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Wound Bed Preparation

Wound Bed Preparation 2015 is an assessment tool which provides a step by step process for identifying person-centered concerns and for providing an accurate diagnosis of wound etiology (i.e., the wound cause).

Wound Management

1. Assess the cause
2. Determine ability for healing: healable, maintenance or non-healable and document this on assessment.
3. Plan and provide for wound care based on the following:
   - assessment of tissue type
   - need for debridement
   - inflammation/infection (use the mnemonics NERDS (superficial infection) and STONEES (deep infection), see page 3.
   - moisture balance
   - status of the edge of the wound
4. Quantify the wound size and appearance using the he MEASURE tool (Keast, 2004), see page 3.
<table>
<thead>
<tr>
<th>NERDS (Superficial Infection)</th>
<th>STONEES (Deep Infection)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N- Non healing</td>
<td>S- Size is bigger</td>
</tr>
<tr>
<td>E- Exudate Increasing</td>
<td>T- Temperature is increased (of wound and surrounding tissue)</td>
</tr>
<tr>
<td>R- Red and Bleeding surface tissue</td>
<td>O- Os-probes to bone or bone visible</td>
</tr>
<tr>
<td>D- Debris (slough or eschar)</td>
<td>N- New areas of breakdown</td>
</tr>
<tr>
<td>S- Smell or odour from wound</td>
<td>E- Exudate increasing</td>
</tr>
<tr>
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<td>E- Erythema/Edema</td>
</tr>
<tr>
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<td>S- Smell</td>
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If any **3 or more criteria present** treat the wound topically

If any **3 or more criteria present**, suggest systemic antibiotic treatment

### MEASURE

<table>
<thead>
<tr>
<th>M</th>
<th>Measure: Length, width, and depth, in centimeters. Measure the longest length in a head to toe method, measure the widest width at right angles to the length. Measure depth using a sterile probe at the deepest area.</th>
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<td>A</td>
<td>Appearance of the wound bed: Evaluate the tissue: Necrotic (black), fibrin (firm yellow), slough (soft yellow), granulation (pink and healthy vs. red and friable = unhealthy), hyperkeratosis, epithelial.</td>
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<td>Edge: Assess the edge of the wound and the area 2-4 cm from the edge of the wound which is the peri-wound skin</td>
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</table>
**Purpose and Intent**

The purpose of this guideline is to focus on prevention, assessment, and management of wounds using current best practice.

The intent is to ensure that clinicians use a consistent framework for prevention, assessment, and treatment of wounds across sites and facilities within the Winnipeg Regional Health Authority (WRHA).

**1. Practice Outcomes**

To provide a clear rationale for assessment and appropriate management of the cause of a wound, and the investigation and management of systemic and local factors that may delay healing, in addition to the assessment and management of person-centered concerns along the continuum of optimal healing.

**2. Background**

In 2015 a review was undertaken of the 2009 Preparation of the Wound Bed document in order to update it according to current best practice. A literature review was undertaken to determine the state of the science since 2009 and this document compiles that evidence in a structured format.

The majority of this guideline has been adapted from the wound bed preparation paradigm introduced by Sibbald et al. in 2000, as a *holistic and systematic approach* to the treatment of chronic wounds e.g., diabetic foot ulcer, venous leg ulcer, pressure ulcer, but is adaptable to include prevention and management of acute wounds.

**3. Levels of Evidence**

<table>
<thead>
<tr>
<th>Level</th>
<th>Source of Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ia</td>
<td>Evidence obtained from meta-analysis or systemic review of randomized controlled trials</td>
</tr>
<tr>
<td>Ib</td>
<td>Evidence obtained from at least one randomized control trial</td>
</tr>
<tr>
<td>Iia</td>
<td>Evidence obtained from at least one well-designed, controlled study without randomization</td>
</tr>
<tr>
<td>Iib</td>
<td>Evidence obtained from a least one other type of well-designed, quasi -experimental study, without randomization</td>
</tr>
<tr>
<td>III</td>
<td>Evidence obtained from well designed, non-experimental descriptive studies</td>
</tr>
<tr>
<td>IV</td>
<td>Evidence obtained from expert committee reports or opinions</td>
</tr>
</tbody>
</table>

Adapted from Registered Nurses Association of Ontario (2007) Levels of Evidence, November 2014
Wound bed preparation was a concept initially used in the field of plastic surgery (Montandon, 1977; Robinson & Friedman, 1996) to ensure systematic preparation of a wound bed before a skin grafting procedure. The intent was to provide a framework for a structured approach to wound bed preparation, and a basis for optimizing the management of open chronic wounds healing by secondary intention.

Preparing the wound bed was first described in 2000 by Sibbald et al. and Falanga with subsequent updates by Sibbald et al. in 2003, 2006, 2011 and 2015. In its initial versions, preparing the wound bed focused on the assessment and treatment of chronic wounds, however over time has evolved in practice to include prevention of wounds and treatment of all types of wounds. Leaper et al. (2012) have reinforced the need for meticulous attention to wound bed preparation.

