

SILVERCEL® Non-Adherent

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Volume 1 | Issue 5 | November 2010 www.woundsinternational.com



Introduction

This article describes in detail the composition, mode of action, supporting evidence and practical application of the silver-containing antimicrobial dressing SILVERCEL® Non-Adherent. This dressing has been designed to eliminate the potential problems of adherence and fibre shed that may be associated with first generation fibrous wound dressings^{1,2}, while maintaining the ability to manage wound infection. With an ever-increasing choice of silver-containing dressings, it is important that clinicians understand the differences between them, and know how and when to use them for successful management of infected or at risk wounds.

*Authors: Clark R, Bradbury S.
Full author details can be found on page 6.*

What is SILVERCEL Non-Adherent?

SILVERCEL Non-Adherent is a sterile absorbent antimicrobial wound dressing for use in moderately to heavily exuding wounds and in wounds that are infected or at an increased risk of infection. It is designed to absorb wound exudate and contains silver-coated fibres (X-STATIC®) that have a broad spectrum of antimicrobial activity³. The dressing has an outer porous film layer designed to prevent adherence of the dressing to the wound and the shedding of fibres⁴. The non-adherent property can help to reduce pain at dressing changes⁵ and associated patient discomfort and anxiety.

SILVERCEL Non-Adherent is a next generation product that is closely related to the silver-containing alginate dressing, SILVERCEL. The difference between the two is that SILVERCEL Non-Adherent has an ethylene methyl acrylate (EMA) outer film layer that uses EasyLIFT™ Precision Film technology.

Why are non-adherence and minimising fibre shed important?

Dried out dressings and adherence of the dressing to the wound have been identified as the most important factors contributing to pain at dressing change⁶. In a survey of 2018 patients, 40.3% found pain at dressing change to be the worst part of living with a wound⁷.

In addition to causing pain, removal of dressings that have become adherent to tissues may cause damage to the wound bed or surrounding skin, and so have a detrimental effect on the

healing process⁸. Dressings that adhere to the wound bed may also result in additional practitioner time and use of resources.

Dressings containing fibres have long been recognised as having the potential to shed their fibres into the wound. Retained dressing fibres have been shown to act as inflammatory stimuli by inducing a foreign body reaction within wound tissue and so potentially perpetuating the inflammatory stage of wound healing^{2,9,10}.

How is SILVERCEL Non-Adherent made?

Production of the absorbent, antimicrobial core of the dressing is based on the manufacturing process for alginate fibres. Briefly, a solution of alginate is forced under pressure through a narrow opening into a bath containing calcium ions, where fibres are formed¹¹. The calcium in the bath forms cross links between alginate polymer strands that reduce the solubility of the fibres in water. Carboxymethyl cellulose (CMC) is introduced during this process to provide additional absorbency to the alginate fibres.

The alginate and CMC fibres are spun together and then blended with silver-coated fibres in processes known as carding and needling. The carding process creates a web of fibres that form a 'felt' and the needling process gives the dressing a coherent structure¹¹. The final dressing is produced by positioning a layer of perforated EasyLIFT™ Precision Film (EMA) either side of the alginate/CMC and silver-coated fibre non-woven material. This 'sandwich' is then exposed to heat and pressure. During the 'lamination' process, the film melts onto the outer layers of the alginate/CMC and silver-coated fibres, forming an irreversible attachment that contributes to dressing integrity. Once cooled, the resulting SILVERCEL Non-Adherent dressing is cut to size for packaging. It is supplied as a sterile, non-woven dressing in either a flat form or rope (packing) presentation.

Understanding the components of SILVERCEL Non-Adherent

The components of SILVERCEL Non-Adherent are listed in [Table 1](#).

| Component | Percentage of dressing by weight (%) | Function |
|--------------------------------|--------------------------------------|------------------------------------|
| High G calcium alginate | 36 | Absorption and tensile strength |
| Carboxymethyl cellulose (CMC) | 6 | Absorption |
| Silver-coated fibres | 28* | Antimicrobial |
| EasyLIFT™ Precision Film (EMA) | 30 | Non-adherence and tensile strength |

**Dressing contains 111mg silver/100cm²*

SILVERCEL® Non-Adherent

made easy



High G calcium alginate

Alginates are derived from seaweed and comprise large molecules that are hydrophilic (ie they have an affinity for binding to water)¹¹. Alginate molecules themselves do not have antimicrobial properties, but are readily combined with antimicrobial agents such as silver.

