Throughout history, it has been observed that wounds tended to heal more quickly with fewer complications when larvae found their way onto open wounds. Larval therapy (LT) is used for the debridement of chronic wounds and to create a wound bed conductive to effective healing. The aim of this article is to discuss the effectiveness of larval therapy for the debridement of chronic wounds through a critical analysis of the relevant literature.

**Key words:** Larval therapy, Chronic wounds, Debridement

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**Larval therapy** (LT) is used in both chronic and acute wounds for the debridement of necrosis, suppuration or infection. Debridement by LT occurs through: the presence and movement of larvae in the wound loosening surface debris; the secretion of proteolytic enzymes which liquify necrotic tissue ingested by larvae, and the secretions altering the wound pH, preventing the growth of bacteria.

The effectiveness of larval therapy (LT) has been demonstrated in non-empirical research. Such studies however, are classified as 'weak' in the hierarchy of evidence, and thus not robust enough to inform evidence-based practice (EBP). This review aimed amongst other things, to critically analyse relevant literature in order to determine the effectiveness of LT as a debridement method for all types of chronic wounds and ultimately, to make recommendations for future nursing practice.

**Methodology**

Key search terms included ‘chronic wounds’ and ‘effectiveness of LT’. MEDLINE, EMBASE, CINAHL, British Nursing Index (BNI), Allied and Alternative Medicine (AMED), the Cochrane Library and PsycInfo, and all literature published in or since 1995.

Chronic wounds such as pressure ulcers (PU), diabetic foot ulcers (DFU), leg ulcers (LU) and fungating/malignant carcinomas have been defined as “wounds which have failed to progress through the four stages of wound healing within an expected timeframe”, or those “of long duration” or that “recur frequently”. The effectiveness of larval therapy was measured by searching articles which detailed both improvements in wounds and those in which LT was less effective. The assessment parameters identified included:

- a decrease in surface area
- a reduction in necrotic tissue
- increased growth of granulation tissue
- complete wound debridement
- LT versus conventional therapy
- maggot-associated pain

**Results**

The inclusion criteria were that the studies should be quantitative research papers relevant to the research question. The final three were experimental designs; one randomised control trial (RCT) and two controlled trials. Sample sizes ranged from 10 to 267, (case studies, where events are bounded by time and well defined, and RCT respectively). Five studies used a convenience method whereby the researcher chooses participants according to whom or what is available. Although convenience sampling is considered the lowliest method of gathering participants, it was justified as these locations are where chronic wound patients are most likely to be receiving their care.

The articles had some significant methodological flaws which brought their reliability and transferability into question. For example, some participants had one cycle of treatment whereas others might have had four, or LT was also administered in different ways within the same study with some receiving free range larvae and some receiving bagged. The obvious exception is Dumville et al., whose study had both validity and rigour; an RCT (267 patients) using a log rank test, a statistical method of comparing spreads of time until the inci-
<table>
<thead>
<tr>
<th>Article</th>
<th>Country of origin</th>
<th>Aim of Research</th>
<th>Research Design</th>
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| 10      | Bratislava        | To test the effectiveness of LT for the treatment of chronic leg ulcers where other therapies have failed | Case series design   | 10 patients with 13 ulcers | • Massive growth of granulation tissue  
• Pain and itching associated with maggots  
• Some patients experienced increased pain whilst others reported reduced pain  
• Decrease in wound odour  
• LT salvaged limbs that would otherwise have needed amputating  
• Prevented patients from developing septicemia |
| 21      | Israel            | To test the effectiveness of LT for the treatment of chronic wounds and ulcers in hospitalised patients | Case series design   | 25 patients with 43 wounds | • Massive growth of granulation tissue  
• Pain and itching associated with maggots  
• Some patients experienced increased pain whilst others reported reduced pain  
• Decrease in wound odour  
• LT salvaged limbs that would otherwise have needed amputating  
• Prevented patients from developing septicemia |
| 14      | Germany           | To test the clinical effects of maggot therapy on chronic leg ulcers as well as any possible side effects and mechanisms of action | Pre- and post-test design | 30 patients | • Temporary increase in wound exudate and inflammation  
• Mild pain  
• Debridement achieved  
• Increase in granulation tissue |
| 7       | Sweden            | To test the effectiveness of LT on chronic ulcers                                | Case series design   | 74 patients       | • Decrease in necrotic tissue  
• Maggots had no debridement effect on sloughy tissue  
• Worked well in diabetic patients  
• Decrease in odour  
• Increased pain  
• Physiologically repellent |
| 11      | UK                | To test the effectiveness of LT on chronic wounds? – No research question given  | Case series design   | 34 patients       | • Decrease in necrotic tissue |
| 16      | USA               | To test the effectiveness of LT for foot and leg ulcers in diabetic patients, where other therapies have failed | Controlled trial     | 18 patients with 20 ulcers | • LT debrided faster than conventional therapy  
• Reduction in necrotic tissue  
• Faster growth of granulation tissue  
• Mild pain – but same patients reported pain during conventional therapy as well |
| 18      | USA               | To test the effectiveness of LT for the treatment of pressure ulcers              | Controlled trial     | 103 patients with 145 pressure ulcers | • Patient anxiety due to maggots  
• LT debrided faster than conventional therapy  
• Reduction in necrotic tissue  
• Rapid growth of granulation tissue.  
• Mild pain – but same patients reported pain during conventional therapy as well |
| 15      | Egypt             | To test the effectiveness of LT for the treatment of diabetic foot ulcers         | Case series design   | 10 patients with 13 ulcers | • 100% of ulcers debrided.  
• Decreased amount of necrotic tissue  
• Decreased size of ulcers – some completely closed |
| 8       | UK                | To test the effectiveness and cost-effectiveness of LT on chronic leg ulcers compared to other debridement methods | Randomised control trial | 267 patients | • No difference in outcome in loose or bagged larvae  
• Sped up wound debridement but not overall wound healing  
• Increase in pain |
| 12      | Turkey            | To test the effectiveness of LT on chronic wounds in a military hospital         | Case series design   | 11 patients       | • Complete debridement achieved  
• Increase in granulation tissue  
• Increased pain |
| 17      | USA               | To test the effectiveness of LT for treating pressure ulcers in spinal cord injury patients | Pre- and post-test design | 8 participants | • All ulcers completely debrided.  
• Increased healing rates of ulcer |
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dence of an event (wound debridement). Sherman\textsuperscript{18} and Sherman\textsuperscript{16} were also found to be methodologically competent.

