Wound dressings

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Abstract

The purpose of wound dressings is to support the local wound environment in order to facilitate wound healing. Dressings range from simple or passive dressings that essentially provide a contact layer to protect the wound bed from further damage and maintain a moist environment, to more advanced or interactive dressings that are capable of modifying the physiology of the wound milieu to optimize healing by, for example, promoting debridement, enhancing granulation tissue formation and re-epithelialization, managing exudate levels and bacterial load. There are also bioactive dressings which can change the cellular or biological aspects of the wound, an example of this would be a topical antimicrobial product. Hence a fundamental prerequisite to choosing the most appropriate dressing is having a clear objective in mind. Essential to this is an accurate assessment of the wound. This article will describe the features of the clinical assessment process as a basis for understanding the principles of wound management and provide details of various dressings and devices together with the indications and limitations of their use.

Keywords Adjunctive therapy; devices; wound assessment; wound bed preparation; wound dressings

Introduction

A structured approach for wound dressing selection should begin with a comprehensive assessment of the patient which takes into account the following elements:

- history – patient and wound
- examination – patient and wound
- investigations – to determine the likely aetiology/pathogenesis
- diagnosis – to facilitate appropriate management
- indicators of healing - to determine progression/regression of the wound.

Often referred to with the acronym HEIDI[1] this approach reminds the clinician of the importance of diagnostic synthesis in order to ensure the most appropriate interventions are chosen. This is of particular importance as individuals with wounds often present with a number of underlying comorbidities (e.g. diabetes, vascular disease, auto-immune conditions), as well as other factors that can have a negative impact on healing (e.g. smoking, malnutrition and polypharmacy). In these instances, the choice of dressing should not be the only consideration. This is nothing more than an approach to diagnostic synthesis which is the basis of all aspects of medicine.

Wound assessment

Following assessment of the patient an evaluation of the wound should be undertaken to include a number of core domains:[2]

- wound baseline information – number of wounds, location, type/classification, duration, treatment aim and reassessment date
- wound assessment parameters – wound size (length, width, depth), undermining/tunnelling, wound bed tissue (type and amount), description of wound margin/edge, colour/condition of surrounding (peri-wound) skin
- wound problems – pain (presence, frequency, severity), exudate (amount, type, consistency, colour), odour, local/systemic signs of infection
- specialists – involvement of appropriate specialists, e.g. vascular surgery, dermatology, geriatrics, plastic surgery.

The presence/absence of these factors will help to determine the most appropriate choice of dressing(s) but also any additional interventions which may be required.

Specific factors that delay wound healing can be summarized by the acronym TIME:[3]

- tissue – dead, dying, or unhealthy
- inflammation/infection
- moisture imbalance – resulting in maceration or scab formation
- epithelial edge – not advancing

Traditionally, the colour of the tissue in the wound bed (i.e. red, pink, yellow, black, green) has been used as a potential determinant for dressing choice, but there are inherent challenges with relying solely on colour (Figure 1).

Employing the use of tools/frameworks such as HEIDI and TIME can help to promote the need for adequate wound bed preparation to facilitate both clinical and cost-effective use of resources.

Wound dressings and type of healing

Primary intention

A detailed description of healing by primary intention is given in chapter 3 of this issue. In wounds healing by primary intention (Figure 2), the purpose of the dressing is to protect the wound in the first 48 hours after injury, after which time the barrier function of the injured tissue should have been established sufficiently that a dressing is no longer required.[4] Characteristics of dressings for these types of wounds include offering some absorbency of exudate, being transparent to facilitate wound inspection and providing a waterproof barrier to allow the patient to bathe/shower as required.

