

Efficacy of medical-grade honey as an autolytic debridement agent

KEY WORDS

- ▶ Autolytic debridement
- ▶ Malodour control
- ▶ Medical-grade honey

Background: The All Wales Tissue Viability Nurses Forum provides a platform for sharing information and experience, and fosters collaborative work between its members, healthcare organisations, communities, and individuals. The Forum worked with Welsh Health Supplies to produce an All-Wales Wound Management Contract, which includes a range of honey-based dressings. **Aims:** In order to gain clinical experience of honey, and to access its effectiveness as a wound debriding agent, the Forum evaluated a case series of honey dressings. **Methods:** Patients with chronic wounds that contained slough and/or necrotic tissue in which honey dressings were being used were recruited on three consecutive dressing changes. **Results:** Honey dressings in this case study achieved partial or total autolytic debridement in the majority of wounds. Additional advantages, such as a reduction in wound exudate, malodour, and pain, as well as the stimulation of new tissue growth, were noted.

Clinicians have knowledge, skill, and experience of the wound debridement methods and products available to them. To enable them to make informed decisions on which wound debridement processor product is the most appropriate, it is essential that clinicians have access to clinical and cost-effectiveness data. However, the lack of robust evidence to support wound care products is well documented (Gottrup et al, 2010).

The case studies presented here were undertaken by the All Wales Tissue Viability Nurse Forum (AWTVNF) and enabled the Forum to gain direct experience using honey as an autolytic debriding agent, evaluate its effectiveness, and achieve positive clinical outcomes for patients involved.

WHAT IS MEDICAL-GRADE HONEY?

Honey is a composition of water and sugars in the form of glucose, fructose, protein, fatty acids, trace minerals, and vitamins (White, 1978). By a process of evaporation and enzymatic action, sugar molecules bind to water molecules, denying microbes access to water (Cooper, 2005). Furthermore, enzymes convert glucose to glucose acid, making the honey too acidic for microbes to grow in. This enzymatic reaction also forms hydrogen peroxide which has

antimicrobial properties. The hydrogen peroxide activates proteases through oxidation, which aids debridement, enhances cutaneous blood flow in ischaemic tissues, stimulates new tissue growth, and forms free radicals, giving honey anti-inflammatory properties (Molan, 2005).

A growing body of evidence demonstrates the effectiveness of medical-grade honey in wound management. These properties include: management of local infection (Cooper et al, 2001; Ahmed et al, 2003; Vandeputte and Van Waeyenberge, 2003), rapid deodorising of wounds (Kingsley, 2001; Molan, 2002; Stephen-Haynes, 2004), promotion of autolytic debridement (Subrahmanyam, 1998; Stephen-Haynes, 2004), stimulation of new tissue growth, and promotion of granulation (Hejase et al, 1996; Subrahmanyam 1998).

METHODS

Medical-grade honey was used in the cases reported here. This was 100% pure Manuka honey from the Advancis Medical (UK) range. Products used were the Activon Tube® (liquid or “runny”), Activon Tulle® (impregnated knitted viscose mesh), and Algivon® (impregnated alginate dressing). All of these products were available through the Welsh Health

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“A growing body of evidence demonstrates the effectiveness of medical-grade honey in wound management.”

Supplies/All Wales Wound Management Contract. No products were given free of charge.

The honey product was used as a primary dressing and its choice and delivery mode were based on the clinician's decision following wound assessment. No restrictions or directions were made with regard to secondary dressing choice.

Inclusion criteria

All wound types were included as long as the wound contained >40% devitalised tissue (i.e. slough and/or necrotic tissue) at the start of the study. Healing was not defined as the target end point; the aim of the honey product was to achieve autolytic debridement. Data were collected on other effects of medical-grade honey, but these were not predetermined target end-points. No ongoing methods of wound debridement were changed in order to gain inclusion in the study. Patients were only included when commenced on a honey dressing that was employed due to the ineffectiveness of or unsuitability of the previous method of debridement.