Findings

Table 1 shows a meta-analysis of the study findings.

**Healing assessment parameters**

Sherman\textsuperscript{18} and Sherman\textsuperscript{16} compared LT with conventional hydrogel therapy, and found LT to be more effective for debridement and overall wound healing in both DFUs and PUs. These results partly reflect the findings of others\textsuperscript{2,14,15} who observed that participants with diabetes had effective outcomes with LT compared to other treatments. Dumville et al.\textsuperscript{16} however, found that LT was considerably faster at debridging LUs than conventional hydrogel therapy, but did not speed up the overall healing process. These results indicate the effectiveness of LT in overall wound healing is subjective to the type of chronic wound.

Although the frequency of applications of LT varied in and between the studies, Tanyuksel et al.\textsuperscript{12} achieved complete debridement in the shortest time – 10 out of 11 wounds were completely debrided in eight days. Complete debridement of PUs and DFUs took an average of one to four weeks\textsuperscript{13} and one to nine weeks\textsuperscript{15} respectively. Unfortunately, there was no comparison with a conventional debridement technique in any of the studies, so it cannot be stated for certain that a conventional technique would have debrided these wounds in less time.

Wolf and Hansson\textsuperscript{7}, Turkman et al.\textsuperscript{17} and Tantawi et al.\textsuperscript{15} observed a reduction in necrotic tissue after LT, although these studies only stated either the amount of reduction or the percentage of participants who had experienced a reduction.

**Pain**

Dumville et al.\textsuperscript{16} reported that 40 per cent of participants experienced increased pain during LT compared to 4.3 per cent of participants who underwent conventional therapy. However, in other studies, the proportion of patients experiencing pain was the same for both interventions\textsuperscript{16,18}.

**Discussion**

This study enhances the understanding of the effectiveness of LT as a debridement method in chronic wounds and in the authors’ opinion, has successfully answered the research question. Based on the weighting of the studies from the critical appraisal, the main findings that can be supported by reliable evidence are that:

- LT is significantly more effective at debridement than hydrogel or a mixture of conventional therapy modalities\textsuperscript{20}, although is no more effective for overall wound healing.
- Effectiveness depends on the type of chronic wound; LT appears to be more effective on PUs than other chronic wounds\textsuperscript{13}, and on wound debridement (but not healing) in leg ulcers\textsuperscript{8}.
- Some experience increased pain during LT, although not appreciably more than with conventional therapy.
- LT can reduce the surface area of all chronic wounds\textsuperscript{16,18}, but so will other debridement methods.
- LT can achieve complete debridement within a shorter time period in certain types of chronic wounds, such as sloughy and/or necrotic chronic venous and mixed venous/arterial leg ulcers compared with hydrogel therapy.
- The results of this review are based on a sample of 590 participants across 11 different studies. This would be a large enough sample to have an impact on practice if all of the studies had been found to have rigorous methodologies, yet they did not. Despite this, the studies that were found to be rigorous made up 65.7 per cent of the 590 participants, increasing the prospect of transferability. Recommendations for practice include:
  - Promoting the wider use of LT for the initial debridement of chronic wounds until an optimum wound bed is achieved.
  - Increasing the availability of training to use LT.
  - Promoting wider availability of LT to match the availability of conventional methods.

**Conclusion**

This review was conducted to test the effectiveness of LT as a treatment intervention for chronic wounds. The quality of evidence was found to be variable; only three of the articles\textsuperscript{16,18} had reliable and rigorous methodologies leading to them being given a greater weighting in our findings. The amalgamation of the results of all the studies under these themes led to a number of findings which correspond with the background research, have implications for future nursing practice and helped to identify any necessary need for further research.

**References**