Methods of Wound Debridement: Best Practice for Clinicians
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Acknowledgments

Methods of Wound Debridement: Best Practice for Clinicians

This document was developed by the WOCN Society’s Clinical Practice Wound Committee between July 2013 – August 2014.

Elliott Douglass, BSN, RN, CWOCN, Chair
Director WOC Nursing Department
Summit Medical Center
Nashville, TN

Karen Keaney, MSN, RN, FNP-BC, CWOCN, Past Chair
APN, CWOCN
St. Joseph’s Regional Medical Center
Paterson, NJ

Rebekah Grigsby, DNP, MSN, RN, CWCN
Dean of Professional Studies
Assistant Professor Department of Nursing
East Texas Baptist University
Marshall, TX

Sandra Lee Hartman, BSN, RN, CWOCN
WOC Nurse
Excela Health Westmoreland Hospital
Greensburg, PA

Jill Michalak, MSN, CWOCN
Enterostomal Therapy Nurse
Mercy St Vincent Medical Center
Toledo, OH

Kelly Sparks, BSN, RN, CWOCN, CFCN
CWOCN
Mercy San Juan Medical Center
Carmichael, CA

Jo Ann Valent, BSN, RN, BC, CWOCN, COS-C
Certified Wound, Ostomy & Continence Nurse
Chilton Medical Center
Pompton Plains, NJ
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Introduction

Wound debridement may be necessary for optimal wound healing (Fleck & Chakravarthy, 2010; Harris, 2009). Wound debridement is defined as the process of removing necrotic, nonviable/dead tissue from pressure ulcers, burns, and other acute and chronic wounds to expose healthy tissue (Leak, 2012; Young, 2012). Necrotic tissue varies in appearance and form. Slough is moist, devitalized tissue that can be soft or fibrous in character. Color can be brown, yellow, green, or gray, and it can be firmly or loosely adhered to the underlying tissue (Ramundo, 2012). Eschar occurs when necrotic tissue is exposed to air, becomes desiccated, and forms a thick, leathery brown or black crust on the wound (Young, 2012).

Nonviable tissue is an impediment to wound healing: It fosters inflammation and infection; causes odor; is a physical barrier to healing; prevents wound contraction and epithelialization; and prevents adequate assessment of the wound (Gray et al., 2011; Lucas & King, 2010; Ramundo, 2012; Young, 2012). Debridement of dead/necrotic tissue, senescent cells, and biofilm removes obstacles to healing; reduces the bioburden (removing a potential nutrient source for bacteria); decreases odor; and permits visualization of the wound. At the molecular level, debridement interrupts the cycle of chronic inflammation and facilitates a level of proteases and cytokines similar to an acute wound (Johnson, Collarte, Lara, & Alberto, 2012; Lucas & King, 2010; Ramundo, 2012; Sibbald et al., 2011; Widgerow, 2012; Young, 2012).

Not all wounds should be debrided. In certain circumstances, dry, stable eschar should not be debrided such as in noninfected wounds or dry gangrene on ischemic limbs or heels (Ramundo, 2012; Young, 2012). In such cases, it may be better to leave hardened eschar in place rather than remove it and create an open wound which might not heal.

Purpose

This document was originally developed by the Wound, Ostomy and Continence Nurses Society™ (WOCN®) as a best practice guide for clinicians providing wound care (Wound, Ostomy and Continence Nurses Society [WOCN], 2005). The purpose of this updated document is to provide licensed clinicians with information to facilitate treatment according to best practices for individuals needing wound debridement.

Selecting the appropriate method of debridement requires careful assessment of the patient, goals of care, characteristics of the wound, setting and skill level of the clinician, and availability of resources (Sibbald et al., 2011; Young, 2012). Before debriding wounds, clinicians must ensure that they have the necessary skills to perform the task, the skill is within their scope of practice, and there is an agency or institutional policy in place regarding debridement (Chadwick, Edmonds, McCardle, & Armstrong, 2013; Harris, 2009; Leak, 2012; Spear, 2010).

This guideline provides an overview of five commonly used types of debridement: Autolytic, biologic, enzymatic, mechanical, and conservative sharp debridement (Falanga et al., 2008; Harris, 2009; Leak, 2012; Lucas & King, 2010; Moore, 2012; Sibbald et al., 2011; Spear, 2010; Young, 2012). The following information is provided for each of the debridement modalities: definition, indications, contraindications, identification of the method as selective versus nonselective, skill level required, method of action, and special considerations.
### COMPARISON OF DEBRIDEMENT METHODOLOGIES

#### Types of Debridement

<table>
<thead>
<tr>
<th>Definition</th>
<th>Autolytic Debridement</th>
<th>Biologic Debridement (Maggot Debridement Therapy [MDT])</th>
<th>Enzymatic Debridement</th>
<th>Mechanical Debridement</th>
<th>Conservative Sharp Debridement (CSD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Autolytic debridement is a natural and highly selective process by which endogenous phagocytic cells and proteolytic enzymes break down necrotic tissue (Evans &amp; Mahoney, 2013; Mayo Clinic Staff, 2014; Sibbald et al., 2011; Smith, Legel, &amp; Hanft, 2009; Spear, 2010; Wu, Ahn, Emmons, &amp; Salcido, 2009; Young, 2012).</td>
<td>• Autolytic debridement is the application of sterile, medical grade larvae (maggots) into the wound for the purpose of removing devitalized tissue, disinfection, and promotion of wound healing (Bio Therapeutics, Education, &amp; Research Foundation [BTER], n.d.a; Jiang, Luo, Chen, Liu, &amp; Wang, 2010; Opletalová et al., 2012; Sherman, 2009).</td>
<td>• Enzymatic debridement of wounds can be achieved with the use of exogenous, proteolytic enzymes.</td>
<td>• Mechanical debridement is a nonselective, physical method of removing both viable and nonviable tissue and debris from a wound using a physical force such as wet to dry dressings, wound irrigation, or pulsatile lavage (Benbow, 2011; Cowan &amp; Stechmiller, 2009; Spear, 2010; Young, 2012).</td>
<td>• CSD is the removal of clearly identifiable, devitalized tissue to above the level of viable tissue using sharp instruments, including but not limited to scalpels, scissors, and curettes (Gray et al., 2011; Harris, 2009; Lucas &amp; King, 2010; Nenna, 2011; Rodd-Nielsen et al., 2013; Spear, 2010).</td>
<td></td>
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<tr>
<td>• Debridement occurs as larvae introduce proteolytic enzymes to promote rapid removal of devitalized tissue.</td>
<td>• Debridement occurs as larvae introduce proteolytic enzymes to promote rapid removal of devitalized tissue.</td>
<td>• Enzymes work directly on the devitalized tissue or indirectly by dissolving the collagen that attaches the devitalized tissue to the wound bed, but have little to no effect on healthy tissue (Falanga et al., 2008; Lucas &amp; King, 2010; Milne, Ciccarelli, &amp; Lassy, 2012; Ramundo, 2012; Ramundo &amp; Gray, 2009; Shi &amp; Carson, 2009; Shi, Ramsay, Ermis, &amp; Carson, 2011; Spear, 2010).</td>
<td>• Mechanical debridement is a nonselective, physical method of removing both viable and nonviable tissue and debris from a wound using a physical force such as wet to dry dressings, wound irrigation, or pulsatile lavage (Benbow, 2011; Cowan &amp; Stechmiller, 2009; Spear, 2010; Young, 2012).</td>
<td>• CSD is differentiated from excisional or surgical debridement, which requires a surgeon, involves extensive debridement that may include viable and nonviable tissue resulting in bleeding and pain, and is best performed in an operating room with anesthesia (Gray et al., 2011; Rodd-Nielsen et al., 2013; Spear, 2010).</td>
<td></td>
</tr>
<tr>
<td>• At present, collagenase is the only enzymatic agent approved by the Food and Drug Administration in the United States (Spear, 2010).</td>
<td></td>
<td>• At present, collagenase is the only enzymatic agent approved by the Food and Drug Administration in the United States (Spear, 2010).</td>
<td></td>
<td>• Minimal pain and bleeding are expected with CSD and repeated debridement is often needed (Ramundo, 2012).</td>
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#### Indications