Wound bed preparation involves the assessment and treatment of the cause of the wound, the investigation and management of systemic and local factors that may delay healing, and the assessment and management of person-centered concerns prior to choosing an appropriate treatment regimen.
4.1. Risk Assessment (Level of Evidence: IV)

In many healthcare settings, a formal risk assessment is conducted to determine the potential for skin breakdown and will determine which clinical interventions can be used.

However, the use of risk assessment scales does not supersede professional observation skills and comprehensive skin examination (Johansen, Moore, van Etten, & Strapp, 2014).

Therefore, it is imperative to use the findings of a risk assessment and/or professional observation skills and comprehensive skin examination to develop an individualized plan of care, which includes prevention of wounds in the first place.

4.2. Identify and Treat the Cause of the Wound (Level of Evidence: IV)

4.2.1. Determine if there is adequate blood supply to heal the wound

If the ulcer is on the lower leg or foot, assess the efficiency of the existing blood supply; consider Ankle Brachial Pressure Index or Toe Pressures. Refer to Regional Wound Care Clinical Practice Guidelines, Venous, Arterial, and Mixed Lower Leg Ulcers [http://www.wrha.mb.ca/extranet/eipt/files/EIPT-013-005.pdf](http://www.wrha.mb.ca/extranet/eipt/files/EIPT-013-005.pdf)

4.2.2. Identify the cause(s) and make appropriate referrals

Complete a thorough history and physical with the patient and relevant caregivers to determine the cause of the wound (e.g., pressure related, venous stasis or diabetic related) (Sibbald et al., 2011; Slachta, 2012; RNAO, 2007).

Refer to the interprofessional team to facilitate a comprehensive review of the person, and the environmental factors contributing to the wound.

4.2.3. Review cofactors and comorbidities which can delay or inhibit healing

The trajectory of wound healing can be delayed or interrupted by systemic disease, nutrition and medications. Conduct a detailed review of cofactors and comorbidities which can delay or inhibit healing using a systems-based approach including:

- Systemic diseases such as diabetes, cancer, auto-immune, cardiovascular
- Low protein intake and history of inadequate nutrition

[www.wrha.mb.ca/ebpt](http://www.wrha.mb.ca/ebpt)
• Medication reconciliation to determine pharmacological impacts (e.g., immunosuppression, long-term steroid therapy)

4.2.4. Determine wound healing trajectory: healable, maintenance, non-healable

Classifying wounds according to their ability to heal is essential to and accurate diagnosis and treatment plan for the wound. In addition realistic goals can be set for interventions with the wound and unnecessary treatments can be avoided. Provide the opportunity to have discussion about the wound with patients and caregivers to establish a plan based on clear goals for healing. (Level of Evidence IV)

Ensure careful documentation and communication of the expected healing trajectory with the person and the team is imperative to ensure that there is no ambiguity in treatment approach or patient expectations.

Table 1

Wound Healability Classification

<table>
<thead>
<tr>
<th>Healable</th>
<th>Maintenance</th>
<th>Non-healable</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The cause of the wound can be identified and corrected.</td>
<td>• Patient unable to follow wound treatment plan at the time</td>
<td>• Malignant wounds</td>
</tr>
<tr>
<td>• Patient factors can be managed</td>
<td>• Resources not available to treat the wound at the time</td>
<td>• Disease process(s) preclude healing (e.g., aggressive immunosuppression)</td>
</tr>
<tr>
<td>• Medical co-morbidities can be managed and do not prevent healing</td>
<td>• Co-morbid medical conditions not optimized for healing</td>
<td>• Patient factors such that maximizing for healing not possible (e.g., severe malnutrition)</td>
</tr>
<tr>
<td>• Treatments can be accessed</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Adapted from “Local Wound Care for Malignant and Palliative wounds” by K. Woo and G. Sibbald, 2010, Skin and Wound Care, 23(9), 417-418. and Optimizing the Moisture Management Tightrope with Wound Bed Preparation 2015 by R.G. Sibbald, J.A. Elliott, E.A. Ayello and R. Somayaji, 2015, Advances in Skin and Wound Care, 28(10), 466-476.
4.2.5. Develop an individualized plan of care (Level of Evidence IV)

For comprehensive wound management options, consider the following:

- Ensure adequate dietary intake to prevent malnutrition and promote wound healing. (Level of Evidence III)

- Implement nutritional supplements if needed. (Level of Evidence Ia) and multivitamin and mineral preparations. (Level of Evidence Ib)

- Assess location, frequency and intensity of pain to determine the presence of underlying disease, the exposure of nerve endings, and efficacy of local wound care (Level of Evidence Iib)

- A high specification foam mattress instead of a standard hospital mattress should be used to prevent pressure ulcers in moderate to high risk patients. (Level of Evidence Ia)

- Pressure management of the heels while in bed should be considered independently of the support surface. (Level of Evidence III)

- Use pressure management for clients in the Operating Room to reduce the incidence of pressure ulcers post operatively. (Level of Evidence Ia)

Person Centred Concerns

4.3. Assess and support person centered concerns (Level of Evidence IV)

4.3.1. Pain

Pain is a subjective experience and influenced by many factors such as past experience, stress, anxiety, and underlying disease process. It can impair the process of wound healing through the release of hormones (Moffat, Franks & Hollinworth, 2002; Solowiej & Upton, 2012; Vuolo, 2009). (Level of Evidence IV)

Refer to Pain Assessment and Management Clinical Practice Guidelines http://www.wrha.mb.ca/extranet/ebp/files/EIPT-017-001.pdf

- The approach to pain management requires an individualized plan of care for each person. (Level of evidence III)
- Assess and document type, cause, intensity and frequency as a baseline. Ask direct questions related to pain using standardized formats such as (visual analogue or numerical rating scale). *(Level of evidence IIb)*

- Anticipate that pain or discomfort will be a factor in wound care at some point for each individual.

