South African General Practitioner. 2021;2(1):24-29
https://doi.org/10.36303/SAGP.2021.2.1.0057

S Afr Gen Pract
ISSN 2706-9613 EISSN 2706-9621

REVIEW

Wounds: an overlooked burden (Part 2) – Wound treatment: a daunting decision

H Parkar,[1] SS Mlambo,[1] L Naude,[2] H Strydom,[3] N Nakidien,[4] AD Cromarty[1]

[1] *Department of Pharmacology, Faculty of Health Sciences, University of Pretoria, South Africa*
[2] *Eloquent Health and Wellness, South Africa*
[3] *Department of Podiatry, Steve Biko Academic Hospital, South Africa*
[4] *WoundNet, South Africa*
Corresponding author, email: *hafiza.parkar@up.ac.za*

Various types of wounds are encountered daily in medical practice, and due to the numerous treatment options available on the market, making the most appropriate choice of treatment may be a rather daunting decision. The wound treatment should not inconvenience the patient to the point that the wound care becomes compromised. It is for this reason that a proper assessment of the wound status be conducted in order to select an appropriate treatment intervention or dressing type, as this will directly impact the way in which the wound heals. This article is based on the expertise of three active wound care practitioners and aims to provide guidance to clinicians when providing primary wound care. The downloadable tables can be printed and used as reference materials in daily practice.

Keywords: wound treatment options, treatment guidelines, speciality wound dressings, surgical wounds, trauma wounds, secondary intention wounds

Introduction

The initial treatment of many different wounds often falls to primary healthcare clinicians. The choice of products/agents to treat a wound can be a rather daunting decision, due to the vast number of products available on the market for the treatment of various wound types. Technological innovations and the development of a wide range of specific treatments for different wounds are a great advancement in wound management, but the success of these is highly dependent on the approach taken by the clinician to treat individual wounds. The initial assessment of the wound and choice of intervention will have a direct impact on the healing of the wound.[1] This article aims to provide a summary of treatment options arranged according to wound classification.

Assessment

As detailed in part one of this series, it is essential that wounds are critically assessed prior to initiating any treatment approaches. The initial assessment and classification of the wound will influence the choice of procedures, agents, and dressings to use. These aspects have a direct impact on the healing time of the wound. In many instances, if the products used do not suit the wound type, the healing process is hindered and the wound can progress to a more critical clinical status.[2]

Various diagnostic guidelines and tools are available to assist clinicians in streamlining their product choices based on the appearance and characteristics of the wound. These include but are not limited to, The Wound Bed Preparation Guideline[3] (endorsed by WHASA), the Triangle of Wound Assessment (Developed by Coloplast)[4] and the T.I.M.E Clinical Decision Support Tool (Developed by Smith & Nephew).[5]

Although these guidelines provide a clinical framework, it is important to remember that wound healing is a holistic practice. Therefore, factors such as the patient's history/profile, socio-economic status and psychological state should be considered during assessment and treatment of the wound. For example, when a secondary dressing is required to secure a primary dressing, this adds to the cost, which may not be affordable for the patient. Another factor to consider during an assessment is pain, as it provides vital information for wound bed preparation, dressing selection and further wound management.[1,6,7]

Wound bed preparation

Wound bed preparation is an important step prior to initiating treatment, and the approaches taken are dependent on the condition of the wound as determined during assessment/monitoring. These approaches include tissue management, infection/inflammation control, moisture balance as well as advancement of the wound edge. The goal of preparation is to optimise the wound environment for the therapeutic agents to accelerate endogenous healing or increase efficacy of advanced therapies.[8-10] To achieve this, visible dirt and debris, devitalised tissue, dressing residue and excessive/dry crusting exudate should be removed, and the wound cleaned through irrigation with cleansing solution. These solutions provide a moist environment and promote granulation tissue formation, but where there is potential for the cleansing solution to collect or be trapped in dead spaces, wound irrigation should be avoided.[3,11]

In instances where there is bleeding and swelling of the wound, direct pressure and elevation can be used. In addition to this, the wound should be washed, disinfected, and treated with the appropriate antibiotic, if necessary. Wound debridement should be performed on wounds where infection is visible and those previously covered with a dressing. It is important for the clinician to ascertain if increases in pain, heat, oedema, and skin redness are related to inflammation, cellulitis or due to bacterial infection. This is necessary to avoid a misdiagnosis that may lead to inappropriate prescription of antibiotics. Procedures during wound preparation for treatment should minimise further trauma as far as possible while ensuring the best initiation of the healing process.[10,12-14]

Treating wounds

Surgical wounds

A surgical wound will usually heal by primary intention, where the edges of the wound are brought together and held in place with a suitable intervention such as sutures, staples or adhesives.[15-17] The standard of care for primary wound closure is sutures, but in cases where there is brisk bleeding and the wound needs to be closed quickly, staples are an effective alternative. Another option is the use of adhesives, such as skin glue or tape. These interventions have been found to be less painful, making them preferable in children. The advantages and disadvantages of these interventions are summarised in Table I.

