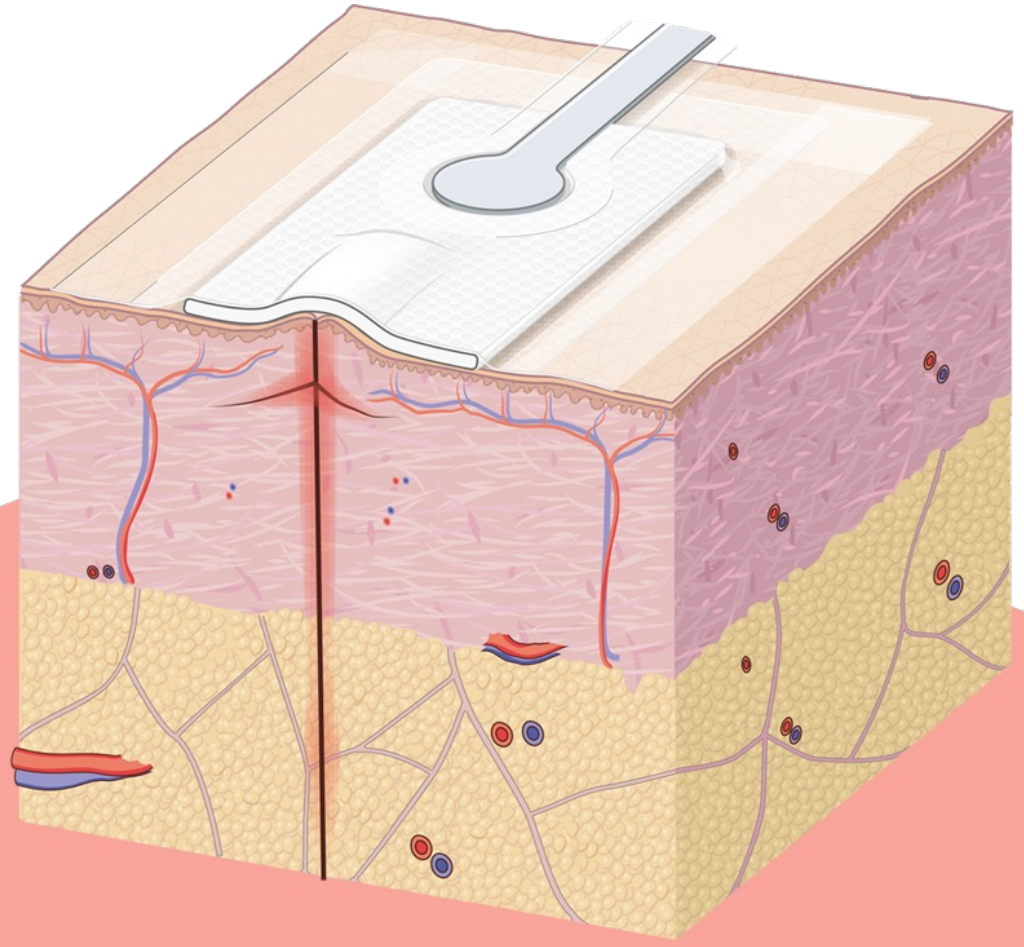
Smith+Nephew

Back to Basics

Mechanisms of actions

PICO

Single Use Negative Pressure
Wound Therapy System



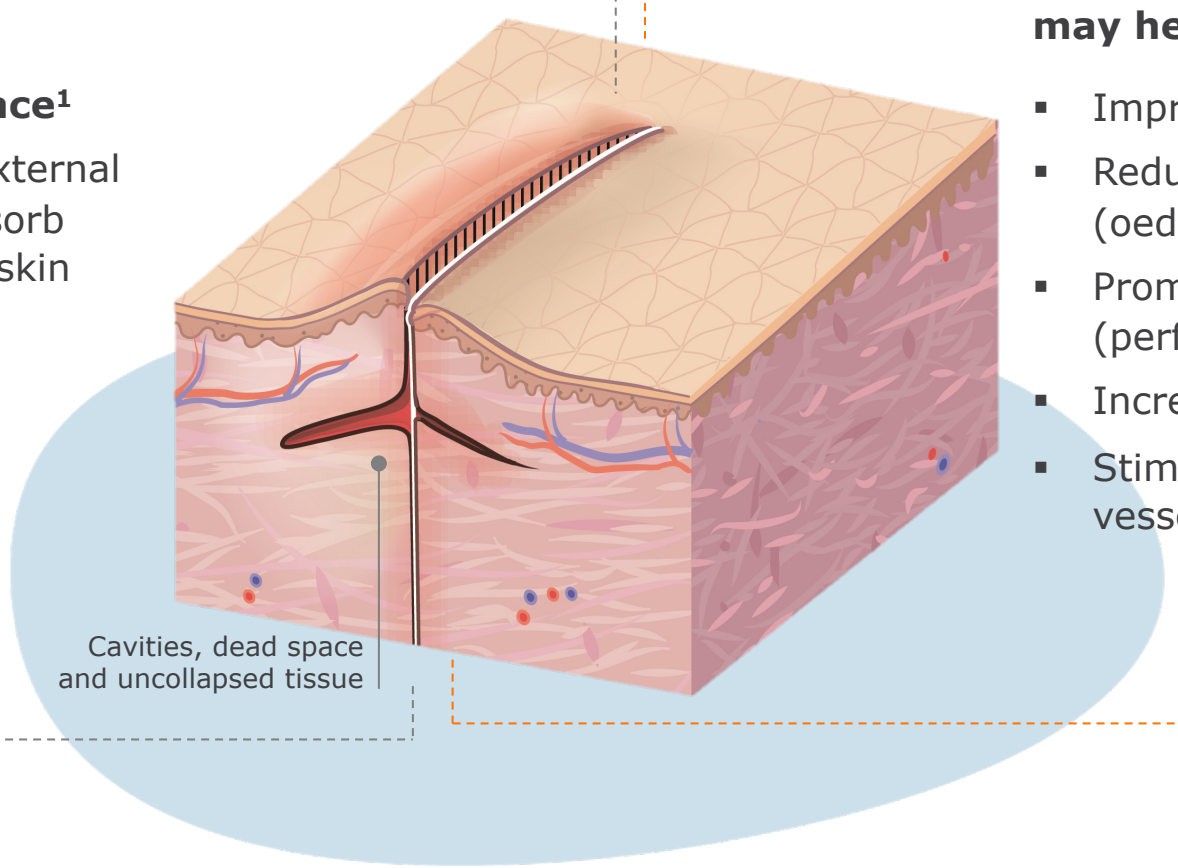
Mechanisms of action

Standard dressing vs. NPWT

Standard dressings

Act at the wound surface[1]

- Provide a barrier to external infection and help absorb wound fluid from the skin surface (exudate)



NPWT

Acts via multiple mechanisms may help[2-10]

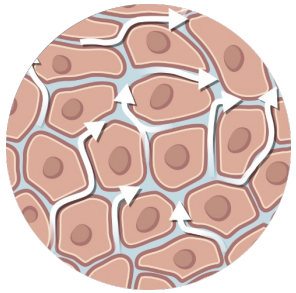
- Improve wound contraction[2,3,8]
- Reduce fluid build up (oedema)[5-7]
- Promote changes in blood flow (perfusion)[8]
- Increase lymphatic drainage[4*]
- Stimulate growth of new blood vessels (angiogenesis)[9-10]

*As demonstrated *in vivo*.

For detailed product information, including indications for use, contraindications, effects, precautions and warnings, please consult the product's Instructions for Use (IFU) prior to use.

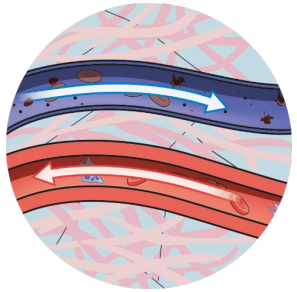
Summary of the MoAs

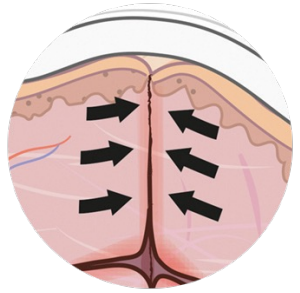
Increases the efficiency of functional lymph vessels which helps to **reduce oedema**[5-7]



Helps to promote **lymphatic drainage**[4*]

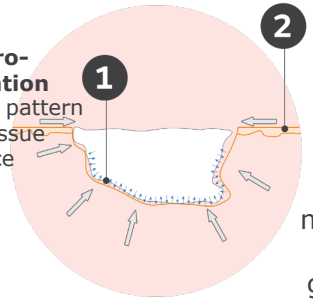
Maintains an **efficient blood supply** to the wound (perfusion), which helps to support the immune response[8-10]





Holds closed incision together, **reducing lateral tension** forces across the incision[2†]

Provides a **moist wound environment** which helps with wound healing[29-32]



1: Micro-deformation "Imprints" a pattern on the tissue surface

2: Macro-deformation: Contraction causes stretch

The combination of macro and micro-deformations (wound contraction and filling of tissue defects with new granulation tissue) leads to **reduction in wound area and wound depth**.[11-13]

*As demonstrated *in vivo*. †As demonstrated in biomechanical modelling.

For detailed product information, including indications for use, contraindications, effects, precautions and warnings, please consult the product's Instructions for Use (IFU) prior to use.

Mechanism of action of NPWT

Smith+Nephew Clinical Scientific Medical Affair (CSMA) experts highlight the following key wound effects between **surgically closed incisions and open wounds**.

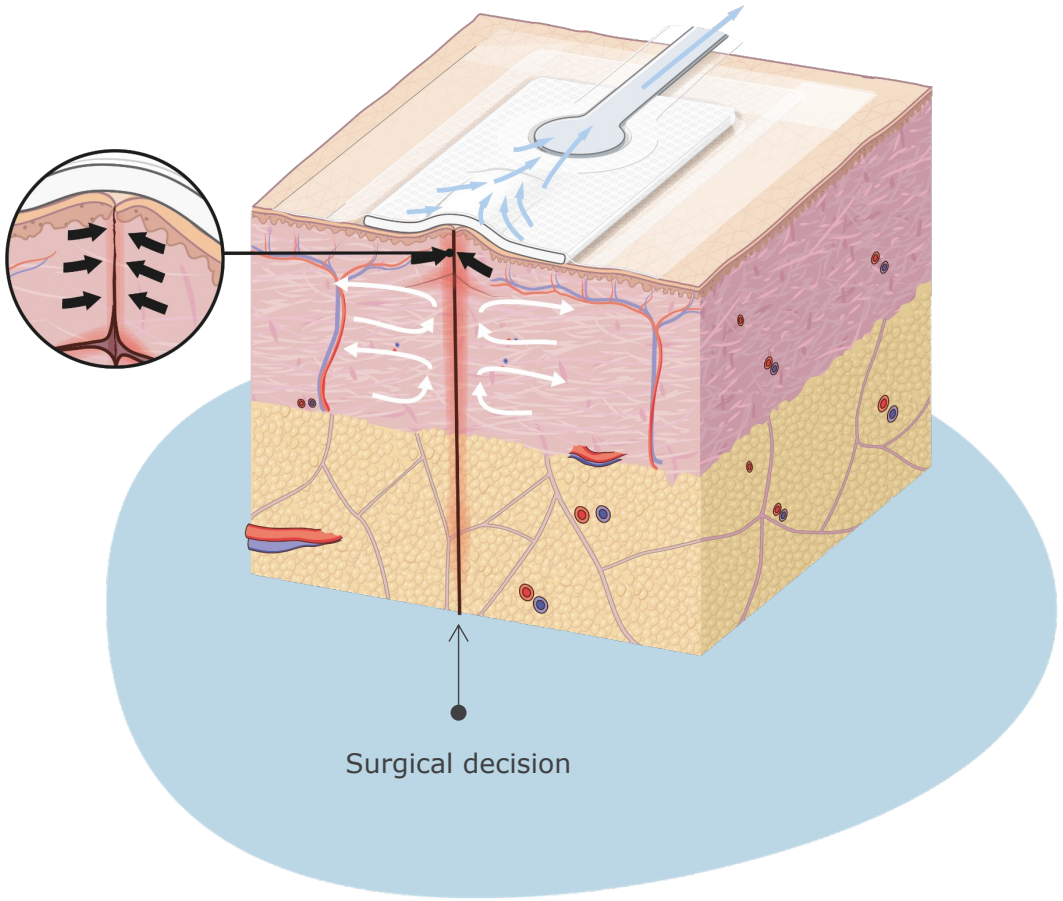
Closed surgical incisions GO TO LINK **Bolstering incisions and reduce infection risks** Summary
Reduce lateral tension
Fluid removal
Blood flow
Maintenance of wound homeostasis

Open wounds GO TO LINK **Improve granulation tissue and exudate management** Summary
Fluid removal
Blood flow
Micro-deformation
Macro-deformation
Maintenance of wound homeostasis

For detailed product information, including indications for use, contraindications, effects, precautions and warnings, please consult the product's Instructions for Use (IFU) prior to use.

MoA for closed incision wounds

Lateral tension and wound strength



By compressing the wound, PICO◇ sNPWT helps to reduce lateral tension placed on the closed incision,[2*] pulling the borders together, facilitating wound healing and increasing breaking strength[2,8,14]

- Sutures hold wound borders together at the skin surface and in the subcutis; they help reduce the lateral tension that can cause wound borders to move apart[14]
- Where wound borders are not closed granulation tissue can form, which increases the risk of undesirable scarring[14]
- Application of negative pressure across the incision, to a wider zone of injury, reduces lateral tension on closed incision, pulling the wound borders together[2,3,8]
- This may result in improvements of quality and appearance of scars.[15†]

*As demonstrated in biomechanical modelling. †When applied post-operatively compared to care with standard dressings; $p<0.001$.

