Silver dressings

To many, any connection between silver and maggots may not be immediately obvious. To healthcare professionals, however, particularly those working in the wound management field, there is a clear link between the two. Both have been used empirically for hundreds of years, long before the existence of microorganisms was even suspected, to treat soft-tissue infections and, as we now are aware, to prevent the proliferation of bacteria. Significantly, both may have a role in the treatment of wound infections caused by microorganisms that have become resistant to antibiotics.

Dilute solutions of silver nitrate have been used since the 1880s for the treatment of eye infections; a 1% solution is still used in many countries for the prophylaxis of gonococcal ophthalmia neonatorum. In 1965, silver nitrate solution was introduced as a treatment for burns, but for this indication it was soon replaced by preparations containing the more effective silver sulphadiazine complex.

Silver ions are active against bacteria, fungi and viruses; they exert antimicrobial effects by interacting with sulfhydryl groups of proteins on multiple target sites resulting in structural and metabolic disruption. As with most antimicrobials, bacteria may develop resistance to silver; numerous reports of Gram-negative silver-resistant isolates have appeared in the literature.

Treatment of wounds with silver preparations may aid wound healing by treating any local infection. However, it has also been suggested that silver might assist wound repair by a mechanism unrelated to its bactericidal effect. Experimental studies have shown that silver induces metallothioneins in dermal fibroblasts and epithelial cells at the wound margin. These molecules, which have an important role in the intracellular uptake and metabolism of zinc and copper, may also have mitogenic effects. The history, mechanism of action and toxicity of silver used in wound management have been comprehensively reviewed by Lansdown [1, 2].

Perhaps somewhat surprisingly, despite the recognised antimicrobial properties of silver, it was not until the 1980s that it was first included in a commercially available dressing, consisting of an activated charcoal cloth containing a low concentration of silver ions that was originally marketed for the treatment of malodorous wounds. The silver was added to the fabric to kill microorganisms that became adsorbed on to the charcoal fibres, not to exert an antimicrobial action within the wound itself. In 1998 the first dressing containing silver (Acticoat) specifically for the treatment of wound infections was marketed, an absorbent dressing bearing a silver-coated high-density polyethylene membrane [3].

Laboratory studies have demonstrated major differences in the silver content and antimicrobial activity of a range of silver-containing dressings [5]. As might be predicted, there is a clear relationship between the antimicrobial activity of a dressing and its total silver content (ranging from <2 to >500 mg/100 cm²). However, it was discovered that other factors also influence the antimicrobial activity of the dressing. These include the distribution of the silver within the dressing (whether it is present as a surface coating or dispersed through the structure); its chemical and physical form (whether it is present in the metallic, bound or ionic state); and the dressing's affinity for moisture, which is a prerequisite for the release of active agents in an aqueous environment. Products that have silver concentrated on
the surface of the dressing, instead of being bound up within their internal structure, performed particularly well in these tests, as did dressings with silver present in the ionic rather than the metallic form.

Silver preparations are widely used in clinical practice for the prevention or treatment of infection in many types of acute and chronic wounds [6-8] and some for wound debridement, although the evidence for this indication is less convincing. Data for the use of silver-containing dressings can be confusing: a Cochrane database review of three published clinical trials concluded that there was insufficient evidence to recommend the use of silver-containing dressings or topical agents for treatment of infected or contaminated chronic wounds [9].

The considerable variation that exists between products both in terms of their total silver content and the amount of silver that they release during testing in the laboratory, may have clinical consequences that are as yet not fully understood. Much work is therefore required to investigate the relevance of these differences in vivo to ensure that these dressings are selected and used appropriately.

Maggots

The benefits of accidental infestations of wounds with maggots, particularly during military conflicts, have been recognised for centuries. Maggots of the common greenbottle *Lucilia sericata* have been used in western medicine to treat infected wounds since at least the time of the American Civil War. Maggots were routinely used in the early part of the 20th century, until the advent of antibiotics caused them to fall into disuse. They were reintroduced into mainstream wound management in the latter part of the century following a series of publications in the US and the UK which described their role in the treatment of a variety of wound types, including leg ulcers, pressure ulcers, diabetic ulcers and infected surgical wounds. In each case the common feature was the speed of debridement associated with maggot therapy and their ability to prevent or eliminate infection [10].

During normal feeding, maggots secrete a powerful mixture of proteolytic enzymes that break down slough and necrotic tissue into a semi-liquid form that the creatures can ingest. During this process, the actively feeding maggots also take up and destroy bacteria. Maggots’ secretions also contain one or more chemicals with antimicrobial properties which are presumed to enhance their ability to kill microorganisms *in vivo* [12]. They may thus help to prevent or combat wound infections. There are many reports that they are active against infections caused by antibiotic-resistant organisms such as methicillin-resistant *Staphylococcus aureus* (MRSA) [11].

Maggots can either be applied directly to a wound, held in place with a piece of fine mesh net which is stuck down to a hydrocolloid frame – the so-called ‘free-range’ technique, preferred for deep or undermining wounds and areas with sinuses, or they can be applied sealed in bags made of foam or net, which greatly enhances clinical and patient acceptability [14].

The ability of maggots to free wounds of dead tissue is remarkable. Often a single treatment lasting two or three days is sufficient to achieve complete debridement of a wound covered with a thick layer of adherent sloughy tissue that has proved resistant to months of treatment with more conventional products. This speed of action makes maggot therapy very cost effective and offers the possibility of delivering significant financial savings to healthcare providers compared with conventional techniques [13].

Illustration of maggots on a scalpel.

References