Calcium alginate is used most widely in wound dressings and contains variable proportions of M-type (mannuronic acid) and G-type (guluronic acid) calcium alginate. When exposed to liquid, eg wound exudate, the calcium ions are exchanged for sodium ions and the alginate becomes able to absorb water. The exchange of ions (and so rate of water absorption) occurs quickly with M-type alginate (which forms a soft, easily disrupted gel), but more slowly with G-type alginate (which tends to retain its structural integrity).

SILVERCEL Non-Adherent contains a high proportion of G-type alginate and therefore is able to absorb exudate while retaining structural integrity.

Carboxymethyl cellulose (CMC)

CMC is a derivative of cellulose and is a superabsorbent polymer¹². It is incorporated into SILVERCEL Non-Adherent to enhance the absorptive capacity of the dressing core.

Silver-coated fibres

The silver-coated fibres contain elemental silver. On contact with oxygen, the elemental silver is converted to silver oxide. When silver oxide dissolves in fluid (eg wound exudate), it dissociates into its separate components and releases positive silver ions (Ag⁺) (known as ionic silver). It is the silver ions that have antimicrobial action¹³.

EasyLIFT™ Precision Film (EMA)

EMA is a synthetic polymer that is well established in its use as a non-adherent wound contact layer¹⁴. In film form

(EasyLIFT™ Precision Film), the polymer is thin, flexible and strong, and has a smooth surface. The surface of the film has been shown in laboratory tests to have a very low propensity to stick to other surfaces¹⁵.

The film is perforated to allow fluid absorption into the central core of the dressing. The holes are evenly sized and spaced in a configuration that allows for optimal fluid absorption while retaining sufficient film to ensure low adherence and to limit the ability of the alginate/CMC and silver-coated fibres to move through the holes and onto the wound surface⁴ (Figure 1).

How does SILVERCEL Non-Adherent work as an antimicrobial dressing?

Despite the widespread use of silver as an antimicrobial agent, the exact mechanisms of action have not been fully determined¹⁶. Silver ions are thought to affect multiple sites within a bacterial cell by binding to negatively charged cell components, eg the cell wall, DNA and RNA. This disrupts the function of these cell elements and results in cell lysis and interference with electron transport, enzyme function and cell division³.

The antimicrobial action of SILVERCEL Non-Adherent relies on the absorption of wound exudate into the dressing, ensuring the availability of positive silver ions. The absorptive properties of the dressing^{17,18} help to manage the increased exudate production often associated with infected wounds, while maintaining the moist wound environment that assists wound healing and protecting the surrounding skin from the potentially damaging effects of exudate¹⁹.

Laboratory testing of SILVERCEL Non-Adherent has indicated that it is

effective against many common wound pathogens, including met(h)icillin-resistant *Staphylococcus aureus* (MRSA), met(h)icillin-resistant *Staphylococcus epidermidis* (MRSE) and vancomycin-resistant *Enterococcus* (VRE). It has also been shown to prevent and disrupt biofilms^{20,21}.

In vitro assessment has shown that the release of silver ions from SILVERCEL Non-Adherent is sustained for up to seven days, even when challenged with high levels of fluid (mimicking wound exudate)¹⁷. This is likely to be longer than the wear time of the dressing on an infected wound, but does suggest that the dressing could remain *in situ* for up to a week while maintaining its antimicrobial efficacy.

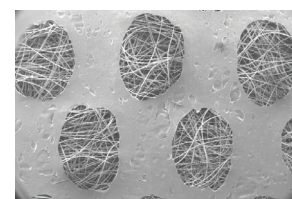
Why doesn't SILVERCEL Non-Adherent stick to the wound bed?