- Develop and evaluate an individualized pain management plan, considering non pharmacological and pharmacological approaches.

- Dressing removal is considered to be the time of most pain, and dried out dressings and adherent products are most likely to cause pain and trauma at dressing changes.

- Gauze is most likely to cause pain. Products such as hydrogels, hydrofibres, alginates and soft silicone dressings are least likely to cause pain.

- Identify the impact the pain is having on the person’s activities of daily living (ADL’s) and quality of life (QOL). *(Level of Evidence IV)*

### 4.3.2. Non-pharmacologic approaches to pain management

**Table 2: Non-pharmacologic approaches to pain management**

<table>
<thead>
<tr>
<th>Provide education about the wound care plan.</th>
<th>Allow for a non-stressful environment and be prepared for wound care prior to starting to minimize the amount of time the wound bed is open to air.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allow the person to participate as needed and when possible.</td>
<td>Recall the pain assessment and avoid triggers.</td>
</tr>
<tr>
<td>Use relaxation strategies to help to support a calm environment and to help with the recovery phase post wound care.</td>
<td>Ensure that proper equipment and limb supports are available, and that person and clinician positioning during wound care is considered to avoid stress and potential injury for both parties.</td>
</tr>
<tr>
<td>Allow for rest periods or “time outs” during complex wound care such as debridement.</td>
<td>Utilize appropriate wound care materials to maintain the wound bed, and non-adherent dressings should be selected.</td>
</tr>
<tr>
<td>Frequently assess for pain before, during, and after wound care.</td>
<td>Consider the solutions being used on the wound and prepare the person for potential discomfort. Use warmed but uncontaminated solutions to cleanse wounds.</td>
</tr>
</tbody>
</table>
4.3.4. Pharmacologic approaches to pain management: (level of evidence IV):

- Selection of analgesia should be based on the type of wound, whether it is acute or chronic, and the level of pain the patient is experiencing.

- Provide an analgesic when a wound is present and prior to wound care, instead of administering analgesia when the pain starts.

- The use of topical analgesia can be considered for the management of wound pain related to cleansing procedure, or dressing applications. Care is needed when treating highly vascular spaces in order to minimize systemic absorption.

- Use the recommendations of the World Health Organization (WHO) for the correct use of analgesics to make the prescribed treatments effective as follows:
  
  1. Analgesics should be given at regular intervals. To relieve pain adequately, it is necessary to respect the duration of the medication’s efficacy and to prescribe the dosage to be taken at definite intervals and the dosage of medication should be adjusted until the patient is comfortable.

  2. Analgesics should be prescribed according to pain intensity as evaluated by a scale of intensity of pain. This point is important because pain-relief medications should be prescribed after clinical examination and adequate assessment of the pain, and not according to the staff’s perception of the pain.

  3. Dosing of pain medication should be adapted to the individual. There is no standardized dosage in the treatment of pain. Every patient will respond differently. The correct dosage is one that will allow adequate relief of pain.

  4. Analgesics should be prescribed with a constant concern for detail, as the regularity of analgesic administration is crucial for the adequate treatment of pain.
5. Once the distribution of medication over a day is established, it is ideal to provide a written personal program to the patient. In this way the patient, his/her family, and staff will all have the necessary information about when and how to administer the medications.

![WHO Pain Ladder](image)

Figure 2. The World Health Organization (WHO) Pain Ladder

### 4.3.5. Activities of Daily Living

Having discussion with the person about which aspects of wound care are impacting them can help to tailor the wound management strategy and goals to implement a person centered care plan that may best promote the setting for wound healing (Slachta, 2012; Woo & Sibbald, 2012). This may include impacts to work life, child care or other concerns.

### 4.3.6. Psychosocial well being

Wound-related psychosocial issues can be addressed by choice of dressings when a person is concerned by wound odour, or by arranging wound dressing routines to coincide with hygiene schedules.

### 4.3.7. Smoking

Smoking delays wound healing and is associated with damage to the endothelial linings of the arteries. Smoking cessation strategies should be discussed in terms of the effect on wound healing and interventions should be offered as part of routine care. Refer to Management of Tobacco Use and Dependence, Regional Clinical Practice Guideline: [http://www.wrha.mb.ca/professionals/tobacco/index.php](http://www.wrha.mb.ca/professionals/tobacco/index.php)
4.3.8. Access to care, financial limitations

Consider the impact of the wound on the person’s financial resources as they may not be able to work or may have limited income. Ensure that there is access to care including review of transportation options.