Note: PICO is not a scar treatment but rather helps prevent scar formation/ aid in scar appearance, by aiding with the prevention of surgical site complication/ wound healing.

Video

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MoA for closed incision wounds

Reduction in lateral tension helps improve the quality and appearance of scars.[15]

Visual Analog Scale (VAS) score

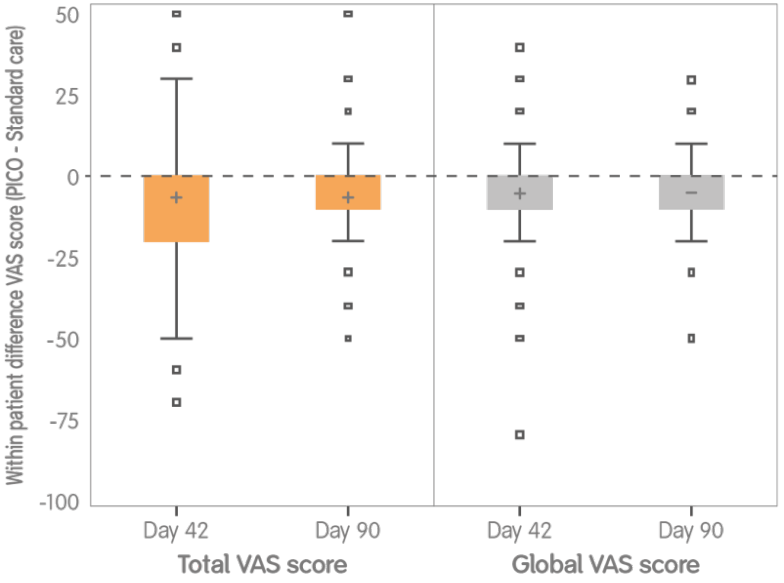

Fig.1: Within patient difference in VAS score (PICO – SC)[15]

Patient Observer Scar Assessment Scale (POSAS)

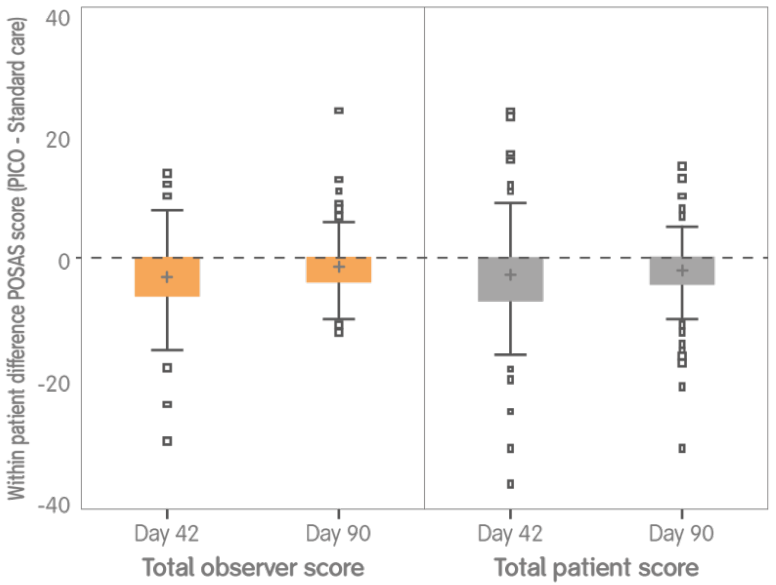

Fig.2: Within patient difference in POSAS score (PICO – SC)[15]

- **200 patients** undergoing bilateral reduction mammoplasty treated with both **PICO◇ sNPWT** and standard dressing[15]
- **Each patient was their own control;** one breast was treated with **PICO** sNPWT and one breast treated with standard dressing
- Patients treated for up to **14 days** to enable a within patient comparison
- Differences in scar quality and aesthetic appearance assessed using the patient and observer scar assessment scale (POSAS) and The visual analogue scale at **42 and 90 days[15]**
- Scar quality as measured by both scoring systems was shown to be **significantly better** on **PICO◇** sNPWT than standard dressing, at both **42 and 90 day** assessment ($p<0.001$) [15]

Video

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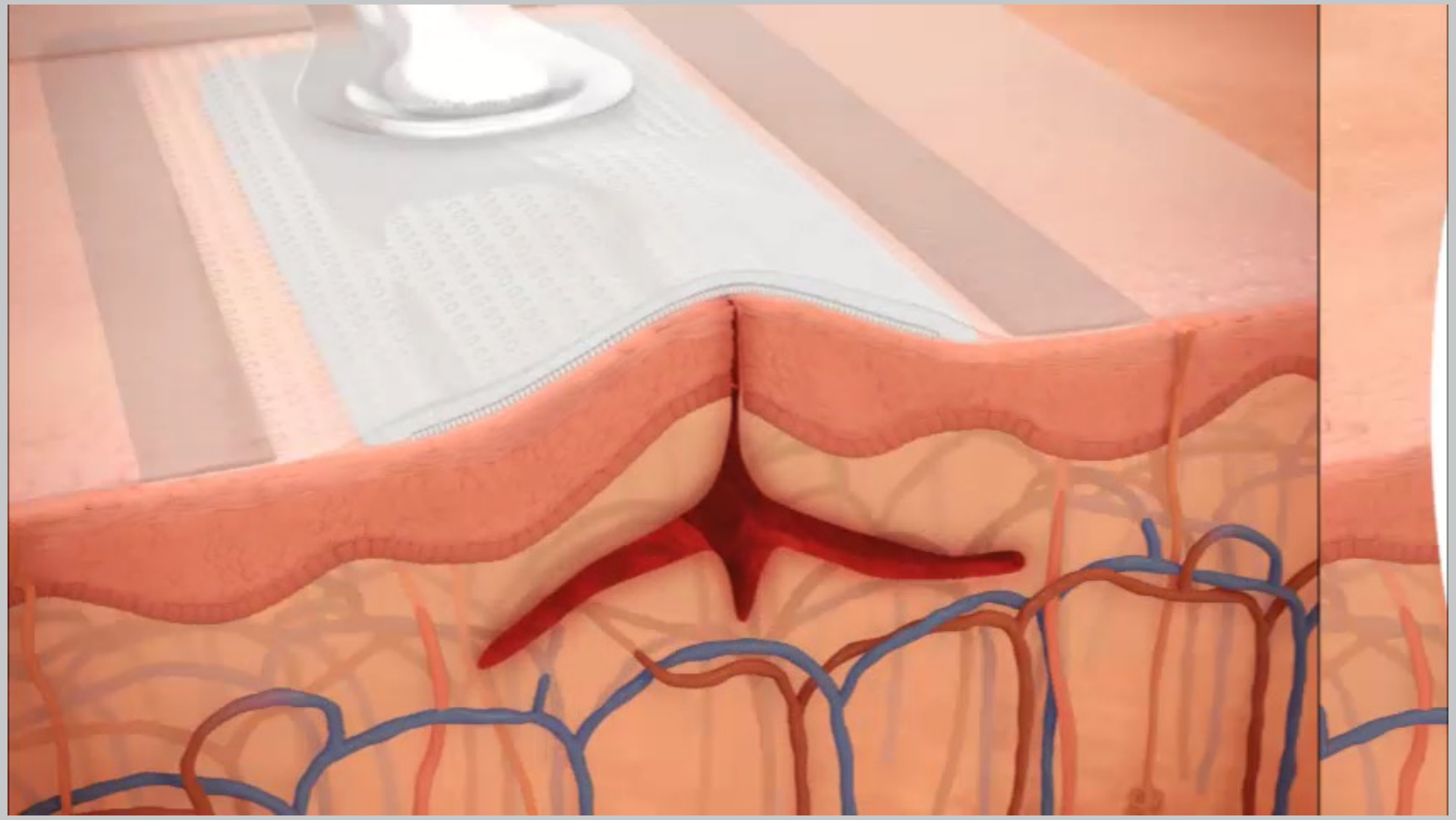
Note: PICO is not a scar treatment but rather helps prevent scar formation/ aid in scar appearance, by aiding with the prevention of surgical site complication/ wound healing.

Lateral tension and wound strength

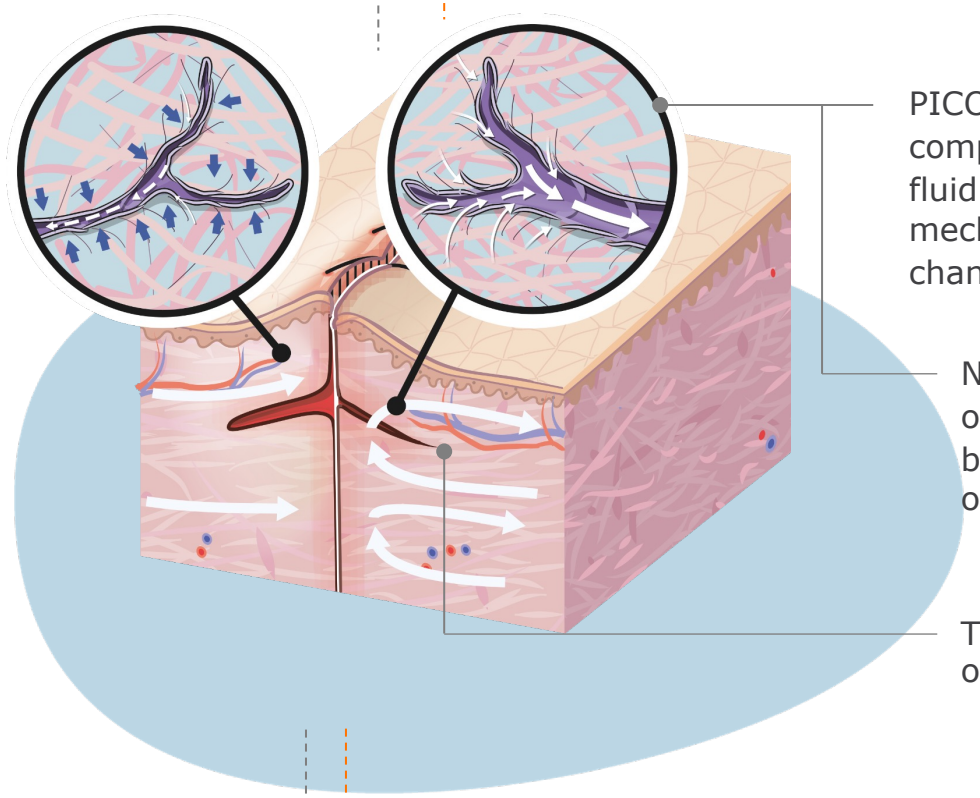


MoA for closed incision wounds

Fluid management | Improve fluid management via lymphatic system

Standard dressings

- Inefficient functioning of the lymphatic system can cause build up of interstitial fluid and potential toxins in the tissues (oedema)[4-5]
- Consequently, accumulation of serious fluid (seroma) and blood (hematoma) can occur within tissue cavities [4,6]
- Standard dressings have no known effects on the lymphatic system



PICO◇ sNPWT

PICO Dressings with AIRLOCK◇ Technology compress the peri-wound area and remove fluid from wound bed, this simultaneous mechanism may enable fewer dressing changes during the healing process.[16-18*]

NPWT helps to increase the activity of the lymphatic system,[4†] in part by reducing oedema and compression of the vessels.[4-7]

This helps to reduce the incidence of seroma in closed surgical incisions[19-24‡]

Video

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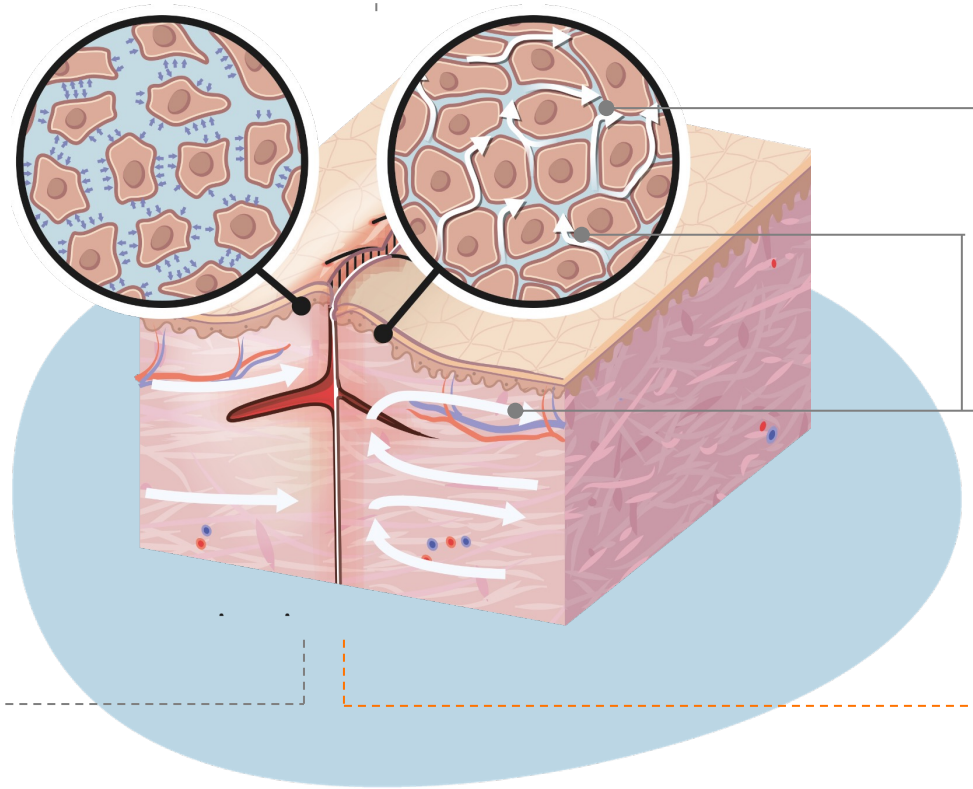
*Compared to care with standard dressings. †As demonstrated *in vivo*.
‡Compared to care with standard dressings.

