Dressings for Necrosed Skin

41

Christine Faure-Chazelles

Contents

C. Faure-Chazelles
Head of Medical Device Pharmacy Department, Montpellier University Hospital, Montpellier, France
e-mail: c-faurechazelles@chu-montpellier.fr

41.1 Introduction

During the physiological process of healing, the initial stage of debridement and inflammation is realised spontaneously. Moist wound healing favours the activity of proteolytic enzymes and the macrophages phagocytosing dead cells, and it allows absorption of tissue debris. However, this slow natural process may lead to negative consequences for wound healing. The necrotic process stops the formulation of granulation tissue and creates a milieu that favours bacterial development. This necrosis may be black and dry or humid or fibrinous, the colour depending on the accompanying bacterial colonisation. The presence of a biofilm prolongs the inflammatory stage and exposes the wound to recurrent infectious episodes [1, 2]. Modern dressings based on the concept of moist wound healing contribute to the acceleration of autolytic debridement.

This chapter presents the different dressings recognised to be effective during debridement and their mode of use. Depending on the type of necrosis—hard and dry or soft and humid—these recommended dressings are mostly absorbent or mixed hydrating/absorbent. These dressings may be gauzes, sheets or gels [3, 4]. Some dressings with osmotic properties are also used for debridement and are briefly described below.

L. Téot et al. (eds.), *Skin Necrosis*,
DOI 10.1007/978-3-7091-1241-0_41, © Springer-Verlag Wien 2015

41.2 Dressings and Autolytic Debridement

41.2.1 Hydrating Dressings

41.2.1.1 Hydrogels

Hydrogels are mainly composed of water (around 80 %) to which is added, depending on the adsorbing components (carboxymethyl cellulose [CMC], alginate, etc.), hydrating agents (gelatin, pectin, etc.), thickening agents (xanthan gum, guar gum), and bacteriostatic agents (propylene glycol, etc.). Gels are mostly used for debridement, but they also exist in the form of gauzes impregnated with gel and transparent sheets.

The physical properties of hydrogels should combine a relatively low viscosity favouring the maximal coverage of the wound and good adherence, preventing the gel from gliding over the wound. Because of their composition, they hydrate and soften the necrotic plaque to facilitate debridement of hard, dry necrosis (Fig. 41.1a). Gels are presented differently depending on the manufacturer: classic tubes, accordion tubes, and syringes. Unexpected events may be observed, such as maceration of the wound edges in the case of heavy exudation or when the gel is applied in excess (Fig. 41.1b). Good care should be taken to apply a uniformly thin layer of hydrogel over a previously cleaned and dried wound bed. The choice of the secondary dressing is crucial, as it will enhance the moisturising effect of the gel. Any absorbing dressing should be avoided. Facility of use of the applicator is the main element of differentiation among the products currently on the market: a long nose for deep wounds, the sharpness of application, and the ease of use of the product as a whole.

41.2.1.2 Hydrogel-Like Devices

Over the last few years, the classic formulations of hydrogels have changed. Adding antiseptics was proposed, and of the products currently on the market, the following could be mentioned:

- A matrix of hydroxyethyl cellulose polymers, insoluble and hydrophilic, containing 85 % water and octenidine dichlorhydrate, a cationic antibacterial belonging to the bipyridine family [5];
- A solution containing hydrogel, but also polyhexamethylene biguanide (PHMB) together with betaine. PHMB is an antimicrobial belonging to the biguanide family, whose property is to reduce the bacterial load by acting on the phospholipids of the bacterial membrane. Betaine is a tensioactive agent called a surfactant, whose action is to dissolve fibrinous material on the wound surface [6].

One of the main expected actions of these devices is to eliminate and prevent biofilm formation.