Local Wound Care

4.4. The provision of local wound care looks beyond the application of the dressing and utilizes assessments of all aspects and characteristics of the wound to help determine the best plan of care for each person. This is an individualized approach based upon meticulous assessment.

4.4.1. Assess and document the wound history (Level of Evidence: III-IV)

- Documentation of a detailed patient and wound history is legally required, and facilitates communication within the inter-professional team.
- A history and physical examination should include discussion with the person or caregiver to help determine the cause and duration of the wound, a history of previous wounds with treatment provided and response to treatment (prevention and treatment strategies, previously trialed or in place with the success of each (Perry & Potter, 2014; Slachta, 2012).
- Use a standardized approach to assessment and documentation as well and indicate the frequency of reassessment to support continuity of care and aid in the determination of healing.

4.4.2. Assess and document the characteristics and location of the wound using a standardized approach (Level of evidence IV)

- Prior to wound assessment, gently cleanse the wound with low-toxicity solutions: normal saline or sterile water. (Level of evidence IV) See Appendix C.
- Fluid used for cleansing should be warmed at least to room temperature. (Level of evidence III)
- Do not use skin cleansers or antiseptic agents (e.g., povidone iodine, iodophor, sodium hypochlorite solution, hydrogen peroxide, acetic acid) to clean wounds. (Level of evidence III)
- Wound assessment and measurement provides the reference point for planning, implementation and evaluation of a wound care strategy. Wound location should be described and documented using the correct anatomical descriptor. *(Level of evidence IV)*

Use consistent parameters for wound assessment, the acronym MEASURE is recommended as a format (Keast, et al. 2004). *(Level of evidence IV)*

Table 3:

*MEASURE*

<table>
<thead>
<tr>
<th>M</th>
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4.5. Tissue, Infection/Inflammation, Moisture Balance, Edge of wound (TIME)

The acronym TIME was developed by an international group of wound healing experts (Schultz et al. 2003). These original concepts of TIME have been modified over the past 10 years based on the latest evidence to incorporate the concept of Debridement and Support (DIMES) (Woo, Ayello & Sibbald, 2008).

<table>
<thead>
<tr>
<th>T</th>
<th>Tissue-Debridement</th>
<th>D</th>
<th>Debridement</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Infection/Inflammation</td>
<td>I</td>
<td>Infection/Inflammation</td>
</tr>
<tr>
<td>M</td>
<td>Moisture Balance</td>
<td>M</td>
<td>Moisture Balance</td>
</tr>
<tr>
<td>E</td>
<td>Edge of wound</td>
<td>E</td>
<td>Edge of wound</td>
</tr>
<tr>
<td>S</td>
<td>Support: products, services, and education</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Several types of tissue can be identified over the course of a wound’s existence:

- **Epithelium**: this appears lighter in colour and indicates that the epidermis is regenerating over the surface of the wound from the wound edges. It is very vulnerable to damage from friction, shear & pressure.

- **Granulation tissue** is comprised of new connective tissue and tiny blood vessels that form on the surfaces of a wound during the healing process and is shiny, red and granular in appearance. Being very fragile, it is injured by mechanical forces such as adherent dressings, pressure, high intensity irrigation, and overzealous wound packing. Wound healing often stalls in the granulation phase if nutrition or blood flow is inadequate or infection is present.

- **Hypergranulation tissue** is also known as over granulation, tissue or proud flesh, and presents as friable, red, sometimes shiny and soft appearance that is above the level of the surrounding skin. Hypergranulation physically impedes epithelial cell movement, and the wound generally will not heal when there is hypergranulation tissue because it will be difficult for epithelial tissue to migrate across the surface of the wound and contraction will be halted at the edge of the wound.
- Slough is a stringy mass which may or may not be firmly attached to surrounding tissue. It can be white to yellow or green to brown. Slough can obscure the wound bed of a pressure ulcer to render it unstageable.

- Eschar is dead granulation tissue, muscle, fat, tendon or skin. Careful consideration is required in order to determine if it is stable and dry not requiring debridement or whether it is causing the wound to be stalled from healing, and requires debridement.

- The types of tissue present within a wound should be described in percentages based on the surface area of the wound e.g. 50% slough, 25% eschar, 25% granulation tissue.

### Debridement

Assess the wound bed of a healable wound for debridement of non-viable tissue such as firm eschar or soft slough. Firm eschar acts as a pro-inflammatory stimulus which decreases wound healing and slough acts as a medium for the proliferation of bacteria (Slachta, 2012). **(Level of evidence IV)**

- Debridement techniques may be considered along a continuum from least invasive (i.e. simple irrigation) to most invasive (i.e. sharp/surgical) and more than one method may need to be considered to remove necrotic tissue from the wound.

- Select the method of debridement most appropriate to the patient condition and treatment goals, type, quantity, depth and location of necrotic tissue caregiver and patient preference (EMWA, 2004; Slachta, 2012).

- Selective debridement techniques include autolytic, enzymatic, and sharp/surgical as they only remove necrotic tissue.

