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Debridement of wounds with honey

Abstract

Honey has been used as a debriding agent since ancient times. Its debriding properties have been rediscovered in more recent times, with various case reports published in the latter decades of the 20th century describing its effectiveness in cleaning up wounds. More recently its effectiveness has been compared with that of modern debriding agents, and honey has been found to work more rapidly than all except larval therapy. A randomised controlled trial demonstrated significantly better debriding with honey than with hydrogel. Other trials have shown that honey is a good alternative to surgical debridement for the treatment of necrotising fasciitis in the genital region. Seven case series and ten single case studies have also been published in which the effectiveness of honey in debriding wounds was reported. A prophylactic action of honey has also been reported, where in a randomised controlled trials comparing honey with silver sulfadiazine for the treatment of burns there was no eschar formed with honey but there was eschar formed in the cases treated with silver sulfadiazine. A similar finding has been reported in an animal model, where adjacent experimental wounds were kept clean with honey-soaked gauze but formed thick dense scabs where treated with saline-soaked gauze. The mechanism of action of honey is as yet unknown, but appears to be by way of stimulating autolytic debridement. Additional advantages using honey rather than other moist debridement are that its antibacterial action prevents bacterial growth from being encouraged, and its osmolarity prevents maceration of periwound skin.

Key words: honey, autolytic debridement, prevention of eschar

Introduction

Honey has long been used as a debriding agent. Crane¹, in her book on the history of honey refers to the virtues of honey listed by Hippocrates, c. 400 BC, including the cleaning of sores and ulcers and the softening of hard ulcers on the lips. She also refers to Celsus, c. 50 BC, recommending a mixture of honey and lint for cleansing old sores, and to a Mediaeval European medical text mentioning the use of honey to help the removal of scabs. There is little reference to be found to the use of honey subsequent to that, but this may be because honey seems to have been standard treatment for infected wounds until the advent of antibiotics, and thus would not rate a mention, according to retired medical professionals and pioneer users of honey in recent decades with whom the author has discussed why they started using it. However, the author has found two publications in German medical journals in the 1930's which report on the use of honey to treat wounds, and in both of these the cleansing effect of honey on the wounds is mentioned.^{2,3}

The debriding action of honey is also mentioned in all of the early papers reporting on the use of honey as a wound dressing in the "rediscovery" of this old wound-care modality.

One case report published in 1955⁴ was of a radical mastectomy wound in which there was localised sloughing of the skin flaps which gave rise to an area of ulceration from which the sloughs were very slow to separate. This had formed a relatively deep cavity, which was packed with honey. From that time the cavity cleaned quickly and healing progressed much more rapidly than had previously been the case. The paper also described treating vulvectomy wounds by pouring honey on large surfaces, or using gauze soaked in honey, with daily treatment. Rapid cleaning of infected purulent surfaces was seen, with quick separation of sloughs.

In 1970 a report was published⁵ on a series of 12 cases in

which honey was used where there had been wound breakdown following a radical operation for carcinoma of the vulva. A "common household brand" of honey was used, which was poured into the wounds twice daily. It was reported that a clean healthy granulating appearance was typical of each wound after the treatment with honey, and that following the application there was "considerable chemical debridement".

Another report, published in 1966⁶, was of a sacral pressure sore containing black slough. This was packed daily with comb honey, this being covered with gauze, and occluded. Within 5 weeks all patches of slough had separated from the wound. Another case reported in this paper was of a broken-down wound from amputation of a big toe. On this there was a hard crust covering the whole area of the 4 x 2.5 cm wound. Comb honey was applied, covered with gauze, and renewed daily. Six days later the crust had started to separate, by a further 5 days a fair amount was removed.

There were two other publications in this intermediate era in which the debriding action of honey was reported, both letters to medical journals. One⁷ described using honey in an Emergency Department as a cleansing and healing agent, applied every 2-3 days under a dry dressing. The other⁸ reported that honey had been used for a number of years to clean up infected wounds.

