



Biofilm: the hidden barrier to healing

“Despite the best care some wounds struggle to heal”

 **smith&nephew**
IODOSORB[®]
0.9% Cadexomer Iodine

Supporting healthcare professionals



Although you can't see biofilms, they exist, preventing wounds from healing.¹⁻³



Non-healing wounds require treatment centered on biofilm disruption and eradication.⁴⁻⁶



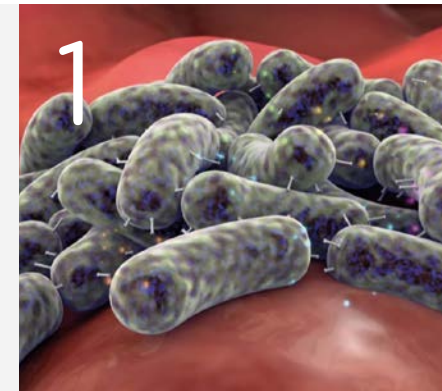
IODOSORB®: for a superior activity against mature biofilms.^{*7}

Our evidence is as real as biofilms.

**in vitro and in animal studies*

Biofilm are thought to be present in up to 78% of all chronic wounds⁸

The biofilm barrier: biofilms are clusters of attached bacteria embedded in a matrix of proteins and sugars which protects them from host defences and antimicrobials.⁹



Biofilm formation

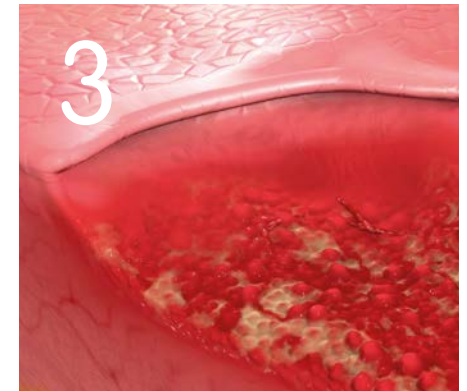
Biofilms form with the initial attachment of single planktonic bacteria, creating a coherent cluster of cells within a protective matrix¹⁰



EPS matrix

This matrix, composed of protein, DNA and sugars, is known as **Extracellular Polymeric Substance**, or EPS.⁹⁻¹¹

The bacteria within the EPS have a **higher tolerance to antimicrobials and the body's immune defences** than single planktonic bacteria.^{10,11}



Delayed healing

An impaired immune response leads to a vicious cycle of tissue damage and low level inflammation.^{12,13}

To effectively disrupt biofilm and promote healing, antimicrobial wound treatments must **penetrate the EPS and attack the bacteria within**¹⁰ with a sustained action that stops biofilms reforming.^{14,15}

Recommendations for a biofilm-based wound care

Ten global experts* from both scientific and clinical disciplines compiled a consensus document, aimed at clarifying and improving the understanding, diagnosis and treatment of wound biofilm.

10 Experts 10 Recommendations 1 Consensus¹⁴

Understanding the role of biofilms in delayed healing¹⁴



1
Problems biofilms cause clinicians
Wounds that contain biofilms may not be identified, resulting in ineffective treatment and delayed healing

2
Understanding biofilms
Biofilms are present in most chronic wounds and are likely to be located both on the surface and in deeper wound layers, but may not be present uniformly across or within the wound

3
Current diagnostic options for biofilms
Wound biofilms are difficult to visualize macroscopically and slough, debris, and exudate may be visually mistaken for biofilm by clinicians/healthcare professionals

4
Clinical indicators of biofilms
Recalcitrance to treatment with antibiotics or antiseptics

- Biofilms are present in up to 78% of chronic wounds⁸
- Biofilm cannot be detected in routine clinical practice
- A non-healing trajectory and lack of response to antibiotics and antiseptics indicate biofilm presence

How to treat wounds with biofilm¹⁴



5
Future options for diagnostic tests
Indication of where the biofilm is located within the wound

6
Biofilm treatment strategy
Debridement is one of the most important treatment strategies against biofilms, but does not remove all biofilm and therefore cannot be used alone: this is one of the critical principles of wound bed preparation (TIME)

