Honey and Contemporary Wound Care: An Overview

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A growing body of research and empirical evidence have supported the re-discovery of medicinal-grade honey as a wound management agent. Pre-clinical study results suggest that honey has therapeutic benefit; clinical study results have shown that honey effectively addresses exudate, inflammation, devitalized tissue, and infection. Honey-containing dressings and gels have been developed to facilitate the application of medicinal-grade honey to the wound. Clinical studies to compare the safety and effectiveness of these products to other moisture-retentive dressings and treatment modalities are warranted.

KEYWORDS: honey, leptospermum, Manuka, wound bed preparation


Honey provides a sugar-rich food source for bees. They harvest honey as nectar, a sugary fluid (approximately 80% water) produced by a variety of plants in order to attract insects and subsequently promote cross-pollination. The bees transport the nectar back to the hive where the nectar is “processed” and transformed into honey (80% sugar, 17% water). The honey then is stored and sealed in the comb using beeswax. During hive processing, most of the water is removed; the binding of the remaining water molecules and the addition of enzymes by the bees help ensure that microbial growth is not supported.

The many different types of honey and the nuances of the finished product depend not only on the flower source, but also on a variety of factors including weather and climatic conditions. Not all honeys are the same. As flavor, consistency, and color of honey vary, so do its therapeutic purposes. These variations in characteristics led Molan to the conclusion that honey should not be considered a generic term.

The therapeutic properties of honey are variable and depend on the type of honey used. Manuka (the Maori name for the New Zealand tea tree/bush Leptospermum scoparium) or Leptospermum is honey derived from the tea tree; the former is the more widely used term. In a review of the literature, Moore showed that Manuka honey has “very special healing properties” and described it as “the best natural antibiotic in the world.”

Medical-grade Manuka honey is prepared purely for medical use and controlled by a rigorous set of systems and standards. These exacting standards apply to the leptospermum honey distributed in the US (Medihoney, Derma Sciences, Princeton, NJ). This product is a blend of L. scoparium (Manuka) and L. polygalifolium know as Jelly Bush.

The purpose of this review is to accentuate the wide-ranging therapeutic advantages that honey can offer using examples from the literature.

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History

Honey as a therapeutic agent has a history that dates back thousands of years; this fact assists in underpinning its therapeutic credentials. Namias noted that honey is mentioned in relation to healing in the Bible, the Koran, and the Torah. In addition, the Edwin Smith Papyrus (17th century BC), Hippocrates, and Democritus in ancient Greece, Galen in ancient Rome, and Avicenna in medieval times all have recorded the medical properties of honey.

Until the first part of the 20th century, honey dressings were part of everyday wound care practice. With the advent of antibiotics in the 1930s and 1940s, views changed and honey was consigned to items of historical interest. Misuse of antibiotics, the emergence of resistant bacteria, and increasing interest in therapeutic honey have provided an opportunity for honey to be re-established as a broad-spectrum, antibacterial agent that is non-toxic to human tissue.

Despite lack of promotional support from large corporations, interest in the use of honey in wound management has increased in recent years. However, a clinical profile in wound care commensurate with other modalities has not been achieved despite offering similar indications of use and an increase in research activity and clinical reports. Zumal and Lulat observed, “The therapeutic potential of uncontaminated, pure honey is grossly underutilized.” Clinicians need reassurance that any health-related agent is safe and meets its stated therapeutic purpose. Therefore, it is important to emphasize that although natural in origin, the honey used in wound care should be of medical-grade standard and not sourced from honey destined for the supermarket shelf. Medical grade honey is filtered, gamma-irradiated, and produced under carefully controlled standards of hygiene to ensure that a standardized honey is produced.

Therapeutic Benefit of Honey in Wound Care

A systematic review of honey as a wound dressing noting the dearth of good evidence on topical wound agents contradicts Molan’s literature review of the evidence (17 randomized, controlled trials involving 1,965 participants and five clinical trials involving 97 participants, plus numerous case studies), supports the use of honey as a wound dressing, and underscores clinician failure to recognize that evidence. Molan’s research review also addressed the range of honey’s therapeutic activities (see Table 1).