But present-day practitioners will question how well does this old debridement modality compare with the use of modern products. Gethin⁹ has compared the rate of decrease in slough observed in five cases treated with honey dressings with that reported in the literature for other desloughing agents and concluded that the rate achieved with honey is slower than with larval therapy but faster than achieved with hydrogels, dextranomer paste or enzymatic agents. Unrecorded observations from clinical experience treating a very large number of wounds with honey and other debriding agents has led ano-

ther wound-care nurse to the opinion that honey works as fast as larval therapy on slough and necrotic tissue but not on hard eschar, but is faster than other agents (J. Betts, Waikato Hospital, New Zealand: personal communication). Some comparisons in results obtained in case studies can also be made, to be seen in the cases described below.

Clinical evidence

The other question present-day practitioners will be asking in this era of evidence-based medicine is what evidence is there to support the use of honey as a debriding agent. The evidence available from clinical trials and case studies is outlined below.

TRIALS CONDUCTED ON DEBRIDEMENT BY HONEY

A randomised controlled trial comparing the effectiveness of manuka honey with that of a hydrogel (*IntraSite* gel; Smith & Nephew) as a desloughing agent has been carried out on two groups of 54 patients.¹⁰ This was conducted on venous leg ulcers (< 100 cm²) with > 50% of the area covered in slough. Excluded were cavity wounds, those with a clinical diagnosis of infection, and patients with poorly controlled diabetes. The average ulcer size was 10.52 cm for honey, 9.87 cm for hydrogel. The average percentage of the wound bed covered with slough was 85.5% for honey, 78.15% for hydrogel. The honey was applied at a rate of 5 g/20 cm² and the hydrogel at 3 g/20 cm². Each was applied weekly under Allevyn hydrocellular foam (Smith & Nephew), with pressure bandaging over this. The wounds were assessed after four weeks. The mean percentage reduction in proportion of wound bed covered in slough was 67% with honey and 52.6% with hydrogel, a statistically significant difference ($p = 0.05$). The primary outcome results were compared with those published from other studies, and it was concluded that in the desloughing of venous leg ulcers manuka honey is slower than larval therapy or curettage but superior to some hydrogels, enzymatic agents, hydrocolloids, paraffin gauze or cadexomer iodine.

A randomised controlled trial has also been conducted on 30 patients to compare honey (from *Syzygium cumini*) and EUSOL in the treatment of Fournier's gangrene (necrotising fasciitis in the genital region).¹¹ The wounds were dressed with gauze soaked in honey or Eusol. The number of patients in which there was clearance of slough was recorded after 7, 10 and 14 days. After 7 days, there was clearance in 57% of the patients with honey and in 50% of the patients with EUSOL. After 7 days there was clearance in a further 7% (to give a total of 64%) of the patients with honey and in a further 19% of the patients with Eusol (to give a total of 69%). After 14 days the slough had been cleared in all of the patients treated with honey but remained in 19% of the patients treated with Eusol. Thus these results showed very little difference in de-sloughing efficiency between these treatments, but they did show that both of these treatments gave quite rapid results.

In another study the results from 20 consecutive patients treated with honey to manage Fournier's gangrene were compared retrospectively with 21 patients treated conventionally (surgical debridement and triple antibiotics) in the same hospital in the same period.¹² Each day, unprocessed honey (15 – 30 ml) was applied on the surface of the ulcer, then covered with gauze. In 10 of the cases the ulcer was also packed covered with gauze soaked in honey. No surgical debridement was required in the group treated with honey, whereas in the group treated conventionally all 21 patients required surgical debridement. After 1 week all necrotic tissue had separated as a result

of the treatment with honey. A retrospective review of the results obtained from the treatment of 33 consecutive patients with Fournier's gangrene has been published also.¹³ The first 21 of the 33 patients were treated by broad debridement, exhaustive cleaning, then skin grafting. The following 12 patients were treated with unprocessed honey (20 – 50 ml per day) without debridement. The average number of subsequent surgical debridements needed for each patient was two (range 1 – 4) for the first 21 but only one for each of the patients treated with honey, a statistically significant difference ($P = 0.05$).

A trial has been conducted comparing honey (type not specified), phenytoin and a mixture of these, in the treatment of 50 chronic leg ulcers.¹⁴ The agents were applied to the ulcer and covered with sofratulle and gauze. Scores were given for the amount of slough present in the ulcers. No significant difference between treatments in respect of slough removal was found over the 4 weeks of the study, but the biggest reduction in score over the first two weeks was in the honey group.