- Mechanical debridement is non-selective because both healthy granulation tissue and necrotic tissue are removed and can cause significant pain and trauma to the patient.

- Vascular assessment is recommended for ulcers in lower extremities prior to debridement to rule out arterial vascular compromise.
• Debridement is not recommended when:
  • There is no necrotic tissue the wound bed
  • The wound is classified as maintenance or non-healing, except in the circumstance where debridement is recommended to decrease a high burden of bacteria.
  • There is dry gangrene and/or inadequate blood supply.
  • The affected limb is pulseless or has an abnormal Ankle Brachial Pressure Index (ABPI) or toe pressures.
  • There is a high risk of exposing bones, joints, or tendons.

**Infection/Inflammation**

Normally, microorganisms are present on the skin without any evidence of infection because a balance exists between host resistance and microbial growth. Infection occurs when this equilibrium is upset, either because of lowered host defenses or increase microorganism quantity or virulence (Swindon, Wiltshire, Bath and north east Somerset Wound Group, 2011). Breaks in the skin allow micro-organism access to deeper tissue where they more readily multiply. The process of increasing bacterial burden follows a step-wise approach affected by host and wound factors (Swindon, Wiltshire, Bath and north east Somerset Wound Group, 2011).

• Wound infection is caused by invasion and multiplication of microbes in the wound tissue and is manifested by a host reaction or tissue injury.

• Infection occurs in wound tissue, not on the surface of the wound bed, and occurs in viable wound tissue. However, necrotic tissue, eschar or other debris in the wound bed can have a high burden of bacteria which requires debridement and systemic antibiotics, especially if it is kept moist.

• Clinical signs when present, can help to determine if a wound infection is superficial (treated topically) or deep (treated systemically).

• If hypergranulation tissue has developed and is not allayed with treatment of the infection (topically and systemically), then cauterization with silver nitrate is indicated. A physician must order the cautery, stating the frequency and duration, and only a clinician trained in the administration of silver nitrate or a Clinical Nurse Specialist may cauterize hypergranulation with silver nitrate sticks.
Table 4

Comparison of Indicators of Infection

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<td>E Erythema/Edema</td>
</tr>
<tr>
<td></td>
<td>S Smell</td>
</tr>
</tbody>
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If any 3 or more present treat the wound topically

If any 3 or more criteria present, suggest systemic antibiotic treatment


- The treatment of infection is managed by wound cleansing, systemic antibiotics, and debridement as needed. (**Level of evidence Ib**)

- Medical management may include appropriate systemic antibiotic therapy for patients with bacteremia, sepsis, advancing cellulitis or osteomyelitis. (**Level of evidence Ib**)

- Biofilms are major contributing factors to persistent, chronic inflammatory changes in the wound bed, and it is likely that almost all chronic wounds contain biofilm on at least part of the wound bed (Leaper et al. 2012; Rajpaul, 2015).

- Biofilm formation has been linked to poor exudate management, as wound exudate is a potentially important nutrient source for wound biofilm. (Leaper et al., 2012).
• The best way to disrupt biofilm is use of frequent aggressive debridement, long duration high-dose systemic antibiotics, and combinations of antibacterial biofilm agents (Phillips, Wolcott, Fletcher, & Schultz, 2010).

**Moisture Balance**

Appropriate wound moisture is required for the action of growth factors, cytokines and cell migration; too much exudate can cause damage to the surrounding skin; too little can inhibit cellular activities and lead to eschar formation, which inhibits wound healing. (Level of evidence Ia)

• The wound bed should be maintained at an optimal moisture balance; too much or too little moisture can impair healing.

• A moist wound environment can stimulate healing which promotes the proliferation of fibroblasts, keratinocytes and endothelial cells, however in chronic wounds excessive fluid blocks cellular proliferation, angiogenesis and excessive amounts of matrix metalloproteinase (MMPs) that impair physiological healing (Woo & Sibbald, 2010, Sibbald, R. G., Goodman, L., Woo, K., Krasner, D., Smart, H., Tariq, G. et al. 2011; European Wound Management Association 2004).

• Heavy exudate should alert clinicians to problems related to the underlying cause or an early sign that there may be increased bacterial burden or infection.

• A wound culture is indicated when the wound is failing to heal, suspect deep tissue infection or the patients clinical situation indicates. See Appendix D for Levine Technique.