7
Mechanical debridement
Biofilms can reform rapidly; repeated debridement alone is unlikely to prevent biofilm re-growth; however, appropriate topical antiseptic application within this time-dependent window can suppress biofilm reformation

- Removing biofilm through repeated debridement is an essential aspect of biofilm treatment
- Biofilm reforms quickly: treatment must focus on both removing and preventing biofilm

Select an effective antibiofilm dressing¹⁴



8
Topical antiseptics used to treat biofilm
Should have strong anti-biofilm effects in appropriate *in vitro* test models against mature biofilms

9
Screening anti-biofilm agents
In vitro biofilm methods with clinically relevant test conditions are useful to screen treatments for their anti-biofilm efficacy

10
Levels of evidence when choosing anti-biofilm treatments
RCTs and comparative clinical evidence of anti-biofilm treatment should be used to support clinical guidelines, protocols, and treatment choices

However, in the absence of RCT-level data, anti-biofilm interventions should be supported by RCT evidence of the broader impact on wound healing

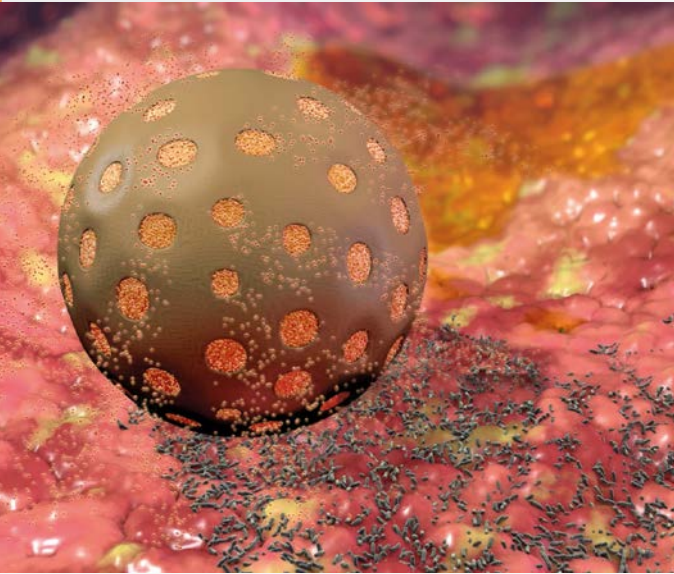
- Biofilm claims should be supported by strong evidence with *in vivo* and *in vitro* tests against mature biofilm and across a variety of appropriate lab models

*Prof. Gregory Schultz, Dr. Randy Wolcott, Prof. Thomas Bjarnsholt, Dr. Matthew Malone, Prof. Masahiro Tachi, Terry Swanson, Prof. David Leaper, Prof. Paul Stoodley, Dr Garth James, Dr. Andrew McBain.

IODOSORB[®]

mode of action

Cadexomer smart micro-bead technology



Representation of a single bead of IODOSORB.

IODOSORB is an antimicrobial dressing that utilises cadexomer smart micro-beads, a unique multi-action system that combines physical absorption and desloughing¹⁶ with a sustained gentle release of iodine.¹⁷⁻¹⁹

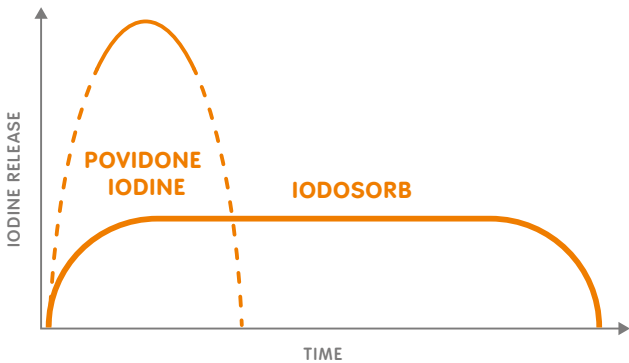
When IODOSORB is applied to the wound surface, fluids such as exudate are absorbed into the micro-bead causing it to swell. This also **promotes autolytic debridement**²⁰ in the wound.

