Honey is an ancient treatment that is increasingly earning its place in modern wound care. Evidence suggests it compares with other dressings in terms of its antibacterial properties, ease of use and ability to promote a moist environment, infection; antibacterial; anti-inflammatory; skin grafts

Since Molan last covered this topic in *Journal of Wound Care*, there have been advances in the selection of honey for use in wound care, based on its antibacterial properties, and in clinical protocols for its use. This paper examines wound-healing results achieved with honey in the past five years, the extent of its use and practical issues relating to its clinical use.

**Use of selected honey**

The potency of honey's antibacterial activity can vary up to a hundred-fold. Honey's antibacterial activity is partly due to the high osmolarity created by its sugar content, although this reduces as it is diluted by exudate. Honey with no antibacterial activity beyond its osmolarity ceases to be effective against *Staphylococcus aureus* when diluted with three or four times its volume of exudate. However, honey produced specifically for wound care can still be inhibitory if diluted to 45-60 times its volume.

Honey's antimicrobial activity is also due to: Honey's phosphorylase, which is formed in a 'slow-release' manner by the glucose oxidase added by bees during its production.

Phytochemicals from the nectar of particular plant species.

Both activities can vary from sample to sample. In manuka honey (*Leptospermum scoparium*) and honey from some other *Leptospermum* species the phytochemical activity can be high, with a broad spectrum of antimicrobial activity. (This activity, the Unique Manuka Factor, is rated as the UMF number on honeys on sale.)

Honey with a medium level of hydrogen-peroxide activity and manuka honey with a medium level of phytochemical activity are equally as potent as antibacterial agents *in vitro*, although manuka honey is about twice as effective against enterococci.

In wound care the catalase in serum and tissues decomposes to some extent the hydrogen peroxide produced by many honeys, whereas the phytochemical component of *Leptospermum* honey maintains its activity. Also, the glucose oxidase which produces the hydrogen peroxide in honey only becomes active when honey is diluted, and its acidity is neutralised by exudate. In contrast, the phytochemical factor in *Leptospermum* honey is active in full-strength honey, giving a more potent antibacterial action that diffuses into the depth of infected tissues, making it the honey chosen for sale for wound care.

**Dressing protocols**

The progressive dilution of honey by exudate, together with the absorption of its components into the blood stream, means its osmotic and antiseptic effects last for only two to three days. Other practical issues that need to be considered when using honey as a wound dressing are described below.

**The osmotic effect**

Honey creates a moist environment by drawing exudate to the wound surface, creating a non-adherent interface between the dressing and wound bed. Lawrence suggested that penetrative osmosis may damage wound tissue, but this does not happen as the underlying circulation provides a flow of replacement fluid. However, osmotic withdrawal of fluid does prevent maceration of periwound skin.

**Dealing with exudate**

Wound exudate can dilute a honey's antibacterial activity, or wash it away, so honey is best soaked when applied directly to the wound. Due to its anti-inflammatory action, placing sufficient honey on the wound will decrease the level of exudate. Until this decrease occurs, frequent dressing changes may be needed on exuding wounds if the honey is being washed away. A new dressing comprising honey gelled with sodium alginate, forms a rubbery sheet similar to a hydrocolloid. This swells into a softer gel as it readily absorbs exudate, keeping honey in contact with the wound bed while preventing the lateral spread of exudate. A honey hydrogel product (L-Mesitran Hydro, Triticum) can be inhibitory if diluted to 45-60 times its volume.

**References**

absorb five times its weight of fluid, but contains only 30% honey before this gets further diluted as exudate is absorbed.

Results observed in clinical practice

In our clinical experience a variety of chronic, acute, infected or heavily colonised wounds that did not respond to ‘normal management’ have been treated with honey. Successful healing was achieved in all patients except those with arterial insufficiency. However, the latter wounds remained free from infection and did not deteriorate further. Varicose ulcers usually healed within three months, including cases where compression could not be used. No patients required systemic antibiotics. As a result, community nurses in our region use honey as the standard treatment for leg ulcers infected or heavily colonised with *Pseudomonas*.

The most notable results have concerned honey’s rapid (within 24 hours) cleansing and deodorising action, particularly on fungating (malignant) wounds. Honey also reduces inflammation and exudate levels, and may suppress the growth of tumour cells, as observed in experimental animals.  

The following randomised controlled trials of honey have demonstrated successful outcomes, when compared with other dressing regimens:

- Honey versus povidone-iodine on central vein catheter exit sites of patients on dialysis
- Honey versus hydrocolloid on split-thickness skin graft donor sites
- Honey versus phenytoin on chronic leg ulcers
- Honey versus povidone-iodine with 70% ethanol washes on severe postoperative wound infections

Table 1 gives examples of case reports where honey proved successful after other treatments failed. Many used honey dressings we developed — Combine (Smith & Nephew) dressing pads impregnated with 25-35g of UMF12 or UMF13 manuka honey.

