TECHNOLOGY UPDATE:
Understanding foam dressings

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Foam dressings are highly absorbent and are available in a range of different shapes, sizes and compositions. They can be used as a primary or secondary dressing on a variety of wound types, from leg ulcers to cavity wounds where exudate is a problem.

Page points

1. *Foam dressings are highly absorbent and can be used as a primary or secondary dressing on wounds producing low to heavy exudate*
2. *Modern foam dressings have been available for around 35 years, have their roots in ancient medicine, and closely comply with Turner's criteria for the ideal dressing*
3. *A distinction is made between 'true foams' and 'pseudo-foams'*

HISTORY OF FOAM DRESSINGS

Foams were one of the first 'modern' dressings to be used in wound management and became widely available in the mid-1970s for lightly, moderately or heavily exuding wounds. Foams offer advantages over traditional gauze dressings as they do not shed particles and can be left in place for several days without causing maceration[1].

Foams closely comply with Turner's criteria for the ideal dressing. He described the properties of such a dressing as the ability to:

- **Remove excess exudate and toxic components**
- **Maintain high humidity at the wound/dressing interface**
- **Permit gaseous exchange**
- **Provide thermal insulation**
- **Protect from secondary infection**
- **Protect from particulate or toxic contamination**
- **Allow removal without trauma at dressing changes[2].**

Majno describes how, in ancient Greek and Roman medicine, sea sponges were used to absorb fluid from wounds. These were also soaked in wine and used as an antibacterial wound dressing[3].

The first commercial 'foam-like' wound dressing was an artificial medicated sponge manufactured by Burroughs Wellcome & Co in the 1880s for the surgeon Joseph Gamgee. This was made from gauze, cotton and coconut fibre, and had a centre capsule containing an antiseptic[4].

Today, foam dressings are available in various forms. Topical wound dressings come in a range of sizes and as sheets, with or without adhesive borders. Foam dressings are available for cavity wounds and are used as a dressing medium in negative pressure wound therapy (V.A.C.® Therapy, KCI; Renasys-EZ, Smith & Nephew). In addition, foam is used in pressure-reducing devices such as mattresses and heel protectors.

Foams are recommended for wounds producing low, moderate to heavy exudate, including leg ulcers, and may be used under compression and on donor sites, skin tears and minor burns[1]. They can be employed as a secondary dressing – particularly as a covering for primary dressings such as amorphous hydrogels. Due to the structure and the viscosity of the hydrogel they are not absorbed into the foam. This has been tested but the results have been not published; however, the method has been used successfully in Australia for many years using contract cotton-based dressings, hydroactive dressings and also with antibacterial impregnated dressings.

DEFINITIONS, CHARACTERISTICS AND ACTIONS

Although many dressings are classified as a 'foam' there are differences in the chemical makeup of different dressings. It is therefore important that clinicians know whether the dressing they are using is a 'true foam' that draws fluid into air spaces or a 'pseudo-foam' that draws in fluid and physically expands as it retains it.

True foams

True foams are soft, open-cell hydrophobic and hydrophilic (see Glossary), non-adherent

References

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3. Majno G. *The Healing Hand.* Cambridge, MA: Harvard University Press, 1991.
4. Thomas S. *Wound Management and Dressings.* London: Pharmaceutical Press, 1990.

dressings that have single or multiple layers. The surface of the dressing is hydrophilic and is placed against the wound to allow exudate to pass through. The main structure of the dressing is hydrophobic, which allows fluid to be held within the dressing.

The mode of action of true foams is to draw fluid into the air spaces by capillary action. The fluid is then held within the structure, although in some dressings a small amount of fluid may pass through the structure and disperse by evaporation.

True foam dressings have the following broad characteristics. They:

- **Are absorbent and allow the passage of exudate through the non-adherent surface to be absorbed in the main body of the product**
- **Maintain a moist environment as the contact material is hydrophilic, which allows exudate to be absorbed from the wound surface**
- **Provide thermal insulation to the wound**
- **Provide cushioning and comfort in situ**
- **Are non-residual in that they do not break down and release particles into the wound**
- **Are non-occlusive and gas-permeable owing to their open cell structure[4-6].**

True foams can be composed of polyurethane or silicone, as described below.

Polyurethane foam dressings

The first foam dressings attempted to mimic the action of the sea sponge, using a polyurethane construction that contained many air spaces. Lyofoam (Mölnlycke HealthCare) was the first polyurethane foam dressing to be developed in the 1970s[4].

Polyurethane foam dressings can be used as topical dressings and cavity wound dressings. Cavity wound dressings are available in pre-formed shapes – either circular or sausage-shaped – for use in cavity wounds. They contain chips of foam encapsulated within a layer of thin, conformable, perforated polymeric film.

Exudate passes through the outer layer and is held within the foam chips (eg Allevyn Cavity devices, Smith & Nephew)[4]. In addition, some foam dressings have an adhesive frame, which provides a waterproof backing (eg Allevyn Adhesive, Smith & Nephew; Lyofoam Adhesive, Mölnlycke HealthCare; Tegaderm Foam Adhesive Dressing, 3M) and there are also charcoal-impregnated foam dressings, such as Lyofoam C (Mölnlycke HealthCare)[5,6].

