
The Healing
POWERS OF HONEY
vet candy
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THE HISTORY OF MEDICINAL HONEY

Dr. Gina Brandstetter

Humans have used honey for medicinal purposes for thousands of years. There are cave paintings, ancient writings, and sacred scripts that tell of honey's many uses before modern times. From these, it is known that ancient civilizations such as those of the Egyptians, Mayans, Greeks, and Romans used honey in a variety of remedies and rituals.

Historical and religious figures such as Hippocrates and the Muslim prophet Mohammad are documented suggesting the use of honey for various remedies.[1] Furthermore, religious texts such as the Bible and the Qur'an[1] have references to honey as a healing substance, emphasizing the extent of its therapeutic use through history.

Honey was also widely used in traditional Chinese medicine and in Ayurveda (a form of traditional medicine that originated in India). Some of the major documented uses were for wounds, burns, sepsis, and ailments such as cough, insomnia, and gastrointestinal disorders.

Despite this long history, the scientific basis of honey's benefits has not been completely elucidated. The ambiguity of its mechanisms of action made medicinal honey's use less common during medieval times and even frowned upon as modern medicine and antibiotics were developed in the nineteenth century. Since then, honey was mostly reserved as an alternative treatment in times of war or antibiotic shortages when more modern treatments were unavailable.

Over the last few decades, the value of honey's medical potential is being rediscovered, and using medicinal honey for wound management is becoming more commonplace today. In the age of rising antibiotic resistance, honey's antimicrobial properties are another key reason modern practitioners are choosing to return to medicinal honey, which is helping treat drug-resistant infections, biofilms, and nosocomial infections.

There are many powerful case studies of wound healing and antimicrobial activity that exemplify the great potential and diversity of applications that honey can have in modern medicine. While more research is still needed in the form of controlled clinical studies, scientists and medical practitioners have come a long way in understanding the properties of honey that make it a powerful therapeutic tool in modern medicine.

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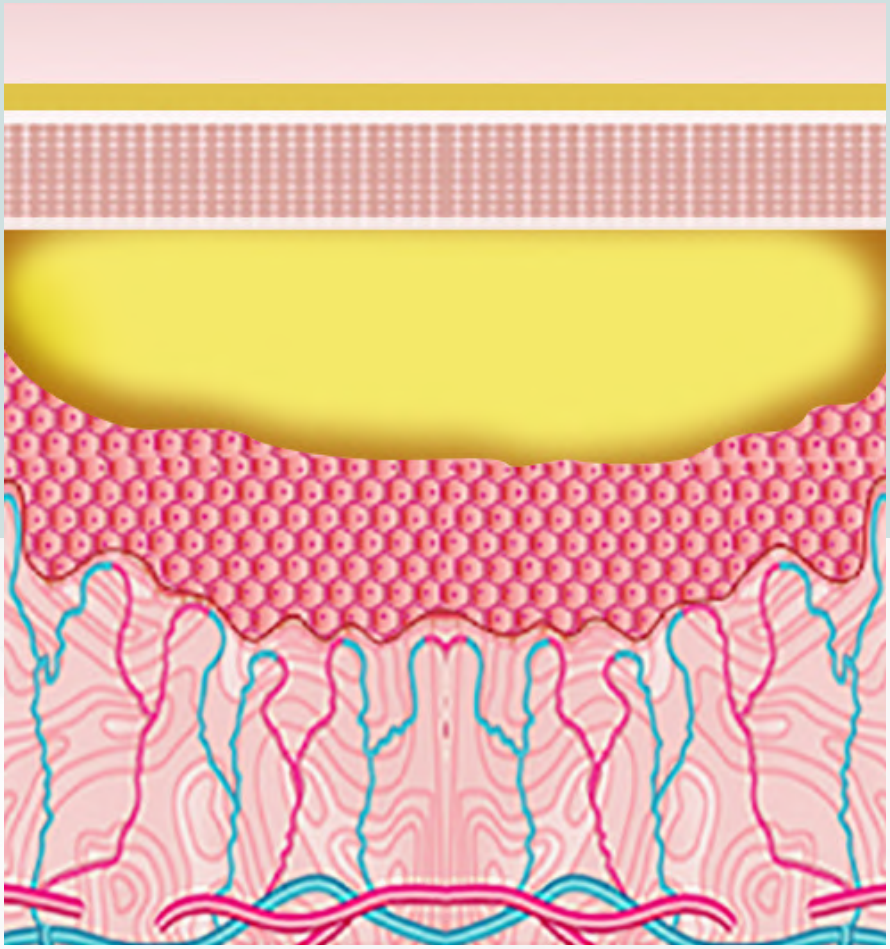
WHAT ARE THE BENEFITS OF MOIST WOUND HEALING?

-Vet Candy Staff

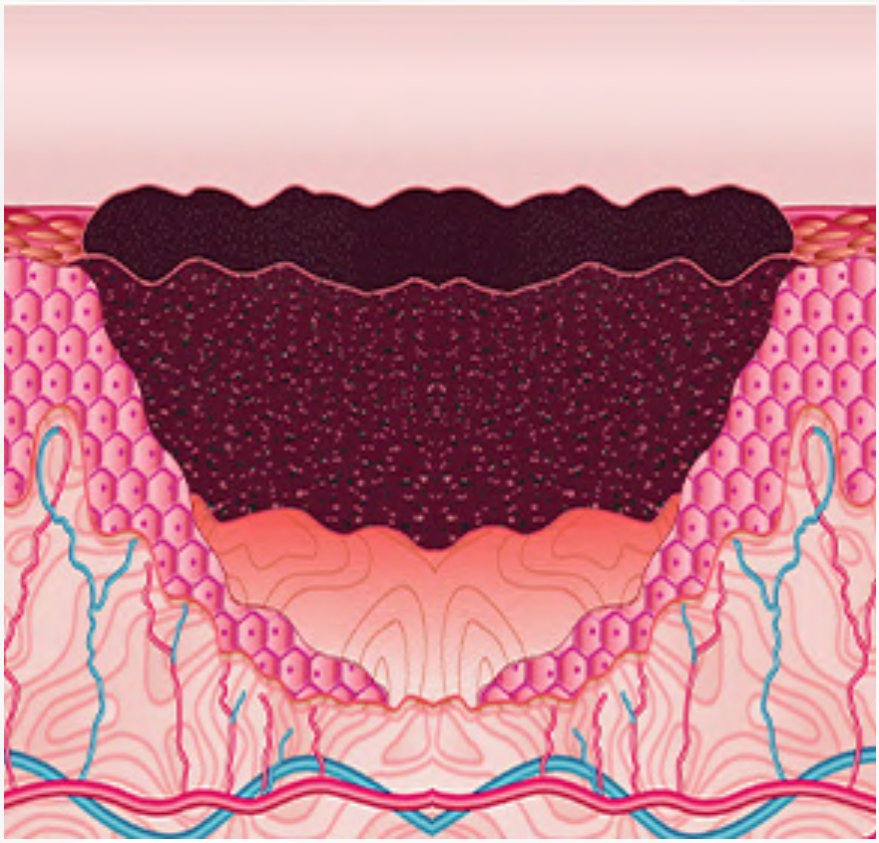


Moist Wound Healing

Moist wound healing is the practice of keeping a wound in an optimally moist environment in order to promote healing.

With moist healing, the body is prevented from developing a scab, therefore wounds are not only healed faster, but also healed better. In fact, research has shown that moist wound healing is up to 50% faster than dry healing with less scar tissue formation.[1]

The benefits of moist wound healing compared to dry are noted below:



Dry Wound Healing

FACTORS	DRY WOUND HEALING	MOIST WOUND HEALING
Timing	The body focuses first on creating a scab before it can focus on the healing process. This process slows down the healing time.	Moist wound healing means continuous wound healing, which results in up to 50% faster healing.
Wound debridement	Dry wounds have slower wound autolytic debridement	Moist environments promote autolytic debridement.
Excess exudate	Excess exudate in dry wounds can lead to maceration of the surrounding skin.	Moist environments absorb excessive exudate.