<table>
<thead>
<tr>
<th>Autolytic Debridement</th>
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<tbody>
<tr>
<td>• Autolytic debridement is indicated for:</td>
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<tr>
<td>o Noninfected wounds (Mayo Clinic Staff, 2014; Wu et al., 2009), or as an adjunctive therapy in infected wounds.</td>
<td>o Surgical debridement is technically difficult due to the close proximity of vital structures;</td>
<td>o Patients who are poor candidates for surgical debridement; as an adjunct to surgical debridement; and patients who do not have access to a healthcare professional to provide sharp debridement;</td>
<td>o Indications for mechanical debridement include:</td>
<td>o Devitalized tissue in infected and noninfected wounds.</td>
</tr>
<tr>
<td>o Acute wounds.</td>
<td>o the patient refuses surgery or its associated procedures (e.g., transfusion);</td>
<td>o Heavily necrotic wounds with minimal viable tissue and greater than 50% nonviable tissue;</td>
<td>o Various types of acute and chronic wounds: pressure, neuropathic/diabetic, and venous (Werdin, Tennenhaus, Schaller, &amp; Rennekampff, 2009).</td>
<td></td>
</tr>
<tr>
<td>o Chronic wounds.</td>
<td>o as an adjunctive treatment for salvaging limbs; and</td>
<td>o infected, necrotic wounds;</td>
<td></td>
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</tr>
</tbody>
</table>
### Autolytic Debridement
- When the extent of the injury is not defined (Ruiz et al., 2010).
- MDT can be used in various types of acute and chronic wounds:
  - Abscesses.
  - Burns.
  - Infected wounds.
  - Leg wounds: venous, ischemic, neuropathic (BTER n.d.b).
- As an alternative to treat osteomyelitis if surgical and medical treatments are not an option or have failed (BTER, n.d.b; Ruiz et al., 2010).
- Pressure wounds (BTER, n.d.b; Davydov, 2011; Marineau, Herrington, Swenor, & Eron, 2011; Ruiz et al., 2010; Sherman, 2009).
- Surgical wounds and traumatic wounds (BTER, n.d.b; Jiang et al., 2010; Marineau et al., 2011).

### Biologic Debridement (Maggot Debridement Therapy [MDT])
- Various types of dermal wounds (e.g., pressure wounds, leg wounds); and
- Thermal burn injuries (Ramundo & Gray, 2009; Shi & Carson, 2009; Shi et al., 2011; Smith & Nephew, Inc., 2014).
- Refer to the manufacturer’s guidelines for specific indications, uses, and product information.

### Enzymatic Debridement
- Enzymatic debridement is not recommended for advancing necrosis (Falanga et al., 2008).
- Enzymatic debridement should not be used for patients with known sensitivities to any of the product’s ingredients (Smith & Nephew, Inc., 2014).
- Use enzymatic debridement with caution in infected wounds (Ramundo, 2012; Ramundo & Gray, 2009).

### Mechanical Debridement
- Contraindications for mechanical debridement include:
  - Presence of significant granulation tissue.
  - Patients with poor perfusion and an intact eschar without signs of infection.
  - Uncontrolled pain.

### Conservative Sharp Debridement (CSD)
- CSD is contraindicated in the following situations:
  - Unable to determine the interface between viable and nonviable tissue; extensive undermining or tunneling.
  - Use caution with exposed bones, ligaments or tendons.
  - Excessive or unexpected bleeding.

### Contraindications
- Contraindications for autolytic debridement include:
  - Patients with poor perfusion and stable, dry, and intact eschar (Ramundo, 2012).
  - As the sole method of debridement for actively infected wounds or wounds with extensive necrotic tissue or significant tunneling and undermining (European Pressure Ulcer Advisory Panel & National Pressure Ulcer Advisory Panel, 2009; Ramundo, 2012).
- MDT is contraindicated in the following situations (Benbow, 2011; BTER, n.d.b; Ruiz et al., 2010; Sherman, 2009):
  - Presence of active hemorrhage, or bleeding disorders with a high risk of bleeding.
  - Copious wound exudate that may flush maggots out of the wound.
  - Wounds in deep body cavities, fistulae or sinus tracts of unknown origin.
- Enzymatic debridement is not recommended for advancing necrosis (Falanga et al., 2008).
- Enzymatic debridement should not be used for patients with known sensitivities to any of the product’s ingredients (Smith & Nephew, Inc., 2014).
- Use enzymatic debridement with caution in infected wounds (Ramundo, 2012; Ramundo & Gray, 2009).
- Contraindications for mechanical debridement include:
  - Presence of significant granulation tissue.
  - Patients with poor perfusion and an intact eschar without signs of infection.
  - Uncontrolled pain.
- CSD is contraindicated in the following situations:
  - Unable to determine the interface between viable and nonviable tissue; extensive undermining or tunneling.
  - Use caution with exposed bones, ligaments or tendons.
  - Excessive or unexpected bleeding.
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</table>
| • Patients at risk of severe infection or sepsis.  
• Immunocompromised patients or patients with severe neutropenia—absolute neutrophil count less than 500 mm^3 (Ramundo, 2012).  
• Third-degree burns. | • Wounds in close proximity to large blood vessels or organs.  
• Presence of life-threatening, acute infection.  
• Acute wounds that require frequent inspection.  
• Devitalized bone or tendon.  
• Inadequate circulation for healing.  
• Acute or rapidly advancing tissue necrosis.  
• Patient is allergic or sensitive to larval proteins or the nutrient media used to ship the maggots, which might include brewer’s yeast, soy, chicken egg, or other ingredients.  
• A non-consenting patient or patient’s representative.  
• Use of non-sterile, non-medical grade maggots. | • If infection is present, an appropriate topical antibiotic powder can be applied to the wound prior to the enzyme, and if the infection does not respond, collagenase should be discontinued until the infection is resolved (Ramundo, 2012; Ramundo & Gray, 2009; Smith & Nephew Inc., 2014).  
• Refer to the manufacturer’s guidelines for specific contraindications and precautions. | | • Patient at high risk of bleeding such as unstable clotting, coagulopathy disorder, and taking anticoagulants (Ramundo, 2012; Rodd-Nielsen et al., 2013; Young, 2012).  
• Fascial plane penetration.  
• Abscess.  
• Dry, stable heel ulcers.  
• Stable, ischemic wounds (Rodd-Nielsen et al., 2013).  
• Dry gangrene.  
• Non-consenting patient or patient’s representative.  
• Patient unable to cooperate or maintain position for the procedure (Rodd-Nielsen, 2013).  
• Extreme pain (Harris, 2009).  
• Advancing cellulitis or sepsis, in which case surgical debridement is preferred (Rodd-Nielsen et al., 2013).  
• Malignant cutaneous wounds such as fungating tumors (Harris, 2009; Rodd-Nielsen, 2013; Spear, 2010; Young, 2012).  
• Pyoderma gangrenosum or vasculitic ulcers, in which case debridement may exacerbate the condition.  
• Wounds on face, hands, and feet near nerves, vascular structures, grafts, prosthesis, dialysis fistulae, or joints (Rodd-Nielsen, 2013; Young, 2012). |
Autolytic Debridement

- Licensed healthcare providers who have been specifically trained in the application/procedure.

Biologic Debridement (Maggot Debridement Therapy [MDT])

- Licensed healthcare providers who have been specifically trained in the application and removal of larvae.

Enzymatic Debridement

- Licensed healthcare providers who have been specifically trained in the application/procedure.

Mechanical Debridement

- Licensed healthcare providers or caregivers who have been specifically trained in the application/procedure.

Conservative Sharp Debridement (CSD)

- Licensed healthcare providers who have been specifically educated, trained and demonstrated competency in CSD in accordance with licensure and facility policies and procedures (Harris, 2009; Leak 2012; Ramundo, 2012; Rodd-Nielsen et al., 2013; Young, 2012).
- Individuals performing CSD must be able to distinguish tissue types and understand the anatomy of the area to be debrided to prevent damage to blood vessels, organs, nerves, or tendons in the area (Chadwick et al., 2013; Gray et al., 2011; Young, 2012).