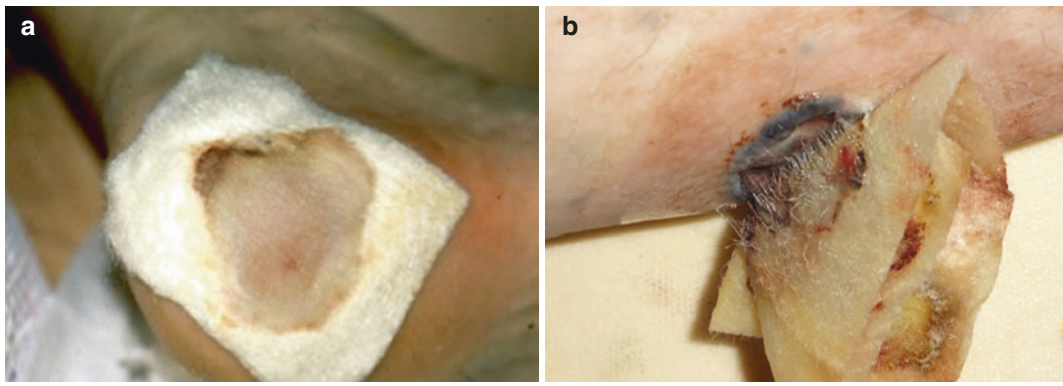

Fig. 41.1 (**a**) Appearance of hydrogel applied on necrotic tissue two days ago. (**b**) During application, the gels sticks to the wound, and the porduct layer should not be applied on the wound edges

41.2.2 Mixed "Hydrating/Absorbent" Dressings

41.2.2.1 Irrigo-Absorbents

Irrigo-absorbent dressings are gaining popularity among debridement dressings, although only one device has been launched under TenderWet [7]. It is a multilayer dressing presenting a shape of a cushion whose centre is mainly composed of polyacrylate particles activated by an adequate volume of Ringer solution. The superabsorbent polyacrylate presents an increased attraction for wound exudate rich in proteins compared with the Ringer solution. The combined action of irrigation is due to the continuous delivery of Ringer and the drainage of exudates. Periwound blanching may be observed when the dressing lies over the wound edges; a water paste or zinc oxide paste can be proposed. The Cleansite study article now in press demonstrates the superiority of the product over normal hydrogel in long-term undebrided chronic leg ulcer.

41.2.2.2 Hydrocolloids

Considered to be active at all wound healing stages, hydrocolloids occupy a relatively modest position in the list of debriding agents. These older devices have been progressively supplanted by more adaptive dressings. Composed mostly of sodium CMC, they jellify when in contact with fibrin or necrosis and provide an optimal level of moisture (Fig. 41.2a). The absorption of exudate occurs slowly and moderately and their use is indicated in the presence of humid necrosis and mainly for superficial wounds owing to the speed of action.

They can be found as fairly thick sheets, opaque or transparent and with anatomical shapes (sacrum, heel, elbow). All are adhesive and do not require secondary dressings. The dressing should lie at least 3 cm over the edges of the wound to obtain maximal adhesion (Fig. 41.2b). In some cases, an adhesive tape can be used to secure the edges of the dressing in place.

41.2.3 Absorbent Dressings

Absorbent dressings are composed of various materials such as alginate, CMC and polyacrylate. Their main characteristic is that they jellify when in contact with exudates without being destroyed. To be active during the debridement stage, the dressing should not dry out between two successive changes. They are available as gauzes or meshes.

41.2.3.1 Alginates

Alginates are polymers of alginic acid obtained from brown algae. They are differentiated from each other by their chemical composition and thus their physical properties. When guluronic acid is predominant compared with mannuronic acid, the dressing will be more rigid. Ca++ and Na+ concentrations and the presence or absence of CMC provide different levels of absorption. The jellification of alginate fibres is concomitant