A polyurethane foam dressing is also used as part of the structural components of a negative pressure wound therapy system (V.A.C.® Therapy, KCI). These foams are available in two forms, dependent on the wound type. The black foam (V.A.C.® GranuFoam, KCI) is composed of a polyurethane foam with a hydrophobic, reticulated open-cell structure (400 to 600µm). This affords uniform distribution of negative pressure and is used in highly exuding wounds and deep cavity wounds[7].

The white foam (V.A.C.® WhiteFoam, KCI) is composed of a polyvinyl alcohol foam, with a hydrophilic (saline moistened), non-reticulated, higher-density cell structure (200-1000µm). This foam type prevents granulating skin tissue growing into the dressing and is easier to handle when placing in and removing from tunnels and small cavities because of its high tensile strength. It is non-adherent, prevents damage to the periwound skin on removal, and promotes graft survival[7].

A number of foam and foam-like dressings incorporate silver into the foam structure and release various levels of silver into the wound and/or hold the silver within the structure of the foam to kill bacteria as they are absorbed (eg Acticoat Moisture Control, Smith & Nephew; Allevyn Ag, Smith & Nephew; Mepliex Ag, Mölnlycke Health Care; Contreet, Coloplast; Biatain Ag, Coloplast).

Silicone foam dressings

Silicone foam dressings were first developed in the 1950s and were mostly used in pilonidal sinus cavity wounds[4].

Silastic foam (Dow Corning) was introduced in the 1970s and comprises a two-component product presented as two separate liquids, a polymer and a catalyst. When mixed together and poured into a cavity wound, they react, releasing heat and expanding to form a more solid structure that conforms to the shape of the cavity. Silastic foam is able to expand to about four times its original volume. The dressings are able to absorb exudate into the air spaces within the structure in a similar manner to other foam dressings.

The first cavity foam dressings required daily removal. These were then decontaminated with an aqueous antiseptic solution such as chlorhexidine, rinsed and replaced in the cavity. The product was used in this manner for about seven days and then replaced with a newly-formed foam as the cavity contracted in size.

Page points

1. *True foams draw fluid into the air spaces by capillary action, which is held within the structure of the dressing*
2. *Pseudo-foams or hydroactive dressings draw fluid in and expand to retain it within the dressing*
3. *Polyurethane dressings are 'true foams' and can be used as topical dressings and cavity wound dressings and are available in a variety of pre-formed shapes*
4. *Polyurethane foam dressings contain chips that hold the exudate*
5. *These dressings are available for use with NPWT and some may incorporate silver into the foam structure*
6. *Silicone dressings absorb exudate into air spaces within the foam and are able to expand to conform to the shape of a cavity*

References

5. Sussman G. Wound dressings: removing the confusion. *Australian J Podiatric Med* 1998; 32(4): 145-48.
6. Sussman G. Management of the wound environment with dressings and topical agents. In: Sussman C, Bates-Jensen B, editors. *Wound Care: A Collaborative Practice Manual for Health Professional, 3rd edition.* Philadelphia, PA: Lippincott Williams & Wilkins, 2001: 257-70.
7. Banwell P (Ed). V.A.C.® Therapy Clinical Guidelines. A reference source for clinicians. © KCI Licensing Inc. September 2007.

Page points

1. *Modern soft silicone dressings incorporate a light adhesive on the foam surface to allow removal without damaging fragile skin*
2. *Hydroactive dressings are 'pseudo-foams' and are able to absorb high levels of exudate*

Useful links

3M Healthcare
B. Braun
Coloplast
Covidien
Hartmann
KCI
Medline Industries
Mölnlycke Health Care
Smith & Nephew
Systagenix Wound Management
Vygon

Modern products are easier and quicker to prepare and can remain *in situ* for up to a week. Cavi-Care (Smith & Nephew), for example, is a version of the silastic foam used in post-pilonidal sinus excision and in some types of dehisced surgical wounds.

A more recent innovation was the introduction of a soft silicone with a light adhesive on the foam surface. This allows the dressing to remain in place, but can be removed without any risk of damage to fragile skin (eg Mepilex, Mölnlycke Health Care; Allevyn Gentle, Smith & Nephew). Such dressings are of particular value in patients with fragile skin and can help to reduce the pain and discomfort at dressing changes[5,6].

Pseudo-foams (hydroactive polymers)

Clinicians should be aware that a number of dressings are inaccurately called foam dressings and have been marketed as 'foam-like' dressings. However, they are in fact absorbent polymers. Their mode of action differs from real foams in that fluid is drawn into the structure of the polymer, which expands, trapping the exudate within the dressing. Some of these products may absorb 20 to 30 times their weight in exudate. They should therefore more accurately be described as hydroactive dressings or pseudo-foam dressings. This type of foam-like dressing may be able to absorb more exudate than some true foams.