Skill level required

- Individuals performing CSD must be able to distinguish tissue types and understand the anatomy of the area to be debrided to prevent damage to blood vessels, organs, nerves, or tendons in the area (Chadwick et al., 2013; Gray et al., 2011; Young, 2012).

Method of action

- Autolysis is the body’s own natural process of removing devitalized tissue by the release of endogenous proteolytic, fibrinolytic, and collagenolytic enzymes (Ramundo, 2012).
- Autolytic debridement requires a moist environment, adequate perfusion, and a functioning immune system; and is enhanced by the use of moisture-retentive dressings (Benbow, 2011; Ramundo, 2012).
- Autolysis can be used alone or in combination with other debridement techniques (Ramundo, 2012).
- Four primary modes of action of medical grade maggots on wounds have been identified: cleaning/debridement of dead/necrotic tissue; disinfection by killing bacteria; stimulation of wound healing; removal of existing biofilm; and inhibition of the formation of new biofilm (BTER, n.d.a; Jiang et al., 2010; Opletalová et al., 2012; Sherman, 2009).
- Larvae may combat wound infection by ingesting microorganisms that are then destroyed in their digestive tracts (Ruiz et al., 2010).
- Four primary modes of action of medical grade maggots on wounds have been identified: cleaning/debridement of dead/necrotic tissue; disinfection by killing bacteria; stimulation of wound healing; removal of existing biofilm; and inhibition of the formation of new biofilm (BTER, n.d.a; Jiang et al., 2010; Opletalová et al., 2012; Sherman, 2009).
- Larvae may combat wound infection by ingesting microorganisms that are then destroyed in their digestive tracts (Ruiz et al., 2010).
- Collagenase works by dissolving the collagen that attaches the devitalized/necrotic tissue to the underlying wound bed (Lucas & King, 2010; Ramundo, 2012; Shi & Carson, 2009; Smith & Nephew Inc., 2014; Spear, 2010).
- Dakin’s solution denatures protein, which loosens the slough. Collagen degradation is affected by the concentration of the Dakin’s solution (Ramundo, 2012).
- Wound surface must be kept moist; enzymes can be used in combination with moist dressings (Ramundo, 2012; Ramundo & Gray, 2009; Shi & Carson, 2009; Shi, Ermis, Kiedaisch, & Carson, 2010).
- Mechanical debridement uses physical force to remove devitalized tissue.
- Wet to dry dressings: Moistened gauze (i.e., open-weave cotton fabric for best results) is lightly packed into the wound bed and allowed to completely dry, trapping debris (Ramundo, 2012). When the dressing is removed in a dry state, debris and tissue are removed from the wound bed.
- Pressurized wound irrigation/pulsatile lavage: Delivers a high pressure stream of fluid (i.e., 4 to 15 pounds per square inch [psi]) directed at the wound bed to remove debris (Ramundo, 2012).
- Pressurized wound irrigation/pulsatile lavage: Delivers a high pressure stream of fluid (i.e., 4 to 15 pounds per square inch [psi]) directed at the wound bed to remove debris (Ramundo, 2012).
- CSD is the most selective and efficient method to remove thick, adherent eschar and devitalized tissue causing little or no damage to healthy tissue.
<table>
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<tr>
<td>• Larvae secrete chemicals and other substances (i.e., allantoin, urea, ammonia, calcium carbonate, etc.) that favor granulation tissue and cell migration, and promote wound healing (Ruiz et al., 2010).</td>
<td>• Enzymes can be used in conjunction with autolytic, mechanical, and sharp debridement (Ramundo &amp; Gray, 2009).</td>
<td>• Noncontact low-frequency ultrasound therapy uses acoustic energy to remove necrotic tissue by mechanical debridement (Ramundo, 2012).</td>
<td>• Mechanical debridement should be discontinued when significant granulation tissue is present, or if significant pain or bleeding occurs.</td>
<td></td>
</tr>
<tr>
<td>• Micromassage of the wound by maggot movement is thought to stimulate granulation tissue formation and wound exudate (Ruiz et al., 2010).</td>
<td>• Manufacturers’ guidelines should be followed to achieve optimal efficacy.</td>
<td>• Hydrotherapy may be used to remove bacteria and debris and promotes softening and loosening of adherent necrotic tissue (Ramundo, 2012).</td>
<td>• The length of time for CSD varies according to the size of the wound and the amount of necrotic tissue and may take days to weeks, and often requires serial debridements (Ramundo, 2012).</td>
<td></td>
</tr>
<tr>
<td>• While biologic therapy is well tolerated and cost-effective, it is not applicable for every wound (Davydov, 2011; Gray et al., 2011; Jiang et al., 2010).</td>
<td>Use with caution in wounds with pseudomonas or wounds with necrosis extending to, and involving, blood vessel walls (Ruiz et al., 2010).</td>
<td>• Negative pressure wound therapy (NPWT) promotes autolytic debridement via a moisture retentive dressing and mechanical nonselective debridement with the removal of the open cell foam or gauze dressing (Loree, Dompmartin, Penven, Harel, &amp; Leroy, 2004).</td>
<td>• CSD is repeated as often as needed to remove devitalized tissue from the wound bed.</td>
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**Duration of therapy**

• The time frame for autolysis varies according to the size of the wound and the type and amount of necrotic tissue.
• Softening and separation of necrotic tissue commonly occurs within a few days, and if significant autolysis is not observed within 1 to 2 weeks, another method of debridement should be considered (Ramundo, 2012).
• Progress with MDT should be observed in 2 days to 2 weeks.
• In an RCT, most of the debridement occurred in the first week of MDT (Opletalová et al., 2012).
• The length of time for enzymatic debridement ranges from days to weeks (Ramundo, 2012).
• Enzymes should be discontinued when the wound is free of devitalized tissue and granulation tissue is visible, or according to the manufacturer’s recommendation (Ramundo & Gray, 2009).
• Mechanical debridement should be discontinued when significant granulation tissue is present, or if significant pain or bleeding occurs.
• The length of time for CSD varies according to the size of the wound and the amount of necrotic tissue and may take days to weeks, and often requires serial debridements (Ramundo, 2012).
• CSD is repeated as often as needed to remove devitalized tissue from the wound bed.
### Special considerations

- **Autolytic Debridement**
  - Autolysis is the most conservative form of debridement.
  - Autolysis may not take place fast enough to encourage rapid wound healing (Young, 2012).
  - Autolysis is a simple/easy form of debridement that is slower than other methods, but causes minimal pain and discomfort for the patient (Ramundo, 2012; Spear, 2010; Young, 2012).
  - Using a moisture-retentive dressing such as an occlusive or semi-occlusive dressing can enhance the process while maintaining a moist wound environment (Ramundo, 2012).
  - During the autolytic process:
    - The wound may increase in length, width, and depth because the full wound is exposed and the true extent of the wound is revealed as the autolytic process continues (Ramundo, 2012).
    - Odor may increase as devitalized tissue is liquefied (Ramundo, 2012; Young, 2012).
    - Exudate may increase, which can cause maceration of the periwound skin (Ramundo, 2012; Young, 2012).
    - The specific autolytic dressing or secondary dressing may need to be reconsidered throughout the treatment.

- **Biologic Debridement (Maggot Debridement Therapy [MDT])**
  - Maggots are medical-grade larvae and should be ordered only from an approved supplier (Ruiz et al., 2010).
  - Maggot larvae are considered a “perishable item” and should be used as soon as possible after delivery—ideally within 24 hours (Sherman, 2009).
  - If maggots are not used upon delivery, check the manufacturer’s recommendations for refrigeration and storage.
  - Maggots are contained in a “cage-like” dressing applied over the wound (BTER, n.d.a; Ruiz et al., 2010; Sherman, 2009).
  - The maggots may be allowed to move freely within the cage dressing, with the wound floor acting as the bottom of the cage, or the maggots may be contained within a sealed pouch that is placed on top of the wound (BTER, n.d.a).
  - The dressing must be kept air permeable because maggots require oxygen to live (BTER, n.d.b).
  - When maggots are satiated, they become substantially larger and seek to leave the site of a wound.
  - Dressings should be changed every 24 to 48 hours and no longer than 72 hours (BTER, n.d.b; Ruiz et al., 2010; Sherman, 2009).

