GUIDELINES FOR THE USE OF
STERILE MAGGOT THERAPY IN WOUND MANAGEMENT

Aim
To provide evidence based guidelines on the use of sterile maggots and management of patients receiving this therapy.

Background
The presence of necrotic or sloughy tissue within a wound delays healing and increases the possibility of infection. Conventional non-surgical methods for debriding wounds tend to be slow and often ineffective involving considerable nursing time and expense. Colonization or infection of such wounds by antibiotic-resistant bacteria represents an additional problem, forming an important source of cross infection. Maggots of the greenbottle fly, Lucilia sericata, have been shown to rapidly remove necrotic tissue from all types of wounds, irrespective of their underlying aetiology. Sterile maggots have been available in the United Kingdom since 1995, when the technique was reintroduced by Zoobiotic Biosurgical Products.

Clinical Speciality
Wound care

Intended Users
Maggot therapy is for specialist use only. Maggot therapy should only be undertaken by a registered healthcare professional who has received training in the use of maggot therapy and following discussion with the Tissue Viability Nurse. Training will be organised by the Tissue Viability Nurse.

Target Population
Patients with long term chronic wounds with thick slough requiring debridement

Definition
Maggot therapy is a method of wound debridement and involves the clinical application of sterile maggots to wounds.

Indications for use
Maggot therapy is suitable for most types of wounds that contain adherent slough or soft necrotic tissue, or wounds that are clinically infected and not responding to antibiotic therapy. These wounds include:

- Infected wounds of all types that have failed to respond to conventional treatments.
- Infected chronic ulcers, such as pressure ulcers, leg ulcers, diabetic feet
- Sloughy wounds
- Traumatic wounds
• Amputation sites
• Dehisced surgical wounds
• Indolent wounds
• Wounds with Osteomyelitis
• Necrotising fascitis
• Wounds containing MRSA

Contraindications
The following wounds are not generally considered to be suitable for maggot therapy
• Any wound where the blood supply is insufficient to permit healing to take place.
• Dry necrotic wounds
• Fistulae
• Wounds that connect with the abdominal cavity
• Any wound that bleeds easily
• Areas of necrotic tissue close to major blood vessels or nerves
• Granulating wounds
• Low exuding wounds
• Heavily exuding wounds (where maggots may drown)
• Fragile surrounding tissue
• Allergies to adhesives
• Malignant fungating wounds

Cautions
• Weight bearing areas, for example heels and buttocks
• Patients prescribed anticoagulants
• Wounds treated with Hydrogels (Hydrogels will kill maggots)
• Terminally ill patients (due to negative association with maggots and death)

References/ Further Reading

**Acknowledgements**
We wish to thank the Derby Hospitals NHS Foundation Trust, Nottingham City Primary Care Trust and ZooBiotic Limited for sharing their Guidelines for Maggot Therapy.

**Written by**
Anthea Baker, Tissue Viability Nurse, Derbyshire County PCT
Barbara Craven, Tissue Viability Nurse, Derbyshire County PCT
Morag Cameron, Primary Care Pharmacist, Derbyshire County PCT
Corinne Heath, District Nursing Sister, Derbyshire County PCT
Ruth Le Bosquet, Tissue Viability Clinical Support Nurse, Derby City PCT

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### Procedure to be followed when using Larvae Therapy - see Appendix 1 for Treatment Pathway Flowchart

<table>
<thead>
<tr>
<th>PROCEDURE</th>
<th>RATIONALE</th>
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<td>- Assess the patient and wound to determine if maggot therapy is a potentially appropriate treatment option  &lt;br&gt;- Refer the patient to the Tissue Viability Nurse</td>
<td>Note that maggot therapy is specialist use only</td>
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**Obtaining informed consent**
- Candidates for maggot therapy should be carefully assessed prior to treatment and informed consent obtained.  
  - During this process, terms such as 'biosurgery' or 'larval therapy' should be avoided. It must be carefully explained to each patient that they will have live maggots on their wound for up to three days and they must be happy to accept this procedure.  
  - A patient information sheet is available through the Tissue Viability Team and should be given to the patient or their carer prior to the commencement of the therapy to address any further concerns that they may have. The Interpreter Service is available to translate into different languages if required.  
  - Document that the patient understands and has agreed to the treatment and written consent is obtained. (Refer to Trust consent policy)  
  - Care and sensitivity is essential if used in a terminally ill patient due to negative association with maggots and death. It is also important that cultural and religious beliefs are taken into consideration when using maggots. |