Honey with unspecified antibacterial activity

The possibility that some honeys may give poor results because they have a low level of antibacterial activity was demonstrated in a prospective randomised controlled trial comparing honey with early tangential excision followed by autologous skin grafting for the treatment of burns. Honey did not provide as good infection control as early tangential excision, although skin grafting was required in only 11 of the group treated with honey. However, in other clinical trials, the author achieved good infection control with the same dressing regimen. For example, a prospective randomised controlled trial compared Jambhul (*Syzygium cumini*) honey with silver sulphadiazine in two groups of 80 patients. (One sixth of the total burn area was full-thickness.) In the honey group the 44 positive swabs recorded at baseline reduced

<table>
<thead>
<tr>
<th>Wound</th>
<th>Outcome</th>
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<tbody>
<tr>
<td>Porous non-adherent dressing placed between graft and honey dressing</td>
<td>Pseudomonas eliminated; donor sites healed faster; better cosmetic results</td>
<td>Robson et al.</td>
</tr>
<tr>
<td>36-month-old surgical wound in the axilla</td>
<td>Healed in 1 month</td>
<td>Cooper et al.</td>
</tr>
<tr>
<td>Skin lesions infected with <em>Pseudomonas</em>, <em>Staphylococcus aureus</em> and <em>Enterococcus</em></td>
<td>Healed within 10 weeks</td>
<td>Dunford et al.</td>
</tr>
<tr>
<td>Skin-graft failure of lower leg cavity wound; infected with <em>Pseudomonas</em>, <em>Staphylococcus aureus</em> and MRSA: donor-site infection</td>
<td>Healed in 8 weeks; elimination of wound odour</td>
<td>Dunford et al.</td>
</tr>
<tr>
<td>Hydroxyurea-induced leg ulcer infected with MRSA treated with UMFI 2 manuka honey under DucDERM (Convatec)</td>
<td>Infection cleared in 14 days; healed in 21 days</td>
<td>Natarajan et al.</td>
</tr>
<tr>
<td>4 x 4cm non-healing traumatic wound</td>
<td>Granulation and epithelialisation visible within 1 week; complete healing in 6 weeks</td>
<td>Dunford et al.</td>
</tr>
<tr>
<td>Ulcer from back of knee to ankle, infected with <em>Streptococcus pyogenes</em> and <em>Staphylococcus aureus</em> treated with Medihoney</td>
<td>Elimination of odour; reduction in pain; reduced bleeding at dressing change; 80% reduction in size in 15 weeks</td>
<td>Stewart</td>
</tr>
<tr>
<td>Bilateral leg ulcers, extending 18cm up from ankle on the inner and outer surfaces of an 88-year-old patient, treated with Medihoney</td>
<td>Healed in 6 weeks</td>
<td>Richards</td>
</tr>
<tr>
<td>Chronic leg ulcers (20 years), Medihoney compared with Aqualast</td>
<td>Cleaner wound bed; infection and exudate cleared in 10 days</td>
<td>Alcaraz and Kelly</td>
</tr>
<tr>
<td>25-year history of venous ulceration and recurrent infection treated with UMFI 10+ manuka honey</td>
<td>Rapid removal of odour; eczema cleared after 10 days, but infection returned under compression and NA dressing (Johnson &amp; Johnson)</td>
<td>Kingsley</td>
</tr>
<tr>
<td>14 cases of gangrene in the genitals and perineum. Honey was applied directly to the wounds, which were covered with a honey-soaked compress</td>
<td>Average debridement time: 5.2 days; granulation: 8.4 days; healing: 28.7 days</td>
<td>Anoukoum et al.</td>
</tr>
<tr>
<td>Fournier’s gangrene, post surgical debridement</td>
<td>Healing in six patients</td>
<td>Gurdal et al.</td>
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</table>
to four after seven days, compared with 42 positive swabs at baseline and 42 after seven days in the silver-sulphadiazine group. Use of honey was associated with a significantly faster rate of healing. Four of the honey-treated wounds required grafting compared with 11 treated with silver sulphadiazine.

Some cases in Table 1 also used honey with unspecified antibacterial activity. Good results were reported in most of these, but the three cases (out of a total of 60) in the trial of Mediproph HoneySoft dressing in which there was infection or failure to heal may be a reflection of the fact that this honey does not have a standardised antibacterial activity.

Pain and honey dressings

There have been a few reports of honey causing pain when applied to wounds. In one study the patient experienced pain for the first 20-30 minutes. We have observed that pain is experienced only in very inflamed wounds and disappears once the inflammation has resolved. But there are many reports of honey relieving pain.

The pain experienced does not seem to be associated with damage to the wound. But there is evidence that honey stimulates nociceptors. Interestingly, patients have reported a 'peppery' sensation when honey is applied to ulcers. It is possible, therefore, that in some patients the nerve endings are sensitised and thus more responsive to the honey's acidity and/or its organic chemicals.

Acceptance by the medical profession

In 2000 an answer to a reader's question in *Journal of Wound Care* commented that 'honey appears to be becoming popular for the management of infected wounds'. This has become even more the case, reflecting the search for alternatives to antibiotics and the increasing awareness of honey's effectiveness.

