

# The Design Principles Of Non-Adherent Materials & The Challenges Of Maximising Dressing Performance Without Compromising The Mode Of Action

## Introduction

Non-adherent dressings are typically either an individual layer with a non-adherent coating e.g. petrolatum or silicone, or a composite dressing which incorporates a non-adherent material at the wound contact interface, e.g. a perforated ethylene methyl acrylate (EMA) film. One of the challenges facing dressing designers is to ensure that the non-adhering wound contact layers must allow the efficient and unimpeded passage of exudate from the wound bed through to the secondary dressing whilst allowing healing to continue undisturbed.

The pore size and/or open area of a number of non-adherent dressings were used to assist in the interpretation of the generated data in a range of *in-vitro* and *in-vivo* experiments. Dressings evaluated included a range of commercially available dressings including silicone coated dressings, a composite alginate/EMA dressing, and polyurethane foam/EMA dressings.

## Method

Average pore size and percentage open area of the silicone coated dressings were quantitatively measured using image analysis software. This information was then used to assist in the interpretation of the generated data in a range of *in-vitro* and *in-vivo* adherence and performance experiments.

## Results

The average pore size of the dressings ranged from 0.2 mm<sup>2</sup> to 1.6mm<sup>2</sup> and open area of the dressings ranged from approximately 5% to 43%. With the exception of one of the dressings, all had a regular pore sizes and uniform pattern pore distribution. *In-vitro*, all dressings behaved in a similar manner by allowing the passage of a simulated wound fluid through to a secondary layer with no evidence of pooling. The performance *in-vivo* was largely similar, however, there was evidence of adherence of the wound to the secondary dressing through the layer with the largest pore size (1.65mm<sup>2</sup>), and embedding of the dressings with the greatest open area (43.3%)<sup>1</sup>.

When compared to fibrous and foam dressings, the composite dressings with EMA demonstrated a lower adherence to an *in-vitro* fibrin clot. Furthermore, in the *in-vivo* adherence model, the alginate/EMA dressing not only demonstrated lower adherence to the wound but less debris was left in the wound under both highly exuding and dry conditions<sup>2</sup>.

## Discussion

All silicone coated dressings performed equally in the *in-vitro* experiments as no dressings prevented fluid passage to the secondary layer. However, the dressings with either the greatest open area or the largest pore size showed characteristics in the *in-vivo* model which may cause potential problems in a clinical setting. Although non-significant, a trend showing an increase in adherence as the pore size increased under the dry/healing conditions in this *in-vivo* experiment was seen. Dressings with the largest pore size of 1.65mm<sup>2</sup> showed occasional adherence. Furthermore, under these dry conditions, the dressing with the largest open area (43.3%) was observed to become "embedded" into the wound bed which caused trauma upon removal. A second mesh dressing evaluated in the *in-vivo* model with a lower open area with a heavier knit was not observed to become embedded. This suggests that the more robust structure may have assisted the dressing to maintain good contact with the surface of the wound but prevent it from becoming embedded in the wound.

The primary function of each of the composite non-adherent dressings was maintained with the added benefit of a non-adherent layer which reduced trauma on removal.