The perforated EasyLIFT™ Precision Film (EMA) outer layer of the dressing provides the non-adherent properties of SILVERCEL Non-Adherent.

In vitro tests examining the potential adherence of wound dressings to a fibrin clot have shown that SILVERCEL Non-Adherent was significantly less adherent when compared to similar products^{15,22}.

An *in vivo* study comparing SILVERCEL Non-Adherent with a Hydrofiber®

Figure 1 Magnified view of the surface of SILVERCEL Non-Adherent (with permission of Systagenix Wound Management)



The perforated EasyLIFT™ Precision Film (EMA) allows for optimal fluid absorption while assisting in preventing adherence and ensuring dressing integrity.

dressing has demonstrated, at the macroscopic level, less debris on the wound surface in the group treated with SILVERCEL Non-Adherent compared with the group treated with a Hydrofiber® dressing²³. Further observations from the same study at the microscopic level demonstrated reduced debris in wound tissues, minimal foreign body reactions and less tissue disruption in SILVERCEL Non-Adherent wounds compared with wounds treated with the Hydrofiber® dressing²³.

Together these data suggest that potential clinical benefits of SILVERCEL Non-Adherent may include reduced wound surface damage, reduced patient discomfort and faster dressing changes.

What is the evidence for use?

SILVERCEL, the absorbent, antimicrobial core of SILVERCEL Non-Adherent, has been assessed clinically in a number of studies (Table 2). Laboratory and clinical data indicate that it has good antimicrobial activity^{24,25}, high absorbent capacity²⁰, demonstrates absorption and retention of fluid in the presence of blood in the clinical situation²⁶, is well tolerated and can be used for a variety of wound types²⁵.

Clinical evaluation of SILVERCEL Non-Adherent to date includes a 20 patient comparator study⁵ and a number of case studies^{27,28} (Table 2). Outcomes measured included:

- **pain at dressing change**
- **adherence to wound**

Table 2 Summary of evidence for SILVERCEL and SILVERCEL Non-Adherent

| Reference | Title | Type | Findings |
|---|--|--|---|
| SILVERCEL | | | |
| Meaume S, Vallet D. <i>J Wound Care</i> 2005; 14(9): 411-19 ²⁹ | Evaluation of a silver-releasing hydroalgininate dressing in chronic wounds with signs of local infection | Multicentre RCT: SILVERCEL (n=51) vs alginate dressing (n=48); venous leg ulcers and pressure ulcers; 4 weeks | <ul style="list-style-type: none"> ▪ SILVERCEL was well tolerated, managed high levels of exudates, provided a moist environment and was easy to remove after saturation; no silver staining was detected in the test group ▪ More patients in the control group than in the SILVERCEL group were treated with systemic antibiotics at final visit (p=0.053) ▪ Four-week closure rate was significantly greater in the SILVERCEL group than in the control group (p=0.024) |
| Teot L, Maggio G, Barrett S. <i>Wounds UK</i> 2005; 1(2): 1-6 ²⁴ | The management of wounds using Silvercel hydroalgininate | Technical review with two case reports | <ul style="list-style-type: none"> ▪ SILVERCEL has proven <i>in vitro</i> activity against >150 micro-organisms isolated from humans ▪ In the clinical situation, SILVERCEL was able to handle heavy exudation |
| Di Leonardo A, Maggio G, Cupertino M, et al. <i>Wounds UK</i> 2006; 2(4): 122-24 ²⁶ | The use of SILVERCEL to dress excision wounds following burns surgery | Case report; 13 year old boy with extensive burns treated with SILVERCEL and Aquacel Ag | <ul style="list-style-type: none"> ▪ Both dressings absorbed and retained exudate ▪ Upon removal of the dressings, the wound bed was clean and suitable to receive skin autografts |
| Kingsley A (ed). <i>Wounds UK</i> 2005; supplement ³⁰ | SILVERCEL Hydroalgininate: a case study series | Case studies | <ul style="list-style-type: none"> ▪ Examples of use on a variety of wound types: pressure ulcers, venous leg ulcers, diabetic foot ulcers, acute wounds |
| Kammerlander G, Afarideh R, Baumgartner A, et al. <i>J Wound Care</i> 2008; 17(9): 384-88 ²⁵ | Clinical experiences of using a silver hydroalgininate dressing in Austria, Switzerland and Germany | Retrospective case series of 76 patients with wounds of varying aetiology treated with SILVERCEL for up to 33 days | <ul style="list-style-type: none"> ▪ 57 wounds were defined as locally infected at start of treatment; 72% showed no signs of infection after 33 days of treatment with SILVERCEL ▪ Healing: by 33 days 80% had improved and 8% were fully healed ▪ After 33 days there was a marked reduction in wound pain |
| SILVERCEL Non-Adherent | | | |
| Russell F. <i>Wounds UK</i> 2010; 6(1): 148 ²⁷ | The use of a new non-adherent silver hydroalgininate dressing in the treatment of a patient with a complex leg ulcer | Case report | <ul style="list-style-type: none"> ▪ Patient found SILVERCEL Non-Adherent comfortable and pain free on removal ▪ Clinicians found it easy to apply and remove ▪ SILVERCEL Non-Adherent was used under compression, was antimicrobial and left no residue in the wound bed |
| Stephens SA, Clark R, Del Bono M, Snyder R. <i>SAWC</i> , Orlando, 2010 ⁵ | From Lab to Leg – The importance of correlating <i>in-vitro</i> and <i>in-vivo</i> test systems to clinical experience | Poster describing 20 patient comparator study: SILVERCEL Non-Adherent and generic alginate | <ul style="list-style-type: none"> ▪ SILVERCEL Non-Adherent was non-adherent in 9/10 patients vs adherent in 10/10 in the generic alginate group ▪ No fibres were observed in SILVERCEL Non-Adherent patients, but were seen in 9/10 generic alginate patients ▪ No patients in the SILVERCEL Non-Adherent group experienced pain at dressing change vs pain ranging from none to very severe in the generic alginate group |
| Ivins N, Taylor AC, Harding KG. <i>CSSWC</i> , Orlando, 2010 ²⁸ | A series of case studies using a silver non adherent dressing | Poster describing non-comparative case series in 13 patients with wounds of different aetiologies treated with SILVERCEL Non-Adherent for up to 12 weeks | <ul style="list-style-type: none"> ▪ Only one of 13 patients required systemic antibiotics ▪ No reports of dressing adherence or dressing residue ▪ Clinicians found SILVERCEL Non-Adherent easy to apply and remove ▪ In over 50% of patients wound exudate level was reduced ▪ Seven patients reported reductions in ulcer-related pain ▪ Two wounds healed completely within 2 months of starting treatment |

PRODUCTS FOR PRACTICE

- ease of application
- requirement for saline soak prior to removal
- presence of macroscopic fibres on wound bed.

Results from a series of case studies performed recently have indicated that the dressing was useful in the management of locally infected wounds in patients with complex concurrent medical problems and a history of recurrent wound infections²⁸. In several cases, the patients experienced a decrease in wound pain when using SILVERCEL Non-Adherent dressing and reduced need for analgesia. The dressing was easy to apply and remove, with no resulting trauma or adherent fibres observed in the wound bed.

In clinical practice, SILVERCEL Non-Adherent has demonstrated suitability for use under compression therapy because of its high absorbent capacity and sustained silver ion release²⁷.

When is SILVERCEL Non-Adherent appropriate?

SILVERCEL Non-Adherent can be used to manage exudate in moderately to heavily exuding partial and full-thickness chronic and acute wounds including, but not limited to:

- pressure ulcers
- venous ulcers
- diabetic ulcers
- donor sites
- traumatic and surgical wounds³¹, including cavities.

SILVERCEL Non-Adherent can be used, under medical supervision, in the management of infected wounds, or wounds in which there is an increased risk of infection. In addition, because the product contains alginate it may assist in supporting the control of minor bleeding in superficial wounds.

