The selection of wound care products for wound bed preparation

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Introduction

The healing of an acute wound is usually a highly organised series of predictable, successive and timely occurrences. The phases of healing may overlap, but include the following three stages, namely the inflammatory, proliferative and maturation phases.

The healing of a chronic wound, on the other hand, is unpredictable and complex. In this case factors that impair wound healing include less active growth factors, persistent high levels of inflammatory cytokines and protease, a bacterial imbalance, abnormal cells and dysfunctional wound matrix component. Chronic wounds are caught up in the inflammatory and proliferative phases, with the result that the wound bed does not epithelialise and close.

In view of these factors steps have been developed to ensure an optimum milieu for wound healing in chronic wounds. These steps are known as wound bed preparation and this is also known as the TIMES model (Table I).

The focus of wound bed preparation is to act pro-actively instead of reactively. In other words, dead tissue is removed in order to avoid later infection.

| T = tissue | Viable wound bed without any dead tissue |
| I = infection | Bacterial balance |
| M = moisture | Moist milieu |
| E = edges | Progressive wound edges |
| S = surrounding skin | Intact skin surrounding the wound |

A superficial infection is diagnosed and managed timeously before a deep infection and/or osteomyelitis or sepsicaemia develops. A dry wound bed is moistened to promote the migration of cells that play an important role in wound healing. Excessive exudate is absorbed to prevent, among other things, maceration of the wound edges and surrounding skin and consequent enlargement of the wound. Wound edges are continuously assessed to check whether the strategy is effective. The surrounding skin is protected to prevent skin damage and the possible development of new wounds.

Reactive management of signs and symptoms is not enough. For instance, to treat an infected wound merely symptomatically is ineffective. Giving pain medication and using a highly absorbent dressing will not clear up the underlying cause, i.e. infection.

It is clear from the above that in-depth knowledge of the physiology and the underlying pathophysiology of wound healing, as well as the unique characteristics of every wound care product, are absolutely essential to ensure that the correct product is selected for a specific patient.

Therefore, it is important to do a comprehensive assessment of a patient with a wound before selecting wound care products. The primary aim is to identify the underlying causes, as well as all the factors that may influence wound healing.

The following factors must also be taken into account when selecting wound care products:
- Size, depth, shape and location of the wound
- Amount of exudate
- Presence of an odour
- Presence of dead tissue
- Bacterial load.

The dressings selected must also be acceptable and affordable to the patient.

The fluid retention ability of dressings that hold back moisture only by absorption can be considerably curtailed by pressure. For instance, if compression bandages are used, dressings must be selected that remain effective even under compression.
New wound care products are continually developed and launched and therefore there is a large variety of products available in South Africa. In view of this, and taking into account the complex and unpredictable nature of chronic wounds, there is a need for guidelines to facilitate the selection of the ideal wound care product(s) for a patient’s needs.

With these facts in mind the Wound Healing Association of Southern Africa (WHASA) has developed a classification system for advanced wound care products available in South Africa (Table II). This may be used as a guideline for selecting products for wound bed preparation.

**Wound bed preparation**

**Debridement**

The primary goal of debridement is to remove dead tissue that could later stimulate an inflammatory reaction or serve as a culture medium for bacterial growth. The bioload of the wound bed is thus controlled by applying debridement. Wounds containing dead tissue also heal slowly as contraction and epithelialisation cannot take place. Debridement therefore ensures a more viable wound bed.

For the purposes of this article the focus will be only on autolytic and enzymatic debridement. Enzymatic debridement comprises the breaking down of dead tissue by enzymes (see section J of Table II for an example of an enzymatic debridement agent). This is accomplished by applying a topical enzymatic agent to dead tissue to digest and liquify it. This occurs by breaking down collagen, elastin and other components of the dead wound matrix. Autolytic debridement is accomplished by covering the wound with moist, interactive dressings or occlusive or semiocclusive dressings. Examples of semiocclusive and occlusive dressings are transparent films and hydrocolloids (See Table II, section F). These help to rehydrate dead tissue and ensure that the enzymes in the exudate do not digest the nonviable tissue.