**Assessing the wound and patient**
- A holistic assessment should be undertaken, including a full nutritional assessment and vascular studies where appropriate.  
  - For treatment of pressure ulcers the patient should be assessed as to their pressure ulcer risk and appropriate interventions introduced to minimise exposure to pressure loads for example the use of orthotic boots is recommended to help minimise exposure to pressure in a patient with a heel ulcer.  
  - There must be a minimum of 4cm intact skin around the wound to maintain a seal.  

Thorough holistic assessment and accurate documentation are a prerequisite to effective wound management.
**PROCEDURE** | **RATIONALE**
---|---
- Wound characteristics are recorded on the Wound Assessment/Evaluation Tool.  
- Measure the wound accurately using the tracing method and a photograph, if appropriate, to assess how the wound is changing.  

**Wounds that can be treated with maggots**  
- Maggot therapy is suitable for most types of infected, sloughy, soft necrotic wounds, irrespective of aetiology. Refer to indications.

**Wounds that are not generally suitable for maggot therapy**  
- Refer to contraindications.

**Things to monitor during maggot therapy**  
- Exudate production is often increased during maggot therapy, and there is sometimes an initial increase in wound odour. This is only temporary and usually resolves after the first dressing change.

- Sometimes patients with ischaemic wounds complain of increased wound pain during treatment. If pain becomes a problem, the maggots should be removed earlier than usual unless the pain can be controlled by the use of analgesics.

- Consider arranging prophylactic analgesia prior to treatment.

**Prior to ordering the Maggots**  
**Determine the most appropriate form to be used**  
Maggots are available in two forms. ‘Free-range’ maggots are applied directly to the wound, and allowed to roam freely over the surface seeking out areas of slough or necrotic tissue.

A second presentation is available in which maggots are applied in tea bags or ‘LarvE Bags’ in which the maggots are enclosed or contained in small fabric bags that are placed directly upon the wound surface. Maggots in bags can be used in some situations where ‘free-range’ maggots may be contra-indicated such as wounds near the anus or other body cavities. The bags can be moved around the wound. This presentation may be preferred by some patients.

- Discuss with the patient which form is preferable to them.

Exudate is increased because the maggots liquify the dead tissue in the wound. This also leads to odour formation.

Pain is thought to result from changes in wound pH.

Free range maggots are more effective than maggots in bags.

Maggots contained in this way cannot move freely over the wound surface and therefore cannot find their way into sinuses or body cavities.
**PROCEDURE** | **RATIONALE**
--- | ---
**Determine the number of maggots required**<br>• Assess the size of the area to be treated and determine the number of maggots to be applied. Experience has shown that it is much more cost effective to use large numbers of maggots for one or two treatment cycles than smaller numbers for an extended period.<br>• A simple ‘calculator’ that may be used to help determine the number of pots required is available through the Tissue Viability Team.<br>The number of maggots required will be determined by the size and condition of the wound. One container of LarvE will generally be sufficient for wounds measuring up to 5 cm x 5 cm. Larger wounds may require two or more pots to effect debridement.

**Type of retention system required**<br>For free-range maggots, one of the following will be required.<br>• **Nylon Net Dressing** - for wounds that are isolated and easy to dress, available in a variety of sizes.<br>• **Nylon Net Sleeve** - (open at both ends) for extensive or circumferential limb wounds (arms or legs).<br>• **Nylon Net Boot** – for extensive wounds on limb extremities (feet, hands, stumps etc.).<br>• **Half Boot** – for toes.<br>The precise nature of the dressing system selected will be determined by the size and location of the area to be treated. Correct selection will facilitate a secure dressing and prevent maggots escaping from the wound environment.