FACTORS	DRY WOUND HEALING	MOIST WOUND HEALING
Cellular growth	A dry environment is not optimal for cellular growth and migration.	Cells need moisture in order to grow, live, and migrate. A moist environment optimizes cellular growth.
Infection risk	Wounds have a higher risk of infection in a dry environment.	With moist environments, there is less risk of infection because the exudate provides factors to eliminate invading pathogens.
Dressing changing	Changing bandages in dry wounds can be painful. Newly formed tissue will stick to the dry dressing, which also leads to prolonged healing.	Moist wounds need less frequent bandage changes. Moist bandages are also more comfortable for the patient because they don't stick to the wound bed when changed and newly formed tissue will remain intact on the wound bed.
Costs	With dry wound care, the animal will require longer treatment and more bandage changes, all resulting in increased treatment costs.	Moist wounds heal 50% more quickly with fewer bandage changes, which means lower treatment costs.
Results	Slow healing and wound contraction from scab healing often results in scar formation.	Moist wound healing means that there is no scabbing. Less scarring and better cosmetic appearance is noted.

THE SECRET POWER OF MANUKA HONEY

Dr. Gina Brandstetter

Manuka honey's use has been extolled for treating many types of wounds. It is primarily used for wound debridement and decontamination, and it has also been shown to have a broad spectrum of antibacterial activity.[1, 3, 4, 5] Some of the applications and successes are described below.

- Honey has been used successfully in acute wounds such as first- and second-degree burns,[2] surgical wounds,[1, 2] contaminated wounds that cannot be surgically debrided,[4] and a wide variety of traumatic wounds[2, 6] (bite wounds, lacerations, abrasions, etc.).
- It has also been useful in non-healing wounds such as ulcerated wounds,[1, 2] dehisced surgical sites, antibiotic-resistant wounds[1, 5] (including MRSA and other multi-drug resistant bacterial strains), and wounds with suspected biofilms or risk of biofilm formation.
- Honey has been used medicinally across diverse species, from humans to small animals,[3] horses, birds, and farm animals.[1,2,3,4]

These healing powers of honey stem from its osmotic, acidic, and enzymatic properties that make it a great wound dressing during the inflammatory phase of healing. Honey creates an osmotic force that draws out edema and exudate while bringing nourishment and cytokines to the wound from the underlying vessels and lymphatics.[5] This process also reduces swelling and pain associated with sites of soft tissue injuries.

Honey, moreover, provides an optimal, moist environment for healing, which in the later days of the inflammatory phase promotes both fibroblastic activity and angiogenesis.[4] As a result, granulation tissue formation and re-epithelialization are enhanced, and the wound healing process is accelerated.[4, 5]

Medicinal honey has shown a broad and unique antimicrobial effect, including efficacy in treating antibiotic-resistant infections. Manuka honey (as compared to other honey varieties) contains higher levels of methylglyoxal(MGO) Manuka honey with an MGO rating of 270+ is suitable for wound healing, which gives it superior antimicrobial activity. It has been found that multi-drug resistant bacteria are not any less susceptible to honey than are naïve strains of bacteria, demonstrating honey's[1] unique effect. Furthermore, there have yet to be any documented acquired bacterial resistances to honey, creating further interest in its medicinal potential.[1]

Ultimately, each wound is unique and requires a nuanced approach. Although Manuka honey is versatile, there are a few contra-indications for its use. It should not be used for actively bleeding wounds, wounds with a healthy granulation bed, or in wounds already showing epithelializing activity.[3]

When used appropriately, medicinal honey can be a powerful tool. Although there remains a need for controlled, clinical studies regarding the healing benefits of honey, its vast medical potential is supported by a wide array of positive case studies and clinical impressions.

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MANUKA HONEY FOR WOUND CARE

Georgie Hollis

Bees manufacture honey as a way to store sugar-rich nectar harvested from flowering plants. We use this yummy, sticky substance as an ingredient in many recipes or enjoy it on its own. However, did you know that honey has excellent wound-healing properties? Its usefulness for wounds has been documented for centuries in Greek, Egyptian, and Roman medicine.

What is special about honey?
Bees have an incredible system for harvesting and storing nectar to preserve it solely as a food source. The properties bees add to the honey help decontaminate wounds and also aid in debridement.

Bees carry their own weight in nectar but also a huge array of bacteria, yeasts, and fungi picked up from the soil and plants within their three-mile territories. Found in their intestines, this array of bugs can include dangerous species such as *Clostridium botulinum, E. coli,* and *Klebsiella,* both *proteus* and *pseudomonas* species, the latter being particularly detrimental to wound healing. Without some form of processing, therefore, the nectar would be a death trap to both bees and humans.

HEALING POWER OF MANUKA HONEY

- Vet Candy Staff

Manuka honey has a broad spectrum of antibacterial activity and is used for wound debridement and decontamination.

- Honey has been used successfully in acute wounds such as burns, surgical wounds, contaminated wounds, and traumatic wounds.
- It has also been useful in non-healing wounds such as ulcerated wounds, dehisced surgical sites, and antibiotic-resistant wounds—including MRSA and other multi-drug resistant bacterial strains—and wounds with biofilm formation.
- Honey has been used medicinally across diverse species, from humans to small animals, horses, birds, and farm animals.

Bees harvest nectar from flowers and store it in specialized stomachs. As they store the nectar, they transfer in a special enzyme called glucose oxidase to lower the pH and add an antimicrobial. Once the stomach is full, the honey solution (of around 70% water) is delivered to worker bees at the hive, who pass it on from mouth to mouth until it reaches the bees at the comb. Each bee will add its own enzymes and reduce the water content. Once placed in the comb, the honey will be fanned to evaporate any residual moisture and bring the water content to below 20%. This supersaturated sugar is now honey.

THE BENEFITS TO WOUNDS

The application of honey to wounds is not new. Two key benefits have been seen. The first positive effect is a debriding (cleansing) action, and the second is the resolution of infection. The high sugar causes an osmotic effect that aids in the softening of dead and sloughy tissue while assisting in the removal of debris. Secondly, the low pH combined with the effect of glucose oxidase will kill or reduce the viability of bacteria in the wound. These two actions are synergistic; healing is now recognized to progress most effectively when the bio-burden is reduced and a moist environment is maintained.

THE MANUKA EFFECT

A lot of attention has been given to Manuka honey for its special abilities as an antimicrobial. This is because nectar from the Manuka plant contributes its own antimicrobial chemistry on top of that provided by the glucose oxidase effect.

SEVEN WAYS MANUKA HONEY HEALS - Vet Candy Staff

Manuka honey has a broad and unique antimicrobial effect, including efficacy in treating antibiotic-resistant infections.

1. Creates an osmotic force that draws out edema and exudate.
2. Reduces swelling and pain.
3. Provides a moist environment for healing, which promotes both fibroblastic activity and angiogenesis.
4. Enhances granulation tissue formation and re-epithelialization, which accelerates the wound healing process.
5. Lowers the pH, which aids wound healing and decreases bacterial growth.
6. Hydrogen peroxide is the reason for the antibacterial activity of honey. Hydrogen peroxide is produced in honey when the enzyme, glucose oxidase, reacts with glucose and water.
7. Methylglyoxal (MGO) is a major antibacterial component in Manuka honey that remains active after the effects of hydrogen peroxide subside. It is produced by conversion of another compound, dihydroxyacetone, that is found in high concentration in the nectar of Manuka flowers.

