

# Prontosan<sup>®</sup> and Askina<sup>®</sup>

Clinical and Scientific Evidence



# Introduction

## **B. Braun Wound Care. Right. From the start.**

Millions of people around the world suffer from chronic wounds. Such patients have to come to terms with months of pain and reduced quality of life and the need for long-term care and treatment. Chronic wound patients and their caregivers would like nothing more than fast, lasting healing.

Successful treatment depends on the hygienic state of the wound, wound bed preparation, choice of wound dressings, the therapist's experience and last but not least, the patient's condition.

Wound coatings, bacterial biofilms, pus, necrotic tissue, detritus and in particular, the bacterial biofilm, delay or inhibit wound healing. Removing this detritus, otherwise known as "detritolysis", accelerates wound healing.

B. Braun has developed a comprehensive range of wound care products which enables optimal wound management by supporting and accelerating endogenous healing.

B. Braun Wound Care products focus on every type of wound at each phase of wound healing. By providing innovative solutions such as Prontosan® Wound Irrigation Solution, bacterial biofilm can be efficiently removed thereby clearing the way for application of advanced wound dressings from the Askina® range, to assist in the complex task of tissue repair.

This guide includes the rationales for using Prontosan® and Askina® and gives an overview of the convincing clinical and scientific evidence available.

# Content

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## Askina®

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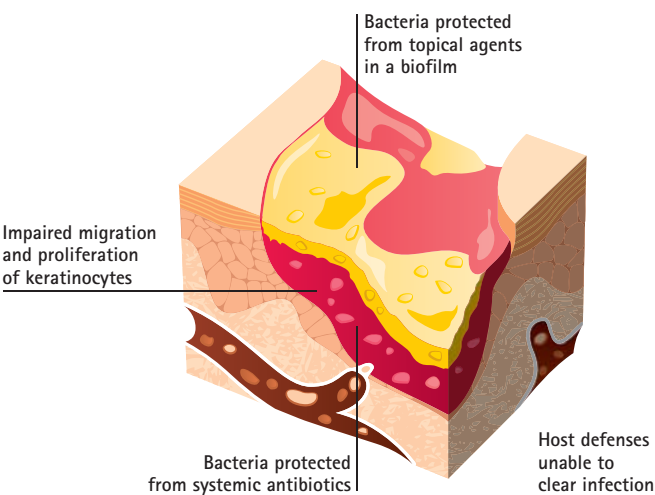
# Prontosan®

## Rationale for the use of Prontosan®

Millions of people around the world suffer from chronic wounds. Such patients have to come to terms with months of pain and reduced quality of life and the need for long-term care and treatment. Chronic wound patients and their caregivers would like nothing more than fast, lasting healing.

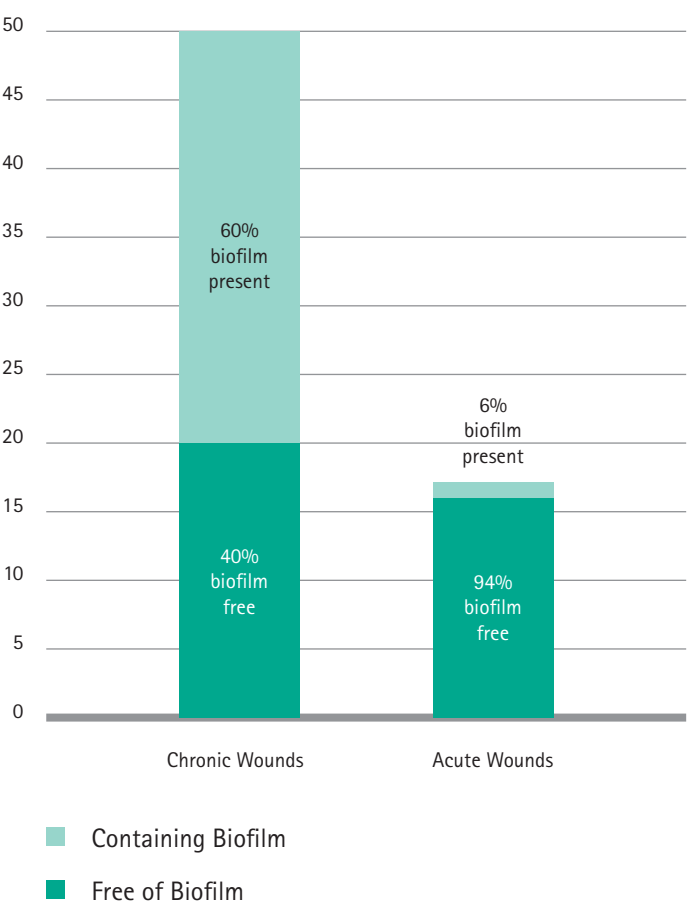
60% of chronic wounds have a biofilm present which is a major barrier to wound healing

The problems a biofilm creates:



Wound cleansing is a prerequisite for proper wound healing. Prontosan® physically removes debris, slough, bioburden and biofilm. In comparison with traditional wound irrigation solutions or wound antiseptics, wounds treated with Prontosan® are closed within a significantly shorter period.

60% of chronic wounds and 6% of acute wounds are present with biofilm at a statistically significant difference ( $p < 0.001$ )



## Biofilms in chronic wounds

James GA, Swogger E, Wolcott R, de Lancey Pulcini E, Secor P, Sestrich J, Costerton JW, Stewart PS.  
Wound Repair Regen 2008;16(1):37-44.

### Objective

This research examined chronic and acute wounds for biofilms and characterized microorganisms inhabiting these wounds.

### Methods

Chronic wound specimens were obtained from 77 subjects and acute wound specimens were obtained from 16 subjects. Culture data were collected using standard clinical techniques. Light and scanning electron microscopy techniques were used to analyze 50 of the chronic wound specimens and the 16 acute wound specimens. Molecular analyses were performed on the remaining 27 chronic wound specimens using denaturing gradient gel electrophoresis and sequence analysis.

### Results

Of the 50 chronic wound specimens evaluated by microscopy, 30 were characterized as containing biofilm (60%), whereas only one of the 16 acute wound specimens was characterized as containing biofilm (6%). This was a statistically significant difference ( $p < 0.001$ ). Molecular analyses of chronic wound specimens revealed diverse polymicrobial communities and the presence of bacteria, including strictly anaerobic bacteria, not revealed by culture.

### Conclusion

Bacterial biofilm prevalence in specimens from chronic wounds relative to acute wounds observed in this study provides evidence that biofilms may be abundant in chronic wounds.

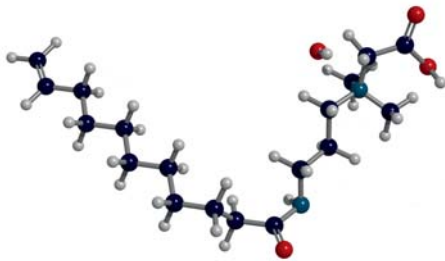
# Prontosan®

## Contents of Prontosan®

Prontosan® contains unique ingredients that have a double effect on the wound bed to create a wound environment optimal for healing.

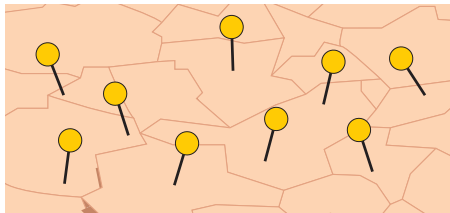
### Betaine

Function in Prontosan®: Surfactant / Detergent

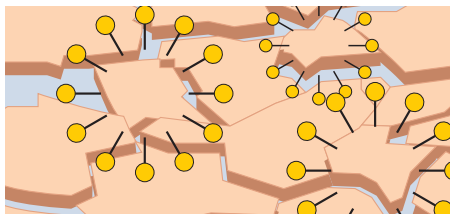


Betaine is a gentle effective surfactant which is able to penetrate, clean and remove the biofilm and wound debris. It is like a detergent that works by...

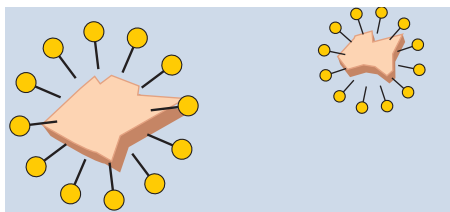
...reducing the surface tension of water



...supporting softening, loosening and detaching of dirt

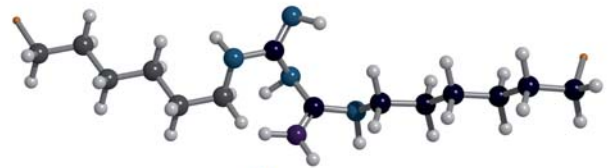


...and dispersing dirt (bind dirt in the solutions, preventing recontamination)



### Polihexanide (PHMB)

Function in Prontosan®: Preservative



repeating structural unit

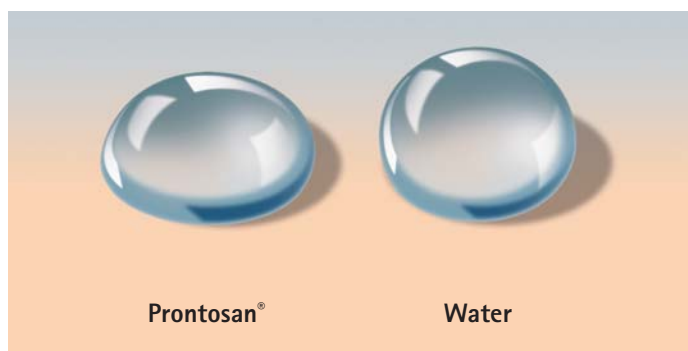
PHMB is a highly effective modern broad spectrum antimicrobial agent that reduces bioburden.

The mode of action can be described as a non-specific electrostatic interaction with the bacterial cell wall. The attachment of polihexanide to the bacterial cell wall results in a disorganisation of the biological structure of the bacteria.

# Prontosan<sup>®</sup>

## The powerful combination of Betaine and Polihexanide

### How to determine cleansing power?

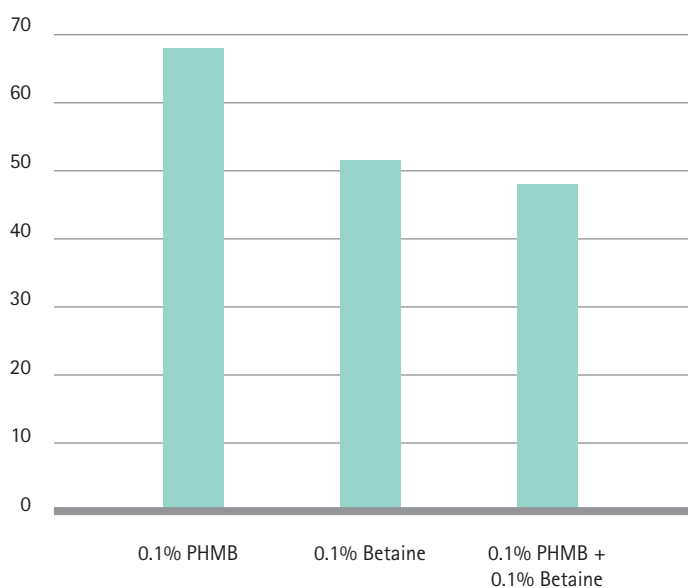


Surface tension is a parameter to measure cleansing efficacy.

The surface tension of Prontosan<sup>®</sup> solution is lower than the surface tension of water. This allows Prontosan<sup>®</sup> to remove biofilm better than water.

### The combination of Polihexainde (PHMB) and Betatine synergetically improves the cleansing power of Prontosan<sup>®</sup>

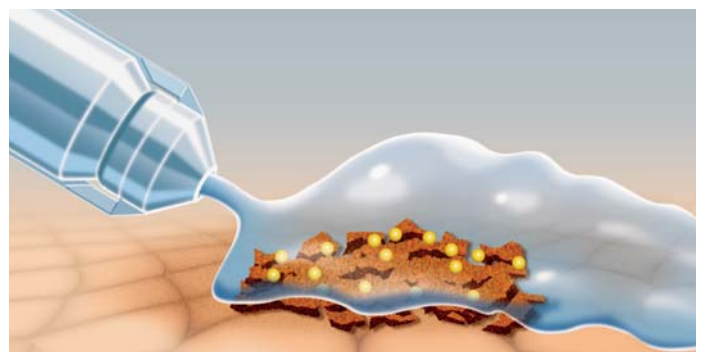
Surface Tension (mN/m)



B. Braun internal tests (report available upon request)

The mixture of 0.1% polihexanide and 0.1% betaine has a lower surface tension than the single substances. These results prove a synergetic effect of the two substances in the mixture. Therefore, the physical cleansing power of Prontosan<sup>®</sup> (combination of 0.1% polihexanide plus 0.1% betaine) is even superior to 0.1% betaine.

### The optimal solution for removal of biofilm



The usually applied irrigation solutions (0.9% NaCl – water – Ringer solution) glide over the biofilm without removing it.



Prontosan<sup>®</sup> is able to remove the biofilm by destroying its structure by physically cleansing.

# Prontosan®

## Available evidence at a glance

Reference	Type	Improved Wound Healing	Prevention and Removal of Biofilm	Antimicrobial Activity	Cytotoxicity and Tolerability	Quality of Life	Cost-effective	Page
Clinical use of polyhexanide on acute and chronic wounds for antisepsis and decontamination. Eberlein T, Assadian O. Skin Pharmacol Physiol 2010;23(Suppl 1):45-51.	Review	●	●	●	●			9
Addressing the challenge of wound cleansing in the modern era. Cutting KF. Br J Nurs 2010;19(11):24-29.	Review		●					10
The effectiveness of a 0.1% polyhexanide gel. Valenzuela AR, Perucho NS. Rev ROL Enf 2008;31(4):247-252.	RCT	●			●	●		11
Evaluation of the efficacy and tolerability of a solution containing propyl betaine and polyhexanide. Romanelli M, Dini V, Barbanera S, Bertone MS. Skin Pharmacol Physiol 2010;23(Suppl 1):41-44.	RCT			●	●	●		12
Experiences in using polyhexanide containing wound products in the management of chronic wounds – results of a methodical and retrospective analysis of 953 cases. Moeller A, Nolte A, Kaehn K. Wundmanagement 2008; 3:112-117.	Cohort	●		●	●	●		13
Assessment of a wound cleansing solution in the treatment of problem wounds. Andriessen AE, Eberlein TE. Wounds 2008;20(6):171-175.	Cohort	●					●	14
Effect of different wound rinsing solution on MRSA biolm in a porcine model. Perez R, Davies SC, Kaehn K. WundM 2010;4(2):44-48.	Animal		●					15
Efficacy of various wound irrigation solutions against biofilms. Seipp HM, Hofmann S, Hack A, Skowronsky A, Hauri A. ZfW 2005;4(5):160-163.	In-vitro		●					16
Polyhexanide and betaine containing wound care solution and get reduce the growth of microorganisms by more than LOG 5 in-vitro. Stolarck R, Minnich K, Olinger S, et al. J Clin Pharmacol 2010;50(9):1071.	In-vitro			●				17
In-vitro test for comparing the efficacy of wound rinsing solutions. Kaehn K, Eberlein T. Br J Nurs 2009; 18(11):4-10.	In-vitro		●					18
Evaluation of toxic side effects of clinical used antiseptics in vitro. Hirsch T, Koerber A, Jacobsen F, et al. J Surg Res 2010;164(2):344-350.	In-vitro				●			19



Type	Improved Wound Healing	Prevention and Removal of Biofilm	Antimicrobial Activity	Cytotoxicity and Tolerability	Quality of Life	Cost-effective	Page
Review	●	●	●	●			9

Clinical use of polihexanide on acute and chronic wounds for antisepsis and decontamination.

Eberlein T, Assadian O.  
Skin Pharmacol Physiol 2010;23(Suppl 1):45-51.

Objective

This article gives a comprehensive review of the clinical use of polihexanide for the treatment of acute and chronic wounds. Current scientific literature is reviewed in order to give an overview of the properties of polihexanide-containing preparations relevant for the treatment of wounds, contraindications, available application forms and special aspects of practical use.

Abstract

Polihexanide is an antimicrobial compound suitable for clinical use in critically colonized or infected acute and chronic wounds. Its beneficial characteristic is attributable particularly to its broad antimicrobial spectrum, good cell and tissue tolerability, ability to bind to the organic matrix, low risk of contact sensitization, and wound healing promoting effect. In addition, no development of microorganism resistance during polihexanide use has been detected to date, nor does this risk appear imminent. The aim of therapy using polihexanide is to reduce the pathogen burden in a critically colonized or infected acute or chronic wound. An increasing number of articles on the subject of wound antisepsis with polihexanide can be found in the medical literature. However, there is still little published information on the practical use of polihexanide-containing wound antiseptics. The use of polihexanide is not the only therapeutic option in management of wounds; therefore, priority is also given to prior surgical debridement and clarification of the cause of the underlying disease, including appropriate therapy.

Conclusion

- Polihexanide is an antimicrobial substance that is highly suitable for use in critically colonized or infected wounds.
- Polihexanide has a broad antimicrobial spectrum, good cell and tissue tolerability, the ability to bind to the organic matrix, a low risk of contact sensitization and a wound healing promoting effect.
- No development of microorganism resistance has been detected with polihexanide use to date, nor does this risk appear imminent.

Type	Improved Wound Healing	Prevention and Removal of Biofilm	Antimicrobial Activity	Cytotoxicity and Tolerability	Quality of Life	Cost-effective	Page
Review		●					10

Addressing the challenge of wound cleansing in the modern era.

Cutting KF.  
Br J Nurs 2010;19(11):24-29.

This article describes Prontosan's mode of action and reviews the current available efficacy data for Prontosan®.

Abstract

Over the past two decades a body of evidence has been generated to support the traditional use of water in cleansing wounds, with studies showing that the use of clean water does not increase the risk of infection or delay healing. However, recent advances in the understanding of wound management have encouraged reforms and led to the development of wound cleansing agents that have the potential to improve clinical outcomes. This article draws on in-vitro and in-vivo evidence including comparative studies of patients with acute and chronic wounds to consider the evidence supporting alternatives to water in wound cleansing.

Quote

"What differentiates Prontosan® from other polymeric biguanides is the inclusion of betaine in the formulation. The resulting low surface tension induced by the surfactant (e.g. betaine) supports physical removal of debris and bacteria."

Type	Improved Wound Healing	Prevention and Removal of Biofilm	Antimicrobial Activity	Cytotoxicity and Tolerability	Quality of Life	Cost-effective	Page
RCT	●			●	●		11

## The effectiveness of a 0.1% polyhexanide gel.

Valenzuela AR, Perucho NS.  
Rev ROL Enf 2008;31(4):247-252.

### Objective

The objective of the study was to evaluate the effectiveness of Prontosan® Wound Gel and to assess if this gel met the recommendations for cleansing wounds provided by the National Group which Studies and Counsels Health Professionals regarding Bed Sores and Chronic Wounds (GNEAUPP) and by the Agency for Health Care Policy and Research (AHCPR).