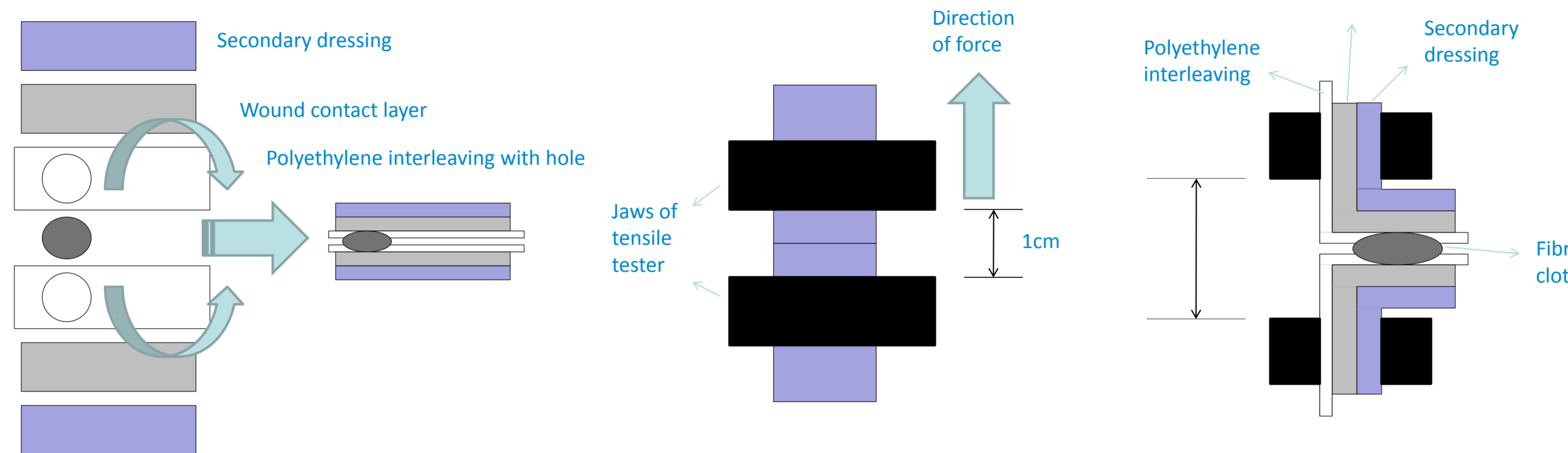
## Conclusion

The need for consideration to the structure and design of a wound contact layer has been demonstrated clearly by the discussed experiments.

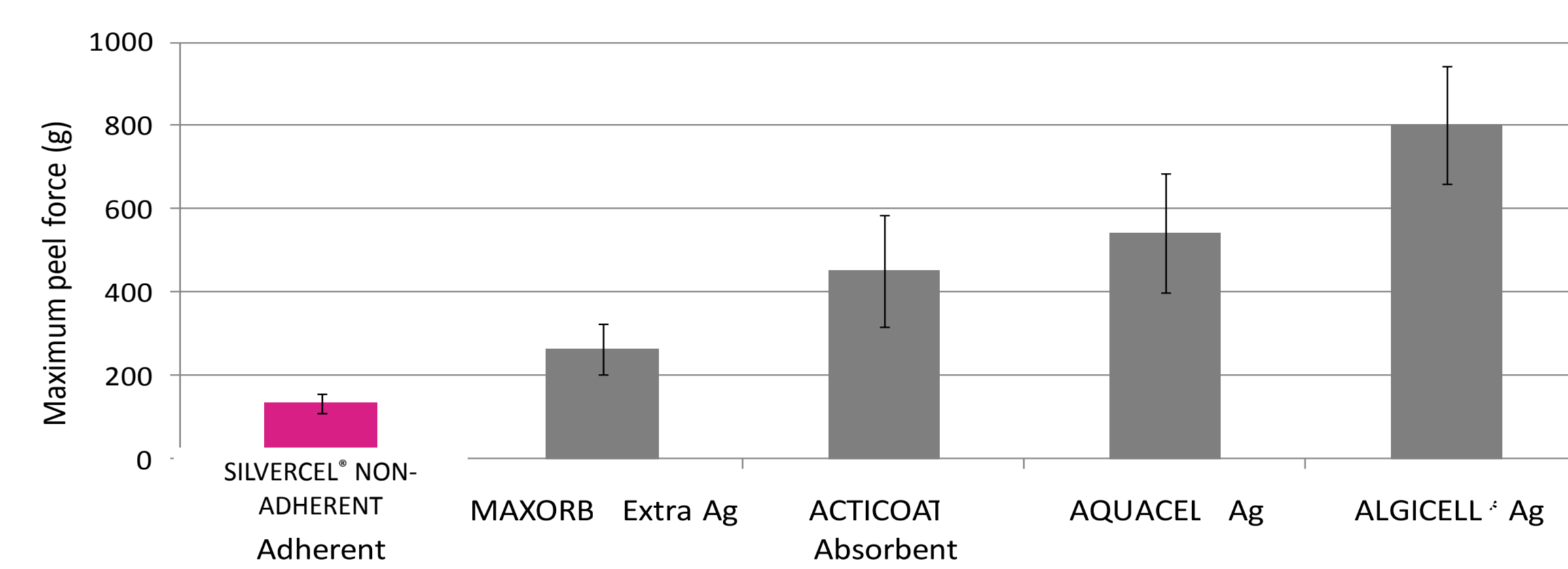
<sup>1</sup> Stephens S, et al. EVALUATION OF A NON-ADHERING SILICONE WOUND CONTACT DRESSING WITH OPTIMISED DESIGN FOR THE MANAGEMENT OF DRY TO HEAVILY EXUDING WOUNDS. Wounds UK 2010; POSTER

