
BioMonde®
Larval Debridement Therapy
Making healing possible

What is Larval Debridement Therapy (LDT)?

The term 'Larval Debridement Therapy' describes the use of maggots, precisely the larvae of the green bottle blowfly Lucilia sericata, for the removal of dead tissue and slough from the wound surface (debridement). Because of its selectivity for dead tissue, it is also known as bio-surgery. Larvae of this necrophagous species have been used since ancient times, and more recently during the 1920's at the dawn of the antibiotic era, to clean chronic, non-healing wounds in an attempt to start the healing process.

Today, LDT is increasingly used in response to the rising challenges posed by multi-resistant bacteria, which may be present in chronic wounds (for review see Thomas S. 2010; Fleischmann W. et al. 2004).

"A precise, natural, sustainable treatment that aids recovery".

When should LDT be used?

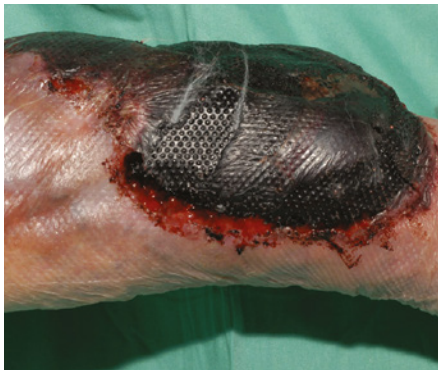
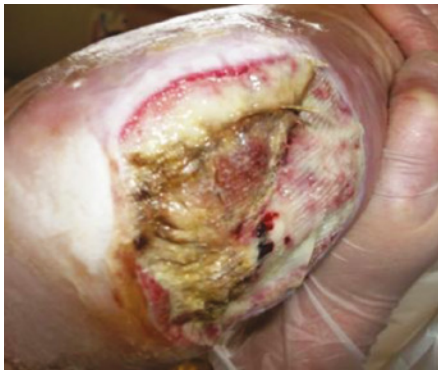
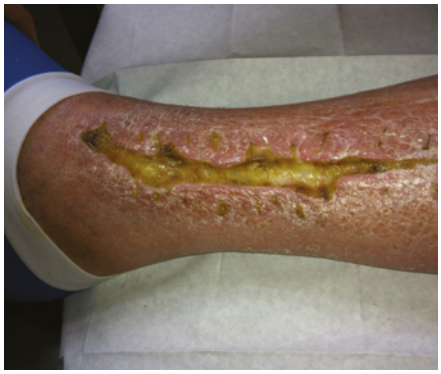
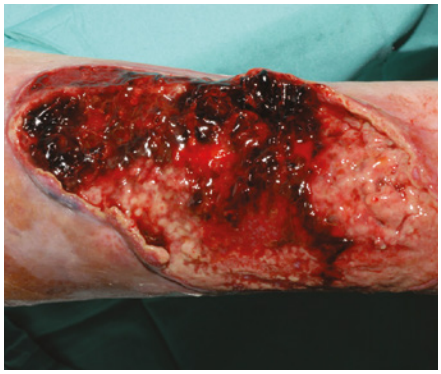
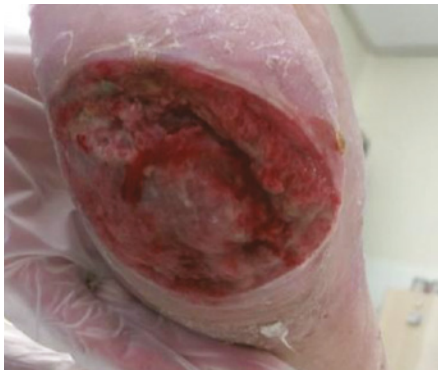
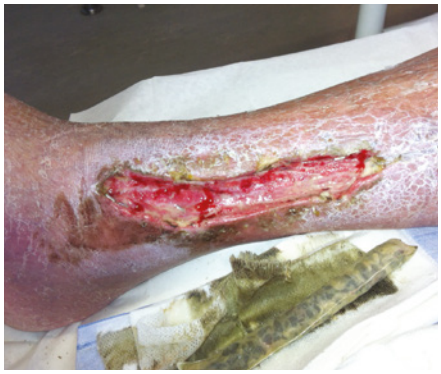
Chronic wounds are notoriously difficult to treat and pose a serious and expensive threat to health care systems. The most frequently occurring chronic wounds are venous leg ulcers (VLU), leg ulcers of arterial or mixed venous-arterial insufficiency, diabetic foot ulcers (DFU) and pressure ulcers (PU) (Thomas S. 2006).