MoA for closed incision wounds

Fluid management | Effects on oedema and swelling

Standard dressings

- If the lymphatic system is compromised and/or overloaded, fluid can accumulate between the cells (interstitial fluid) causing oedema and swelling[25-26]
- Uncontrolled oedema may delay or compromise wound healing and increase the risk of infection[27]
- Standard dressings have no known beneficial effects of oedema and swelling



PICO◇ sNPWT

NPWT may help to reduce post-operative oedema[5-7]

Proposed mechanisms for this possible effect of NPWT may include improvements in the functionality of damaged lymph vessels and increased efficiency of functional lymph vessels[4,6,14]

Video

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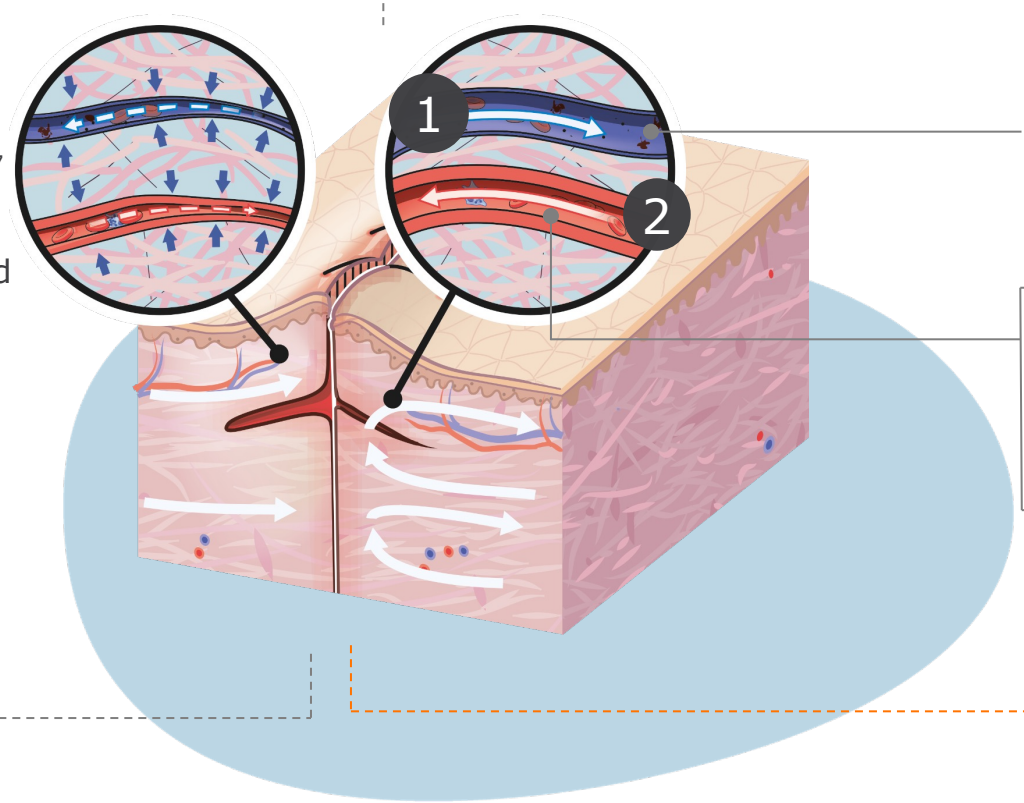
MoA for closed incision wounds

Fluid Management | Effects on blood vessels, perfusion and angiogenesis

Standard dressings

- Uncontrolled oedema can cause compression of blood vessels[27]
- This may lead to decreased blood circulation and impair wound healing[27]
- Standard dressings have no known beneficial effects on oedema and blood circulation



PICO◇ sNPWT

May help to reduce build up of interstitial fluid (oedema) and minimise compression of blood vessels[25]

In vivo, promotes changes in blood flow (perfusion), which may be beneficial to the wound[8*]

May help to form new blood vessels (angiogenesis) around the incisional margin[28]

*As demonstrated *in vivo*.

Video

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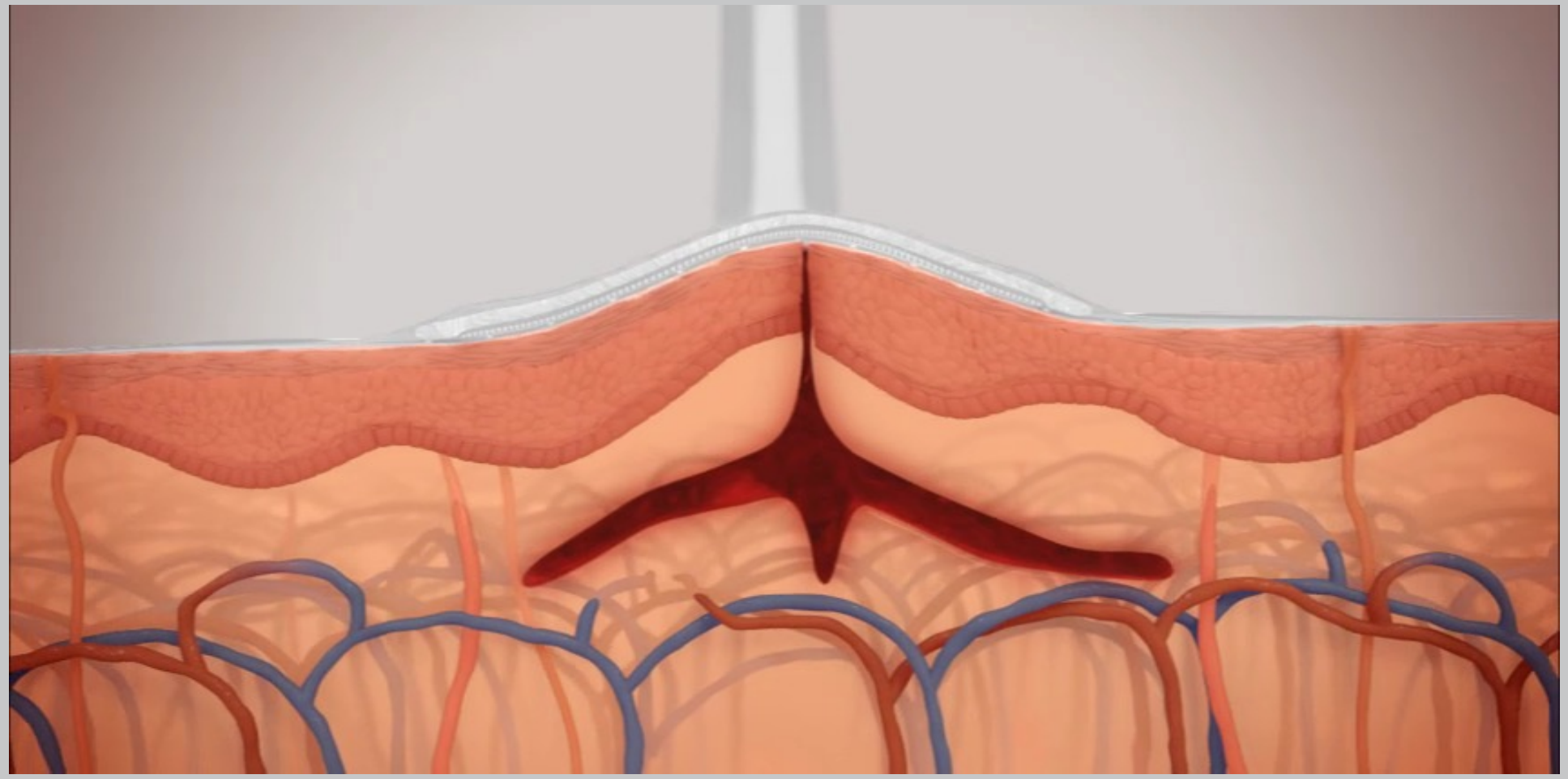
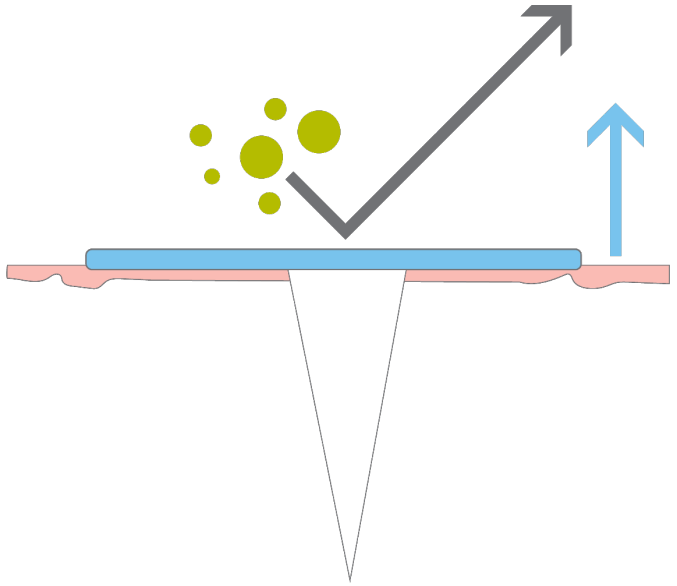
Fluid management



MoA for closed incision wounds

Maintenance of wound homeostasis



Provides a closed, moist wound environment[29-32]

- Controlled moisture evaporation[8] (*in-vitro*) and helps to minimise heat loss[1]
- Helps to minimise contamination[5]