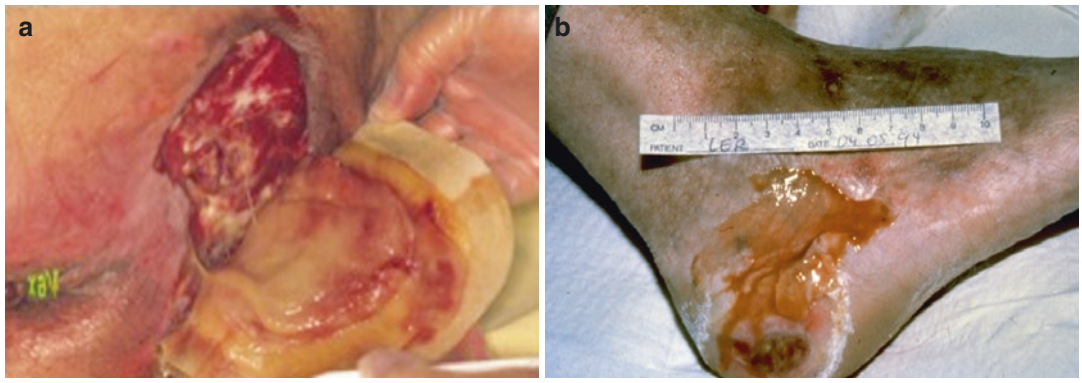

Fig. 41.2 (**a**) Aspect of hydrocolloid after two days. Gelification smells and look like pus. (**b**) Hydrocolloid dressing should ideally be placed 3 cm over the wound edges

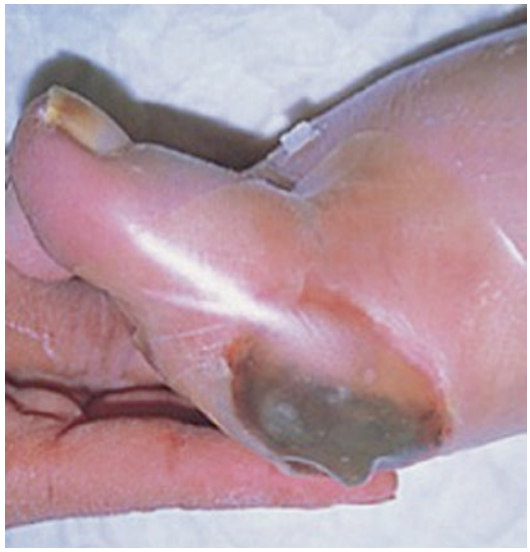

Fig. 41.3 Highly exudating wound covered with an alginate will be changed when saturated

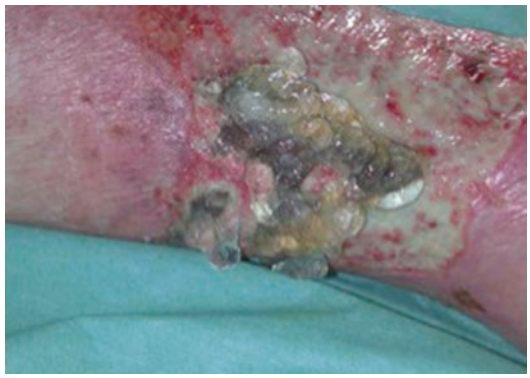

Fig. 41.4 Saline is applied over an alginate in order to facilitate the dressing removal

with the formation of Na alginate, which is soluble in water and highly hydrophilic, and/or with the presence of CMC (Fig. 41.3).

Maintaining the adapted level of moisture without occlusiveness allows better efficacy. Their haemostatic capacity is also an interesting property [8]. In order to facilitate the removal of the dressing, NaCl 0.9 % may be used (Fig. 41.4). Alginates are contraindicated over dry wounds or during the epidermisation stage. Sequential use of alginates during the debridement stage is recommended by numerous guidelines [9].