**Ordering sterile maggots**<br>• Prescription to be written by GP or supplementary nurse prescriber within a clinical management plan.<br>Zoobiotic Ltd is the principal supplier of sterile maggots in the UK. When placing an order, provide details of the delivery address, the number of maggots required, the date and time of delivery and the address to which the invoice should be sent. Tel 0845 2301810 Fax 01656 668047.
• Confirm patient’s pharmacy is happy to order and accept delivery.<br>• Pharmacy to order maggots (LarvE) by telephone or fax from Zoobiotic Ltd during working hours from Monday to Friday. Orders received before 2.30 pm can be dispatched by courier for delivery the following day.<br>• Deliveries are not made on Sundays or Mondays.
PROCEDURE | RATIONALE
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**Storing sterile maggots**  
- Wherever possible, maggots should be used on the day of delivery, although in exceptional circumstances they can be stored overnight in a cool place. If maggots must be stored in this way they may be placed in the bottom of a fridge but not near to the ice making section. Unless the ambient temperature is particularly high, there is no need to store maggots in this way if they are to be applied within 8 hours of receipt.  
- If maggots are stored in a fridge, it is recommended that they be allowed to return to room temperature before use.  
Keeping the maggots cool, but not too cold, prolongs their life and ensures that they are at their most active when applied to the wound.

**Application of sterile maggots**  
- Maggot therapy should only be undertaken by an individual who has previous practical experience in the management of wounds, and a thorough understanding of the wound healing process and has received the appropriate training  
This is important to maintain appropriate standards of care.

**Items required for performing a dressing**  
- Prepare the following items:  
  - LarvE pack containing one or more vials of sterile maggots, sterile saline and a nylon net dressing, bag or sleeve  
  - illustrated application guide supplied with the LarvE Pack  
  - A hydrocolloid sheet dressing or a roll of zinc compound tape or viscopaste bandage  
  - shermond dressing aid and gauze swabs  
  - Pair of sterile scissors  
  - A roll of waterproof adhesive tape 2.5cm wide (e.g. Sleek™)  
  - A perforated plastic film dressing e.g Release  
  - An absorbent dressing pad e.g. Mesorb  
  - A roll of adhesive tape e.g Scanpor  
  - A lightweight retention bandage if appropriate e.g. K Band  
  - Yellow bag  
The dressings selected will be determined by the size and location of the area to be treated, but for a simple procedure these items will generally suffice.
### Preparation of maggots
- Add to the container about 5 ml of sterile saline, which is of equivalent to a depth about 1-2 cm in the bottom of the tube, and gently agitate the container.

  This releases all the maggots from the top and side wall of the tube into the solution. Accumulating all the maggots in a single container in this way speeds up and facilitates the process of application.

- If more than one pot of maggots is to be applied, pour the contents of this first container into the second and agitate as before.

- Repeat this process as many times as necessary.

### Preparation of sterile field
- Organise the materials and layout on a suitable surface, using an aseptic technique.

  The contents of the maggot container are sterile and this will ensure that asepsis is maintained.

- Ensure the patient is positioned comfortably and in a suitable position for the dressing to be applied and that they fully understand all aspects of the treatment.

  This is to reassure the patient and address any concerns that they might have.

### Application of maggots using standard technique
  i.e. Free Range

Refer to Illustrated Application Guide

### Preparation of the wound site
- Remove any existing dressing and clean the wound with warm water to remove any dressing residues

  Some dressing residues, for example hydrogels that contain propylene glycol, may inhibit maggot development.

- Cut a hole in a hydrocolloid sheet the size and shape of the wound and place securely onto the surrounding skin. Alternatively cut strips of hydrocolloid dressing and place around the wound.

  This protects the peri-wound skin and forms a layer upon which to attach the nylon net.

- If the wound is relatively small and of limited depth, a double layer of hydrocolloid may be applied to form a shallow chamber into which the maggots are introduced.

  This gives the maggots room to develop and prevents them from being squashed.

- If a hydrocolloid dressing cannot be used, the skin surrounding the wound may be protected with strips of a bandage impregnated with zinc paste e.g zinc compound tape or viscopaste

  Some patients react badly to hydrocolloid dressings so alternative ways of protecting the skin must be devised

- Cut the sterile retention net a little smaller than the hydrocolloid ensuring it is large enough to cover the wound area.
### PROCEDURE

**Removing maggots from their container**
- Slowly pour the saline containing the maggots onto the piece of sterile nylon net (*LarvE Net*) that is supplied with each container of *LarvE*.
- The net should be placed upon a sterile gauze swab and pre-moistened with saline to overcome surface tension effects.
- If the maggots are poured out too quickly, the saline (and some of the maggots) may run off the net onto the surrounding area.
- Replace the lid on container

**Applying maggots to a wound**
- Invert the net over the wound and tape securely to the hydrocolloid sheet using a waterproof adhesive tape such as Sleek.
- The maggots will not fall off the net when it is inverted, as they will be held in place by surface tension.
- If a zinc paste bandage is used in place of the hydrocolloid sheet, press the nylon mesh firmly down into the paste and apply a further layer of bandage around the edges to anchor the net in position.
- The central part of the net must remain un-occluded in order to permit free drainage of exudate and allow the maggots to obtain an adequate supply of oxygen.

