# Use of larval therapy in a chronic diabetic foot ulcer: A case study

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**Article points**

1. Larval, or maggot, therapy has been used in wound care during various periods in history and is again in common use today.
2. The authors report a case where the application of larval therapy moved a chronic diabetic foot ulcer from static to healing.
3. Depression and dementia in the patient complicated the management of the wound, but are common comorbidities among older people with diabetes.
4. Larval therapy in the present case improved a range of wound parameters and the authors recommend its introduction earlier in the natural history of chronic diabetic foot ulcers.

**Key words**

- Debridement
- Depression
- Larval therapy

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**Larval therapy is one of the tools available to clinicians in the management of diabetic foot ulceration. In this case study, the use of larval therapy to treat chronic diabetic foot ulceration in an older woman with a range of physical and psychological comorbidities is reported. Larval therapy reduced wound slough and local debris in this case, and was followed by an increase in wound-bed granulation and reductions in wound area and exudate volume. The authors suggest that larval therapy should be considered earlier in the natural history of chronic diabetic foot ulceration.**

The use of maggots in wounds is reported as far back as 1557, when Ambrose Pare described their positive effects (Turkmen et al, 2010). During the American Civil War (1861–1865) maggots were applied to war wounds – with William Baer later refining the technique by using sterile maggots (Chan et al, 2007). Larval therapy in wound care became popular in Europe and North America in the 1930s, but its use declined following the introduction of antibiotics in the 1940s (Chan et al, 2007). In the 1980s, when concerns over antibiotic resistance surfaced, larval therapy experienced a revival and is now used widely in the UK (Courtenay, 1999).

In the following case, the authors report the use of larval therapy in a non-healing diabetic foot ulcer. The patient was an elderly woman, resident in a care home. She had a range of comorbidities – in particular, vascular insufficiency, depression and dementia – that made clinical management a challenge for the podiatrists, care home staff and her GP.

## Case report

### Patient history

In August 2008, an 89-year-old woman – Ms M – was referred by staff at the care home in which she was resident to a community podiatry team for the treatment of foot ulceration. Ms M has insulin-dependent type 2 diabetes ($HbA_{1c}$ level 5.9% [41 mmol/mol] in September 2008) and a range of comorbidities, comprising limited mobility, angina, hypertension, dementia and depression. Aetiology of the ulceration was unknown, however Ms M's footwear (tight, slip-on style high-street shoes) were a possible cause.

Initial assessment was difficult due to Ms M's reluctance to engage in her care. The community podiatrist reported neuroischaemic ulcers on the right first metatarsal phalangeal joint (MTPJ; dorsal and medial aspects) and on the right lateral maleolus. A dry eschar was also present over the apex of the right hallux. Antibiotics (Co-amoxiclav; GlaxoSmithKline, Middlesex) were commenced and the care home staff were advised on an appropriate wound dressing regimen and pressure relief

for the foot. The care home staff said that they were experiencing difficulties in administering daily oral medications to Ms M.

By October 2008 the ulcers had deteriorated and Ms M was referred to a diabetes specialist podiatrist (DSP) at a large university teaching hospital. Initially, Ms M did not want to attend the hospital, but agreed after encouragement by the community podiatrists. On presentation, Ms M would not allow the DSP to assess, swab or X-ray her foot and requested to be, and was, taken back to her care home. The DSP was only able to supply Ms M with a temporary trauma shoe. The diabetes specialist and community podiatrists agreed that subsequent assessment and treatment of Ms M's ulcers would be undertaken at the care home to avoid causing her further distress.