The type of intervention used is dependent on wound factors including, the anatomical position, type, depth, desired cosmetic result and the degree of tension.[15] If the tension is too low, the wound edges will not be properly opposed, limiting the primary intention healing, and reducing wound strength, whereas if the tension is too high, the blood supply to the region may become compromised and lead to tissue necrosis and wound breakdown. These factors will also determine whether the wound should be left open or covered with a dressing.

Dressing selection and protocol plays a key role in post-surgical wound care. It is centred around the concept of undisturbed wound healing, which involves keeping the dressing in situ for an extended period of time postoperatively (minimum 48 h up to seven days), without unnecessary "ritualistic" dressing changes. This allows the wound to heal with minimal disruptions while limiting exposure to infectious pathogens. The ideal dressing in this instance should meet the following requirements: conformable, well fixed, absorbent, protective, waterproof and eliminate dead space. Proper dressing protocol and selection helps to prevent the failure of wound healing.[18-20]

Non-surgical wounds

These are wounds resulting from trauma and include lacerations, sharp object penetration and skin tearing. In contrast to "clean" surgical wounds, they are considered to be "dirty" due to possible contamination. The treatment of these wounds (discussed in Table I) is similar to that of surgical wounds except that they must be considered non-sterile. The wound should be cleaned with a mild antiseptic, and if the time lapse since wounding is longer than six hours, it should be left open for at least 48 hours and then closed with a dressing if there are no signs of infection. If there are signs of infection, antimicrobial therapy should be considered. This is known as delayed primary closure or healing by tertiary intention and is a practice commonly associated with treatment of trauma wounds.[15,21]

Trauma wounds

Trauma wounds range in complexity from simple (e.g. abrasions) to serious wounds that may be associated with major underlying injuries or significant tissue loss (e.g. gunshot wounds). When dealing with any traumatic injuries, first aid always needs to take priority, and in the case of severed blood vessels, haemorrhaging should be stopped and the patient stabilised.[13] Following this, thorough cleansing and debridement of trauma wounds should be carried out to reduce possible contamination. Where devitalised tissue is present and sharp debridement of the wound is inappropriate, topical dressings can be used e.g. hydrogels, alginates and hydrocolloids. If the wound cannot be primarily sutured in the case of extensive tissue loss, delayed primary closure[15] or advanced wound dressings must be considered. Table II summarises a variety of treatment options available.

Secondary intention wounds

Wounds displaying distinct areas of tissue loss, that cannot be closed by simple approximation of the wound edges, will heal by secondary intention.[27,28] This means that the wound area must heal through replacement of the lost tissue, typically from the wound bed.[29] This can take up to six weeks for complete healing but depends on wound characteristics, anatomical site, clinical complications and patient compliance with treatment procedures.[30] The greatest risks for these wounds are infection, drying out, maceration due to copious exudate formation especially in the first few days, lifting or removal of the newly forming granulation tissue and compromised blood flow to the wound bed.

Treatment options will depend on the size and depth of the wound, presence of any infection, the amount of exudate, the required dressing conformability and change frequency, requirement of debridement of compromised tissue or eschar.[31,32] Some dressings can perform almost painless enzymatic debridement to replace the surgical debridement during wound preparation,[33] while dressings aimed at reducing inflammation can promote healing and avoid degrading to chronic wounds.[34]

Wound management in these wounds is directed at maintaining a clean granulating base, while avoiding desiccation and crust formation.[30] The primary dressing should be non-adherent and absorptive, replaced in time with less absorbent dressings as the exudate decreases. Hydro-conductive dressings and alginates are suitable for wounds with excessive exudate and can be left for several days before changing, while film dressings are not suitable for exuding wounds as they would promote wound maceration.[35] Silver impregnated or iodine-containing dressings are recommended for infected wounds but both of these can slow the healing process and should be discontinued once the

Table I: Treatment options for surgical and non-sterile primary intent wounds[15,21-25]

Product classification	Benefits	Drawbacks	Considerations
		Clean surgical wounds	
A. Sutures or stitches[22-24]	• Reduces the infection rate • Stops bleeding • Accelerates wound healing • Ensures a better cosmetic result	• Painful • Anaesthetic required • Possible rejection from body • Discomfort when stitches must be removed • Tension of stitch may tear tissue • Dehiscence	• Type of suture material used: ◦ Natural: higher inflammatory reaction in tissues ◦ Synthetic: low inflammatory reaction ◦ Absorbable or non-absorbable • Which suture technique to use – single or double mattress/continuous • Tension or retention used in obese patients • Location of the wound • Sutures left too long promote formation of scar tissue resulting in epithelialisation of suture sinuses which may lead to the formation of small abscesses and the "rail track appearance"
B. Staples[15]	• Reduces wound closure/ operation time • Can be placed quickly	• Infection more likely • Painful when removing • More prominent scarring • Dehiscence	• Location of the wound: e.g. linear lacerations on scalp or extremities • Communication to patients on when the staples should be removed
C. Glue[25]	• Rapid wound closure • Painless • Quick bonding • No needles or staples required • Waterproof • Easy for patients	Cannot be used on wounds with: • Jagged edges • High moisture areas • Contaminated wounds • Mucosal surfaces • Bite wounds • Puncture wounds • Dehiscence	• Wound should be in a horizontal plane to prevent run off • Good preparation of wound bed: wound must be clean and dry
		Non-sterile primary intent wounds	
Same options as above but consider cleaning and local antibacterial therapy		• Infection • Pain • Delayed healing	• Do not close contaminated and infected wounds, but leave them open to heal by secondary intention[21] • In treating contaminated wounds and clean wounds that are more than six hours old, manage with surgical toilet, leave open and then close 48 hours later[21] • Dressings to be chosen according to wound bed characteristics T.I.M.E