Secondary intention

A detailed description of healing by secondary intention is given in the article on pages 13–19 of this issue. For wounds healing

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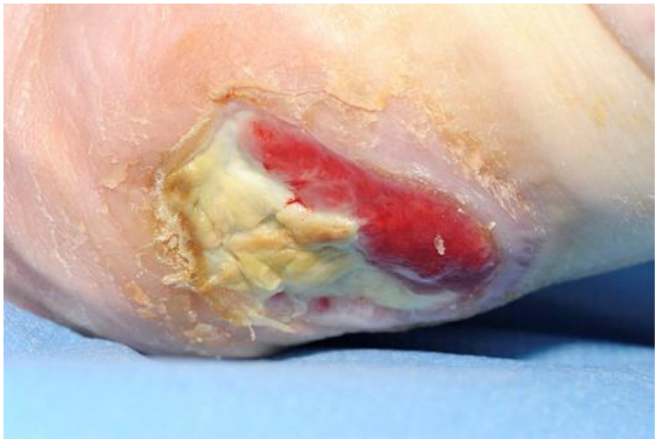

Figure 1 Wound showing granulation, slough and maceration.

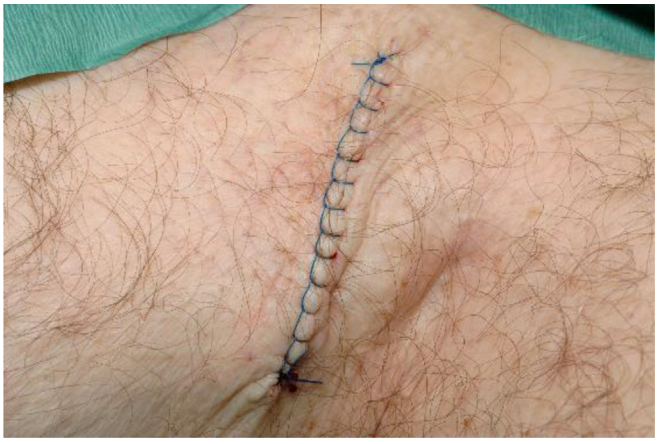

Figure 2 Wound healing by primary intention.

by secondary intention (Figure 3a and b), dressing choice needs to support the requirement for granulation tissue formation, the pre-requisite for this being moist wound healing to encourage quicker re-epithelialization. A moist environment also enhances the process of autolysis which aids in the removal of dead tissue present in a wound.[5] Other than gauze dressings, all currently available wound care products attempt to meet the requirement of maintaining a balance of moisture (exudate) in the wound area. The frequency of dressing change will be dependent on the wound characteristics with the presence/absence of infection being a key consideration in the requirement for daily dressing changes.

Secondary healing of an open wound also relies on the process of wound contraction. Therefore, the choice of dressing is an important factor, particularly in deep cavity wounds which may require packing in order to encourage wound closure. The choice of packing material depends on a number of wound-related factors including, but not limited to, location (e.g. proximity to internal organs/tissues), depth (being able to determine extent of wound), wound dimensions, presence/absence of infection and levels of exudate. It is important to pack wounds gently with a dressing that conforms easily to the wound shape and which can also be removed easily without causing further trauma.

Aims of wound management

In order to choose the most appropriate dressing (primary and secondary), it is essential to consider the aim/goal of management. Objectives for treatment might include:

- protection of a healing wound bed
- promotion of granulation tissue formation
- support of autolysis to promote debridement of dead tissue
- management of local and/or systemic infection
- management of excessive exudate
- malodour control
- management of hyper-granulation.

In all situations the condition of the surrounding (peri-wound) skin should also be taken into account. In addition, the underlying aetiology/diagnosis needs to be taken into consideration to determine if additional interventions are required.

Types of dressing

Dressings can be divided into a number of generic categories.[6] Prescribing information can be found in the *British National Formulary*[7] (BNF). A description of the common types of dressings is given below and summarized in Table 1.

Basic wound contact dressings

Absorbent/superabsorbent dressing: The primary purpose of these dressings is to absorb exudate, particularly those with high levels of leakage The wound and surrounding skin should be monitored for maceration and if this occurs may require a superabsorbent dressing which has the capacity to absorb large amounts of exudate. It is important to establish the underlying cause of the increased exudate and treat it if possible.

Low adherence dressings: Many dressings adhere to the wound and hence cause trauma – particularly when the skin is fragile. Various 'low-' or 'non-'adherence dressings are marketed but most will adhere to a certain extent and care should be taken. For example, impregnated gauzes are used to provide a covering only. They may provide a degree of absorbency.