Examples of moist interactive dressings are amorphous hydrogels, impregnated hydrogels and hydrogel sheets. Polysaccharides such as honey products may also be used. Medicated honey products may also be used. These products have a dual action – they stabilise the bioload, and also debride.

Debridement of dry eschar includes the following steps:

- Incise in a matrix pattern with a sterile surgical blade
- Apply an enzymatic debriding agent
- Cover the area with a transparent film dressing
- Remove dressing after two days and remove soft eschar with sterile forceps

**Ensuring a bacterial balance**

It is important to differentiate between a superficial and a deep infection of the wound as their management differs.

Topical antimicrobial dressings containing iodine silver or chlorhexidine may be used to lower the bioload (see Table I, section E). Povidone iodine has brief antimicrobial activity and its action is also diminished as soon as it is exposed to organic material. On the other hand, cadexomer iodine slowly releases iodine from its micropheres while absorbing bacteria. It has a threefold action: it absorbs high exudate levels, therefore simultaneously lowers the bacterial load and debrides dead tissue. It is also effective against methicillin-resistant *Staphylococcus aureus* (MRSA).

Medicated honey products may also be used. These products have a dual action – they stabilise the bioload, and also debride.

Hydrophobic dressings have a great attraction for microorganisms, therefore changing the dressings lowers the bacterial load of the wound.

An antiseptic solution may also be used for a few days to stabilise the bacterial load of an infected wound. However, chronic use is not recommended as these solutions are cytotoxic.

Deep infections are characterised by a wound that increases in size, an elevated temperature, new or satellite areas of tissue breakdown, an offensive odour, visible bone or bone that can be probed, redness, heat and oedema of the surrounding skin.

In cases of deep infection the patient should receive systemic antibiotics. In this case it is essential to take a wound biopsy or a wound swab to identify the causative organism and to find an antibiotic to which the specific organisms are sensitive. While waiting for the laboratory results, the wound may be treated with antimicrobial dressings.

The use of metronidazole as a gel on the wound bed and/or systemically is very effective for the control of anaerobics and naturally also for the treatment of an offensive odour.
Table II: The Wound Healing Association of Southern Africa classification system for advanced wound care products

<table>
<thead>
<tr>
<th>Category</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SURROUNDING SKIN PROTECTORS</strong></td>
<td>Barrier creams: 3M Caslon Cream®, Calimiseptine® Barriers films: 3M Caslon Spray®, Akinza Barr or Film®, ConsuCare Protective Barrier W® OxySite Spray®, Silense Spray®</td>
</tr>
</tbody>
</table>
Wound Care: The selection of wound care products for wound bed preparation

MOISTURE CONTROL

Moisture addition and debridement
- Actiform®
- Nu-Gel®
- L-Mes tran®
- Cutimed®

Hydrogel sheets
- Melladerm®
- L-Mes tran®
- Intrasite®
- Granuflex®
- Curatifil®
- Citrugel®
- Curasalt®
- Mebo®
- Mepilex®
- Melanat®
- Mcell®
- Biatain®
- Leukomed®
- Cosmpore®

Dressings
- Hydroacti®
- Hydrogel®
- Hydroderm®
- Hydroacti®
- Ultrasorb®
- SorbaGel®
- Sorbalgon®
- Seasorb®
- Melasorb®
- Meloln®
- Eclypse®

Composite
- Ceramic®
- Drawtex®

Alginate
- Cerafit®

Silver
- Silver®

Hydrocolloids
- Tielle®
- Permafoam®

Fixation
- Leukoplast®
- Dermaplast®
- Tensoplast®

Nylon tapes
- Microporous paper tapes
- Microporous transparent tapes

Moisture balance
Permeable occlusive film dressings
- Akinova®
- Biocell®
- Epsil® Absorbent®
- Hydrofilm®
- Leukomed®T
- Mefibrin®
- OptiSkin®
- Polyskin Transparent Dressing®
- Spyrofilm®
- 3M® Tejaderm®