Table II: Treatment options for wounds arising from trauma[26]

Type of wound	Characteristics	Potential problems	Goals	Dressing
1. Deep, moist wound *Example degloving injury*	• Deep cavity with copious exudate and maceration of surrounding skin	• Maceration • Lack of healing • Bleeding	• Absorb drainage and fill dead space	• **Primary:** Hydrofibre, alginate or foam cavity filler • **Secondary:** Foam, composite or superabsorber
2. Shallow, moist wound *Example: abrasion or burn wound*	• Superficial • Signs of inflammation • Painful	• Maceration • Infection	• Moist wound healing • Pain relief • Prevent infection	• **Primary:** Hydrogel, hydrogel sheet, impregnated tulle, hydrocolloid, silicone foam dressing • **Secondary:** Transparent film with hydrogel or impregnated tulle
3. Deep infected wound *Example: crush injury, dog bite, spider bite*	• Increased exudate • Odour • Necrotic tissue	• Spread of infection • Lack of healing • Pain	• Remove necrotic tissue • Fill dead space • Treat infection	• Sharp debridement • **Antimicrobial dressings:** Cadexomer iodine, honey, silver, PHMB, hydrophobic dressings, HOCL
4. Shallow infected wound *Example: abrasion, burn, skin tear*	• Clinical signs of infection • Increased pain	• Spread of infection • Lack of healing	• Treat infection • Promote moist wound healing	• **Antimicrobial dressings:** iodine, chlorhexidine, honey, hydrophobic dressings
5. Laceration *Example: skin tear or cut*	• Wound not sutured but skin aligned	• Wound dehiscence	• Wound closure • Prevent dehiscence • Prevent infection	• Steristrips • Hydrocolloid • Hydrogel sheet

