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Posters presented at SAWC, Spring 2026

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In vivo; wound area measurement in a 12 day porcine wound healing model at day 6; 93% of original wound area remaining with RENASYS WOUND+ with use of a wound filler vs 101% with tNPWT drape and foam filler; p<0.05

RENASYS◊ WOUND+ Dressings

It's time to reset expectations of traditional negative pressure wound therapy (tNPWT)



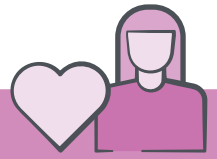
Innovation

Faster wound closure, enhanced outcomes*[1]



Efficiency

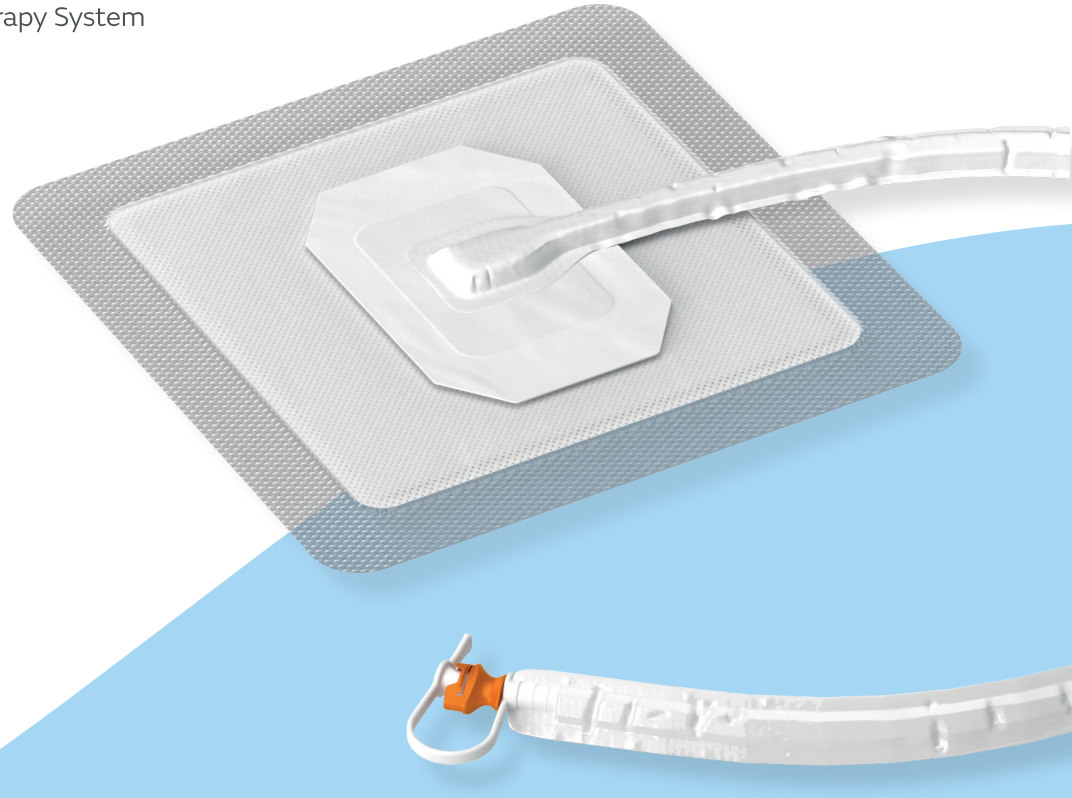
Simple application and wearable for up to 7 days[3]



Patient experience

Reduced dressing changes and less painful on removal†[4,5]

RENASYS◊ WOUND+
Negative Pressure Wound
Therapy System



* *in vivo*; wound area measurement in a 12 day porcine wound healing model at day 6; 93% of original wound area remaining with RENASYS WOUND+ with use of a wound filler vs 101% with tNPWT drape and foam filler; $p<0.05$.
† n=96; Italian study from 2007–2015.

Initial experience of a novel traditional Negative Pressure Wound Therapy dressing incorporating a distribution layer (tNPWT+DL†) in the treatment of soft tissue injuries

Erich S Lemker MD[1], Thoms G Baboolal PhD[2]

[1]Community Regional Medical Center, Fresno, CA, USA; [2]Global Clinical and Medical Affairs, Advanced Wound Management R&D, Smith+Nephew, Hull, UK.