<sup>2</sup> Hart J, Bell A. EVALUATION OF A NOVEL ANTI-MICROBIAL SILVER ALGINATE/CMC WOUND DRESSING IN THE PORCINE PARTIAL-THICKNESS EXCISIONAL WOUND MODEL. SAWC 2009 & WOUNDS UK; POSTER

## FIBRIN CLOT METHOD

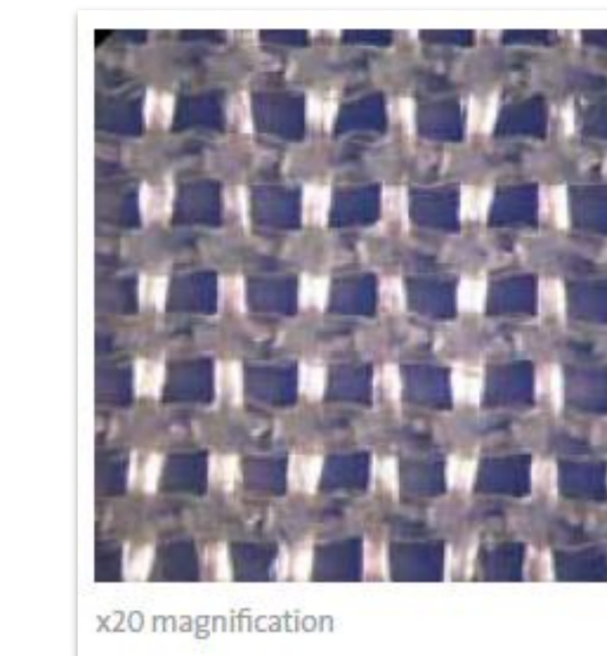


- Bovine serum albumin (20mg/ml) and plasma fibrinogen (6mg/ml) solutions were prepared in phosphate buffered solution (PBS) and mixed together with a 1:1 ratio. A further thrombin solution (25IU/ml) was prepared of which 15µl was transferred into a small 3ml sealable sample pot. 3ml of the bovine serum albumin/fibrinogen mixture was transferred to the same sample pot and sealed and placed in a 37°C incubator for 1 hour for the fibrin clot to form.
- Foam, Alginate and composite dressings with EMA were tested using the fibrin clot Method.
- The dressings with EMA demonstrated a lower adherence to the fibrin clot.



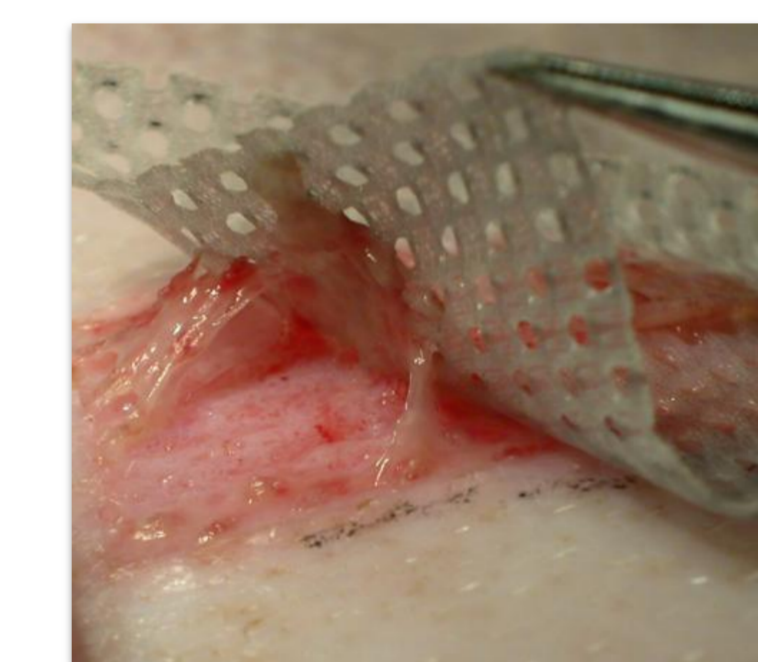
## PORE SIZE AND OPEN AREA

- Dressings were measured for average pore size and percentage of open area



- Pore sizes ranged from 0.2mm<sup>2</sup> to 1.6mm<sup>2</sup>
- The open area of dressings ranged from 5% to 43%
- *In-vitro* all dressings allow free passage of simulated wound fluid through to a secondary dressing without evidence of pooling.