A traditional wound care regimen was undertaken (comprising advice to remain non-weight bearing, infection control, sharp debridement and a dressing regimen to address exudate and malodour) and maintained until November 2008 when further deterioration of the MTPJ ulcer occurred. The ulcer had become highly sloughy and exuding with maceration of the periwound margin and signs of spreading cellulitis. Ms M's GP recommended hospital admission for intravenous antibiotic therapy, however Ms M – supported by her daughter – decided against admission. The following alternative course of treatment was undertaken in the care home:

- A short course of metronidazole.
- Maintenance of the ongoing course of Co-amoxiclav (GlaxoSmithKline).
- Daily wound dressing (Aquacel Ag, Mepilex [Mölnlycke Health Care, Dunstable]) by care home staff (extending to every 2–3 days as exudate levels decreased).
- Weekly review by the community podiatrist, with any necessary sharp debridement being carried out during these visits.
- Advice to remain non-weight bearing.

The ulcers proved unresponsive and in January 2009 a referral for Ms M was made to the hospital vascular department. No revascularisation was possible. Ms M, her daughter and the vascular department clinicians considered the options for amputation. All parties agreed that Ms M's circumstances and general poor health made her an unsuitable candidate and she was referred back to the podiatry team for clinical management.

## Initiation of larval therapy

Following discussions with Ms M, her daughter and her GP, a trial of larval therapy was agreed on. A prescription was raised for BioFOAM dressings (5 cm × 5 cm; ZooBiotic, Bridgend), which contain *Lucilia sericata* larvae and absorbent foam chips confined to a woven polyester fabric pouch that allows the passage of wound exudates and larval secretions. Also at this time, Ms M's GP initiated pharmacological management of her depression.

Prior to the commencement of larval therapy, written consent was obtained from Ms M's daughter for both treatment and photographic monitoring of the wound. *Figure 1* shows Ms M's MTPJ ulcer immediately prior to the commencement of larval therapy.

The first course of larval therapy was applied in April 2009. The larval pouch was left *in situ* for 5 days. To manage the increased volume of wound exudate during larval therapy, daily change of secondary gauze dressings was undertaken by the care home staff, during which the staff reinforced to Ms M that the appearance of her ulcer and her foot may be altered once all the dressings were removed. Ms M was advised to be non-weight bearing and antibiotic therapy was maintained during the course of larval therapy.

*Figure 1. The ulcer on the right first metatarsal phalangeal joint of Ms M's right foot immediately prior to the commencement of larval therapy, 8 months following initial presentation.*

**Page points**

1. In October 2008 Ms M's ulcers had deteriorated and she was referred to a diabetes specialist podiatrist (DSP) at a large university teaching hospital. On presentation, Ms M would not allow the DSP to assess, swab or X-ray her foot.
2. The ulcers proved unresponsive to traditional wound care and in January 2009 a referral for Ms M was made to the hospital vascular department. No revascularisation was possible.
3. A trial of larval therapy was agreed on and the first course of larval therapy was applied in April 2009.

Following 5 days' therapy, the larval dressing was removed (*Figure 2*). Wound slough had decreased significantly, there was evidence of some granulating tissue on the medial aspect and a reduction in toe size. Bone fragments were evident and were removed with sharp debridement.

Prior to the application of the second larval pouch, the wound was treated with Purilon Gel (Coloplast, Peterborough) to breakdown the dry, necrotic tissue on the apex of the toe. Larval therapy was then recommenced for a further 5 days on the same regimen. On removal of the second larval application (*Figure 3*), minimal slough was present with evidence of further granulation and the involved toe had reduced in size.

Following the second course of larval therapy, Ms M's ulcer continued to improve over time with traditional wound care. *Figure 4* shows the full auto-amputation of the toe, reduced ulcer area, minimal slough and a granulating wound bed by September 2009.

Ms M became increasingly engaged during dressing changes and positive about the progress her wound was making. Regular photography of the wound and review of the pictures helped Ms M to appreciate the change. At the time of writing, the wound was continuing towards healing.