Introduction

- Traditional and single-use Negative Pressure Wound Therapy (tNPWT, sNPWT) are effective and widely used interventions used to manage a range of open wound indications, and closed incisions (1). In a randomized control trial comparing tNPWT with sNPWT††, sNPWT†† demonstrated superior outcomes including faster wound closure when used with and without a wound filler (2). These benefits are attributed to proprietary technology delivering a unique mode of action, distributing negative pressure across the wound and wider therapeutic zone incorporating the peri-wound area (3). Until now, this mode of action has been unique to wounds treated with sNPWT††. These cases present the initial experience of a novel tNPWT+DL† dressing incorporating this same proprietary technology (**Figure 1**). The dressing features a negative pressure distribution layer, and a silicone wound contact layer.

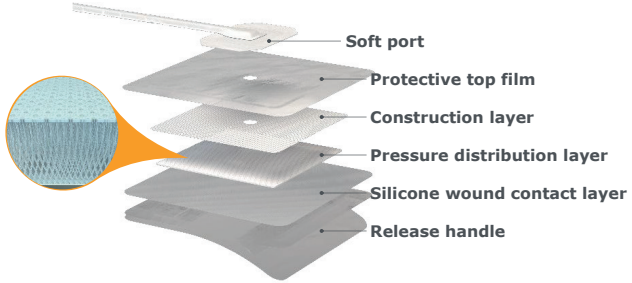


Figure 1. Novel tNPWT+DL† dressing and constituent layers.

Methods

- Two retrospective cases are presented following the treatment of large complex, and challenging soft tissue wounds. The novel tNPWT+DL† dressing† was utilized in each case under the care of the lead author in the acute and post-acute setting. Wounds were surgically debrided when required and dressings were changed every 2-3 days unless otherwise stated. A Biodegradable Temporizing Matrix were utilized when appropriate. Treatment goals included controlling of edema and preparing the wounds for definitive closure.

Conclusions

- The novel tNPWT+DL† dressing was successfully utilized to achieve the primary treatment goals, promoting granulation tissue formation and wound size reduction prior to grafting. In each case, periwound skin and tissue edema were well controlled.
- The proprietary pressure distribution layer enabled multiple open and closed wounds to be covered with a single dressing without the need for bridging.
- The silicone contact layer allowed for repositioning during dressing changes.
- The ability to cut and modify the dressing aided application and patient comfort.

Case 1

- A 75-year-old female presented following a dog attack, with trauma to the right leg resulting in open wounds on the medial thigh and posterior distal leg. Upon initial presentation, the wound was surgically debrided and treated with traditional negative pressure (tNPWT) for 14 days prior to treatment with the novel tNPWT+DL dressing† as an in-patient. The patient had no wound related comorbidities.



Figure 2. Wounds pre- and post-debridement and initiation of treatment with the tNPWT+DL† dressing. Application to the medial thigh wound allowed both the open wound and closed incisions to be covered with the same dressing. Modification of the dressing aided application around the almost circumferential posterior distal wound. Both wounds were connected to a single NPWT pump†††.



Figure 3. Post-debridement, following 5 days tNPWT+DL† treatment. Complete closure of incisional wounds

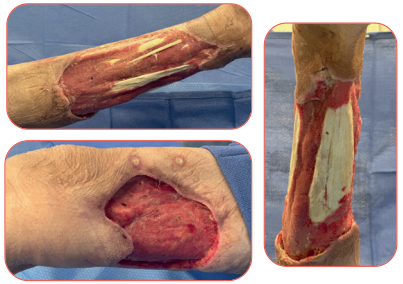


Figure 4. Day 14 tNPWT+DL† treatment. Medial thigh wound achieved a 36% area reduction and transitioned to sNPWT†† treatment. Following debridement of the posterior distal wound, a BTM was applied, and tNPWT+DL† treatment continued without a wound filler.



Figure 5. Day 52 post treatment initiation. Medial thigh wound had granulated in preparation for a split thickness skin graft. BTM has almost completely granulated and continues treatment with the tNPWT+DL† dressing allowing decreased dressing changes.



Figure 5. Following grafting, the medial thigh wound is completely healed, and the posterior distal wound continues to progress toward full closure.