Video

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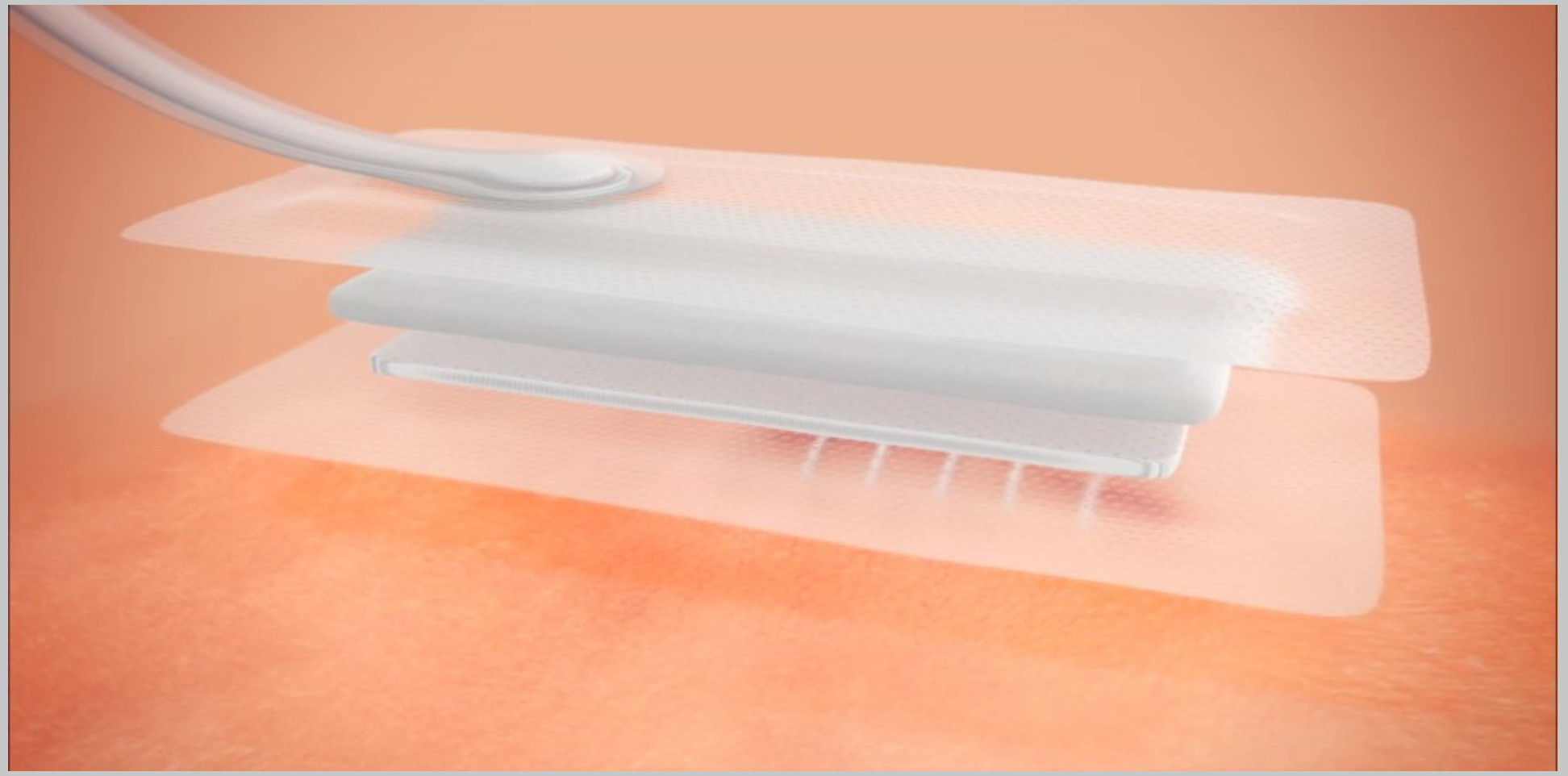
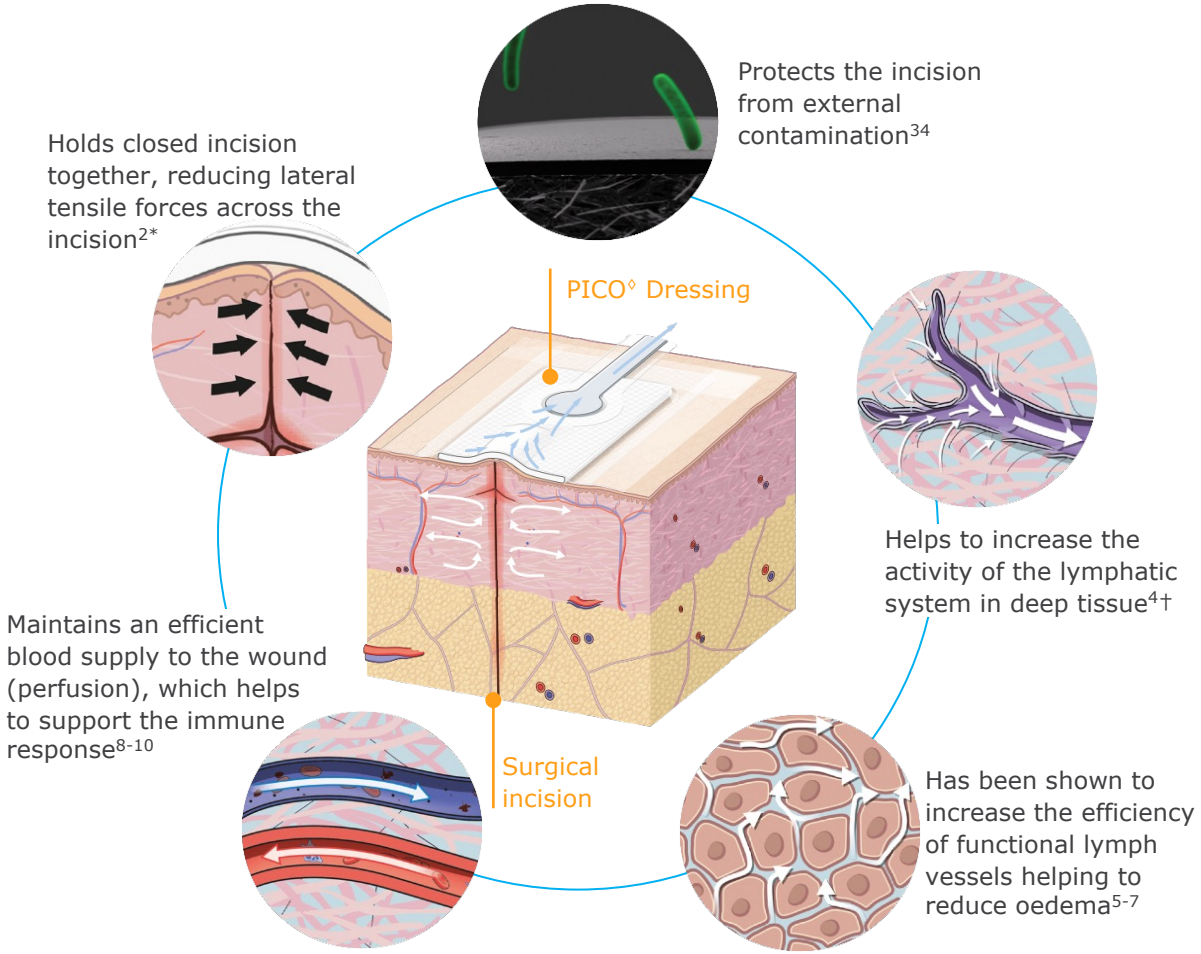
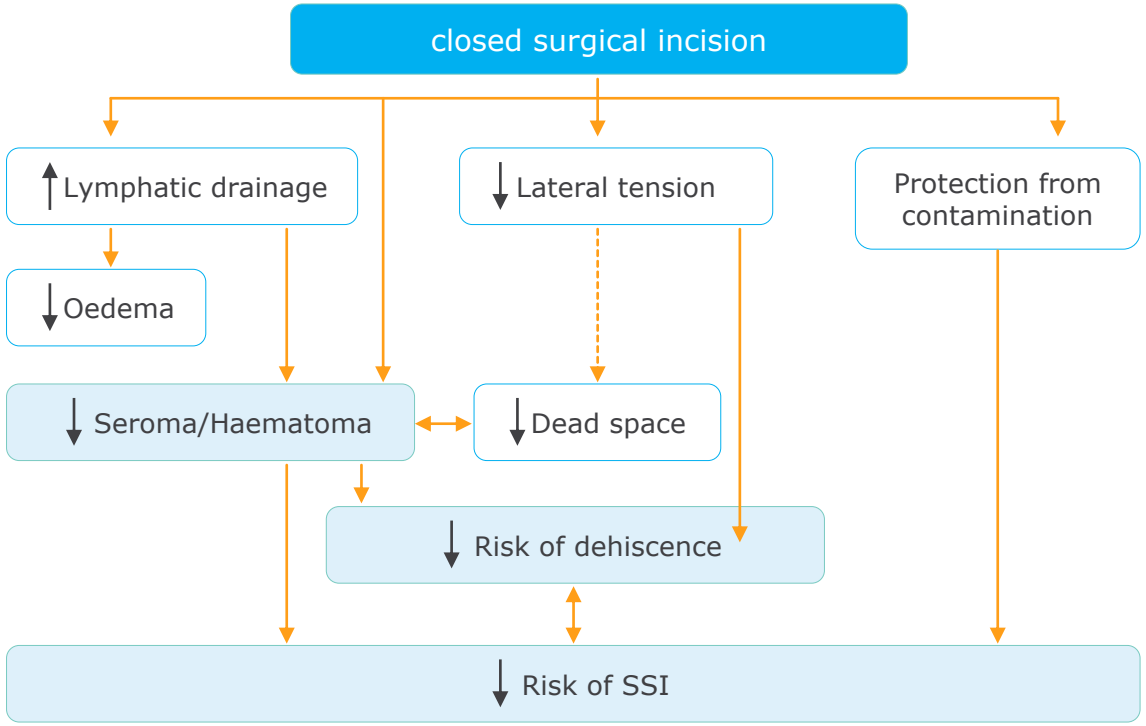
Maintenance of wound homeostasis



Summary: NPWT has multiple mechanisms of action which may help promote incisional wound healing and reduce the odds of SSCs.[1,7,30,31,33]





This pathway is adapted from the WUWHS guidelines document and it shows how NPWT can help reduce SSCs and lateral tension while increasing lymphatic drainage. This effect is likely to contribute to faster and stronger healing, and a reduced risk of infection and dehiscence[35]

*As demonstrated in biomechanical modelling †As demonstrated *in vivo*

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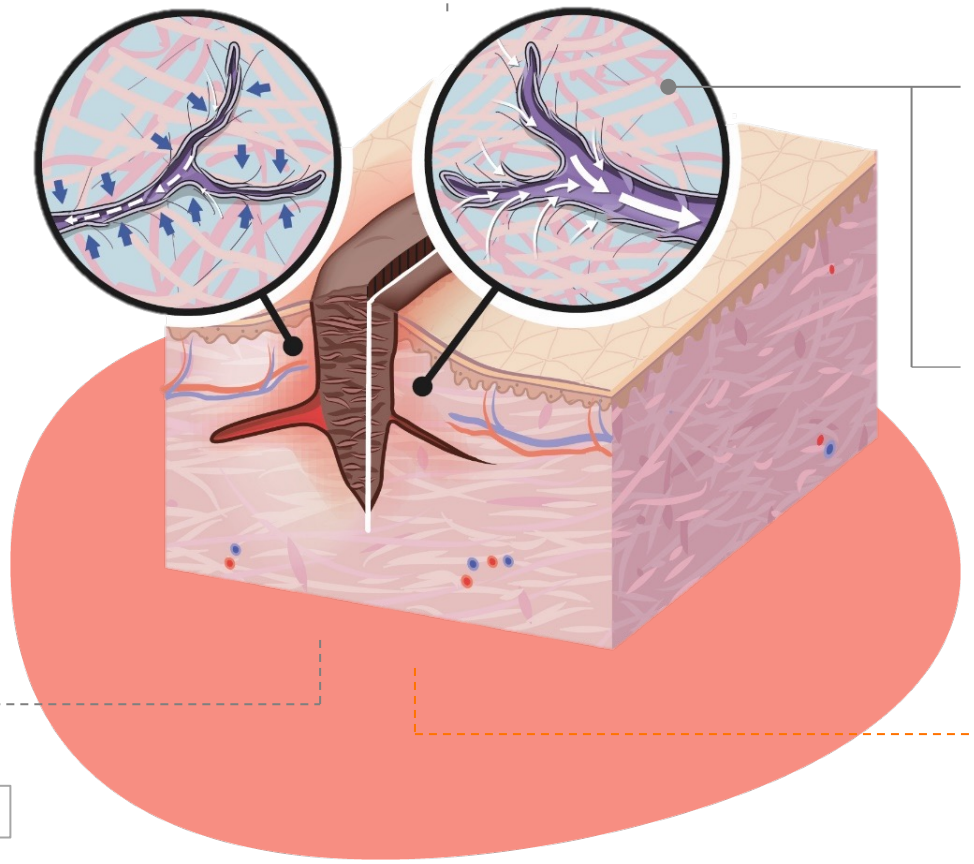
MoA for open wounds

Fluid Management | Improve fluid management via lymphatic system

Standard dressings

- Inefficient functioning of the lymphatic system can cause build up of interstitial fluid and potential toxins in the tissues (oedema)[4,6]
- Uncontrolled oedema may delay or compromise wound healing[27]
- Standard dressings have no known effects on the lymphatic system



PICO◇ sNPWT

PICO Dressings with AIRLOCK◇ Technology compress the peri-wound area and remove fluid from wound bed, this simultaneous mechanism may enable fewer dressing changes during the healing process.[16-18*]

NPWT helps to increase the activity of the lymphatic system,[4†] in part by reducing oedema and compression of the vessels.[4-7]

*Compared to care with standard dressings. †As demonstrated *in vivo*.

Video

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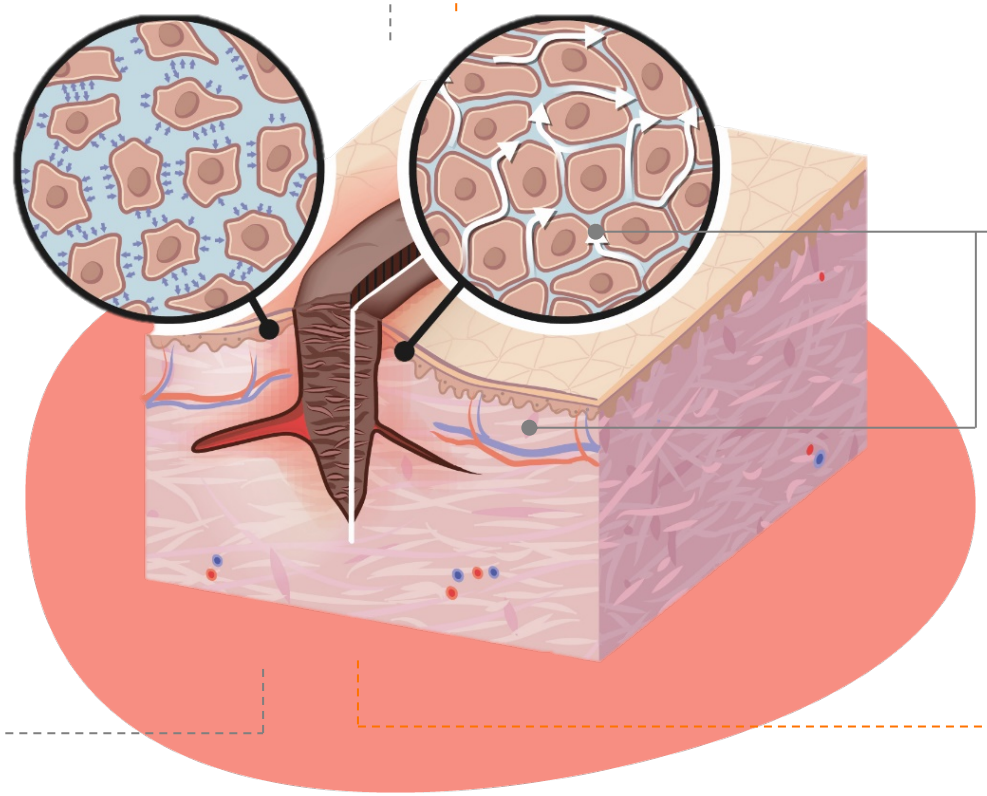
MoA for open wounds

Fluid Management | Effects on oedema and swelling

Standard dressings

- If the lymphatic system is compromised and/or overloaded, fluid can accumulate between the cells (interstitial fluid) causing oedema and swelling[25-26]
- Uncontrolled oedema may delay or compromise wound healing and increase the risk of infection[27]
- Standard dressings have no known beneficial effects of oedema and swelling



PICO◇ sNPWT

NPWT helps been shown to improve the functionality of damaged lymph vessels and increase the efficiency of functional lymph vessels, helping to reduce oedema[4,6,14]