### Methods

A multicenter, randomized, non-blind clinical trial was performed to compare the efficacy of Prontosan® Wound Gel with the recommendations of the GNEAUPP and the AHCPR for wound cleansing in the control of bacterial burden, wound healing, pain and wound odour. The wounds in the control group were cleansed with normal saline, and if debridement was required, autolytic debridement by means of hydrogel was carried out. The wounds in the experimental group were cleansed with normal saline and then a 0.1% polyhexanide gel (Prontosan® Wound Gel) was applied.

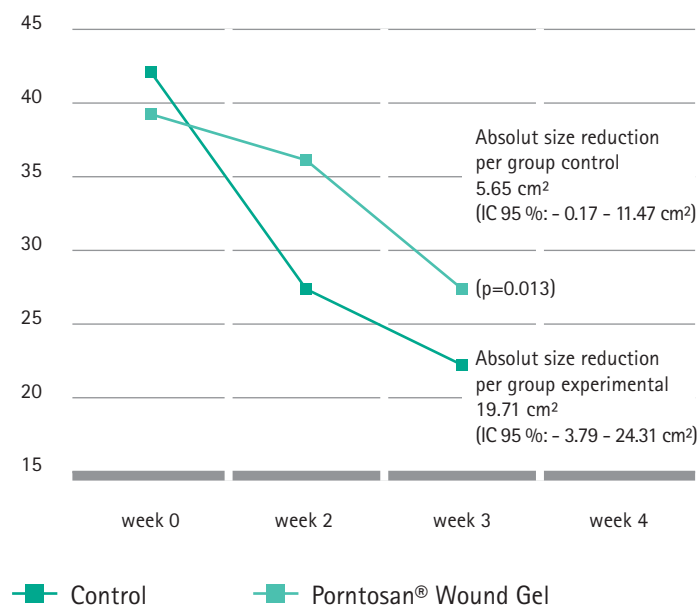
### Results

The data obtained in the final evaluation of the lesions studied were as follows: a reversal in positive cultures ( $p=0.004$ ); an improvement in the stagnation of the cicatrization process ( $p=0.000$ ); reduction in the size of the wound ( $p=0.013$ ); an improvement in the percentage of granulation tissue ( $p=0.001$ ); an improvement in the percentage of slough in the bed of the wound ( $p=0.002$ ); an improvement in the presence of exudation ( $p=0.008$ ); an improvement in the presence of purulent exudation ( $p=0.005$ ); an improvement in the condition of skin nearby the wound ( $p=0.021$ ); an improvement in pain control ( $p=0.049$ ); an improvement in erythema in nearby skin ( $p=0.004$ ); an improvement in edema in skin nearby the wound ( $p=0.000$ ); an improvement in the heat in the skin nearby the wound ( $p=0.004$ ); and an improvement in the odor ( $p=0.029$ ).

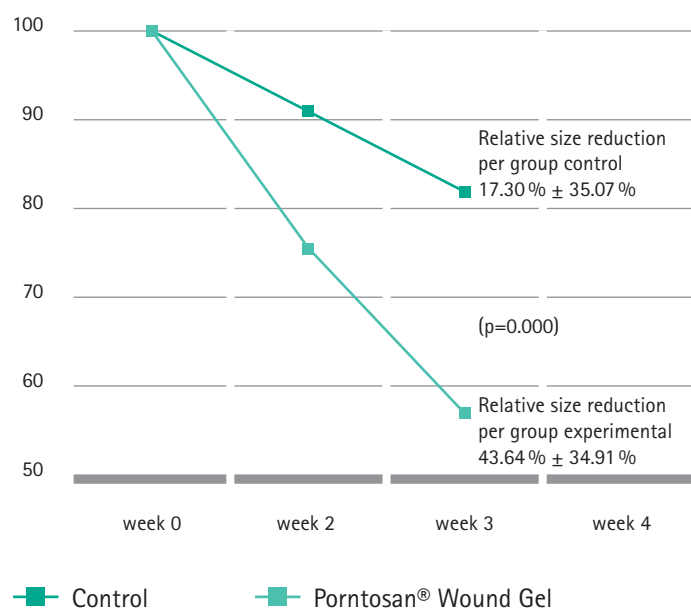
### Conclusion

The results of this study show that that Prontosan® Wound Gel is a highly effective wound cleansing agent that contributes successfully to wound bed preparation and increases patients' quality of life by alleviating pain and minimizing wound odor.

Absolut size reduction (cm<sup>2</sup>) per group



Relative size reduction (%) per group



Type	Improved Wound Healing	Prevention and Removal of Biofilm	Antimicrobial Activity	Cytotoxicity and Tolerability	Quality of Life	Cost-effective	Page
RCT	●		●	●	●		12

Evaluation of the efficacy and tolerability of a solution containing propyl betaine and polihexanide.

Romanelli M, Dini V, Barbanera S, Bertone MS.  
Skin Pharmacol Physiol 2010;23(Suppl 1):41-44.

Objective

The objective of this randomized controlled trial was to investigate the effects of a wound cleansing solution containing polihexanide and betaine (Prontosan® Wound Irrigation Solution) in venous leg ulcers.

Methods

A portable device was used on the wound bed to assess surface pH, which has been shown to be one of the most useful non-invasive biophysical parameters in order to correlate the level of bacterial burden in different types of chronic wounds. In addition, patients were asked to self-assess subjectively the intensity of pain using a validated 10-mm visual analogue scale.

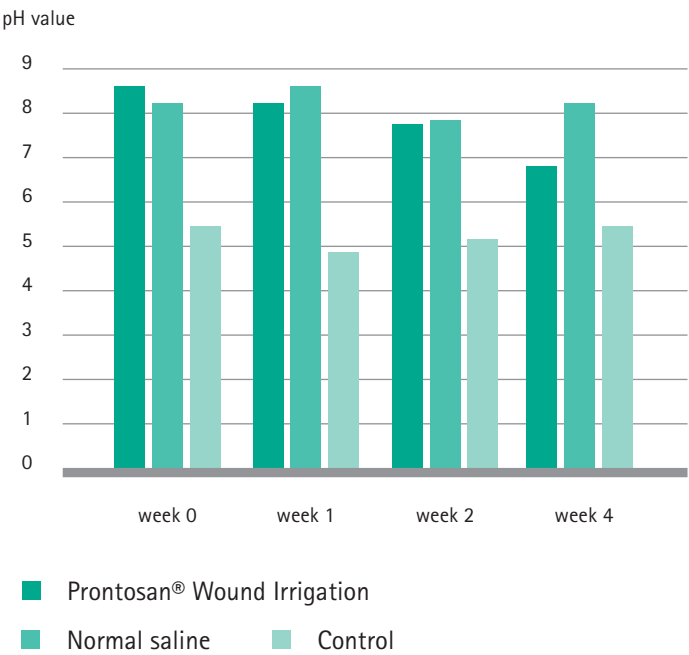
Results

Baseline pH on the wound surface (median range) was initially 8.9, and after 4 weeks of cleansing treatment and moist wound dressing was reduced and stable at 7.0 in the group treated with active cleanser. The pH value was significantly lower ( $p<0.05$ ) in this group compared to the control group at the end of the study. The treatment with the solution containing polihexanide and betaine (Prontosan® Wound Irrigation Solution) was well tolerated by the patients and was found useful in the absorption of wound odour. Pain control was better controlled ( $p<0.05$ ) in the polihexanide and betaine group when compared to the control group.

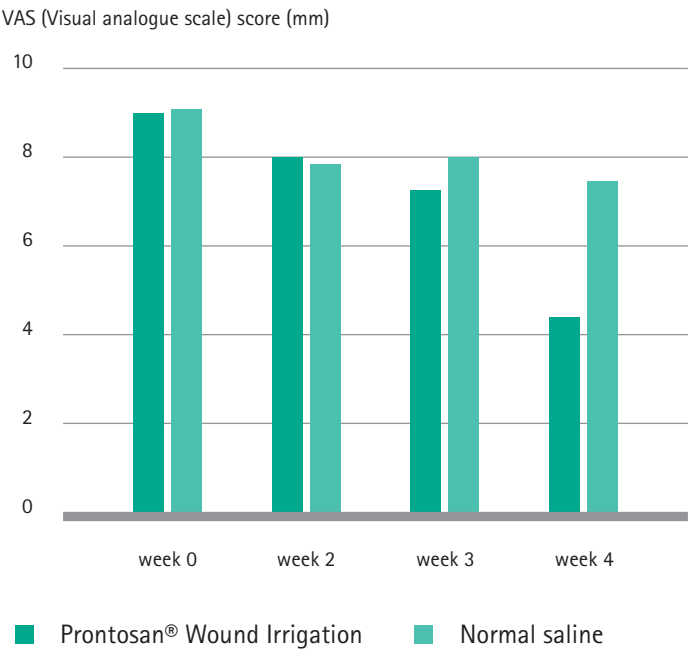
Conclusion

Treatment with Prontosan® Wound Irrigation Solution can lead to a decrease in pH, which is a surrogate marker for bacterial burden and is well tolerated for the treatment of chronic ulcers.

Results of pH measurement in the wounds during the study period of 4 weeks.



Pain evaluation during treatment of venous leg ulcers before and after 4 weeks of treatment with Prontosan® Wound Solution compared to standard therapy.



Type	Improved Wound Healing	Prevention and Removal of Biofilm	Antimicrobial Activity	Cytotoxicity and Tolerability	Quality of Life	Cost-effective	Page
Cohort	●		●	●	●		13

Experiences in using polyhexanide containing wound products in the management of chronic wounds – results of a methodical and retrospective analysis of 953 cases.

Moeller A, Nolte A, Kaehn K.  
Wundmanagement 2008;3:112-117.

Objective

The objective of this retrospective analysis was to assess the healing process of chronic and poorly healing wounds after the introduction of Prontosan® Wound Irrigation Solution and Prontosan® Gel to the standard of care at a municipal hospital in Germany.

Methods

The following interventions were added to standard wound care: routine irrigation of the wound with Prontosan® Wound Irrigation Solution at every dressing changes and the additional application of Prontosan® Wound Gel to every wound if there was no or only moderate exudation. Two years after the implementation of Prontosan®, the charts of 953 patients were retrospectively analyzed.

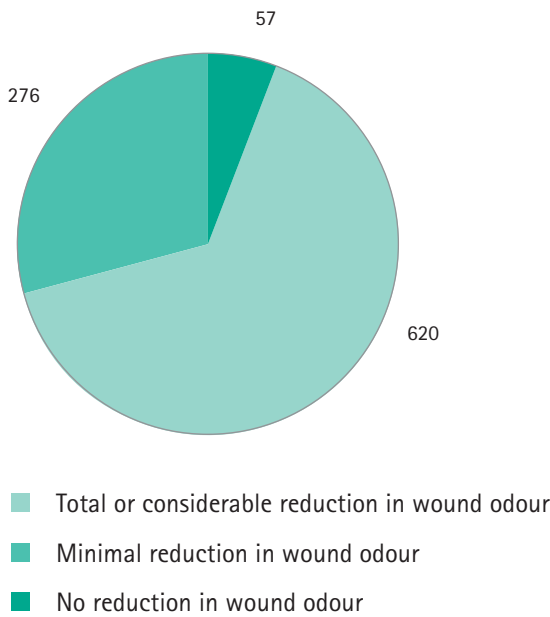
Results

In 80% of the wounds wound closure could be achieved with the combination therapy. Almost two thirds of the patients (620/953) found a great to complete reduction or improvement in odor. In 29 cases (3%) a first or renewed wound infection developed after the beginning of treatment. Only 1% of the treated patients reported a slight burning sensation, 99% had no pain or discomfort.

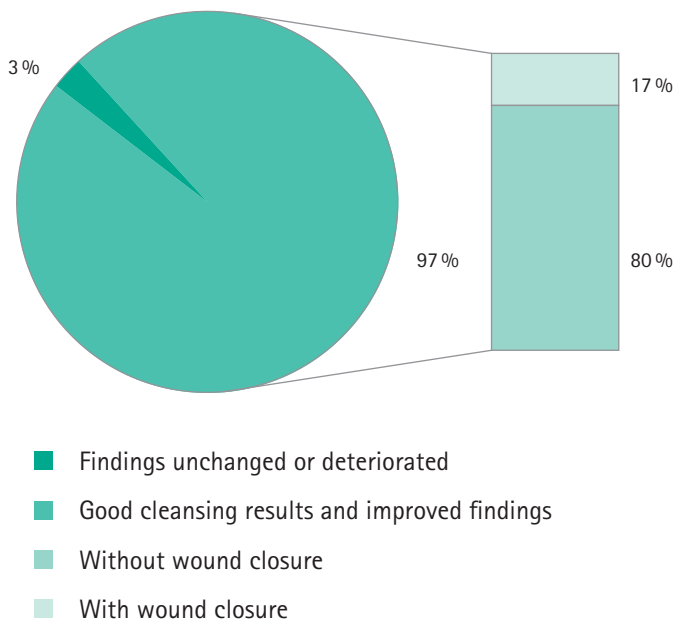
Conclusion

On the basis of the evaluated retrospective data it was decided to continue with the use of Prontosan® Wound Irrigation Solution and Prontosan® Wound Gel for the treatment of chronic wounds at the Municipal Hospital Bielefeld Mitte in Germany.

Evaluation of wound odour reduction by patients.



Wound healing progress (n=953).



Type	Improved Wound Healing	Prevention and Removal of Biofilm	Antimicrobial Activity	Cytotoxicity and Tolerability	Quality of Life	Cost-effective	Page
Cohort	●					●	14

Assessment of a wound cleansing solution in the treatment of problem wounds.

Andriessen AE, Eberlein TE.  
WOUNDS 2008;20(6):171-175.

Objective

This retrospective analysis of existing data was performed looking at the clinical efficacy and cost-effectiveness of using a wound cleanser (Prontosan<sup>®</sup> Wound Irrigation Solution) to treat problem wounds.

Methods

This retrospective analysis of existing data was performed looking at the clinical efficacy and cost-effectiveness of using a wound cleanser to treat problem wounds. Wound cleansing upon dressing changes using a polyhexanide containing solution (Prontosan<sup>®</sup> Wound Irrigation Solution) in venous leg ulcers was compared to cleansing with either Ringer's solution or normal saline.

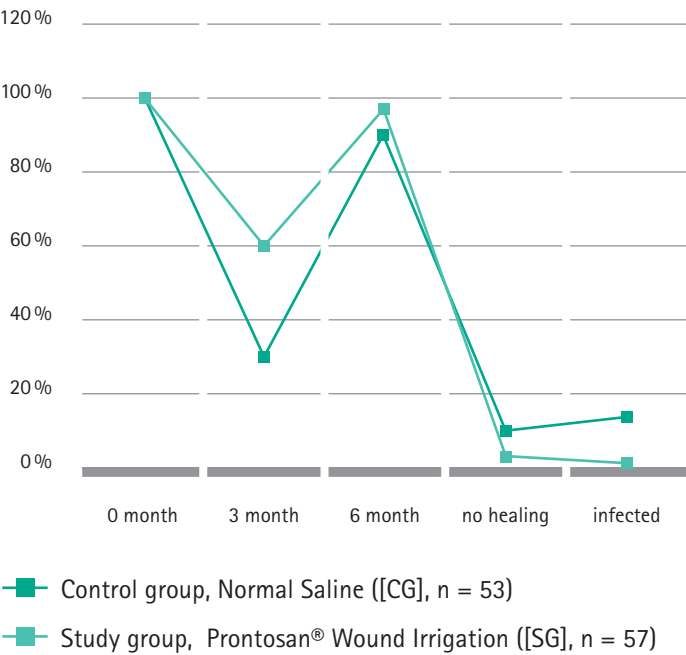
Results

The wounds of the patients treated with Prontosan<sup>®</sup> Wound Irrigation Solution healed faster and in more cases (97% versus 89%). The Kaplan-Meier mean estimate (and associated standard error [SE]) demonstrated a statistically significant difference between treatment groups ( $p<0.0001$ ) in time to healing. The Kaplan-Meier mean time to healing for the study group (SG) was 3.31 months (SE= 0.17) compared to 4.42 months (SE = 0.19) for the control group ([CG], normal saline/Ringer's solution).

Conclusion

Wound cleansing with Prontosan<sup>®</sup> Wound Irrigation Solution can lead to faster healing when compared to traditional wound cleansers such as normal saline and Ringer's solution and is therefore cost-effective.

Results after 6 months of treatment (% of wounds)



Type	Improved Wound Healing	Prevention and Removal of Biofilm	Antimicrobial Activity	Cytotoxicity and Tolerability	Quality of Life	Cost-effective	Page
Animal		●					15

Effect of different wound rinsing solution on MRSA biofilm in a porcine model.

Perez R, Davies SC, Kaehn K.  
WundM 2010;4(2):44-48.

Objective

The objective of this study was to assess the effectiveness of a four wound cleansers on MRSA biofilm removal on dermal wounds in swine.

Methods

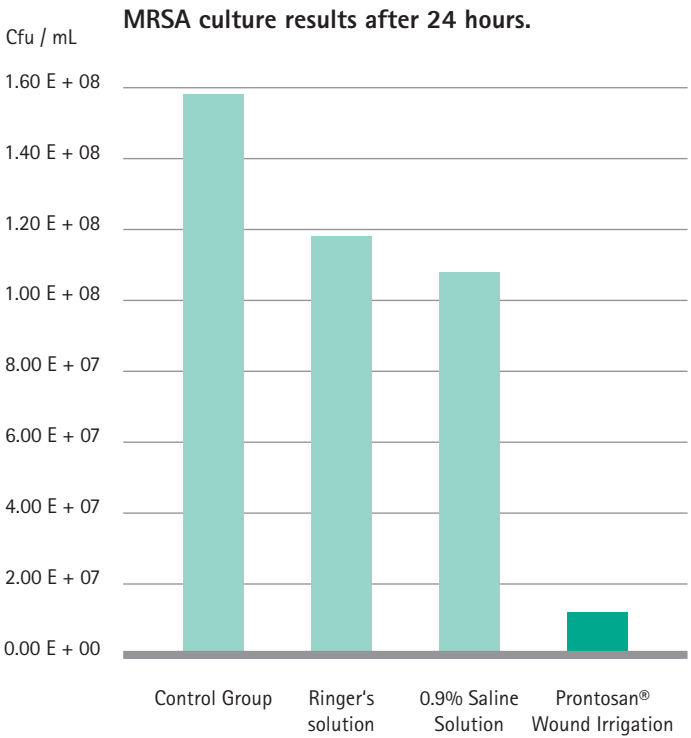
Partial thickness wounds on swine were spiked with MRSA and covered with polyurethane dressings for 24 hours to allow growth of biofilm. The wounds were then assigned to four groups. In three groups the wounds were cleansed twice a day by rinsing with i) Prontosan® Wound Irrigation Solution, ii) Ringer's solution, and iii) sterile saline. The wounds in the control group were not rinsed. Four wounds from each group were cultured at 48 and 72 hours respectively.

Results

Means of MRSA counts at 48 and 72 hours were significantly reduced (p<0.05) in group i) compared to group ii) and iii).

Conclusion

Removal of MRSA biofilm was only demonstrated using Prontosan® Wound Irrigation Solution; both normal saline and Ringer's solution failed to reduce MRSA counts.