Although systematic reviews have concluded that there is a low level of evidence to support the use of honey on chronic wounds, they have not acknowledged that in many published case reports it was only used after standard treatments failed. (Most of the randomised controlled trials on honey have been on acute wounds.)

Following increasing evidence from laboratory-based research of honey's antimicrobial properties and from clinical experience of its ability to promote healing, editorial comments in medical journals are now changing from being disparaging to accepting.

### Honeys produced specifically for wound care

There are over 500 reports of case studies and clinical trials where honey intended as a food product has been used as a wound dressing, and none have reported any adverse effects. However, clinicians are reluctant to use non-sterile products on open wounds, and it is unlikely the bacterial content of raw honey would meet regulatory requirements for wound-management products. Although raw honey does not contain disease-causing vegetative bacteria (unless recently contaminated), it can contain viable bacterial spores, including *Clostridium* species.

Several commercially available honey items produced specifically for wound care have been approved by the regulatory authorities:

- Australia, Canada and EU member states — a honey ointment (L-Mesitran, Triticum) comprises honey and Medilan, sunflower oil, cod liver oil, aloe vera, calendula, vitamins A, C and E and zinc oxide; L-Mesitran Hydro (Triticum), a hydrogel dressing that contains 30% honey and is also available as an island dressing (L-Mesitran Border) or incorporated into an open-weave polyester net (L-Mesitran Net). The Triticum products are made from honey of unspecified origin and antibacterial activity.
- Australia and all EU member states — Medihoney Antibacterial Wound Gel, Medihoney Antibacterial Honey Barrier (Medihoney, Australia) and (in Australia) Woundcare 18+ (Comvita Medical, New Zealand). These honeys are harvested from *Leptospermum* species, and their standardised antibacterial activity stems from the unidentified phytochemical antibacterial component derived from *Leptospermum*. Medihoney is funded for use in hospitals in Queensland and New South Wales, Australia.
- All EU member states — ActiVon Tulle (Advancis) a triple layer of low-adherent knitted viscose primary dressing BP Type 1 impregnated with honey, and Alginon dressing (Advancis), a honey-impregnated mechanically bonded calcium alginate (M type) fibre dressing. Both are made from *Leptospermum* honey with standardised antibacterial activity. ActiVon Tulle is available on the Drug Tariff in the UK.

### Table I (continued). Examples of honey dressings that have achieved successful results after other treatments failed

<table>
<thead>
<tr>
<th>Wound</th>
<th>Outcome</th>
<th>Reference</th>
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<tbody>
<tr>
<td>Retrospective review of 50 cases of lactational breast</td>
<td>Good response</td>
<td>Efem²⁶</td>
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<tr>
<td>abscesses incised, drained and packed daily with honey-</td>
<td></td>
<td></td>
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<tr>
<td>Skin excoriation due to oesomy bag leakage</td>
<td>Rapid epithelialisation</td>
<td>Aminu et al.²⁷</td>
</tr>
<tr>
<td>soaked ribbon gauze</td>
<td>twot wounds did not heal but did not worsen.</td>
<td>Ahmed et al.²⁵</td>
</tr>
<tr>
<td>1 acute traumatic, 23 complicated surgical and</td>
<td>Others healed in a mean time of 3 weeks (range:</td>
<td></td>
</tr>
<tr>
<td>21 chronic non-responding wounds treated with</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HoneySoft (Mediproph)</td>
<td>1-28 weeks</td>
<td></td>
</tr>
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Australia, New Zealand and all EU member states

...Apinate dressing (Convita Medical, New Zealand), a honey-imregnated mechanically bonded calcium alginate (M type) fibre dressing made from Leptospermum honey with standardised antibacterial activity a

...All EU member states — HoneySoft dressings (Medipro) are pads of polyethylenevinylacetate fibre impregnated with honey of unspecified origin and antibacterial activity. HoneySoft is reimbursed in the Netherlands, in Belgium for trauma patients, in burn centres in England that have own budgets, and in Greece.

The use of honey-imregnated dressings, honey ointments and honey gel dressings have overcome comments that honey is messy to use and difficult to keep in place.6,45,46

Conclusion
In 1999 an editorial in Advances in Wound Care commented that there is a tremendous opportunity to re-examine old treatments and apply them in the current environment.5

Honey, the most ancient of... versus amniotic membrane in the treatment of burns. Burns 1994; 20:4, 331-333.


23 Ahmed,A.K., Hoekstra, EH., Babayo,U.D.Another


25 Tovey, F. Honey and sugar as a dressing for wounds and ulcers.Trop Doct 2000; 30: 1.


Potency of honeys’ antibacterial activity can be variable

...— use honey with standardised antibacterial activity a

Only use products licensed for wound care as they have been finely filtered and stabilised by gamma-irradiation to kill spores

Ensure sufficient honey remains in contact with the wound bed by using absorbent dressings impregnated with honey, as honey gel dressings. Fill any cavities with honey

Ensure the dressings cover any areas of inflammation surrounding the wound. Due to honey’s high osmolarity, there is no risk of skin maceration

Change dressings often enough to prevent the exudate washing the honey out of the dressing

Edited and sterilised


Box 1. Key issues for practice