OBSERVATIONS ON DEBRIDEMENT IN TRIALS CONDUCTED ON OTHER EFFECTS OF HONEY

A randomised controlled trial was conducted comparing the effectiveness of packing of wound cavities with gauze soaked in locally produced honey ($n = 23$) and gauze soaked in Eusol ($n = 20$), on healing wounds from incised pyomyositis abscesses.¹⁵ The number of days until the wounds "became clean" was recorded, but that term was defined as devoid of slough and exudate. After 2 days of treatment 56.5% of the wounds dressed with honey had become clean, compared with 45% of the wounds dressed with Eusol. After 6 days of treatment 100% of the wounds dressed with honey had become clean, compared with 65.5% of the wounds dressed with Eusol, a statistically significant difference ($p = 0.007$).

In another randomised controlled trial, with 92 patients, honey was compared with *Opsite*[®] (Smith & Nephew) for effectiveness in treating superficial burns.¹⁶ It was noted that honey (unprocessed, applied as honey-soaked gauze covered with a pad, changed every two days) gave debridement of the wounds.

OBSERVATIONS ON DEBRIDEMENT BY HONEY IN CASE SERIES STUDIES

A case series study of treatment with honey of 15 dehiscent caesarean wounds, with disruption of the wound down to the rectus sheath, has been reported.¹⁷ Twice daily a thin layer of commercial honey was laid through the length of the wound, the wound then being approximated with micropore tape and covered with a sterile top dressing. In all of the cases slough and necrotic were replaced by granulation and advancing epithelialisation within 2 days.

A case series study of 20 ulcers, mean size 20 cm², treated with Apinate (Comvita) alginate fibre dressings impregnated with manuka honey covered with Aquacel[®] hydrofibre (Convatec) and/or Allevyn hydrocellular foam (Smith & Nephew) has also been reported.⁹ Dressings were changed once or twice weekly, according to clinical need. Ten of the ulcers had 20% or more of the wound area covered with slough. After 2 weeks, the slough was unchanged in five of the ulcers and in the other five there was a mean decrease in area of slough of 29%.

A study has also been carried out on the use of a non-adherent tulle dressing impregnated with manuka honey (Activon Tulle, Advancis) on a series of 20 wounds of varied aetiology that were non-healing, not responding to current treatment, sloughy or malodorous.¹⁸ In 16 of the 20 patients there was an improvement in the cleanliness of the wounds and a decrease

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→ in the amount of slough. In one of the two cases described in detail the burn wound (20 x 15 cm) had been allowed to dry out and was covered with hard eschar. Little progress was made with 1½ weeks of hydrogel treatment, the eschar remaining hard. Changing to the honey dressing gave softening of the eschar in 1 week. The wound was visibly debriding within 3 weeks, and after 10 weeks it had totally debrided and there were large areas of epithelialisation.

Another publication¹⁹ has reported on using honey to treat 59 wounds and ulcers of various types, 47 of which were not healing with conventional treatment. The treatment consisted of daily application of 15 – 30 ml of unprocessed honey. It was reported that slough and necrotic tissue was rapidly replaced with granulation, the slough and necrotic and gangrenous tissues gradually separating from the floor and walls of the ulcers so that they could be lifted off with forceps without the patients feeling any pain. In Fournier's gangrene, cancrum oris and decubitus ulcers the slough separated from the wound in 2 – 4 days but in the other types of wound it took much longer. It was pointed out that the use of honey on the wounds spared the patients having to undergo surgical debridement.

A case series study on the wound-healing effects of honey with 40 patients with wounds of various types has been carried out.²⁰ Honey (unspecified type) was spread over the wound then covered with a dry dressing. It was reported that honey cleansed the wound rapidly. Another paper has reported the results of a case series study, with eleven patients, using unprocessed Sudanese honey to treat a variety of wounds (chronic ulcers, burns, pyogenic abscesses).²¹ The wounds were dressed daily, being "soaked in honey". The resultant cleanliness of the wounds was commented on as an advantage of using honey. An infected appendectomy scar, full of pus, was clean after 3 days of treatment.

A very brief report has been published²² on the findings in a Phase 2 trial of honey dressings (*Honeysoft*; MediProf) on a series of 60 wounds of various types. It was noted that a debridement of wound surfaces was observed. No details were given of the time taken for this, but it was stated that the mean period of treatment with honey was 3 weeks.