*Figure 2. Ms M's ulcer following 5 days' larval therapy. Note the reduction in slough, the appearance of granulation tissue and the reduced size of the first toe.*

*Figure 3. Ms M's ulcer following a second 5 day course of larval therapy. Note the minimal slough, further granulation and the reduced size of the toe.*

*Figure 4. Ms M's ulcer after two courses of larval therapy followed by 4 months of traditional wound care. Note the full auto-amputation of the toe, reduced ulcer area, minimal slough and granulating wound bed.*

## Discussion

The principles of gold-standard, multidisciplinary diabetic foot care are described elsewhere (Edmonds and Foster, 2005; Young et al, 2007). A number of adjuvant therapies are available for use in chronic wounds that fail to respond to traditional treatment, one of which is larval therapy. A number of recent studies suggest that larval therapy is both clinically and cost-effective (Wayman et al, 2000; Lodge et al, 2006; Thomas, 2006; Rodgers, 2009).

There are two methods of larval therapy application: (i) free-range larvae applied directly to the wound and contained by a secondary dressing, and (ii) the use of a pre-prepared pouch containing the larvae (e.g. BioFOAM [ZooBiotic], as used in the present case). The primary role of larvae in wound care is to debride non-viable tissues and slough from the wound bed via the secretion of powerful proteolytic enzymes and subsequent digestion of the degraded tissues (Chan et al, 2007). In removing the non-viable tissues, the larvae reveal the full extent of a wound and, thus, allow better clinical assessment and expose underlying healthy tissue (Armstrong et al, 2002). Furthermore, the larvae's enzymatic

secretions have broad-spectrum antibacterial properties that help to control local infection (Cullen, 2009; Turkmen et al, 2010). Larval therapy is reported to be cost-effective in a range of chronic wound types, including diabetic foot ulcers (Wayman et al, 2000; Lodge et al, 2006).

Immediate reactions to proposed larval therapy can include disgust – the prospect being associated with a certain "yuck factor", as Acton (2007) puts it. However, larval therapy is reported to be generally well accepted when appropriate patient education has been provided prior to treatment (Armstrong et al, 2002; Chan et al, 2007). Despite anecdotal clinical experience suggesting that larval therapy is well tolerated, there is a lack of evidence regarding patient experience during larval therapy. The neuropathic status of the individual should be a taken into account when considering larvae therapy; those without peripheral sensory loss may experience discomfort from the movement of the larvae *in situ* – although it has been suggested that pouch-contained larval therapy, rather than free-range larvae, may reduce the amount of detectable movement (Rodgers, 2009).

Diabetes places people at greater risk of a range of comorbidities. The case reported here highlights the medical and psychological complexities that can impact on the management of a diabetic foot ulcer. Depression occurs more commonly among people with diabetes than those without diabetes (Talbot and Nouwen, 2000), and was one of the issues facing Ms M and those caring for her and her wound. Ms M's depression and dementia made it necessary for the attending podiatrists, and care home staff, to make clinical management decisions that supported and reassured Ms M and facilitated a trusting clinician–patient relationship.

Prior to the commencement of larval therapy, Ms M's GP commenced her on pharmacological antidepressants to manage her depression. Although no formal quality-of-life measures were undertaken in this case, the attending podiatrists and care home staff observed an improvement in Ms M's mood and increased interaction with other care home residents. This change coincided with both the pharmacological management of her depression and the larval therapy-induced improvement in her foot ulcer.

## Conclusion

If used appropriately, larval therapy can be both clinically and cost-effective in a sub-set of diabetic foot wounds. In the present case, two applications of the larval therapy BioFOAM (Zoobiotic) induced clinically significant improvements in a range of wound healing measures (wound slough, granulation, wound area). Without the progress in wound healing achieved following larval therapy, it is likely that Ms M's chronic ulcer would have ultimately exposed her to systemic infection and amputation. The authors believe that the use of larval therapy generated improvements in the wound and in the patient's quality of life. The benefits of larval therapy suggest that its use earlier in a chronic diabetic foot ulcer's natural history could move the wound towards healing with greater speed and improve patient quality of life. ■

***"If used appropriately, larval therapy can be both clinically and cost-effective in a sub-set of diabetic foot wounds. In the present case, two applications of the larval therapy BioFOAM induced clinically significant improvements in a range of wound healing measures."***

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