Normal, 'acute', wound healing follows an ordered sequence of cellular and biochemical events, with wound closure achieved within a few weeks. The three major phases of wound healing comprise of the inflammatory, proliferative and remodelling/epithelialisation phase. But, in chronic wounds, this ordered sequence of events is disturbed. Possible causes, or barriers to healing, may involve slough or necrosis present on the wound surface; infection; prolonged inflammation, and imbalance of moisture or deleterious composition of wound fluid. The holistic clinical concept of wound bed preparation (WBP) was developed to describe the wound situation of individual patients in the context of their underlying diseases, and to provide the basis for the removal of barriers to healing (Schultz G. et al. 2003; Stephen-Haynes J. 2007).

Wound Bed Preparation and T.I.M.E.

A credible way of looking at WBP is through T.I.M.E. T.I.M.E. stands for Tissue (non-viable), Infection, imbalance of Moisture, and wound Edge (not migrating). When following the T.I.M.E. concept, the removal of dead tissue (debridement), is considered the necessary first step. There is an on-going discussion regarding whether debridement is necessary due to the difficulty in establishing a clear relationship between debridement and healing in prospective, controlled clinical studies. There is, however, broad consensus amongst wound healing experts that a wound cannot heal as long as it is covered with dead tissue. A well-granulated wound bed provides the basis for spontaneous healing, or for wound coverage by surgical or other therapeutic means (EWMA Position Document 2004).

Larval debridement therapy is cost effective when compared to other mainstream debridement interventions including surgical, sharp, mechanical and autolytic debridement methods.

How it works

Larval debridement therapy is thought to have a direct effect on at least three of the T.I.M.E. components: it removes non-viable tissue effectively, it helps combat infection by reducing the bio-burden, and it helps normalize the wound closure by facilitating the remodelling process (for review see *Nigam Y. et al. 2010*). LDT's effects on the complement system can normalize prolonged inflammation, often considered a barrier to healing. An indirect effect of LDT is that moisture balance may also be normalized. Too much or "wrong" wound fluid is often caused by infection, slough dead tissue and excessive eschar on the wound surface, and inflammation (*Schultz G. et al. 2003*).

Debridement is achieved by the action of proteolytic enzymes, which are secreted by larvae (*Chambers L. et al. 2003*). These enzymes liquefy proteinaceous material on the wound surface, which is subsequently sucked up by the larvae as nutrition. The action of larval enzymes is restricted to dead tissue; living tissue in the wound bed, including granulation tissue, is unaffected. This selective process is one of the major advantages of LDT as it spares healthy tissue necessary for healing (*Fleischmann W. et al. 2004; Gottrup F. 2012*).

Bacteria contained in this material are taken up at the same time by larvae, meaning the bio-burden is reduced. The antibacterial effect of LDT is further enhanced by the secretion of bactericidal factors, which consist of small, heat-stable peptides (*Bexfield A. et al. 2008; Cerovsky et al. 2010*). In addition, larval secretions can prevent the formation of and reduce preformed biofilms (*Harris L. 2009; Cazander G. et al. 2009*).

Remodelling and re-epithelialisation is again fostered by proteolytic enzymes contained in larval secretions. It has been shown that these enzymes support the movement of fibroblasts and keratinocytes (*Horobin A. et al. 2006*).