**Edge of wound**

The final stage of wound healing is epithelialization, which is the active division, migration, and maturation of epidermal cells from the wound margin across the open wound bed. Healthy wound edges or margins present as advancing pink epithelium growing over mature granulated tissue. The edge of the wound includes the peri-wound skin 2-4cm from wound edge. (Level of evidence IV)

• Assess the Wound Edges/Margins (not periwound) and describe the characteristics using the following descriptors:
1. Colour - pink edges indicate growth of new tissue; dusky edges indicate hypoxia; and erythema indicates physiological inflammatory response or cellulitis.
2. Raised edges where the wound margin is elevated above the surrounding tissue may indicate pressure, trauma or malignant changes.
3. Sensation – note increased pain which may be indicative of trauma or infection.
4. Defined/undefined, attached or detached
5. Fibrotic/callused/firm, macerated/soft
6. Flush/Contraction - wound edges are coming together, signs of healing
7. Epibole (Epiboly) - Rolled/curled under edges. Epithelial tissue migrates down sides of the wound instead of across. Edges that roll over will ultimately cease in migration secondary to contact inhibition once epithelial cells of the leading edge come in contact with other epithelial cells.
8. Tunneling - course or pathway that can extend in any direction from the wound, results in dead space with potential for abscess formation. (Can be distinguished from undermining by fact that tunneling involves a small portion of the wound edge whereas undermining involves a significant portion of the wound edge.)
9. Undermining – tissue destruction underlying intact skin along the wound margins; is the destruction of tissue or ulceration extending under the skin edges (margins) so that the wound is larger at its base than at the skin surface.
10. Sinus Tract - a discharging blind-ended track that extends from the surface of the skin to an underlying area or abscess cavity. Caused by the degradation of subcutaneous tissue in a linear manner with another wound opening at the other end of the tunnel.
11. Both tunneling and undermining are caused by shearing forces against the wound and other factors such as infection.

- Assess the tissues within 4 cm of the wound edge, the periwound by inspection and palpate for moisture, temperature, texture, turgor, pulses and mobility. Assess for colour, induration, warmth, and edema around the wound. Observe for brawny edema, hyper or hypopigmentation, presence or absence of hair. Make the following observations:

  1. Erythema – redness may be from infection, irritation from drainage, urine/feces, dermatitis/trauma from tape or dressing. Redness from infection may be seen as diffuse and indistinct, or as intense with demarcated borders, red streaking. In dark skin, the skin may appear purple or a gray hue or deepening of the ethnic skin colour.
2. Edema and induration – observed as slight swelling and firmness at the wound edge. If accompanied by warmth, may indicate infection; induration is a hardened mass or formation with defined edges.
3. Colour changes: reddish skin tone – may reflect infection, blue or pallor – poor vascularity, brown staining – on leg reflects venous insufficiency.
4. Texture – excessive dryness and scaling is reflective of hyperkeratosis, weeping skin associated with acute condition.
5. Maceration – white and wrinkled from excessive moisture.
6. Temperature – normal temperatures range from cool to warm and is dependent upon vasoconstriction or vasodilatation; warmth may reflect infection or a new wound, cool reflect decreased circulation.
7. Scar – connective tissue reflective of dermal damage; new scars are pink and thick, over time become white and atrophic.
8. Ecchymosis – Non-blanchable discolouration of variable size may be caused by vascular wall damage, trauma, or vasculitis.
9. Lesions/rashes – Skin lesions should be described in terms of type, size, color, distribution, and configuration.

Support with products, services, and education

The provision of successful wound care needs to be supported by knowledge of wound care products, and services available to people with wounds and to clinicians involved with wound care. In addition, ongoing education is paramount to achieving the best possible outcomes. Support with products, services and education can make the right treatment plan even better. This includes use of support surfaces and interfaces such as mattresses, wheelchair cushions and positioning devices.

- Consider supportive products that complete the treatment. For example, choice of an elastic net as a secondary dressing rather than risking a tape stripping injury on fragile skin.
- Education of clinicians is required to ensure knowledge and application of the latest evidence base in their practice.
- Education of patients and their families on the expected outcomes for the wound and the plan to achieve them is vital for successful wound treatment.
- Product selection guides, community resources, wound and skin care product specialists, and connection of the right product to the right application contribute to successful outcomes in wound management.
5. Dressing Selection

Dressings alone will not promote wound healing unless the cause of the wound and person-centred concerns are determined. Within this framework it is imperative to communicate within the inter-professional team to determine the healing trajectory of the wound (healable, maintenance, or a non-healing wound). *(Level of evidence IV)*

- Dressing selection requires a wound to be cleansed and measured, and assessed to determine the type of tissue in the wound bed. The presence of superficial or deep infections needs to be evaluated with the use of the mnemonics NERDS and STONEES.

- Choose a dressing regimen and select a dressing with the goal of maintaining moisture balance, to promote healing or maintenance of the wound and address person centered concerns. For non-healing wounds person centered concerns may have higher priority and dressing selection may be based less on clinical decisions but firmly rooted in the person’s choices. *(Sibbald et al., 2011)*.

- To promote optimal wound healing it is important to question the frequency of dressing changes and the need for wound irrigation. When dressings are changed, wounds cleansed or when wounds are left without dressings for assessment wound cooling occurs. The optimum temperature for cells to regenerate is 37°C. At 33°C, wound healing becomes compromised as neutrophils, fibroblasts and epithelial cell activity decreases. Recovery time for the wound to return to core body temperature can take up to 4 hours, depending on how long it has been left uncovered *(McGuiness, Vella, & Harrison 2004)*.