OBSERVATIONS ON DEBRIDEMENT BY HONEY IN SINGLE CASE STUDIES

Harris²³ has described a case where there were bilateral multiple stasis ulcers on the lower legs, of more than 5 years duration. The ulcers on one leg were treated daily with unprocessed honey covered with gauze, and on the other leg with Elase R (a bovine fibrinolysin; Parke Davis) to facilitate removal of slough. It was reported that initially the healing was much more rapid with the honey treatment, although after 1 month the ulcers on both legs were healing well.

In another case study²⁴ a patient with bilateral venous ulcers had the ulcer on one heel dressed with 50 g Medihoney™, covered with a non-adherent dressing with gauze over that, and on the other heel dressed with Aquacel® (Convatec). Each was then covered with a surgipad. The amount of exudate, resultant from the patient's chronic lymphoedema, indicated that twice-daily dressing changes would be best, but the patient would only allow changes to be made every day or two days. After 10 days of treatment the ulcer dressed with honey appeared cleaner and less sloughy than that dressed with Aquacel®.

Other case studies allowing comparison of honey with hydrogel as debriding agents have been published. In one of these²⁵ a pressure ulcer on sacral area, with a necrotic area of 2 x 1 cm was first treated with hydrogel (Solugel, Johnson and

Johnson) covered with an absorbent dressing (Melolite, Smith & Nephew), with no improvement over 4 weeks. It was then dressed with Apinate (Apimed New Zealand), an alginate fibre dressing impregnated with manuka honey. After 1 week the necrotic area started breaking down, and after 2 weeks the necrotic tissue lifted off with the dressing. After 3 weeks it had practically disappeared. In the other²⁶, a venous leg ulcer, 19 x 9 cm, with a necrotic area 8 x 3 cm, showed no improvement in 4 weeks of treatment with a hydrogel (SoloSite, Smith & Nephew). Within 7 days of Apinate dressings being used the necrotic tissue was loosened, and was completely debrided 3 days later by it lifting off with the dressing.

A case has been reported where honey was compared with Debrisan by using the two treatments at different ends of a long wound discharging in four places after closure of the abdominal wall after surgery.²⁷ Two weeks of various treatments had given no notable results. At the start of the study all four discharging wounds were in the same state. Both ends showed loss of necrotic tissue after 8 days, but only the end treated with honey showed epithelialisation starting.

Several other papers simply describe the debridement obtained when honey is used. In a paper reporting the results of treating wounds with healing impaired by radiotherapy²⁸ the details were given of one case where there was wound breakdown alongside a stoma inserted after tracheostomy. The wound had a layer of thick slough, and was highly exudative. It was dressed with hydrofibre rope soaked in Medihoney™, changed daily. After 5 weeks the wound had de-sloughed.

In another case in this paper a wound in the cheek resulting from radiotherapy was healing with dressings of Medihoney™ under non-adhesive foam, changed daily. The frequency of dressing changes was decreased as the wound started to heal, but then an area of slough developed in the wound. This was successfully debrided by application of Medihoney™ as before.

Another case report²⁹ has described the use of honey where a break-down of a surgical wound (from breast reduction surgery) gave a wound of 3 cm diameter with slough and necrosis present. It was completely debrided in two weeks of application of a 3 mm depth of Medihoney™ covered with an adhesive foam dressing.

Another case study published³⁰ was of a 2 cm deep wound of 3 cm diameter on the breast from surgical excision of cancer, not healing because of radiation damage. One day after applying manuka honey the base of the wound could be seen to be clearing of slough.

A case has been reported of a diabetic patient with a chronic wound containing pus and necrotic tissue that extended over the sole of the foot.³¹ After one week of using honey (Sudanese) the pus and necrotic tissue were cleared.

Another case reported of treatment of a diabetic ulcer with honey involved a deep neuropathic ulcer on the heel, 85% of the ulcer area being necrotic.³² After sharp debridement of necrotic tissue Medihoney™ was applied with a physiotulle pad. After 5 days the wound was rapidly debriding. The wound bed had a clean appearance in the photograph shown of it at this stage.