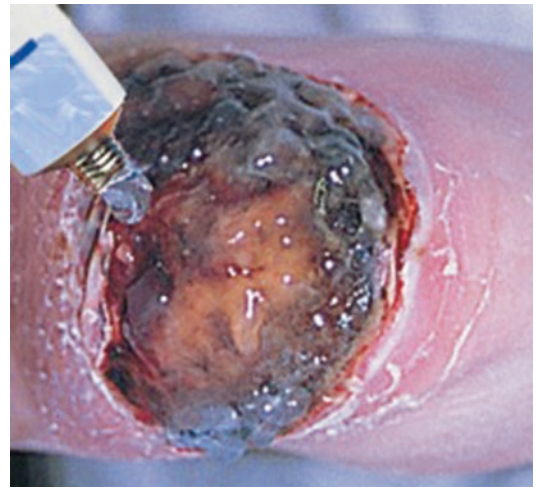

Fig. 41.5 Hydrofiber removal is easy thanks to the CMC gelification

41.2.3.2 Hydrofibres

Hydrofibre technology was introduced in 1999 when launching the product, whose composition has recently changed. This unwoven dressing is composed of sodium CMC and of a vertical and horizontal matrix containing regenerated cellulose. Hydrofibres are characterised by their high degree of hydrophilia combined with a large capacity for absorption. Looking at their composition, they are similar to hydrocolloids as they jellify when in contact with exudates (Fig. 41.5), but they have the capacity to retain moisture inside the matrix (bacterial sequestration) [10]. The recently developed matrix enhances these properties; thus, it is better to cover the dressing with a secondary dressing, allowing some moisture (hydrocolloid, foams). Removal of the dressing is facilitated by hydration.

41.2.3.3 Dressing with Polyacrylate Fibres

There is one unique dressing in this recent category. It consists of a gauze composed of polyacrylate fibres and coated in a micro-adherent lipido-colloid layer (TLC-Contact) (Fig. 41.6a).

The mesh version does not contain lipido-colloid. Together with the hydro-debriding fibres, polyacrylate fibres jellify and adhere to fibrinous residues, absorb them and drain them in order to

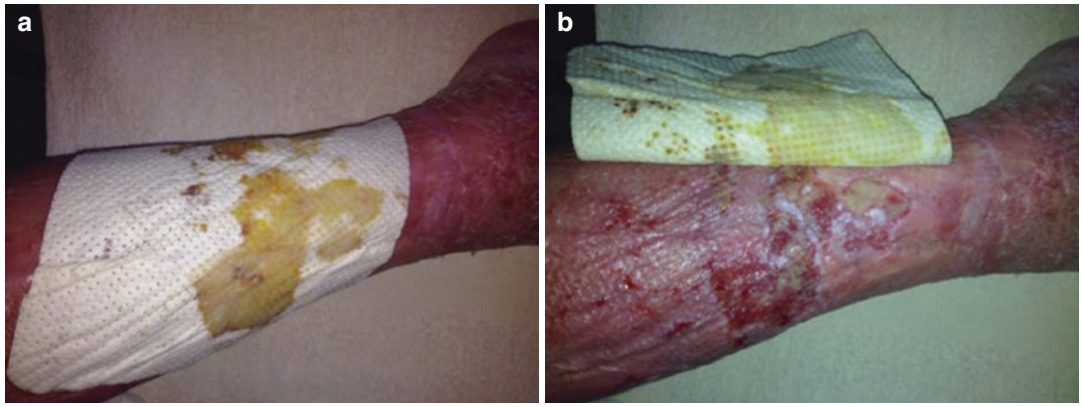

Fig. 41.6 (**a**) Polyacrylate fiber dressing is a fast remover of undesired tissues over a fibrinous leg ulcer. (**b**) When saturated the polyacrylate dressing is mechanically resistant enough to be removed as a whole, without leaving debris over the wound

enhance their elimination: this mechanism favours autolytic debridement (Fig. 41.6b). Resistance to traction is also observed. The clinical study EARTH, whose publication is in process, has confirmed advantage of these dressings in highly exudative, chronic wounds with non-inferiority to hydrofibres [11].

41.2.3.4 Dressings and Osmotic Pressure

Dressings Containing Salts

Salts with 20 % NaCl were added to the initial composition of hydrogels to form a hyperosmotic dressing. This formulation is more adapted to the necrotic plaques, which are black, hard and dry. The periwound has to be specifically checked when using these dressings.