Table III: Treatment options for secondary intent wounds

Product classification	Benefits	Drawbacks	Considerations and indications
1. Hydrocolloids[36-38] *Dressings consist of an adhesive rubbery matrix containing a gel forming colloidal suspension such as sodium carboxymethyl cellulose (CMC), pectin or gelatine, containing fluid absorbing particles*	• Facilitate autolytic debridement and reduces pain • Thermal insulation of the wound bed • Waterproof and impermeable to bacteria • Creates moist wound interface • Absorb low to moderate levels of exudate • Various sizes, shapes, and forms • Self-adherent and conformable • Fewer dressing changes needed	• Produce an odour and leave a residue in the wound bed which may be mistaken for infection • May roll over certain body areas that are prone to friction • May adhere to the wound bed and can be difficult to remove • Can cause hypergranulation • Can cause skin stripping in fragile and compromised skin	• Use on clean wounds, burns, pressure ulcers, venous ulcers • De-slough necrotic wounds • Not recommended for heavily draining wounds, sinus tracts or fragile skin • Not recommended on clinically infected and full-thickness wounds due to the semi-occlusive nature of the dressing
2. Alginates[6,26,39] *Made from seaweed, alginate dressings are non-woven and highly absorptive. Available in ropes, sterile pads and can include antimicrobials. Fibres turn into a gel as they absorb exudate. Alginates also serve as a haemostat to stop bleeding*	• Highly absorbent capacity, preventing wound edge maceration • May be used on clinically infected wounds • Non-adherent, trauma free removal • Autolytic debridement • Non-occlusive and has haemostatic properties for minor bleeding • Frequency of dressing changes is reduced	• Requires secondary dressing to secure • May cause desiccation of the wound bed, as well as drying exposed tendon, capsule, or bone • Distinctive odour noticeable during dressing changes	• Use on sinuses, heavily exuding, bleeding, and flat cavity wounds • Should be changed daily when initiating treatment, and thereafter, every other day or when saturated • Contraindicated for dry eschar, third-degree burns, surgical implantation and heavily bleeding wounds • Should not be packed tightly in cavities as the dressing can expand • Capable of absorbing up to 20 times their weight in fluid • Use antimicrobial alginate in infected wounds
3. Hydro-conductive wound dressing[40,41] *Features exclusive fibre technology aiding effective wound bed preparation without damaging newly formed tissue*	• Draws exudate away from the wound surface • Removes toxic components such as slough, wound debris and bacteria that compromise wound healing • Exerts strong vertical and horizontal exudate dispersion and retains wound fluid	• Contraindicated for use on wounds with arterial bleeding • Requires secondary dressing	• Can be used in high exudate wounds, chronic wounds or acute wounds • Promotes endogenous wound healing or wound closure
4. Gauze[42] *Comes in woven and nonwoven forms, can be impregnated with various products, such as petrolatum, iodides, and antimicrobials*	• Readily available in many sizes and forms • Effective for packing wounds with tunnels, tracts, or undermining	• Requires secondary dressing • Fibres may shed or adhere to the wound • Requires frequent changes – dried out gauze may stick to the wound bed and disrupt wound healing	• Used on draining, necrotic, and infected wounds, those requiring debridement or packing, wounds with tunnels, tracts, or dead space, surgical incisions, burns, dermal ulcers, and pressure ulcers • Can be combined with other topical products
5. Foam[42-44] *Soft open-celled, consisting of hydrophilic polyurethane or film-coated gel. Many sizes, shapes, and forms are available*	• Absorptive, waterproof, non-adherent and non-occlusive • Impermeable to bacteria • Moist wound interface • Reduce the risk of maceration • Conformable and easy to apply	• May require secondary dressing or tape • If not changed appropriately, foam dressings can let excess moisture accumulate, macerating peri-wound skin • Plain foams not very conformable	• Not recommended for non-draining wounds or dry eschar • Some foams cannot be used on wounds with tunnelling or tracts • Can be used under compression • Can be used in infected wounds if combined with antimicrobial • Silicone border foams have better conformability • Silicone foam dressings work well with burn wounds and compromised skin
6. Hydrogel[26,36] *Group of complex insoluble polymers with a high water content. Available in amorphous gels, flat sheets or as combination antimicrobial dressings*	• Rehydrate the wound bed and reduce wound pain • Promote autolytic debridement • Non-adherent, waterproof and easy to remove • Does not damage granulation tissue • Conformable and flexible	• May need to be secured by a secondary dressing • Absorptive properties may result in maceration of peri-wound skin	• Gel formulation used on dry low exuding wounds • Sheet formulation used on low to moderate exuding wounds such as excoriated skin and small burns • Can be used with topical medications on infected wounds • Cannot be used in combination with hydrofibres, alginates and/or polyurethane foam dressing
7. Hydrofibre[26,45] *Soft, sterile non-woven pad or ribbon dressing composed of sodium carboxymethylcellulose which interacts with wound exudate to form soft gel. Similar appearance to an alginate*	• Highly absorptive, non-adherent gel • Infrequent dressing • Moist wound interface • Promote autolytic debridement • Conformable and flexible • Available as antimicrobial	• Secondary dressing required to secure it	• Pressure ulcers, partial- and full-thickness wounds, dermabrasion, painful wounds, dermal ulcers, radiation burns, donor sites, necrotic wounds, infected wounds or wounds at risk for infection • Use antimicrobial hydrofibre when infection is present • Contraindicated for dry eschar, non-exuding wounds, third-degree burns, and heavy bleeding
8. Transparent film dressing[42,46] *Consist of a thin, polyurethane membrane coated with a layer of acrylic adhesive*	• Impermeable to bacteria • Conformable and flexible • Protects the wound surface and provides a moist wound environment • Available in a wide variety of sizes, both sterile and in bulk • Wound can be examined through dressing	• Painful removal • Dressing may stick to granulation tissue	• Indicated for partial-thickness wounds with little or no exudate, wounds with necrosis and as both a primary or secondary dressing • Can be used to secure other dressings, cover IV sites, donor sites, lacerations, abrasions, and second-degree burns • Not to be used on highly exuding or infected wounds • Not to be used on fragile or compromised peri-wound skin

Table III: Treatment options for secondary intent wounds

Product classification	Benefits	Drawbacks	Considerations and indications
9. Protease modulating matrix[47,48] *Comprised of a sterile, freeze dried composite of 45% oxidised regenerated cellulose (ORC) and 55% collagen*	• Removes proteases from the wound fluid • Maintains an optimal wound healing environment and is conducive to granulation tissue formation, epithelisation, and rapid wound healing	• Not to be used in infected wounds (if infected use 1% silver)	• Before treatment, dry necrotic tissue must undergo surgical, enzymatic, or autolytic debridement • Wounds with low or no exudate, apply matrix and hydrate with saline solution • Can be used on venous leg ulcers, diabetic foot ulcers and pressure ulcers
10. Enzymatic dressings[49] *Collagenase and papain-urea enzymatic debridement*	• Selective removal of dead tissue by enzymatic action • Fast-acting and painless	• Expensive • Need to be used frequently depending on exudate • Can cause maceration	• Use on sloughy wounds • Use on wounds with minimal to moderate exudate • Not to be used on infected wounds