Type	Improved Wound Healing	Prevention and Removal of Biofilm	Antimicrobial Activity	Cytotoxicity and Tolerability	Quality of Life	Cost-effective	Page
In-vitro		●					16

Efficacy of various wound irrigation solutions against biofilms.

Seipp HM, Hofmann S, Hack A, Skowronsky A, Hauri A.  
ZfW 2005;4(5):160-163.

Objective

The objective of this study was to test the efficacy of three wound cleansing solution against biofilms.

Methods

The effectiveness of solutions applied for wound cleansing in clinical practice was evaluated by means of the Biofilmyl® method. This method permits the exact quantification of biofilms using endotoxins released from bacterial cell walls. First, biofilm test specimens were cultivated with *Pseudomonas aeruginosa* on silicone surfaces. Subsequently, in separate test series, the specimens were exposed to three different irrigants for 24 h each: a) normal saline solution, b) Ringer's solution, c) surfactant polyhexanide solution (Prontosan® Wound Irrigation Solution).

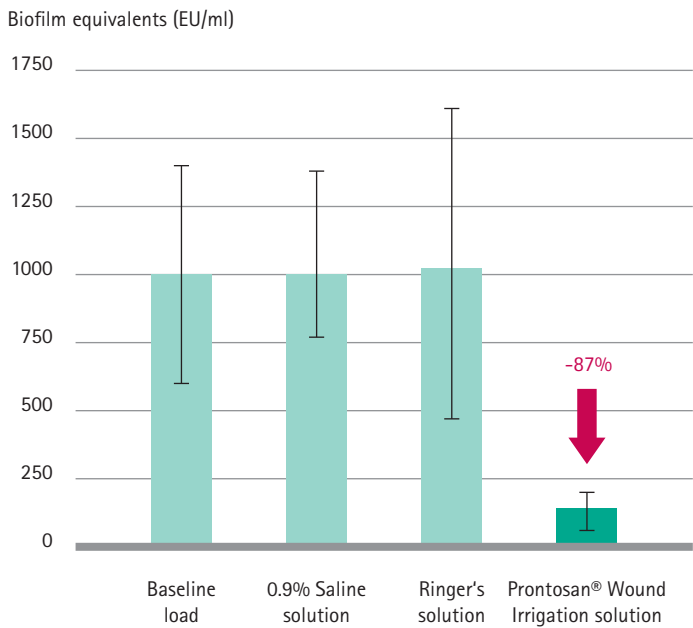
Results

The results showed no decrease in the original biofilm load after exposure to normal saline solution as well as Ringer's solution, while the surfactant polyhexanide solution (Prontosan® Wound Irrigation Solution) achieved a significant reduction ( $p<0.001$ ) of the biofilm by 87%.

Conclusion

Using the Biofmyl® method, Prontosan® Wound Irrigation Solution shows a better reduction of biofilm when compared to normal saline and Ringer's solution.

Comparison of the efficacy of wound rinsing solutions on biofilm.





Type	Improved Wound Healing	Prevention and Removal of Biofilm	Antimicrobial Activity	Cytotoxicity and Tolerability	Quality of Life	Cost-effective	Page
In-vitro			●				17

## Polyhexanide and betaine containing wound care solution and gel reduce the growth of microorganisms by more than LOG 5 in-vitro.

Stolarck R, Minnich K, Olinger S, et al.  
J Clin Pharmacol 2010;50(9):1071.

### Objective

To investigate the antimicrobial effects as a possible supportive mechanism of action of Prontosan® Wound Irrigation Solution and Pronotsan® Wound Gel.

### Methods

In-vitro testing was performed according to USP 32-NF 27 2009, method 51 evaluating 13 microorganisms at 7, 14, and 28 days following exposure to 3 lots of the compounds/products.

### Results

Growth reduction was near identical at each of the 3 evaluation days and above log 5 for all 3 lots of gel and solution in 12/13 organisms tested. Log 5.8 (average): *Staphylococcus epidermidis* (5.9, 5.8, 5.8); Log 5.7: *Pseudomonas aeruginosa* (5.7, 5.7, 5.6), *Serratia marcescens* (5.7, 5.7, 5.6), *Candida albicans* (5.7, 5.7, 5.7); Log 5.6: *Vancomycin resistant Enterococcus faecalis* (5.6, 5.6, 5.6), *Proteus mirabilis* (5.7, 5.6, 5.6); Log 5.5: *Staphylococcus aureus* (5.5, 5.5, 5.5), *Methicillin-resistant Staphylococcus aureus* (5.5, 5.5, 5.4), *Acinetbacter baumannii* (5.6, 5.5, 5.5); Log 5.4: *Escherichia coli* (5.5, 5.4, 5.4), *Enterobacter cloacae* (5.5, 5.4, 5.4); Log 5.3: *Enterococcus faecalis* (5.3, 5.3, 5.3). In *A. brasiliensis* the log reductions were for the gel 1.9 (1.9, 1.9, 1.8), 2.1 (2.1, 2.1, 2.1), and 2.5 (3.2, 2.2, 2.1) and for the solution 2.1 (2.2, 2.1, 2.0), 2.3 (2.3, 2.3, 2.2), and 2.8 (2.8, 2.8, 2.7) at 7, 14, and 28 days, respectively.

### Conclusion

The log 5 reductions in antimicrobial activity in 12/13 microorganisms tested is suggested as a possible supportive mechanism of action of enhanced wound healing when using a combination of 0.1% polyhexanide and 0.1% of betaine either as a gel or an irrigation solution.

### Log growth reduction at 7, 14 and 28 days for Prontosan® Wound Irrigation Solution and Prontosan® Wound Gel.

Microorganism	7 days	14 days	28 days
<i>Staphylococcus epidermis</i>	5.9	5.8	5.8
<i>Pseudomonas aeruginosa</i>	5.7	5.7	5.6
<i>Serratia marcescens</i>	5.7	5.7	5.6
<i>Candida albicans</i>	5.7	5.7	5.7
<i>Vancomycin resistant Enterococcus faecalis</i>	5.6	5.6	5.6
<i>Proteus mirabilis</i>	5.7	5.6	5.6
<i>Staphylococcus aureus</i>	5.5	5.5	5.5
<i>Methicillin resistant Staphylococcus aureus</i>	5.5	5.5	5.4
<i>Acinetbacter baumannii</i>	5.6	5.5	5.5
<i>Escherichia coli</i>	5.5	5.4	5.4
<i>Enterobacter cloacae</i>	5.5	5.4	5.4
<i>Enterococcus faecalis</i>	5.3	5.3	5.3
<i>A. brasiliensis</i>	see abstract		

Type	Improved Wound Healing	Prevention and Removal of Biofilm	Antimicrobial Activity	Cytotoxicity and Tolerability	Quality of Life	Cost-effective	Page
In-vitro		●					18

In-vitro test for comparing the efficacy of wound rinsing solutions.

Kaehn K, Eberlein T.  
Br J Nurs 2009;18(11):4-10.

Objective

The aim of this study was to test the efficacy of four solutions to solubilize and remove wound coatings using a wound coating mode.

Methods

An in-vitro model that mimics wound coatings (human plasma dried onto adhesive glass slides) was used to compare the efficacy of four sterile solutions used to cleanse wounds: saline and Ringer's (both salt solutions), a betaine surfactant-containing wound rinsing solution (Prontosan<sup>®</sup> Wound Irrigation Solution) and an antiseptic solution (Octenisept<sup>®</sup>).

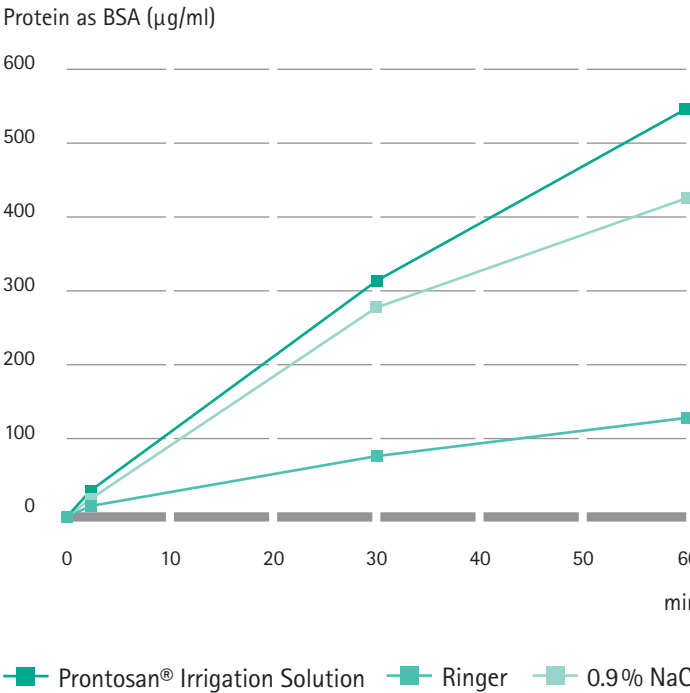
Results

Both salt solutions and the wound rinsing solution were found to remove protein from the test wound coatings, whereas the test coatings became fixed and insoluble when immersed in antiseptic solution (Octenisept<sup>®</sup>).

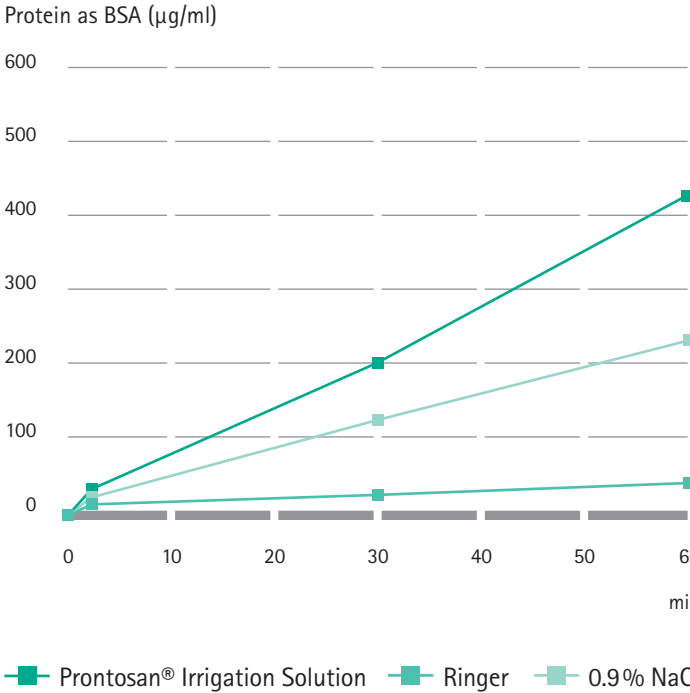
Conclusion

Saline solutions were less efficient than a betaine surfactant containing wound rinsing solution (Prontosan<sup>®</sup> Wound Irrigation Solution) in removing protein from adherent test wound coatings.

Protein concentrations in supernatants of the test series with plasma.



Protein concentrations in supernatants of the test series with fibrin slides.



Type	Improved Wound Healing	Prevention and Removal of Biofilm	Antimicrobial Activity	Cytotoxicity and Tolerability	Quality of Life	Cost-effective	Page
In-vitro				●			19

## Evaluation of toxic side effects of clinical used antiseptics in vitro.

Hirsch T, Koerber A, Jacobsen F, et al.  
J Surg Res 2010;164(2):344-350.

### Objective

The objective of this study was to evaluate cytotoxic effects of five clinically used products on human skin cells.

### Methods

Five clinically used products (Prontosan®, Lavasept®, Braunol®, Octenisept®, and Bataisodona®) were tested. The minimal inhibitory concentration was determined against *Staphylococcus aureus*, *Enterococcus faecalis*, *Pseudomonas aeruginosa*, and *Escherichia coli*. The cytotoxic effects on primary keratinocytes, fibroblasts, and a HaCaT cell line were determined (MTT assay and BrdU-ELISA) at a wide range of concentrations.

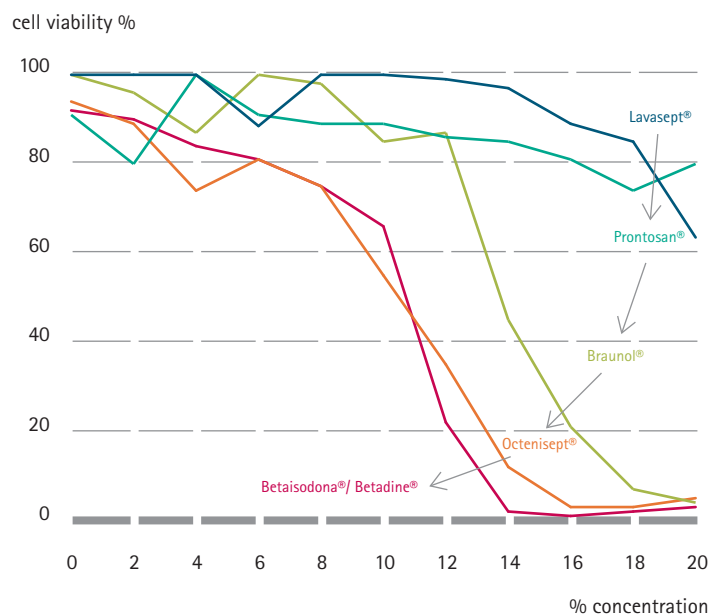
### Results

The agents tested showed effective antibacterial properties (Octenisept®, Lavasept®, and Prontosan® showed higher efficacy than Braunol® and Bataisodona®) and different degrees of cytotoxicity. Lavasept® and Prontosan® demonstrated less toxicity on primary human fibroblasts and keratinocytes, whereas Octenisept®, Bataisodona®, and Braunol® showed a significant ( $p < 0.05$ ) decrease in cell viability to 0% on keratinocytes at concentrations of 4%, 7.5%, and 12.5%, and on fibroblasts at 7.5% and 10%, respectively.

### Conclusion

Due to the cytotoxic effect of some antiseptics on human skin cells, it is advised that health care professionals balance the cytotoxicity of the medication, their antiseptic properties, and the severity of colonization when selecting a wound care antiseptic. In this study, Lavasept® and Prontosan® showed best result regarding antibacterial efficacy and cell toxicity.

### Cytotoxicity of products on skin cells.



■ Lavasept® ■ Prontosan® ■ Braunol®  
■ Octenisept® ■ Bataisodona®/Betadine®

# Rationale for the use of Askina® dressings

## Askina®

Healing a chronic wound requires care that is patient centered, cost effective and evidence based.

Through this understanding, B. Braun has developed a range of dressings designed to care for a wound and to support the natural healing process.

The products of Askina® range are based on various technologies aimed to achieve a specific treatment objective. As a result, the Askina® range offers a choice of dressings for each phase of the wound healing: from necrosis to epithelialization including the debridement and granulation phases.

# Overview of the Askina® product range

## Askina® Calgitrol® Ag

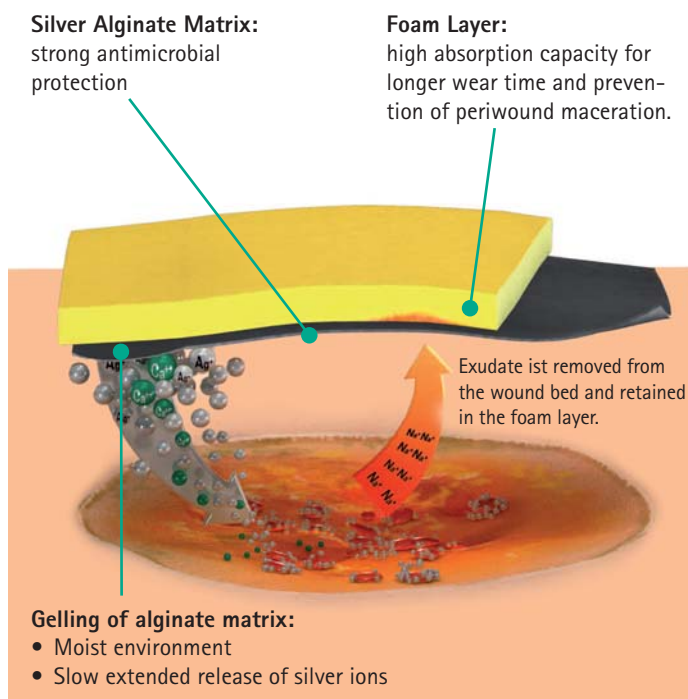
### Description

Askina® Calgitrol® Ag patented matrix formulation combines calcium alginate and silver alginate with 10% of bonded water. In contact with exudate, the alginate matrix forms a soft gel allowing the liberation of silver ions.

Askina® Calgitrol® Ag is available as:

- Askina® Calgitrol® Ag, a technologically advanced wound dressing that incorporates the barrier effectiveness of ionic silver with the absorbency capabilities of calcium alginate and polyurethane foam.
- Askina® Calgitrol® THIN, a thin layer of silver alginate matrix. Soft and conformable, it is well adapted for deep and difficult to dress wounds. It should be used with absorptive secondary dressing, like Askina® Foam.

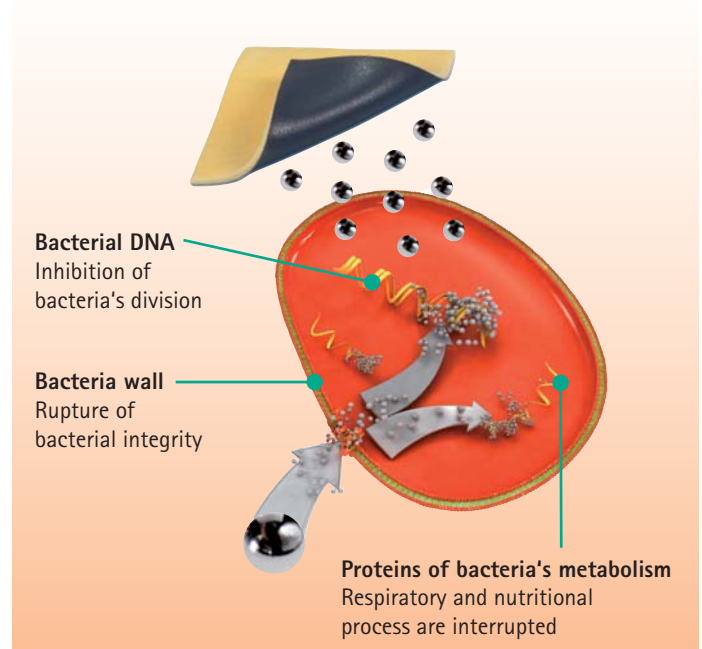
### How it works (1)



### How it works (2)

#### Mechanism of action of Silver ions:

Multiple action on 3 bacterial vital systems ensures fast killing action combined with a low risk of bacterial resistance.