- **Enzymatic Debridement**
  - Enzymatic debridement is considered a conservative method.
  - The decision to use an enzyme is based on the following:
    - Availability.
    - Cost.
    - Ease of dressing changes.
    - Frequency of dressing changes.
  - An enzyme requires a prescription.
  - Well-adhered eschar should be crosshatched with a No.10 blade by a licensed/credentialed healthcare provider to allow penetration of the enzyme using care not to damage underlying viable tissue.
  - Consider softening the eschar via autolytic debridement first (Ramundo, 2012; Ramundo & Gray, 2009; Smith & Nephew, Inc., 2014).
  - Collagenase should be applied at least once daily or twice per day with a cover dressing. The cover dressing can be moist or dry (Ramundo & Gray, 2009; Smith & Nephew, Inc., 2014).
  - The enzyme may cause mild and transient burning or pain, or slight erythema if the ointment contacts the periwound skin (Ramundo & Gray, 2009; Smith & Nephew, Inc., 2014).

- **Mechanical Debridement**
  - Mechanical debridement may cause pain, bleeding, and damage to healthy, exposed granulation and epithelial tissue (Cowan & Stechmiller, 2009; Ramundo, 2012; Spear, 2010).
  - Consider a pain management program.
  - Note: Wet to dry dressings are not generally an acceptable form of moist wound care or debridement.
  - Wet to dry gauze dressings are not appropriate for debridement in most cases because they do not support optimal granulation and moist wound healing; are costly, time consuming and labor intensive; can cause pain, bleeding and trauma to healthy tissue; do not provide a bacterial barrier; and are less effective than other methods (Cowan & Stechmiller, 2009; Gray et al., 2011; Harris, 2009; Leak, 2012; Lucas & King, 2010; Nenna, 2011; Sibbald et al., 2011).
  - The wound may increase in length, width, and depth because the full wound is exposed and the true extent of the wound is revealed as necrotic tissue is removed.
  - Prior to performing CSD, the clinician should determine if the setting and environment are clean and safe with adequate lighting to perform CSD; if there is a stable surface to position the patient; and if assistance is available (if needed) during the procedure (Rodd-Nielsen et al., 2013).

- **Conservative Sharp Debridement (CSD)**
  - Caution should be used with CSD for patients who are taking anticoagulant medications.
  - Caution is advised if using CSD in infected wounds (Ramundo, 2012; Young, 2012).
  - If surgery is not an option, appropriate antibiotic coverage is needed along with CSD on infected wounds (Ramundo, 2012).
  - CSD often requires additional debridements (Gray et al., 2011; Ramundo, 2012; Rodd-Nielsen et al., 2013).
  - The wound may increase in length, width, and depth because the full wound is exposed and the true extent of the wound is revealed as necrotic tissue is removed.

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**Notes:**

- **Availability:** Choose a supplier that can deliver within 24 hours.
- **Cost:** Consider cost when selecting a debridement method.
- **Ease of dressing changes:** Evaluate how easy it is to change dressings.
- **Frequency of dressing changes:** Consider how frequently dressings need to be changed.
- **Side effects:** Evaluate potential side effects of each method.

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**References:**


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**Contact Information:**

- WOCN® National Office ◊ Mount Laurel, NJ 08054
- [www.wocn.org](http://www.wocn.org)
<table>
<thead>
<tr>
<th>Autolytic Debridement</th>
<th>Biologic Debridement (Maggot Debridement Therapy [MDT])</th>
<th>Enzymatic Debridement</th>
<th>Mechanical Debridement</th>
<th>Conservative Sharp Debridement (CSD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>©Protection for the periwound skin should be included to prevent maceration, denudation, and further skin damage during treatment (Young, 2012).</td>
<td>• Multiple courses of maggot therapy may be administered depending on the severity of the non-healing wound. Most patients require 2 to 3 applications of MDT (Davydov, 2011).</td>
<td>• Enzymes are sensitive to pH range: Acidic or highly alkaline solutions can decrease the effectiveness of collagenase and should be avoided (Ramundo, 2012; Ramundo &amp; Gray, 2009).</td>
<td>• Use sterile instruments such as forceps, scissors, and #10 blade scalpels for CSD (Rodd-Nielsen et al., 2013). Use aseptic technique. Non-sterile gloves are appropriate (Perelman et al., 2004; Ramundo, 2012; Rowley, Clare, Macqueen, &amp; Molyneux, 2010; WOCN, 2012).</td>
<td>• Policies and procedures should be in place and supplies should be available to manage complications such as minor bleeding (Ramundo, 2012; Rodd-Nielsen et al., 2013).</td>
</tr>
<tr>
<td></td>
<td>• Maggots do not reproduce in the wound because they are still in the larval stage and too immature to replicate (Davydov, 2011). Reproduction only occurs when they become adult flies and mate (Ruiz et al., 2010).</td>
<td>• Collagenase is effective over a wide pH range, but the optimal pH for collagenase activity is 8.5 (Shi et al., 2011).</td>
<td>• The need for analgesia during the procedure should be assessed, and adequate pain control provided (Ramundo, 2012; Rodd-Nielsen et al., 2013).</td>
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<tr>
<td></td>
<td>• The wound may increase in length, width, and depth because the full wound is exposed and the true extent of the wound is revealed as the process continues.</td>
<td>• Normal saline and Dakin’s solution are compatible with collagenase (Smith &amp; Nephew, Inc., 2014).</td>
<td>• CSD poses a risk for transient bacteremia (Ramundo, 2012; Rodd-Nielsen et al., 2013).</td>
<td>• CSD should be discontinued if the following occurs: ©Severe or uncontrolled bleeding. ©The pain tolerance of the patient has been reached. ©Fatigue of the person performing the debridement.</td>
</tr>
<tr>
<td></td>
<td>• Odor is controlled by maggots ingesting devitalized tissue and bacteria (Benbow, 2011).</td>
<td>• Do not use cleansers or dressings containing heavy metals (e.g., silver, iodine), or acidic or hyperchlorite solutions with collagenase because they can deactivate the active ingredients in the enzyme (Ramundo &amp; Gray, 2009; Shi &amp; Carson, 2009; Shi et al., 2010).</td>
<td>• Policies and procedures should be in place and supplies should be available to manage complications such as minor bleeding (Ramundo, 2012; Rodd-Nielsen et al., 2013).</td>
<td>• The need for analgesia during the procedure should be assessed, and adequate pain control provided (Ramundo, 2012; Rodd-Nielsen et al., 2013).</td>
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<tr>
<td></td>
<td>• Maggots can be removed from the wound using gloved fingers, forceps, or moistened gauze pads followed by flushing the wound with saline.</td>
<td>• Include protection for the periwound skin to prevent maceration, denudation, or further skin damage during treatment.</td>
<td>• CSD poses a risk for transient bacteremia (Ramundo, 2012; Rodd-Nielsen et al., 2013).</td>
<td>• The need for analgesia during the procedure should be assessed, and adequate pain control provided (Ramundo, 2012; Rodd-Nielsen et al., 2013).</td>
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<tr>
<td></td>
<td>• Care should be taken to avoid killing/bursting maggots in the wound because some patients can have anaphylactic reactions to larval protein, and the maggots contain the bacteria and necrotic tissue they ingested in the wound (BTER, n.d.b).</td>
<td>• Exudate may increase during the debridement process and cover dressings may need to be reconsidered throughout the treatment.</td>
<td>• CSD should be discontinued if the following occurs: ©Severe or uncontrolled bleeding. ©The pain tolerance of the patient has been reached. ©Fatigue of the person performing the debridement.</td>
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<tr>
<td>• Pain and minor bleeding have occurred with MDT (Davydov, 2011; Ramundo, 2012; Sherman, 2009).</td>
<td>• Pain is usually a result of the caustic exudate that denudes the periwound skin.</td>
<td>• The wound may increase in length, width, and depth because the full wound is exposed and the true extent of the wound is revealed as enzymatic debridement continues.</td>
<td>Refer to the manufacturer’s guidelines for specific information about the administration and application of the enzyme.</td>
<td></td>
</tr>
<tr>
<td>• Pain is usually a result of the caustic exudate that denudes the periwound skin.</td>
<td>• The periwound skin should be protected with a hydrocolloid, zinc oxide based moisture barrier ointment, and the manufacturer's system should be utilized to help prevent skin breakdown.</td>
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<td>• Therapy may need to be stopped to address the pain.</td>
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<td>• Some patients report a tickling sensation from the movement of the larvae in the wound.</td>
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<td>• Exposure to hydrogel with polyethylene glycol may negate the action of the larvae (Young, 2012).</td>
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<tr>
<td>• MDT is not recommended as the sole method for debridement of neuropathic/diabetic foot wounds because larvae cannot remove callus (Chadwick et al., 2013).</td>
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<tr>
<td>• Disposal of larvae should be according to facility policy, and used larvae should be considered biohazardous waste.</td>
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<td>• Refer to the manufacturer’s guidelines for other specific/special considerations regarding MDT.</td>
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<td>• See Appendix A for a sample template for policies and procedures for MDT, and Appendix B for a sample template for an MDT consent form (BTER, n.d.b, c).</td>
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</tbody>
</table>
Glossary