As the bead swells, its internal bonds break and active iodine is released producing sustained **antimicrobial action for up to 72 hours**.^{17,18,21}

Iodine has long been proven an effective broad spectrum antimicrobial,^{22,23} killing bacteria by acting on multiple targets in the bacterial cell.²⁴

Older iodine formulations such as povidone iodine deliver high and short-lived doses²⁵ which may have a cytotoxic effect.²⁶

Cadexomer smart micro-bead technology harnesses the effectiveness of iodine by delivering it in effective, non-toxic concentrations²⁷ to **create a wound environment conducive to healing**.^{17,28}



For illustration purposes, not based on actual data.

Dual action to disrupt biofilm²⁹



Disrupting the matrix

It is suggested that cadexomer beads are able to dehydrate and directly destroy the biofilm structure.²⁹



Killing exposed bacteria

Once the cadexomer beads are able to breach the biofilm-specific matrix, the iodine can subsequently kill the exposed bacteria within the biofilm community.²⁹

Why silver is not effective against biofilm

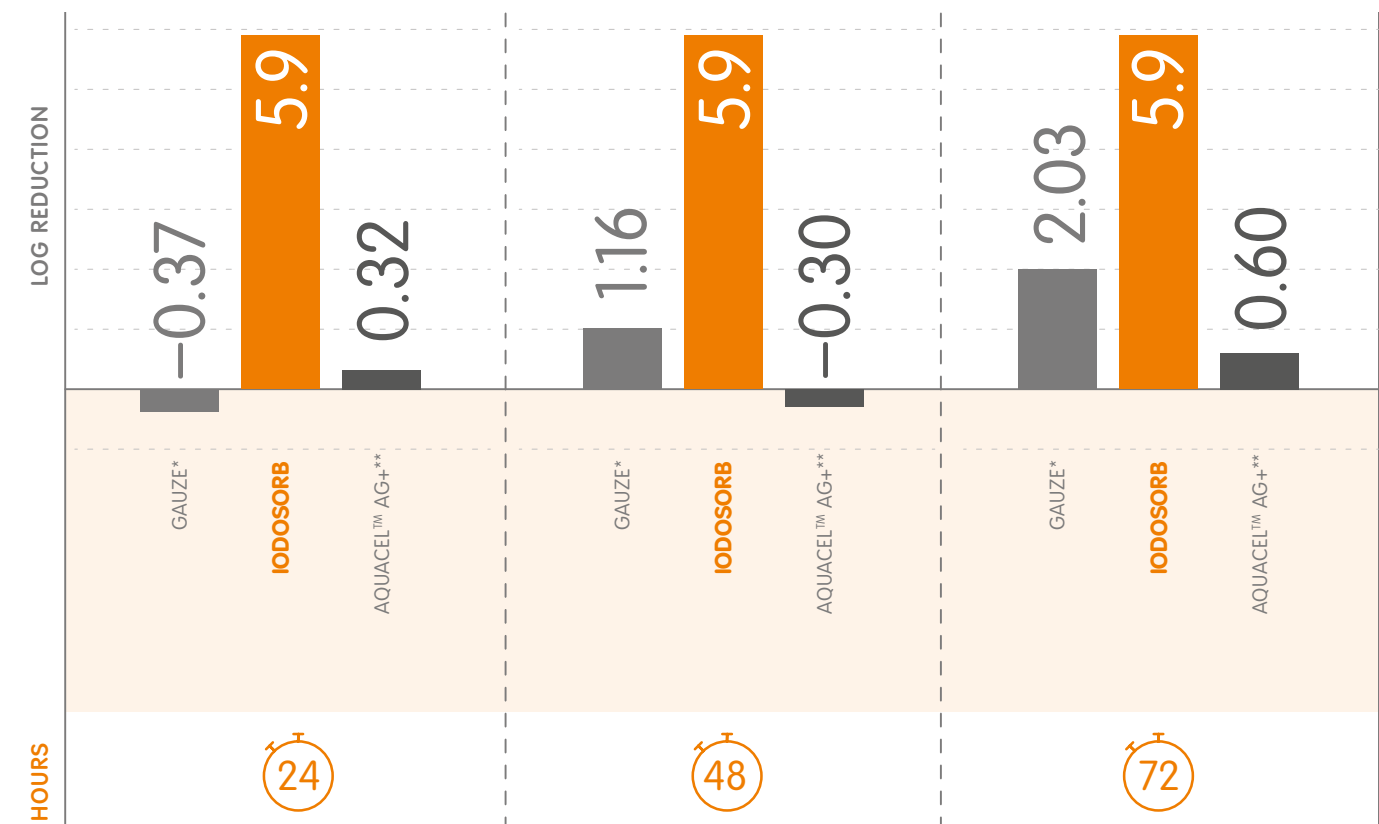
- ✗ Charged ions, such as silver or chlorides are more easily neutralised by the EPS matrix.³⁰
- ✗ Moreover the concentration of silver required to eradicate biofilm is estimated to be 10 to 100 times higher than that used to eradicate planktonic bacteria.³¹ Such concentrations are currently unavailable in any silver dressing.