Case 2

- A 48-year-old male presented with two open wounds previously surgically debrided and treated with tNPWT requiring bridging at an outside facility. Both wounds were the result of an infection and were connected by tunnelling. The patient was diabetic, with a Hgb A1C of 12%, and anemic with a Hgb level of 8.8 g/dL.



Figure 7. BTM was applied to both wound beds and bolstered with foam wound filler and the tNPWT+DL† dressing.



Figure 8. Day 14 (left) and Day 31 (right) following initiation of treatment with the tNPWT+DL† dressing. At day-31, the wound bed is completely granulated.



Figure 9. Day 44, the wound bed was prepared for split thickness skin graft (STSG) using a hydrosurgery debridement system. STSG was bolstered with sNPWT††.



Figure 10. Day 69, STSG has taken and wounds are completely closed.

References: (1) Apelqvist J, Willy C, Fagerdahl A-M, Fraccalvieri M, Malmsjö M, Piaggesi A, et al. EWMA Document: Negative Pressure Wound Therapy. Journal of Wound Care. 2017;26(Sup3):S1-S154. (2) Kirsner R, Dove C, Reyzelman A, Vayser D, Jaimes H. A prospective, randomized, controlled clinical trial on the efficacy of a single-use negative pressure wound therapy system, compared to traditional negative pressure wound therapy in the treatment of chronic ulcers of the lower extremities. Wound Repair Regen. 2019;27(5):519-29. (3) Brownhill VR, Huddleston E, Bell A, Hart J, Webster I, Hardman MJ, et al. Pre-Clinical Assessment of Single-Use Negative Pressure Wound Therapy During In Vivo Porcine Wound Healing. Adv Wound Care (New Rochelle). 2021;10(7):345-56.

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†RENASYS◊ WOUND+ Negative Pressure Wound Therapy dressing, Smith & Nephew.

††PICO◊ single-use Negative Pressure Wound Therapy, Smith & Nephew.

†††RENASYS◊ EDGE Negative Pressure Wound Therapy, Smith & Nephew

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Initial experience of a novel traditional Negative Pressure Wound Therapy dressing incorporating a distribution layer (tNPWT+DL†) in patients with surgical and traumatic wounds.

Erich S Lemker MD[1], Phu C Tran MD[1], Thoms G Baboolal PhD[2]

[1]Community Regional Medical Center, Fresno, CA, USA; [2]Global Clinical and Medical Affairs, Advanced Wound Management R&D, Smith+Nephew, Hull, UK.

Introduction

- Traditional and single-use Negative Pressure Wound Therapy (tNPWT, sNPWT) are effective and widely used interventions used to manage a range of open wound indications, and closed incisions (1). In a randomized control trial comparing tNPWT with sNPWT††, sNPWT†† demonstrated superior outcomes including faster wound closure when used with and without a wound filler (2). These benefits are attributed to proprietary technology delivering a unique mode of action, distributing negative pressure across the wound and wider therapeutic zone incorporating the peri-wound area (3). Until now, this mode of action has been unique to wounds treated with sNPWT††. These cases present the initial experience of a novel tNPWT+DL† dressing incorporating this same proprietary technology (**Figure 1**). The dressing features a negative pressure distribution layer, and a silicone wound contact layer.

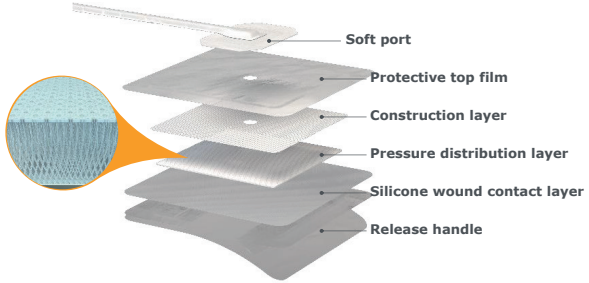


Figure 1. Novel tNPWT+DL† dressing and constituent layers.

Methods

- Three retrospective cases are presented following the treatment of complex and challenging traumatic and surgical wounds. The novel tNPWT+DL† dressing was utilized in each case under the care of the lead authors, in the acute and post-acute setting. Wounds were surgically debrided when required and dressings were changed every 2-3 days unless otherwise stated. Treatment goals were to control edema and to prepare the wounds for definitive closure or secondary intention.

