

# World Wide Wounds

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## Atraumatic dressings

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**The ability to remove a dressing without causing trauma to the wound and surrounding skin or pain to the patient is an important feature in the performance of that product. Over the years dressings with a variety of different types of wound contact layers have been developed that aim to reduce adherence to a drying wound. This article discusses the causes of traumatic injuries associated with the removal of dressings and proposes that the term 'atraumatic dressings' be adopted to describe products that do not cause such problems in clinical practice.**

**The article also contains a review of the literature relating to a new category of products, based upon soft silicone technology, which is claimed to impart properties to the dressing that makes them ideally suited for the treatment of most types of wounds where adherence or secondary trauma has been identified as a real or potential problem.**

Sponsored by an educational grant from Mölnlycke Health Care.

# Atraumatic dressings

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## KEYPOINTS

1. In a wound management context, the terms 'adherent' and 'adhesive' are sometimes used interchangeably. This causes confusion and can lead to a misunderstanding of the properties of the products concerned.
2. The term 'adherence' describes the interaction between a dressing and the wound, whilst the term 'adhesive' should be used to describe the interaction that takes place between the dressing and the intact peri-wound skin.
3. Some products, such as island dressings, have a so-called 'non-adherent' or 'low-adherent' pad located in the centre of an adhesive retention layer and are therefore described as non-adherent, low-adherent or adhesive. Depending upon the nature of the wound contact layer and the strength of the adhesive bond formed between the dressing and the skin, removal of such dressings may damage the fragile, newly-formed epithelium leading to extended healing times and/or cause further trauma to the surrounding skin.
4. A new term 'atraumatic dressings' is proposed to take account of both these factors and more accurately define products which, on removal, do not cause trauma either to newly formed tissue or to the peri-wound skin. Dressings coated with soft silicone appear to meet both these criteria and could therefore reasonably be described in this way.

## KEYWORDS

**NON-ADHERENT DRESSINGS ADHERENT DRESSINGS ADHESION WOUND PAIN WOUND TRAUMA SOFT SILICONE TECHNOLOGY ATRAUMATIC DRESSINGS**

## INTRODUCTION

When Winter published his seminal paper in 1962 on the effect of occlusion upon the rate of epithelialisation of superficial wounds in the young domestic pig<sup>1</sup>, he began a new chapter in our understanding of the mechanisms by which wounds heal, and the influence that dressings can have upon this process. Based upon the results of this and later work, he identified a number of criteria that he believed characterised a good surgical dressing<sup>2</sup> (Box 1).

Although Winter was referring to the properties of a single dressing, these performance criteria are equally applicable to a dressing system which comprises a primary wound contact layer, some form of secondary absorbent layer and an appropriate retention layer.

There are significant practical advantages in separating the functions of the primary wound contact layer from those of the secondary absorbent layer, as this provides the clinician with a degree of flexibility when selecting or constructing a dressing system for a particular wound at a given stage in the healing cycle. The important contribution made by the secondary dressing is often overlooked during this selection process, but can be vital in determining the success or otherwise of a particular treatment, especially when using products such as hydrogels or alginate sheets<sup>3</sup>.

This review considers the key aspects of dressing performance as described by Winter, which relate to damage to the

healing wound and surrounding skin. Once adherence has occurred, dressing removal can be very painful and may cause damage to the fragile, newly-formed epithelium leading to extended healing times and an increased risk of scar tissue formation.

The first 'modern' dressing to be produced as a low-adherent wound contact layer was developed by Lumiere during World War I. Called 'tulle gras', it was made from an open-weave cloth coated with soft paraffin containing 1.25% Balsam of Peru (as a mild antiseptic). Following reports of skin reactions in some patients, Balsam of Peru was eventually omitted from the formulation. A review of the development of tulle gras type dressings has been published previously<sup>4</sup>.

In recognising the limitations of paraffin gauze, some manufacturers have developed new types of wound contact materials that may be used as 'stand alone' dressings or as facing layers for absorbent dressing pads. These include perforated or vacuum-ruptured plastic films, foams, finely woven nylon mesh, heat-calendered non-woven fabrics made from hydrophobic fibres, silicone-coated knitted fabrics (e.g. NA Ultra), and even a non-woven material coated with metallic aluminium. Such dressings have been described by their manufacturers and others as 'non-adherent' or more accurately 'low-adherent'. The structure and use of many of these low-adherent materials has been reviewed previously<sup>5</sup>.