- Dressings with the largest pore sizes showed adherence of the secondary dressing to the wound bed - Mepitel One had the largest pore sizes of 1.6mm<sup>2</sup>
- Dressings with the greatest percentage open area showed evidence of embedment into the wound - Urgotul had the greatest percentage open area of 43%.



Mepitel: Embedment in the wound bed



Mepitel: Adherence of secondary dressing



Alginate dressing adherence

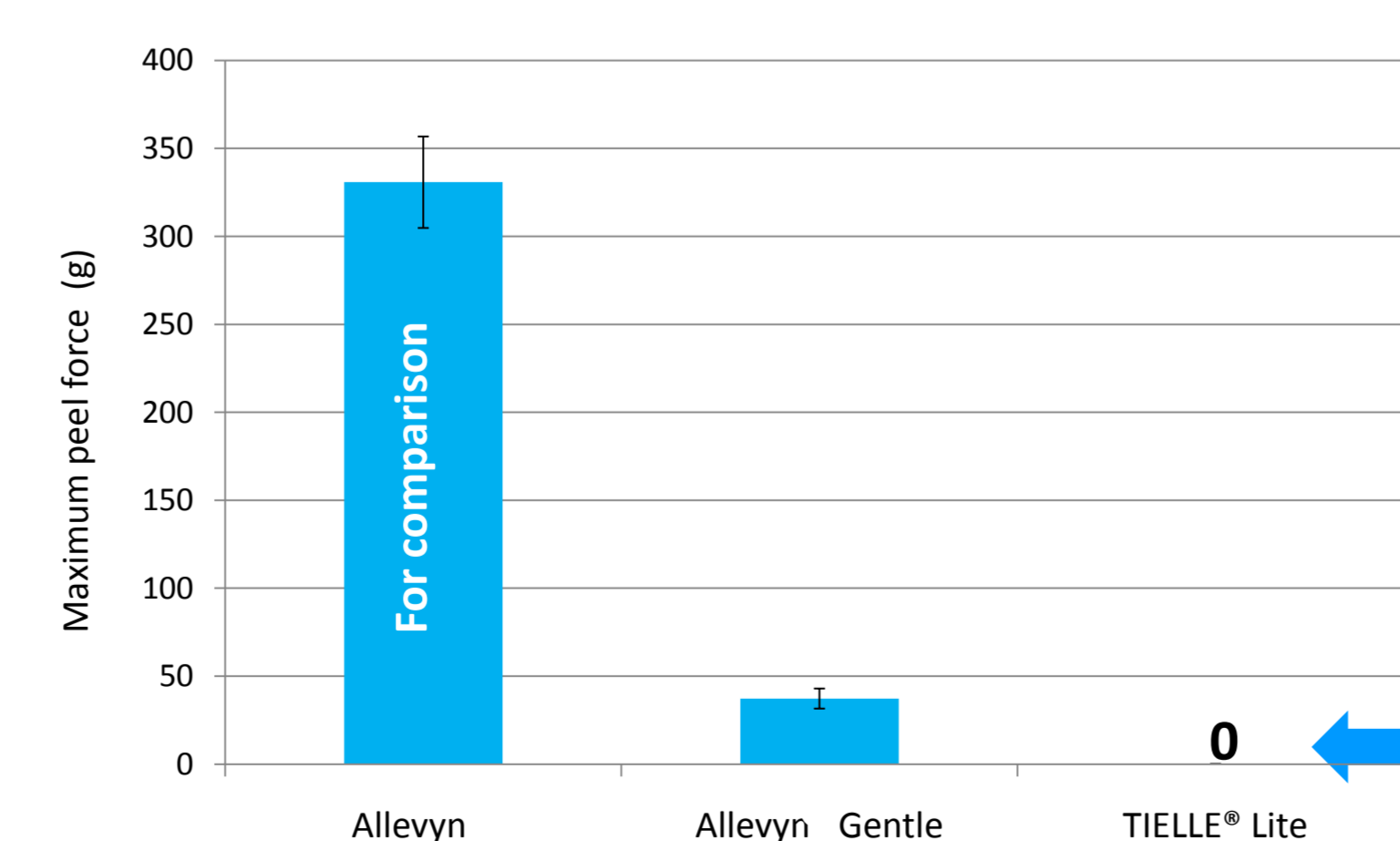
- ADAPTIC TOUCH® was found to have optimally designed pore size combining free passage of fluid with non-adherence.