Conclusions

- The novel tNPWT+DL† dressing was successfully utilized to achieve the primary treatment goals of, promoting granulation tissue formation and wound size reduction prior to grafting. In each case, the periwound skin and tissue edema were well controlled, aiding these goals.
- The proprietary pressure distribution layer enabled multiple open and closed wounds to be covered with a single dressing.
- The ability to cut and modify the dressing aided application around the orthopedic pins.
- The silicone contact layer allowed for repositioning at dressing changes and ease of application over irregular contours such as the inframammary folds.

Case 1

- A 67-year-old male presented with a comminuted open proximal and mid tibial fracture resulting from a road traffic accident. Upon initial presentation, the wound was irrigated, the tibia debrided and antibiotic beads were utilized by the orthopedic surgeon. The patient had no know pre-existing conditions.

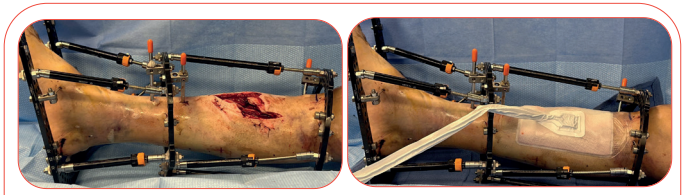


Figure 2. Treatment initiation with the tNPWT+DL† dressing. Surrounding incisional wounds and small lacerations were treated under one dressing. Modifications to the dressing were needed to conform to the external fixator pins.

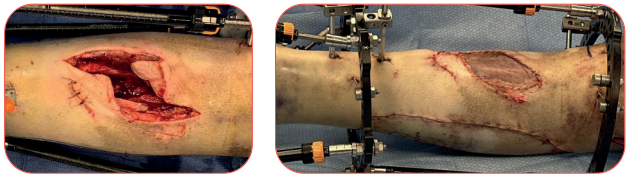


Figure 3. Day 4, wound management was continued following medial gastrocnemius flap and split-thickness skin graft (STSG). One dressing covered the STSG and muscle flap donor site incision.

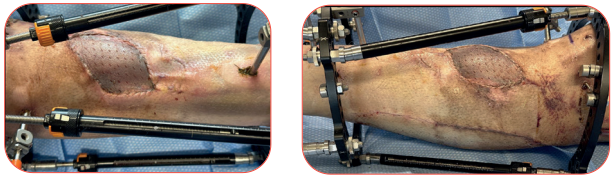


Figure 4. Day-11, muscle flap and STSG are viable. tNPWT was discontinued.

Case 2

- A 40-year-old female presented in the post-acute clinic with bilateral surgical site dehiscence two weeks following breast reduction for symptomatic macromastia. Both wounds showed signs of tissue necrosis. The patient was obese and had a history of smoking.



Figure 5. The right breast wound centered around the "T" junction of closure. The left breast wound encompassed the meridian and left peri-areolar closure sites. Post-debridement, treatment was initiated with the tNPWT†† dressing. Both wounds were connected to a single NPWT pump†††.

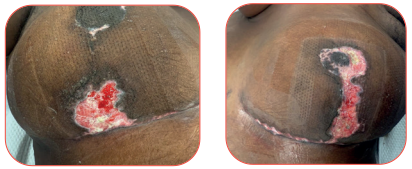


Figure 6. Day 4, edema had reduced, wounds were clean and granulating. Treatment continued with the tNPWT+DL† dressing.

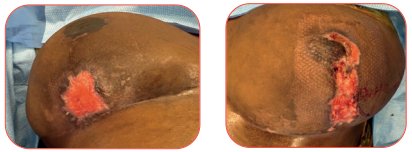


Figure 7. Day 32, wounds continued to granulate. Islands of epithelialization were apparent on the left breast. Wounds were closed with STSG and bolstered with the tNPWT+DL† dressing.



Figure 8. Day 39, both STSGs had adhered and were viable. Treatment was transitioned to sNPWT††.

Case 3

- A ~50-year-old male presented with an open wound following a tibial crush injury. 4-6 week previously, the injury had been treated with orthopedic fixation, a fasciotomy, and STSG. On presentation to the plastic surgery department, the wound showed partial loss of the skin graft and contained non-viable muscle tissue.