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## MECHANISMS OF ADHERENCE

According to Winter, the main cause of adherence of dressings to wounds is 'the mechanical key formed by proteinaceous exudate, which on drying becomes a good glue'. He also recognised a secondary mechanism of adherence in which new tissue grows into the structure of the dressing and thus incorporates some of the components into the healing wound.

Using a pig model, Winter examined the performance of a commonly used perforated plastic film dressing (Melolin). After several days the film became firmly attached to the wound as columns of exudate connecting the dressing to the wound surface dried out. Histological studies showed that after extended use regular patches of damage were visible on areas corresponding to the perforations, although the epidermis immediately beneath the plastic film remained intact. Winter's view was that as new epidermis 'floats on the wound surface' in the first week or so, it can be damaged as easily by removing a lightly adherent dressing as one that is very firmly stuck. He concluded that 'the actual adherence is not particularly relevant; it is an all-or-nothing phenomenon'.

This observation calls into question the value of the term 'low-adherent', as this is commonly understood to describe the force required to remove the dressing rather than quantify the degree of damage caused by its removal. Whilst there may be some correlation between the two parameters, this may not be as reliable as is generally assumed.

Irrespective of the nature of the wound contact layer, most dressings also require the use of a bandage or some form of adhesive layer to keep them in position. This adhesive layer may be separate, or be an integral part of the product itself, forming an island dressing in which the low-adherent pad is

### Box 1: Characteristics of a good surgical dressing. Adapted from Winter 1962

Creates ideal microclimate for most rapid and effective healing (prevents dehydration and is permeable to oxygen)  
Is sterilisable  
Provides good absorption of blood and exudate  
Protects against secondary infection  
Has sufficient mechanical protection to wound  
Is non-adherent  
Is non-toxic  
Is non-allergenic or sensitising  
Does not shed loose material into wound  
Conforms to anatomical contours  
Resists tearing  
Resists soiling  
Is non-flammable  
Its properties remain constant in a range of temperatures and humidities  
Has a long shelf life  
Has small bulk (hospital storage problem)  
Accepts and releases medicaments  
Is cost effective

located centrally on a sheet of plastic, foam, or fabric, coated with adhesive. Whilst this adhesive area does not come into contact with the wound and therefore cannot cause damage to the newly formed tissue, repeatedly removing and replacing such dressings can damage the surrounding skin, especially if the patient is elderly or the skin is particularly fragile.

A number of surveys have been undertaken in recent years to identify practitioners' views on wound related pain and trauma. The first of these was a postal survey conducted in the UK in which questionnaires were sent to 1,000 nurses, 373 of whom responded<sup>6</sup>. The results indicated that although prevention of pain and/or trauma is considered by the majority of practitioners to be their principal consideration when changing dressings, there is no consensus about the types of products that are best able to overcome these problems. Of particular concern was the fact that 39% of those who responded were not aware of any products specifically designed to overcome the problems of adherence, whilst the remaining 60% identified no less than 28 dressings, most of which are not claimed by their manufacturers to possess such a property. The reason for this confusion is not clear, but it may be due in part to the somewhat non-specific and poorly defined nature of the term 'low-adherent' and a failure to appreciate the performance characteristics of many of the dressings in current use.

Findings from this survey prompted a larger international survey<sup>7</sup>, in which questionnaires were sent to 14,657 practitioners in 11 countries including the UK. A total of 3,918 questionnaires were completed and returned (27% response rate). The results of this survey were generally in agreement with those of the first in that pain and trauma were ranked as the most important factors to consider when changing a dressing. Pain was most commonly associated with dressing changes and was related to dressings drying out or adhering to the wound bed, factors that were also considered to be responsible for wound trauma. Perhaps not surprisingly, pain-free removal and non-adherence were considered to be the most important characteristics of a dressing and products such as hydrogels, gel-forming fibres and the soft silicone products were generally highly rated in this regard.