Examining the evidence

IODOSORB[°] has a long history of effectiveness against biofilms with superior results compared to other topical antimicrobials such as PHMB, silver and povidone iodine.¹⁵

A new independent *in vitro* study showed that IODOSORB is effective at eradicating mature *Pseudomonas aeruginosa* biofilm³² when compared to Aquacel[™] Ag+^{**}.

Reduction in biofilm bacteria[†]



*Non-antimicrobial control
**Aquacel[™] Ag+ is a product formerly known as Aquacel[™] Ag+ Extra
†All figures shown are Log Reductions (Log₁₀ CFU/ sample) measured *in vitro*

Superior efficacy against biofilm proven across different lab models^{7,32,33}

Five challenging and clinically relevant biofilm methods showed IODOSORB[°] to be more effective than Aquacel[™] Ag+^{**} in all biofilm models:

Log Reduction (Log₁₀ CFU/sample)

| | TREATMENT (HRS) | AQUACEL [™] AG+ ^{**} | IODOSORB |
|--|-----------------|--|----------|
| Colony biofilm model ^{‡7} | 24 | <2 | >9 |
| Drip flow reactor ^{‡7} | 24 | <1 | >6 |
| Lubbock chronic wound model ^{§33} | 24 | <2 | >9 |
| 2016 Porcine skin ex vivo model ^{‡32} | 24 | <2 | >5 |
| 2016 Mouse wound biofilm model ^{§7} | 48 [¥] | <2 | >4 |



Aquacel[™] Ag+^{**} showed minimal effect (<2x reduction) in 5 clinically relevant biofilm models.

[‡]*Staphylococcus aureus* mature biofilms | [§]MRSA biofilms | [¥]Mixed bacterial cultures
Pseudomonas aeruginosa PA01, *Staphylococcus aureus* Mu50, and *Enterococcus faecalis* V583
^{**}Aquacel[™] Ag+ is a product formerly known as Aquacel[™] Ag+ Extra
[¥]Treatment every 24 h for 48 h total.

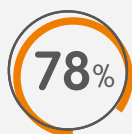
Notes

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Closer to zero biofilm



Biofilms are present in up to 78% of chronic wounds.⁸



Wounds that contain biofilms may not be identified, resulting in ineffective treatment and delayed healing.¹⁻³



Most topical antimicrobials, including silver dressings, fail to disrupt biofilm.^{15,31}



IODOSORB[®] with cadexomer smart micro-bead technology is highly effective in the treatment of wounds with biofilm.^{7,32}



IODOSORB dual action can breach the biofilm's protective matrix and kill the bacteria within.²⁹



IODOSORB's biofilm efficacy has been verified by independent data.³² Its efficacy in healing wounds is also supported by a positive Cochrane review.³⁴

IODOSORB: efficacy backed by evidence.