Video

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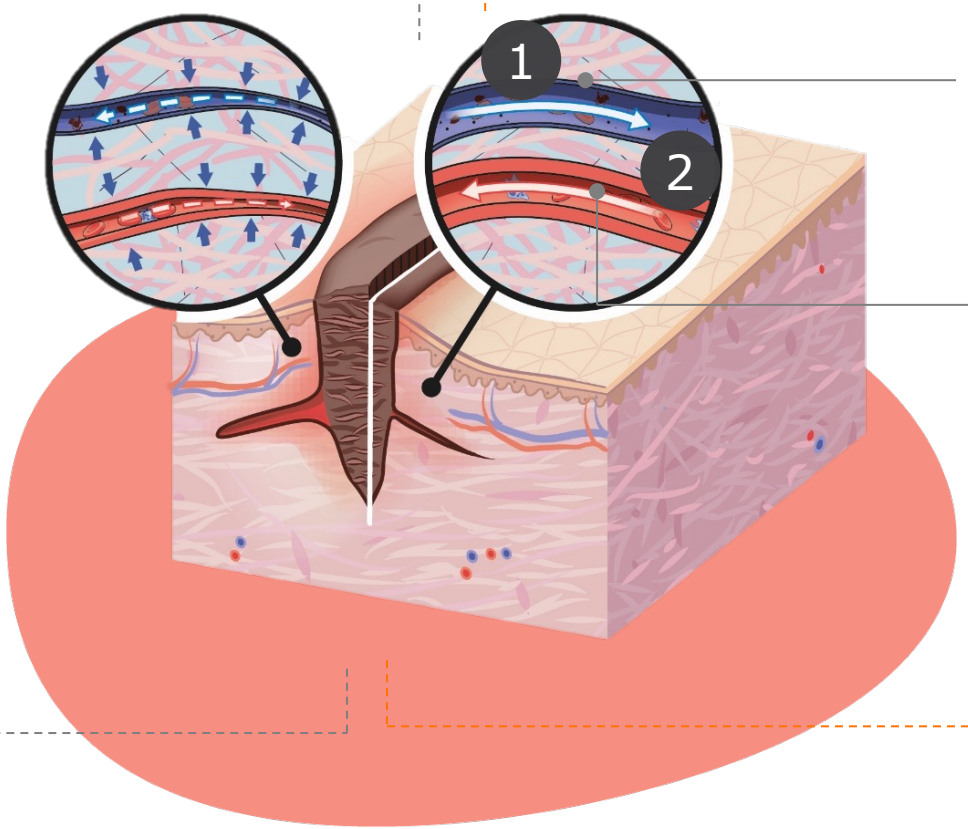
MoA for open wounds

Blood flow | Increased blood flow helps in the process of wound healing and granulation tissue formation

Standard dressings

- Uncontrolled oedema can cause compression of blood vessels[27]
- This may lead to decreased blood circulation and impair wound healing[27]
- Standard dressing have no known beneficial effects on oedema and blood circulation



PICO◇ sNPWT

Helps to reduce build up of interstitial fluid (oedema) and minimise compression of blood vessels[25]

Maintains an efficient blood supply to the wound (perfusion), which helps to support the immune response and remove debris[6,8]

Can promote the formation of new blood vessels (angiogenesis)[9-10] which facilitates tissue growth and wound healing

Video

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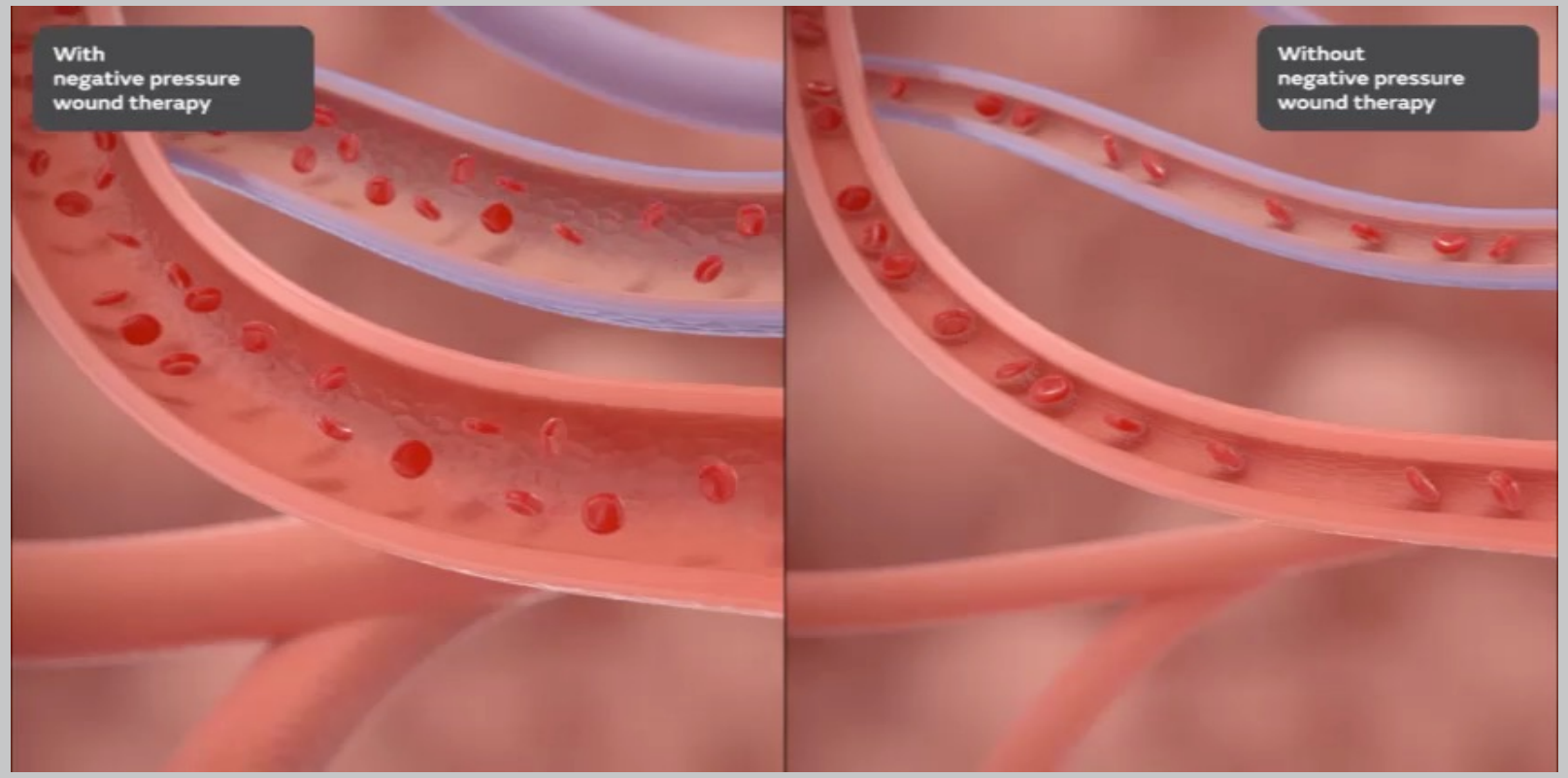
Fluid management



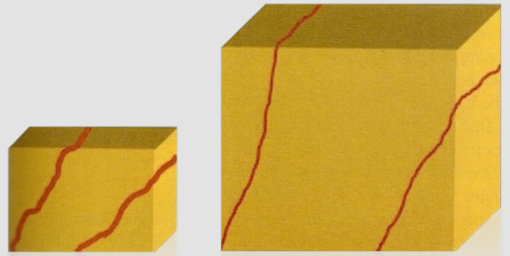
Increased blood flow helps in the process of wound healing and granulation tissue formation.

NPWT directly influences blood flow (*in-vivo*)

- Stimulation of blood flow experimental wounds[36]
- Tissue stretching shown to increase blood flow[13]

NPWT reduces oedema[37]

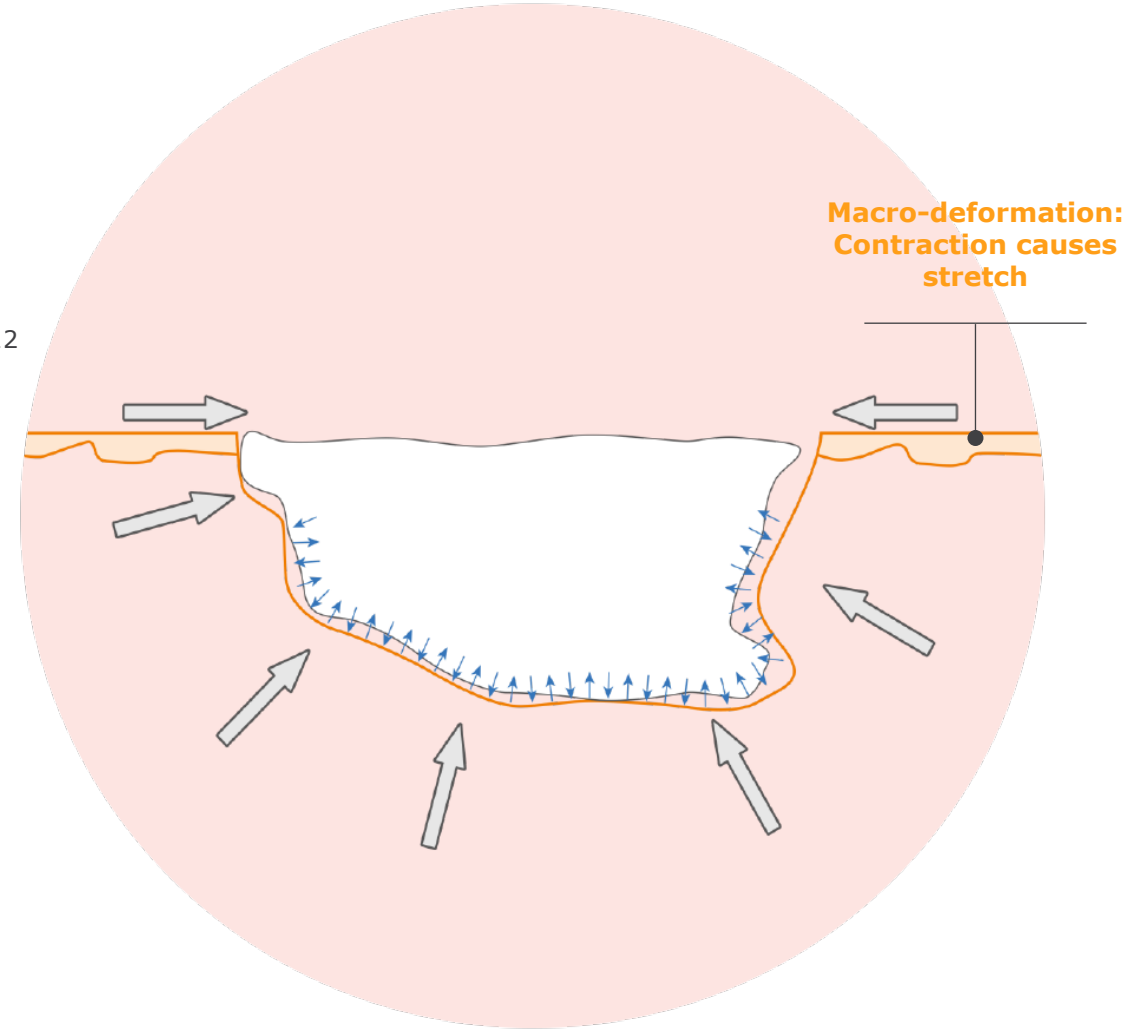
- Reduces gap between capillaries and cells
- Improves blood flow to cells



MoA for open wounds
Macro-deformation

The stretch or contraction of tissue when NPWT is applied.

- When NPWT is applied to a wound an immediate reduction in wound area or 'wound contraction' occurs[12] (*in-vivo*)
- This reduction in wound area appears to be permanent as the wounds remained contracted after discontinuation[11,12]



Video

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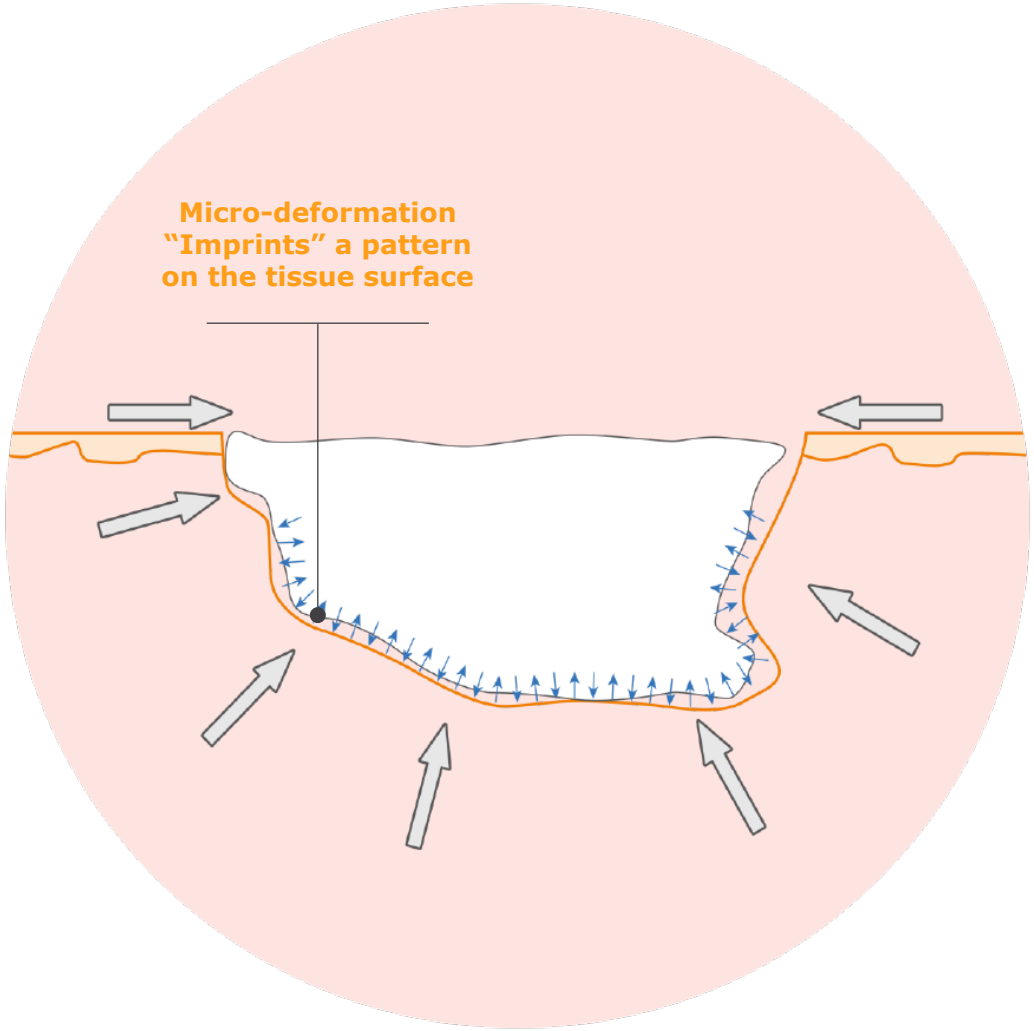
MoA for open wounds
Micro-deformation

The transfer of an imprint of the surface topography of the compressed wound filler to the tissue surface

- When negative pressure is applied, tissue bulges into the open pores of the wound filler[11] (*in-vitro*)
- Cells are stimulated to proliferate leading to new granulation tissue formation[11,29,38,39] (*in-vitro*)



Note: There is no micro-deformation in closed incision wounds. Micro-deformation happens in open wounds only when filler is being used.