In terms of their ability to prevent pain and trauma, dressings fall broadly into three main categories as shown below, although it is recognised that the value of these definitions is somewhat limited, as adherence of a dressing to a wound can be influenced by many different factors:

- **Adherent** – those which most practitioners would consider to be likely to adhere to any type of drying wound. For example simple dressing pads or cotton gauze.
- **Low-adherent** – products with a wound-contact surface that is designed specifically to reduce adherence, for example some absorbent wound dressings and other products that are designed specifically for this purpose as previously described.

- **Non-adherent** – those that maintain a moist gel layer over the wound, for example hydrocolloids, hydrogels and alginates. These would not be expected to adhere provided that they are not allowed to dry out. The performance of some of these materials will therefore be largely determined by the choice of a secondary dressing where this is required.

It is important to recognise that this simple classification only relates to the interaction that takes place between the dressing and the wound itself, it takes no account of possible trauma caused to the surrounding skin by removal of adhesive products such as hydrocolloids, adhesive films and self-adhesive foams. It is proposed that a new term 'atraumatic dressings' be adopted to take account of these factors and more accurately define products which, on removal, do not cause trauma either to newly formed tissue or to the peri-wound skin.

Recently a category of dressings has been introduced which are claimed to overcome the twin problems of adherence to the wound and damage to the surrounding skin. They rely upon an adhesive technology involving the use of 'soft' silicone, a material that adheres readily to intact dry skin but does not stick to the surface of a moist wound and does not cause damage upon removal<sup>8</sup>. The literature relating to this new group of products is reviewed below.

#### SOFT SILICONE DRESSINGS: A LITERATURE REVIEW

##### Mepitel

Mepitel, the first product of this category to be introduced, is a porous, semi-transparent wound contact layer consisting of a flexible polyamide net coated with soft silicone. The nature of the bond that forms between Mepitel and the skin surface allows the dressing to be removed without causing trauma or pain, or damaging delicate new tissue around the wound margin. The gentle adhesion between the dressing and the intact skin inhibits the movement of exudate from the wound on to the surrounding area and helps to prevent maceration.

Although Mepitel is non-absorbent, it contains 14 pores/cm<sup>2</sup>, each 1.2mm in diameter, which allow the passage of exudate from the wound into a secondary absorbent dressing.

The dressing is supplied between two layers of plastic film, which must be removed before use. Prior to application, if clinically indicated, the wound should be cleansed and the surrounding skin thoroughly dried. A dressing should be selected that overlaps the wound margin by at least two centimetres and, if necessary, this may be cut to size or shape before removal of the protective films. If more than one piece of Mepitel is required, the dressings may be partially overlapped, ensuring that the pores are not blocked.

Moistening gloves with sterile water or saline will help to stop the dressing sticking to the fingers and ease application. Once in position the dressing should be smoothed into place, ensuring a good seal with the surrounding skin, and covered with an appropriate absorbent secondary dressing and a suitable fixation device or bandage.

##### Clinical use of Mepitel

Vloemans and Kreis<sup>9</sup>, in an open prospective study, evaluated Mepitel as an alternative to conventional treatments including paraffin gauze, for the fixation of skin grafts in children. Using Mepitel, they found that changing the outer absorbent dressing was painless, as was the final removal of the Mepitel itself, requiring no analgesia or anaesthesia. Graft take rates were good; in 42 out of 45 cases the take was almost complete (>95%). Because the dressing requires a margin of healthy skin, its use was limited to minor skin grafts (maximum 6% of the total body area) and the authors suggested that it could only be used on flat or convex areas; on concave areas firm fixation is either difficult or impossible.

Platt *et al*<sup>10</sup> also compared Mepitel with paraffin gauze as the first dressing layer applied to 38 newly grafted wounds in a prospective randomised trial. At the first postoperative dressing change all patients in the paraffin gauze group experienced some degree of pain on dressing removal. In contrast, 53% of patients dressed with Mepitel experienced no pain.

Adamietz *et al*<sup>11</sup> in a prospective study involving 21 patients, evaluated Mepitel as a method of protecting skin during radiotherapy for malignant disease. In seven of the patients treated the skin was intact, but five patients had epitheliolysis, and nine patients had ulcers, seven of which were malignant. The silicone-coated net was shown to cause no additional irritation of irradiated skin and it was suitable for the treatment of both dry desquamation and the moist desquamation that occurs with high doses of radiation. This latter condition is particularly difficult to manage with conventional dressings as the skin is very fragile and easily damaged by the removal of dressings that can adhere to the drying serous fluid on the skin surface. When applied over ulcerative wounds, the dressing was easy to remove and did not cause damage to the newly formed epithelium.