Data collection

Data were collected on all wounds included at each of three consecutive dressing changes from the time of recruitment. Wound type, location, size and depth, percentage of devitalised tissue including necrotic and/or slough covering the wound bed, pain (using a 1–10 pain scale), exudate level, presence of infection, presence of malodour, and photographs were collected. No specific time was set between dressing changes and data were collected at each of the three consecutive dressing changes.

Sample size

No predetermined study size was set, resulting in 22 patients with wounds who were recruited. No patients were excluded or removed from the study.

The authors recognise that a controlled study design, and a large sample size, would have been required to carry out robust statistical analysis of the results, hence, evaluations of the individual cases are presented here. Common themes were compared across the 22 cases based. This observational method of investigation is valid, given that the data were collected by skilled clinicians (Nelson, 2000).

RESULTS

Wound types

Wound types comprised surgical wounds (9%), leg ulcers (14%), and pressure ulcers (uncategorised, 19%; Category III, 29%; Category IV, 29%). The inclusion of different wound types allowed better scope to evaluate the effectiveness of honey as a debriding agent in different wound aetiologies. The most common wound type was pressure ulcers, which represented 77% of wounds overall.

As was expected, there were no Category I and II pressure ulcers included, as these do not have slough and necrosis in the wound bed (European Pressure Ulcer Advisory Panel and National Pressure Ulcer Advisory Panel, 2009). Twenty-nine percent of the wounds were Category III and a further 29% were Category IV pressure ulcers; a further 19% of pressure ulcers were uncategorised due to large amounts of necrosis preventing accurate visualisation and classification of the wounds.

Devitalised tissue

At the beginning of the evaluation, clinicians assessed the amount of devitalised tissue within the wound bed. The assessment of devitalised tissue as a percentage could be seen as subjective, so wounds were photographed throughout the study period. Some 82% of patients had ≥80% devitalised tissue at the first visit (*Figure 1*). Slough and necrotic tissue were evaluated separately as it was considered that autolytic debridement of necrosis may take longer than slough debridement and may also result in the formation of slough as the necrosis is softened during the process.

Autolytic debridement of necrotic tissue

At the start of the evaluation 68% (15/22) of wounds had >40% necrotic tissue in the wound bed. At the end of the data collection and use of honey products, 87% of wounds had reduced in the amount of necrotic tissue to <40%, and 67% experienced 100% debridement of necrosis. Only 13% (2/22) of patients experienced little or no debridement (*Figure 2*).

Autolytic debridement of slough

The number of wounds with >40% slough in the wound bed was 36% (8/22). By the end of the evaluation the slough had been reduced in 90% of cases with 25% of cases reaching 100% debridement (*Figure 3*).

Time taken for autolytic debridement

The average time taken to achieve complete autolytic debridement of all devitalised tissue was 31.7 days. The range was 6–109 days (Figure 4). Photographs from four of the cases are presented in Figure 5. Each case is shown before treatment with one of the medical-grade honey products, and again at the final evaluation.

Granulation

Granulation and healing were not endpoints of this evaluation; however, healing was achieved in 50% of patients. At the start of the evaluation, 81% of wounds had $\leq 20\%$ granulation tissue in the wound bed. By the end of the evaluation, 50% of wounds had $\geq 61\%$ granulation tissue in the wound bed.

Malodour

Some 40% of patients experienced wound malodour. By evaluation end clinicians reported complete elimination of malodour in 81% and a noticeable reduction in 19%.

Pain

Pain was assessed using a visual analogue scale from 0–10, with 0 being no pain and 10 being severe pain. Five patients had no pain at the beginning or the end of the evaluation. Following treatment with honey products 71% of patients who initially presented with pain saw a reduction in pain levels (Figure 6).

Exudate

Exudate levels were recorded at the second (midpoint) and the final evaluations as increasing, decreasing, or remaining the same. At the second evaluation an increase in exudate was recorded in 38% of patients; this was expected due to the debridement process and action of honey. However, by the end of the evaluation 76% of patients experienced a reduction in exudate levels (Figure 7).

DISCUSSION

These case study outcomes suggest that medical-grade honey is an effective autolytic debridement agent, as was the case in $\geq 80\%$ of the cases reported. Other effects reported comprised reductions in malodour, exudate levels, pain, and the stimulation of tissue growth.