# Overview of the Askina® product range

## Askina® Gel

### Description

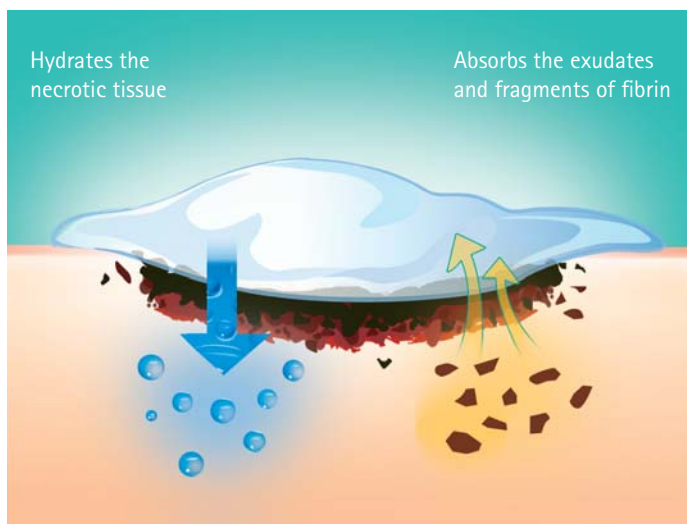
Askina® Gel is a clear, viscous, sterile hydrogel

### Composition:

- purified water (hydrating agent to provide moisture to the wound)
- glycerol (softening and absorbing agent)
- disodium EDTA (gelling agent)
- Carbopol 940 (acrylic polymer, thickener)
- Sorbital (modified starch polymer)

### How it works

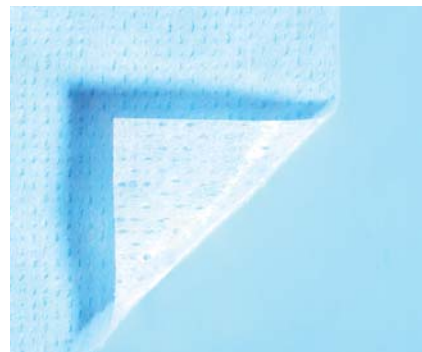
Askina® Gel, by providing a moist environment at the wound surface, assists in the debridement and removal of necrotic and other devitalised material. It rehydrates dry necrotic tissues by releasing moisture. It can also absorb wound slough and excess exudate.



## Askina® SilNet

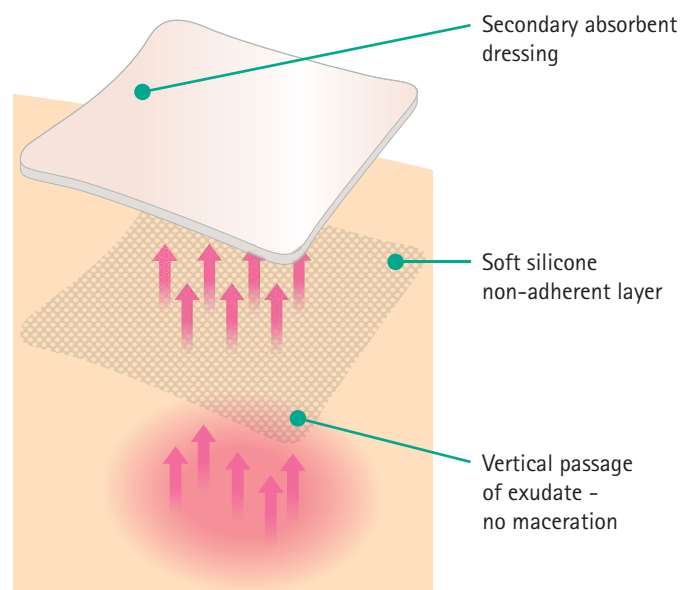
### Description

Askina® SilNet is a thin, porous, soft silicone wound contact layer, consisting of a conformable non-woven material, coated on both sides with a soft silicone layer.



### How it works

Askina® SilNet adheres gently to the wound and surrounding skin and facilitates atraumatic dressing removal. Its porous structure allows vertical passage of exudate into the secondary absorbing dressing.

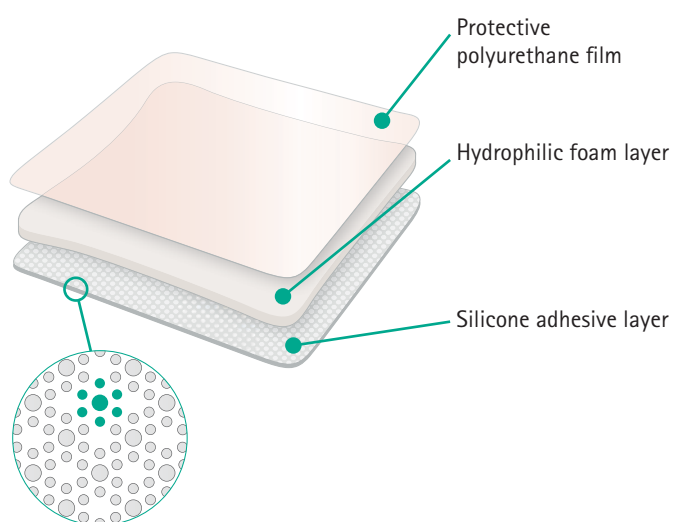


Askina® SilNet can be left in place for several days, as long as the exudate passes freely into the secondary dressing.

## Askina® DresSil

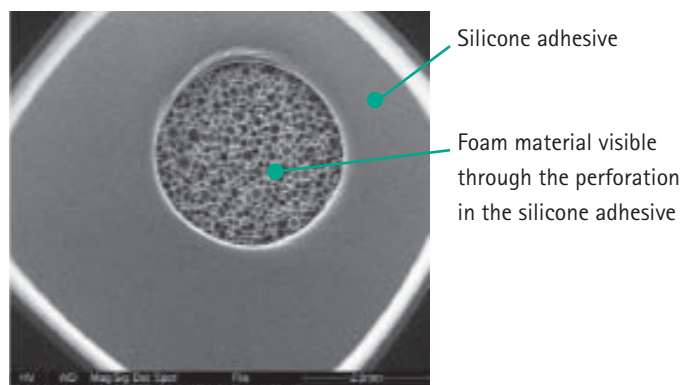
### Description

Askina® DresSil is a self adherent foam dressing with soft silicone adhesive on one side and a vapour permeable waterproof film on the other. It combines the absorption capacity of the foam with the soft adhesion of the silicone contact layer.



### How it works

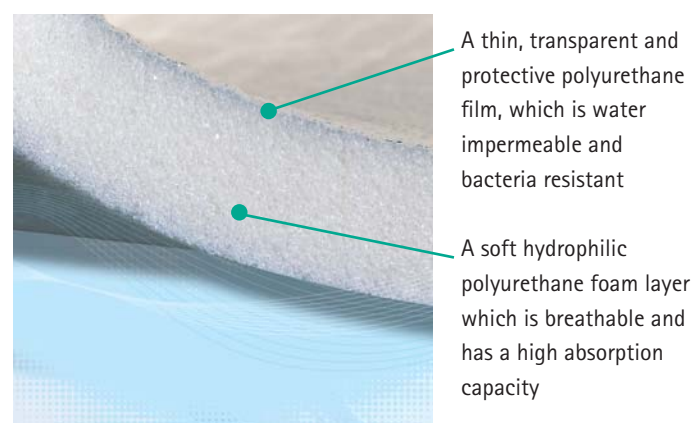
The silicone wound contact layer is perforated with repeated "flower pattern" holes to allow exudate to pass through to the foam layer, preventing exudate leaking onto the surrounding skin and maceration of the wound edges. The excess moisture is evaporated through the film backing material.



## Askina® Foam

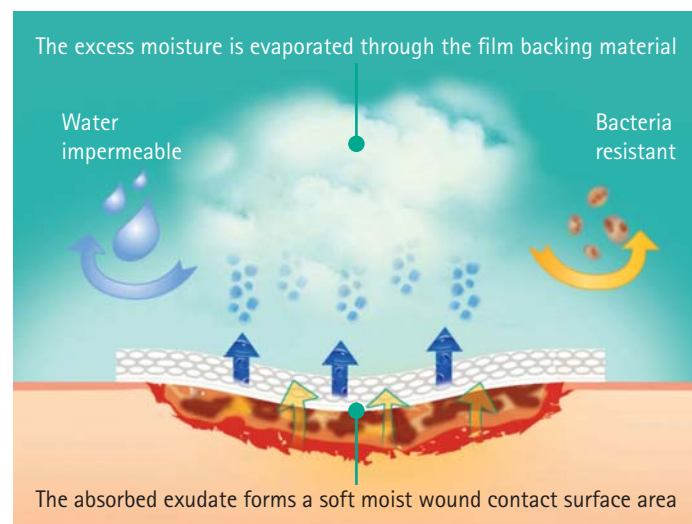
### Description

Askina® Foam is a two layered non-adherent foam dressing consisting of:



### How it works

Regeneration of absorption capacity





# Askina®

## Available evidence at a glance

Askina® Calgitrol® Ag	Type	Improved wound healing	Antimicrobial Activity	Tolerability and Cytotoxicity	Page
Reference					
Study of Silver Migration from Wound Dressing Materials using Porcine Serum; Mr Christopher David; Jarvis, Sheffield, Analytical Services, Sheffield Assay Office, Sheffield, UK; Report HOSP217 at B. Braun Hospicare	In-vitro			●	28
Assessment of Bactericidal Potential of Askina® Calgitrol® Ag Dressings; Dr Anthony Hayes and Mr Marc Isaacs, Confocal; Microscopy and Bioimaging Unit, Cardiff; School of Biosciences, Cardiff, UK; Report HOSP216 at B. Braun Hospicare	In-vitro		●		29
Antimicrobial properties of ten silver-containing dressings; Stephan Thomas, B.Pharm., Ph.D., F.R. Pharm. S. Pamela McCubbin B.Sc. Ph. D.; Journal of wound care vol 12, No 8, September 2003	In-vitro		●		30 32
Assessment of the antimicrobial effectiveness of a new silver alginate wound dressing: a RCT; C. Trial, MD; H. Darbas, MD J-P. Lavigne, MD; A. Sotto, MD; G. Simoneau, MD, L. Téot, MD; Y. Tillet, PharmD; Journal of wound care vol 19, No 1, January 2010	RCT	●	●		33
Askina® Calgitrol® Ag: clinical use of an advanced ionic silver dressing; E. Ricci, M. Pittarello, R. Cassino, M. Moffa, S. Ferrero, M. Gonella, E. Tonini; Acta Vulnologica Volume 5 - No. 3 - Pages 105-111 - September 2007	Cohort	●	●		34
Clinical effectiveness of silver alginate dressing in outpatient management of partial-thickness burns; Supaporn Opananon, Pornprom Muangman, Nantaporn Namviriyachote; International Wound Journal Volume 7, Issue 6, pages 467-471, December 2010	Cohort	●	●		35
In Vitro Evaluation of the Antimicrobial Effectiveness and Moisture Binding Properties of Wound Dressings; Pornanong Aramwit, Pornprom Muangman, Nantaporn Namviriyachote and Teerapol Srichana; International Journal of Molecular Sciences; Int. J. Mol. Sci. 2010, 11, 2864-2874; doi:10.3390/ ijms11082864	In-vitro		●		36 38
Comparative Evaluation of Erythema and Edema Skin Reaction and Skin Discoloration; Work carried out in conjunction with the University of Florida, USA, for the FDA submission file 510(k); Report HOSP240 at B. Braun Hospicare	In-vitro			●	39
Evaluation of Leachable Silver from a Wound Dressing Using the Swine Model; Dr Joseph Carraway and Ms Wendy R. Sharp, NAMSA, Northwood, OH, USA; Report HOSP213 at B. Braun Hospicare	In-vitro			●	40
Cytotoxicity study; ISO 10993 Method: Biological Evaluation of Medical Devices, Part 5: tests for Cytotoxicity; in vitro Method guidelines; Report HOSP201 at B. Braun Hospicare	In-vitro			●	40



# Askina®

Available evidence at a glance

Askina® Gel

Reference	Type	Physical properties	Improved Wound Healing	Patient's comfort	Page
Passage of moisture in / out of gelatine; Laboratory Testing carried out at B. Braun Hospicare; Data referenced in BBH 257PTDF REV001	In-vitro	●			42
Tackiness of a hydrogel at 45°, 60° and 90°angles of inclination; Laboratory Testing carried out at B. Braun Hospicare; Data referenced in BBH 257PTDF REV001	In-vitro	●			43
Evaluation of Askina® Gel – product characteristics and the patient experience; Isabella Beuken et al. European Conference on Advances in Wound Management; Harrogate, 9-11 November 2008	Cohort		●	●	44 45

# Askina®

## Available evidence at a glance

### Askina® SilNet

Reference	Type	Improved wound healing	Absence of pain	Fluid handling properties	Physical properties	Page
Evidence of absence of stripping of epidermal cells; SCANNING ELECTRON MICROSCOPE (SEM) ANALYSIS - carried out by Agenda 1 Analytical Services Limited, UK.; Report HOSP259 at B. Braun Hospicare	In-vitro		●			46
Evidence for no impedance using Askina SilNet when Askina SilNet is placed against a foam dressing; Laboratory Testing carried out at B. Braun Hospicare; Standard I.S. EN 13726-1:2002 Test Methods for primary wound dressings - Part 1: Aspects of Absorbency; Data referenced in BBH 264PTDF REV002	In-vitro			●		47
Experiences of a combination of Askina® SilNet with Topical negative pressure; Frans Meuleneire, EWMA Conference, Geneva, 2010	Cohort	●	●			48

### Askina® DresSil

Reference	Type	Improved wound healing	Absence of pain	Fluid handling properties	Physical properties	Page
Evidence of absence of stripping of epidermal cells; SCANNING ELECTRON MICROSCOPE (SEM) ANALYSIS - carried out by Agenda 1 Analytical Services Limited, UK; Report HOSP266 at B. Braun Hospicare	In-vitro		●			50
Adhesiveness; Laboratory Testing carried out at B. Braun Hospicare; Data referenced in BBH 301PTDF REV004	In-vitro				●	51
Wicking; Laboratory Testing carried out at B. Braun Hospicare; Data referenced in BBH 301PTDF REV004	In-vitro			●		52
Fluid Handling Capacity; Laboratory Testing carried out at B. Braun Hospicare; Data referenced in BBH 301PTDF REV004	In-vitro			●		52
Retention; Laboratory Testing carried out at B. Braun Hospicare; Data referenced in BBH 301PTDF REV004	In-vitro			●		53

# Askina®

## Available evidence at a glance

### Askina® Foam

Reference	Type	Improved wound healing	Absence of pain	Fluid handling properties	Physical properties	Page
Fluid Handling Capacity Laboratory Testing carried out at B. Braun Hospicare; Standard I.S. EN 13726-1:2002 Test Methods for primary wound dressings – Part 1: Aspects of Absorbency Data referenced in BBH 283PTDF REV007	In-vitro			●		54
Retention Capacity Laboratory Testing carried out at B. Braun Hospicare Data; referenced in BBH 283PTDF REV007	In-vitro			●		54

### Askina® Transorbent®

Reference	Type	Improved Wound Healing	Patient's comfort	Page
Comparison and evaluation of the performance characteristics, usability and effectiveness on wound healing of Askina® Transorbent® vs a hydrocolloid with foam backing Marie Brown-Etris, RN, CETN – President; Etris Associates, Inc. Philadelphia, USA 5th European Conference on Advances in Wound Management Harrogate, 21 –24 November 1995	RCT	●	●	56 58

# Askina® Calgitrol® Ag

Type	Improved wound healing	Antimicrobial Activity	Tolerability and Cytotoxicity	Page
In-vitro				28

## Study of Silver Migration from Wound Dressing Materials using Porcine Serum

Mr Christopher David, Jarvis, Sheffield, Analytical Services, Sheffield Assay Office, Sheffield, UK  
Report HOSP217 at B. Braun Hospicare

### Background and objective

The aim of this trial was to determine the quantity of silver ions released from the Askina® Calgitrol® Ag dressing during time by measuring the concentration obtained into porcine serum.

### Method

Three batches of Askina® Calgitrol® Ag were analysed; tests were carried out in duplicate. A circular disk (3.9cm diameter) was cut from each dressing and immersed in 20ml of porcine serum under fixed conditions. At fixed time intervals the porcine serum containing the dressing was filtered;

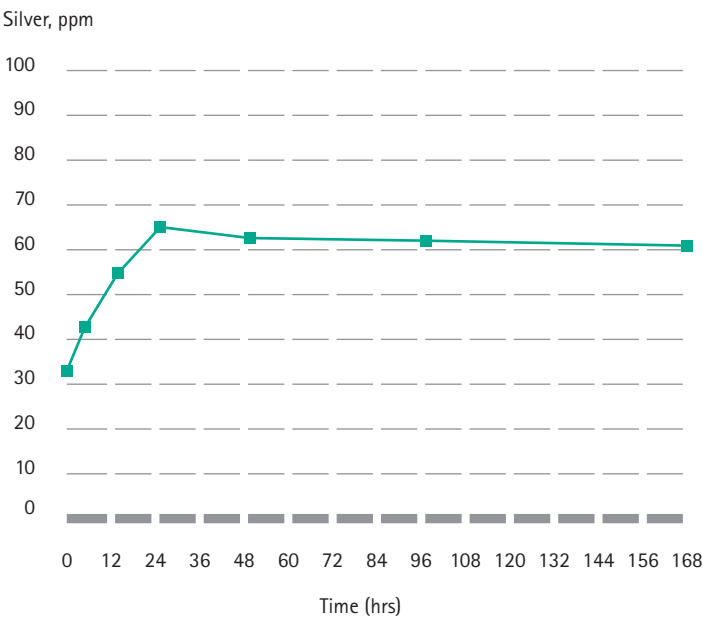
**A** The filtrate was analysed for silver content by ICP-OES (Inductively coupled plasma optical emission spectroscopy); this gives the percentage of silver released from Askina® Calgitrol® Ag.

**B** The residue of the dressing in the filter paper was completely broken down by mineral acids and analysed separately for silver content by ICP-OES; this gives the percentage of silver left in the dressing.

### Results

Askina® Calgitrol® Ag releases a relatively low level of the total silver available in the dressing. Askina® Calgitrol® Ag releases silver gradually to a steady state value.

Silver ions released from Askina Calgitrol Ag (ppm)



### Conclusion

Askina® Calgitrol® Ag wound dressings release silver ions through a controlled and sustained delivery. The resulting concentrations are maintained above the value of 30 – 40 ppm of silver ions, i. e. the concentration needed to obtain satisfactory antibacterial action. Askina® Calgitrol® Ag therefore ensures for sustained antimicrobial activity during a 7 days period.

# Askina® Calgitrol® Ag

Type	Improved wound healing	Antimicrobial Activity	Tolerability and Cytotoxicity	Page
In-vitro		●		29

## Assessment of Bactericidal Potential of Askina® Calgitrol® Ag Dressings

Dr Anthony Hayes and Mr Marc Isaacs, Confocal Microscopy and Bioimaging Unit, Cardiff School of Biosciences, Cardiff, UK;  
Report HOSP216 at B. Braun Hospicare

### Objective

To test the bactericidal potential of Askina® Calgitrol® Ag dressings on the following microorganisms: Staphylococcus aureus, Escherichia coli and Candida albicans

### Method

To visualise bacteria and assess their growth characteristics, cell populations were stained using the LIVE/DEAD® BacLight™ bacterial viability kit (Molecular Probes; Invitrogen). The kit consisted of two fluorescent dyes, SYTO 9 (green) and Propidium Iodine (red), pre-aliquoted in sealed plastic pipettes. The bacteria (Candida albicans ATCC2091; Escherichia coli ATCC 8739 and Staphylococcus aureus ATCC 6538P) were stained with the dye mixture and incubated on Askina® Calgitrol® Ag.