Figure 9. Treatment was initiated with the tNPWT+DL† dressing. Following surgical debridement, the wound measured 12 x 5 cm.



Figure 10. Dressing change on Day 6. Skin islands from the previous graft remained viable.



Figure 11. Dressing change on Day 9. Wound area had reduced by 27%. Initial edema had subsided. Treatment continued with sNPWT††.



Figure 12. Dressing change, Day 39 following debridement.

References: (1) Apelqvist J, Willy C, Fagerdahl A-M, Fraccalvieri M, Malmsjö M, Piaggesi A, et al. EWMA Document: Negative Pressure Wound Therapy. Journal of Wound Care. 2017;26(Sup3):S1-S154. (2) Kirsner R, Dove C, Reyzelman A, Vayser D, Jaimes H. A prospective, randomized, controlled clinical trial on the efficacy of a single-use negative pressure wound therapy system, compared to traditional negative pressure wound therapy in the treatment of chronic ulcers of the lower extremities. Wound Repair Regen. 2019;27(5):519-29. (3) Brownhill VR, Huddleston E, Bell A, Hart J, Webster I, Hardman MJ, et al. Pre-Clinical Assessment of Single-Use Negative Pressure Wound Therapy During In Vivo Porcine Wound Healing. Adv Wound Care (New Rochelle). 2021;10(7):345-56.

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Understanding the Biomechanical Effects of a Novel tNPWT+DL† Dressing

Euan Motion[1], John Vaughan[1], Daniel J. Fitzgerald[1], Louise France[2] and Runi Brownhill[1]

[1]Science & Research Group, Advanced Wound Management R&D, Smith+Nephew, Hull, UK. [2]Faculty of Science and Engineering, University of Hull, Hull, UK

Introduction

- Whilst traditional Negative Pressure Wound Therapy (tNPWT) systems have demonstrated efficacy in managing hard-to-heal wounds[1], they are limited by their localized pressure delivery. In contrast, single-use NPWT (sNPWT) systems[2] have shown accelerated healing outcomes, attributed to their ability to distribute negative pressure across a wider therapeutic zone. To bridge this gap, a novel cuttable and repositionable tNPWT dressing, enhanced with a distribution layer (tNPWT+DL†) has been developed (**Figure 1**).

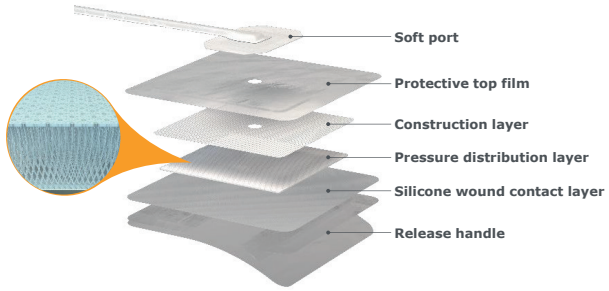


Figure 1. Novel tNPWT+DL† dressing and constituent layers.

Study Aim

- To map the biomechanical responses of tissue when undergoing therapy delivered by the tNPWT+DL† dressing compared to those generated by tNPWT with drape and foam filler*.

Methodology

- *In vitro* studies conducted with porcine tissue substrates (pork belly tissue with a minimum depth of 30 mm, n=3).
- Wounds (~ 30 mm diameter, ~15 mm deep) were created followed by the application of NPWT systems with a foam filler using a 15 cm × 15 cm dressing (10 cm × 10 cm pad size).
- Tissue pressure experienced under dressings were obtained through calibrated needle probes inserted into the tissue at various depths and locations over a 12 h period.
- Tissue displacement (up to 24 h) was demonstrated by inserting metallic markers into the porcine tissue in a grid pattern and imaging with micro-CT with and without the application of the NPWT. The data was then used to validate a finite element analysis (FEA) model.

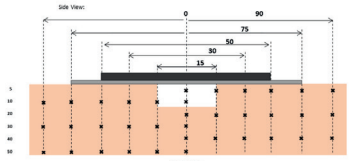


Figure 2. Representation of moisture measurement sensor locations (in mm) on wounded porcine tissue model.

Methodology cont.

- Tissue moisture movements were detected using bespoke sensors placed at various depths and locations surrounding the wound as indicated in **Figure 2**.
- Moisture sensor data was collected over a range of time points over 4 h with the probe left in place for 30 s for each reading, and the mean resistance (MΩ) was calculated for each time stamp. Colour maps of % change in moisture as a function of time were then produced in MATLAB™ (The MathWorks, Inc.).