Professor Peter Molan of the University of Waikato in New Zealand led research that found honey derived from the Manuka plant *(Leptospermum scoparium)* exhibited an exceptional antimicrobial profile comparable to topical gentamicin. A compound called methyglyoxal has since been identified that enables a sustained antimicrobial effect even upon dilution by up to ten times volume for volume. The concentration of methyglyoxal present in Manuka honey has been found to be directly proportional to its antimicrobial effect.

Each batch of honey is tested for its methyglyoxal concentration and tested for antimicrobial effect against phenol as a control. If the compound is as effective as a 10% phenol solution, then it is given a +10 rating. The test increases to +15 against a 15% phenol solution, and so on. For wound management, a +10 rating is sufficient to combat most pathogens. A +10 rating has an MGO rating of 263.

Honey is a natural miracle. With antibiotic resistance in the news and home health a booming industry, its demand has quickly begun to outstrip supply. Medical-grade honey, although potentially higher in price per gram, is the only way to guarantee efficacy for use in open wounds. Clinically harvested, prepared, and filtered, it is gamma-sterilized to preserve the essential plant compounds and enzymes that guarantee its antimicrobial effect. Combined with the osmotic power and low pH of honey, the Manuka factor adds what is becoming a valuable tool to help clean up wounds while defeating both regular and resistant species of bacteria.

TWO FACTS ABOUT PH AND WOUNDS

- Vet Candy Staff

1. The pH of honey is acidic, between 3.6 and 3.7.
2. Acidic environments have been shown to decrease bacterial growth, increase fibroblast activity, and increase oxygen release, which all promote healing.

THE SECRET OF GLUCOSE OXIDASE

Throughout its storage, despite the bacterial and fungal spores within it, honey remains airtight and safe, sealed in the comb. The glucose oxidase deserves further explanation; it is an effective antimicrobial backup that is activated upon dilution. As the moisture content increases, glucose oxidase reacts and releases tiny levels of hydrogen peroxide and gluconic acid. This process has an antimicrobial effect on local microbes, including many common wound pathogens.

Amazingly, the levels of hydrogen peroxide released by this glucose oxidase reaction are close to those produced by neutrophils at wound beds in our own bodies' defense against microbial proliferation.

Unfortunately, as with all enzymes, glucose oxidase is denatured by heat. Any benefit will be lost during the pasteurization process used as a standard method to reduce contamination of food-grade honey.

Even if we can source unpasteurized honey to be sure we have preserved the glucose oxidase enzyme, the residual bacteria and spores may become viable in wounds due to rapid dilution through osmosis. The best option when searching for honey to use in wound care is to opt for cold (gamma)-sterilized, medical-grade honey, which guarantees sterility while maintaining the functionality of beneficial enzymes.

Some common pathogens are sensitive to Manuka honey include *E. coli, Staphylococcus aureus* (both methicillin-sensitive and resistant strains), *Pseudomonas aeruginosa, Candida sp.*, and *Dermatophilus congolensis*.

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THE HEALING POWERS OF HONEY

Now, more than ever, the value of honey's medical potential is being rediscovered and using medicinal honey for wound management is becoming more commonplace today. On this episode of Vet Candy Podcast, **Dr. Jennifer Chatfield** and **Dr. Jason Chatfield** speak with veterinary surgeon and wound expert, Dr. Courtney Campbell. The trio review the science and why veterinarians should consider medicinal honey for moist wound care.

LISTEN

A VETERINARY NURSE'S THOUGHTS ON MEDICAL-GRADE HONEY

Amanda Curtis

Over recent years, the application of sterile, medical-grade Manuka honey in wound management has risen in popularity. With antimicrobial, debridement, and anti-inflammatory properties, it is no wonder this sticky substance has become a wound cupboard staple. But is it really being used to its maximum benefit, or is it over-utilized in wound management? Manuka honey has been used for centuries as a wound dressing, from the Egyptians using a honey, grease, and lint mixture to dress wounds to Hippocrates recommending honey as a 'natural' wound ointment. The more recent resurgence in the use of Manuka honey for wound management could be down to the prevalence of biofilms and antibiotic-resistant bacteria and pressure to find an alternative, and often more holistic, approach to conventional antibiotic and antimicrobial therapies.

Originating in New Zealand, Manuka honey comes from bees foraging on the nectar of the wild Manuka plant. Known as a non-peroxide-producing honey, Manuka has other natural properties that set it apart from some other tabletop honeys; these include methylglyoxal (MGO), an organic compound that is linked to Manuka's antimicrobial properties, dihydroxyacetone (DHA), and leptosperin. Some Manuka honey is identified and graded by the presence of all three of these components and based on their ratios is given a Unique Manuka Factor (UMF). Please note not all Manuka honey is graded with UMF. You can also use MGO for grading, which is equally good. MGO Levels of 270+ are therapeutical and equivalent to a UMF of 10. Low grade Manuka would have a MGO rating of 85-270. These grading systems were devised in response to replica honeys either being sold as genuine Manuka honey or claiming to have the same benefits.

The use of non-sterile raw honeys has also risen within wound management. This may be due to the cost of sterilized medical products or a lack of availability, but it comes with potential risks. Non-sterilized honeys may contain *Clostridial botulinum,* which could potentially cause wound botulism, and other pathogenic organisms that could cause contamination of wounds.

A comparison study by Cooper and Jenkins in 2009 looked at the antimicrobial efficacy and microbial flora present in sterilized, medical-grade honey in relation to standard raw tabletop honeys. They found that the latter exhibited relatively low antimicrobial activity when compared to the medical-grade Manuka honey. They also found the presence of potentially pathogenic organisms, which could be harmful to already high-risk patients.

Although the study's authors noted that to date there had not been any reported infections traced to the use of non-sterile honey, it would be negligent to ignore the potential risks. So, as veterinary professionals, when looking to utilize Manuka honey in our wound patients, we need to ensure that we are considering the limitations of store-bought, non-sterile honey, especially within a clinical setting, and ensuring we opt for a sterilized medical product where possible (Cooper and Jenkins, 2009).

As veterinary nurses and technicians, we can incorporate a lot of sterilized, medical-grade Manuka honey's properties into a well-rounded wound management protocol—these are Manuka's antimicrobial and autolytic debridement effects. All traumatic wounds upon presentation should be considered contaminated, and with increased awareness of wound biofilms, including a topical antimicrobial agent during the initial stages of wound management is not unreasonable.