## TIELLE® Lite



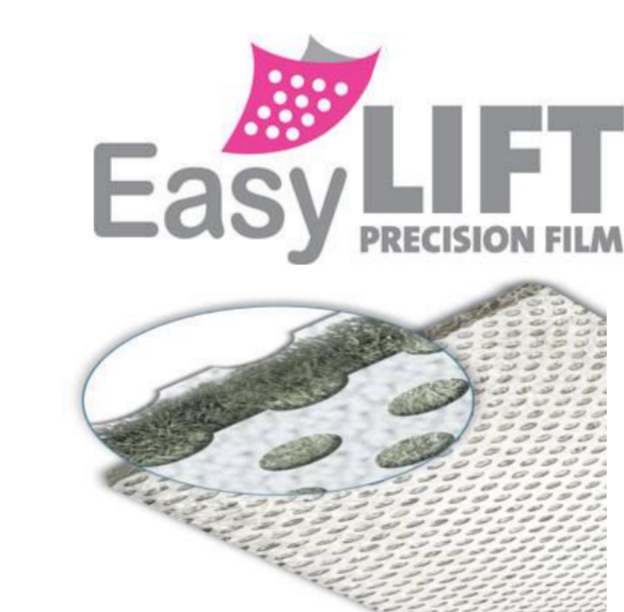
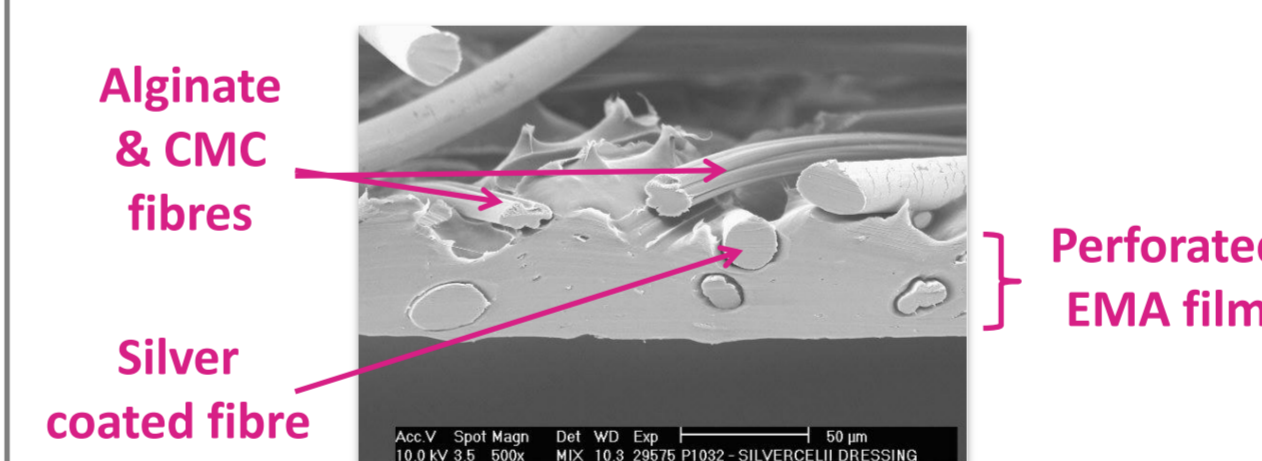
- Designed to minimise adherence for low exuding, dry and bleeding wounds whilst maintaining the properties of TIELLE® hydropolymer dressing
- TIELLE® Lite utilises a textured EMA with micro-funnels
  - Highly non-adherent wound contact layer
  - Micro-funnels wick away fluid

## Fibrin Clot Result (illustrating relative adherence)



TIELLE® Lite unable to obtain value fibrin clot would not stick to dressing to allow for evaluation