Advanced wound dressings

Alginates: These dressings are derivatives of seaweed, some contain calcium and are classified as haemostatic. All forms of alginates require moderate to heavy levels of exudate for optimum effect, as their purpose is to absorb exudate. Their use should be avoided on dry wounds as they may adhere to the wound bed. They should not be moistened in the absence of exudate. They are available in sheet or packing (ribbon) form and can be used for shallow, flat wounds as well as for packing of wound cavities. They can be left in place for a number of days (in the absence of infection). Some alginates contain silver so can be used as a topical antimicrobial in the presence of local infection.

Capillary-acting dressings: These are low-adherence dressings with the ability to wick away exudate into a core absorbent layer. The three-layer structure provides a rapid capillary action so the wound needs to be monitored carefully to ensure that it does not dry out too much. They can be used for most wounds where management of drainage is the primary aim.

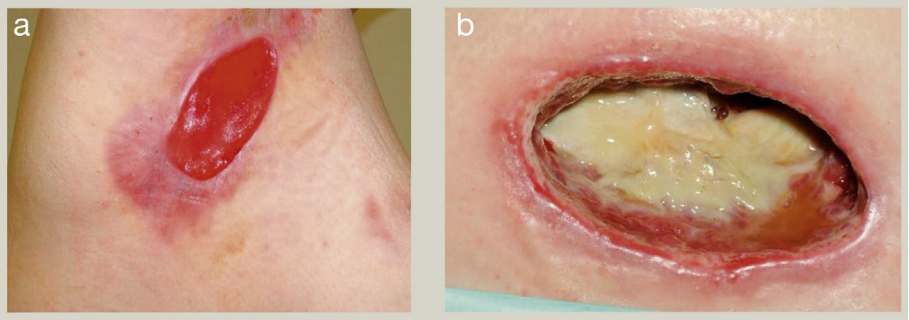

Figure 3 (**a**) and (**b**): Wounds healing by secondary intention.

Films: These are transparent, semi-permeable dressings, with or without an absorbent island. The permeability may vary between dressings, so wounds and the peri-wound area should be monitored for maceration. Many now include a skin-safe adhesive to reduce the risk of trauma in fragile skin; however, caution should be taken if the patient has particularly vulnerable skin. It may be advisable to use a skin protectant (barrier) product underneath the dressing to avoid any harm. They are most useful for post-operative wounds healing by primary intention as they facilitate easy monitoring of the wound.

Foams are primarily indicated for the management of exudate. They are available with or without an adhesive border, those with a border will not require a secondary dressings to secure them in place. The dressings can be left in situ for a number of days (in the absence of infection). Foams absorb exudate into the core of the dressing, so they hold fluid away from the wound and peri-wound area reducing the risk of maceration. Some are available with silver so have antimicrobial properties. There is an emerging body of evidence that some foam dressings can be used prophylactically on the sacrum and heels to reduce the risk of pressure ulcer development, particularly in high-risk patients, i.e. those on intensive/critical care.

Hydrocolloids: These dressings contain carboxymethylcelluose (CMC) and are indicated for use to facilitate debridement through enhancement of autolysis. Their flexible nature and different thicknesses/sizes mean they are useful for awkward areas such as the sacrum, heels and elbows. They protect the wound bed, encourage angiogenesis and can be left in place for 5–7 days. However, the wound and peri-wound tissue should be monitored carefully as the occlusive nature of the dressing can lead to maceration.

Hydrogels: The main purpose of hydrogels is to facilitate debridement through enhancement of autolysis. These dressings are available as gels and sheets. Some preparations absorb as well as donate moisture, so the choice of which hydrogel to use should be based on exudate levels. Evidence suggests that hydrogels can help to manage local wound pain. They will require a secondary dressing to secure them, i.e. a non-adherent dressing that will not simply absorb the gel as this would reduce the efficiency of the gel.