Hydrocolloid
- Akinova Biofilm Transparent®
- Akinova Hydro®
- Akinova Thinsite®
- Contiform®
- Granuflex®
- Hydrocoll®
- Ultras® Pro Algin®
- Hydrocolloidal Dressing

Fibrous hydrocolloid
- Aquacel®

Acrylic
- 3M® Tejaderm®
- Absorber Clear Acrylic Dressing

Ionic hydrogel
- Actiform Cool®

Cera alba
- Melb®

Specialised postoperative dressing
- OptiSkin®/Visible

Actively responsive (absorption/addition)
Second-generation hydrogel sheets
- Cutimed® Sorbact®

Hydroactive
- Granules
- Mellafith®
- Megasorb®

Polymeric membrane dressing
- PolyMem®

Super-absorbers
- Cut sorb®/Ultra
- Cut med® Sorbact®
- Hydroactive
- Sorbion Sachet S®
- Sorbion Sachet Border®

Other
- Cut med® Sorbact® Pad

Moisture absorption
Non-woven fabric
- Aquacel®
- Biostat®/DuraStat®
- Cosmpore® E
- Cosmpore® Advance

Permeable film
- Leukomed®T Plus
- OptiSkin® Pad-App.
- OptiSkin® Pad-App. visible
- 3M® Tejaderm Plus Pad®
- Hydrofilm® Plus

Foam dressings
- 3M® Tejaderm Foam®
- Ahsuzof® Pad®
- Ahsuzof® Border®
- Alevyn®
- Alevyn® Caustic
- Alevyn® Gentle Border®
- Alevyn® Gentle Border Heal®
- Alevyn® Heal®
- Alevyn® Sacrum®
- Alevyn® Traheostomy®
- Akinova Foam®
- Akinova Foam Cavity®
- Akinova Foam Transm®
- Biatain®
- Cut med® Cavity
- Cut med® Silic®
- Cut med® Silic® B
- Cut med® Silic® Sacrum
- Cut med® Silic® Heal
- Dual Dress® 50®
- Kendall® Foam Dressing
- Liganova®
- Mepilex®
- PermaKomp®
- Tulle

Alginate
- Algipan®
- Akinova Soap®
- Curasorb® Sodium
- Chloride Dressing
- Curasorb®
- Curasorb® Zinc Calcium Alginate Dressing
- Kalosorb®
- Melj soap®
- Multihane®
- Seastat®
- Softfilm®

Capillary
- Geodon®
- DioneX®

Gum
- Cerdak®

Composite
- Al® line®
- Comahalan®
- Epsil®
- Epsil® Adherent®
- Epsil® Adherent Sac®
- Epsil® Boot®
- Epsil® Absorbent®
- Exa®/Ex®

PAIN REDUCTION

Buprenorphine foam
- Biatain Burt®

Superficial wound pain relief
- Phystop a®

Polymeric membrane dressing
- PolyMem®

Betaisotrode
- Melb®

Epithelialisation dressing
- Cuticoll® Epigraft

SCAR MANAGEMENT

Adhesive Conform®
- Bio-Oil®
- C-ca Care®
- Hydrocoll®
- Mepilex®
- Oleova Clear®
- Oleova Fabric®
- Oleova Foam®
- Oleova Scar Shape®
- Scarban®
- Scar Sci. area®
- Silor LTS®

FIXATION

Elastic adhesive plasters
- Elastoplast®
- Leukoplast®
- Tensoplast®
- Dermaphist EAB®

Wide-area fixation

Non-woven fabric
- Hydrocoll®
- Cutimed®

Elastic adhesive plaster tapes
- Leukopore®
- Micropore®
- Omnigrip®

Microperforated transparent tapes
- Leukopore®
- Omnifilm®

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An offensive odour may be additionally managed with dressings containing activated carbon. Some of these dressings also contain silver to control bacterial growth (Table II, section G).2,13 Dressings containing povidone or cadexomer iodine or silver are also very effective for managing an offensive odour.2,13

Should the patient experience pain, dressings may be selected that promote comfort and reduce pain. Certain dressings are designed specifically for this purpose (Table II, section H).