Video

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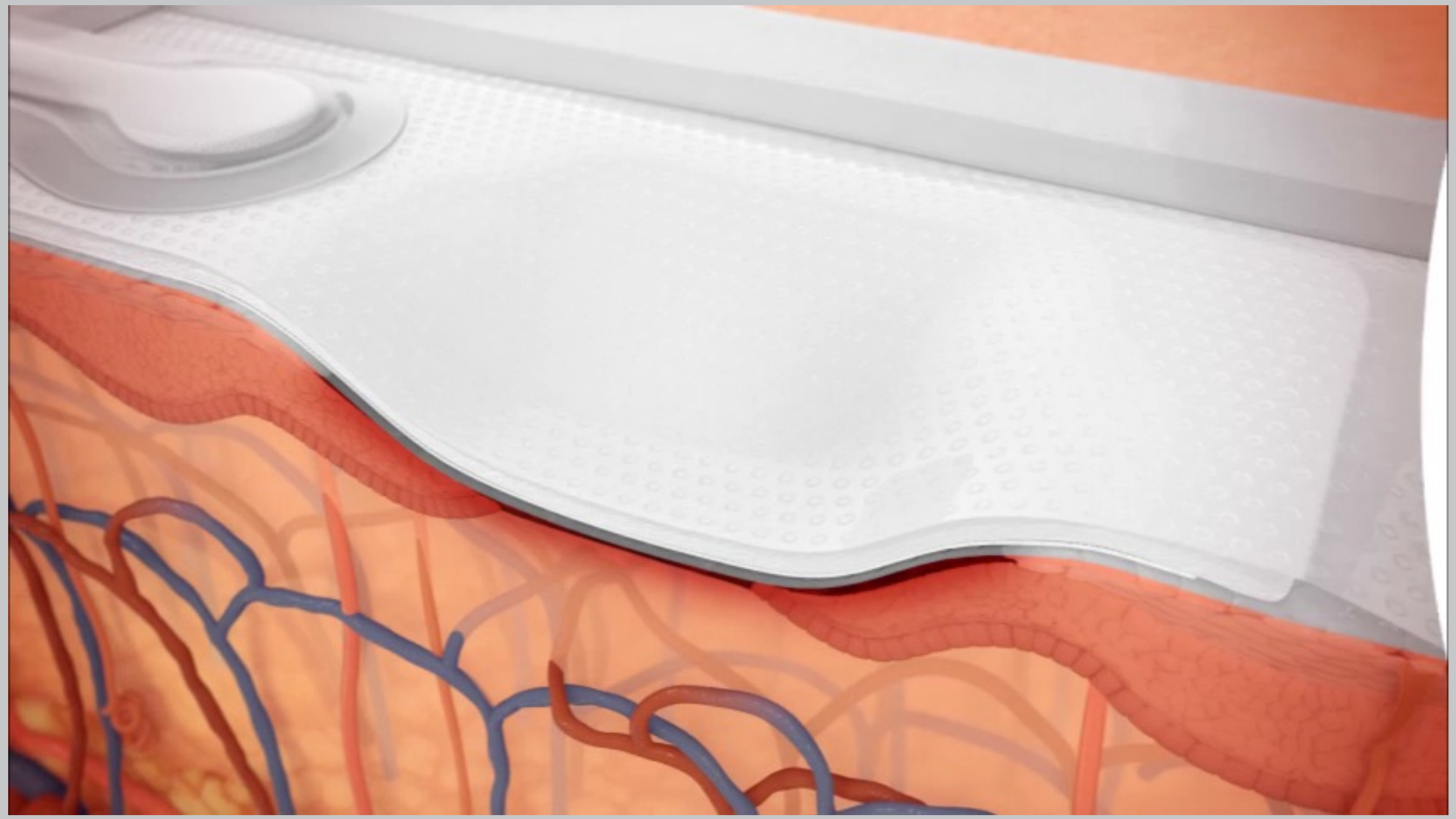
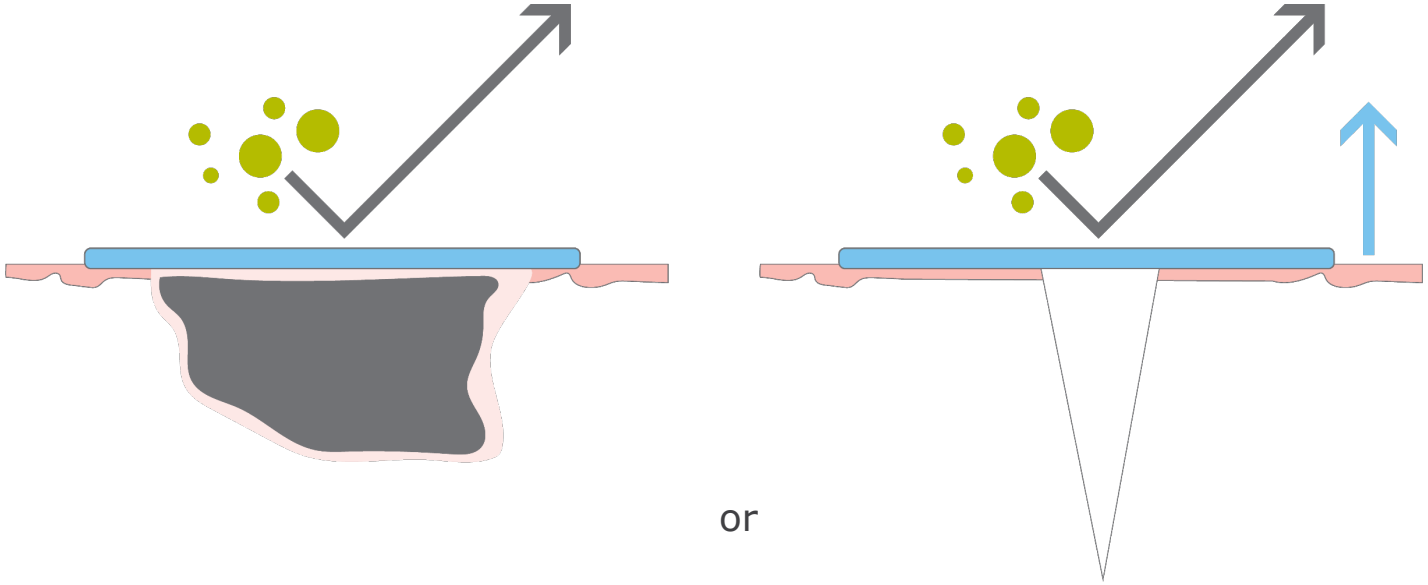
Micro and macro-deformation



MoA for open wounds

Maintenance of wound homeostasis



NPWT with a wound filler

or

NPWT without a wound filler

Provides a closed, moist wound environment[29-32]

- Controlled moisture evaporation[8] (*in-vitro*) and helps to minimise heat loss[1]
- Helps to minimise contamination[5]

Video

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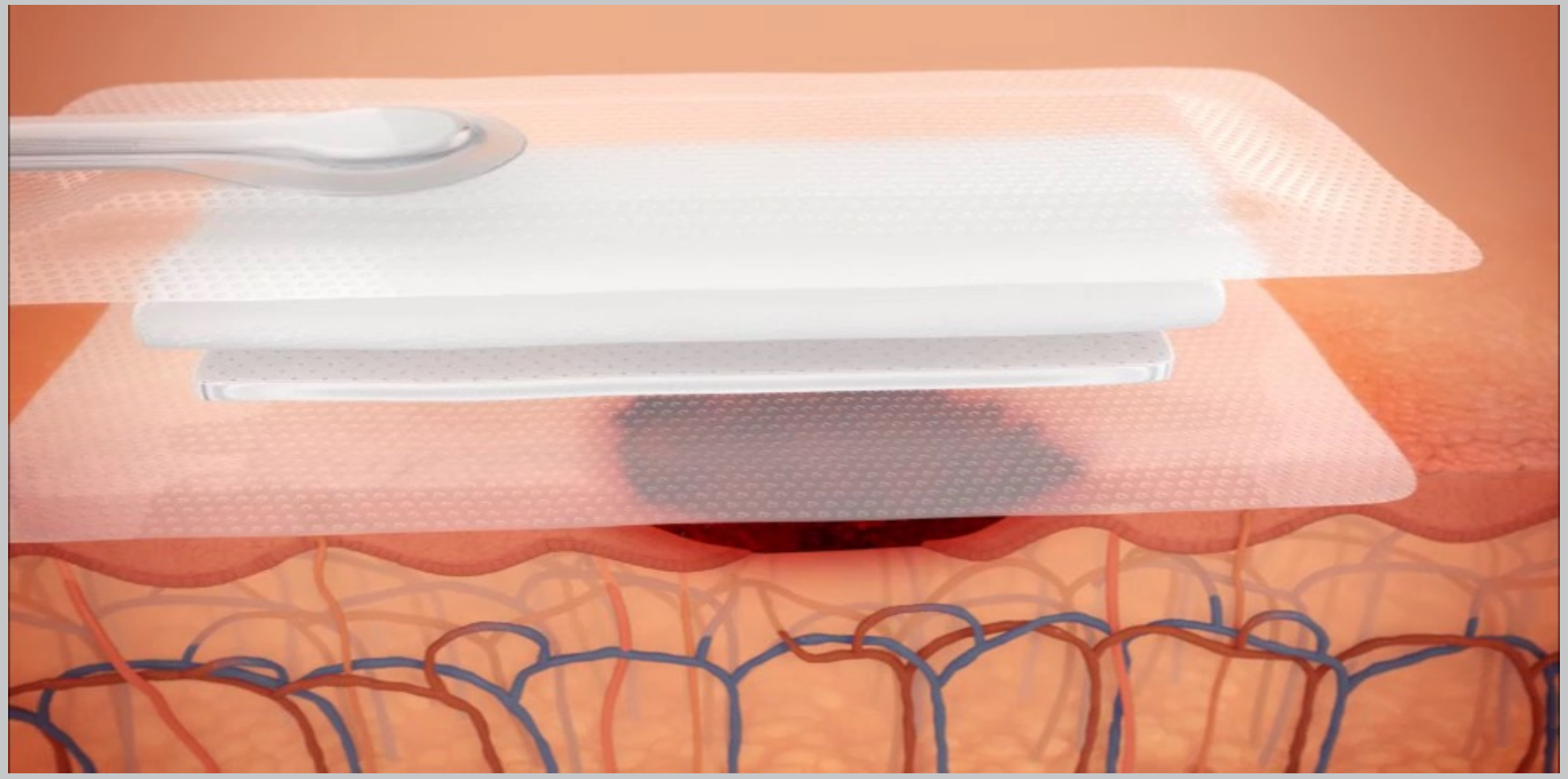
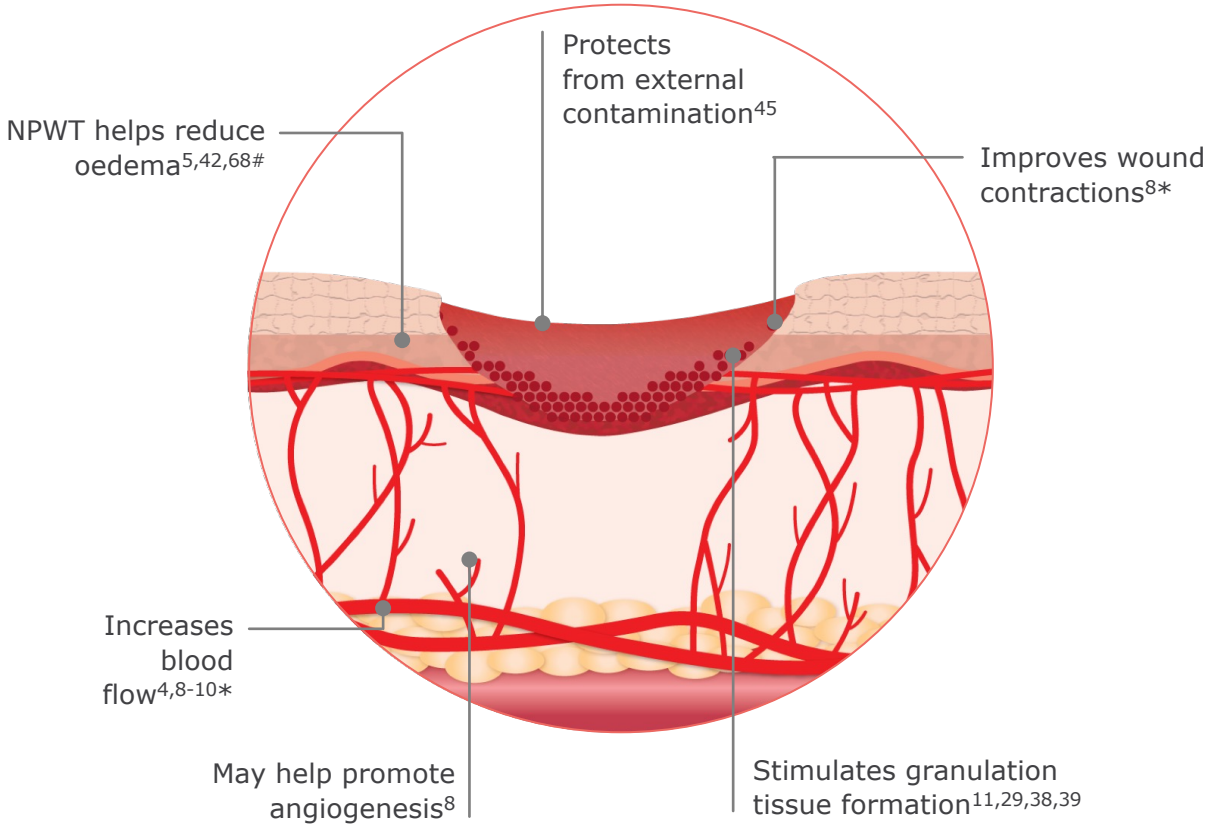
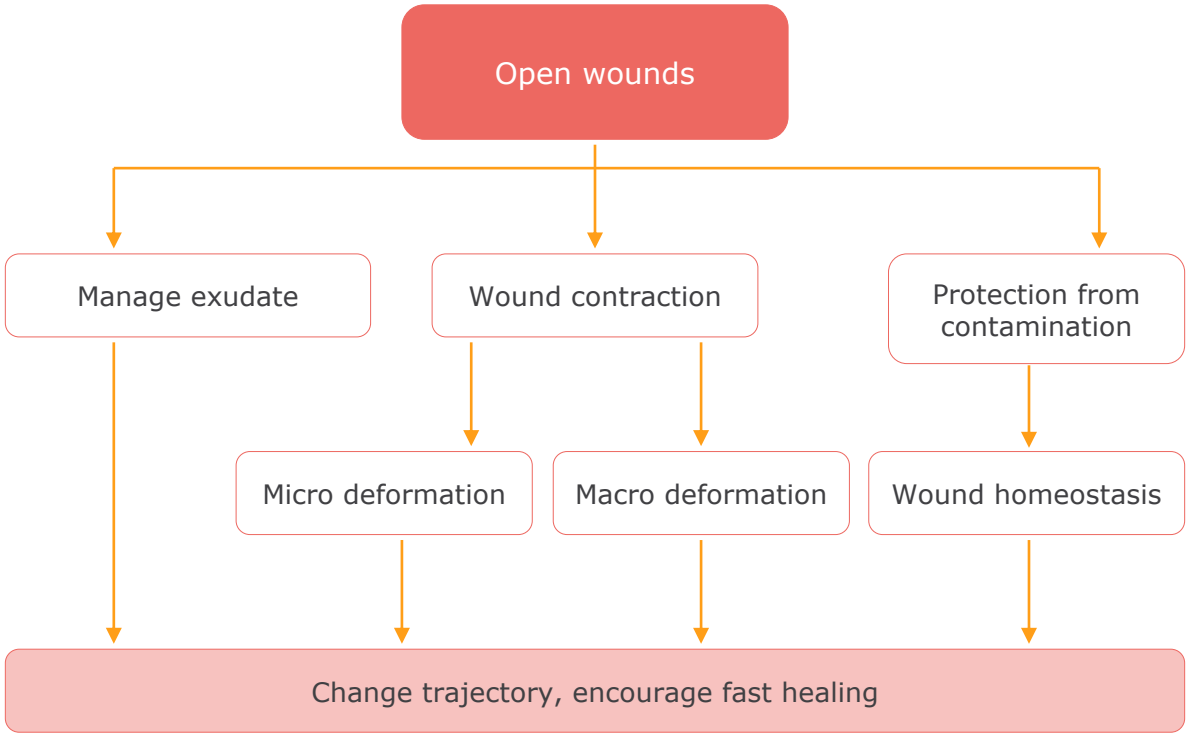
Maintenance of wound homeostasis