Wound bed preparation. Wound bed preparation may be viewed as management of the wound in order to accelerate endogenous healing. The bio-activity of honey aligns closely with the concept of wound bed preparation. The physiology of healing in acute wounds is a carefully controlled series of events that ensures healing progresses in a timely fashion. However, in chronic wounds this orderly sequence is disrupted and the repair process is delayed. If wound bed preparation is to be successful, the impediments to healing must be recognized and addressed, implying appropriate management of exudate, devitalized tissue, and associated bioburden. The appropriate application of honey dressings offers a way forward in managing potential wound-related barriers to healing.

Exudate. A clinical study by Al-Waili and Saloom compared honey with topical antiseptics in 50 patients with postoperative abdominal wound infections; Ahmed et al’s non-randomized study of 60 patients with chronic surgical or trauma wounds; and Betts and Molan’s in vivo pilot study reported that honey helps reduce the amount of wound exudate. This is most likely a consequence of honey’s anti-inflammatory properties. Inflammation — increased vessel permeability — increases fluid movement into soft tissue, subsequently increasing surface exudate. A decrease in inflammatory cells has been found (histologically) in animal models following application of honey in full-thickness burns. Similar findings have been reported in animal studies comparing ampicillin and nitrofurazone in treating infection of full-thickness wounds.

The anti-inflammatory activity of honey also has been documented in clinical studies of human burn wounds and in in vitro studies. The potential
consequences of effectively managing inflammation include rapid reduction of pain, edema, and exudate; additionally, hypertrophic scarring is minimized by avoiding protracted inflammation that may result in fibrosis.\textsuperscript{21} It follows that reducing inflammation lessens exudate production and dressing change frequency, which may conserve resources in terms of dressings used, staff time, and unnecessary disturbance of the patient and the wound bed.

\textbf{Devitalized tissue.} It has been established that dressings that create the type of moist wound environment that honey provides facilitate the process of autolytic debridement. The osmotic pull of honey draws lymph from the deeper tissues and constantly bathes the wound bed. Lymph fluid contains proteases that contribute to the debriding activity of honey. In addition, the constant sluicing of the wound bed is believed to help remove foreign body (eg, dirt and grit) contamination.\textsuperscript{21} Molan\textsuperscript{22} has suggested the most likely explanation for honey’s debriding activity — the conversion of inactive plasminogen to plasmin, an enzyme that breaks down the fibrin that tethers slough and eschar to the wound bed. Stephen-Haynes,\textsuperscript{23} who presented the results of three patient case studies and an additional five patients who benefited from management of wound malodor, attests to the clinical impact of honey in debridement. Malodor is known to occur in a variety of wounds in conjunction with slough and necrotic tissue; it is a particular concern when managing fungating lesions. Malodorous substances such as ammonia and sulphur compounds are produced when bacteria metabolize protein. Because honey provides bacteria an alternative source of energy (glucose), these noxious compounds are no longer produced and wound malodor is avoided.

\begin{table}
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\caption{The Bioactivity of Honey}
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\textbf{Bioactivity of honey*} & \textbf{Suggested Rationale*} \\
\hline
Prevention of cross-contamination & Viscosity of honey provides a protective barrier \\
Provides a moist wound healing environment & Osmolarity draws fluid from underlying tissues \\
Dressings do not adhere to wound surface. & The viscous nature of honey provides an interface between wound bed and dressing \\
Tissue does not grow into dressings & Osmotic outflow sluices the wound bed \\
Promotes drainage from wound & Bacterial preference for sugar instead of protein (amino acids) means lactic acid is produced in place of malodorous compounds \\
Removes malodor & Bioactive effect of honey \\
Promotes autolytic debridement & Stimulation of healing has been observed together with objective measurements in animal wounds \\
Stimulates healing & Number of inflammatory cells (histologically) found to be reduced in honey-treated wounds \\
Anti-inflammatory & Antiseptic properties found to be effective against a range of microbes including multi-resistant strains \\
Managing infection & \\
\hline
\end{tabular}
\end{table}

\textsuperscript{*}not necessarily research-based. Adapted from the literature.
Maceration. Macerated periwound skin can be a problem in some wounds and is often related to the dressing used. The osmotic action of honey, previously mentioned, has been shown in previous reviews of the literature to reduce the risk of maceration — honey draws moisture rather than donates it. Thus, periwound skin is protected from overhydration.