The use of Mepitel in more extensive wounds resulting from wide local excision of skin tumours was investigated by Dahlström<sup>12</sup>. Mepitel was compared with paraffin gauze as a temporary dressing before split skin grafting in a prospective randomised controlled trial involving 64 patients. After excision of the tumour, the wound was dressed according to the randomisation schedule and covered with a saline-soaked absorbent secondary dressing. All dressings were removed on the following day and an unmeshed split skin graft applied, which was left exposed. The principal outcome

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variables of the study, determined upon removal of the primary dressing, were adherence, bleeding, pain and the time taken for removal. Significant differences were detected between the two treatments in favour of Mepitel for all parameters examined. The author concluded that Mepitel was 'an optimum temporary dressing for delayed split skin grafting'.

The reduction in pain associated with the use of Mepitel, makes it particularly useful for the treatment of paediatric patients. Two published studies have compared Mepitel with silver sulphadiazine (SSD) in treatment of burns and scalds and a third in the treatment of fingertip injuries.

Gotschall *et al*<sup>13</sup> performed a randomised clinical trial in children with partial-thickness burns caused by hot non-viscous fluids involving less than 15% total body surface area. Sixty-three children were assigned treatment with either Mepitel or SSD. Data were collected on time to wound healing, pain at dressing change, infection, and resource use. Wounds treated with Mepitel healed significantly faster than the controls and patients required 75% fewer dressing changes. Time to 25% epithelialisation was 3.5 days for Mepitel dressed wounds and 6.7 days for the control, a reduction of 48%. The median time for complete healing for Mepitel-treated wounds was 10.5 days and for SSD-treated wounds 27.6 days. Wounds dressed with Mepitel exhibited less eschar formation, and patients experienced less pain at dressing change. There were also financial savings associated with the use of Mepitel. Although no significant difference in wound infection rates was recorded between the two treatment groups, wounds dressed with Mepitel yielded higher levels of bacteria and a wider variety of species on microbiological examination. The authors concluded that 'the use of Mepitel represents a significant advance in the treatment of partial-thickness burns in children', but recommended that 'additional effort is required to determine treatment protocols that optimise efficacy while providing opportunities to adequately monitor wound healing and infection'.

In the second study Bugmann *et al*<sup>14</sup> described a prospective randomised pilot investigation involving 76 children with previously untreated burns less than 24 hours old. After randomisation 41 children were treated with Mepitel and 35 with SSD. Five children were subsequently withdrawn from both groups because they underwent tangential skin excisions and skin graft. Initial debridement and cleansing were the same for both treatment groups. In the Mepitel group, one or more sheets of the dressing were then applied directly to the burn in a single layer that overlapped onto the intact skin and covered with gauze soaked in chlorhexidine solution. Wounds in the control group were covered with a thick layer of SSD covered by a piece of paraffin gauze followed by a layer of absorbent gauze. Wounds in both treatment groups were redressed every two

to three days until complete healing was achieved. As in the previous study, removal of Mepitel was easy and atraumatic. It also produced a significantly reduced healing time compared to SSD-treated wounds: 7.6 days and 11.3 days respectively. The authors suggested that the faster healing time found in the Mepitel group may be related to a direct effect of silicone on epithelial growth or to a decrease in surface-cell damage compared to the SSD group.

Hand injuries are common in children and can be a source of considerable pain and stress to the patient. In a prospective randomised trial, O'Donovan *et al*<sup>15</sup> compared Mepitel with paraffin gauze in the treatment of 45 children with isolated fingertip injuries. Following randomisation, 20 children received Mepitel and 25 paraffin gauze. Although no differences were found in healing rates, important statistically significant differences were recorded in both adherence of the dressing and the stress exhibited by the patient over the first three weeks of treatment, leading the authors to conclude that Mepitel dressings offer a less painful and easier alternative to traditional dressings for this indication.