When the bacteria are live or viable they fluorescence green; they change to red if the bacteria wall is damaged; hence dead or dying bacteria are stained red. At specific time intervals (0, 1, 2, 3, 4, 12 & 24 hours) the dressing was observed and scanned using a Leica TCS AOBS confocal laser scanning microscope.

Cell counts for live (green) and dead (red) micro-organisms were performed using Image J Software and were based on 10 images per time point. The values are expressed as percentage viability for each time point.

### Results

After a 12 hour incubation period there were high levels of bacterial mortality, at 24 hours there was close to 100% cell death in all cultures.

### Micro-organism viability (%) on Askina® Calgitrol® Ag dressings

	0hrs	1 hr	2 hrs	3 hrs	4 hrs	12 hrs	24 hrs
C. Albicans	97.73	97.69	92.6	83.67	56.91	46.22	0
E. Coli	89.71	76.5	79.19	56.35	43.01	27.36	5.43
S. Aureus	100	100	99.27	99.1	95.17	76.7	0.55

### Conclusion

Askina® Calgitrol® Ag wound dressings are able to immobilize bacteria within a 24 hour period.

Type	Improved wound healing	Antimicrobial Activity	Tolerability and Cytotoxicity	Page
In-vitro		●		30/32

## Antimicrobial properties of ten silver-containing dressings

Stephan Thomas, B.Pharm., Ph.D., F.R. Pharm. S. Pamela McCubbin B.Sc. Ph. D  
Journal of wound care vol 12, No 8, September 2003

### Background and objective

The aim of this in vitro study was to determine the ability to release silver in sufficiently high concentrations to exert a significant antimicrobial effect of 10 silver containing dressings.

### Method

#### Test organisms

Three standard organisms were used: a Gram-positive bacteria *S. aureus* (ATCC 6538P), a Gram-negative organism, *E. Coli* (ATCC 8739), and a yeast, *C. Albicans* (ATCC 2091). The test methods used during this study were designed to compare the performance of the dressings under different simulated conditions of use. A non woven swab was used as a negative control and Acticoat® as a positive control.

#### Method 1: Zone of Inhibition Test

Samples of each dressing were placed upon agar plates inoculated with 0,2 ml of a long-phase broth culture of each test organism. After incubation, the zone of inhibition was evaluated: a clear region around the perimeter of the test sample which was free of bacterial growth. The zone of inhibition Method simulates the use of the dressings on lightly exuding wound and predicts the ability of dressings to kill or prevent bacterial growth in this situation.

#### Method 2: Challenge test

To portions of each dressing measuring 40mm x 40mm were added 0,2ml of a long-phase culture of each test organism. After 2h of incubation the dressing samples were transferred into Oxoid solution and vortexed to remove any viable organisms remaining in the dressing. Serial dilutions were performed and the number of viable organisms present determined using the standard surface counting technique.

The microbiological challenge test provides an indication of the ability of each dressing to kill or prevent the growth of pre-determined numbers of bacteria applied directly to it in the form of suspension, to reflect the action of the dressing when applied to more heavily exuding wound.

#### Method 3: Microbial Transimission Test

In this test the strip of dressing forms the bridge between two separate agar blocks in a Petri dish: one sterile, the other inoculated with the test organism. The third test determines the ability of bacteria to survive on the dressing surface and migrate along it. The positive result suggests that it is possible that microorganisms could be transported laterally out of a contaminated wound onto the surrounding skin.

#### Method 4: Silver Content of the Dressing

The total extractable silver content of each dressing was determined following acid digestion of the sample using the inductively coupled plasma optical emission spectroscopy (ICP – OES).

### Results

#### Method 1: Summary of Zone of Inhibition Test Results

	S. Aureus (ATCC 6538P)	E. Coli (ATCC 8739)	C. Albicans (ATCC 2091)
Group A (Score 3) Products that show evidence of sustained activity over two or more days	Acticoat Aquacel Ag Calgitrol Ag Contreet H Silverlon	Acticoat Calgitrol Ag Contreet H Silverlon	
Group B (Score 2) Products that produce a well-defined zone of inhibition at on time interval	Arglaes Powder Silvasorb	Aquacel Ag Arglaes Powder	Acticoat Arglaes Powder Calgitrol Ag Contreet H Silvasorb Silverlon
Group C (Score 1) Products that produce no well-defined zone of inhibition in this test	Actisorb Avance Contreet Ag	Actisorb Avance Contreet Ag Silvasorb	Actisorb Aquacel Ag Avance Contreet Ag

Askina® Calgitrol® Ag has a sustained antimicrobial activity during two or more days.

# Askina® Calgitrol® Ag

Type	Improved wound healing	Antimicrobial Activity	Tolerability and Cytotoxicity	Page
In-vitro		●		30/32

## Method 2: Summary of microbial challenge test results

	S. Aureus (ATCC 6538P)	E. Coli (ATCC 8739)	C. Albicans (ATCC 2091)
Group A (Score 4) Products that demonstrate marked antibacterial activity after 2 hours incubation	Acticoat Calgitrol Ag	Acticoat Calgitrol Ag Contreet H Silverlon	Acticoat Calgitrol Ag Contreet H Silverlon
Group B (Score 3) Products that demonstrate marked antibacterial activity after 4 hours incubation	Silverlon	Contreet H Aquacel Ag Silvasorb	
Group C (Score 2) Products that demonstrate marked antibacterial activity after 24 hours incubation		Actisorb	
Group D (Score 1) Products that demonstrate limited evidence of anti-bacterial activity after 24 hours incubation	Aquacel Ag Contreet H Contreet Ag Silvasorb		Contreet Ag Aquacel Ag Silvasorb
Group E (Score 0) Products that demonstrate no convincing evidence of antibacterial activity after prolonged incubation	Actisorb Avance	Avance	Actisorb Avance

Rapid and wide range antibacterial activity: Calgitrol® and Acticoat® are the only dressings active within first 2h after application, against all 3 tested microorganisms.

## Method 3: Microbial Transmission Test

Product	S. Aureus (ATCC 6538P)	E. Coli (ATCC 8739)	C. Albicans (ATCC 2091)
	Transfer +/-	Transfer +/-	Transfer +/-
Acticoat	-	-	-
Actisorb	+	+	-
Actisorb *	-	-	-
Avance	+++	+++	+++
Aquacel Ag	-	-	-
Askina Calgitrol Ag	-	-	-
Contreet Ag	-	-	-
Contreet H	-	-	-
Silvasorb	-	-	-
Silverlon	-	-	-
Control	+++	+++	-

Each + indicates the results for a single test strip

\* Only the inner core of the Actisorb was used in this test

Negative result for Askina® Calgitrol® Ag signifies the absence of risk of transmission of microorganisms through the dressing.

# Askina® Calgitrol® Ag

Type	Improved wound healing	Antimicrobial Activity	Tolerability and Cytotoxicity	Page
In-vitro		●		30/32

## Method 4: Silver content of the dressing and the total performance score

Product	Batch No	Ag content (mg/100 cm <sup>2</sup> )	Total performance score
Silverlon	102S02-01	546	19
Askina® Calgitrol® Ag	131-71	141	20
Acticoat	010814A-08 020214A	109 101	20
Contreet Ag	74853.01	47	9
Contreet H	31576B 267462 344046	31.2 32.4 31.4	13
Aquacel Ag	2H55863	8.3	10
Silvasorb	2082001	5.3	9
Actisorb Silver 220	0138-03 0135-04	2.9 2.4	2
Avance	1106947	1.6	0
Arglaes powder	527027	6.887 mg/g	0

The silver content of tested dressings indicates that major differences exist between these products, with values ranging from 1.6 to 546mg/cm<sup>2</sup>. Also included are the total scores achieved by each dressing in the various laboratory tests. Askina® Calgitrol® Ag has the second highest silver content and the best overall performance score (with Acticoat®).

### Conclusion

Askina® Calgitrol® Ag, which contains high concentration of silver, performed very well in all tests. The reason for this is likely to be that the silver, already available in the ionic form, is concentrated on the surface of the dressing in a hydrophylic coating which facilitates its rapide release.



Type	Improved wound healing	Antimicrobial Activity	Tolerability and Cytotoxicity	Page
RCT	●	●		33

Assessment of the antimicrobial effectiveness of a new silver alginate wound dressing: a RCT

C. Trial,MD; H. Darbas, MD J-P. Lavigne, MD; A. Sotto, MD; G. Simoneau, MD, L. Téot, MD; Y. Tillet, PharmD  
JOURNAL OF WOUND CARE VOL 19, NO 1, JANUARY 2010

Objective

To compare the efficacy and tolerability of a new ionic silver alginate matrix (Askina® Calgitrol® Ag) with that of a standard silver-free alginate dressing (Algosteril®).

Method

Patients with locally infected chronic wounds (pressure ulcers, venous or mixed aetiology leg ulcers, diabetic foot ulcers) or acute wounds were eligible for this prospective, open-label, controlled and randomised trial. Patients were randomised to receive one of the two dressings for a two-week period. Criteria of efficacy were based on the evolution, from day 1 to day 15, of local signs of infection using a clinical score ranging from 0 to 18, and the evolution of the bacteriological status for each wound. The latter was determined by (blind) bacteriological examinations of results obtained from two biopsies performed at days 1 and 15. A three-point scale (deterioration, unchanged, improvement) was also used. Acceptability, usefulness and tolerance were also assessed.

Results

Forty-two patients (20 women and 22 men, 68.9 ± 18.8 and 66.5 ± 15.7 years old respectively) were randomly assigned to receive either Askina® Calgitrol® Ag (n=20) or Algosteril® (n=22). Most had chronic wounds such as pressure ulcers (57%) or venous or mixed aetiology leg ulcers and diabetic foot ulcers (29%); few had acute wounds (14%). Clinical scores of infection were comparable in both groups at inclusion, 8.9 ± 2.4 and 8.6 ± 3.2 in the Askina® Calgitrol® Ag group and the Algosteril® group respectively (not significant), but decreased significantly in both groups at day 15, 3.8 ± 2.9 in the Askina® Calgitrol® Ag group (p=0.001) and 3.8 ± 3.4 in the Algosteril® group (p=0.007). There was no significant difference between the two groups at day 15. Although there was also no significant difference in bacteriological status between the treatment groups, a trend in favour of Askina® Calgitrol® Ag was found for the relative risk of improvement, especially in patients who were not treated with antibiotics either at the beginning of the study or during it. No differences between groups were observed regarding local tolerance, acceptability and usefulness of the dressings.

Conclusion

The regression of local signs of infection, local tolerance, acceptability and usefulness were similar for the two dressings. However, Askina® Calgitrol® Ag improved the bacteriological status of the wounds. Further trials are required to show that it has a positive impact on the healing process.

# Askina® Calgitrol® Ag

Type	Improved wound healing	Antimicrobial Activity	Tolerability and Cytotoxicity	Page
Cohort	●	●		34

## Askina® Calgitrol® Ag: clinical use of an advanced ionic silver dressing

E. Ricci, M. Pittarello, R. Cassino, M. Moffa, S. Ferrero, M. Gonella, E. Tonini  
Acta Vulnologica Volume 5 - No. 3 - Pages 105-111 - September 2007

### Objective

This open ended, non-controlled non-randomized study assessed the clinical efficacy of an absorbent, isolating composite ionic silver dressing. Thirty-seven patients with infected or critically colonised wounds, but without deep infection requiring general antibiotic treatment, were recruited for the study.

### Method

The evaluation parameters were: pain; evolution of the bacterial population as measured by swab; change in wound surface area (Visitrak® system); evolution of the infection. The clinical picture of infection was defined by criteria according to Harding and to Sibbald.

Dressings were changed at saturation.

The observation period was two weeks.

The assessment parameters were:

- 1) Evolution of the infection (defined by clinical criteria according to Harding and Sibbald).
- 2) Evolution of the bacterial population as measured by swab.
- 3) Pain (as measured on a visual analog scale [VAS]).
- 4) Changes in the base of the wound (classified as necrotic, infected, clean).
- 5) Monitoring of exudate by clinical observation of the amount of exudate defined as high (presence of perilesional maceration). average (saturation of the dressing within 48 hours); low (saturation after 72 hours).
- 6) Clinical evaluation of the lesion by the caregiver (resolved, improved, unchanged, worse).
- 7) Tracking of wound surface area (Visitrak®, Smith & Nephew); a reduction in wound surface area is generally considered as the true indicator of the progress of healing, as demonstrated in a study by Falanga, since re-epithelialization is activated only after all the needs of the wound have been taken care of.
- 8) Dressing in terms of comfort, wear time, performance and residuals.

### Results

Infection.—Clinical signs of infection resolved in 34 of 37 cases (91.89%) within the 2-week observation period.

Wound improvement with resolution of infection was observed within 14 days of treatment in 34/37 patients; pain when changing dressings was present, especially at the first dressing. The evolution of the bacterial populations was present from the first week. Performance in terms of patient/operator comfort was very high.

### Conclusion

The study product showed excellent overall performance on all given criteria. These results suggest that Askina® Calgitrol® Ag is performant silver dressing in terms of clinical efficiency, but also in terms of patients' comfort.

# Askina® Calgitrol® Ag

Type	Improved wound healing	Antimicrobial Activity	Tolerability and Cytotoxicity	Page
Cohort	●	●		35

## Clinical effectiveness of silver alginate dressing in outpatient management of partial-thickness burns

Supaporn Opasanon, Pornprom Muangman, Nantaporn Namviriyachote  
 International Wound Journal Volume 7, Issue 6, pages 467–471, December 2010

A prospective descriptive study

### Background and objective

The purpose of this study was to compare the efficacy of Askina® Calgitrol® Ag and 1% silver sulfadiazine (1% AgSD) in the outpatient management of partial-thickness burn wounds at Burn Unit, Siriraj Hospital. A prospective descriptive study was conducted between January 2008 and January 2009 in Burn Unit, Division of Trauma Surgery, Siriraj Hospital, Mahidol University, Thailand.

### Method – study design

The 65 patients with partial-thickness burn wounds, less than 24 hours post-burn injury, had a total body surface area (TBSA%) less than 15% were treated at Siriraj Outpatient Burn Clinic. All patients were divided into Askina® Calgitrol® Ag treated group (30 patients) and 1% AgSD treated group (35 patients). The data were compared by the demographics including age, gender, % TBSA burn, pain score, number of wound dressing change, nursing time and time of wound healing. Patients included in both groups were comparable with no significant differences in demographic data of age, gender, location of burn and type of burn injury ( $P > 0.05$  evaluated by paired Student's t-test) between both group.

### Results

The present results showed that average pain scores in the Askina® Calgitrol® Ag treated group were significantly lower than the 1% AgSD treated group ( $2.23 \pm 1.87$  versus  $6.08 \pm 2.33$ , respectively) between both groups ( $P < 0.02$ ). Patients treated with Askina® Calgitrol® Ag had significantly lower number of wound dressing change ( $P < 0.02$ ) and nursing time ( $P < 0.02$ ) compared with 1% AgSD treated group. The Askina® Calgitrol® Ag group needed less frequent wound dressing. Healing time was  $7 \pm 3.51$  days after the application of Askina® Calgitrol® Ag. This was significantly shorter than that of control wounds ( $14 \pm 4.18$  days).

### Conclusion

The results suggest that Askina® Calgitrol® Ag significantly decreases the level of pain, the frequency of dressing changes and the healing time compared with 1% AgSD treated group. The presented data suggest that Askina® Calgitrol® Ag is an effective dressing managing the partial-thickness burn wounds at the outpatient clinic.

# Askina® Calgitrol® Ag

Type	Improved wound healing	Antimicrobial Activity	Tolerability and Cytotoxicity	Page
In-vitro		●		36/38

## In Vitro Evaluation of the Antimicrobial Effectiveness and Moisture Binding Properties of Wound Dressings

Pornanong Aramwit , Pornprom Muangman , Nantaporn Namviriyachote and Teerapol Srichana

### Background and objective

**Abstract:** A variety of silver-coated dressings and some impregnated with other chemicals are now available in the market; however, there have been few studies analyzing their comparative efficacies as antimicrobial agents. Besides antimicrobial properties, the ability to absorb moisture is also an important factor for healing. Bolton et al. suggested that the use of more moisture-retentive dressings generally supports faster healing compared with less moisture-retentive dressings. The objective of this study is to evaluate the antimicrobial effectiveness of five commercially available antimicrobial dressings in vitro. The moisture penetration of each dressing will also be investigated.

### Method

Five commercially available silver-containing and chlorhexidine dressings, Urgotul® SSD, Bactigras®, Acticoat®, Askina® Calgitrol® Ag and Aquacel® Ag were tested to determine their comparative antimicrobial effectiveness in vitro against five common wound pathogens, namely methicillin-sensitive and -resistant Staphylococcus aureus, Bacillus subtilis, Escherichia coli and Pseudomonas aeruginosa. Mepitel®, a flexible polyamide net coated with soft silicone, was used as a control. The zones of inhibition and both the rapidity and the extent of killing of these pathogens were evaluated, as well water vapour absorption capacity.

### Corrected Zone of Inhibition Test

The antimicrobial effect of each dressing was tested using corrected zone of inhibition method. The bacterial isolates were grown in broth for 4 to 6 h, and the broth was used to inoculate Muller-Hinton agar plates to form a confluent lawn. The various wound dressings (about 1 cm<sup>2</sup>) were applied to the center of each lawn, and all plates were incubated for 24 h at 37°C. The inhibition zone surrounding the tested dressing was then determined.

### Bactericidal Activities of Antimicrobial Dressings

In order to determine the onset and duration of antimicrobial activity of each dressing, bactericidal activities at different time points were determined by bacterial broth culture method which was adopted from Fraser et al. with some modifications.

### Wound Dressing Water Vapor Absorption

Dressings (about 9 inch<sup>2</sup>) were prepared in an aseptic manner and precisely weighed. Each dressing was placed in a desiccator pre-equilibrated with salts to make the relative humidity a desired value. Potassium sulfate or potassium acetate powder was placed in a desiccator to achieve a percentage relative humidity of about 90% and 20% at 30°C, respectively, as reported by Greenspan. After 30 min, 1, 1.5, 2, 2.5, 3, 4, 5, 6, 8, 12, 24, 48 and 72 h, each dressing was taken from the desiccator using sterile forceps and again precisely weighed. The equilibrium moisture absorption was determined by the percentage weight change.

