg(ONT) MScCH, National Educator, Shoppers Home Health Care; Director, Interprofessional Team, Canadian Association of Wound Care Institute, Toronto, Ontario, Canada

Richard "Sal" Salcido MD, William Erdman Professor, Department of Rehabilitation Medicine; Senior Fellow, Institute on Aging; Associate, Institute of Medicine and Bioengineering, University of Pennsylvania Health System, Philadelphia, Pennsylvania, USA

promotes healing.[61] Expert opinion recommends that caution should be considered in the use of tap water for immunocompromised individuals, especially the use of nonpotable water, which may be a problem in developing countries.

Avoiding cytotoxic solutions, such as Dakin's and povidone-iodine, to cleanse healable wounds or using them for only limited periods is reasonably prudent practice. However, there is a place for these agents in the management of maintenance or nonhealable wounds to potentially control bioburden and odour. In these cases, the reduction in bioburden and moisture reduction outweighs the small potential for tissue toxicity.

Wound irrigation has also been the subject of controversy and disagreement between health professionals. In general, the authors recommend that clinicians should not irrigate wounds where they cannot see where the solution is being instilled into the dead space at the base of the wound, or if they cannot retrieve the irrigating solution. More research on wound cleansing is needed.

7. Debride: healable wounds – sharp or conservative surgical, autolytic, mechanical, enzymatic, biological (medical maggots); nonhealable and maintenance – conservative surgical or other methods of removal of nonviable slough

The wound bed is optimally prepared by aggressive and regular debridement of any firm eschar or soft slough if the wound is healable. A firm eschar serves as a pro-inflammatory stimulus inhibiting healing, whereas the slough acts as a culture media for bacterial proliferation and should be removed.[62] Debridement may also promote healing by removing senescent cells that are deficient in cellular activities and biofilms that contain the bacterial colonies.[63]

Sharp debridement is the most expeditious method but may not always be feasible because of pain, bleeding potential, cost, professional/system regulations and lack of clinician expertise. Cardinal et al conducted a retrospective review of 366 persons with VLUs and 310 persons with DFUs over 12 weeks, observing wound surface area changes and closure rates.[64] Interestingly, VLUs had a significantly higher median wound surface area reduction with surgical debridement (when clinically indicated due to the presence of debris) vs. no surgical debridement (34%, $p<0.019$). Centres with more frequent debridement were associated with higher rates of wound closure ($p<0.007$ VLUs, $p<0.015$ DFUs). The debridement frequency did not statistically correlate to higher rates of wound closure. There was some minor evidence of a positive benefit of serial debridement in DFUs (odds ratio 2.35; $p<0.069$).

Alternatively, autolytic debridement is most accepted to work by keeping a moist wound environment to enhance the activities of phagocytic cells and endogenous enzymes on nonviable tissues. Mechanical debridement with saline wet-to-dry dressing contributes to local trauma and pain. In the US, the Centers for Medicare and Medicaid Services, in its Tag F314 guidance, cautions that there should be limited use of wet-to-dry dressings. Emerging technology using ultrasonic devices has also been demonstrated to aid wound bed preparation without the incumbent painful and traumatic scraping and cutting associated with sharp and mechanical debridement. When using enzymatic debridement, clinicians should ensure that the cleansing solutions and type of dressing used to cover the wound do not interfere with or cancel out the action of the enzyme.

In summary, the different methods of debridement have distinct features in terms of pain potential, cost, healthcare professional time and skill level required, resources used and wound characteristics. Select the appropriate method of wound debridement considering the patient, the wound characteristics, and the skill and knowledge of the clinician, along with the available resources.

8. Assess and treat the wound for superficial critical colonization/deep infection/abnormal persistent inflammation (mnemonic NERDS), deep infection (mnemonic STONEES) or persistent inflammation: any 3 NERDS – treat topically: Nonhealing, ↑ Exudate, Red friable tissue, Debris, Smell; any 3 STONEES – treat systemically: ↑ Size, ↑ Temperature, Os, New breakdown, ↑ Exudate, ↑ Erythema/edema (cellulitis), Smell; persistent inflammation (non-infectious): topical and/or systemic anti-inflammatories.