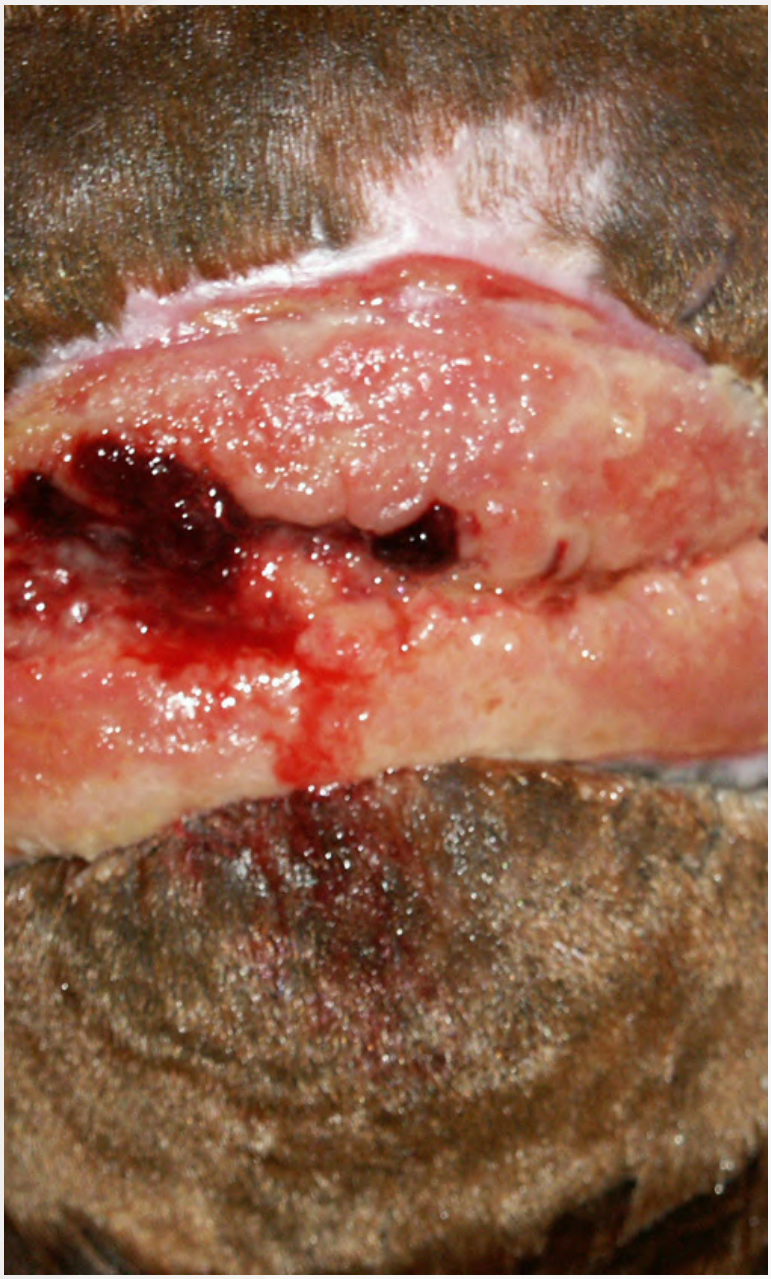
Manuka honey's unique properties, such as its significantly higher content of MGO than other honeys, its low pH (approximately between 3.2 and 4.5), and the osmotic effect produced by honey's low water and high sugar content, can all support the body's natural process of autolytic debridement where necrotic and devitalized tissue is broken down and removed. All of this makes sterile, medical-grade Manuka honey the perfect match for the inflammatory phase of wound healing.

Despite all the beneficial properties of Manuka honey, consider where it can facilitate wound healing and where it can delay it, such as during the proliferative stages of healing, when we are looking to optimize granulation tissue and fibroblast activity. We know now that maintaining a moist wound environment can optimize healing, but the natural properties of honey (low pH and high sugar content) can hinder fibroblast activity in stages of wound healing, causing the exacerbated growth of granulation tissue (Hollis, 2017).

Manuka also has the potential to cause maceration of the surrounding healthy tissue due to the peroxide process and osmotic effects causing significant increases in exudate levels, which is beneficial to our natural debridement process but not so much for our healthy surrounding tissue (Hollis, 2012). Therefore, when applying Manuka honey, we need to consider our secondary dressing layer and ensure it exhibits suitable absorbent properties to handle any increases in exudate levels. Also, the use of barrier creams applied to the surrounding healthy tissue may help prevent maceration.

We should also consider how appropriate its use is for post-surgical wound dehiscence, especially if there are dissolvable sutures remaining, as honey may cause a rapid further breakdown of surgical sites—a clinical decision should be made on whether these sutures are still viable or whether they are just acting as foreign material (Hollis, 2012).

Sterilized, medical-grade Manuka honey should be a staple of every veterinary professional's wound management toolkit. Its antimicrobial, anti-inflammatory, and debridement properties all help to promote moist wound management, and the multiple preparations now available—gels, impregnated dressings, and foam preparations–all make Manuka dressings a viable option when dealing with secondary intention or delayed primary intention healing. With some extra care and consideration when using these products, we should be able to support wounds through the inflammatory process of healing and onto further stages with minimal complications.



BENEFITS OF MOIST WOUND HEALING

- Provides continuous wound healing
- Promotes autolytic debridement
- Heals up to 50% faster, fewer bandage changes
- Removes excessive exudate
- Optimizes and increases cell growth
- Less risk of infection
- Painless bandage removal

References

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TWELVE MAIN INHIBITING FACTORS THAT AFFECT WOUNDS

Dr. Derek C. Knottenbelt

Wound healing is a natural event—all wounds want to heal if they can. The perception that horses' wounds don't heal is simply untrue; there is no evolutionary advantage in a wound that does not heal. However, for sure there are differences of healing rates in different anatomic locations and in different breeds or even individuals. These are of course inherent challenges that should not divert the clinician towards feelings of pessimism and negativity.

It may seem simplistic to say that if everything that inhibits healing is removed, a wound will heal fast and well, but it's true! When attending a fresh wound, the clinician will need to try to identify everything that is going to adversely affect the healing process and try to take proactive steps to address the issues. On the other hand, when presented with a wound that has not healed and has become either exuberant or indolent, it's critical to identify the reasons for the failure as far as possible. This might involve delving back into the history of the wound to seek useful information that may suggest measures to eliminate the inhibitors. Removal of all inhibitors results in a good, fast healing process in both fresh and chronic wounds; other measures are not usually required. The difficulty is identifying the inhibitors dealing with each of the relevant factors individually, spatially, and temporally. Proactive steps to address the inhibitors will usually help enormously.

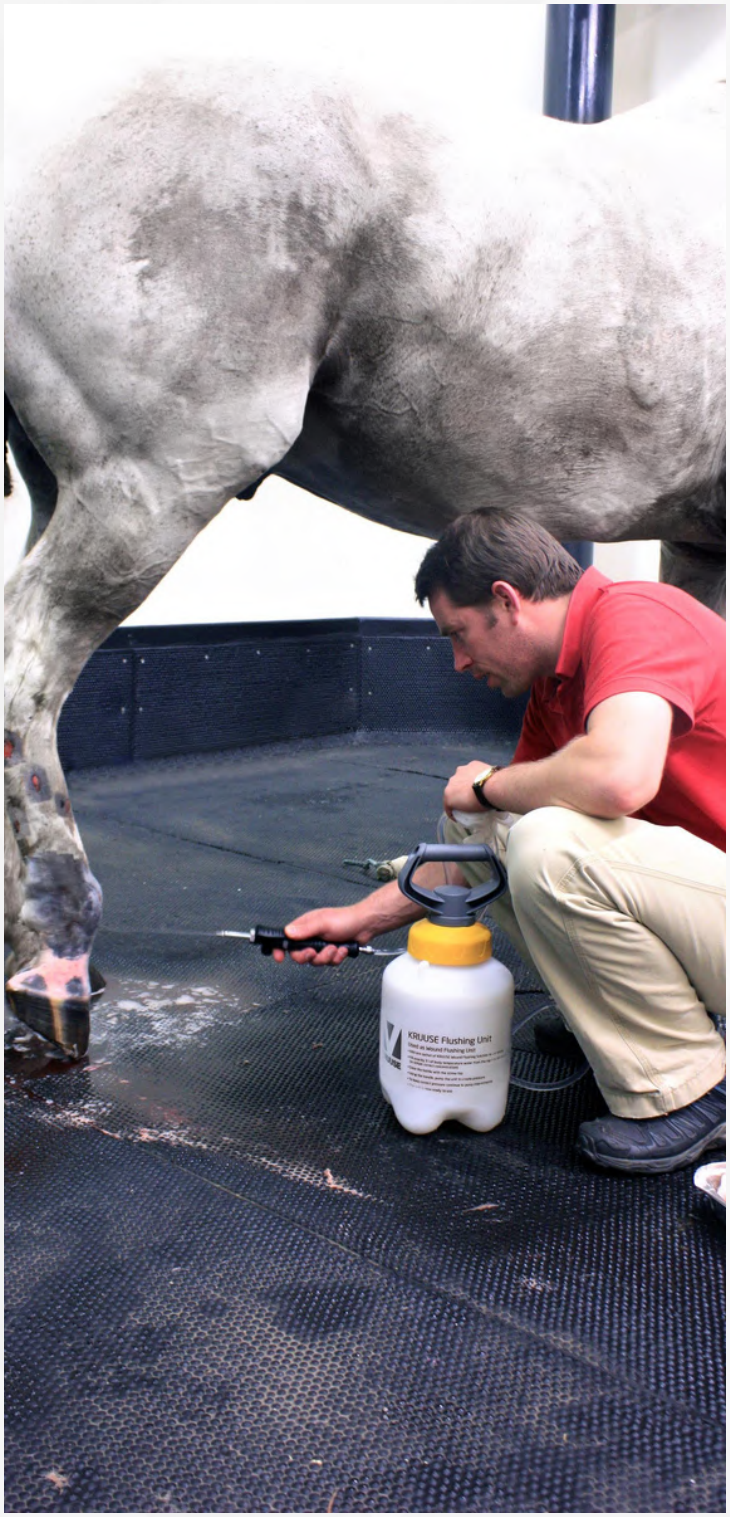
There are twelve main identifiable factors that inhibit healing.