Summary: NPWT has multiple mechanisms of action that help improve the speed, strength and quality of wound healing,* lead to fewer dressing changes[17,40,41] and faster healing of chronic wounds[41†,43]





Schematic representation of the multiple proposed mechanisms of action of sNPWT on acute and chronic wounds

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*Compared to care with standard dressing.
†n=9; 44 weeks mean wound duration prior to study
#in partial thickness burns

Not all NPWT systems are the same

PICO◇ sNPWT

Product features,
benefits and applications

The PICO◇ Single-use Negative Pressure Wound Therapy

Features:

Improved device performance

- The PICO 7 pump has a significantly* higher maximum leak rate tolerance than the original PICO pump[46]

Cost savings

- The dressing full indicator on the PICO System led to a low frequency of outpatient clinic visits and home visits, creating a potential saving in treatment costs[47,48†]

Designed to improve patient quality of life

- The PICO pump is quiet (<30db at 1m)[49]
- The belt clip is to enable portability worn by the patient during use

Increased flexibility

- Multipacks of five dressings available, allowing therapy to be tailored to patients' clinical needs

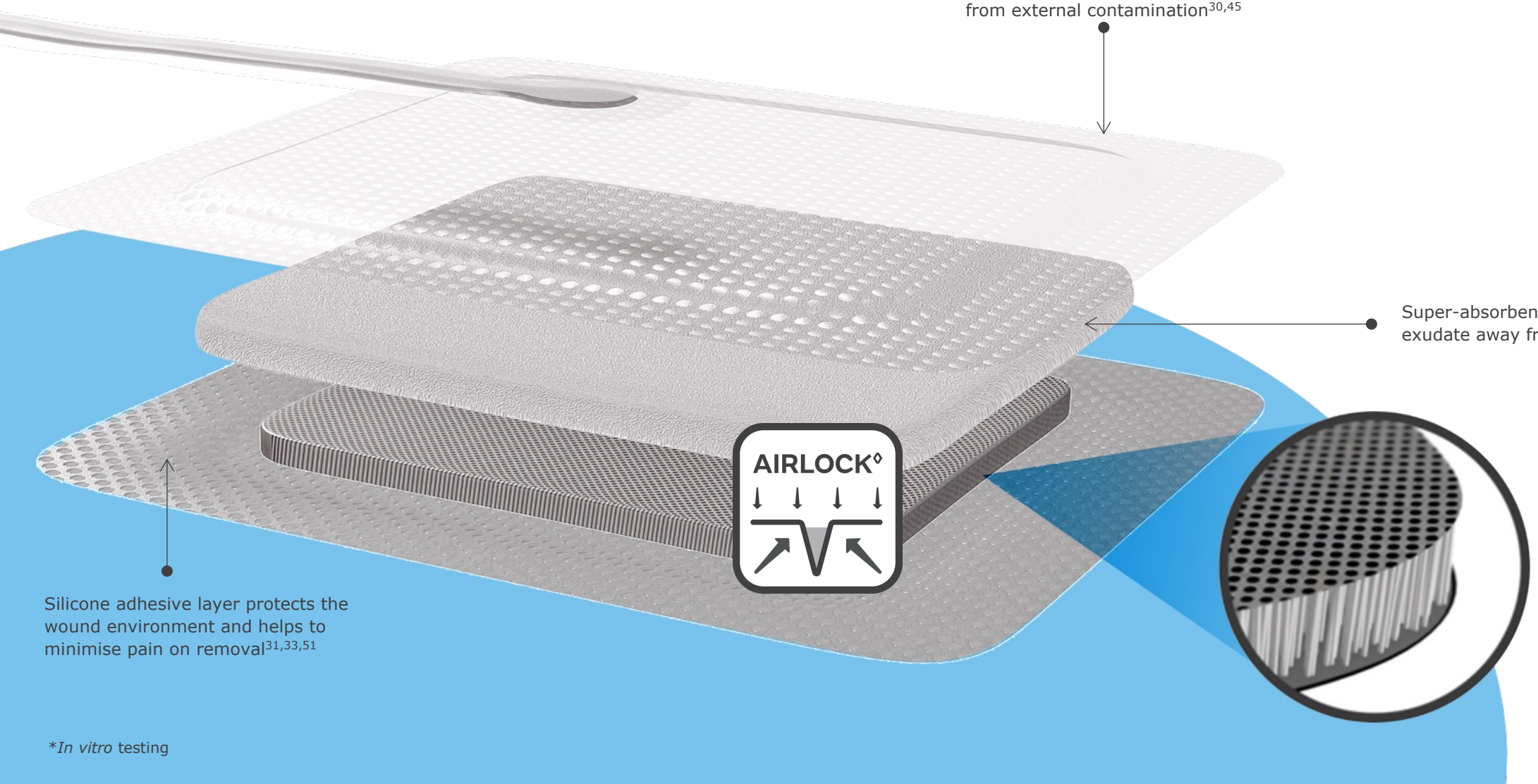
The PICO System is suitable for use in both hospital and homecare settings.[50]

*p<0.001. †As demonstrated in a 4-patient case study on complex DFUs. Reduction per patient of 1-2 outpatient visits and 1-3 home visits per week; compared to pre-NPWT.

Only PICO◇ sNPWT dressings have AIRLOCK◇ Technology

Wide delivery. Constant pressure. **Optimal outcomes.**

Top film layer has a high moisture vapour transmission rate and protects the wounds from external contamination[30,45]



Super-absorbent core locks exudate away from wound[52*]

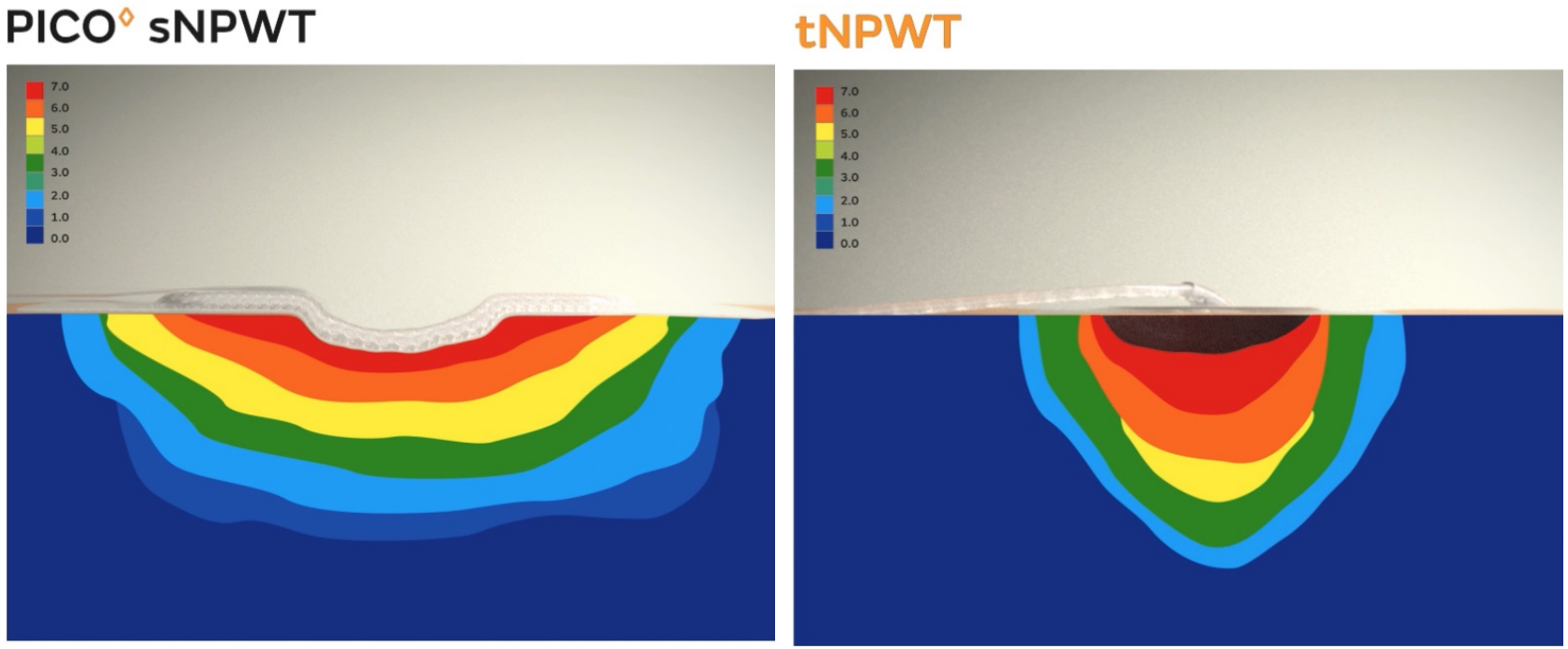
Silicone adhesive layer protects the wound environment and helps to minimise pain on removal[31,33,51]

The PICO System with **AIRLOCK** Technology allows the delivery of negative pressure across the entire dressing to ensure that treatment is delivered to a wider zone beyond the wound itself.[53,54]

**In vitro* testing

PICO◇ sNPWT with the proprietary AIRLOCK◇ Technology

Deliver negative pressure across the entire dressing area,[54-56] providing benefits to the wound and surrounding area[37,57]