Chronic wounds containing bacteria and/or the presence of bacteria obtained from a surface swab do not define or portend infection. In fact, the mean number of bacterial species per chronic ulcer has been found to range from 1.6 to 4.4.[65] Critical to wound healing, however, is achieving an appropriate bacterial balance and understanding the differences between contamination, colonization and frank bacterial damage with surface critical colonization or surrounding/deep infection. The risk of infection is determined by the number and nature of invading bacteria as well as host resistance, as outlined in the following equation:

Infection = number of organisms x organism virulence

Host resistance

Host resistance is the most important factor in infection, and refers to the host's ability to resist bacterial

invasion and prevent bacterial damage through the immune response.[66] In addition, an adequate blood supply is needed for the wound to heal, as a decreased or inadequate blood supply favours bacterial proliferation and damage that may prevent or delay healing. Infection is more prevalent in certain disease conditions. For example, individuals with diabetes have at least a 10-fold greater risk of being hospitalized for soft tissue and bone infections of the foot than individuals without diabetes.[67] Local factors inhibiting healing may include a large wound size, the presence of foreign bodies (e.g. prosthetic joints, a thread or remnants of gauze or a retained suture) and an untreated deeper infection, such as osteomyelitis.[68] External contamination of the wound bed by microorganisms can occur from the ambient environment, dressings and the patient's secretions and hands, along with the hands of healthcare providers (alcohol hand rinses are more effective in reducing hand bacteria than washing with soap and water).

By using this superficial and deep-surrounding tissue separation, the clinician can identify wounds with increased bacterial burden that may respond to topical antimicrobials and deep infection that usually requires the use of systemic antimicrobial agents. The mnemonics NERDS and STONEES represent the initials of the signs to categorize the 2 levels of bacterial damage or infection (see Enabler on page 22, Spring 2012). This concept was introduced in 2007 and validated in 2009.[66,69] Three or more of these signs should be sought for the diagnosis in each level. If increased exudate and odour are present, additional signs are needed to determine if the damage is superficial, deep or both.

There are now at least 5 classes of antimicrobial dressings and some miscellaneous products for use in chronic wounds with critical colonization, as defined by any 3 of the NERDS criteria:

- Silver dressings combined with alginates, foams, Hydrofibers and hydrogels.
- Honey dressings in a calcium alginate wafer and hydrogel.
- Iodine in a cadexomer carbohydrate or polyethylene glycol slow-release formulation.
- PHMB (polyhexamethylene biguanidine) derivative of chlorhexidine in a foam or gauze packing.
- Miscellaneous antimicrobial dressings, often with a paucity of clinical studies to support their use.

The treatment of critical colonization often takes 2–4 weeks in a healable wound where the cause has been corrected and patient-centred concerns have been addressed. There is some, but limited, evidence to show the benefit of these dressings.[70] If the wound is in bacterial balance, antibacterial dressings are not needed for the re-epithelialization stage of wound healing, unless they also provide anti-inflammatory activity.[70,71] They are also not efficacious in the treatment of deep and surrounding tissue infection that requires the use of systemic agents. Studies that do not select the proper subpopulation (e.g. healable critically colonized wounds without deep infection) or measure complete wound healing have failed to demonstrate any benefit from these dressings.[72]

The use of antimicrobial dressings should be reviewed at frequent and regular intervals every 1–2 weeks and discontinued if critical colonization has been corrected or if they do not demonstrate a beneficial effect after 2–4 weeks. There is currently a great tendency to overuse antimicrobial dressings, creating a cost-inefficient use of these useful devices. The conflicting evidence and misuse of these dressings have led some European healthcare systems to completely delist silver products.

Silver dressings

The effectiveness of silver-releasing dressings in the management of nonhealing (stalled) chronic wounds has been reviewed in a meta-analysis.[73] In comparison to alternative antimicrobials, silver dressings significantly:

- improved the wound-healing rate (95% confidence interval [CI] 0.16–0.39, $p<0.001$);
- reduced odour (95% CI 0.24–0.52, $p<0.001$) and pain-related symptoms (95% CI 0.18–0.47, $p<0.001$);
- decreased wound exudate (95% CI 0.17–0.44, $p<0.001$); and
- had a prolonged dressing wear time (95% CI 0.19–0.48, $p<0.028$).

Silver's broad spectrum of antimicrobial activity can be used in critically colonized chronic wounds that have the ability to heal. Silver must be ionized to exert an antimicrobial effect. Ionized silver requires an aqueous or water environment and should not be used in a maintenance or nonhealable wound where the desired outcome is the combination of moisture reduction and bacterial reduction. Silver should not be in close proximity to any oil-based products (e.g. petrolatum, zinc oxide) where the oil molecules may interfere with the ionization of the silver. Products that produce a continuous supply of ionized silver are likely to be more efficacious, and higher levels of silver release are often necessary to treat micro-organisms such as *Pseudomonas* in a complete environment, such as a wound.