Ensuring a moist milieu

A moist wound milieu ensures rapid re-epithelialisation since the epithelial cells migrate freely into the fluid layer over the wound bed.11 A dry environment, on the other hand, causes dehydration and dessication of the superficial cells and the formation of a hard crust. In this case epithelial cells must tunnel through under the dry crust to close the wound, a time-consuming process that demands a great deal of energy.11

A granulating, moist wound bed may therefore be covered with hydrocolloid or permeable film dressings to maintain fluid balance, promote epidermal migration, keep the wound temperature constant and to protect the wound bed against contamination and mechanical trauma.12,14 (Table II, section F)

However, exudate from chronic wounds may also be detrimental to wound healing.3,15 This exudate consists mainly of serum with many white blood cells. It serves as a source of proteases, enzymes that break down protein and therefore can damage healthy tissue. Excessive exudate also causes maceration of the wound edges and surrounding skin.15

If the exudate levels are high, it is important to select dressings that absorb exudate and restore the fluid balance. Alginate dressings can absorb a volume of up to 20 times their weight.11,12,16 Examples are Kaltostat®, Seasorb®, Sorbalgon®, Melgisorb® and Curasorb®. These products are developed from brown seaweed and differ in their composition. It has the appearance of a soft, fluffy material and forms a gel as soon as it makes contact with wound exudate promoting autolysis and granulation.12,17

Highly absorbent hydrophilic foam products may also be used. Foam and hydropolimer dressings are both made of polyurethane but differ greatly in design and fluid management ability. They can absorb moderate to large amounts of exudate and are available as flat dressings and cavity dressings.12,14,17

Negative pressure therapy may also be used for wounds with large volumes of exudate. This type of therapy causes a vacuum on the wound bed and consequently suctions fluid mechanically out of the wound and the surrounding oedematous tissue.3,17 It also promotes blood circulation, stimulates the formation of granulation tissue and reduces the bacterial load (Table II, section F).4

In the late stage of the proliferative phase when epithelialisation commences, the exudate levels are drastically reduced and the wound bed is inclined to become dry. At this stage products that keep the wound bed moist may be selected, as listed in Table I, section F. The use of a hydrocolloid or a transparent film dressing will also ensure that the wound bed remains moist.19

Continual assessment of the wound edges

The wound edges can serve as an important parameter to determine whether or not the present wound treatment is effective over time. When the edges of a deep wound show signs of new granulation tissue formation or when the edges of a superficial wound is recolonised by visible epithelial islands, this indicates wound healing.

A wound that does not reduce in size or one that grows bigger, or whose wound edges are undermined, an underlying problem, such as an undiagnosed infection or ineffective treatment, should be suspected.3 In this case the patient must be reassessed or referred.16

Protection of the surrounding skin

The repeated application and removal of adhesive dressings or plaster may damage surrounding skin. The use of bandages or tubular bandages to keep dressings in place can prevent skin damage.2 Very thin hydrocolloid dressings may also be used to protect the skin. Adhesive dressings or plaster may even be fixed on top of these.2,17

Proteases in wound exudate and chemical irritants in urine and faeces may cause excoriation of the skin. Barrier creams and barrier spray may be used to protect the skin against potential damage (Table II, section A).12,14

Conclusion

No single wound dressing is suitable for all types of wounds and for all stages of wound healing. A patient’s wounds must therefore be assessed at every dressing change to determine whether the dressing is still effective and whether another type of product should be selected.

A thorough knowledge of the action, the indications and contraindications of all wound care products is therefore absolutely essential. Without this knowledge ineffective products may be selected which waste precious time and resources.

It is also important to treat patients holistically and to
consider how an underlying illness, nutritional status and immunity can influence wound healing.

References