PROPHYLACTIC ACTION OF HONEY

As well as removing slough and necrosis, honey has been reported to prevent the formation of these. A paper on the treatment of Fournier's gangrene³³ refers to applying unprocessed honey to patients to treat this condition and noticing rapid healing changes in an average period of 10 days. It was

commented that honey immediately halts the spreading necrosis and debrides the wounds. In a randomised controlled trial with 50 patients comparing honey (unprocessed) with silver sulfadiazine for the treatment of superficial burns³⁴ it was noted that 15 of the 25 in the group treated with silver sulfadiazine had eschar form which had to be removed, but no eschar formed in any of the group treated with honey. There was a similar observation in a randomised controlled trial comparing honey with silver sulfadiazine for the treatment of burns covering an average of 27% of the body surface area of paediatric patients.³⁵ In the 32 patients who had their burns dressed with honey there was a decrease in oedema and exudate, and no eschar formation was seen with any of them. In a study where an animal model was used, 18 rabbits had adjacent circular wounds 155 – 206 mm² dressed with honey-soaked gauze or water-soaked gauze for a comparative study of the effect of these dressings on wound healing.³⁶ These wounds were created and dressed under aseptic conditions. It was observed that the honey-treated wounds were pinkish and moist but the wounds of the control group were wet, exuding and covered with thick and dense scabs.

Discussion

The mechanism of the debriding action of honey is unknown. The author has been unable to find any reports of honey having proteolytic activity, and work in the author's research laboratory using sensitive assays has been unable to detect any. It can therefore be assumed that honey removes attached slough, necrotic tissue and eschar by facilitating autolytic debridement. This has been assumed to be by way of honey creating a moist wound environment, that it does through its high sugar content causing constant osmotic withdrawal of fluid from the wound bed which is replaced from the underlying circulation. However, the faster rate of debridement observed with honey than with hydrogels, reported in the papers cited above, suggests that honey must have a stimulatory action on proteases in the wound bed. Chirife *et al.*³⁷ have reported that in the treatment of hundreds of wounds with granulated sugar (sucrose) most cases were healed without needing surgical debridement of necrotic tissue, the necrotic tissue lifting off with forceps after 5 – 7 days of dressing with sugar. This raises the possibility that it may be the sugar content of honey that is responsible for the activation of proteases in the wound bed to give autolytic debridement. Very preliminary findings from research in the author's laboratory are indicating that both sugar and honey activate digestion of fibrin (as a model for detachment of slough), but honey does this more strongly. It also appears that there are differences between different types of honey in the degree of activation of proteolysis, which may account for the differences in speed of debridement reported from clinical studies on the use of honey in the papers cited above.

Another possible explanation for the differences in speed of debridement is that in different studies there would almost certainly have been differences in how well the honey was kept in contact with the wound and to what degree it got diluted by exudate even if it were kept there. The importance of such practical aspects of using honey as a wound dressing has been discussed by Molan and Betts³⁸ in light of their experiences in the use of honey as a wound dressing, which has been put into the development of the types of honey dressings now on sale and in the process of registration which will keep honey present on the wound bed even when there is a lot of exudate from wounds. Molan and Betts³⁸ have pointed out that

the frequency of dressing changes that is needed depends on the amount of exudate coming from each wound, but this does not seem to have been a consideration in most of the cases in the papers cited above.

Although honey when it is handled is a very viscous liquid, or even a solid, when it gets to body temperature on a wound it becomes very fluid, and with the addition of even quite small proportions of exudate it becomes quite watery. This is why, unless it is sealed in place by an adhesive occlusive dressing with no leakage, it is necessary for honey to be held in some sort of dressing material. The Ancient Egyptians, four millennia ago, mixed honey with fat and cotton fibre to make wound dressings,³⁹ and in Roman times, c. 50 BC, a mixture of honey and lint was used¹, but this ancient wisdom seems to have been forgotten.

One of the types of honey wound dressings widely in use in the UK has manuka honey held in a few layers of a non-adherent tulle which is non-absorbent so does not retain honey when there is an outflow of exudate. In a case study⁴⁰ that type of dressing (*Activon Tulle*; Advancis) was used on an infected flap donor site wound and it was found that debridement of eschar was still needed. A case series study has been carried out using *Activon Tulle* dressings on 20 wounds of varied aetiology that were non-healing, not responding to current treatment, sloughy or malodorous.¹⁸ In this study 20% of the wounds did not improve, but no details were given of the length of time for which the wounds were treated. In the two cases described in detail one "looked much healthier" after 4 weeks and in the other it took 10 weeks to debride eschar.