Medical Honey Dressings

Sterile dressings are now available. They have physicochemical and microbiological properties that are comparable to the ancient description of honey when it was used empirically in ancient times [12].

Its high osmolarity favours wound exudation and mechanically induces the elimination of dead tissues and foreign bodies (including microorganisms). This mechanism induces a moist ambience that favours wound healing. This debridement is accompanied by an antibacterial effect on Gram-positive, Gram-negative and Gram-resistant bacteria, whatever their presentation, whether planktonic or biofilm. Honey is either attached to the gauze or present as a paste.

41.3 How to Use These Dressings

Hygiene should be respected during the dressing change. Whichever dressing is used, the protocol is important. The wound should be cleaned carefully (with water and soap), rinsed and dried. The dressing should then be applied respecting the mode of use specified by the manufacturer. Debridement, being an active stage, should be carried out rapidly; the frequency of the dressing change is usually every 2 days. The use of these debriding dressings does not prevent active debridement during the dressing change.

41.4 How to Choose the Dressing

This autolytic debridement is suitable for all types of wound, except for infected or heavily exudating wounds. It acts in a selective manner on the tissues. It is easy to use requiring no training before use, which makes them easily accessible to nurses. The cost is moderate compared with surgical debridement. Its main inconvenience is the slow process, but the absence of

pain and bleeding, preventing microtrauma on the surface of the wound, is an advantage.

References

1. James GA, Swogger E, Wolcott R, et al. Biofilms in chronic wounds. Wound Repair Regen. 2008;16(1): 37–44.
2. Fromantin I, Seyer D, Watson S, Rollot F, Elard J, Escande MC, De Rycke Y, Kriegel I, Larreta GV. Bacterial floras and biofilms of malignant wounds associated with breast cancers. J Clin Microbiol. 2013;51(10):3368–73.
3. Powers JG, Morton LM, Phillips TJ. Dressings for chronic wounds. Dermatol Ther. 2013;26(3):197–206. doi:10.1111/dth.12055.
4. Meaume S. Methods of non-surgical debridement of wounds in 2011. Soins. 2011;752:44–7.
5. Hämmerle G, Strohal R. Efficacy and cost-effectiveness of octenidine wound gel in the treatment of chronic venous leg ulcers in comparison to modern wound dressings. Int Wound J. 2014. doi:10.1111/iwj.12250.
6. Horrocks A. Prontosan wound irrigation and gel: management of chronic wounds. Br J Nurs. 2006; 15(22):1222, 1224–8.
7. Paustian C. Debridement rates with activated polyacrylate dressings (TenderWet). Ostomy Wound Manage. 2003;49 Suppl 2:13–4.
8. Dumville JC, O'Meara S, Deshpande S, Speak K. Alginate dressings for healing diabetic foot ulcers. Cochrane Database Syst Rev. 2013;25:6.
9. Chaby G, Senet P, Vaneau M, Martel P, Guillaume JC, Meaume S, Téot L, Debure C, Dompmartin A, Bachelet H, Carsin H, Matz V, Richard JL, Rochet JM, Sales-Aussias N, Zagnoli A, Denis C, Guillot B, Chosidow O. Dressings for acute and chronic wounds: a systematic review. Arch Dermatol. 2007;143(10): 1297–304.
10. Philbin S. Pressure ulcer management using sodium carboxymethylcellulose hydrofiber® foam dressings. Ostomy Wound Manage. 2013;59(3):10–2.
11. Meaume S, Perez J, Rethore V, Sebbane G, Dompmartin A, Bressieux JM, Leguyadec T, Tacca O, Bohbot S, Meaume S, Perez J, Rethore V, Sebbane G, Dompmartin A, Bressieux JM, Leguyadec T, Tacca O, Bohbot S. Management of chronic wounds with an innovative absorbent wound dressing. J Wound Care. 2012;21(7):315–6, 318, 320–2.
12. Vandamme L, Heyneman A, Hoeksema H, Verbelen J, Monstrey S. Honey in modern wound care: a systematic review. Burns. 2013;39(8):1514–25.