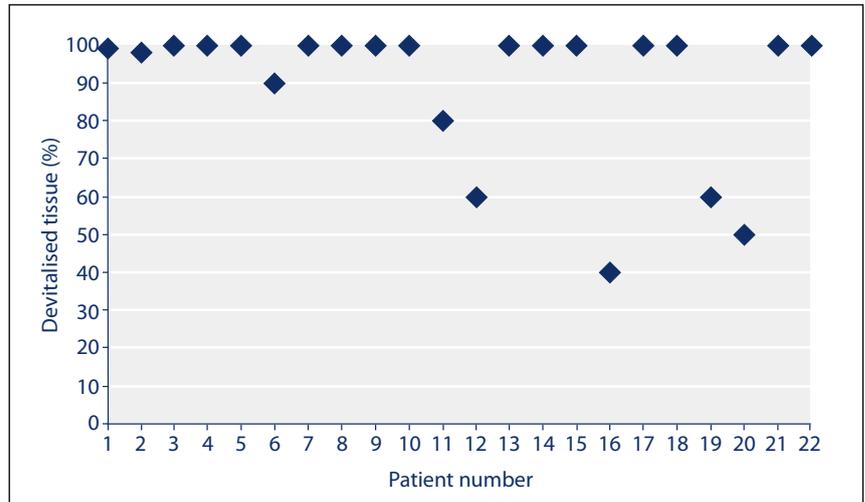


Figure 1. Percentage of devitalised tissue at the start of the study.

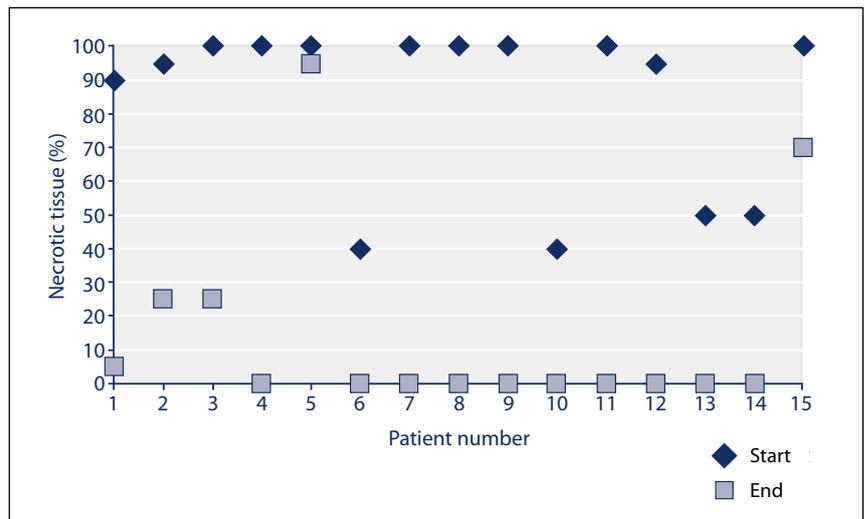


Figure 2. Percentage of necrotic tissue at the start and end of the study.