Results

- The tNPWT+DL† dressing delivers significantly greater NPWT in the tissue that spans beyond the wound area, and to wider regions when compared to tNPWT* ($p<0.05$), with a -47.38 mmHg (6.86-fold) increase in delivery of NPWT at pad edge (**Figure 3**).

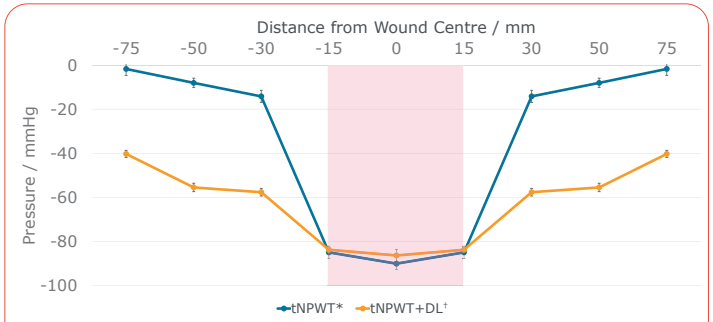


Figure 3. Mean (n=3) measured pressure (mmHg) with respect to distance from WC (0 mm) for each mode of therapy at a depth of 30 mm, 12 h of therapy. The pink zone represents the area under the wound.

- The tNPWT+DL† dressing delivers significantly greater tissue displacement, and therefore compressive forces, that extend beyond the wound area and to wider regions when compared to tNPWT* ($p<0.05$), a 12.35-fold increase at pad edge (**Figure 4**). This can also be demonstrated via FEA analysis (**Figure 5**).

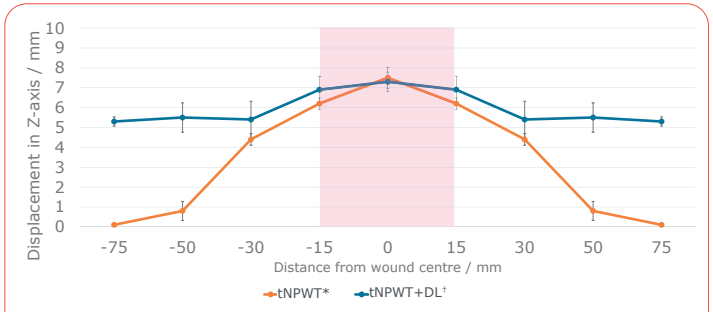


Figure 4. Mean (n=3) tissue displacement (mm) with respect to distance from WC (0 mm) for each mode of NPWT. at various depth of 30 mm at 12 h. The e pink zone represents the area under the wound.

Results cont.

- The tNPWT+DL† dressing demonstrated greater moisture movement into regions beyond the wound, whereas tNPWT* demonstrated a more localised effect (**Figure 6**).

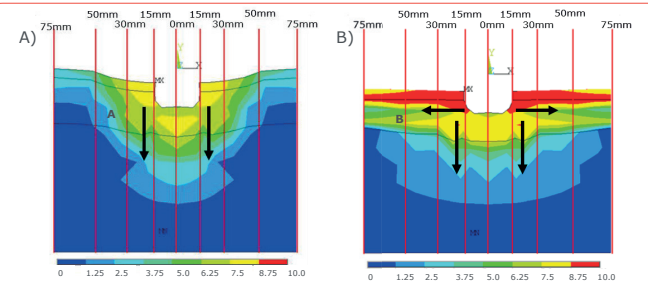


Figure 5. 2D wound finite element analysis model (ANSYS™) showing tissue displacement values (mm), validated with *in vitro* measurements using metallic markers and CT scanning to calculate displacement across the porcine tissue with A) tNPWT*, or B) tNPWT+DL†.