FACTOR 1: INFECTION

CONTROL INFECTION & ELIMINATE INFECTION

Prospective:

Fresh wounds are seldom infected—they are, however, invariably contaminated. They become infected after 6-12 hours, when bacterial infection becomes established. The threat of infection can be minimized or eliminated by flushing and irrigating with body temperature physiological solution at body temperature under mild and controlled pressure. Antiseptic solutions can be used if the wound is likely to be contaminated by pathogenic bacteria but otherwise should probably not be used. The natural antibacterial functions of inflammation are efficient and should not be harmed! Antibacterial dressings with Manuka honey can be used to prevent infection from developing further in a wound that is not sterile.



Retrospective:

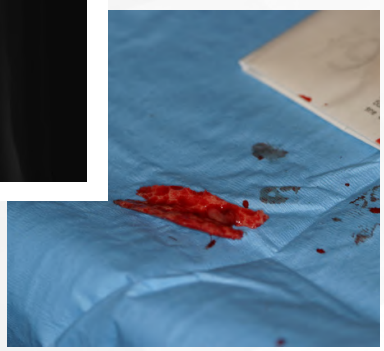
Infection becomes established after 6 hours and can be a significant inhibitor of healing in chronic wounds. It is important to determine the bacteria involved by taking swabs from several sites in and on the wound. Some infections are serious! As soon as swabs and, if necessary, tissue samples have been taken, the wound must be debrided and pressure-flushed to get rid of as much infection and biofilm as possible. Use sharp surgical debridement to remove bulk infection and convert the wound to a clean (sterile) wound. Antibiotics may be required but are generally a poor way of controlling infection in a wound.

FACTOR 2: NECROTIC TISSUE

REMOVE ALL LOOSE AND NECROTIC TISSUE

Prospective:

Non-viable tissue in a wound bed is a strong inhibitor of healing and must be removed. Often, the tissue is visibly severely compromised, and there is no point in leaving it in a wound site. Non-viable soft tissue does not bleed, and so removing it most often leads to a positive outcome. As a rule, viable tissue should be preserved. Surgical and/or hydro-surgical debridement should be performed to remove loose, non-viable tissue fragments. The viability of tendon, ligament, and bone can be hard to establish, and often they show "non-viability" only after some weeks or even months. Burns cause skin and tissue necrosis that may become obvious only slowly.



Manuka honey against genetically diverse *Staphylococcus pseudintermedius* - Vet Candy Staff

SCIENCE CORNER

Staphylococcus pseudintermedius is an opportunistic zoonotic pathogen that can cause infections that require prolonged and intensive treatment.

Researchers evaluated the ability of Manuka honey to inhibit strains of *Staphylococcus pseudintermedius* growth in an in vitro study.

The results showed that all strains of *S. pseudintermedius* were inhibited by ≤ 12% medical-grade Manuka honey.

In addition, the susceptibility to tetracycline, penicillin, chloramphenicol, and gentamicin was significantly increased when combined with honey, although sensitivity to oxacillin was decreased. Virulence activity was also significantly reduced in over half of isolates.

The study suggests that Manuka honey is not only highly potent against novel multi-drug resistant *S. pseudintermedius*, but it also acts synergistically with several antibiotics. In addition, Manuka honey modulates *S. pseudintermedius* virulence activity.

Read more by clicking on the link below:
Antibacterial and anti-virulence activity of Manuka honey against genetically diverse Staphylococcus pseudintermedius

Retrospective:

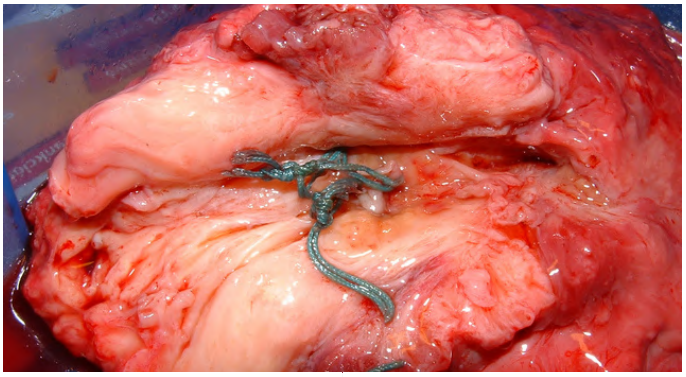
Necrotic tissue of all types is often responsible for failed wound healing and persistent, low-grade inflammation in the wound bed. A full history of the wound will often establish whether this is a likely factor in the failed healing process. Necrotic soft tissue is usually overcome relatively easily, but bone, tendon, and ligament are commonly involved because they are slow to manifest their lack of viability. Provided this is the only factor present, removal of the necrotic tissue will usually trigger a rapid healing process. Often necrotic tissue is complicated by infection, which must also be considered. Surgical debridement is usually required to remove necrotic tissue.

FACTOR 3: FOREIGN BODY

REMOVE ALL FOREIGN MATTER

Prospective:

A foreign body in a wound can be obvious or less so. Gross foreign body removal is usually accomplished easily, but microscopic contamination of a wound can be highly problematic. Sand, vegetation, and small metal or glass objects can be almost impossible to identify unless wound exploration is perfect. A gloved finger is usually the most sensitive way of identifying foreign matter. Radiography and ultrasonography can be helpful. Flushing with a physiological solution under pressure (limited to 7-12 psi / 0.8 bar) is usually enough to remove most foreign matter. Sutures and implant bodies as well as chemicals and ill-advised wound "dressings," e.g. mastitis cream, can act as foreign bodies.



Retrospective:

When a wound fails to heal over a long period with repeated draining tracts and a static wound bed, it is a cardinal sign of the presence of a foreign body. Foreign bodies may be detected by radiography or ultrasonography, but surgical exploration is sometimes the only way to find them. All foreign bodies must be removed from a chronic wound. Remember that, in effect, necrotic tissue acts as a foreign body. Suture materials and swabs left in a wound should always be considered when surgical wounds fail to heal. Castration ligation is a common example of an iatrogenic foreign body.

FACTOR 4: TISSUE DEFICIT

RESTORE TISSUE DEFICITS WHERE POSSIBLE OR WAIT FOR DEFICIT TO BE FILLED BY HEALTHY GRANULATION TISSUE

Prospective:

Where large tissue deficits occur, the prospects for rapid wound healing are low. In some circumstances it can be possible to restore some sort of tissue congruity by reconstructive surgery, but in others there is no option but to wait for granulation tissue to cover the wound. From that point, options for tissue restoration usually involve skin grafting of an appropriate type. The loss of vital tissue can be a critical event even if it is only a small area (e.g. the cornea or the upper eyelid). Tissue deficit is invariably complicated by vascular compromise and consequent or incidental necrotic tissue. Tissue deficits can also result in catastrophic loss of function or neurologic disaster.