**Completing the dressing**
- Apply a swab moistened, but not saturated, with saline over the outside of the net and cover with a dressing with a perforated plastic film wound contact layer such as Release.
- Complete the dressing with an absorbent pad such as Mesorb held in place with tape or a bandage as appropriate.
- Occlusive dressings or film dressings should **not** be used, as these will cause the maggots to suffocate.

### RATIONALE

When the saline containing the maggots is poured out onto the net in this way, the liquid is immediately drawn away through the mesh by the swab, leaving the maggots in a heap on the surface.

This effectively forms an enclosure that prevents the maggots from escaping onto the surrounding skin.

This will provide a secure maggot dressing for patients for whom hydrocolloid dressings are contraindicated.

If this is not done the young maggots may die.

The young hatchlings are quite delicate and need to be kept moist.

Securing all dressings will ensure containment of the maggots.
### PROCEDURE
- Any unused maggots should be disposed of, as they can no longer be considered sterile.
- Any unused maggots must not be redistributed.

### RATIONALE
- These are easier to apply than the standard dressing and provide a more effective method of preventing the maggots from escaping.

**Application of maggots using a LarvE boot or half boot.**
- For an extensive wound on the foot, a net boot is available. Smaller boots (half-boots) are produced for the treatment of necrotic toes.
- When using the boot, place a ‘collar’ or ring of hydrocolloid dressing around the limb above the wound.
- Apply the boot over the limb and fix the open end to the hydrocolloid ring using waterproof adhesive tape.
- Areas of healthy skin enclosed within the net boot should be protected with a piece of hydrocolloid, a thin layer of zinc paste or white soft paraffin.
- When using the boot system, instead of pouring the maggots out onto a piece of net or into the bag prior to application, pour the maggots onto a moistened nonwoven gauze swab and gently wipe the swab over the wound surface.
- Apply a suitable outer dressing as described previously.

**Application of maggots using a LarvE sleeve.**
- For extensive or circumferential wounds on the leg a net sleeve, open at both ends, can be slid into place over the affected area and sealed to hydrocolloid collars, placed above and below the margins of the wound.
- When using this technique, slide the net into position, fix to the upper collar and push up the lower part of the net to expose the wound.
- Protect the healthy skin enclosed within the sleeve as previously described, and apply the maggots to the wound using a swab as described above.
- Once the maggots are in place, slide the open end of the sleeve down over the wound and fix to the second hydrocolloid collar.
- The collar should be applied in two overlapping pieces without excessive tension to prevent any possible tourniquet effect.

- The maggots will adhere to the wet material, removing them from the swab.

- See ‘Completing the dressing’ in the previous section.

- This is the easiest way of applying the sleeve without scraping the maggots of the wound surface.

- See ‘Application of maggots using a LarvE boot or half boot’.

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### PROCEDURE

- Apply the outer dressing as described previously

### RATIONALE

See ‘Completing the dressing’ in a previous section

#### Application of LarvE Bag

- Before applying LarvE Bags to the wound, it may be advisable to protect the surrounding skin from excoriation with a thin film of a Cavilon or 50:50 WSP and liquid paraffin.

- A sufficient number of LarvE bags to cover the wound surface are then removed from their transit containers and placed in position.

- The bags are then covered with moist gauze and a suitable absorbent pad held in place with tape or a bandage as appropriate.

- Because maggots in bags grow much more slowly than the free-range variety they may be left in place for 4-5 days after which time they should be removed and disposed of as described below.

- It is possible to reposition them around the wound every couple of days

- This form may be more suitable for terminally ill patients

#### Daily evaluation, aftercare and duration of treatment

- Use Core Care Plan which is available through the Tissue Viability Team.