The anti-inflammatory action of larval secretions has been demonstrated in laboratory investigations, however, the underlying mechanism is not yet fully clear (*van der Plas M. et al 2009; Cazander G. 2012*).

While recent clinical studies have proven the debridement efficacy of LDT (*Dumville J. et al. 2009; Oplatelova K. et al. 2011*), the antibacterial, wound healing and anti-inflammatory effects are merely based on extensive clinical experience (*Gottrup F. & Jørgensen 2012; Gilead et al. 2012*). There are, however, convincing biochemical studies available, which describe the modes of action of LDT and thus support the clinical observations.

The cost-effectiveness of LDT

Cost pressures on our health systems are increasing, with politicians, payers and health insurance providers looking for cost-effective treatments. Cost-effectiveness can only be established if the efficacy of a product has been demonstrated. In the highly fragmented wound healing market, this can be difficult due to the domination of medical devices, which do not need to demonstrate clinical efficacy in the same way as pharmaceutical products. Although carrying out well-controlled, blinded studies with chronic wound patients can be difficult, attempts have been made to

demonstrate the cost-effectiveness of LDT - especially as the clinical benefits of LDT over other treatments seem so pronounced (*Thomas S. 2006*). This is particularly true when debridement is considered the first endpoint - a position that needs to be achieved in order to initiate the next steps in the treatment process.

A recent study by Professor Ceri Phillips and the Swansea Centre for Health Economics at Swansea University, Clinical Efficacy and Cost-effectiveness of Larval Therapy in Wound Debridement, concluded that larval debridement therapy is cost effective when compared to other mainstream debridement interventions including surgical, sharp, mechanical and autolytic debridement methods (report in progress).

Modes of application

Larval Debridement Therapy can be achieved by free-range larvae or by bagged larvae.

The number of larvae put on the wound is approximately 8–10 per cm^2 of necrotic or sloughy area (*Fleischmann W. 2004*). The larvae can be left on the wound for four days. Depending on the amount of dead tissue, a clean wound should be achieved after 1 to 3 applications.

Free range larvae

In the case of free range larvae, a dressing or 'cage', is put in place to prevent the larvae from escaping. Although more time consuming, this may be the most suitable application for irregularly shaped wounds, with undermining edges and tunnels.

Bagged larvae — BioBags

Using larvae contained in a bag-like device makes the application and removal of larvae significantly easier for the clinician. Biomonde is the only provider of bagged larvae in Europe. Larvae are placed in BioBags of different sizes, which consist of a polyester net and a cube of PVA foam that acts as a spacer. Larval secretions penetrate through the net and liquefied, proteinaceous material is taken back by the larvae. BioBags are simply placed on the wound areas that need to be debrided and covered with an appropriate secondary dressing. BioBags can be left on the wound for up to four days.

Investigations have demonstrated that free and bagged larvae are equally efficacious in terms of debriding the wound (*Blake F.A.S. et al. 2007*).

Importance of debridement

There is an on-going debate on the clinical relevance of debridement. Some people, mainly payers, claim there is no benefit from debridement if it does not assist in healing wounds more quickly, and they are asking for convincing clinical data to demonstrate this. This does not take into account the view that debriding a wound is the necessary first step in effective treatment regimes. Without debridement, a wound will never heal. Furthermore, surgical skin grafting, or other therapeutic methods supporting wound closure can only be applied after the wound is clean and well granulated (*Schultz G. et al. 2003*).

There is an inherent risk of infection if wound debris is not removed as quickly as possible, as it harbours bacteria which may penetrate into the wound environment and cause local or systemic infection with the risk of sepsis. There is, therefore, no dissent about the need for effective debridement amongst wound healing experts (EWMA position document on wound bed preparation 2004). Several consensus papers about the clinical relevance of debridement have been generated recently (*Gray D. et al. 2011; EWMA position document on debridement 2012*).

More information

For more information about Larval Debridement Therapy, please contact one of our team on **+44 (0) 845 230 1810** or email **info@biomonde.com**

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