Honey helps healing - Vet Candy Staff

SCIENCE CORNER

A study looked at the intra-lesional application of medical-grade honey (MGH) for healing and infection control. Data from 127 horses with lacerations were included. The horses were divided into treatment and control groups. Treatment groups received a single intra-lesional treatment. The study looked at 69 MGH-treated and 58 control cases.

Results indicated that MGH-treated horses were more likely to heal completely and to have no signs of infection compared to control cases. No adverse effects from MGH were noted.

Read the full article by clicking on the link below:
Intra-lesional application of medical grade honey improves healing of surgically treated lacerations in horses

Retrospective:

Large or small tissue deficits usually require significant second intention healing prior to natural healing or reconstructive surgery. Dealing with sites with historical tissue deficits is dependent on what other factors are present. Vascular, neurological, or physical compromises can be significant; reconstructive surgery and/or skin-grafting procedures are often required. Attempts to reconstruct these wounds require a full understanding of other factors that might have been involved at the outset; a very good history of the wound is vital. An unhealthy and/or exuberant granulation tissue bed is usually an indicator of other inhibiting factors. Skin grafting is a useful and practical way of addressing the consequences of tissue deficit.

FACTOR 5: MOVEMENT

STOP OR REDUCE MOVEMENT WITHIN THE WOUND SITE

Prospective:

Where movement occurs within a wound site (absolute movement) or where there is movement in the tissues around a wound site (relative movement), this can be a very strong inhibitor of healing. Wounds over joints or those that occur in tissues that have a high mobility (e.g. involve the hoof/foot, tendons, or highly mobile muscle masses such as the epaxial muscles, e.g. lips or eyelids) are liable to movement-related inhibition. Appropriate movement restriction by bandage and casts helps healing significantly. Methods of immobilizing wounds should be used as soon as possible. Casting of hoof and foot injuries is a good example.

Retrospective:

Chronic movement within or around a wound commonly causes chronic, low-grade inflammation and repeated tissue damage. Wounds over joints and those involving tendons are prone to non-healing. The history will usually help, but the signs are usually obvious. The exuberant granulation tissue must be removed, and where possible, the site should be immobilized by casting, bandage casting, or splinting. Delayed first intention healing is used for heel bulb injuries; the wound is allowed to undergo some natural and assisted debridement before closure and immobilization. Where immobilization is not possible and there are issues with movement restriction, further delayed healing is inevitable.

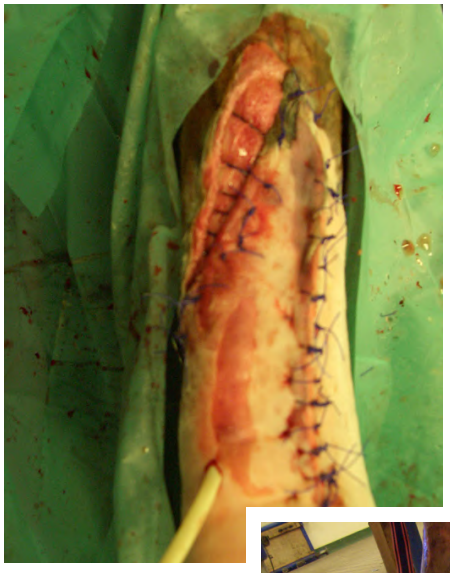
Movement damages and inhibits healing, even when all other factors are controlled.

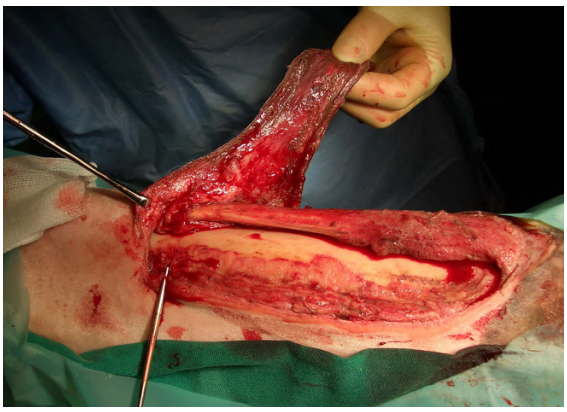
FACTOR 6: IMPAIRED BLOOD SUPPLY

DO NOT MAKE MATTERS WORSE! PRESERVE WHAT BLOOD SUPPLY THERE IS!

Prospective:

Wounds need a blood supply to heal. Without a blood supply, the wound has no chance at all, no matter how small it is. Failure to heal can result from damage to arterial blood supply (ischemia), failure of capillary bed integrity (clotting takes place), or failure of venous drainage (causing edema). Arterial bleeding in a wound site means that an artery is compromised. Most tissues have at least some collateral circulation, so the last thing these wounds need is sustained compression. Blood supply must be supported and nurtured! There is usually little that can be done to restore blood supply; time and careful tissue handling are important.





Retrospective:

The sustained loss of blood supply is catastrophic to tissues; gangrene or ischemic necrosis ensues. Where significant vascular compromise occurs, healing is very poor, with poor-quality granulation tissue. Neovascularization itself needs a good blood supply, so granulation tissue usually brings with it its own neovascularization. Doppler or laser Doppler scanning of the blood supply to a wound can help to identify major vessel compromises. Normal granulation tissue has a rich blood supply, and that is usually enough to maintain the healing process and allow grafting to take place.

Effect of Manuka honey on biofilm formation

SCIENCE CORNER

- Vet Candy Staff

Methicillin-resistant Staphylococcus aureus (MRSA) are among the most important biofilm-forming pathogens responsible for hard-to-treat infections. Researchers evaluated the effects of Manuka honey on the genes essential for staphylococcal biofilm formation from two hospital MRSA strains.

MRSA strains were isolated after 4, 8, 12 and 24 hours from cells grown in biofilm. The results of the study showed that Manuka honey significantly reduced cell viability in biofilm.
Manuka honey downregulated the genes encoding laminin, elastin, and fibrinogen binding protein involved in biosynthesis of polysaccharide intercellular adhesins in both strains.

Read more by clicking on the link below:
Effect of Manuka honey on biofilm-associated genes expression during methicillin-resistant Staphylococcus aureus biofilm formation

FACTOR 7: CONTINUED TRAUMA

ELIMINATE CONTINUED TRAUMA

Prospective:

A wound that is subjected to continual trauma will not heal. Wounds occurring in situations likely to suffer from this problem require protection. This is a common problem where wounds are caused by harness or tack. It is a particularly common problem in working and/or harness horses. Repeated trauma to the lips and mouth occur simply by use of the standard bit and bridle. Wounds that involve the hoof are often subjected to repeated trauma, either through movement spread of the wound site or by direct contact with other insult. Such wounds need to be dressed and/or protected from further injury.

Retrospective:

It is usually obvious if a wound has been subjected to continued trauma, but careful observation of the wound's management may be required. Some types of continued trauma are more subtle and less easily addressed. Simply removing the cause of the continued trauma is usually enough to trigger rapid healing, but the cause of the continued damage has to be identified and eliminated. Additionally, sometimes the trauma is not obvious—self-trauma and movement of tissues are forms of continued trauma. In effect, movement within a wound bed or the surrounding tissues also results in continued trauma to the wound bed. Casting or dressings can be used to prevent further trauma.

FACTOR 8: POOR OXYGENATION

MAINTAIN HEALTHY SURFACE OXYGENATION

Prospective:

Wounds that occur where poor surface oxygen is likely to be present will heal poorly. The important point is that oxygen is provided, of course, from the blood supply and also from the surface. The gradient of concentration of oxygen between the two is important for the development of good granulation tissue. Wounds that occur in the axilla or in the sheath/penis area and wounds that are a result of penetration injuries (particularly in the foot) can develop anaerobic infection as a result of poor oxygen tension. Wounds need oxygen to heal!