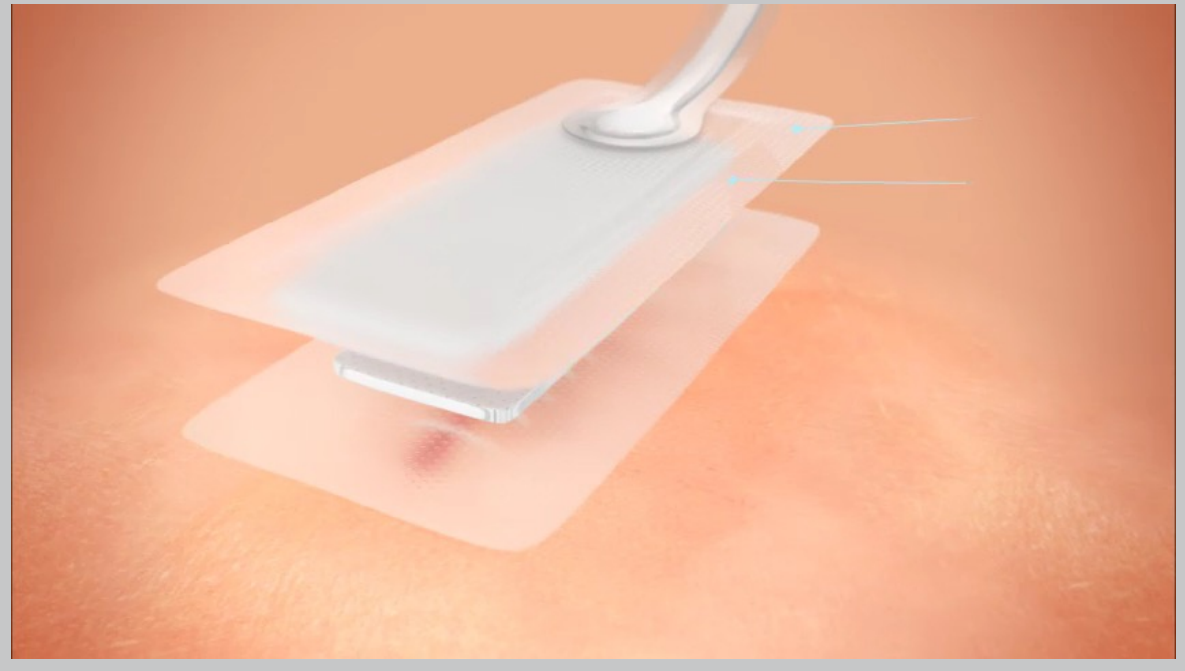
CT imaging of tissue compression

- Delivery of negative pressure across the dressing to surrounding tissue,[54-56] which may benefit perfusion[57] and management of oedema[37]
- Consistent delivery of negative pressure for the duration of therapy[31,53]
- **PICO** sNPWT showed less wound edge inflammation, yielding a pro-healing environment[38,58]
- Fewer changes to skin health and barrier function than with tNPWT[38]

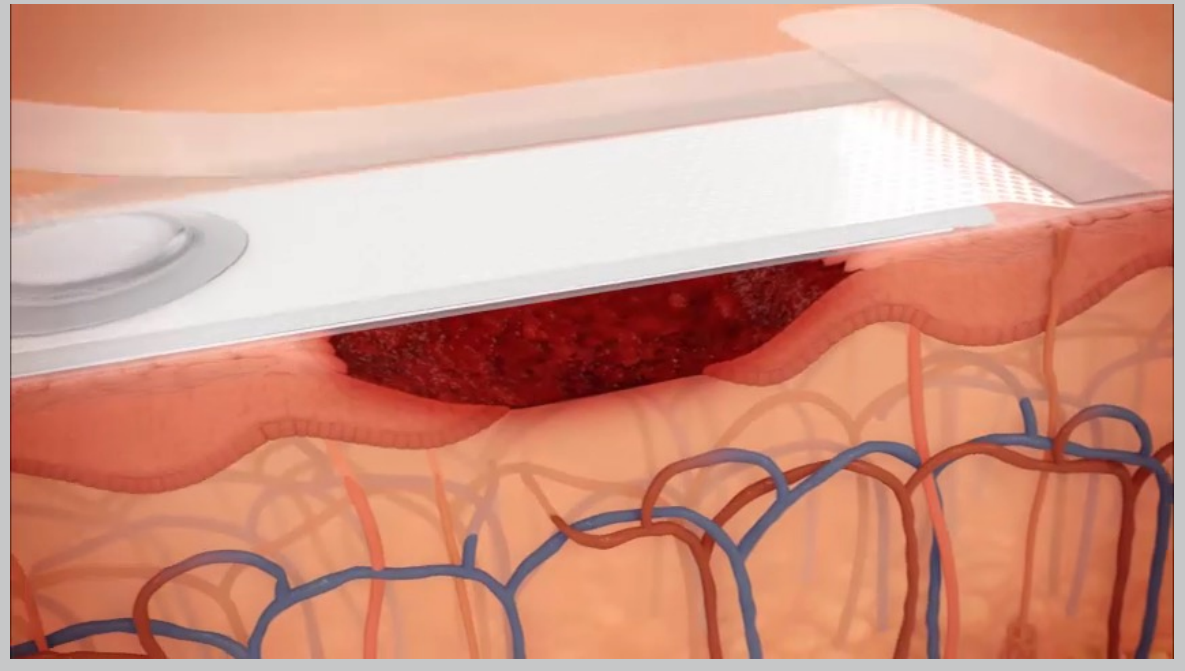
For detailed product information, including indications for use, contraindications, effects, precautions and warnings, please consult the product's Instructions for Use (IFU) prior to use.

PICO◇ Dressing: A pioneering dressing

Closed surgical incisions



Open wounds



Unique design to facilitate delivery of negative pressure at the wound bed.[8,59]

- Exudate and bacteria are retained in the dressing and away from the wound bed[52,60]
- Dressing can be disconnected from the pump to enable showering
- Dressing is waterproof[61]

Using PICO◇ sNPWT with wound fillers

Choosing a wound filler

Distribution of negative pressure requires intimate contact with the entire wound surface.

If the wound depth is under 0.5cm the **PICO** Dressing can be applied directly to the wound without the need for a filler

OUS	US
Wound >0.5cm in depth **are likely** to require a foam or gauze	
Wound >2.0cm in depth **must be** treated with the use of filler	
	Recommend to treat wound up-to 4.5cm in depth

Did you know?

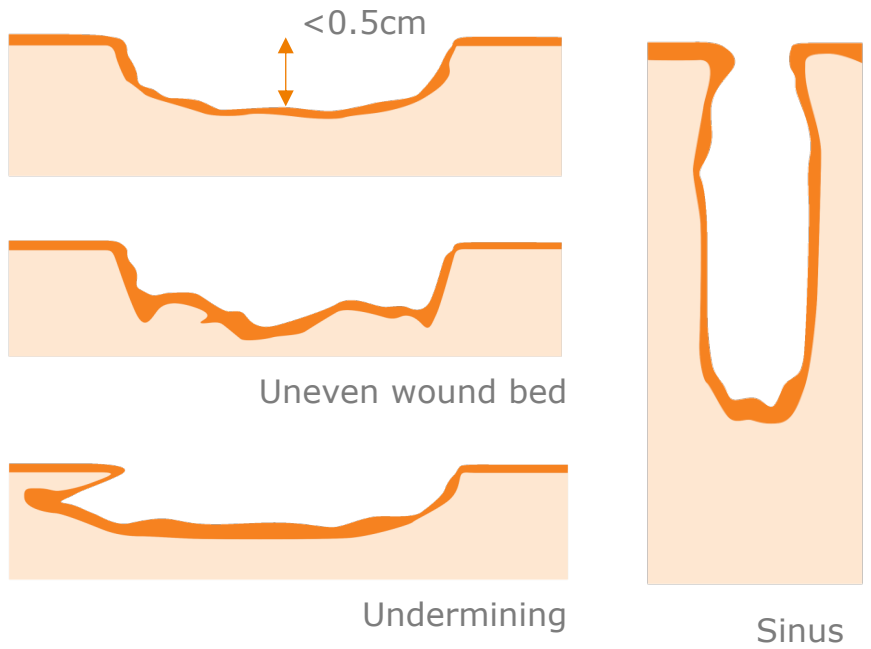
In a variety of chronic wounds deeper than 2cm, use of PICO sNPWT as part of the integrated care bundle:

1. Shown to significantly reduce mean time to wound healing by 11.75 weeks*[62]
2. Shown to have 3.23 days longer mean dressing wear time*[62]

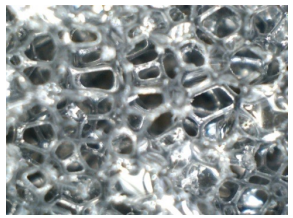
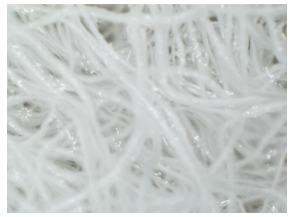
You may still consider the use of a filler for wounds especially if:

1. The wound bed is uneven
2. There is undermining
3. There is a sinus

Wound types



Using PICO◇ sNPWT with wound fillers

Types of NPWT filler	Qualities[63]	Wound type[63]
Foam   Polyurethane foam saturated with water Open cell structure and hydrophobic material properties allow for efficient fluid management.	▪ Stimulates rapid granulation tissue formation, wound contraction ▪ Removal of high volumes of exudate	▪ Compartment syndrome ▪ Acute wounds with large tissue loss ▪ Post operative open abdomens and sternotomy wounds
Gauze   Gauze saturated with water Hydrophilic nature of fibres absorbs and retains fluid. Not optimal for management of viscous fluid.	▪ Easy and fast to apply on uneven, large, deep wounds ▪ Reduced pain and trauma reported on removal ▪ Slower initial stimulation of granulation tissue ▪ Reduced post therapy contraction may reduce scarring	▪ Cosmetic surgery ▪ Skin flap preparation/stabilisation ▪ Skin grafts and use over joints

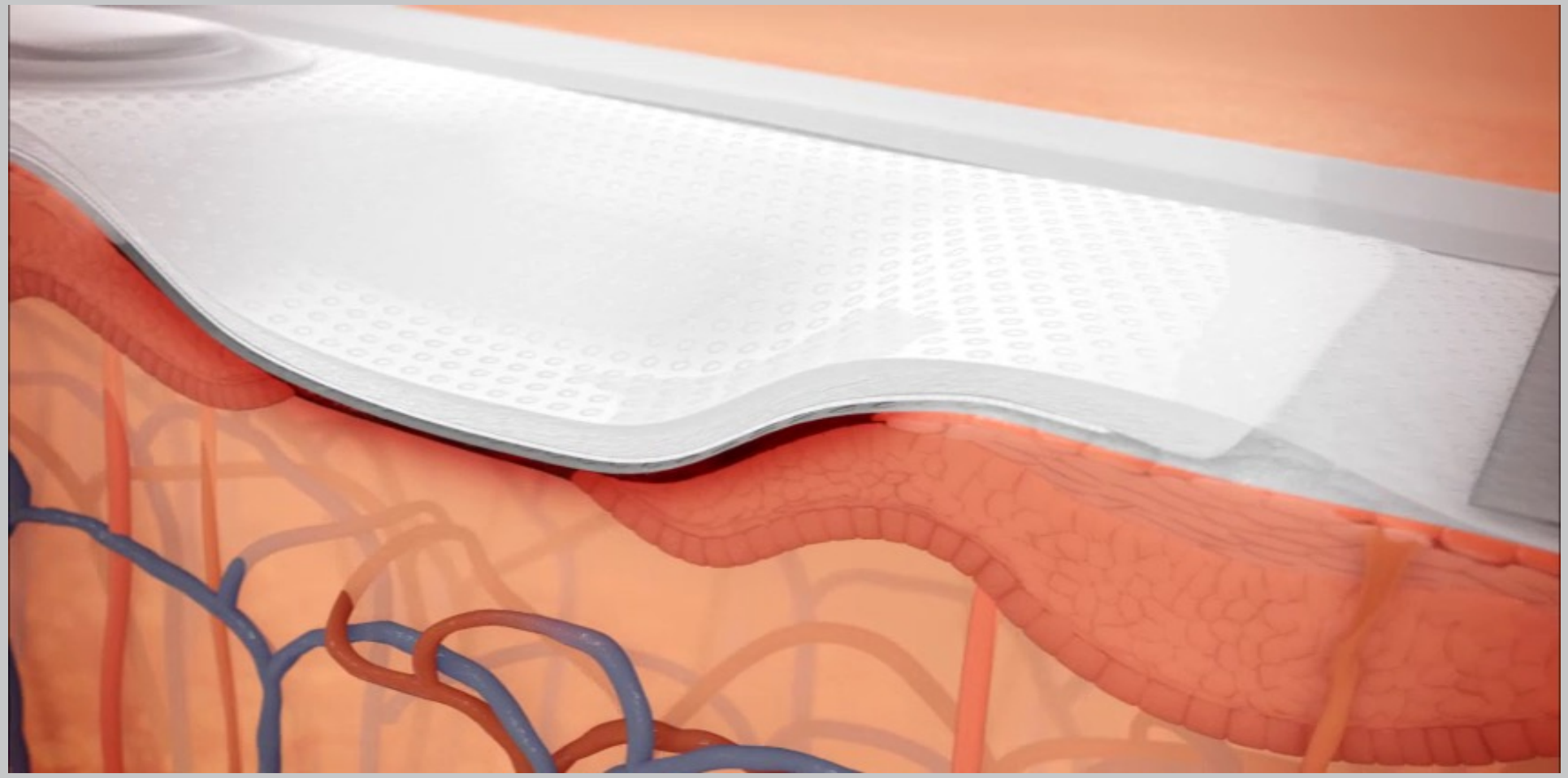
Did you know?

The PICO System demonstrated superior healing outcomes, where only 13.5% of application with PICO System required a filler.*[29,64]

*in a study of VLUs and DFUs.; Vs. tNPWT; At 12 weeks; n-161; p≤0.021

For detailed product information, including indications for use, contraindications, effects, precautions and warnings, please consult the product's Instructions for Use (IFU) prior to use.

PICO◇ sNPWT is compatible with foam & gauze



Clinical studies demonstrate the overall rates of healing with foam and gauze are similar[65-66] however the characteristics of granulation tissue can differ

Foam: thick granulation tissue – suitable for use on wounds where scarring does not pose a problem e.g. sternotomy wounds[67]

Gauze: less thick but dense granulation tissue – suitable for use where cosmetic results are of greater importance or where scar tissue may restrict movement[67]

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