Bioburden. Honey has been shown in clinical observations to have the ability to manage wound infection in situations where conventional antimicrobial (antibiotics/antiseptics) have failed. Honey also has been found to be effective in vitro against a range of multiresistant organisms including methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Enterococcus* (VRE), and other multiresistant Gram-negative organisms including *Pseudomonas aeruginosa*. Other *in vitro* studies involving different microorganisms also have demonstrated honey’s effectiveness against antibiotic-resistant bacteria. George and Cutting specifically identified honey’s antibacterial activity. The binding of water can be added to these antibacterial properties:

- The high sugar content/low water activity provides osmotic action
- Acidic pH (3.2 to 4.5) inhibits bacterial growth
- Glucose oxidase enzyme helps produce hydrogen peroxide
- Plant-derived factors (present in some honeys and not specifically identified).

The antibacterial action most likely reaches below the wound surface. Although topical honey manages superficial bacteria (bactericidal in action rather than bacteriostatic) it also has been shown *in vitro* to provide prompt clearance of deep-seated infection and boils with unbroken skin, suggesting that honey’s antibacterial activity may diffuse through the skin to deeper tissues. Cooper et al. performed sensitivity testing of 17 strains of *P. aeruginosa* isolated from infected burns using two honeys with different types of antibacterial activity; Wahdan compared the antibacterial activity of a sugar solution and honey on 21 types of bacteria and two types of fungi.

Biofilms. In recent years, attention has turned to the potential role of biofilms in wound infection. A biofilm may be described as a bacterial community living within a self-produced extracellular polysaccharide (EPS) matrix. The EPS protects the bacterial community from antimicrobial and phagocytic onslaught. Lately, *in vitro* evidence has indicated that honey is an effective agent for preventing biofilm formation. In addition, Okhri et al. found in an *in vitro* study that laboratory-grown Pseudomonal biofilms were disrupted following application of Manuka honey. These findings are particularly encouraging when considering the emergence of antimicrobial-resistant bacteria. No evidence has yet been presented that bacterial resistance to honey has occurred — it is highly unlikely that bacteria will select for resistance to honey because bacteria rely on sugar as a source of food.

Cross-contamination. Use of honey dressings may help prevent cross contamination. This is and will remain an important issue in healthcare. The viscous nature of honey is believed to provide a physical barrier that helps safeguard patients by preventing cross-contamination.

<table>
<thead>
<tr>
<th>TABLE 2</th>
<th>HONEY DRESSINGS AVAILABLE AND SUGGESTIONS FOR USE</th>
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<tbody>
<tr>
<td>Application/indications</td>
<td></td>
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<tr>
<td>Honey liquid or gel dispensed from a tube</td>
<td>Applied directly onto wound or onto appropriate dressing before application</td>
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<tr>
<td>Absorbent alginate dressing with honey</td>
<td>Can be applied to most acute/chronic wounds including infected or sloughy wounds</td>
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<tr>
<td>Honey in a hydrocolloid-like sheet</td>
<td>Should be selected according to the exudate level of the wound</td>
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Dressing Wounds with Honey

All dressings must be used in accordance with the manufacturer’s instructions. This helps endorse the maxim do no harm and ensure that the full benefit of the product is realized.

Because of its fluid and viscous nature, honey can be difficult to apply. This is particularly true when profuse exudate is present, diluting the honey. Experience has shown that use of the appropriate honey vehicle, including a secondary dressing, can sometimes circumvent this problem (see Table 2).

Allergy. Before honey is applied to a wound, the patient should be asked routinely if he/she is allergic to honey or bee products, including bee stings. It is advisable not to proceed with a honey-containing dressing if the answer is affirmative.

Discomfort. Occasionally, some patients report transient stinging on application of honey. The discomfort often disappears in a short period of time or after the first few applications. Analgesia is required only in those rare circumstances when pain may persist. In a review paper, Molan noted that patient response to honey applied to open wounds was reported as soothing, pain-relieving, and non-irritating, and demonstrated no adverse effects.

Conclusion

The resurgence of interest in honey as a modern wound dressing offers opportunities for both patients and clinicians. Recent additions to the honey product range of dressings indicate commercial confidence in the future of therapeutic honey. The wheel has turned full circle and honey is being re-established as a valuable agent in modern wound care management. Its advantages — providing a moist environment, debriding, deodorizing, antibacterial, anti-inflammatory capabilities — are factors that have been shown to facilitate healing. These advantages have been experienced by patients and clinicians in Europe and Australia and are now available to patients in North America. Use of any medical device must be based on clinical justification and available evidence about product safety and effectiveness. Continued research is needed to increase understanding about the role of honey in a variety of wounds and its effect on healing compared to other treatment modalities.

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