### Results

#### Zone of inhibition test

**Corrected zone of inhibitions (mm) generated by topical antimicrobial dressings.**

Microorganism	Urgotul® SSD	Bactigras®	Acticoat®
S. Aureus	1.41 ± 0.86	1.13 ± 0.42	13.30 ± 0.78
MRSA	0.19 ± 0.11	0.36 ± 0.33	6.69 ± 0.14
B. Subtilis	2.39 ± 2.11	7.12 ± 1.24	10.98 ± 0.49
P. Aeruginosa	9.05 ± 3.34	0	17.62 ± 4.82
E. Coli	6.44 ± 1.22	0.78 ± 0.16	15.98 ± 0.84

Microorganism	Askina® Calgitrol® Ag	Aquacel® Ag	Mepitel®
S. Aureus	24.33 ± 3.12	12.97 ± 0.85	0.00
MRSA	8.11 ± 4.33	1.84 ± 0.95	0.00
B. Subtilis	5.62 ± 1.48	6.69 ± 1.39	0.00
P. Aeruginosa	21.08 ± 0.89	22.56 ± 1.77	0.00
E. Coli	12.42 ± 0.69	10.58 ± 0.47	0.00

### Conclusion

Acticoat® and Askina® Calgitrol® Ag produced the largest zones of inhibition, which may due to the high concentration of silver contained in these dressings (105 mg/100 cm<sup>2</sup> and 141 mg/100 cm<sup>2</sup>, respectively) compared with 3.75% of silver sulfadiazine in Urgotul® SSD and 0.5% chlorhexidine in Bactigras®.

# Askina® Calgitrol® Ag

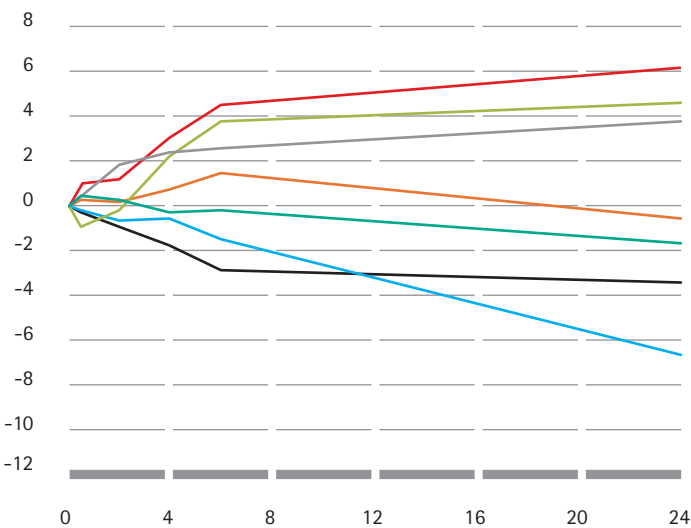
Type	Improved wound healing	Antimicrobial Activity	Tolerability and Cytotoxicity	Page
In-vitro		●		36/38

## Results

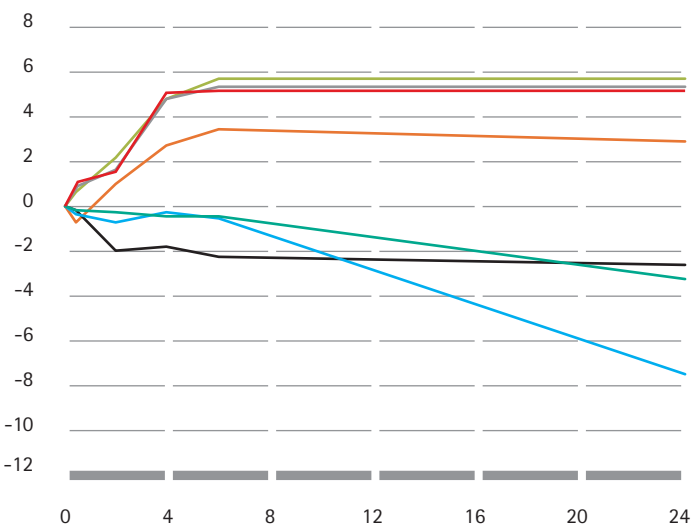
### Bactericidal Activities of Antimicrobial Dressings

Bactericidal activity was indicated by a reduction in bacterial counts presented as log10c.f.u. (colony forming units) mL<sup>-1</sup> over time. These curves also indicated the rate of bacterial killing and provided an additional index of efficacy against the described isolate. The normal growth rate of each organism was represented by the growth control and that of the Mepitel® dressing, which contained no antimicrobials.

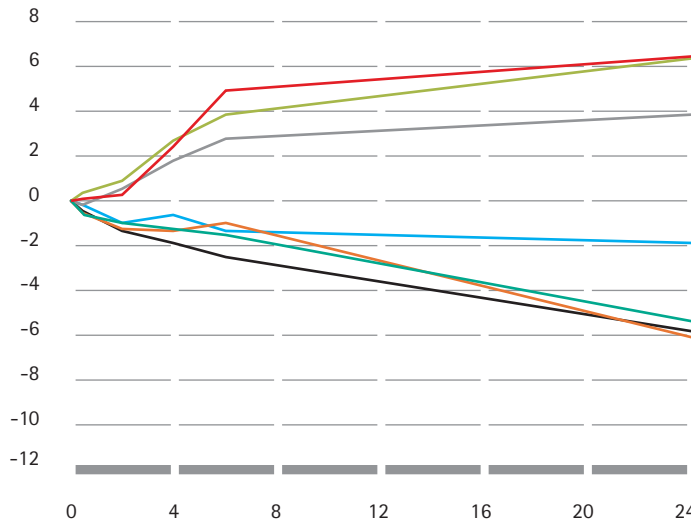
(a) Methicillin-sensitive *Staphylococcus aureus* (ATCC 6338P)



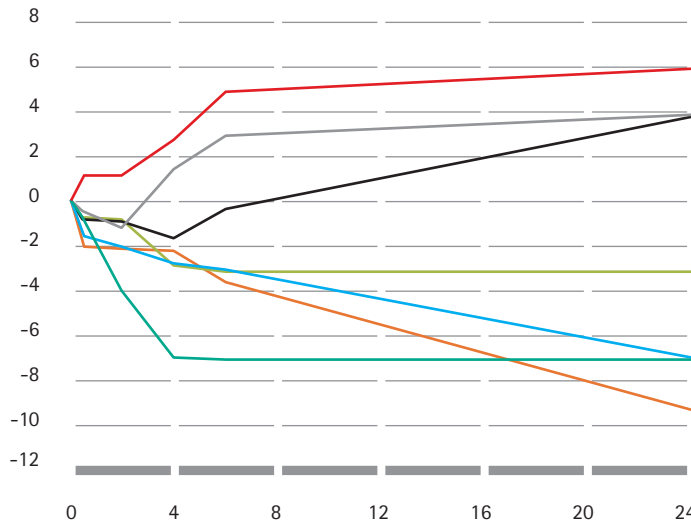
(b) Methicillin-resistance *Staphylococcus aureus* (ATCC 25923)



(c) *Bacillus subtilis* (ATCC 6633)



(d) *Pseudomonas aeruginosa* (ATCC 27853)

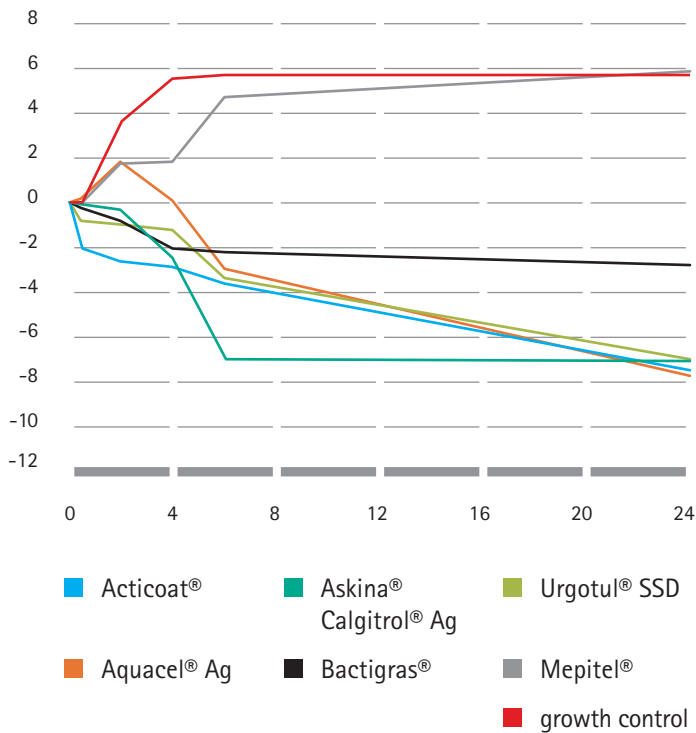


- Acticoat®
- Aquacel® Ag
- Askina® Calgitrol® Ag
- Bactigras®
- Urgotul® SSD
- Mepitel®
- growth control

# Askina® Calgitrol® Ag

Type	Improved wound healing	Antimicrobial Activity	Tolerability and Cytotoxicity	Page
In-vitro		●		36/38

(e) Escherichia coli (ATCC 25922)



## Conclusion

Overall, Acticoat® seemed to be the most effective dressing against these five tested organisms, especially with Grampositive bacteria, whereas Urgotul® SSD and Bactigras® seemed to have a lower antimicrobial effect compared with the other dressings. For the Gram-positive bacteria, *S. aureus* (Figure 1a,b) and *B. subtilis* (Figure 1c), the Acticoat® dressing exerted maximal bactericidal activity, achieving more than a 4 log reduction of bacterial growth after 24 h. The killing patterns of *S. aureus* and *B. subtilis* by silver dressings were similar to MRSA, except for Aquacel® Ag, which slightly reduced both *S. aureus* and *B. subtilis* counts but had no effect on MRSA.

With *P. aeruginosa* (Figure 1d), Acticoat®, Askina® Calgitrol® Ag and Aquacel® Ag exhibited a good bactericidal effect.

The maximal killing of *P. aeruginosa* was achieved at 4 h with Askina® Calgitrol® Ag and the reduction in bacterial counts was sustained. The killing pattern for *E. coli* (Figure 1e) by Askina® Calgitrol® Ag was similar to that for *P. aeruginosa* except for the maximal killing, which was found at 6 h.

All dressings exhibited bactericidal activity and achieved more than a 4 log reduction of *E. coli* (Figure 1e) except for Bactigras®, which had a less pronounced effect.

# Askina® Calgitrol® Ag

Type	Improved wound healing	Antimicrobial Activity	Tolerability and Cytotoxicity	Page
In-vitro			●	39

## Comparative Evaluation of Erythema and Edema Skin Reaction and Skin Discoloration

Work carried out in conjunction with the University of Florida, USA, for the FDA submission file 510(k) Report HOSP240 at B. Braun Hospicare

### Objective

To evaluate the irritation reactivity of several silver-containing dressings for: erythema, oedema, skin discoloration

### Method

The skin on the inner forearm was swabbed in its entirety with 70% isopropyl alcohol to remove traces of oils and cleanse the surface. Rectangles (approx. 6 x 12.5mm) were cut from each dressing and affixed to a band-aid, which was then applied to the skin. Where the product was in the form of a foam gel, a one gram quantity of the gel was placed on the surface of the band-aid and then affixed to the skin in the appropriate place. The dressings were arranged to avoid the area of the bent elbow.

### Results

None of the dressings caused Erythema. Two of the dressings (3 and 5) showed very slight to slight signs of Edema. All of the dressings showed signs of discoloration except Askina® Calgitrol® Ag and silver island dressing B.

Silver-containing dressings tested	Skin Discoloration	Erythema	Edema
Askina® Calgitrol® Ag – B. Braun Medical	0	0	0
Burn dressing A (nanocrystalline silver)	1	0	0
Burn dressing A (nanocrystalline silver)	3	0	1
Silver dressing B (nanocrystalline silver)	2	0	0
Silver dressing B (nanocrystalline silver)	3	0	2
Film silver dressing A	0	0	0
Film island dressing B	0	0	0

A 0 to 4 score was used to evaluate the skin reactions for erythema, edema and any discoloration.

### Conclusion

Askina® Calgitrol® Ag wound dressings do not cause any discoloration or skin staining.

Type	Improved wound healing	Antimicrobial Activity	Tolerability and Cytotoxicity	Page
In-vitro			<div></div>	40

Evaluation of Leachable Silver from a Wound Dressing Using the Swine Model

Dr Joseph Carraway and Ms Wendy R. Sharp, NAMSA, Northwood, OH, USA.  
Report HOSP213 at B. Braun Hospicare

Objective

To evaluate the level of silver released from Askina® Calgitrol® Ag, following its application to full thickness wounds in a domestic swine.

Protocol – method

Two circular full thickness wounds (2.0 – 2.3cm diameter; 5–7mm deep) were surgically induced on the back of a single swine. Askina® Calgitrol® Ag dressings were placed on each wound with the dark side of the dressing against the wound, and held in place with a film dressing, Askina® Derm. At pretreatment (day 0), day 1, 3 and 7, a blood specimen was obtained and the specimen was processed to serum. The serum was analysed for silver by Inductively Coupled Plasma (ICP) Spectroscopy.

Results

Under the conditions of the study, the serum levels of silver were comparable at each interval (day1, day 3 and day 7). The highest level detected was 0.008ppm, at day 7. When compared to the normal human blood levels of silver, this amount is considered insignificant.

Samples	Amount of silver in parts per million (µg/g)
Pretreat	ND
Day 1 (Orange Serum)	0.005
Day 1 (Yellow Serum)	0.005
Day 3	0.002
Day 7 (Dark Orange Serum)	0.008
Day 7 (Light Orange Serum)	0.007
Detection limit	0.001

ND = None Detected

Conclusion

Askina® Calgitrol® Ag wound dressings do not result in any significant elevation of silver ions into the blood serum.

Cytotoxicity study

ISO 10993 Method: Biological Evaluation of Medical Devices, Part 5: tests for Cytotoxicity; in vitro Method guidelines  
Report HOSP201 at B. Braun Hospicare

Objective

This in vitro biocompatibility study was conducted in order to determine the potential for cytotoxicity of Askina® Calgitrol® Ag.

Method

A single extract was prepared using single strength Minimum Essential Medium supplemented with 5% serum and 2% antibiotics (IX MEM). A 1:8 dilution of the test extract in IX MEM was placed onto three separate confluent monolayers of fibroblast cells propagated in 5% CO2. After incubation at 37° in the presence of 5% CO2 during 48h, all monolayers (test, reagent control, negative control and positive control) were examined microscopically to determine any change in cell morphology.

Conclusion

Under the conditions of this study, the test extract (Askina® Calgitrol® Ag) showed no evidence of causing cell lysis or cytotoxicity.





Type	Physical properties	Improved Wound Healing	Patient's comfort	Page
In-vitro	<div></div>			42

Passage of moisture in/out of gelatine

Laboratory Testing carried out at B. Braun Hospicare  
Data referenced in BBH 257PTDF REV001

In-vitro test for comparing the capability of water donation of hydrogels

Background and objective

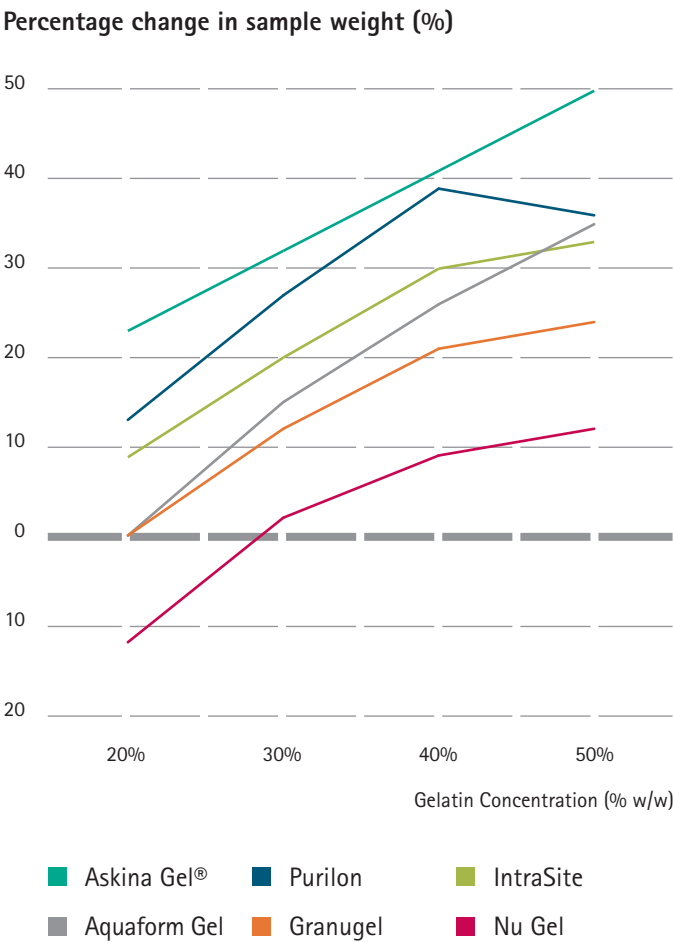
Hydrogels have a special ability to adapt to their environment and can either hydrate the wound or absorb exudate. In the case of necrotic wounds, hydrating helps to soften the necrotic tissue and to facilitate its removal which is less traumatic for the patient. The objective of this study was to determine the hydration capability of Askina® Gel, and to compare it to the one of other hydrogels present in the market.

Method

A given hydrogel was placed on a gelatine preparation and its loss of weight (hydration) or increase of weight (absorption) is determined after 48 hours. The gelatine preparation were solutions of gelatine (20% - 50%) with electrolytes, representing a good model of dry and necrotic wounds.

Results

Water donation was measured at different percentage of gelatine solution. The results are reported to the following graph:



Conclusion

Askina® Gel showed the best water donation capacity among tested samples.

# Askina® Gel

Type	Physical properties	Improved Wound Healing	Patient's comfort	Page
In-vitro	<div></div>			43

## Tackiness of a hydrogel at 45°, 60° and 90° angles of inclination

Laboratory Testing carried out at B. Braun Hospicare Data referenced in BBH 257PTDF REV001

### In-vitro test for comparing the stability of hydrogels

#### Background and objective

Tackiness may be defined as the more or less pronounced ability of a given hydrogel to adhere to the (wound) surface on which it has been placed, despite the tendency to flow away before the secondary dressing can be applied.

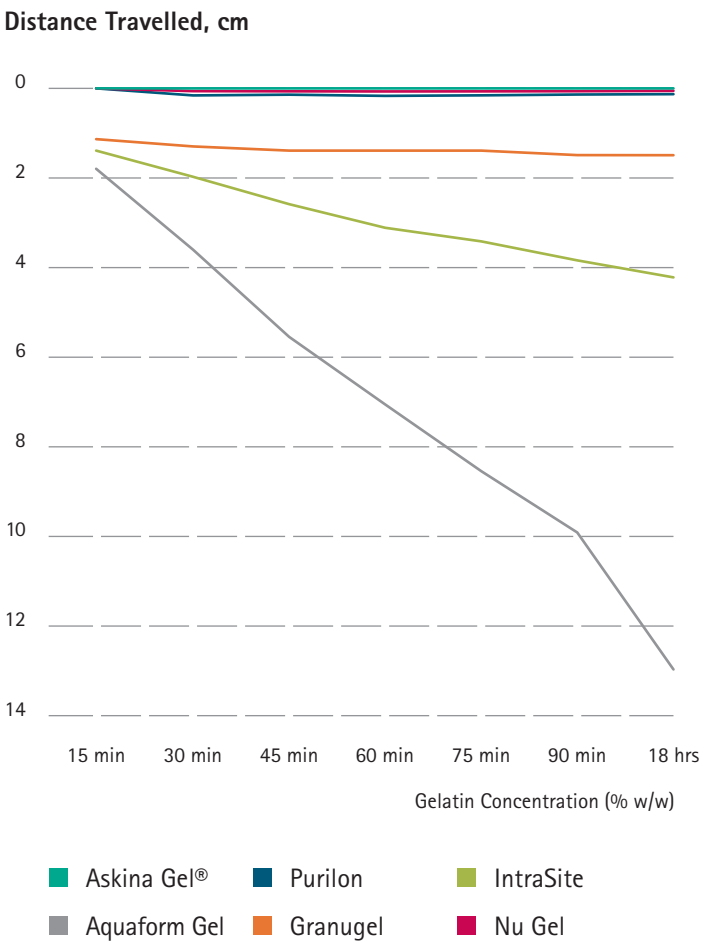
The objective of this study was to determine the tackiness of Askina® Gel, and to compare it with the tackiness of other hydrogels present in the market.