The antimicrobial dressing can also be used prophylactically where there is an

increased risk of wound infection, such as in patients who:

- have an open wound with delayed healing, possibly indicating critical colonisation
- have a recurrent history of wound infection
- are immunocompromised, or have a condition that may diminish the classical signs of infection, eg diabetes
- have 'dirty' or heavily contaminated open surgical or traumatic wounds^{32,33}.

SILVERCEL Non-Adherent may be appropriate for use in wounds with low exudate levels where an antimicrobial dressing with sustained antimicrobial action is required, eg under compression, as it can be moistened with normal saline prior to application. Deep wounds can be loosely packed with the rope (packing) version.

SILVERCEL Non-Adherent case study

Mr W is a 66 year old security guard with a longstanding history of recurrent venous leg ulceration and Type 2 diabetes. Mr W has suffered with recurrent infections during episodes of ulceration that have required treatment with systemic antibiotics.

Mr W presented with a venous ulcer to the gaiter region of his right leg. The ulcer had an area of 2cm² and had been present for 14 weeks. The wound bed consisted of slough and granulation tissue with evidence of local infection, and a static wound edge. Erythema, oedema, eczema and scarring were observed to the surrounding skin. Moderate exudate levels and wound odour were also noted. Mr W was complaining of intermittent moderately-severe wound pain between dressing changes that was tolerable with regular codeine-based analgesia.

In view of the wound infection, pain, exudate levels and fragility of the surrounding skin, SILVERCEL Non-Adherent was felt to be a good choice for the topical treatment of this wound. Four-layer bandaging was continued and the eczema of the surrounding skin was treated with a potent steroid ointment. Dressing changes were performed twice weekly.

Outcome

When reviewed on day 4, there was no evidence of infection in the wound bed. Mr W was still experiencing intermittent wound pain between dressing changes, but it was mild in severity, and he was not requiring any oral analgesia.

On day 11, exudate levels had decreased and Mr W did not complain of any wound pain. The dressing, however, had dried out and required soaking before removal to prevent trauma. It was decided to continue the SILVERCEL Non-Adherent dressing to prevent recurrence of infection. The dressing was moistened on application. Mr W was still requiring twice weekly dressing changes to continue treatment of his surrounding skin.

On day 18, the whole of the wound bed was healthy granulation tissue and there was an epithelialising wound edge. The wound size had reduced to 0.5cm². SILVERCEL Non-Adherent was discontinued, and a non-adherent dressing was applied. The wound healed completely within two weeks.

The use of SILVERCEL Non-Adherent in this case was very successful. The wound infection resolved without the requirement for systemic antibiotics. Exudate levels were well managed and the wound pain resolved quickly as the infection was treated. The dressing was easy to use. Continued use as prophylaxis once infection had resolved and exudate levels decreased was facilitated by moistening the dressing before application. No fibre shedding from the dressing was observed.



Initial assessment



Final assessment

Contraindications

The dressing should not be used on patients with a known sensitivity to alginates, CMC, EMA or silver, or for surgical implantation. SILVERCEL Non-Adherent should be removed in patients undergoing MRI (magnetic resonance imaging) scanning³¹.

Step-by-step guide to application

Step 1: Wound bed preparation

Prepare the wound bed according to local policies, such as debridement of devitalised tissue and cleansing of the wound bed and surrounding skin.

Step 2: Prepare dressing for application

Decide which of the flat or rope (packing) presentations of SILVERCEL Non-Adherent dressing is most suitable.

The flat version of SILVERCEL Non-Adherent is suitable for superficial wounds and all other wound types where the dressing can be placed in direct contact with the wound bed. The rope (packing) version can be packed into deep wounds and cavities.

Choose a dressing size slightly larger than the wound, then cut using clean scissors or fold the dressing to the shape of the wound so it does not overlap the wound margins. Moisten with normal saline if using on a wound with lower exudate levels.

Step 3: Apply dressing

Gently apply the dressing (either side down) to fit the wound bed, or loosely pack deeper wounds or cavities with the rope (packing) version.