Pseudomonas requires a higher silver level than most other bacterial organisms. Silver resistance is uncommon because there are at least 3 antimicrobial mechanisms with silver targeting and combining with membranes, cytoplasmic organelles and DNA.

The amount of silver released from these dressings is a fraction of that released from silver sulfadiazine cream formulations. Serum silver levels even from high-release silver dressings are in the 1–5 μm range. Modern silver dressings seldom exceed the normal range unless large surface areas are treated over a prolonged time or the patient has a large skin surface area to total weight ratio. Silver dressings can cause temporary periwound staining but do not leave permanent silver deposits in the dermis (argyria or blue discoloration of the skin). The silver in the dressing should be combined with the appropriate moisture balance format matched to the wound to control exudate and prevent maceration, but facilitate the delivery of ionized silver to the wound surface.

Honey, iodine and PHMB

The Cochrane Collaboration conducted a systematic review of the honey literature and concluded that honey, as a topical treatment for superficial and partial-thickness burns, may improve healing times compared with some conventional dressings. Jull et al conducted a multicentre randomized controlled trial on VLUs with compression comparing honey to usual care.[74] There were 187 patients in the honey group and 181 patients in the usual-care group, with no difference between the 2 groups for total wound healing at 12 weeks.

In clinical practice, honey dressings may be useful for thick eschar, which often continuously reforms when treated with other dressings. Some of this action may be due to the antibacterial and hyperosmolar characteristics of the honey. Scoring the wound with a blade to help break down the eschar may facilitate the process. Ten trials have been conducted with cadexomer iodine and some are old, with venous ulcers treated topically without compression. In a randomized controlled trial study comparing cadexomer iodine with standard care with both groups receiving compression, the daily or weekly healing rates favoured cadexomer iodine.[75] In a pilot study of PHMB foam compared with foam alone, the PHMB dressing resulted in decreased pain and no change in wound size.[76]

Evaluating Evidence of Antimicrobials in Vitro and Animal Models: The Literature

Beware of in vitro testing of antimicrobial dressings because these results often do not correlate with clinical activity. Although studies may demonstrate statistical significance, clinical significance is the parameter of interest; moreover, the strength of evidence for the majority of these in vitro studies is low. When evaluating topical antimicrobial agents for wound treatment, appropriate tests must be used. For instance, the in vitro evaluation of an antimicrobial agent such as silver can be performed with a multitude of tests, but of these, only the logarithmic reduction or decimal reduction time test conducted in serum has been shown to predict clinical outcomes.[77,78] In vivo antimicrobial assays, such as the Walker Mason modified model (rodent) or the Wright model (porcine), can also be used with success to determine antimicrobial efficacy.[79] Similarly, the efficacy of topical agents on wound healing can be evaluated in vitro (cellular culture or tissue explant models) or in vivo (rodent or porcine wound-healing models). However, the only model that predicts a clinical outcome is the porcine model of wound healing.[80]

A recent Cochrane Review explored antibiotic and antiseptic use for persons with VLUs. The authors concluded that there is no evidence for the routine use of systemic antibiotics[75] when treating the cause of VLUs.

9. Select a dressing to match the appropriate wound and individual person characteristics:

- Healable wounds: autolytic debridement: alginates, hydrogels, hydrocolloids, acrylics
- Critical colonization: silver, iodides, PHMB, honey
- Persistent inflammation: anti-inflammatory dressings
- Moisture balance: foams, Hydrofibers, alginates, hydrocolloids, films, acrylics
- Nonhealable, maintenance wounds: chlorhexidine, povidone-iodine

Whenever patients and healthcare professionals develop a treatment plan for patients with wounds, dressing selection is an important primary focus. Once the healable, nonhealable or maintenance status of a wound is determined, appropriate holistic interprofessional interventions that address cofactors can be optimized. The dressing selection should be the last part of the process because if the healability is not accurately assessed or other cofactors are unmanaged, the wound will not heal. Dressing choice needs to consider unit costs and clinical effectiveness. Kerstein et al explored cost-effectiveness for venous ulcers and PUs, and concluded that the purchase price of the dressing should not be the only indicator.[81] Normal saline gauze dressings (least expensive for product) were found to be the most expensive when nursing time and patient feedback were taken into account (Table 6).