**Acute wound**: Disruption in the integrity of the skin and underlying tissue that progresses through the healing process in a timely and uneventful manner.

**Biofilm**: Bacteria that forms microbial communities which demonstrate increased resistance to antibiotics and interferes with wound healing. Must be removed with debridement.

**Chronic wound**: Wound that is unresponsive to initial therapy despite appropriate care. A chronic wound fails to respond to treatment and heal in the normally expected time frame (i.e., approximately 4 weeks), and becomes “stuck” in the inflammatory phase. Wound chronicity is attributed to the presence of intrinsic and extrinsic factors including medications, poor nutrition, co-morbidities, or use of inappropriate dressings.

**Denudation**: Loss of the epidermis, caused by prolonged exposure to urine, feces, body fluids, wound exudate, or friction.

**Infected wound**: Wound typically has at least one or more of the following symptoms: foul odor, purulent drainage (pus), debris (yellowish to greenish) or dead tissue, and ongoing symptoms of inflammation (i.e., fever, pain, redness, swelling, warmth). The infection can also affect the surrounding tissues and may cause a bacterial skin infection (cellulitis) or an acute or chronic bacterial bone infection (osteomyelitis). If the infection spreads to the blood vessels, the bacteria may spread and cause infection in other areas of the body (sepsis or systemic infection).

**Maceration**: Softening and breakdown of skin from prolonged exposure to moisture. Often presents as white rim around the immediate periwound edge.

**Noninfected wound**: Wound that is free from bacteria, odor, purulent drainage (pus), or dead tissue and shows no signs of inflammation (i.e., fever, pain, redness, swelling, warmth). Mild erythema can be present and is a part of the initial inflammatory phase.
References


doi:10.1097/01.ASW.0000363469.25740.74

doi:10.1177/0897190010366938


doi:10.1097/01.ASW.0000383755.62091.1e


**Acknowledgment about Content Validation**

This document was reviewed in the consensus-building process of the Wound, Ostomy and Continence Nurses Society known as Content Validation, which is managed by the Center for Clinical Investigation.
Appendix A

Policies & Procedures Template for Maggot Debridement Therapy (MDT)
Source: Bio-Therapeutics Education and Research Foundation. Used with permission.

These sample policy/procedure and consent forms are not intended to be adopted and used as a substitute for a particular organization’s specific forms. The documents are to be used only as guides to developing policies/procedures and consent forms. Each organization must develop individualized forms in accordance with guidance and approval of appropriate administrative, legal, and risk management departments.

DISCLAIMERS AND LEGAL NOTICES

This template for maggot debridement therapy policies and procedures is provided by the BioTherapeutics, Education and Research Foundation, without warranties concerning the applicability of this draft at any specific facility. Please modify the document as needed to fit the specific policy, procedure, formulary, or logistic demands of your institution. Be sure to read and follow all warnings and labeling information associated with products used in the application and removal of maggot therapy dressings.

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The BioTherapeutics, Education and Research (BTER) Foundation is a public charity whose mission is to support patient care, education, and research in maggot therapy, leech therapy, and the other diagnostic and treatment modalities that use live animals. More information about our services can be found at the address below, or on the internet at: www.BTERFoundation.org

Disclosure: Ronald Sherman, one of the co-authors of this template and Board Member of the BTER Foundation is also the Co-Founder and Laboratory Director of Monarch Labs, which produces and distributes Medical Maggots™ and other biotherapy products.
POLICY NAME
Maggot Debridement Therapy Policy and Procedure

POLICY NUMBER
XXXXXX

PURPOSE
The purpose of this policy is to provide guidelines for the use of Maggot Debridement Therapy (MDT) in wound management.

PERSONNEL
ET and/or Wound Care Specialist
MD, DO, DPM, PA, NP
RN, LPN, LVN, CCA, CNA, NA
Physical therapists
Pharmacy and/or Supply & Receiving staff
Social Worker/Case Manager
Infection Control

INDICATIONS
Non-healing wounds that contain slough or necrotic tissue (neuropathic and/or ischemic foot ulcers, pressure ulcers, venous stasis ulcers, traumatic wounds, and problematic post-surgical wounds). Some therapists also use MDT for maintenance debridement, or to determine the level of viability by debriding the necrotic tissue until reaching the viable tissue underneath. Some therapists use MDT for palliation of odor, drainage or pain. Be sure to document the indication(s) for treatment.

WARNINGS, CONTRAINDICATIONS and RELATIVE CONTRAINDICATIONS
1. Persons allergic to fly larvae or materials used in their manufacture (brewer’s yeast; soy) may manifest allergic reactions to maggots prepared in such media. Check manufacturer’s labeling.
2. Rapidly advancing infection that needs frequent inspection and possibly surgical intervention. MDT dressings could impair direct visualization of the wound.
3. As an alternative to surgical resection for osteomyelitis, when surgery itself is not contraindicated. Surgical resection, when feasible, is the preferred method of debriding dead bone.
4. Necrosis extending to, and involving, blood vessel walls may be dissolved by the maggots’ digestive secretions, along with the other necrotic tissue, leading to serious bleeding. If such wounds are to be treated with maggot therapy, then treatment should be rendered under close or intensive observation.
5. Unable to obtain informed consent from patient or power of attorney for healthcare.
6. Patients with natural or pharmacologically induced coagulopathy are at increased risk of bleeding; if they are treated with MDT they must be observed closely and frequently.
7. Disinfected maggots should never be transferred from one patient to another.
8. Vials of medicinal maggots should never be used more than once. They are not intended nor approved for multi-dosing.
9. *Pseudomonas* infections may not always respond to maggot therapy; they may need specific antimicrobial therapy before and/or during MDT.
10. Medicinal maggots should not be used if the sterile seal is broken, if the container is damaged, if
the maggots have a strong offensive odor, or if they are known or suspected of being
contaminated.

PERSONAL PROTECTION
Personal protective equipment (PPE) will be used at all times, as appropriate. Clean gloves will be used
when handling maggots or wound dressings. Mask, eye protection, and gown, when performing treatment
where exposure to blood/body fluids is likely.

COMPETENCIES
Only licensed personnel who have been trained in the procedure will apply MDT dressings. Any licensed
personnel may remove MDT dressings. Outer dressings may be changed by any personnel allowed to
change simple dry dressings by current hospital policy. Patients, family members and caregivers may
remove MDT and/or change outer dressings as a part of teaching prior to discharge.

PROCEDURES – Dressing Application
The specific procedures and supplies for applying maggot therapy dressings depend on the location and
dimensions of the wound. Several methods will be described here, but the successful therapist will often
have to improvise. All of these dressings have in common the fact that they are designed to create a ‘cage’
over the wound floor, providing the maggots with free access to the wound bed (and undermined areas),
but preventing them from leaving the proximity of the wound. An absorbent dressing (i.e., gauze) on the
outside of the cage-dressing collects the liquified necrotic tissue drainage, and gets replaced as frequently
as necessary (as frequently as it gets soiled). It is crucial that adequate air reaches the maggots through the
dressing, and that the maggots do not drown in the liquid exudate that they create.