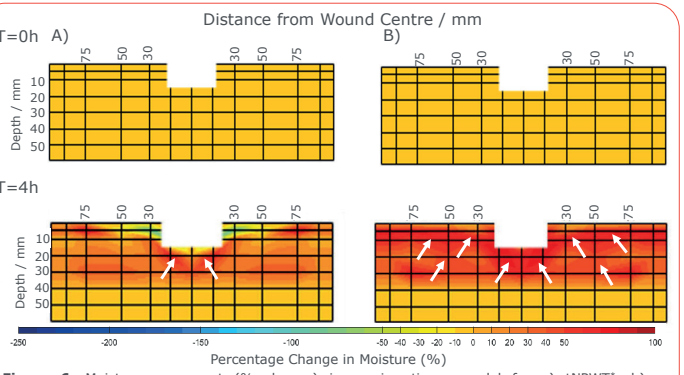


Figure 6. Moisture movement (% change) in porcine tissue model for a) tNPWT*, b) tNPWT+DL†. Data represented as averaged (n=3) colour maps at 0 h and 4 h. Red denotes positive change in moisture movement, white arrows indicative of moisture movement.

Conclusions

- The tNPWT+DL† dressing delivers more uniform negative pressure that goes beyond the wound.
- The tNPWT+DL† dressing delivers compressive forces and moisture movement that goes beyond the wound.
- These effects may help manage oedema and excessive interstitial fluid[3] surrounding the wound to support a pro-healing environment.
- These findings support that the novel tNPWT+DL† dressing successfully delivered the benefits of NPWT to wider tissue regions, creating a wider zone of therapy. This is consistent with previous findings on the use of sNPWT systems[2].

References: 1. Hurd T, *et al*. Adv Wound Care (New Rochelle). 2017 Jan 1;6(1):33-37. **2.** Kirsner R, *et al*. Wound Repair Regen. 2019 Sep;27(5):519-529. **3.** Birke-Sorensen H, *et al*. Journal of Plastic, Reconstructive & Aesthetic Surgery. 2011;64:S1-S16.

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The Biological Impact of a Novel tNPWT+DL† Dressing Using *ex vivo* Human Skin

Euan Motion[1], John Vaughan[1], Daniel J. Fitzgerald[1], Holly Wilkinson[2], Matthew J. Hardman[2] and Runi Brownhill[1]
[1]Science & Research Group, Advanced Wound Management R&D, Smith+Nephew, Hull, UK, [2]Hull York Medical School, Hull, UK

Introduction

- Whilst traditional Negative Pressure Wound Therapy (tNPWT) systems have demonstrated efficacy in managing hard-to-heal wounds[1], they are limited by their localized pressure delivery. In contrast, single-use NPWT (sNPWT) systems[2] have shown accelerated healing outcomes, attributed to their ability to distribute negative pressure across a wider therapeutic zone. To bridge this gap, a novel repositionable tNPWT dressing, enhanced with a distribution layer (tNPWT+DL†) has been developed (**Figure 1**).

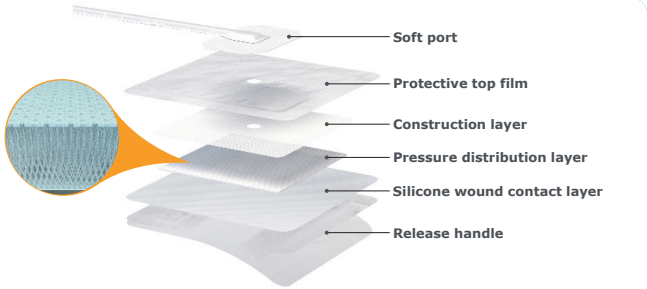


Figure 1. Novel tNPWT+DL† dressing and constituent layers.

Study Aim

- The work detailed here was carried out to investigate and compare the biological effect of tNPWT‡ and tNPWT+DL† on cells surrounding a wound, using an *ex vivo* human skin model.

Methodology

- A novel *ex vivo* culture system arranged human skin, donated from elective surgery with fully informed consent (NHS REC 19/NE/0150 and 17/SC/0220), onto a SILSKIN support, with access to culture media provided via channels. A 3 cm diameter, 1 cm deep wound was created in the *ex vivo* skin sample to trigger a host injury response (**Figure 2**). Treatments delivered therapy for 48 h.