TABLE 6

Modern classes of dressings

Class	Description	Tissue debridement	Infection	Moisture balance	Indications/contraindications
1. Films/membranes	• Semipermeable adhesive sheet; impermeable to water molecules and bacteria	+	–	–	• Moisture vapour transmission rate varies from film to film • Should not be used on draining or infected wounds* • Create an occlusive barrier against infection
2. Nonadherent	• Sheets of low adherence to tissue • Nonmedicated tulles	–	–	–	• Allow drainage to seep through pores to secondary dressings • Facilitate application of topical medications
3. Hydrogels	• Polymers with high water content • Available in gels, solid sheets or impregnated gauze	++	–/+	++	• Should not be used on draining wounds • Solid sheets should not be used on infected wounds
4. Hydrocolloids	• May contain gelatine, sodium carboxymethylcellulose, polysaccharides and/or pectin; sheet dressings are occlusive with a polyurethane film outer layer	+++	–/+	++	• Use with care on fragile skin • Should stay in place for several days • Should not be used on heavily draining or infected wounds* • Create an occlusive barrier to protect the wound from outside contamination • Odour may accompany dressing change and should not be confused with infection
5. Acrylics	• Clear acrylic pad enclosed between 2 layers of transparent adhesive film	+++	–/+	++	• Use on low- to moderately draining wounds where the dressing may stay in place for an extended time • May observe wound without changing
6. Calcium alginates	• Sheets or fibrous ropes of calcium sodium alginate (seaweed derivative); have hemostatic capabilities	++	+	+++	• Should not be used on dry wounds • Low tensile strength – avoid packing into narrow, deep sinuses • Bioreabsorbable
7. Composite	• Multilayered, combination dressings to increase absorbency and autolysis	+	–	+++	• Use on wounds where dressings may stay in place for several days*
8. Foams	• Nonadhesive or adhesive polyurethane foam; may have occlusive backing; sheets or cavity packing; some have fluid lock	–	–	+++	• Use on moderately to heavily draining wounds • Occlusive foams should not be used on heavily draining or infected wounds*
9. Charcoal	• Contains odour-absorbing charcoal within product	–	–	+	• Some charcoal products are inactivated by moisture • Ensure dressing edges are sealed
10. Hypertonic	• Sheet, ribbon or gel impregnated with sodium concentrate	+	+	++	• Gauze ribbon should not be used on dry wounds • May be painful on sensitive tissue • Gel may be used on dry wounds
11. Hydrophilic fibres	• Sheet or packing strip of sodium carboxymethylcellulose; converts to a solid gel when activated by moisture (fluid lock)	+	–	+++	• Best for moderate amount of exudates • Should not be used on dry wounds • Low tensile strength – avoid packing into the narrow, deep sinus
12. Antimicrobials	• Silver, iodides, PHMB, honey aniline dyes with vehicle for delivery: sheets, gels, alginates, foams or paste	+	+++	+	• Broad spectrum against bacteria • Should not to be used on patients with known hypersensitivities to any product component
13. Other devices	• Negative-pressure wound therapy applies localized negative pressure to the surface and margins of wound	–	+	+++	• This negative pressure-distributing dressing actively removes fluid from wound and promotes wound edge approximation • Advanced skill required for patient selection
14. Biologics	• Living human fibroblasts provided in sheets at ambient or frozen temperature; extracellular matrix • Collagen-containing preparations; hyaluronic acid, platelet-derived growth factor	–	–	–	• Should not be used on wounds with infection, sinus tracts or excessive exudate or with patients known to have hypersensitivity to any of the product components • Cultural issues related to source • Advanced skill required for patient selection

Adapted from the CAWC.

* Use with caution if critical colonization is suspected.

–, no activity. +, minimal activity. ++, moderate activity. +++, strong activity.