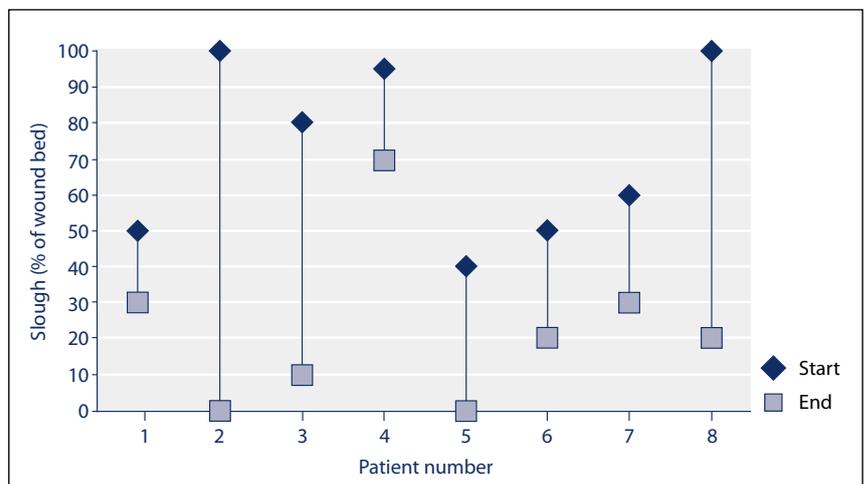
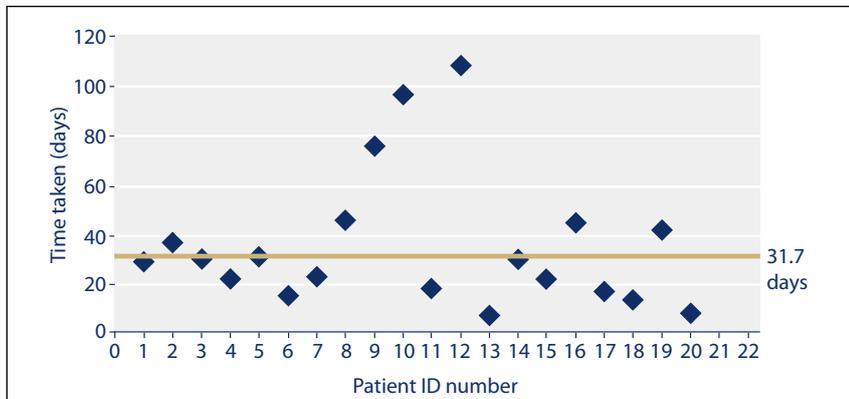


Figure 3. Percentage of slough at the start and end of the study.

Figure 4. Time taken for autolytic debridement.



Autolytic debridement

This evaluation considered the autolytic debridement properties of honey on devitalised tissue within wounds of different aetiologies. The results showed that medical-grade honey could

achieve complete autolytic debridement in an average of 31.7 days. Overall, honey as an agent for debridement was considered effective in wounds that contained $\geq 40\%$ devitalised tissue.

Debridement is recognised to be an essential process in achieving wound healing in chronic wounds (Wolcott et al, 2009). Devitalised tissue needs to be debrided rapidly as it acts as a reservoir of potential infection. Debridement is also necessary to ascertain the extent of a wound, which will influence further management. Evidence to support the effectiveness of the various methods of debridement gained from randomised controlled trials (RCTs) is inadequate (Leaper, 2002). Such was the case for medical-grade honey, as clinical evidence obtained before 2000 was based on the use of generic honeys and not on sterile, medical-grade honey (Moore et al, 2001). In more recent years the effectiveness of medical-grade honey has been demonstrated with robust research on medical-grade honey products designed specifically for wound management (Misirlioglu et al, 2003; Vandeputte and Van Waeyenberge, 2003; White and Molan, 2005; Gethin and Cowman, 2008). There is now a growing body of evidence that supports the use of medical-grade honey as an effective autolytic debriding agent (Subrahmanyam 1998; Stephen-Haynes, 2004; Molan, 2005).

Honey promotes debridement by autolysis and creates a moist wound environment due to its high osmotic properties (Cooper et al, 2001). There have been several studies that highlight the effectiveness of honey as a debriding agent (Gray and White, 2005; Balsler et al, 2007). Gethin and Cowman (2009) compared honey to hydrogel in 108 patients with leg ulcers that had $>50\%$ slough and found honey to be a superior debriding agent. The present evaluation demonstrated a high level of debridement with 67% of necrotic wounds reaching 100% and a reduction in slough in 90% of wounds containing slough.

In 13% of patients in the present evaluation, debridement was unsuccessful. In these cases liquid honey was used with a secondary foam dressing, which might have caused the honey to be absorbed into the dressing taking it away from the wound bed and therefore limiting its debridement potential. Another consideration is that the eschar may have been too dehydrated to allow absorption of the



Figure 5. (a–b) Category IV pressure ulcer at the beginning and end of treatment with Algivon®. (c–d) Leg ulceration at the beginning and end of treatment with Activon Tulle®. (e–f) Category IV pressure ulcer at the beginning and end of treatment with Activon Tube®. (g–h) Category IV pressure ulcer at the beginning and end of treatment with Activon Tube®.

honey (Romanelli, et al, 2010). Scoring the eschar may enable the honey to penetrate and facilitate the debridement process. These factors may be related to individual clinician inexperience.