Retrospective:

A wound that suffers from prolonged low-oxygen tension will fail to heal and will usually have a cyanotic appearance and poor-quality granulation tissue. The nature of the bacterial proliferation will very often dictate whether the wound is in a hypoxic or anaerobic state—horses that develop tetanus can automatically be assumed to have an anaerobic infection site somewhere! Occlusive dressings create an artificial anaerobic surface, and as a general rule, they should not be used in normal wound management—this is quite a common fault with dressing management. Heavy, multilayer bandages also tend to reduce the surface oxygen tension, and that can be harmful to wound healing.

SCIENCE CORNER

Efficacy of *Melaleuca alternifolia* and *Rosmarinus officinalis*, Manuka honey-based gel, and propolis against canine *Staphylococcus pseudintermedius* - Vet Candy Staff

Antimicrobial resistance remains one of the most crucial challenges to be solved in both human and veterinary medicine. Essential oils and honeybee products are natural compounds that are frequently used for their medicinal properties. Researchers evaluated the antibacterial properties of tea tree *(Melaleuca alternifolia), Rosmarinus officinalis,* Manuka-based gel, and propolis against 23 strains of *Staphylococcus pseudintermedius* that had been isolated from canine pyoderma.

Tea tree essential oil was able to generate larger inhibition zones compared to those of rosemary. Tea tree also showed in vitro antibacterial properties against *Porphyromonas gingivalis, Porphyromonas endodontalis, S. aureus, E. coli, Streptococcus mutans, and Listeria monocytogenes.* No statistical significances were found among the two oils in their ability to inhibit bacterial growth. Rosemary essential oil showed antimicrobial properties against *L. monocytogenes, E. coli*, and *Salmonella enterica*.

For the two honeybee products tested, the Manuka-based gel was found to have the lowest MIC, making this product one of the most promising natural antimicrobials.

Read more by clicking on the link below:
In vitro efficacy of essential oils from *Melaleuca alternifolia* and *Rosmarinus officinalis*, Manuka honey-based gel, and Propolis as antibacterial agents against canine *Staphylococcus pseudintermedius* strains

FACTOR 9: HEALTH STATUS OF THE PATIENT

RESTORE / MAINTAIN A HEALTHY HORSE!

Prospective:

Usually the health status of the patient is obvious at the outset. However, it is also important to recognize the major obstacles to healing that might occur in cases that are immunocompromised (Equine Cushing's Disease/ PPID), have a tumor-based disorder (lymphoma), are malnourished (primary or secondary), or are on concurrent medication (immunosuppressive or corticosteroid drugs in particular). Each factor may have to be addressed in so far as possible; not everything can be corrected, of course. Massive blood loss also plays its part in failed wound healing since blood proteins may be low and appetite may be suppressed.

Retrospective:

The health status of a horse that has a non-healing wound is often overlooked, and in any case, it can be hard to assess unless the possibility of underlying metabolic or physical compromise is directly considered. There may be direct harmful compromising aspects that arise from the wound, such as chronic blood or plasma loss with resultant loss of oxygenation and nutritional constituents, sustained infection (causing anemia), or difficulty with feeding or movement to food and/or water sources. The metabolic status and health of a horse with a chronic wound must be established.

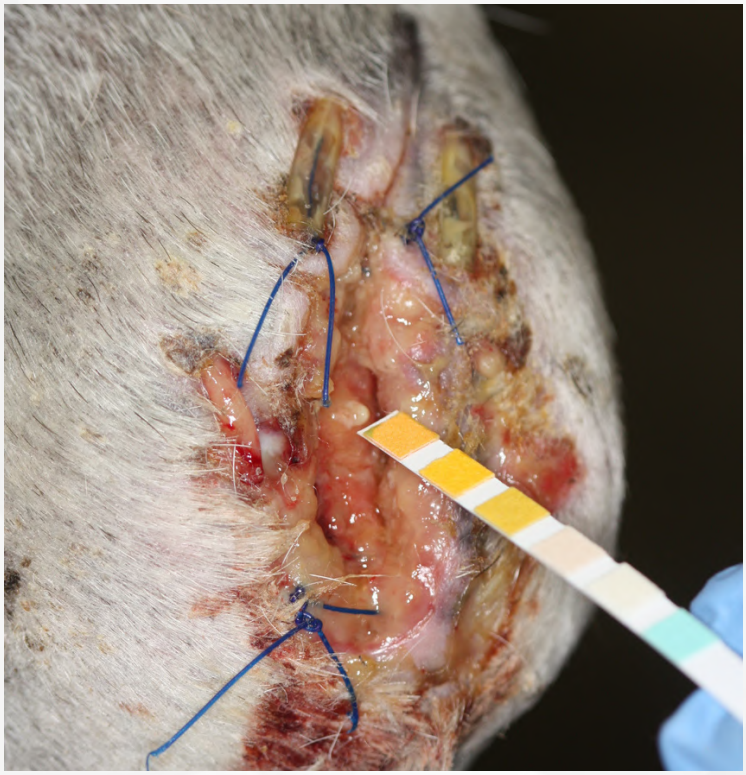
FACTOR 10: LOCAL FACTORS

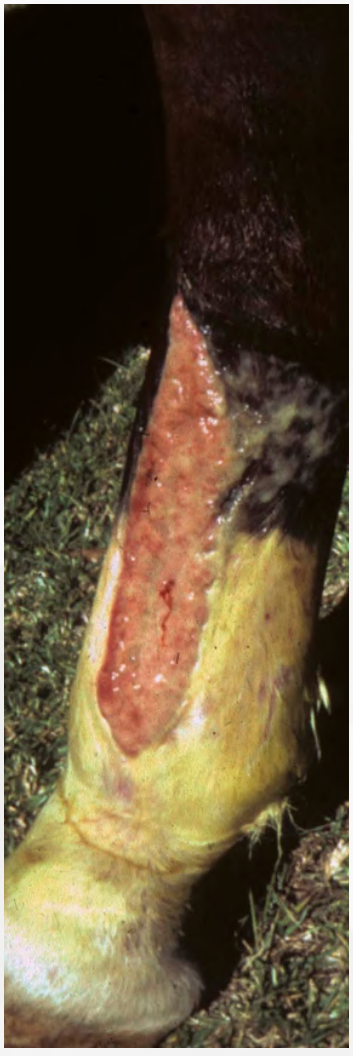
CORRECT / ELMINATE ANY ABNORMAL INHIBITING LOCAL FACTORS

Prospective:

Local factors that can be present in acute wounds and that might affect wound healing include:

1. Local pocketing of fluid and/or dead space in the wound site
2. Tension within the wound bed (centripetal from sutures or centrifugal from natural primary contraction)
3. Local temperature—excessive heat and cold are harmful.
4. Local tissue hydration status—wounds heal best when moist! Excessive drying or wetting/maceration are harmful to healing.
5. Altered pH or osmotic tension—ideally, wounds need a pH of around 4.25 to 4.75 to heal properly. Bacteria find it hard to survive in this environment.





Retrospective:

Local factors play a significant role in the continuing failure of a wound to heal. Wounds that are allowed to dry out and those that are kept too wet, as well as those with a chronic high pH, often fail to heal. Pocketing and dead space filled with exudate and infection is obvious in most cases. Establishing a surface/wound bed pH of 4.5 and a moist wound-healing environment at body temperature are conducive to healing. Drains and dressings that have rationality and physiological value are best.

FACTOR 11: IATROGENIC FACTORS (IDIOCY)

BE SMART - DONT DO ANY HARM

Prospective:

Many owners will attempt to manage wounds themselves, usually driven by marketing hype for many "wound-healing products," advertised as being "certain to heal a wound" without any physiological rationality. Irrational materials such as acids and caustics are also commonly used. Owners should be carefully advised how to manage a wound physiologically and the absolute need to seek immediate veterinary attention, no matter how small the wound—some of the most dangerous wounds are very small. Wounds can also be caused by poor bandaging methods. A proper veterinary-supplied first aid kit and client training are important ways to improve wound management outcomes.