Persistent Inflammation

Chronic wounds may stall in the inflammatory stage. These wounds demonstrate markedly increased activity of inflammatory cells and associated mediators such as matrix metalloproteinases (MMPs) and elastase.[82] Wound healing is stalled because degradation of the extracellular matrix and growth factors occurs more rapidly than their synthesis, hindering the wound from progressing toward the proliferative phase and ultimately re-epithelialization. Harding et al reported that the longer a wound remains in the inflammatory phase, the more cellular defects are detected with potentially delayed healing.[83] Recently, there has been a renewal of interest in wound diagnostic testing that will result in tests for increased MMPs at the bedside. There are wound dressings with oxidized reduced collagen and cellulose that can trap MMPs, and these dressings can be combined with antimicrobials such as silver. In the Sibbald cube (see Enabler on page 22, Spring 2012), these specialized dressings can be combined antimicrobials, depending on the presence of the mnemonic NERDS (superficial antibacterial dressing criteria) or STONEES (systemic antibiotic criteria) and where the presence of increased inflammation can also be treated topically or systemically.

Appropriate moisture is required to facilitate the action of growth factors, cytokines and migration of cells including fibroblasts and keratinocytes. Moisture balance is a delicate process. Excessive moisture can potentially damage the surrounding skin of a wound, leading to maceration and potential breakdown.[84] Conversely, inadequate moisture in the wound environment can impede cellular activities and promote eschar formation, resulting in poor wound healing. A moisture-balanced wound environment is maintained primarily by modern dressings with occlusive, semi-occlusive, absorptive, hydrating and hemostatic characteristics, depending on the drainage and other wound bed properties.

TABLE 7

Summary of advanced therapy options

Substantiated advanced therapies	Indication	RCT or meta-analysis available?	Results
OASIS	VLU	Yes[87]	Complete healing
	DNFU	Yes[88]	Complete healing equal to PDGF
Growth factors (PDGF)	DNFU	Yes[89,90]	Complete healing
Apligraf	DNFU	Yes[91–93]	Complete healing
(epidermal cells, dermal fibroblasts, bovine collagen)	VLU	Yes[94]	Complete healing
Dermagraft (fibroblasts)	DNFU	Yes[95–97]	Complete healing
Hyperbaric oxygen therapy	DNFU	Yes[98]	Prevents amputation
Electrical stimulation	PU	Yes[99]	Complete healing
Therapeutic ultrasound	VLU	Yes[100]	Faster healing
	DNFU	Yes[101]	Complete healing
Negative-pressure wound therapy	Postsurgical wounds	Yes[102]	Complete healing
Promogran	VLU	Yes[103,104]	Decrease wound size

DNFU = diabetic neurotrophic foot ulcer; PDGF = platelet-derived growth factor; PU = pressure ulcer; RCT = randomized controlled trial

10. Evaluate expected rate of wound healing: healable wounds should be 30% smaller by week 4 to heal by week 12. Wounds not healing at the expected rate should be reclassified or reassessed, and the plan of care revised

It is noted that a 20–40% reduction in 2 and 4 weeks is likely to be a reliable predictor of healing.[11,85] Sheehan et al noted that a 50% reduction at week 4 was a good predictor for persons with DFUs.[86] One measure of healing is the clinical observation of the edge of the wound. If the wound edge is not migrating after appropriate wound bed preparation (debridement, bacterial balance, moisture balance) and healing is stalled, then advanced therapies should be considered. The first step prior to initiating the edge-effect therapies is a reassessment of the patient to rule out other causes and cofactors. Clinicians need to remember that wound healing is not always the primary outcome. Consider other wound-related outcomes, such as reduced pain, reduced bacterial load, reduced dressing changes or an improved quality of life.

11. Use active wound therapies (e.g. skin grafts, biological agents, adjunctive therapies) when other factors have been corrected and healing still does not progress (stalled wound)

A nonhealing wound may have a cliff-like edge between the upper epithelium and the lower granulation in comparison to a healing wound with tapered edges like the shore of a sandy beach. Several edge-effect therapies support the addition of missing components: growth factors, fibroblasts, or epithelial

cells or matrix components. If all the factors are corrected in a healable wound, active adjunctive therapies may be considered (Table 7).[87-104]

Provide Organization Support

12. For improved outcomes, education and evidence-informed practice must be tied to interprofessional teams and improved cost-effective patient care outcomes with the cooperation of healthcare systems

When a patient has a wound, it is important that the healthcare team provides education to the patient and his/her circle of care and involves everyone in the treatment plan. Healthcare professionals may assume that patients know more about their wounds than their current understanding. One study surveyed persons with DFUs and their self-foot-care behaviours. Healthcare providers conducted a detailed foot assessment and provided education on each visit. The results indicated that the knowledge base is often less than expected by the healthcare professional and that this leads to treatment gaps.[105] The behaviour of healthcare providers changed during the course of the study, resulting in an increased chance that the patient's socks were removed, leading to a thorough examination and patient education.