In one case (unstaged pressure ulcer to the sacrum), the patient's general health deteriorated and they became dehydrated. The patient died shortly after the final data, suggesting that end of life changes may have potentially influenced the ability of the patient's skin to repair (Sibbald et al, 2010).

Pain

In the present study, 71% of patients reported a reduction in pain. It has been suggested that honey used on wounds may be painful due to its acidity (Al-Swayeh and Ali, 1988) and osmotic action. The type of honey used may also influence pain experienced (Betts, 2009).

In an RCT undertaken by Jull et al (2008) pain increased in 25% of patients who used alginate-impregnated honey dressings. Dunford and Hanano (2004) and Gethin and Cowman (2008) disagreed with these findings, reporting no difference in pain levels between patients with venous legs ulcers treated with honey compared with a control group. Dunford and Hanano (2004) concluded that the pain experienced by patients within the study was possibly due to infection, ulcer size, or chronicity rather than the honey dressings.

Malodour

Malodour is common in chronic wounds due to the presence of bacteria within the wound (Bowler et al, 1999). Odour is caused by bacteria metabolising amino acids, which release malodourous ammonia and sulphur compounds (White and Molan, 2005).

Honey reduces malodour in two ways. First, it reduces bacterial load within the wound (Cooper and Jenkins, 2009; Cooper and Gray, 2012). Second, the glucose within the honey is metabolised by the bacteria in preference to the amino acids; meaning that malodourous compounds are not released as a result (White and Molan, 2005). Clinicians reported total eradication of malodour in 81% of patients in the present evaluation. This is supported by findings of other authors (Kingsley, 2002; Gethin and Cowan, 2005).

Granulation

In the present study $\geq 50\%$ of wounds had at least 61% of granulation tissue by study end, with some achieving 100% granulation. Other authors report similar effects of honey in stimulating tissue growth (Molan, 2002; White and Molan, 2005). Honey has been shown to be effective in restarting the healing process of chronic wounds (Tur et al, 1995). It is suggested that the effect of stimulating angiogenesis is due to the anti-inflammatory properties of honey and its ability to decrease oedema, consequently decreasing pressure on capillaries, improving blood flow and oxygen supply to the wound (Kaufman et al, 1985). This effect may be amplified by honey's stimulation of the growth of fibroblasts, the action of the hydrogen peroxide-enhancing cutaneous blood flow in

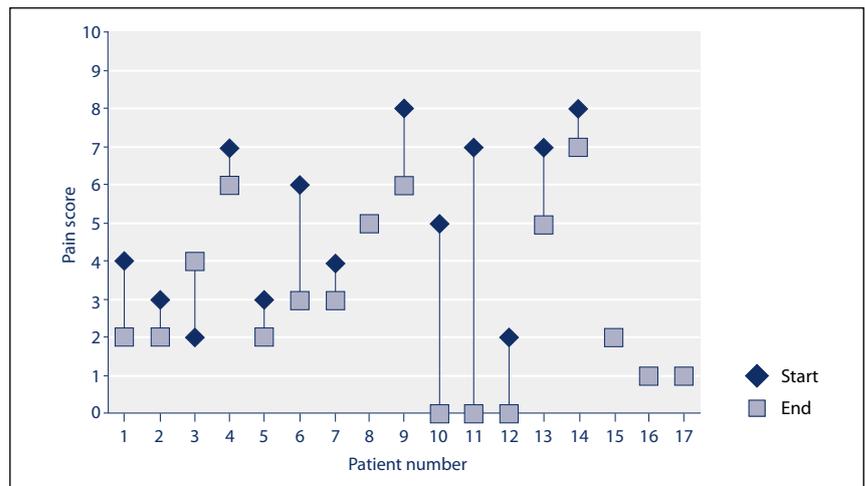


Figure 6 Wound pain scores at the start and end of the study.