Hydroactive dressings are designed for wounds producing medium to high exudate. These multi-layered highly absorbent polymer dressings, some with an adhesive waterproof outer layer, have a similar action to hydrocolloids in that they absorb exudate into the polymers of the dressing. However, instead of forming a gel in contact with exudate, the wound fluid is trapped within the polymer structure itself and continues to expand as more exudate is absorbed. The surface of the product interfaces with the wound, maintaining a moist environment. The dressing is highly absorbent, waterproof, expandable and leaves no residue.

Hydroactive dressings are indicated for use in highly exuding surface and cavity wounds including leg ulcers, pressure ulcers and minor burns. They are particularly useful over joints such as elbows, knees, fingers and toes because of their ability to expand or contract without causing constriction. Hydroactive dressings are not indicated for dry or lightly exuding wounds (eg Cutinova Hydro, Smith & Nephew; Biatain, Coloplast; Tielle, Systagenix; TenderWet Active, Medline Industries).

Some confusion arose when the range of Cutinova dressings changed ownership from BDF to Smith & Nephew. Apart from Cutinova Hydro, which retained its name, all other dressings in the range were renamed. Cutinova Thin became Allevyn Thin, Cutinova Foam became Allevyn Compression and Cutinova Cavity became Allevyn Plus Cavity. The original Allevyn range are true foams, whereas the Cutinova range are hydroactive polymers or pseudo-foams[5,6].

GLOSSARY

Hydrophobic
Repels water molecules

Hydrophilic
Attracts water molecules

Capillary action
The process of drawing up fluid through a dressing's contact layer and transferring it across the dressing. The aqueous component of the absorbed fluid evaporates into the larger cells in the back of the dressing and is lost as water vapour to the environment [4]

Polymers
A macromolecule composed of a large number of repeating monomers such as polystyrene (whose name means many styrene molecules)

Polyurethane
On the most frequently used of all polymers in dressings consisting of a chain or organic units joined by urethane links. It is very versatile and can be found in many forms, including:
- Films, such as Opsite (Smith & Nephew) and Tegaderm (3M)
- Foams, such as Lyofoam (Mölnlycke Health Care) and Allevyn (Smith & Nephew)
- Gels, such as AquaClear (Hartmann)
- Hydroactive dressings, such as Cutinova Hydro (Smith & Nephew)

Silicone
Silicones are man-made polymers that include silicon together with carbon, hydrogen, oxygen and sometimes other chemical elements. They are typically heat-resistant, nonstick and rubber-like

CONCLUSION

Foam dressing products play an important role as both primary and secondary dressings in moderately to severely exuding wounds. Foam is a modern dressing with its roots in ancient medicine and incorporates many of the properties of Turner's ideal dressing, which allows their use in a wide range of wound types.

AUTHOR DETAILS

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Expert Commentary

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This paper gives an unusual and highly technical perspective on foam dressings and clinicians reading it should know that their use in practice is in fact quite straightforward. 'Foam' dressings, whatever their chemical components, are well recognised as soft spongy materials that are both clinician and patient friendly. They are used for their absorptive properties with a clear understanding that some products absorb more than others (sometimes denoted by the manufacturer adding terms such as 'lite' or 'plus' or similar to the product name). It is also understood that some brands are better absorbers and retainers of fluid than others.

It is important for clinicians to have an accurate understanding of the concept of fluid management – the combination of absorption and transpiration – because this is important in practice. If a product relies on vapour release it is vital that the clinician is aware that other products should not be layered on top as this may impede the dressing's action.

For senior clinicians an understanding of the technology as described here is important as they will need to decide which products to include in their formularies. But this information also needs to be simply translated so that the 'average' clinician knows roughly how much fluid different products absorb and what to do to get the best from them. For example, some foam dressings may not be suitable for use under compression bandaging and some should not be covered with further occlusive or semi-occlusive dressings such as films. However, for the average clinician, the distinction between absorbing fluid into spaces or into fibres is probably a step too far and the use of terminology such as 'pseudo foam' or 'foam-like' products is possibly not helpful unless there is a very clear reason for understanding the distinction between these.

More published research is needed regarding the use of a foam in combination with a hydrogel. It could be argued that the foam would absorb the fluid from the gel, reducing its ability to absorb exudate and the capacity of the hydrogel to rehydrate the wound, unless additional gel was applied in recognition of this.

For patients and clinicians, some of the benefits of foams are their ability to conform and their softness (or comfort), which gives them advantages over many other product groups. The addition of a soft silicone layer to some products adds to this patient comfort by removing the trauma at dressing changes. The broad range of brand extensions available means that there is now a foam for almost every situation. Thus there are foam dressings available for wounds producing very low quantities of exudate through to those suitable for very highly exuding wounds. There are also products designed for fragile wounds and others for wounds that need an adhesive seal and waterproofing because a patient is incontinent or simply wishes to bathe or shower.

The main benefit of foam dressings in practice, though, is their simplicity and familiarity. There is nothing complex about using a foam dressing, as long as a dressing with the correct absorbency is chosen. You simply peel and stick. In a world where care is increasingly being provided by unqualified practitioners and by the patients or carers themselves, it is important that a product 'does no harm' in addition to its clinical benefit and this is why foam dressings are so widely used.