Importance of Holistic Interprofessional Coordinated and Collaborative Care

Accurate wound diagnosis and the development of successful treatments plans can be a challenging undertaking, given the complexity of chronic wounds. A holistic interprofessional approach to care requires that each member of the team has unique professional knowledge that contributes to the individualized plan of care. In the management of patients with DFUs, utilizing a team approach and primary healing outcomes can be associated with relatively low costs related to a visit to an interprofessional team, antibiotics and plantar pressure downloading in the community setting.[106] When healing occurs following an amputation, multiple hospital admissions and an extended length of hospital stay are tabulated, with a significantly higher cost of healing. Implemented treatment plans that do not yield wound-healing rates at the expected trajectory require a timely referral to an interprofessional team that can re-evaluate the diagnosis and causative factors. Redefining the treatment goals with input from the patient, family and healthcare provider is essential. Given geographical and system differences, the ideal full complement of an interprofessional expert team may not always be accessible. Therefore, it is important to realize that only 2 disciplines working collaboratively with the patient and/or family may be successful.

Clinicians must distinguish between interdisciplinary networks with 2 members of the same profession (such as 2 nurses or assistants vs. a nurse practitioner, who may have a similar role to a physician on an interprofessional team), compared with the physician and nurse of an interprofessional team. For chronic wound care, the physician and nurse are best supplemented with a member of the allied healthcare team (e.g. occupational therapist, physical therapist, foot care specialist, dietitian, social worker).

Many patients with chronic stalled wounds are complex older adults who live with multiple comorbidities, and who require lengthy assessment and coordination of the treatment interventions. This necessitates the healthcare system policy maker to support interprofessional clinician teams to provide the best possible evidence-informed practice.

Conclusion

The concept of wound bed preparation includes the treatment of the whole patient (treat the cause and patient-centred concerns) (Table 8). The approach to the local wound bed has 4 components, starting with

TABLE 8
Summary

Wound bed 2011	Recommendations
Treat the cause	• Determine blood supply to heal • Identify/treat the cause (if possible) to determine healability • Review cofactors/comorbidities to create an individualized plan of care
Patient-centred concerns	• Assess, support and provide education for individualized concerns (e.g. pain, activities of daily living, psychological well-being, smoking, access to care)
Local wound care (DIM+ E)	• Cleanse, assess characteristics and monitor local wounds • Debride healable wounds (conservative for nonhealable or maintenance wounds) • Treat critical colonization, infection and persistent inflammation • Achieve moisture balance • Consider advanced therapies for healable but stalled chronic wounds
Systems	• Link improved cost-effective patient outcomes to education, evidence-informed practice, interprofessional teams and healthcare system support

Practice Pearls

- Clinicians should classify wounds as healable, nonhealable or maintenance. Treatment plans differ depending on healability.
- Distinguish a superficial increased bacterial burden that can be treated topically versus from surrounding tissue infection requiring systemic therapy (mnemonics NERDS and STONEES).
- A new topical diagnostic will help distinguish wounds stuck in the inflammatory stage.
- Wound bed preparation emphasizes treating the whole patient and not just the hole in the patient (treat the cause).
- Patient-centred concerns include the accurate documentation and treatment of pain.
- Optimal local wound care for a healable wound includes debridement, infection/inflammation and moisture balance before the edge effect and use of advanced therapies.
- If a wound is not 30% smaller by week 4, it is unlikely to heal by week 12. Reassess and consider interprofessional team involvement if "stalled."

the mnemonic DIM (Debridement, Infection/prolonged inflammation control and Moisture balance) before the mnemonic DIME, which includes advanced Edge-effect therapies for wounds with the ability to heal. In addition, this article has introduced the concept of healable, nonhealable and maintenance wounds, along with the integration of clinical criteria for superficial critical colonization (mnemonic NERDS) and topical antimicrobial dressings versus deep and surrounding tissue infections (mnemonic STONEES) requiring systemic agents. Bacterial damage needs to be distinguished from persistent inflammation with soon-to-be-available bedside MMP testing. The ultimate treatment process should include the leadership of an interprofessional wound management team, and patient participation is paramount for the best achievable outcome. After reading this article, clinicians will be able to distinguish between healable, nonhealable and maintenance wounds and design appropriate management plans.

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