#### Method

To determine the tackiness of a hydrogels, 1g of hydrogel is placed on a series of glass plates inclined at 45, 60 and 90 degrees. The distance travelled by the gel after defined time periods is measured.

### Results

Distance travelled by each hydrogel sample was measured and reported to the following graph:



### Conclusion

In the group of tested hydrogels, 3 hydrogels, including Askina® Gel, remained in place during 18 hours, which signifies excellent stability. In clinical condition, Askina® Gel can be applied in all positions, without risk of leakage.

# Askina® Gel

Type	Physical properties	Improved Wound Healing	Patient's comfort	Page
Cohort		●	●	44/45

## Evaluation of Askina® Gel – product characteristics and the patient experience

Isabella Beuken, Staff Nurse, Co-Authors: Emma McLeod, Staff Nurse, Ann McLinton, Practice Development Facilitator, Heather Hodgson, Tissue Viability Nurse Specialist Out Patient Department, Beatson West of Scotland Cancer Centre, Glasgow and , Gartnavel General Hospital, Glasgow  
Results presented at the European Conference on Advances in Wound Management Harrogate, 9-11 November 2008

### Abstract

#### Background and objective

Radiotherapy is one of the major treatment modalities used in the management of cancer (SEHD, 2001). Almost all patients receiving radiotherapy are at risk of a degree of skin damage (NHSQIS, 2004) and the increasing use of chemoradiotherapy also affects the severity of skin reactions experienced (Wells et al, 2003). This therefore presents a significant challenge for the healthcare system to ensure optimum quality of care. When a moist desquamation skin reaction arises the integrity of the skin is compromised and the principles of moist wound healing apply (NHSQIS, 2004). A hydrogel is recommended as an option for the treatment of moist desquamation (NHSQIS, 2004) and have been explored for this use in other radiotherapy treatment centres (Macmillan et al, 2007).

#### Method

Over a four week period, thirty six patients identified to have moist desquamation (RTOG 2b and RTOG 3), dry desquamation (RTOG 2a) where the skin was on the verge of breaking down, or a combination of both, were evaluated when using Askina® Gel as the skin care intervention.

The product was evaluated in the Out Patient Department of the cancer centre using a tool designed to assess the following product characteristics:

- use of the delivery system;
- product application;
- ability to spread the product over the wound;
- ability of the product to stay on the wound;
- ability to rehydrate the wound;
- removal of the product and removal of any residue left on the wound prior to further application.

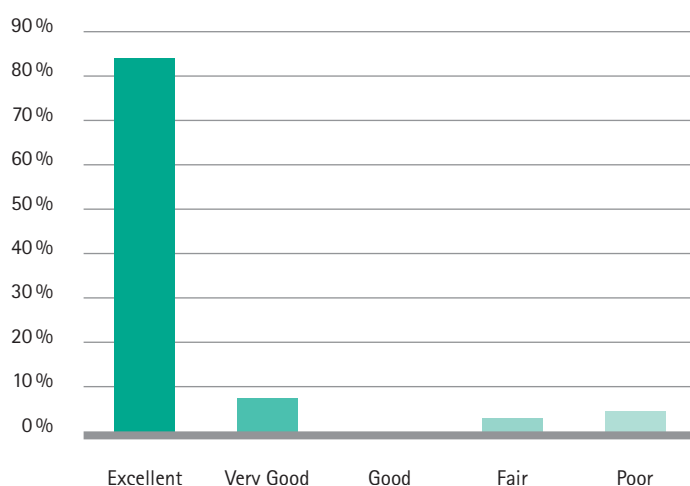
Score	Description
RTOG 0	No visible change to skin
RTOG 1	Faint or dull erythema
RTOG 2A	Tender or bright erythema
RTOG 2B	Patchy moist desquamation, moist oedema
RTOG 3	Confluent moist desquamation



### Results

Askina® Gel was noted mainly as "Excellent" and "Very good" on all studied criteria.

#### Ease of Using the Askina Delivery System



### Conclusion

Results demonstrate Askina® Gel to having favourable product characteristics and to be suitable for use by patients who self care for their radiotherapy reaction. In regard of the study results Askina® Gel was accepted as a product of reference for the care of skin damages caused by radiation therapy in the 2 major Schottische clinics.

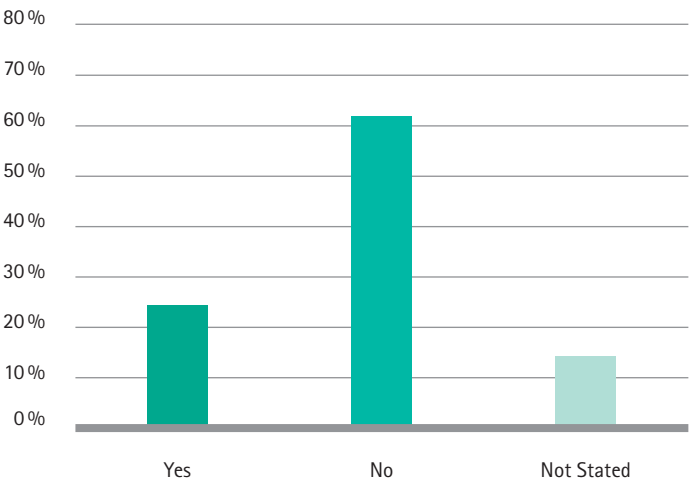
# Askina® Gel

Type	Physical properties	Improved Wound Healing	Patient's comfort	Page
Cohort		●	●	44/45

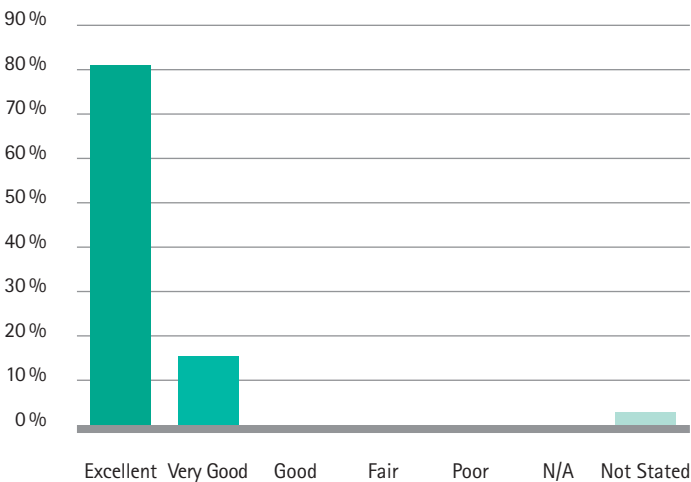
Ease of Product Application



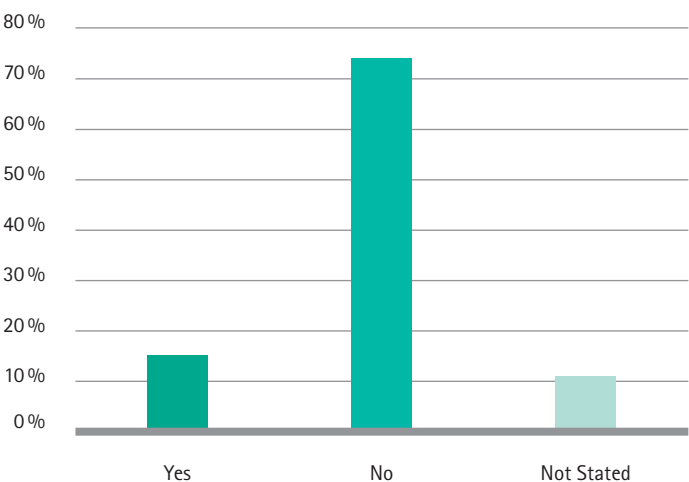
Did Askina Gel cause any pain?



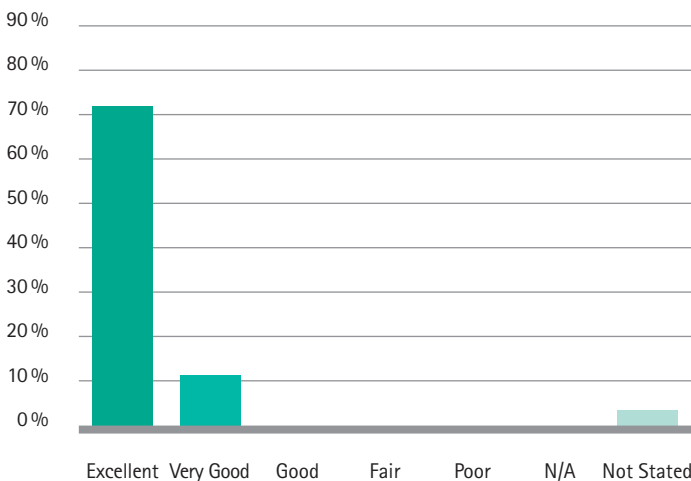
Ease of Spread over the Wound



Did Askina Gel cause any irritation?



Ability to Stay on the Wound on Initial Application



Type	Improved wound healing	Absence of pain	Fluid handling properties	Physical properties	Page
In-vitro		●			46

Evidence of absence of stripping of epidermal cells

SCANNING ELECTRON MICROSCOPE (SEM) ANALYSIS - carried out by Agenda 1 Analytical Services Limited, UK.  
Report HOSP259 at B. Braun Hospicare

Background and objective

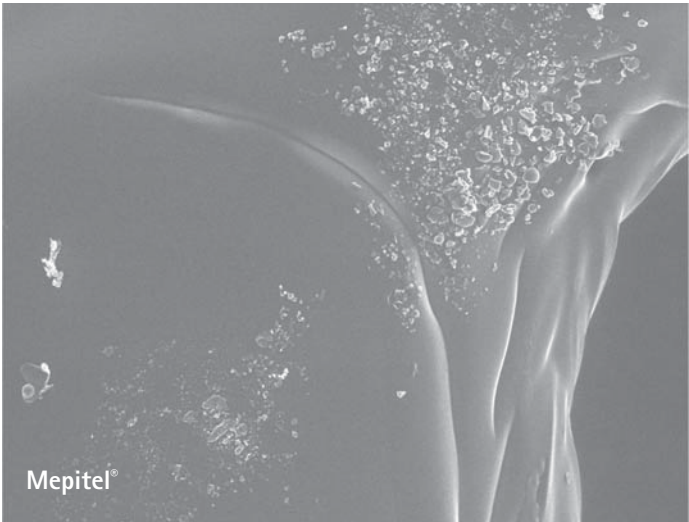
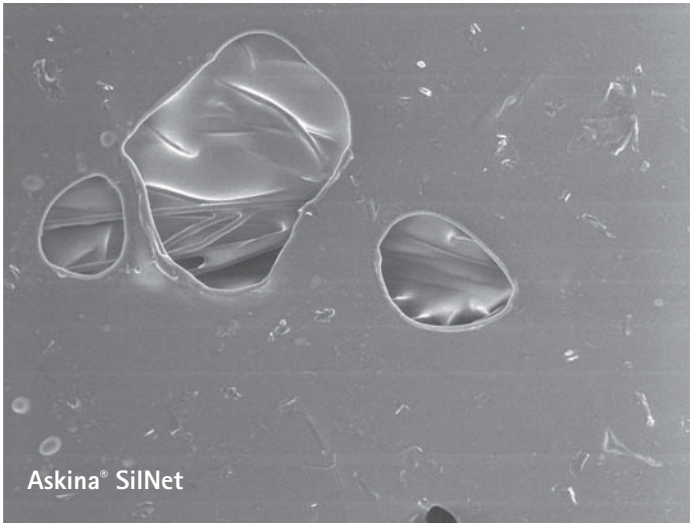
The aim of this study is to demonstrate that the silicone adhesive used in Askina® SilNet does not cause the stripping of epidermal cells. A silicone adhesive is extremely soft and will flow over the uneven skin surface to create a large effective contact area with the skin. As a result, less adhesion force per square millimetre is needed, compared with traditional dressings, to create the same level of fixation. This property helps to prevent damage to the skin barrier.

Method

A small piece of Askina® SilNet was observed by the Scanning Electron Microscopy, the instrumentation used to observe minute surface details of small organisms/objects at high magnification by means of electron lenses. The system produces a magnified snap-shot image of the object (12.5mm diameter circle surface). The samples of Askina® SilNet, Mepitel® (the market leading silicone contact layer) and Askina® Transorbent® (dressing with acrylic adhesive) were observed before applying the dressing on the skin, and after its removal from the skin.

Results

The snap shots of the surface of the 3 tested samples after removal from the skin:



There was no epidermal cells on the surface of Askina® SilNet and Mepitel®, while there were many epidermal cells present at the surface of Askina® Transorbent® (acrylic adhesive.)

Conclusion

Askina® SilNet is completely atraumatic, which does not cause any stripping of epidermal cells, even after repeated removal, comparable to the leading market product, Mepitel®. The use of this dressing is thus recommended for the protection of fragile skin.

Type	Improved wound healing	Absence of pain	Fluid handling properties	Physical properties	Page
In-vitro			●		47

## Evidence for no impedance using Askina® SilNet when Askina® SilNet is placed against a foam dressing

### Results

Fluid handling capacity (FHC) of Askina® Foam through the interface dressing:

Product	FHC of Askina® Foam	FHC of Askina® Foam	FHC of Askina® Foam	FHC of Askina® Foam
Askina® Foam (Batch # J3107) (without any interface dressing)	201,76	N/A	N/A	N/A
Askina® Foam (Batch # J3107) + Askina® SilNet	N/A	201,76	-0,31	0,15
Askina® Foam (Batch # J3107) +Mepitel		198,43	-3,33	1,65
Askina® Foam (Batch # J3107) + URGO		197,91	-3,85	1,91
Askina® Foam (Batch # C25101) (without any interface dressing)	210,70	N/A	N/A	N/A
Askina® Foam (Batch # C25101) + Silflex®	N/A	201,97	-8,73	4,14
Askina® Foam (Batch # C25101) + Adaptic Touch		208,94	-1,76	0,84

### Conclusion

The difference between the fluid handling characteristics of "Foam" and "Foam + Askina® SilNet" are insignificant: Askina® SilNet does not impact the flow of liquid into Askina® Foam, and does not affect the vapour transmission.

\* Fluid Handling Capacity can determine a dressing's ability to absorb exudate and transmit moisture.

Fluid Handling Capacity = Absorbency + Vapour Loss



Type	Improved wound healing	Absence of pain	Fluid handling properties	Physical properties	Page
Cohort	●	●			48

## Experiences of a combination of Askina® SilNet with Topical Negative Pressure

Frans Meuleneire, Woundcare Centre – AZ St Elisabeth, Zottegem – Belgium  
Presented at EWMA Conference, Geneva, 2010

### Background and objective

Topical Negative Pressure (TNP) is an innovative treatment for various types of complex or problematic wounds. Often we observe a firm adhesion of the foam dressing onto the wound surface. This is a major problem in fragile granulation tissue of wounds that are treated with TNP, especially during dressing changes. The use of an interface can avoid such problem.

### Method

We assessed the wounds after use of the combination of Askina® Silnet with TNP treatment in 7 cases. Dressing changes was performed every 3 to 4 days. We evaluated the efficacy, trauma at dressing change, transfer of exudate through the silicone wound contact layer and pain at dressing removal. The results have been illustrated by photo documentation.

### Results

In none of evaluated cases we did observe any negative consequence. At time of dressing change, the wound had a vital aspect. We did observe any problem of adherence on the granulation tissue. Furthermore it was possible to change the dressings without use of painkillers.



1. Lady with bilateral chronic venous leg ulcers. Exacerbating wounds. Planning: skin grafts. Pre-operative wound bed preparation with TPN (Topical Negative Pressure).



2. Start of TNP in combination with silicone interface. Need for protection against ingrowth of the granulation tissue into the sponge. Application of a Silicone dressing(\*) as an interface between wound bed and the sponge



3. Both wounds have been treated with TNP. Negative pressure has been performed with -175 mm Hg (Interface dressings may influence the delivery of Topical Negative Pressure Therapy)



4. Twice a week, dressings have been changed. No trauma or pain has been observed at the moment of dressing removal.



5. Result after 7 days TNP with Silicone interface dressing. Five days later, on January 25th, a skin graft has been performed on both ulcers.



6. Five days post-operative, the dressing has been removed without adherence on the skin graft. The surrounding skin has been protected by a hydrocolloid.



7. After removal of the stitches and the surplus of skin graft at the edges, we can observe a 100% vital skin graft aspect. We still continue with the Silicone dressing(\*) without TNP.



8. About 1 month after starting the combination of TNP with the new Silicone dressing(\*), the ulcers have been healed completely. Compression stockings has been applied to avoid edema.

### Conclusion

This observational study demonstrates the advantage of using Askina® SilNet in combination with Topical Negative Pressure. This combination avoids ingrowth of the granulation tissue into the foam cells, which helps to create the most favourable means for the management of exudate and thereby assures the continuation of the healing process.





Type	Improved wound healing	Absence of pain	Fluid handling properties	Physical properties	Page
In-vitro		●			50

Evidence of absence of stripping of epidermal cells

SCANNING ELECTRON MICROSCOPE (SEM) ANALYSIS - carried out by Agenda 1 Analytical Services Limited, UK  
Report HOSP266 at B. Braun Hospicare

Background and objective

The aim of this study is to demonstrate that the silicone adhesive used in Askina® DresSil does not cause the stripping of epidermal cells. A silicone adhesive is extremely soft and will flow over the uneven skin surface to create a large effective contact area with the skin. As a result, less adhesion force per square millimetre is needed, compared with traditional dressings, to create the same level of fixation. This property helps to prevent damage to the skin barrier.

Method

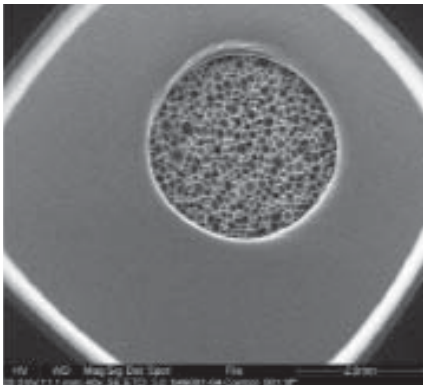
The small surface of Askina® DresSil was observed before applying the dressing on the skin, and after its removal by the Scanning Electron Microscopy, the instrumentation used to observe minute surface details of small organisms/objects at high magnification by means of electron lenses. The system produces a magnified snap-shot image of the object (12.5mm diameter circle surface).