Retrospective:

When dealing with a chronic, non-healing wound with an indeterminate or unreliable history, it is always worth considering whether something stupid has been done; e.g. use of inappropriate medications such as wound powder, strong chemical antiseptics or disinfectants, talcum powder, bovine mastitis cream, or use of caustics such as copper sulphate (picture) or battery acid, etc. in an attempt to reduce granulation tissue production. The premise or panic measures that drive this are usually self-fulfilling—the worse the wound gets, the more the panic and the greater the irrationality.

Many iatrogenic measures that compromise healing create a wound-bed status where one or more of the other inhibitors is present, e.g. foreign material, excessive drying or wetness, high or low pH, or necrosis. Often several factors are present.

FACTOR 12: TUMOR TRANSFORMATION
CONSIDER TUMOUR TRANSFORMATION

Prospective:

Horses with sarcoidosis in particular are liable to develop sarcoids in the wound site; this risk is largely restricted to the summer months. This is probably the tumor transformation that most needs to be directly and prospectively considered when attending a fresh wound case. If the horse has concurrent sarcoidosis, or if the wound actually involves a sarcoid site, special measures will have to be considered. Since sarcoid transformation of wound sites is a vector-related event, fly control over summer months has to be exemplary. Wounds that fail to heal or produce excessive granulation tissue are suspicious!

Retrospective:

Tumor transformation of a wound site is very dangerous indeed. The sarcoid (picture left) and granulation tissue can look very similar, but the treatment options are diametrically opposite. Squamous cell carcinoma (pictures right) can also result in failure of healing and of course has even worse implications. Hemangioma/sarcoma and lymphoma or malignant histiocytoma are all encountered in the wound bed from time to time and also resemble either granulation tissue or indolent wound sites. It is better to biopsy the site before embarking on any surgical management of what looks like exuberant granulation tissue.

And then of course…

There are some wounds that in spite of everything they simply don't heal. Most of these will require histological conformation of the problem but some need to be completely reassessed and the wound freshened to start the process of healing. SOMETIMES there is an explanation – for example BURN WOUNDS do not heal well at all and often take years (they also have a much higher risk of carcinoma development) some genetic / inherited diseases have a strong inhibition of healing. A good example is the Hereditary Equine Regional Dermal Aesthenia Syndrome (HERDA). This disease covers a spectrum of inherited skin structure defects that affects Quarter horses and occasionally other breeds. In this case wounds are extremely slow to heal and some may never do so. There are no measures that can be taken to help these unfortunate animals. Other genetic conditions that inhibit healing include epidermolysis bullosa which affects Belgian horses in particular.

HONEY FOR WOUND CARE

Dr. Maureen McMichael

Use of honey to treat wounds dates back to 2000 BC and has recently experienced a resurgence due to the growing worldwide problem of antibiotic resistance. Honey has multiple helpful properties for wound care including immuno-modulant, antibacterial, and a process known as autolytic debridement. The healing properties are due to honey's high osmolarity, high antioxidant content, low levels of hydrogen peroxide, low pH, Bee-defensin-1, polyphenolic and flavonoid compounds and enzymes. The enzymes include glucose oxidase, amylase, invertase, catalase and methylglyoxal (MGO).

The debridement action of honey is crucial to the healing and takes the place of much of the debridement that would occur subsequent to the initial debridement. Honey (and sugar) are also less painful than other debridement type dressings such as wet to dry dressings (which debride dead/dying tissue when the wet part sticks to the wound, dries, and then is ripped off). Honey (and sugar) dressings are removed via warm water lavage so do not tend to hurt as much as wet to dry dressings.

WHY MANUKA?

Manuka honey is collected by European honeybees from the Manuka tree, primarily in New Zealand or Australia. MGO, which is present in most honey at very low levels, is present in Manuka honey at much higher concentrations and is one of the most important antibacterial compounds for wound healing. To clarify the concentration of MGO in Manuka honey a standardization was created, Unique Manuka Factor (UMF). Researchers have concluded that honey with an MGO rating of 270+ is considered active. MGO has been shown to have some activity against biofilms and, so far, resistance has not been reported to occur with Manuka honey.

HOW TO APPLY

Manuka honey can be applied to any wound regardless of the level of contamination or infection. First the wound should be thoroughly flushed (warm tap water is fine), any obvious necrotic areas removed, and then patted dry.

At that point the Manuka honey can be added as a

pre-prepared dressing. After the honey-soaked dressing is placed on the wound, a larger absorbent foam dressing covers it and then the wound is wrapped in typical fashion. Depending on the contamination of the original wound, the dressing is changed every 12-24 hours for the first several days.

CHANGING THE WOUND DRESSING

The wound dressing should be changed every 12 hours (highly contaminated) to 24 hours (less contaminated) at first. Once the wound is looking healthier it can be changed less frequently. The bandage is removed and the innermost honey-soaked bandage can be removed using warm water lavage (tap water is fine) to help unstick it from the wound if needed. The wound is thoroughly lavaged with warm tap water and then patted dry. The honey bandages are then placed on the wound and the process repeated.

WHEN TO STOP THE HONEY

When the wound has a nice bed of healthy, pink granulation tissue, it is time to either continue covering it with non-adherent dressings (allowing it to close primarily via contraction in a small wound), close the wound primarily or perform a graft.

CONCLUSION

Honey, particularly Manuka honey, is an essential tool in the veterinarian's clinic that allows both the treatment and prevention of antibiotic-resistant bacteria to proliferate. By choosing Manuka honey for wounds we can mitigate the resistance that is becoming more and more prevalent today while helping our patients heal quicker.

CONTINUING EDUCATION INFORMATION

This program 20-797076 is approved by the AAVSB RACE to offer a total of 1.0 CE Credits, with a maximum of 1.0 CE Credits being available to any individual veterinarian or veterinary technician/technologist. This RACE approval is for the subject matter categories of medical and non medical using the delivery method of lecture/seminar .This approval is valid in jurisdictions which recognize AAVSB RACE; however, participants are responsible for ascertaining each board's CE requirements. This program is also approved in the State of New York for 1.0 CE Credits.

The American Association of Veterinary State Boards RACE committee has reviewed and approved the program referenced above as meeting the Standards adopted by the AAVSB.

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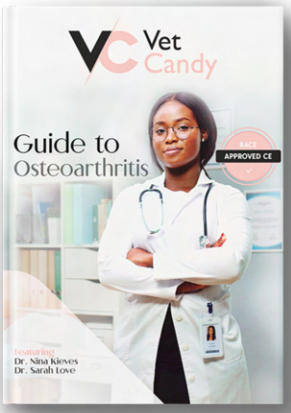

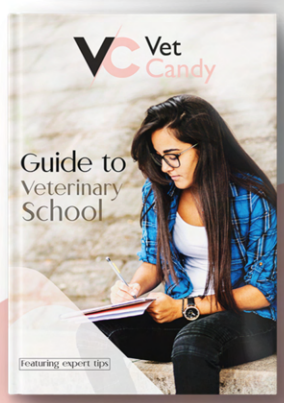

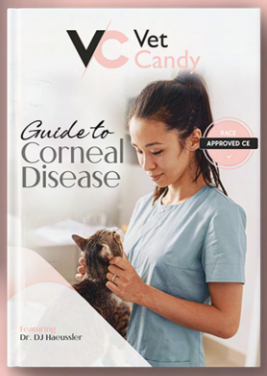

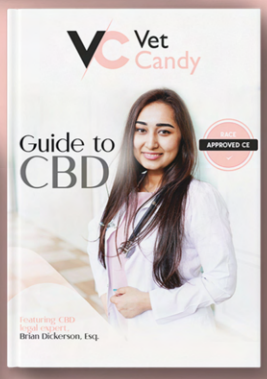

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