6. Wound Reassessment

6.1. *Wounds reassessment should occur on a regularly scheduled basis using a standardized format (Level of evidence IV)*

Assessment and documentation of the characteristics of the wound guides care and helps to determine the presence or absence of healing. The initial percentage reduction in surface area is often used as an indicator that the wound is responding to the treatment, within health care organizations. For example, Orridge, Purbhoo, et al. *(2004)* used 20-30% healing in 4 weeks as an indicator of whether a wound care specialist consultation was required or not, for any type of wound being treated.

- Reassessment must be standardized so that all clinicians who assess wounds must use the same technique, for comparative purposes over time.
• Wounds should be reassessed between 1-4 weeks, when there is a change noted in the wound or change in dressing regimen at minimum.

• Healing is anticipated to occur at 12 weeks with improvements of 25% or greater at 4 weeks.

• It is anticipated the healable wound will show approximately a 25-30% size reduction by week 4 with an anticipated healing time of 12 weeks. If this is not the case then consideration of factors that are impacting healing (i.e., infection, nutrition, pressure offloading) need to be re-evaluated (Woo & Sibbald, 2011; Perry & Potter, 2014).

• If the goal of 25-30% size reduction by in four weeks is not met, infection should be suspected as one of the causes of delayed healing and if wound culture supports the clinical picture.
7. References


8 Primary Author(s)

Revised by

Carole Hamel RN, MN, IIWCC
Tamara Wells RN, MN, CHPCN(C), IIWCC
Jane McSwiggan M.Sc., OT Reg. (MB)
Appendix A: Exudate Measurement Tools

Note: Remove dressing from the wound prior to the assessment of exudate

1  Quantity: Bates-Jensen (2007) method of quantifying amount of drainage:
   •  None
   •  Scant with no measurable exudate
   •  Small with wet wound tissue
   •  Moderate with saturated wound tissue
   •  Large with wound tissue bathed in wound fluid
   •  None- wound tissues dry
   •  Scant- wound tissues moist
   •  Small- wound tissues very moist; drainage less than 25% dressing
   •  Moderate- wound tissues wet; drainage involves 25 to 75% if dressing
   •  Large- wound tissues filled with fluid-involves more than 75% of dressing

2. Type –serous, sanguineous, purulent or a combination of these (Wound Care Education Institute).
Appendix B: Odour measurement

Very strong: Odour is evident on entering the room (6–10 feet or 2–3 meters from the patient) with the dressing intact.

Strong: Odour is evident on entering the room (6–10 feet or 2–3 meters from the patient) with the dressing removed.

Moderate: Odour is evident at close proximity to the patient when the dressing is intact.

Slight: Odour is evident at close proximity to the patient when the dressing is removed.

No odour: No odour is evident, even at the patient’s bedside with the dressing removed.
Appendix C: Wound Cleansing

1. **Choose an appropriate method to cleanse the wound with each dressing change that avoids trauma to the wound bed and supports patient preference**
   - Wound cleansing is a process that removes less adherent inflammatory contaminants from the wound surface and renders the wound less conducive to microbial growth which is an essential component to wound healing (Joanna Briggs, 2008).
   - Effective wound cleaning requires selection of methods that minimize chemical and mechanical trauma to wound tissue while removing surface debris and contaminants.
   - Showering may be a feasible alternative that in the right circumstances (an acceptable water supply) and will not increase the chance of infection or impair wound healing but may support patient comfort. This should be assessed on an individual basis (level of evidence IV)

2. **Use fluid that is at least at room temperature for cleansing.** Colder solutions can slow down cellular repair and add to patient discomfort.

3. **The use of skin cleansers or antiseptic agents** is not recommended (e.g. Povidone iodine, sodium hypochlorite solution, hydrogen peroxide, acetic acid) to clean wounds. These are reserved for wounds that are non-healable (e.g. povidone iodine) or those in which the local bacterial burden is a greater concern than the stimulation of healing (e.g. aqueous chlorhexidine 0.05%).

4. **Irrigate wounds for cleansing when the wound has moderate/copious exudate; contain slough or eschar; are critically colonized or infected; have increased depth and/or tunneling or undermining (Level of Evidence 1b)**
   - Use enough irrigation pressure to enhance wound cleansing without causing trauma to the wound bed. Pressures of approximately 13 psi are effective in reducing infection and inflammation (Joanna Briggs, 2008). Irrigation with higher pressures risk the change of penetrating soft tissue that can impair wound healing.
   - Use volumes of 100-150ccs

**Note: Contraindications**
- Cavities, sinuses, tunnels or other areas where the base of the wound is not clearly visible should not be irrigated. In addition irrigation is contraindicated if it is unclear where the solution is going or if it cannot be retrieved (Woo & Sibbald, 2011).
• Consult a wound care specialist if in doubt about irrigation of cavities, sinuses, tunnels or other areas where the base of the wound is not clearly visible.

5. **Eye protection and other appropriate personal protective equipment should be used where there is the potential of splash back of body fluids.**

6. **Other considerations:**

   • Prefilled Saline bottles

   Irrigate wound with a single-use 100 ml squeeze bottle of saline or water; this method exerts approximately 4 psi of pressure and is used for wounds that are: shallow, have minimal exudate, have little to no slough or eschar; are not critically colonized or infected.