Wound documentation supplies – Camera, wound tracing device, marker, Skin Ulcer Flow Sheet,
Nursing records.

Miscellaneous supplies – Consent form, PPE (see below), rubbish collection supplies.

I) Planar Wounds (Examples: ischial or sacral pressure wounds, plantar foot wounds, anterior
tibial wounds, etc.)

A) Pre-assembled MDT dressings (i.e., LeFlap [Monarch Labs])
1. Assess wound for appropriateness (see Clinical Indications, above).
2. Obtain MD order.
3. Obtain patient and/or family informed consent, and consent for photography, if applicable.
4. Gather and inspect all supplies. Read and understand product literature (preferably before
reaching the bedside).
5. Photograph the wound before the first treatment (recommended), and periodically thereafter
to measure and document progress.
6. Gently cleanse the wound and peripheral skin (never use povidone iodine or other skin
irritants), cut hair, if extensive, and protect the skin with a skin protectant, if possible.
7. When using a dressing like LeFlap, it will be necessary to cut out from the hydrocolloid layer
a hole that matches the dimensions of the wounds. If the dressing itself needs to be trimmed
to fit the anatomy, then LeFlap DuJour is the better choice, because it can be trimmed without
losing adhesiveness. If the dressing already has a hole cut out in the foundation
(hydrocolloid) layer, then it will not be necessary to cut the hole. Using the wound tracing
device and marker, outline the wound, and cut out the pattern. Trace the pattern onto the
hydrocolloid pad, and cut out the shape of the wound from these dressings.
8. Place the dressing on the skin, open the netted (flapped) layer, and place the maggots on the wound (easily accessible because of the hole in the hydrocolloid layer).

9. The dose of maggots is 5-10 per square cm. If the maggots come as “maggot-impregnated gauze” then simply calculate the amount of gauze necessary to contain the desired number of maggots, and place that amount of gauze over the wound. If this amount of gauze is not adequate to cover the entire wound, then an additional pad of gauze can be moistened with sterile water or saline and placed over the wound bed. For example, if the wound were 5 cm by 7 cm, then its surface area would be 5 x 7 = 35 cm. The dose wound be 175 - 350 maggots. If the vial of maggot-impregnated gauze contained 600 maggots, then the therapist would need about half that to equal 300 maggots. The therapist would take or cut half the gauze and place it over the wound. There is no need to count each maggot, or attempt repeatedly to get every single maggot out from the vial. The maggots can simply be transferred from the vial to the wound within the maggot-impregnated gauze pad.

10. Now peel back the adhesive liner and flap down the netted fabric layer. Press firmly in place, to create a good bond.

11. If the patient or wound area is likely to move a lot or become soiled, it may be desirable to reinforce the dressing with silk, cloth or pink plastic tape, or with transparent membrane dressings, in a “picture frame” pattern. The film should cover the hydrocolloid frame and peripheral skin, but must NOT cover the central porous wound covering, or else it will prevent air from reaching the maggots and prevent the necessary drainage of necrotic wound exudate.

12. Cover this “maggot cage dressing” with dry absorbent gauze and secure loosely with a short gauze wrap or two pieces of tape. Air should be able to enter the dressing and the liquefied necrotic tissue should be able to drain out. Check this outer dressing every 4-6 hours for soiling, and replace with clean dry gauze as needed.

13. Leave the maggot cage dressing in place for approximately 48 hours.

B) Do-It-Yourself (DIY) dressings, custom-made at the bedside
Sometimes the size or shape of a wound does not lend itself easily to being covered with a standard maggot dressing. In such cases, it is valuable to be able to create a MDT dressing from locally available products. The procedure is similar to that described above, except that the netted fabric layer must be adhered to the hydrocolloid layer with glue, tape, and other bonding materials.

1. Assess wound for appropriateness (see Clinical Indications, above).
2. Obtain MD order.
3. Obtain patient and/or family informed consent, and consent for photography, if applicable.
4. Gather and inspect all supplies. Read and understand product literature (preferably before reaching the bedside).
5. Photograph the wound before the first treatment (recommended), and periodically thereafter to measure and document progress.
6. Gently cleanse the wound and peripheral skin (never use povidone iodine or other skin irritants), cut hair, if extensive, and protect the skin with a skin protectant, if possible.
7. Using the wound tracing device and marker, outline the wound, and cut out the pattern. Trace the pattern onto a hydrocolloid pad, and cut out the shape of the wound from the pad.
8. Place the cut-out hydrocolloid pad over the wound, to expose the wound but cover the peri-wound skin. Apply securely to the skin, such that it frames the wound.
9. Coat the hydrocolloid ring with a layer of liquid adhesive, such as NuHope Adhesive or Skin Bond (Smith & Nephew). The adhesive will become tacky while the maggots are placed within the wound bed.
The dose of maggots is 5-10 per square cm. If the maggots come as “maggot-impregnated gauze” then simply calculate the amount of gauze necessary to contain the desired number of maggots, and place that amount of gauze over the wound. If this amount of gauze is not adequate to cover the entire wound, then an additional pad of gauze can be moistened with sterile water or saline and placed over the wound bed. For example, if the wound were 5 cm by 7 cm, then its surface area would be 5 x 7 = 35 cm. The dose wound be 175 - 350 maggots. If the vial of maggot-impregnated gauze contained 600 maggots, then the therapist would need about half that to equal 300 maggots. The therapist would take or cut half the gauze and place it over the wound. There is no need to count each maggot, or attempt repeatedly to get every single maggot out from the vial. The maggots can simply be transferred from the vial to the wound within the maggot-impregnated gauze pad.

Place a porous cover (i.e., polyester net, such as Creature Comforts™ by Monarch Labs or Tegapore by 3M) over the maggots in the wound, making sure to extend it well past the wound edges, and affix it securely to the hydrocolloid pad with another layer of glue. The layers of glue above and below the porous net will bond with each other, through the pores. Then add a layer of cloth or silk tape to sandwich the bond (hydrocolloid - glue - net - glue -tape).

If the patient or wound area is likely to move a lot or become soiled, it may be desirable to reinforce the dressing with silk, cloth or pink plastic tape, or with transparent membrane dressings, in a “picture frame” pattern. The film should cover the hydrocolloid frame and peripheral skin, but must NOT cover the central porous wound covering, or else it will prevent air from reaching the maggots and prevent the necessary drainage of necrotic wound exudate.

Cover this “maggot cage dressing” with dry absorbent gauze and secure loosely with a short gauze wrap or two pieces of tape. Air should be able to enter the dressing and the liquefied necrotic tissue should be able to drain out. Check this outer dressing every 4-6 hours for soiling, and replace with clean dry gauze as needed.

Leave the maggot cage dressing in place for approximately 48 hours. If maggots escape the dressing they should be disposed of in a red garbage bag. The dressing may be resealed, if possible, or may need to be removed completely and replaced with a normal saline moist to moist dressing (see below), changed every shift until new dressing orders can be written.

Three-dimensionally complicated wounds (Examples: stump wounds, large heel wound, anterior foot wound, which cannot easily be covered with a simple sheet of fabric without wrinkling). These wounds are usually best covered by bag-like or stocking-like dressings, which can cover the stump, foot or circumferential let wounds.

For years, nylon stockings have been used for this purpose. They are simple to work with, readily available, and of low cost. The stretchable weave allows them to fit a variety of sized wounds. The major drawback, however, has been the fact that the smallest maggots, when first applied, can escape through the expandable holes. This can be quite disconcerting (seeing up to 5% of the applied larvae crawling out of the dressing), although it is of little concern, since the larvae, before finding their way to the wound bed, are germ-free and will desiccate within 30 minutes, so they will not spread to anyone else. Up until now, our only suggestion has been to use white- or ivory-colored nylon stockings, so the larvae will exit mostly unnoticed.