In a second paper involving the management of hand wounds, Mepitel was compared with paraffin gauze and Adaptic, an apertured cellulose acetate non-adherent dressing coated with a petrolatum emulsion<sup>16</sup>. A total of 108 patients undergoing hand surgery were recruited to the study and randomly assigned to treatment with one of the three products under examination. The selected primary dressing was covered with gauze and a crepe bandage together with a plaster of Paris splint as appropriate. The dressing was left intact until the first follow-up appointment. The performance of each dressing was judged in terms of ease of application and removal, amount of blood on secondary dressing, appearance and condition of the wound and pain experienced during dressing removal. Removal of Adaptic and Mepitel was reported to be 'very easy' for 88% and 84% of wounds respectively, compared to 57% of wounds dressed with paraffin gauze. This difference achieved significance for Adaptic but not Mepitel. Pain scores were also lower for Adaptic-treated patients, 75% of whom experienced no pain compared to 56% for Mepitel and 51% for paraffin gauze. All dressings were more difficult to remove from raw tissue and although Mepitel appeared to perform better than the other products in this situation, insufficient numbers of subjects with this type of wound prevented further analysis. The reason for the relatively poor pain scores achieved with Mepitel was discussed by the authors who suggested that this was probably due to the dressing adhering to the intact but bruised or injured skin around the wound. The authors concluded that of the three dressings, Adaptic had significant advantages over the other products examined in terms of performance and cost, and recommended it as the dressing of choice for this particular application. Mepitel, they suggested, could be used with advantage on wounds such as raw nail beds, as reported

some years earlier by Williams<sup>17</sup> who also described its use following traumatic amputation of the fingers, and in the treatment of a dehiscid abdominal wound.

Taylor<sup>18</sup> recorded how the dressing improved the quality of life in a patient with severe mycosis fungoides, a progressive skin tumour, which resulted in the formation of extensive ulceration over her scalp, neck and back. Gates<sup>19</sup> similarly described how the dressing reduced the pain from an extensive arterial leg ulcer and improved the condition of the surrounding skin.

The genetic skin disorder, epidermolysis bullosa (EB) is particularly difficult to manage. Patients typically develop blisters, often as a result of minor trauma, which is caused by separation of the component layers of the skin. Several types of EB have been described: intra-epidermal, junctional (between the epidermis and dermis) and intradermal<sup>20</sup>. Depending upon the type, the symptoms vary from mild seasonal blistering to a life-threatening condition, often with large areas of skin loss, that can involve the oral, gastrointestinal, or respiratory tract. Because the skin of individuals with EB is so fragile, the use of traditional adhesive dressings should be avoided, as removal may cause further traumatic injuries. In some forms of EB it may even be necessary to dress non-blistered areas to prevent blister formation. Once a blister has formed, it is recommended that it be lanced and all fluid gently expelled to prevent it from extending. At this stage a dressing which does not damage the skin should be applied and held in place with a bandage – not adhesive tape. Mepitel is particularly useful, both for the treatment of intact blisters and areas where the epidermis has been lost. This is because it stays in place and prevents the type of frictional damage that can occur as a result of dressing slippage.

Clinical literature produced by the manufacturer also records that Mepitel has been used successfully to treat skin tears, burns, donor sites, and punch grafts (see [www.tendra.com](http://www.tendra.com)).

In summary, clinical experience with Mepitel suggests that in order to function correctly, the dressing needs to be kept in intimate contact with the surface of the wound. Wounds on convex areas present few problems but on concave, contoured or jointed areas, adequate padding must be applied to exclude voids beneath the dressing where fluid might accumulate. Where clinically indicated, topical steroids or antimicrobial agents can be applied either over or under Mepitel (see [www.dressings.org/Dressings/mepitel.html](http://www.dressings.org/Dressings/mepitel.html)). Depending on the nature and condition of the wound, Mepitel may be left in place for extended periods, up to 7-10 days in some instances, but the outer absorbent layer should be changed more frequently as required. When Mepitel is used for the fixation of skin grafts and protection of blisters, it is recommended that the dressing should not

be changed before the fifth day post-application. As with all types of dressings, wounds should be regularly monitored for signs of infection or deterioration. When used on bleeding wounds, or wounds producing high viscosity exudate, Mepitel should be covered with a moist absorbent dressing pad. If Mepitel is used on burns treated with meshed grafts, or applied after facial resurfacing, imprints can occur if excess pressure is placed upon the dressing. Following facial resurfacing it is recommended that the dressing be lifted and repositioned at least every second day.