Chambers⁴¹ has described two cases of treatment of wounds with honey where debridement was needed. One was a pressure ulcer 10 x 5 cm on the buttock, containing hard dead tissue. Use of *Activon Tulle* (*Advancis*) dressings failed to debride the ulcer, but after four days of straight manuka honey being applied there was visible improvement in the wound, with desloughing after ten days to reveal a granulating cavity 12 cm deep. The other case was a pressure ulcer on the sacrum, which grew to 6 cm diameter using *Activon Tulle* (*Advancis*) dressings. The crust shed after 48 hours of straight manuka honey being applied, to reveal healthy granulating tissue.

Even with dressings which retain honey better, the frequency of dressing changes is also important, because exudate can flush away the honey from the wound surface into secondary dressings. This was illustrated in a case study with a wound that was 75% covered with slough.²⁶ The dressings for the first 9 weeks were changed every 4 – 5 days. There was copious fluid loss from the ulcer due to the leg being oedematous. The wound was still sloughy after 10 weeks, and becoming inflamed, so the frequency of dressing changes was increased to every 3 – 4 days. There was a great reduction in slough by 3 weeks after that.

Failure to keep honey in contact with the wound surface, or allowing it to become too diluted, removes the additional advantages from using honey instead of other moist debriding agents. Hippocrates was aware of the hazards of keeping a wound wet, writing: "We must avoid wetting all sorts of ulcers".⁴² The antibacterial activity of honey eliminates the risk of the moist environment encouraging the growth of bacteria. The potent anti-inflammatory activity of honey⁴³ will decrease the exudate which is supplying fibrinogen which could be forming additional fibrin clot to attach slough to the wound bed. Another advantage of using honey as a debriding agent is that the high osmolarity of honey will draw moisture from the skin surrounding the wound and thus prevent the mace-

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→ ration that can be experienced with other moist dressings. Robson and Cooper²⁸ have described applying honey to the periwound skin to reduce and prevent maceration in a case with copious exudate which had caused maceration. Stephen-Haynes¹⁸ reported a rapid improvement in macerated periwound skin when honey dressings were used on the wound.

It has been noted⁴⁴ that in cases where there is a significant distance between the honey and interstitial fluid, as in the case of thick eschar, the osmolarity of honey will result in further dehydration of eschar and delay debridement. However, scoring the eschar with a blade, applying honey in a liquid form and then occluding the honey with a film membrane allows the honey to penetrate the eschar to the wound bed below, facilitating debridement. Another way that debridement of hard eschar by honey can be hastened is to score the eschar with a blade then soak it with a saline pack first to soften it. At the suggestion of the author this was tried on a large area of hard eschar that resulted from a chemical burn: debridement was achieved within 48 hours.

Another advantage of using honey as a debriding agent is the removal of particles in the wound as well as the slough, necrotic tissue and eschar. The removal of subcutaneous calcium phosphate deposits from the venous leg ulcers of a patient with *calcinosis cutis* by the use of honey dressings

has been described.⁴⁵ These hard lumps were causing chronic inflammation. Prior to the use of honey the patient had required sharp debridement every three months to remove the deposits. Medihoney™ was applied to the ulcers as a 3 mm deep layer, covered with a non-adherent dressing and a dressing pad. When the ulcers were examined two weeks later there were calcium phosphate granules on the dressing pads. The removal of the deposits from the ulcers continued with continued dressing with honey, as did the removal of slough.

It was noted in one of the very early publications on the use of honey as a wound dressing that dirt is removed with the bandage when honey is used as a dressing, leaving a clean wound.³ This has also been reported to the author in a personal communication (I. J. Fisk, Yarra Valley Clinic, Coldstream, Victoria, Australia), this feature being found to be very useful in a country general practice for the painless removal of grit embedded in wounds as a result of injury sustained by contact with the ground. And not only does the removal with honey avoid the trauma of scrubbing the wound or picking out debris with forceps, the anti-inflammatory action of honey soothes the pain resulting from the injury which caused the embedding. All considered, honey is a very effective debriding agent, well accepted by patients,⁴⁶ readily available, inexpensive, and with additional activities which are of benefit. ■

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