Cover with an appropriate secondary dressing, the choice of which will depend on wound type, wound position, exudate level and condition

of the surrounding skin. For example, if the surrounding skin is fragile, adhesive secondary dressings may not be suitable and other methods of securing the primary dressing, such as a cotton tubular bandage should be considered. Large surgical or traumatic wounds, particularly when over joints, may require the secondary dressing to be sufficiently conformable to adhere properly while allowing an adequate range of movement. Under compression bandaging, a secondary dressing may not be necessary because of the wool layer, unless exudate levels are particularly high, when a simple gauze pad may suffice.

Step 4: Dressing review

The frequency of dressing changes will depend on exudate levels and general condition of the wound bed. Dressing changes should be performed when the secondary dressing has reached its absorbent capacity or if strikethrough is evident on any compression bandaging. Daily dressing changes may be required initially for infected wounds if exudate levels are particularly high.

Assessment of change frequency should also depend on condition of the surrounding skin. For example, the presence of maceration or eczema may necessitate more frequent changes. The dressing may remain in place for up to seven days if appropriate.

Tips for dressing removal

Gently remove the secondary dressing and then remove SILVERCEL Non-Adherent from the wound bed and discard. If the primary wound dressing appears dry, saturate the dressing with sterile saline solution prior to removal.

If the wound bed appears dry and wound bioburden is no longer an issue, an alternative dressing such as a simple non-adherent dressing may be appropriate for redressing the wound.

When should treatment be discontinued?

A silver-containing dressing is no longer indicated once resolution of any local or systemic infection has occurred, except when it is being used prophylactically. Prophylactic use of silver-containing dressings should be based on the patient's risk of wound infection and relies upon sound clinical judgement¹³. Cooper (2004) states that judicious, prophylactic use of topical antimicrobial therapy can prevent development of infection, promote healing and thus minimise antibiotic use³².

A consensus document by the World Union of Wound Healing Societies³³ suggests use of antiseptic therapy should be reassessed after 10–14 days if an infected chronic wound is not improving. While studies suggest that the possibility of resistance to silver developing is limited in the clinical setting³⁴, indicating that treatment may be continued after this time without encouraging resistance, regular assessment should be performed and clinical need should guide duration of treatment.

Why choose SILVERCEL Non-Adherent?

SILVERCEL Non-Adherent is an appropriate choice of dressing for patients with wounds showing signs of infection or that are at increased risk of infection, and that have moderate to high exudate levels, fragile periwound skin, and/or pain on dressing removal. SILVERCEL Non-Adherent is suitable for use on a wide variety of wound types, and may also be used under compression.

The sustained release of silver ions, high absorbency and non-adherent wound contact layer of SILVERCEL Non-Adherent make it a next generation product that is designed to maintain effective ongoing antimicrobial action, to provide quick and pain-free dressing changes, and to avoid traumatising the wound bed or periwound skin, whilst not leaving fibres behind in the wound.

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Further case studies are available online at: www.woundsinternational.com

Healthcare practitioners are advised to consult the Package Insert for SILVERCEL Non-Adherent before applying the dressing to a wound.

Supported by an educational grant from Systagenix. The views expressed in this 'Made Easy' section do not necessarily reflect those of Systagenix.

Author details

Clark R¹, Bradbury S².

1. Project Leader, Systagenix Wound Management, Gargrave, UK
2. Research Nurse, Department of Dermatology and Wound Healing, Cardiff University, Cardiff, UK

Summary

The sustained antimicrobial efficacy, high absorbency, non-adherence and lack of fibre shed of SILVERCEL Non-Adherent mean that this next generation dressing is an ideal choice for clinicians wanting to minimise pain, discomfort and wound bed trauma at dressing changes, while protecting against and dealing with the effects of high wound bioburden.

To cite this publication

Clark R, Bradbury S. SILVERCEL® Non-Adherent Made Easy. *Wounds International* 2010; 1(5): Available from <http://www.woundsinternational.com>