#### **Mepilex, Mepilex Border and Mepilex Transfer**

**Mepilex** is an absorbent dressing made from polyurethane foam, the outer surface of which is bonded to a vapour-permeable polyurethane membrane that acts as a barrier to liquid and micro-organisms. This membrane, which has a wrinkled appearance, is applied in this way to accommodate the slight swelling that occurs as the dressing absorbs exudate. The inner surface of the foam is coated with a layer of soft silicone that helps to hold the dressing in place without sticking to the surface of the wound or causing trauma to delicate new tissue on removal.

**Mepilex Border** is an absorbent, self-adhesive island dressing with a perforated soft silicone adhesive wound contact layer. The absorbent core of the dressing consists of three components: a thin sheet of polyurethane foam; a piece of non-woven fabric; and a layer of super-absorbent polyacrylate fibres. The first layer, the polyurethane foam, transports the exudate away from the wound to the second layer. This, non-woven layer, spreads the exudate horizontally and transports it to the third layer, a highly absorbent material on the surface of the dressing. The vapour permeable backing film evaporates the exudate from the wound pad. This fluid handling system minimises the risk of maceration. In addition, the soft silicone adhesion layer helps to prevent maceration by inhibiting the lateral movement of exudate from the wound to the surrounding skin.

Both Mepilex and Mepilex Border are promoted for use on many types of exuding wounds including leg and pressure ulcers, and traumatic wounds with resulting skin loss. They may also be used under compression bandaging.

**Mepilex Transfer** is a thin, conformable soft silicone dressing that conforms closely to the wound and the surrounding skin, even where the surface is uneven. The seal that is formed between the dressing and the intact skin ensures that exudate moves vertically through the dressing into a secondary absorbent pad.

All the dressings in this range will, to some degree, maintain a moist wound environment while minimising the risk of maceration, although in the case of Mepitel and Mepilex Transfer, the moisture content of the wound will be greatly

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influenced by the choice of secondary dressing. Mepilex and Mepilex Border have an intrinsic absorbent layer and do not require secondary dressings (see [www.tendra.com](http://www.tendra.com)).

A laboratory-based study<sup>8</sup>, examined the effects of repeated application and removal of Mepilex Border to test sites on the backs of volunteers compared with that of four other adhesive dressings: Allevyn Adhesive, Biatain Adhesive, Tielle and Duoderm Extra Thin. Dressings were changed every 24 hours and the force required to remove each sample was determined using a jig that removed each sample at a constant speed of 25mm per second with a peel angle of 135 degrees. The results indicated that although there was reasonable correlation between the two parameters for most of the dressings examined, unexplained results were obtained with Biatain adhesive, which caused a significant loss of stratum corneum but had the lowest peel force of all the products examined. Mepilex Border, which had the second lowest peel force, caused the least damage to the stratum corneum with statistical significance, producing results that were no different to the control site. Although this study does not reflect normal usage of these dressings (i.e. left in place for several days), it does demonstrate the 'skin-friendly' nature of soft silicone.

## CONCLUSION

The literature cited in this review clearly identifies that pain and trauma associated with dressing removal is of major concern to patients and healthcare professionals alike.

It is also clear that there is considerable confusion in the minds of users concerning the use of terms such as adherent and adhesive, which if used inappropriately, will provide a totally false impression of the performance of a dressing or family of dressings. The term 'low-adherent' seems particularly inappropriate or misleading if applied to a self-adhesive dressing unless it is fully understood that – in this context – adherence, or the lack of it, relates specifically and solely to the interaction between the dressing and the wound.

It is therefore proposed that a new term 'atraumatic dressings' be adopted to describe products which, on removal, do not cause trauma either to newly formed tissue or to the peri-wound skin. This term can be applied both to adhesive and non-adhesive dressings. It should be the responsibility of the manufacturers of such dressings to demonstrate by means of clinical studies that their products comply with this requirement before they are described in this way. The results of the current literature review clearly suggest that dressings coated with soft silicone appear to meet this requirement and could therefore reasonably be included in this group.

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World Wide Wounds is jointly published by SMTL, Wales and  
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This article is sponsored by  
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soft silicone adhesive  
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