Table IV: Treatment options for infected secondary intent wounds

Product classification	Benefits	Drawbacks	Considerations and indications
1. Iodine[50,51] *Available as a povidone iodine ointment/ impregnated sheet or as a cadexomer iodine paste/flat sheet*	• Highly effective against bacterial, protozoal and fungal infections • Removes biofilm • Promotes autolytic debridement • Conformable and flexible	• Iodine allergy • Can cause microbial resistance if used over a long period of time	• Critically colonised wounds • Moderate to highly exuding wounds • Cavities and flat surface wounds • Reassess the wound after 14–21 days and evaluate need for continuation
2. Silver dressings[3,51] *Variety of silver dressings are available. These dressings contain ionic silver for immediate and controlled release. Transparent film, hydrocolloids, hydrogels, foams, alginates, hydrofibres, and composites*	• Inhibits pathogen growth, especially of antibiotic-resistant strains. • Cost-effective • Moist wound dressing interface	• Secondary dressing required secure silver dressing • Sensitivity to silver in some patients • May stain peri-wound tissue black due to oxidation. • Contraindicated in dry wounds or wounds with eschar	• Moderate to heavily draining wounds, partial- and full-thickness wounds, pressure ulcers, surgical wounds, donor sites, dehisced wounds, cavity wounds, and wounds with sinus tracts or tunnels • Critically colonised wounds • Low to moderate exuding wounds • Used in combination with absorptive dressing in highly exuding wounds • Dressing must be removed and wound cleaned before the patient has magnetic resonance imaging (MRI)
3. Chlorhexidine[52] *Paraffin tulle coated with chlorhexidine antiseptic agent*	• Effective against a broad range of Gram-positive and Gram-negative bacteria • Can be used postoperatively • Non-adherent	• Not effective against *Pseudomonas aeruginosa*	• Moderately infected wounds or as prevention • Small, superficial wounds • Not to be used in critical colonised wounds or grossly infected wounds
4. Honey[26,53,54] *Biologic wound dressing with multiple bioactivities that work in concert to expedite the healing process. Available in pastes, sheets, ointment and combination dressings*	• Broad spectrum antimicrobial activity • Reduces wound odour • Autolytic debridement properties • Moist wound healing interface	• Highly exuding wounds can cause maceration • May cause stinging sensation due to low pH	• Critically colonised wounds • Low to moderate exuding wounds • Appropriate for use in diabetic patients
5. Polyhexamethylene biguanide (PHMB)[55-57] *These are dressings impregnated with the antiseptic agent PHMB available as gel disks or foams*	• Effective against bacterial and fungal infections • Have a sustained effect • Effective against drug resistant wound pathogens	• May require secondary dressing	• Critically colonised wounds • Flat, cavity or sinus wounds • Gel PHMB disc can be used to de-slough infected wounds • Reassess wound after 14 days and evaluate need for continuation • Not to be used in dry wounds or wounds with eschar
6. Hydrophobic dressings[58,59] *Bacteria and fungi with hydrophobic cell surfaces are attracted to and trapped within a hydrophobic dialkyl carbamoyl chloride (DACC) grid impregnated with acetate tissue which inactivates them*	• No endotoxins are released in the wound bed • Available in different formulations	• May require secondary dressing • Odour present due to trapping of bacteria within the dressing	• Flat, cavity or sinus wounds • Moderate to heavily exuding wounds

wound is clean. Many of the advanced and exudate-absorbing dressings require a secondary dressing to hold the primary dressing in place and this should take into consideration the status of the surrounding skin that could be damaged by the removal of the secondary dressing.[6,35] Tables III and IV provide a summary of treatment options available for secondary intention wounds.

Wounds due to patient pathologies

Chronic wounds

Chronic wounds have different aetiologies and examples include diabetic foot, venous, arterial, mixed leg, pressure and malignant ulcers.[60] The processes by which chronic wounds heal differ from acute wounds and consequently, chronic wounds take longer to heal, resulting in extended treatment plans.[11] A damaged matrix, inflammatory enzymes and senescent cells are usually present within chronic wound beds, making wound debridement essential, though care should be taken not to remove new or healthy tissue.[10] Surgical debridement is non-selective and often removes viable tissue as well, which is why some clinicians would opt for autolytic, chemical, or biological methods.[61]

In chronic wounds, cellular proliferation and angiogenesis are hindered by the wound exudate[62,63] which contains excessive levels of matrix metalloproteinases that break down matrix proteins, growth factors, and cytokines.[62-65] Owing to this, an ideal dressing for chronic wounds should provide a moist environment, absorb exudate, prevent maceration of surrounding tissue and be impermeable to bacteria.[10] Where there is poor blood circulation, compression stockings or bandages should be utilised, and in the case of diabetic foot and pressure ulcers, offloading strategies must be employed to eliminate abnormal pressure points.[66] Most importantly, clinicians should determine the vascular status of the patient before choosing any treatment modality.[67] Further elaboration on chronic wounds and their treatment options will be expanded on in part 3 of this series.