Dressing types, indications for use and special considerations

Dressing type[a]	Examples of product type[b]	Purpose/indications for use	Limitations/cautions
Basic wound contact dressings			
Absorbent	Adpore Cosmopore Mepore	Management of mild to moderate exudate	Can lead to maceration of wound or peri-wound area
Super absorbents	Curea Cutisorb Ultra Zetuvit Plus	Suitable for moderate to heavily exuding wounds due to additional cellulose/ polymer wadding	Dressings can become heavy as they absorb exudate so close monitoring is required
Low adherence	Atrauman N-A DressingTricotex Jelonet	Suitable for clean, granulating, lightly exuding wounds without necrosis Protect wound bed prior to application of a secondary dressing	Level of adherence can vary, may cause trauma on removal. Paraffin reduces the absorbency of Tulle dressings so maceration can occur
Advanced wound dressings			
Alginates	Sorsbsan Urgosorb	Form a soft gel on contact with exudate Absorbent and can promote autolysis	Adhere to the wound bed if allowed to dry out or if insufficient exudate present

(*continued on next page*)

Table 1 (*continued*)

Dressing type[a]	Examples of product type[b]	Purpose/indications for use	Limitations/cautions
Calcium alginate/calcium sodium alginate	ActivHeal Algisite MCutimed Kaltostat	Haemostatic	Require a secondary dressing to secure in place
Capillary-acting dressings	Vacutex	Management of exudate, slough and necrosis Capillary and draining action promotes debridement	Rapid capillary action means its use should be avoided with arterial bleeding. Not for use on dry, necrotic wounds Do not use in combination with paraffin based dressings
Films	Askina Derm Leukomed T OpSite Flexifix Tegaderm	Allow passage of water vapour and oxygen Impermeable to water and bacteria Suitable for partial-thickness, lightly exuding wounds Available with and without a central absorbent pad	Permeability may vary between dressings, can risk maceration Adhesive properties can cause further trauma of vulnerable skin
Foams	ActivHeal Foam Adhesive Allevyn Adhesive Polymem Tielle	Hydrophilic properties to maintain a moist environment Available as adhesive and non-adhesive products Can be used in combination with other dressings	Variable absorbency Careful assessment of peri-wound area required to reduce risk of skin stripping on removal
Hydrocolloids Fibrous (Hydrofiber)	Aquacel Urgoclean	Facilitate debridement through enhancement of autolysis	Requires adequate level of exudate, not for use on dry wounds Can also lead to leakage, maceration and odour Does not facilitate daily inspection
Hydrocolloid layer on a film/foam pad	Biatain Comfeel Duoderm Granflex Hydrocoll	Semi-permeable to water vapour and oxygen Available with and without an adhesive border	
Hydrogels		Facilitate debridement through enhancement of autolysis Donate liquid to wounds	Can lead to maceration of wound bed/ wound edge Leakage can occur
Amorphous	Aquaform Intrasite Gel Nu-Gel	Some also have ability to absorb small amounts of exudate	Slow to debride (weeks)
Sheet	ActiFormCool Hydrosorb Comfort	Available in amorphous and sheet form	Unsuitable for heavily exuding wounds
Odour control	CarboFLEX Clinisorb	Manage wound malodour Can be used in combination with other dressings Consider debridement of sloughy/necrotic tissue to enhance odour control	Product loses adsorption properties once wet
Soft polymer dressings	Sorbion Suprasorb X Adasorb Allevyn Gentle Cutimed Mepilex Adaptic Touch MepitelPhysiotulle	Often contain silicone polymer to provide a non-adherent or gently adherent layer Useful where patient has fragile skin Available with and without an absorbent pad	Suitable for light-moderate exuding wounds only Heavy bleeding leading to clot formation can cause the dressing to adhere to wound bed and may cause trauma on removal

Table 1 (*continued*)