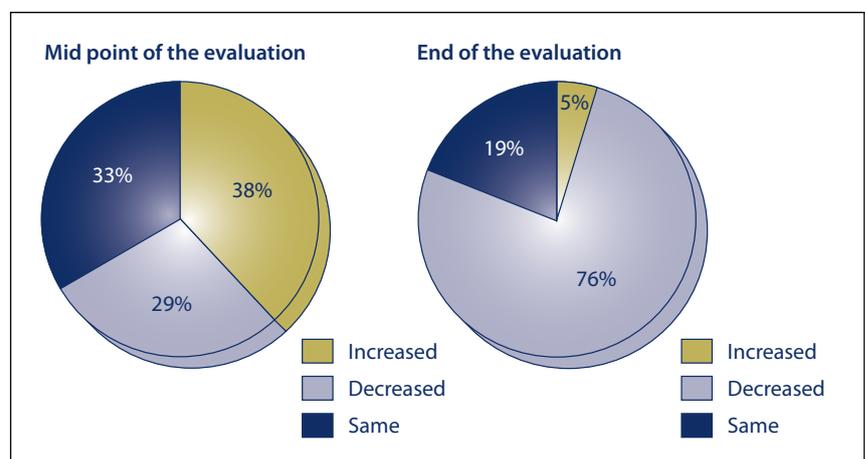


Figure 7. Wound exudate scores at the midpoint and end of the study.

“Clinicians can feel confident using medical-grade honey products.”

ischaemic tissues, and the stimulation of cytokine production by leukocytes (Molan, 2005).

CONCLUSION

A larger study is required to confirm the findings reported here. However, the case studies presented suggest that the use of medical-grade honey preparations were effective with 87% of wounds achieving a high percentage of autolytic debridement of devitalised tissue. Medical-grade honey should be considered as an effective option for autolytic debridement. These case studies also suggest that medical-grade honey is multifaceted in its action in wound management with observed reductions in exudate, pain, malodour, and the stimulation of granulation tissue.

It was identified that clinical knowledge of the actions of medical-grade honey and its optimum application could have been improved to ensure appropriate use. If the study was repeated, clinician education would need to be included.

Clinicians can feel confident using medical-grade honey products. The present cases suggest clinical effectiveness and substantiate manufacturers' claims. 