There is now a maggot-specific, fixed-weave (non-stretchable) polyester net dressing in the shape of a stocking, which will avoid the problem of escaping larvae (LeSoc™ by Monarch Labs). Since it is not stretchable, it comes in a variety of sizes to match the needs of the patient. Both can be applied in a similar fashion, which will be described below.
Warning - since fixed-weave fabrics do not stretch, be sure not to use them in a manner, or on patients who are susceptible to, constriction by the fabric, leading to ischemia.

1. As described previously, assess the wound for appropriateness (see Clinical Indications, above).
2. Obtain MD order.
3. Obtain patient and/or family informed consent, and consent for photography, if applicable.
4. Gather and inspect all supplies. Read and understand product literature (preferably before reaching the bedside).
5. Photograph the wound before the first treatment (recommended), and periodically thereafter, to measure and document progress.
6. Gently cleanse the wound and peripheral skin (never use povidone iodine or other skin irritants), cut hair, if extensive, and protect the skin with a skin protectant, if possible.
7. Cut a hydrocolloid pad into 1 cm wide strips, and place these strips as a fence around the wound. For example, they should be placed around the mid foot, proximal to a fore-foot wound involving the toes or toe stumps; for a circumferential leg wounds, one strip should be placed around the leg just proximal to the wound, and another just distal to the wound. For a breast wound involving the axilla, a fence could be made by laying strips down the mid-chest, laterally along the scapula and antero-lateral chest wall, and then across the proximal arm and down the flank or back.
8. Coat the hydrocolloid ring with a layer of liquid adhesive, such as NuHope Adhesive or Skin Bond (Smith & Nephew). The adhesive will become tacky while the maggots are placed within the wound bed.
9. The dose of maggots is 5-10 per square cm. If the maggots come as “maggot-impregnated gauze” then simply calculate the amount of gauze necessary to contain the desired number of maggots, and place that amount of gauze over the wound. If this amount of gauze is not adequate to cover the entire wound, then an additional pad of gauze can be moistened with sterile water or saline and placed over the wound bed. For example, if the wound were 5 cm by 7 cm, then it’s surface area would be 5 x 7 = 35 cm. The dose wound be 175 - 350 maggots. If the vial of maggot-impregnated gauze contained 600 maggots, then the therapist would need about half that to equal 300 maggots. The therapist would take or cut half the gauze and place it over the wound. There is no need to count each maggot, or attempt repeatedly to get every single maggot out from the vial. The maggots can simply be transferred from the vial to the wound within the maggot-impregnated gauze pad.
10. Now place the porous, sock-like dressing (nylon stocking, LeSoc™ dressing, etc) over the maggots in the wound, making sure to extend it at least far enough to cover the hydrocolloid strips. Affix it securely to the hydrocolloid strips with another layer of glue. The layers of glue above and below the porous net will bond will with each other, through the pores. Then add a layer of cloth or silk tape to sandwich the bond (hydrocolloid - glue - net - glue -tape). The excess netted fabric can be trimmed, carefully, with scissors.
11. If the patient or wound area is likely to move a lot or become soiled, it may be desirable to reinforce the dressing with silk, cloth or pink plastic tape, or with transparent membrane dressings, in a “picture frame” pattern. The film should cover the hydrocolloid frame and peripheral skin, but must NOT cover the central porous wound covering, or else it will prevent air from reaching the maggots and prevent the necessary drainage of necrotic wound exudate.
12. Cover this “maggot cage dressing” with dry absorbent gauze (perhaps roll gauze). Air should be able to enter the dressing and the liquefied necrotic tissue should be able to drain out. Check this outer dressing every 4-6 hours for soiling, and replace with clean dry gauze as needed.
13. Leave the maggot cage dressing in place for approximately 48 hours. If maggots escape the dressing they should be disposed of in a red garbage bag. The dressing may be resealed, if possible, or may need to be removed completely and replaced with a normal saline moist to moist dressing (see below), changed every shift until new dressing orders can be written.
**PROCEDURES - Dressing Removal**

Dressing removal is essentially the same for all types of maggot therapy dressings. Remove all or nearly all maggots quickly and completely, disposing of them as wet dressing waste.

1. Maggot debridement dressings should be removed after approximately 48 hours (maximum 72 hours).
2. To remove the dressings, place an infectious waste (i.e., “red”) bag next to or under the dressing.
3. Inspect the dressing and surrounding skin carefully, noting any problems or abnormalities.
4. Remove the outer gauze dressing and gently loosen (but do not remove) the hydrocolloid pad from the skin.
5. Quickly peel back the hydrocolloid pad and the entire cage dressing from the wound with one hand, while wiping the larvae in the same direction with a moist 4x4” gauze held in the other hand, “sandwiching” the maggots between the hydrocolloid pad and the fresh moist gauze pad. The “wiping” gauze pad can be moistened with normal saline, irrigation water, or gentle antimicrobial (i.e., hydrogen peroxide). If using the latter, be sure to rinse out the antimicrobial thoroughly after removing the maggots (see #21, below).
6. Toss the MDT dressing and sandwiched larvae into the infectious waste bag. If the bag is mounted underneath the wounded limb, then the loose maggots will drop into the bag below as they attempt to escape.
7. Irrigate the wound with normal saline.
8. It may be necessary to use gloved fingers, forceps, or cotton swabs to remove a few immature larvae. Never kill the larvae within the wound if you are unable to extract them. It is better to leave live larvae in the wound, which will crawl out on their own and bury themselves in a dry gauze dressing, rather than risk leaving dead larvae within the wound.
9. Check the bedding for loose larvae, which may wander off in search of the infectious waste bag. Grasp them firmly and drop them off at that destination.
10. Secure the waste bag in the following manner: Tie a knot in the plastic bag (or drop the paper bag into a plastic bag, and tie a knot in that plastic bag). Then place this plastic bag into a second infectious waste bag and seal it securely with a knot. This technique is called “double-bagging.” Be sure that the knots are tied completely, securely, and “AIR-TIGHT.” A bow tie made from two opposing edges of the bag (“rabbit-ear bow-tie”) is not adequate to prevent maggots from escaping from the bag. Drop the double-bagged maggots and dressings into the infectious waste bin.
11. Assess the wound for another application of maggots, or another appropriate dressing.
12. Apply that dressing.

**ADDITIONAL CONSIDERATIONS**

1. Maggot therapy must be performed within the context of good skin and wound care (pressure relief, cleanliness, repositioning of those with immobility, limb positions and dressings that optimize lymph and venous drainage and arterial perfusion, as per standard policies and procedures).
2. Patients with fever or changes in mental status should be evaluated for spread of infection (i.e., bacteremia, cellulitis) or elevated serum ammonia levels. Maggot dressings may need to be removed immediately to facilitate wound inspection.
3. See also package labeling and manufacturer guidelines.
4. Someone must be on-call and available at all times to answer questions and address problems with MDT patients. The name and contact number must be clearly identifiable in the patient’s chart, and should be made known to the nursing staff and to the patient and/or family.
5. Staff must notify the wound care specialist on call for MDT patients if: the maggots are escaping, if the dressing comes loose, if the patient is not tolerating the therapy; or if there are any other non-routine problems.
6. If the patient does not tolerate the presence of the maggots (5-30% of patients experience some pain or discomfort after 30 hours, as the larvae grow larger, especially if the wounds were painful before MDT), then pain meds and anxiolytics should be readily available. If analgesics do not adequately control the pain, the dressing should be removed immediately. The pain should cease completely as soon as the dressings are removed. Replace the MDT dressing with a moist dressing, changed every shift, until new dressing orders can be written.

7. If maggots are seen to escape from the dressing, inspect the area and notify the wound care specialist on-call for MDT patients. Loose maggots should be “double-bagged” and discarded with infectious waste. If the dressing has a small defect or opening, and if the cage is not very full, then the dressing may be resealed. However, if the escape is due to the maggots being mature and leaving the wound, or due to too many larvae within the cage which is now bursting open, then the dressing should be removed and the wound inspected. The dressing can be replaced with a normal saline moist to moist dressing, changed every shift until new dressing orders can be written.

8. Contact the person on-call for MDT dressings if the patient expires. The dressings must be removed immediately if the patient expires.