## SILVERCEL® NON-ADHERENT



- Designed to minimise adherence whilst maintaining the potent antimicrobial activity and high absorbency of SILVERCEL®
- Conformable while entrapping fibres to ensure dressing remains laminated when wet
  - Reduces fibre shed and dressing residue being left behind
  - Allows for easy, one piece, atraumatic, pain free removal
- An absorbent non-adherent antimicrobial dressing composed of:
  - Calcium alginate & carboxymethylcellulose (CMC) fibres
  - Silver coated fibres
  - Ethylene methyl acrylate (EMA) film
 Perforated to allow passage of exudate  
 Highly non-adherent material  
 Optimal size and distribution of holes to minimise adherence whilst retaining fluid handling and antimicrobial properties of SILVERCEL®

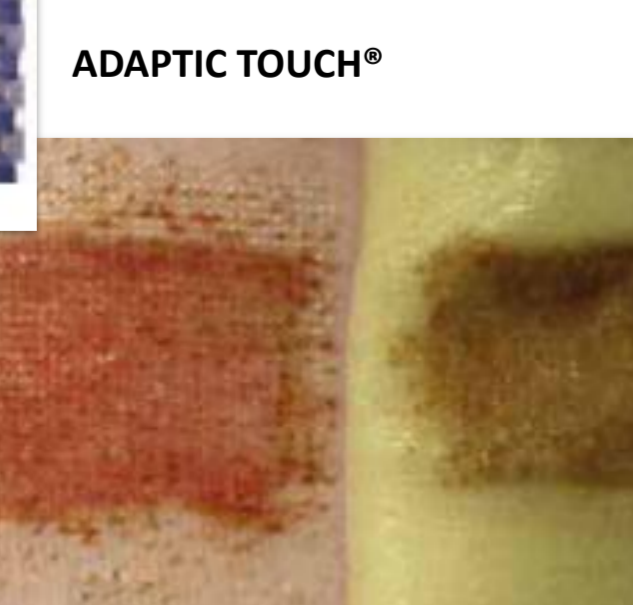
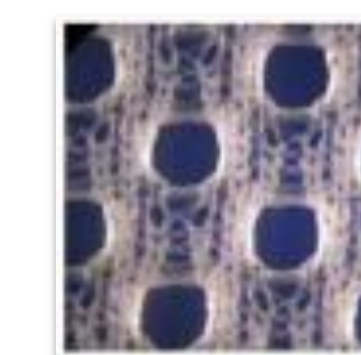
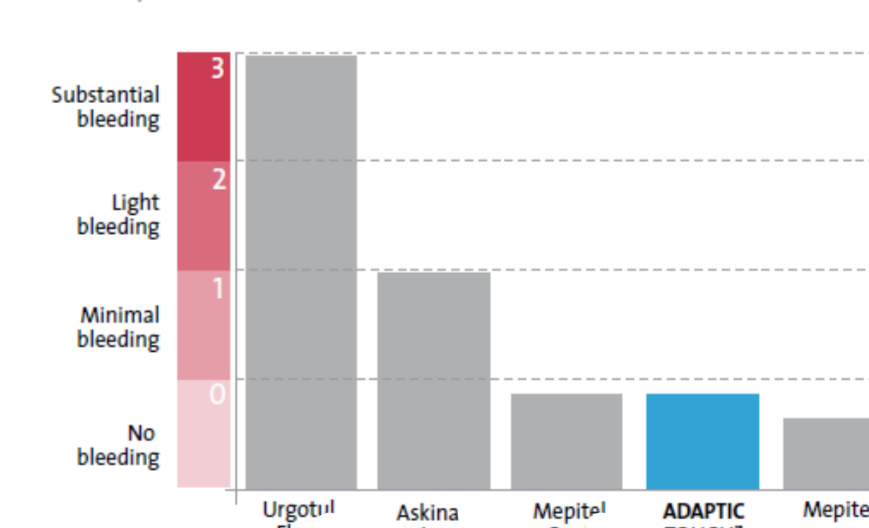
## ADAPTIC TOUCH®

A silicone wound contact layer for:

- Management of dry to heavily exuding, partial and full-thickness chronic wounds
- Traumatic and surgical wounds, donor sites and 1<sup>st</sup> and 2<sup>nd</sup> degree burns
- Suitable for use, with negative pressure wound therapy (NPWT)

## In vivo porcine model

Damage to wound on removal of wound contact layer - Day 7<sup>1</sup>  
 In vivo partial thickness model



Adherence of secondary dressing to wound - Day 7<sup>1</sup>  
 In vivo partial thickness model