Wound monitoring

All wounds, regardless of aetiology need to be monitored and post-treatment follow-up is important till the wound is completely healed. As a wound environment changes constantly, the wound needs to be reassessed when performing dressing changes so that the appropriate interventions can be applied. This may require changing the type of dressing to suit the newly developed characteristics. Using the same treatment plan for the duration of the healing time is no longer a valid practice.[1] Referral of patients, especially those with complicated wounds, to wound care specialists is of paramount importance in order to prevent unwanted clinical outcomes such as amputation.[68]

In summary/concluding remarks

The crux of wound care is "using the right product on the right wound at the right time".[1] This can be achieved by thorough wound assessment and matching the wound characteristics to the treatment plan resulting in favourable wound healing. As there are many new products available on the market, keeping abreast of new developments in wound care is an ambitious task, however, clinicians should use updated clinical decision-making tools and reference materials (such as the tables in this article) to achieve favourable clinical outcomes.

Conflict of interest

The authors have no conflict of interest to declare.

Funding source

National Research Foundation.

ORCID

H Parkar https://orcid.org/0000-0003-3732-1409
SS Mlambo https://orcid.org/0000-0002-5622-2046
L Naude https://orcid.org/0000-0002-6414-5802
H Strydom https://orcid.org/0000-0001-6524-7133
N Nakidien https://orcid.org/0000-0003-1532-1168
AD Cromarty https://orcid.org/0000-0002-9512-6081

References

1. Baranoski S, Ayello EA. Wound dressings: an evolving art and science. Advances in Skin and Wound Care. 2012;25(2):87-92. https://doi.org/10.1097/01.ASW.0000411409.05554.c8.
2. Parkar H, Cromarty A. Wounds: an overlooked burden (Part 1) – effective wound management starts with proper wound assessment. South African General Practitioners Journal. 2020;1(5):196-8. https://doi.org/10.36303/SAGP.2020.1.5.0045.
3. Sibbald RG Goodman L, Woo KY, et al. Special considerations in wound bed preparation 2011: an update. Advances in Skin Wound Care. 2011;24(9):415-36. https://doi.org/10.1097/01.ASW.0000405216.27050.97.
4. Dowsett C, Protz K, Drouard M, Harding K. Triangle of wound assessment made easy. Wounds International. 2015:1-6.
5. World Union of Wound Healing Societies. Strategies to reduce practice variation in wound assessment and management: The TIME Clinical Decision Support Tool. London: Wounds International; 2020.
6. Dabiri G, Damstetter E, Phillips T. Choosing a wound dressing based on common wound characteristics. Advances in Wound Care. 2016;5(1):32-41. https://doi.org/10.1089/wound.2014.0586.
7. Bechert K, Abraham SE. Pain management and wound care. The Journal of the American College of Certified Wound Specialists. 2009;1(2):65-71. https://doi.org/10.1016/j.jcws.2008.12.001.
8. Halim A, Khoo T, Saad AM. Wound bed preparation from a clinical perspective. Indian Journal of Plastic Surgery. 2012;45(2):193-202. https://doi.org/10.4103/0970-0358.101277.
9. Sibbald RG, Orsted H, Schultz GS, Coutts P, Keast D. Preparing the wound bed 2003: focus on infection and inflammation. Ostomy Wound Management. 2003;49(11):24-51.
10. Panuncialman J, Falanga V. The science of wound bed preparation. Surgical Clinics of North America. 2009;89(3):611-26. https://doi.org/10.1016/j.suc.2009.03.009.
11. Alhajj M, Bansal P, Goyal A. Physiology, granulation tissue. StatPearls [Internet]. 2020.
12. Krasner D, Rodeheaver G, Woo K, Sibbald G. Chronic Wound Care 5: BookBaby; 2012.
13. Leaper DJ. Traumatic and surgical wounds. British Medical Journal. 2006;332(7540):532-5. https://doi.org/10.1136/bmj.332.7540.532.
14. Hess CT. Checklist for successful wound healing outcomes. Advances in Skin and Wound Care. 2020;33(1):54-5. https://doi.org/10.1097/01.ASW.0000617008.87552.bc.
15. Azmat CE, Council M. Wound closure techniques. c2020. StatPearls. Treasure Island (FL): StatPearls Publishing; 2020.
16. Dumville JC, Coulthard P, Worthington HV, et al. Tissue adhesives for closure of surgical incisions. Cochrane Database of Systematic Reviews. 2014;11:CD004287. https://doi.org/10.1002/14651858.CD004287.pub4.
17. Webster J, Scuffham P, Stankiewicz M, Chaboyer WP. Negative pressure wound therapy for skin grafts and surgical wounds healing by primary intention.

Cochrane Database of Systematic Reviews. 2014;10:CD009261. https://doi.org/10.1002/14651858.CD009261.pub3.