Conclusion

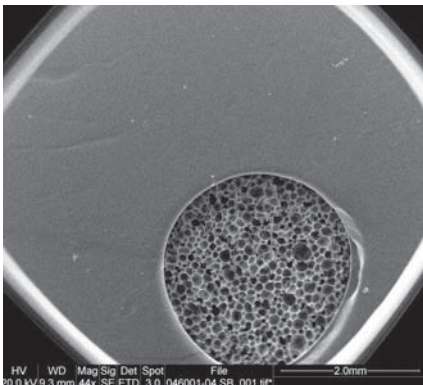
High level of silicone gives good security/flow, yet does not remove any skin cells on removal.

Results

Askina® DresSil BEFORE contact with skin cells



Askina® DresSil AFTER contact with skin cells



No stripping of skin cells

Type	Improved wound healing	Absence of pain	Fluid handling properties	Physical properties	Page
In-vitro			●		51

Fluid handling capacity

Laboratory Testing carried out at B. Braun Hospicare  
Data referenced in BBH 301PTDF REV004

Background and objective

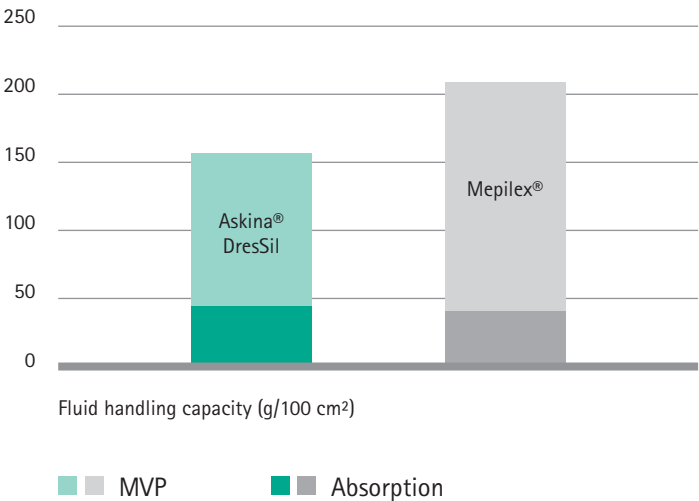
The good fluid handling characteristics of the dressing are important for patient comfort and safety (no maceration, no leaking), but also for the healthcare professionals as they signify longer wear time and less frequent dressing changes.

The aim of this study was to assess the absorbency and vapour loss of Askina® DresSil in comparison with the with the market leading product, Mepilex®.

Method

The fluid handling characteristics were determined according to the Aspects of Absorbency is carried out as per Standard I.S. EN 13726-1:2002 "Test Methods for primary wound dressings – Part 1: Aspects of Absorbency" were measured according to the Standard I.S. EN 13726-1:2002 "Test Methods for primary wound dressings – Part 1: Aspects of Absorbency".

Results



Conclusion

The fluid handling characteristics of Askina® DresSil are in line with fluid handling characteristics of Mepilex®.

Retention Capacity

Laboratory Testing carried out at B. Braun Hospicare  
Data referenced in BBH 301PTDF REV004

Background and objective

The retention capability of the dressing is the ratio between capacity under pressure and free absorption capacity of the dressing. This property reflects the possibility to use the dressing under compression therapy.

The aim of this study was to compare the retention capability of Askina® DresSil and the one of the market leading products.

Method

The retention was determined according to the following method.

A 50mm diameter is taken from the centre of the dressing and saturated with 0.9% saline solution for 24hrs. The sample is removed from the saline and reweighed. Then the sample is placed on a flat surface and a 1120g weight (which is equal to a pressure of 35mmHg) is placed on the sample for three minutes. After three minutes, the weight is removed and the sample is reweighed. From these weights the % retention can be calculated.

Results

The results are expressed as a percentage of the liquid which is retained after saturated dressing was placed under pressure. Askina® DresSil retains under pressure 70% of the liquid.

Product	Company	Retention % / 24h
Askina® SilNet	B. Braun	70,04
Mepilex®	Mölnlycke	54,16
Allevyn® Gentle	S&tN	54,26

Conclusion

The retention capacity of Askina® DresSil is heigher than the retention of the two leading competitor products. The product is suitable for the use under compression therapy.

Type	Improved wound healing	Absence of pain	Fluid handling properties	Physical properties	Page
In-vitro			●		52

Wicking

Laboratory Testing carried out at B. Braun Hospicare  
Data referenced in BBH 301PTDF REV004

Background and objective

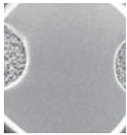
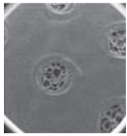
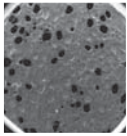
Askina® DresSil's silicone wound contact layer is perforated to allow exudate to pass through to the foam layer, preventing exudate leaking onto the surrounding skin and maceration of the wound edges.

The objective of this study was to determine the wicking properties of Askina® DresSil and to compare them with market leading competitor products.

Method

The same quantity (1ml) of test liquid was placed on the surface of the dressing samples. The time needed for the liquid to be completely absorbed is measured.

Results

Product	Company	Type of perforation in the silicone layer	SEM image	Wicking time
Askina® SiNet	B. Braun	„Flower“ pattern		38 sec
Mepilex®	Mölnlycke	Continuous flood coating with microscopic holes		3 min
Allevyn® Gentle	S&tN	Uniform pattern of holes		> 60 min

The table resumes the wicking time of tested dressings with SEM images of the silicone layers. The wicking time of Askina® DresSil is the best among the tested dressings.

Conclusion

The distinctive design of Askina® DresSil's silicone contact - "flower pattern" holes in the coated adhesive enables very quick and vertical absorption of the exudate.

Type	Improved wound healing	Absence of pain	Fluid handling properties	Physical properties	Page
In-vitro				<div></div>	53

Adhesiveness

Laboratory Testing carried out at B. Braun Hospicare  
Data referenced in BBH 301PTDF REV004

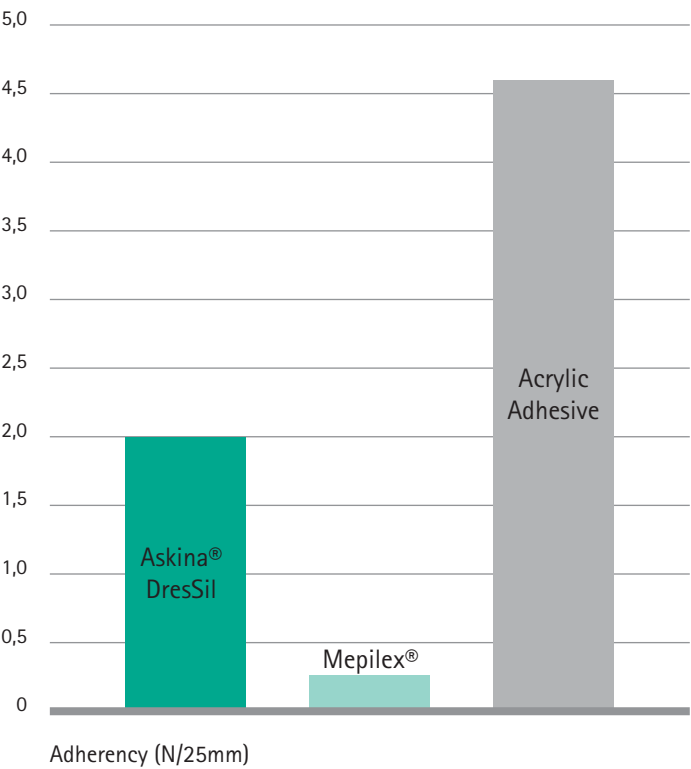
Background and objective

One of the major benefits of Askina® DresSil is its soft and safe adherence due to the silicone adhesive layer. The aim of this study was to compare the adherency of the Askina® DresSil with the adherency of the market leading product, and the one of a dressing with an acrylic adhesive.

Method

Adhesiveness is a modified version of the test Method 11.53. The dressing is peeled from a clear embossed polyethylene liner that has been stuck to the stainless steel plate with double sided tape. The strength needed to peel-off the dressing is measured.

Results



Conclusion

The adhesiveness of Askina® DresSil is similar to the adhesiveness of the market leading product, Mepilex®. The silicone layer provides for the soft and safe adhesion and atraumatic dressing removal.

Type	Improved wound healing	Absence of pain	Fluid handling properties	Physical properties	Page
In-vitro			●		54

Fluid handling capacity

Laboratory Testing carried out at B. Braun Hospicare  
Standard I.S. EN 13726-1:2002 "Test Methods for primary wound dressings – Part 1: Aspects of Absorbency"  
Data referenced in BBH 283PTDF REV007

Background and objective

The good fluid handling characteristics of the dressing are important for patients comfort and safety (no maceration, no leaking), but also for the healthcare professionals as they signify longer wear time and less frequent dressing changes.

The aim of this study was to assess the absorbency and vapour loss of Askina® Foam and to compare them to those of four other non-adhesive foam dressings present in the market.

Method

The fluid handling characteristics were determined according to the "Test Methods for primary wound dressings – Part 1: Aspects of Absorbency", carried out as per Standard I.S. EN 13726-1:2002.

Results

Product	Absorbency, g/100cm²/ 24hrs	MVP (Moisture Vapour Permeation), g/100cm²/24hrs	Fluid Handling Capacity (10x10 dressing), g/100cm²
Askina® Foam (SE)	59	150	209
Allevyn Non-Adhesive (SE)	68	131	199
Biatain Non-Adhesive (SE)	84	121	205

Conclusion

Askina® Foam fluid handling capacity is among the highest in the market which stands for longer wear time (3 – 7 days, depending on the amount of the exudate).

Retention Capacity

Laboratory Testing carried out at B. Braun Hospicare  
Data referenced in BBH 283PTDF REV007

Background and objective

The retention capability of the dressing is the ratio between capacity under pressure and free absorption capacity of the dressing. This property reflects the possibility of use of the dressing under compression therapy.  
The aim of this study was to compare the retention capability of Askina® Foam with the retention capacity of other non-adhesive foam dressings existing in the market.

Method

The retention was determined according to the following Method:

A 50mm diameter is taken from the centre of the dressing and saturated with 0.9% saline solution for 24hrs. The sample is removed from the saline and reweighed. Then the sample is placed on a flat surface and a 1120g weight (which is equal to a pressure of 35mmHg) is placed on the sample for three minutes. After the three minutes, the weight is removed and the sample is reweighed. From these weights the % of retention was calculated.

Results

Product	% Retention, 24 hrs
Askina® Foam (SE)	74.34
Allevyn Non-Adhesive (SE)	48.70
Biatain Non-Adhesive (SE)	86.18

Conclusion

The retention capacity of Askina® Foam is between the highest in the market, which makes it ideal for the use under compression therapy.



# Askina® Transorbent®

Type	Improved Wound Healing	Patient's comfort	Page
RCT	●	●	56/58

## Product presentation

### Description

The Transorbent® Technology features a patented design that provides a unique absorption process.

#### A Thin Polyurethane Layer

Impermeable to liquids and bacteria but vapour permeable.

#### B Foam Layer

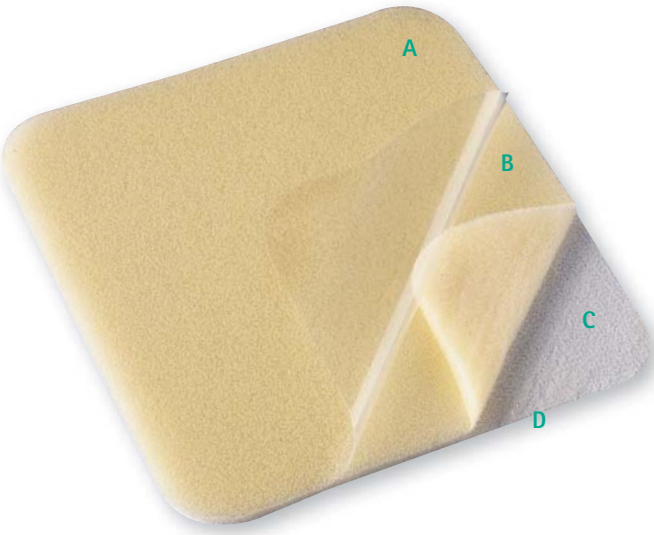
Provides a means for the escape of moisture vapour giving the dressing its comfortable smoothness and conformability.

#### C Dry Hydrogel Layer

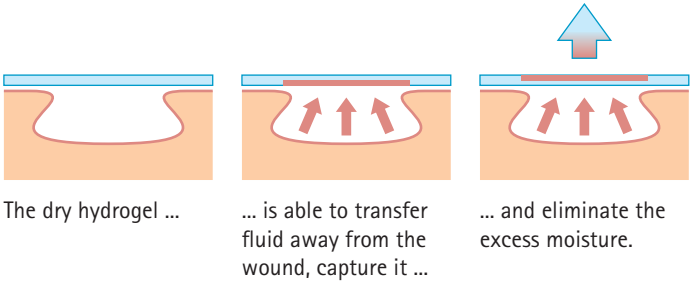
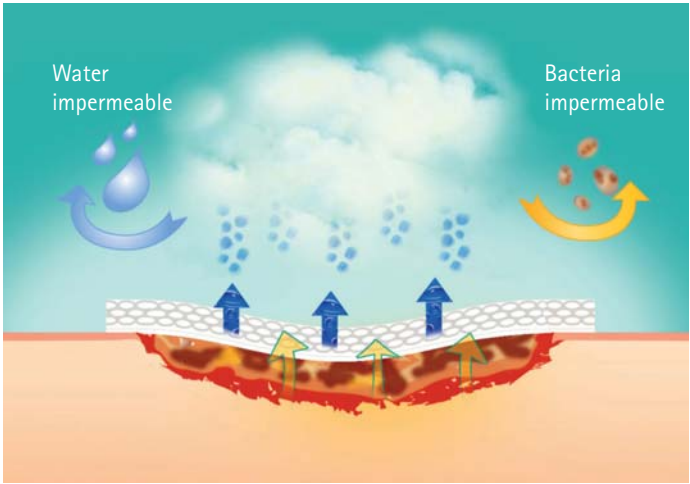
Absorbs wound exudate and preserves a moist healing environment. Excess exudate is evaporated through the foam and upper layers.

#### D Adhesive Layer

Sticks to the intact and dry surrounding skin but not to the wound surface.



### How it works





# Askina® Transorbent®

Type	Improved Wound Healing	Patient's comfort	Page
RCT	●	●	56/58

## Clinical evidence

Comparison and evaluation of the performance characteristics, usability and effectiveness wound healing, of Askina® Transorbent® vs a hydrocolloid with foam backing.

Marie Brown-Etris, RN, CETN - President / Etris Associates, Inc. Philadelphia, USA

Results presented at the 5th European Conference on Advances in Wound Management / Harrogate, 21 -24 November 1995

This data summarizes the results of a 7 site, 10 week investigation, involving 140 patients, of which 121 remained in the study throughout the 10 week period.

### Background and objective

The objective of the study was to evaluate and compare two widely used dressings, Askina® Transorbent® with a leading hydrocolloid with foam backing, for the management of Stage II, Stage III and Stage IV pressure ulcers.

### Method

This 10 week, multi-center study was stratified, open label and prospective. Wounds were randomized according to surface area and stage so that final comparison could be made among similar wounds.

Once enrolled in the study, a baseline wound assessment and risk assessment using the Braden scale was performed on each participant and documented on the case report forms. The participant was visited weekly for evaluations.

The wound assessment included

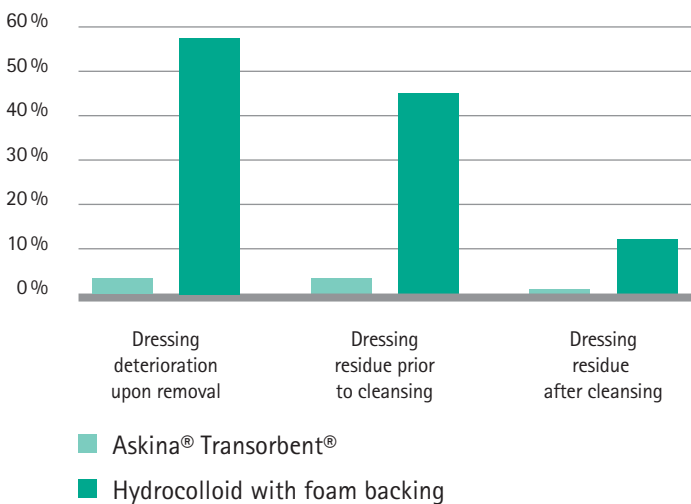
- Metric measurement of wound dimensions.
- Tracing of wound on transparent film.
- Stage of wound.
- Wound location.
- Condition of margins and periwound area.
- Exudate level.
- Odor.

Additional data collected included

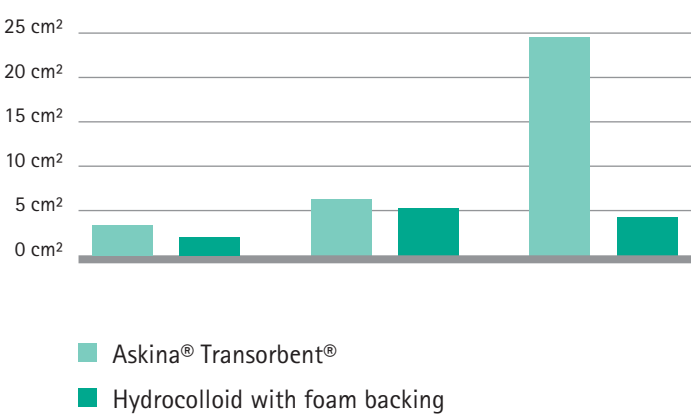
- Previous wound treatments.
- Form of pressure relief.
- Nutritional status
- Diagnostics and medical condition

## Result

### Dressing residue in periwound area



### Surface area reduction over 10 Weeks



# Askina® Transorbent®

Type	Improved Wound Healing	Patient's comfort	Page
RCT			56/58

## Conclusion

Askina® Transorbent® performed best overall.

This is evidenced by its ability to reduce wound surface area in healing wounds to a greater extent than the hydrocolloid when pressure ulcers were followed closely for up to 10 weeks.

The largest sampling (Stage III, 2 cm – 30 cm<sup>2</sup>) which produced data from 78 participants, demonstrated that there was a 21 % greater reduction in wound surface area in the Askina® Transorbent® group over the hydrocolloid group i.e., overall mean area reduction of 6.3 cm vs 5.2 cm. Stage 11(2cm –30 cm) the overall mean reduction of 3.6 cm experienced by the subjects in the Askina® Transorbent® group was 57% greater than the reduction of 2.3 cm observed with the subjects in the hydrocolloid group.

In addition, the results from the group treated with Askina Transorbent demonstrated statistically significant improvements over the group treated with the hydrocolloid dressing in the following areas:

- Dressing deterioration at the time of removal.
- Dressing residue prior to cleansing.
- Dressing residue after cleansing.

This confirms Askina® Transorbent® to be superior in its ability to maintain integrity and minimize the residue commonly associated with hydrocolloid deterioration.