DOCUMENTATION
1. Consents
2. Skin Ulcer Flow Sheet
3. Dressing Change Flow Sheet
4. Wound Measurement Flow Sheet
5. Multidisciplinary Care Plan
6. Nursing Flow Sheet
7. Patient and Family Teaching Form
8. Discharge

REFERENCES

APPROVALS:

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Original Date: __________ Effective Date: __________ Expiration Date: __________
Supercedes #: __________ Originating Department: __________________________
Appendix B

Template for Maggot Debridement Therapy (MDT) Consent Form

Source: Bio-Therapeutics Education and Research Foundation. Used with permission.

These sample policy/procedure and consent forms are not intended to be adopted and used as a substitute for a particular organization’s specific forms. The documents are to be used only as guides to developing policies/procedures and consent forms. Each organization must develop individualized forms in accordance with guidance and approval of appropriate administrative, legal, and risk management departments.

Bio-Therapeutics Education & Research Foundation

36 Urey Court, Irvine, CA 92617 ~ Phone: 949-275-8315 ~ Fax: 949-679-3001 ~ www.BTERFoundation.org

Advancing Healthcare through Education & Research in BioTherapy

DISCLAIMERS AND LEGAL NOTICES

This template for Informed Consent to maggot debridement therapy is provided by the BioTherapeutics, Education and Research Foundation, without warranties concerning the applicability of this draft at any specific facility. Please modify the document as needed to fit the specific policy, procedure, formulary, or logistic demands of your institution. Be sure to read and follow all warnings and labeling information associated with products used in the application and removal of maggot therapy dressings, and inform your patients of the true risks, benefits and options, as this is only a sample of the document that you should use.

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The BioTherapeutics, Education and Research (BTER) Foundation is a public charity whose mission is to support patient care, education, and research in maggot therapy, leech therapy, and the other diagnostic and treatment modalities that use live animals. More information about our services can be found at the address below, or on the internet at: www.BTERFoundation.org

Template for Maggot Debridement Therapy (MDT) Consent Form
I, ___________________, hereby acknowledge that I have been informed about the procedure of maggot therapy, the reasons for its use, reasonable goals of therapy, likely risks, and appropriate alternatives, as outlined below. Furthermore, I acknowledge that I have had the opportunity to ask questions and have had those questions answered to my satisfaction.

**Description of the maggot therapy procedure (check those that apply):**
- ☐ Placement of live, germ-free (“medical-grade”) fly larvae (“maggots”) on the wound, within special dressings to confine them to the wound. The dressings and maggots will be removed within 24-72 hours
- ☐ Photographs may be taken for the purposes of (delete all those not applicable) monitoring efficacy of the treatment, documentation in the medical record, teaching or publication.
- ☐ Other aspects of treatment: _______________________________________________

**Persons who will be involved in the procedure**
- ☐ ________________________________________________________________________
- ☐ ________________________________________________________________________
- ☐ ________________________________________________________________________

**Indications (reasons) for using maggot therapy (check those that apply):**
- ☐ Debridement (removal) of dead tissue
- ☐ Debridement (removal) of dead, infected tissue
- ☐ Other: ________________________________________________________________

**Risks, Warnings Possible Complications**

**The following risks occur in over 10% of patients:**
Pain or discomfort, particularly in patients already experiencing wound pain. Maggot-associated pain or discomfort usually manifests at about 24 hours into therapy, and increases as the larvae grow larger. If pain medication does not control the pain, then the maggots can be removed early to achieve immediate relief of maggot-associated pain.

**The following risks occur in approximately 1-2% of patients:**
Because medicinal maggots are highly perishable, they should not be stored for more than 24 hours. Therefore, they are prepared and shipped overnight, immediately before their intended use. Rarely, they are delayed during transport (especially by bad weather conditions).

The instinctive behavior of maggots is to leave the wound (host) once they are finished working (satiated). Therefore, they are “self-extracting.” But some are finished earlier than others. Depending on a variety of conditions, most maggots will be satiated by 48 hours; a few will not be satiated until nearly 72 hours. If the dressings are left on for the full 72 hours, then those that are already satiated will attempt to escape. If the dressing comes loose, they may be successful. If the dressing is removed at 48 hours or earlier, before all of the larvae are satiated, then some may hide in crevices if there is still necrotic tissue to be found. These will leave once they, too, are satiated, most likely within the following 24 hours, by entering the covering dressings and hiding therein. Those dressings should be removed and discarded as wound dressing (infectious) waste in a sealed container to prevent their escape from the waste container. If not properly disposed, escaped maggots or those not properly disposed of could pupate and mature to adult flies approximately two weeks later.
The following risks occur in less than 1% of patients:
Patients allergic to fly larvae, brewer's yeast, soy proteins or other ingredients may manifest allergic reactions.

Although medicinal maggots are disinfected, they could become contaminated during processing, shipping, or handling by the user. This could lead to infection of the wound.

Fever or changes in mental status could occur, and may or may not be due to the therapy. Sometimes they are due to the wound itself; sometimes to other medical problems in the body. Regardless of the cause, if such symptoms do occur it may be necessary to remove the maggot dressings in order to examine the wound and determine the cause of the fever or mental changes.

Additionally, medicinal maggots are not guaranteed to be effective for every wound. The amount of necrotic tissue may be too extensive to be debrided within one or two treatments, and may require additional treatments with maggots or other methods. If the blood flow is inadequate to support the growth of new, healthy tissue, then the cleaner, bigger wound may not heal; it may even become infected or necrotic, again, before it has had a chance to heal, requiring additional debridement or more aggressive removal (resection or amputation).

Mild bleeding is common during maggot debridement, and it is common for the wound drainage during maggot therapy to be blood-tinged. Patients with coagulopathy (“bleeding tendency”) or delicate or damaged blood vessels (“friable tissue” and vascular grafts) are at increased risk of significant bleeding during maggot therapy. Close supervision of the wound and dressing may be necessary in such situations, and you will need to inform your therapist immediately should you observe more than a small amount of blood-tinged drainage from the wound or maggot dressings.

*Pseudomonas aeruginosa* wound infections are particularly difficult to treat by any means, and they may be more resistant to maggot therapy as well. If your wound is suspected of having *Pseudomonas* infection, you may be asked to use special treatments before maggot therapy in order to reduce or eliminate the *Pseudomonas*. Your therapist may use “extra” maggots in order to better combat the *Pseudomonas*. Nevertheless, cases have been reported in which *Pseudomonas* infections persist, or even grow bigger, during maggot therapy. Like your therapist, you will need to be vigilant about monitoring and reporting any signs of growing infection, before, during, and after maggot therapy.

**Alternative treatment options (check those that apply):**
- Surgical debridement or resection.
- Amputation
- Enzymatic debriding agents
- Autolytic debriding agents
- Mechanical debriding agents/devices

**Pre-procedure requirements (check those that apply):**
- Answer all questions completely and honestly, including all underlying medical and surgical problems, medications, allergies, etc.
- Study all of the information given: reading materials, videos, etc.
- Stop any medication or wound treatments so recommended by your healthcare provider, such as:

  ___________________________________________________________________________________

- Begin any medication or wound treatments so recommended by your healthcare provider, such as:

  ___________________________________________________________________________________

**Requirements during therapy (check those that apply):**
Ensure that dressings are changed as frequently as recommended, and even more so if they become wet or soiled.

If the dressings being removed (or the wounds themselves) are dry, apply moist gauze, not dry gauze (i.e., irrigation water or saline).

Inform your therapist immediately if you find that the maggot dressing has become soiled or loose.

Inform your therapist immediately if you are having pain that is not adequately controlled.

Inform your therapist immediately if you or your wound develops symptoms that are unusual or problematic (bleeding, fever, confusion, etc).

Keep all required appointments.

Post-therapy requirements (check those that apply):

- Keep all required appointments.
- Inform your therapist immediately if you or your wound develops symptoms that are unusual or problematic (fever, confusion, etc).

Additional requirements (check those that apply):

- 
- 
- 

Of my own free will and without coercion, I agree to undergo maggot therapy and promise to adhere to the treatment and post-treatment activities, as stipulated above, as they are intended to make the treatment most successful.

Patient:

Printed Name    Signature    Date

Consent administered by:

Printed Name    Signature    Date

Witness:

Printed Name    Signature    Date