18. World Union of Wound Healing Societies (WUWHS). Closed surgical incision management: Understanding the role of NPWT: Wounds International; 2016.
19. Berg L, Martinez J, Serena T, Dhoonmoon L, Ousey K. Meeting report: promoting wound healing by optimising dressing change frequency. Wounds International. 2019;10(3):68-75.
20. Morgan-Jones R, Bishay M, Hernández-Hermoso JA, et al. Incision care and dressing selection in surgical wounds. Wounds International; 2019.
21. Mekhail P, Chaturvedi S, Chaturvedi S. Surgical management of wounds. Wound Healing - New insights into Ancient Challenges: IntechOpen; 2016. https://doi.org/10.5772/64536.
22. Burkhardt R, Preiss A, Joss A, Lang NP. Influence of suture tension to the tearing characteristics of the soft tissues: an in vitro experiment. Clinical Oral Implants Research. 2008;19(3):314-9. https://doi.org/10.1111/j.1600-0501.2007.01352.x.
23. Yag-Howard C. Sutures, needles, and tissue adhesives: a review for dermatologic surgery. Dermatologic Surgery. 2014;40:S3-S15.0. https://doi.org/10.1097/01.DSS.0000452738.23278.2d.
24. Dockery GD, Crawford ME. Lower extremity soft tissue and cutaneous plastic surgery. Elsevier Health Sciences; 2012.
25. Cascarini L, Kumar A. Case of the month: Honey I glued the kids: tissue adhesives are not the same as "superglue". Emergency Medicine Journal. 2007;24(3):228-9. https://doi.org/10.1136/emj.2006.036392.
26. Vowden K, Vowden P. Wound dressings: principles and practice. Surgery. 2017;35(9):489-94. https://doi.org/10.1016/j.mpsur.2017.06.005.
27. Velnar T, Bailey T, Smrkolj V. The wound healing process: an overview of the cellular and molecular mechanisms. Journal of International Medical Research. 2009;37(5):1528-42. https://doi.org/10.1177%2F147323000903700531.
28. Grey JE, Enoch S, Harding KG. Wound assessment. BMJ. 2006;332(7536):285-8. https://doi.org/10.1136/bmj.332.7536.285.
29. Vermeulen H, Ubbink DT, Goossens A, et al. Dressings and topical agents for surgical wounds healing by secondary intention. Cochrane Database of Systematic Reviews. 2004:1:CD003554. https://doi.org/10.1002/14651858.CD003554.pub2.
30. Bernstein G. Healing by secondary intention. Dermatologic Clinics. 1989;7(4):645-60. https://doi.org/10.1016/S0733-8635(18)30559-X.
31. Dumville JC, Keogh SJ, Liu Z, et al. Alginate dressings for treating pressure ulcers. Cochrane Database of Systematic Reviews. 2015;5:CD011277. https://doi.org/10.1002/14651858.CD011277.pub2.
32. Dumville JC, O'Meara S, Deshpande S, Speak K. Hydrogel dressings for healing diabetic foot ulcers. Cochrane Database of Systematic Reviews. 2013;7:CD009101. https://doi.org/10.1002/14651858.CD009101.pub3.
33. Patry J, Blanchette V. Enzymatic debridement with collagenase in wounds and ulcers: a systematic review and meta-analysis. International Wound Journal. 2017;14(6):1055-65. https://doi.org/10.1111/iwj.12760.
34. Dissemond J, Augustin M, Dietlein M, et al. Efficacy of MMP-inhibiting wound dressings in the treatment of chronic wounds: a systematic review. Journal of Wound Care. 2020;29(2):102-18. https://doi.org/10.12968/jowc.2020.29.2.102.
35. Jones V, Grey JE, Harding KG. ABC of wound healing: Wound dressings. BMJ. 2006;332(7544):777. https://doi.org/10.1136/bmj.332.7544.777.
36. Dhivya S, Padma VV, Santhini E. Wound dressings – a review. BioMedicine. 2015;5(4):22. https://doi.org/10.7603/s40681-015-0022-9.
37. Morgan N. What you need to know about hydrocolloid dressings. Wound Care Advisor. 2013;2(3):28-30.
38. Advanced tissue [Internet]. Your guide to hydrocolloid dressings. 2014. Available from: https://advancedtissue.com/2014/12/guide-hydrocolloid-dressings/. Accessed 24 January 2021.
39. Baranoski S. Choosing a wound dressing, part 2. Nursing. 2008;38(2):14-5. https://doi.org/10.1097/01.NURSE.0000309710.85229.59.
40. Wolcott RD. The effect of a hydroconductive dressing on the suppression of wound biofilm. Wounds. 2012;24(5):132-7.
41. Schultz GS, Sibbald RG, Falanga V, et al. Wound bed preparation: a systematic approach to wound management. Wound Repair and Regeneration. 2003;11:S1-S28. https://doi.org/10.1046/j.1524-475X.11.s2.1.x.
42. Baranoski S. Choosing a wound dressing, part 1. Nursing. 2008;38(1):60-1. https://doi.org/10.1097/01.NURSE.0000305919.47233.61.
43. Hedger C. Choosing the most appropriate dressing: foams. Wound Essentials. 2014;9(2):16-20.