Dressing type[a]	Examples of product type[b]	Purpose/indications for use	Limitations/cautions
Antimicrobials			
Synthetic products		For use on infected wounds	If systemic infection present patients will require appropriate systemic treatment Avoid use in known allergies/special populations (e.g. pregnant woman, children)
	Cutimed Siltec Sorbact	Contains dialkylcarbamoyl chloride (DACC)	
	Flaminal Forte gel	Contains glucose oxidase and lactoperoxidase	
	Kendal AMD	Contains polyhexamethylene biguanide (PHMB),	
	Prontosan, Suprasorb X+PHMB Telfa AMD	Contains betaine surfactant and polyhexanide	
Honey	Actilite	Medical-grade honey has antimicrobial and anti-inflammatory properties	Avoid if known allergy to bee venom Patients with diabetes should be monitored for changes in blood-glucose concentrations Avoid use of gels in deep cavities where removal would be difficult
	Activon Tulle Medihoney	Promotes autolytic debridement and may help to control wound malodour Available in gel and sheet form	
Iodine	Iodoflex	Management of local wound infection	Systemic absorption of iodine may occur if used on large wounds or with prolonged use
Cadexomer iodine	Iodosorb Iodozyme	Acts as an antiseptic	
	Oxyzyme	Wide spectrum of antimicrobial activity	
Povidone Iodine	Inadine		
Silver	Algisite Ag Urocell Silver Aquacel Ag Acticoat Mepilex Ag Actisorb Silver 220	Should only be used when clinical signs and symptoms of infection are present Available as alginates, foams, hydocolloids, low adherent, soft polymer and with charcoal	Caution with use of silver sulfadiazine-impregnated dressings as blood disorders and skin discolouration can occur
Specialized dressings			
Protease modulators	Promogran Urgostart	Non-healing wounds where elevated protease activity is suspected	Can be challenging to determine definition of non-healing
Silicone dressings	Ciltech (gel and gel sheet)	Local management of hypertrophic scars	Not for use on open wounds Application times should be increased gradually
	Kelo-cote (gel and spray) Cica-Care (sheet) Mepiform (sheet)	Available in gel, sprays and sheet form Sheet forms can be washed and reused	
Skin protection	Cavilon	To protect skin and avoid skin stripping from removal of dressings Skin barrier, available as an applicator, wipe, cream and film Emollient, available as creams and ointments	
	Epaderm		May cause challenges with dressing adherence

[a] Consider any cultural, religious or personal beliefs that may preclude use as some contain animal products.
[b] This is not exhaustive list, they are examples only. Readers should refer to their local formulary and BNF for sizes and prescribing information.