REFERENCES

- Ahmed AK, Hoekstra MJ, Hage J et al (2003) Honey-medicated dressing: transformation of an ancient remedy into modern therapy. *Ann Plast Surg* 50(2):143–7
- Al-Swayeh OA, Ali AT (1998) Effect of ablation of capsaicin-sensitive neurons on gastric protection by honey and sucralfate. *HepatoGastroenterology* 45(19):297–302
- Betts J (2009) Guidelines for the clinical use of honey in wound care. In: White R, Cooper R, Molan P (eds) *Honey in Modern Wound Management*. Wounds UK, Aberdeen: 80–90
- Blaser G, Santos K, Bode U et al (2007) Effect of medical honey on wounds colonised or infected in MRSA. *J Wound Care* 16(8):325–8
- Bowler PG, Davies BJ, Jones SA (1999) Microbial involvement in chronic wound malodour. *J Wound Care* 8(5):216–8
- Cooper R (2005) The antibacterial activity of honey. In: White R, Cooper R, Molan P (eds) *Honey: A Modern Wound Management Product*. Wounds UK, Aberdeen: 24–32
- Cooper RA, Molan PC, Krishnamoorthy L et al (2001) Manuka honey used to heal a recalcitrant surgical wound. *Eur J Clin Microbiol Infect Dis* 20(10):758–9
- Cooper RA, Jenkins L (2009) A Comparison between medical grade honey and table honeys in relation to antimicrobial efficacy. *Wounds* 21(2):29–36
- Cooper R, Gray D (2012) Is Manuka honey a credible alternative to silver in wound care? *Wounds UK* 8(4):54–63
- Dunford CE, Hanano R (2004) Acceptability to patients of a honey dressing for non-healing venous leg ulcers. *J Wound Care* 13(5):193–7
- European Pressure Ulcer Advisory Panel, National Pressure Ulcer Advisory Panel (2009) *Treatment of Pressure Ulcers: Quick Reference Guide*. NPUAP, Washington DC
- Gethin G, Cowman S (2005) Case series of the use of Manuka honey in leg ulcers. *Int Wound J* 2(1):10–5
- Gethin G, Cowman S (2008) Bacteriological changes in sloughy venous ulcers treated with manuka honey or hydrogel: an RCT. *J Wound Care* 17(6):241–7
- Gethin G, Cowman S (2009) Manuka honey vs hydrogel – a prospective, open label multicentre, randomised controlled trial to compare desloughing efficacy and healing outcomes in venous ulcers. *J Clin Nurs* 18(3):466–74
- Gottrup F, Apelqvist J, Price P (2010) Outcomes in controlled and comparative studies on non-healing wounds: recommendations to improve the quality of evidence in wound management. *J Wound Care* 19(6):237–68
- Gray D, White R (2005) Mesitran ointment case studies. *Wounds UK* 1(Suppl3):32–5
- Hejase MJ, Simonin JE, Bihrl R et al (1996) Genital Fournier's gangrene: experience with 38 patients. *Urology* 47(5):734–9
- Jull A, Walker N, Parag V et al (2008) Randomised clinical trial of honey-impregnated dressings for venous ulcers. *Br J Surg* 95(2):175–82
- Kaufman T, Eichenlaub EH, Agel MF et al (1985) Topical acidification promotes healing of experimental deep partial thickness skin burns: a randomized double-blind preliminary study. *Burns* 12(2):84–90
- Kingsley A (2001) The use of honey in the treatment of infected wounds: case studies. *Br J Nurs* 10(Suppl2):13–20
- Leaper D (2002) Sharp technique for wound debridement. Available at: <http://bit.ly/12jEvgu> (accessed 14.02.2013)
- Misirlioglu A, Eroglu S, Karacaoglan N et al (2003) Use of honey as an adjunct in the healing of split-thickness skin graft donor site. *Dermatol Surg* 29(2):168–72
- Molan P (2002) Re-introducing honey in the management of wounds and ulcers – theory and practice. *Ostomy Wound Manage* 48(11):28–40
- Molan P (2005) Mode of action. In: White R, Cooper R, Molan P (eds) *Honey: A Modern Wound Management Product*. Wounds UK, Aberdeen: 1–23
- Moore OA, Smith LA, Campbell F et al (2001) Systematic review of honey as a wound dressing. *BMC Complement Alt Med* 1(2):1
- Nelson EA (2000) The use of case reports in wound care. *J Wound Care* 9(1):23–6
- Romanelli M, Vowden K, Weir D (2010) Exudate management made easy. *Wounds International* 1(2). Available at: <http://bit.ly/XE9IY4> (accessed 14.02.2013)
- Sibbald RG, Krasner DL, Lutz JB (2010) SCALE: Skin changes at life's end final consensus document. *Adv Skin Wound Care* 23(5):225–36
- Stephen-Haynes J (2004) Evaluation of honey-impregnated tulle dressing in primary care. *Br J Community Nurs* 9(Suppl6):21–7
- Subrahmanyam M (1998) A prospective randomised clinical and histological study of superficial burn wound healing with honey and silver sulfadiazine. *Burns* 24(2):157–61
- Tur E, Bolton L, Constantine BE (1995) Topical hydrogen peroxide treatment of ischemic ulcers in the guinea pig: blood recruitment in multiple skin sites. *J Am Acad Dermatol* 33(2 Pt 1):217–21
- Vandeputte J, Van Waeyenberge P (2003) Clinical evaluation of L-Mesitran – a honey based wound ointment. *Eur Wound Manage* 3(2):8–11
- Vuolo J (2009) *Wound Care Made Incredibly Easy*. Lippincott and Wilkins, London
- White J W Jr (1978) Honey. *Adv Food Res* 24:287–375
- White R, Molan P (2005) A summary of published clinical research on honey in wound management. In: White R, Cooper R, Molan P (eds) *Honey: A Modern Wound Management Product*. Wounds UK, Aberdeen: 130–42
- Wolcott RD, Kennedy JP, Dowd SE (2009) Regular debridement is the main tool for maintaining a healthy wound bed in most chronic wounds. *J Wound Care* 18(2):54–6