   • Commercial Wound Cleanser

   Irrigate wound with a commercially prepared low toxicity spray wound cleanser (follow manufacturers’ instructions). Commercially prepared wound cleansers contain surfactants which may facilitate the removal of adherent material from the wound bed. These surfactants may also decrease friction between a scrubbing device and the wound providing a safer cleansing strategy.

   • Scrubbing of the wound with saline soaked gauze is not recommended (Level of evidence IV)

   Scrubbing can lead to tissue trauma and impair or delay wound healing. Therefore the when cleansing use the gentlest method. If cleansing the wound with a saline or other wound cleansing product does not lead to proper cleansing of the wound then an alternate strategy such as irrigation should be implemented (Joanna Briggs, 2008).

   • Adherent dressings

   Dressings that adhere should be soaked or compressed with a moist saline gauze and gently removed from surface to soften adhered dressings or wound debris where indicated and may be done after irrigation & prior to application of a new dressing for additional cleansing and loosening wound debris (Joanna Briggs, 2008). **(Level of evidence IV)**
Appendix D: Wound Swabbing

Use the Levine technique to obtain a wound culture swab to guide the use of appropriate antibiotic agents. It is recommended for use as it detects significantly more organisms, as it samples a greater concentration of microorganisms from both the surface and slightly below the surface of the wound (National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel and Pan Pacific Pressure Injury Alliance, 2014).


The Levine technique for performing quantitative swab cultures:

1. Cleanse the wound with normal saline.
2. Remove/debride non-viable tissue.
3. Wait two to five minutes.
4. If the ulcer is dry, moisten the swab with sterile normal saline.
5. Culture the healthiest looking tissue in the wound bed.
6. Do not culture exudate, pus, slough, eschar, or heavily fibrous tissue.
7. Rotate the end of a sterile applicator over a 1 cm² area for 5 seconds.
8. Apply sufficient pressure to the swab to cause tissue fluid to be expressed.
9. Insert swab into collection device.
10. Label and send to laboratory promptly, do not leave in a warm place or the culture will deteriorate.
Appendix E: Nutrition

Altered blood values indicating inadequate nutrition or other compromise:

Serum albumin < 30g/l delays healing, <20g/l) impairs healing,

Significant anemia; (HgB < 100 delays healing, < 80g/L impairs healing);
Appendix F: Glossary of Terms

**Biofilms**: A biofilm is a complex microbial community, consisting of bacteria embedded in a protective matrix of sugars and proteins. Biofilms provide a protective effect for the micro-organisms embedded within them, improving their tolerance to the host's immune system, antimicrobials, and environmental stresses. Biofilms stimulate a chronic inflammatory response which benefits the organisms of the biofilm. It is not possible to categorically state when a wound is biofilm-free, because there is a lack of definitive clinical signs and laboratory tests. The best way to disrupt biofilm is use of frequent aggressive debridement, long duration high-dose systemic antibiotics, and combinations of antibacterial biofilm agents.

**Callous**. See hyperkeratotic tissue

**Colonization**: the presence of replicating bacteria attached to the wound tissue, not causing any injury to the host.

**Contamination**: the presence of bacteria on the wound surface, not causing any injury to the host.

**Critical Colonization** (also known as increased bacterial burden or occult or covert infection): occurs when bacteria delay or stop wound healing without the presence of classic signs and symptoms of infection (i.e. pain, erythema, edema, purulent discharge, and increased warmth. Refer to Table 2 p. 25).

**Infection**: involves the presence of replicating micro-organisms in a wound with associated host injury. Invasion of the micro-organisms into the host tissues produces various local and systemic responses. Key elements to wound infection

**Debridement** is the removal of necrotic tissue, exudate, bacteria and metabolic waste from a wound in order to improve or facilitate the healing process.

- **Autolytic debridement** highly accepted and is achieved by keeping the wound bed moist, stimulating phagocytic and enzymatic activity on non-viable tissues. This can be facilitated through the use of hydrogels, hydrocolloids or other.

- **Conservative Sharp debridement** can only be performed by designated and trained health care providers (policy # pending).

- **Mechanical debridement** includes the use of wet to dry dressing which is not recommended due to the trauma and pain to the patient and the wound but irrigation can provide an effective tool. While there are other forms of
non-selective mechanical debridement available such as pulsed lavage the evidence supporting this usage is minimal or negative.

**Edema.** May indicate infection or pressure induced tissue trauma.

**Erythema.** May be due to inflammation, infection, Stage 1 pressure ulcer (refer to recommendations for pressure ulcers), venous or arterial disease (refer to recommendations for venous and arterial ulcers).

**Hyperkeratotic tissue or callous.** This abnormally thick or hard area of skin can lead to increased local pressure especially when present on the plantar aspect of the foot. It is important to remove this type of callus and referral to an appropriate specialist is recommended.

**Induration.** Hardening or thickening of tissue may be due to inflammation, infection, or accumulation of blood and is a sign that further investigation into the wound is required.

**Maceration.** Excessive moisture occurs when the dressing is not absorbing exudate adequately and/or when there is limb edema, increased pressure or infection. The skin often appears pale or white, may be elevated and is friable.