Table 1

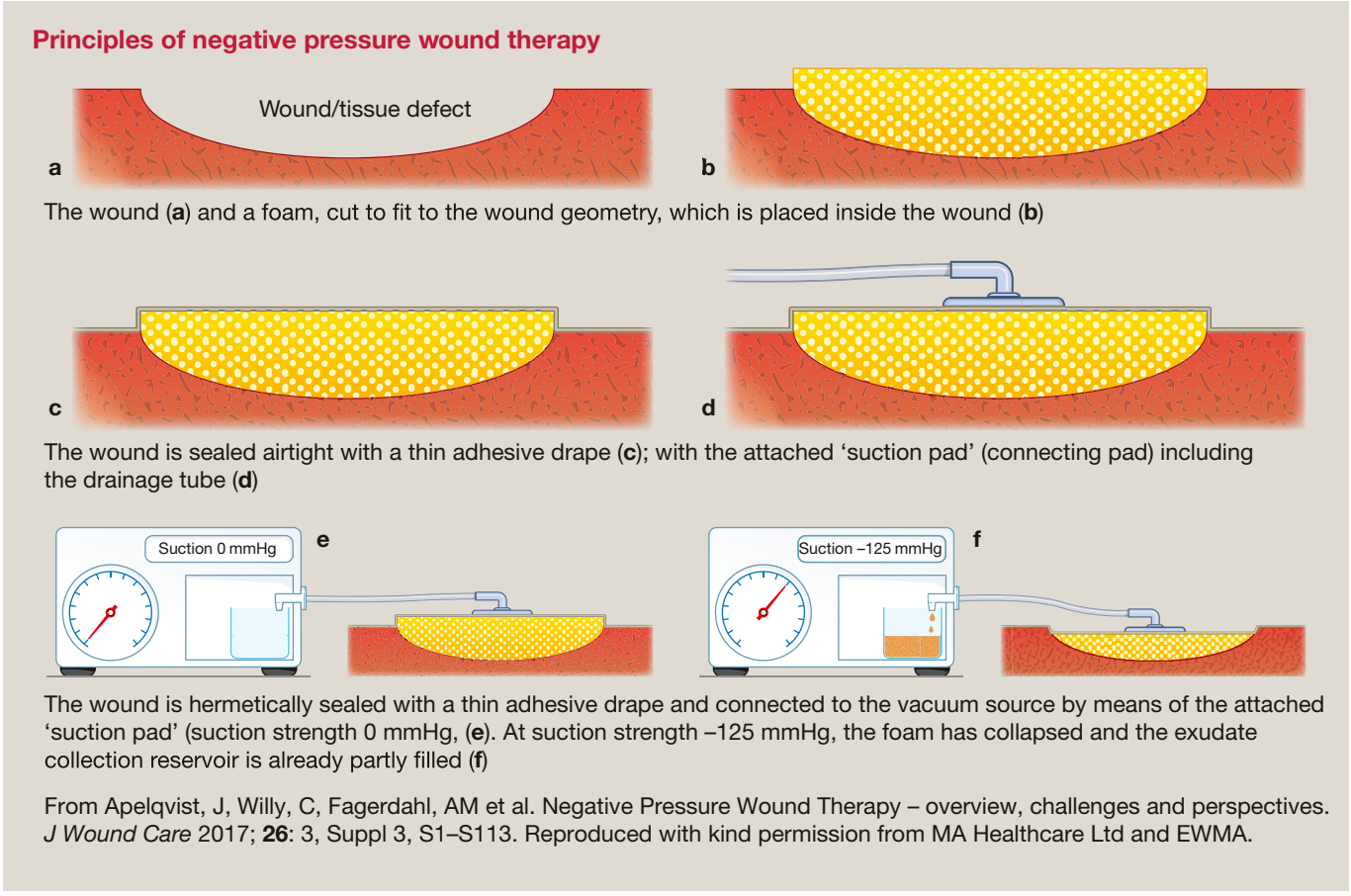

Figure 4

Odour control: Odour-controlling dressings contain charcoal as this can adsorb the noxious gases produced by sloughy, necrotic or fungating wounds. They are available as single or multi-layer products (i.e. with foam and alginate layers) depending on the degree of adsorption and exudate management required. They lose their odour-control function once they become wet. The multi-layer products will help to debride a wound if dead tissue is the cause of the malodour. However, many are only able to mask the smell, therefore the reason for the malodour should be investigated, e.g. presence of infection, and appropriate treatment commenced.

Soft polymer dressings: These dressings often contain silicone, so they are non-adherent, or very gently adherent. They can be used on light-moderate exuding wounds as well as heavily exuding but will need a secondary absorbent dressing. They can be left in place for a number of days (in the absence of infection) to reduce the frequency of dressing change required.

Antimicrobial and antiseptic dressings

Honey is antimicrobial and in the form of a dressing can provide a moist environment to facilitate autolysis and manage malodour. It is available in different preparations, e.g. tube, tulle, alginate (sheet and ribbon) and as a hydrogel. Use should be avoided in those known to have an allergy to bee venom.

Iodine and silver: Both silver and iodine have antimicrobial properties and used in many dressings and similar preparations. They are indicated for use in the management of local wound infection in acute and chronic wounds. The most common preparation of silver containing dressings is nanocrystalline which is able to kill bacteria by altering their DNA. Silver products tend to have a longer period of action. The most common form of iodine used in wound care is povidone-iodine. These products deliver the iodine content very quickly and can be washed away if there are high levels of exudate. Some patients may report skin irritation with the use of silver or iodine dressings and some discoloration of the wound bed and surrounding skin may occur. Routine use of silver and iodine is not recommended, and caution should be applied if a patient has a known allergy.