44. Parkar H. Clinical review: foam dressings. Wound Healing Southern Africa. 2019;12(2):5-7.
45. Van Den Bulcke R. Selection of wound dressings. In: Mani R, Téot L, editors. The basic needs to achieve wound healing. Jaypee Brothers Medical Publishers; 2011.
46. Sussman G, Technology update: Understanding foam dressings. Wounds International. 2010;1(2).
47. Fletcher J, Dhoonmoon L, Chadwick P, et al. Use of oxidised regenerated cellulose (ORC) and collagen dressings (PROMOGRAN™ Protease Modulating Matrix and PROMOGRAN PRISMA™ Wound Balancing Matrix) to kick-start the treatment of chronic wounds. Wounds UK. 2020;16(1):92-99.
48. Westby MJ, Norman G, Dumville JC, Stubbs N, Cullum N. Protease-modulating matrix treatments for healing venous leg ulcers. Cochrane Database of Systematic Reviews. 2016;12:CD011918. https://doi.org/10.1002/14651858.CD011918.pub2.
49. Ramundo J, Gray M. Enzymatic wound debridement. Journal of Wound Ostomy and Continence Nursing. 2008;35(3):273-80. https://doi.org/10.1097/01.WON.0000319125.21854.78.
50. Sibbald R, Leaper D, Queen D. Iodine made easy. Wounds International 2011;2(2):1-6.
51. Swanson T, Angel D, Sussman G, et al. Wound infection in clinical practice: principles of best practice. 2016.
52. Weinstein RA, Milstone AM, Passaretti CL, Perl TM. Chlorhexidine: expanding the armamentarium for infection control and prevention. Clinical Infectious Diseases. 2008;46(2):274-81. https://doi.org/10.1086/524736.
53. Molan PC, Rhodes T. Honey: a biologic wound dressing. Wounds. 2015;27(6):141-51.
54. Evans J, Mahoney K. Efficacy of medical-grade honey as an autolytic debridement agent. Wounds UK. 2013;9(1):30-6.
55. Moore K, Gray D. Using PHMB antimicrobial to prevent wound infection. Wounds UK. 2007;3(2):96-102.
56. Mulder GD, Cavorsi JP, Lee DK. Polyhexamethylene biguanide (PHMB): an addendum to current topical antimicrobials. Wounds. 2007;19(7):173-82.
57. Rippon MG, Rogers AA, Westgate S. Treating drug-resistant wound pathogens with non-medicated dressings: an in vitro study. Journal of Wound Care. 2019;28(9):629-38. https://doi.org/10.12968/jowc.2019.28.9.629.
58. Hardy D. Chronic oedema and associated complications. Wounds UK. 2010;6(4):138-45.
59. Bullough L, Little G, Hodson J, Morris A. The use of DACC-coated dressings for the treatment of infected, complex abdominal wounds. Wounds UK. 2012;8(4):102-9.
60. Frykberg RG, Banks J. Challenges in the treatment of chronic wounds. Advances in Wound Care. 2015;4(9):560-82. https://doi.org/10.1089/wound.2015.0635.
61. Falabella AF. Debridement and wound bed preparation. Dermatologic Therapy. 2006;19(6):317-25. https://doi.org/10.1111/j.1529-8019.2006.00090.x.
62. Drinkwater S, Smith A, Sawyer B, Burnand K. Effect of venous ulcer exudates on angiogenesis in vitro. British Journal of Surgery. 2002;89(6):709-13. https://doi.org/10.1046/j.1365-2168.2002.02085.x.
63. Bucalo B, Eaglstein WH, Falanga V. Inhibition of cell proliferation by chronic wound fluid. Wound Repair and Regeneration. 1993;1(3):181-6. https://doi.org/10.1046/j.1524-475X.1993.10308.x.
64. Grinnell F, Ho C-H, Wysocki A. Degradation of fibronectin and vitronectin and vitronectin in chronic wound fluid: analysis by cell blotting, immunoblotting, and cell adhesion assays. Journal of Investigative Dermatology. 1992;98(4):410-6. https://doi.org/10.1111/1523-1747.ep12499839.
65. Wysocki AB, Staiano-Coico L, Grinnell F. Wound fluid from chronic leg ulcers contains elevated levels of metalloproteinases MMP-2 and MMP-9. Journal of Investigative Dermatology. 1993;101(1):64-8. https://doi.org/10.1111/1523-1747.ep12359590.
66. Boghossian J, Miller J, Armstrong D. Offloading the diabetic foot: toward healing wounds and extending ulcer-free days in remission. Chronic Wound Care Management and Research. 2017;4:83-8. https://doi.org/10.2147/CWCMR.S114775.
67. Kane D. Chronic wound healing and chronic wound management. Chronic wound care: a clinical source book for healthcare professionals. 4th ed Malvern, PA: HMP Communications. 2007. p. 11-24.
68. Flores AM, Mell MW, Dalman RL, Chandra V. Benefit of multidisciplinary wound care center on the volume and outcomes of a vascular surgery practice. Journal of Vascular Surgery. 2019;70(5):1612-9. https://doi.org/10.1016/j.jvs.2019.01.087.