- Check the outer bandages, absorbent padding and gauze on a daily basis and change if they become excessively wet or malodorous

- Maggots should be left on a wound for 3 days, (bags 4-5 days) because under ideal conditions they will be fully grown by this time. Sometimes, however, if their growth rate is reduced, it may be appropriate to leave them an additional day.

- If pain becomes a problem it may be necessary to remove them earlier, if increasing the patient’s analgesia is not an option.

- This maintains the comfort and dignity of the patient and prevents the outer dressing from becoming saturated, which could adversely effect maggot growth

- This will ensure that the maggots perform optimally
## PROCEDURE

### Removal of maggots from a wound
- Removal of maggots is a simple process
- First position a clinical waste disposal bag (yellow bag) under the wound.
- Depending upon the location and size of the wound, remove the net retention dressing with or without the hydrocolloid frame, and gently remove the maggots with a gloved hand or a pair of forceps.
- Any maggots that have found their way into the depths of a wound will generally come to the surface if the wound is irrigated with a stream of sterile water or saline.
- Maggots will not pupate or turn into flies with a wound and they cannot multiply or ‘breed’. If further maggots are to be applied, it does not matter if a few small individuals are missed, as these will easily be retrieved at the time of the next dressing change by which time they will be fully grown.

### RATIONALE
- This is to catch any maggots that fall out of the wound.
- It is generally easier to remove the hydrocolloid and net in one piece.
- They have to come to the surface to breathe

### Reassessment of the wound:
- When all the maggots have been removed, reassess the wound to see if further maggot therapy is required or whether a change to conventional therapy is indicated.
- If a further batch of maggots is to be ordered, dress the wound with an appropriate conventional dressing until the maggots are delivered.

### The disposal of maggots removed from wounds
- Provided an aseptic procedure is used, the maggots supplied by Zoobiotic are sterile up to the time that they are introduced into the wound.
- As soon as they come into contact with tissue or body fluid, however, they must be regarded as potentially contaminated, and therefore must be disposed of as any other type of dressing residue or clinical waste in accordance with the Trusts clinical waste policy.
- For users in the community where disposal may be difficult, special containers for disposal of maggots are available from Zoobiotic with the order.

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<td>- If full debridement has been facilitated maggots are normally no longer required.</td>
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<td>- If a further batch of maggots is to be ordered, dress the wound with an appropriate conventional dressing until the maggots are delivered.</td>
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**On the death of a patient**
- If a patient dies unexpectedly during maggot therapy, the maggots have to be removed from the wound prior to the transfer of the patient to the mortuary, and disposed of as described above
- A note should accompany the body to the mortuary stating that maggot therapy has been removed
- Maggots feed on decomposing tissue.
- To respect the dignity of the patient and the sensitivities of the family.

Dressings are usually left in situ following death of a patient.

**ADDITIONAL DOCUMENTATION AVAILABLE**
The following items are available through the Tissue Viability Team or Derby City PCT Tissue Viability Website:
- Patient Information Sheet
- Maggot Calculator
- Instructions for ordering maggots
- Core Care Plan
- LarvE Core Care Plan (problem solving)
- Illustrated Application Guide is available in the LarvE pack
APPENDIX ONE

Infected, moist necrotic or sloughy wound that has not responded to products in the South Derbyshire Wound Care Formulary.

Does the patient and wound meet the indications for use outlined on page 2 Of the guidelines for the use of sterile maggots?

Yes

Wound assessment form completed

Contact Tissue Viability Nurse to assess for suitability of maggot therapy

Treatment is undertaken by an individual with the appropriate knowledge and skills in the use of sterile maggots in wound care

Using the patient information leaflet, explain the procedure and discuss this treatment option with the patient.

Using the local policy document, record the patient's informed consent to the use of sterile maggot therapy.

Confirm that the patient's pharmacist is happy to order and accept delivery of the sterile maggots.

Using the calculator table, ascertain the number of maggots to be ordered and determine the type of retention required. Prescribe and liaise with the patient's pharmacist on delivery and dispensing of the prescription.

Treatment is completed in accordance with the Guidelines for the use of Sterile Maggot Therapy and the core care plan (available through the Tissue Viability Team) for the use of sterile maggot therapy is commenced

Patient tolerance and wound progress are documented at each stage of the treatment to facilitate evaluation and determine need to change management options