Specialized dressings

Protease modulators: In normal wound healing a balance of matrix metalloproteases (MMP) and tissue inhibitors of MMP is required. Evidence suggests that elevated protease activity is associated with non-healing wounds. Therefore, dressings that help to rebalance MMP levels have been developed. The majority of these dressings contain collagen which helps to 'mop-up' the excess MMPs. They are available with and without silver if local wound infection is suspected, as well as gels, foam, packing and those with/without borders. Their indication for use is in chronic wounds that show no signs of healing after 4 weeks of standard treatment.

Silicone dressings: Wound healing can take 12 months or more and can even extend up to 2 years. Most wounds heal without complications. However, abnormal scarring can occur, e.g. hypertrophic scars. Products that contain silicone can help with scar management. These are available as gels, sprays and silicone sheets.

Skin protection: Many individuals with wounds have fragile, vulnerable peri-wound skin or can develop skin problems as a result of repeated dressing application and removal. Therefore, it is advisable to use a protectant or barrier product underneath a dressing to avoid any harm. These products are available as liquids and sprays as well as moisturizers and cleansers with surfactants or humectants to help maintain skin's acid mantle and barrier.

Dressings or devices?

Negative pressure wound therapy (NPWT) is sometimes referred to as a dressing, but the majority of these products are a combination of a primary dressing and a pump together as a NPWT system.

NPWT describes the application of continuous or intermittent sub-atmospheric pressure to the wound. Benefits include wound size reduction, promotion of blood flow to the wound bed, removal of excess fluid, stimulation of granulation tissue and proliferation of cells. NPWT also protects the wound, decreases the risk of bacterial invasion and maintains a moist environment.[8] The effective range of negative pressure is between −50 mmHg and −150 mmHg with no current agreement on the optimal level as this may be adjusted depending on circumstances.[9] Figure 4 illustrates the principles of NPWT.

Debate has existed for some time as to whether a gauze or foam interface dressing have any differential effects. NPWT devices have evolved from large cumbersome machines to smaller, single-use, portable devices for the management of many wound types including acute, traumatic, surgical, dehisced and chronic wounds. Contraindications to use include:

- exposed arteries, veins, nerves, organs or anastomotic sites
- confirmed and untreated osteomyelitis
- non-enteric and unexplored fistulas
- wounds with suspected malignancy in or on margins (exception may be end of life care to enhance quality of life).

NPWT systems have also been used prophylactically for the prevention of surgical site infection (SSI) in closed-incisional wounds.[10] Studies have also demonstrated the use of NPWT with instillation (NPWT-i) for the management of infection in open wounds.[11] NPWT should certainly be considered as an option for wound management.

Dressings, adjunctive interventions and person-centred care

While dressings are essential for managing the local wound environment to optimize healing, there are also other cornerstones of management that are vital[5] for a number of the most common wound types. For example:

- Venous leg ulcers – compression therapy (bandages and hosiery)
- Diabetic foot ulcers – off-loading footwear/devices, blood-glucose management
- Pressure ulcers – pressure redistribution devices, repositioning

Any patient with a wound requires adequate nutrition and hydration to support the bio-physiological requirements of the wound healing process.

Conclusion

The delivery of optimum, person-centred wound care[12] requires the input of an inter-disciplinary network of healthcare professionals including but not limited to tissue viability nurses, physicians, surgeons, physiotherapists, podiatrists, occupational therapists, dietitians and pharmacists. The basic principles of wound aetiology, physiology and pathology should be considered when planning wound management strategies and choosing dressings or other devices for therapy. ◆

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Practice points

- Dressing choice needs to be based on a comprehensive patient assessment and includes establishing a diagnosis for the wound aetiology
- Wounds healing by primary intention are generally uncomplicated and may not require a dressing after a 48-hour period
- Wounds healing by secondary intention have different dressing requirements depending on their characteristics
- There is a wide range of dressings available, the choice of which depends on the goal(s) of management, in addition to dressings, devices and adjuvant therapies may be required to achieve a successful outcome
- Management of an individual with a wound requires a focused, interdisciplinary approach with clearly identified goals