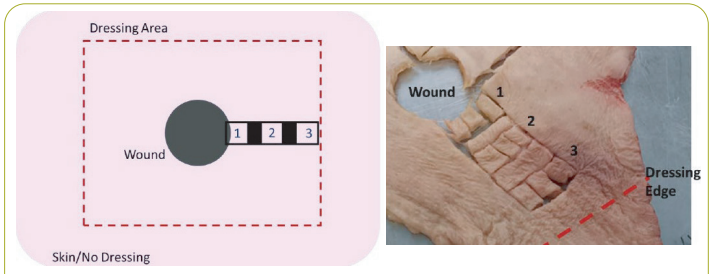


Figure 2. Collection of human skin. Skin was removed from the culture set up following 48hrs of culture at 37 °C and 5% CO_2. Samples were removed at defined locations; the wound edge (WE; 1; 1.5 cm from wound centre), the peri-wound (PW; 2; 2.75 cm from wound centre) and the extended zone (EZ; 3; 4 cm from wound centre).

Methodology cont.

- Observational measurements were taken from skin harvested at the wound edge (WE), peri-wound (PW) and extended zone (EX) locations for histological staining (**Figure 2**).

The following analyses were undertaken on tissue samples:

- Haematoxylin and eosin (H&E) staining was used to assess the degree of epidermal-dermal junction (EDJ) disruption. Images were assessed no a Nikon E400 microscope with SPOT camera (Image Solutions UK Ltd. , Preston).
- Immunohistochemical staining (rabbit anti-loricrin antibodies) was used to determine the percentage dysregulation of loricrin, an epidermal structural protein. Stain intensity was quantified using Image J (V. 1.8.0; NIH, US).
- Epidermal cell viability was measured using TUNEL staining. TUNEL positive (green) cells were manually counted and expressed as a percentage of total cells (DAPI, blue). Composite images for analysis were created using Image J (V. 1.8.0; NIH, US).

Results

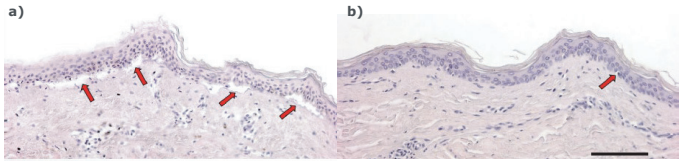


Figure 3. H&E stained wound edge sections treated with either a) tNWPT‡ or b) tNPWT+DL†. Higher-power images illustrate substantial epidermal-dermal junction damage following tNPWT‡, with little damage following tNPWT+DL† treatment. Epidermal-dermal separation (red arrows). Bar = 150 µm.

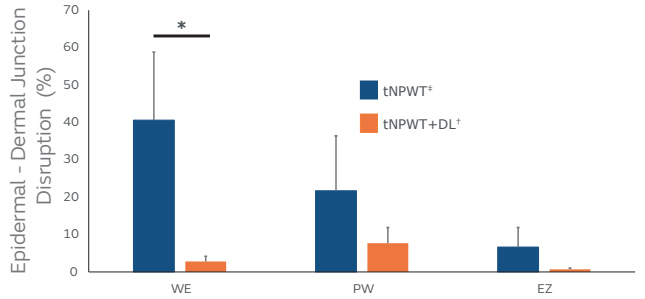


Figure 4. Mean (n=3 donor skin samples) percent EDJ disruption with respect to locations relative to the wound, WE=wound edge, PW=peri-wound, EZ=extended zone. NPWT delivered for 48 h. Graph show mean plus SEM, *p<0.01.

- The tNPWT+DL† dressing delivered significantly reduced disruption to the epidermal-dermal junction at the wound edge (WE) compared to tNPWT‡ (p<0.01) (**Figures 3** & **4**).

Results cont.

- The tNPWT+DL† dressing retained significantly greater epidermal cell viability at the wound edge (WE) compared to tNPWT‡ (p<0.02) (**Figure 5**).

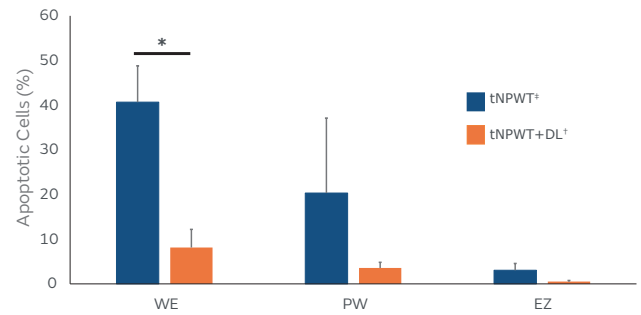


Figure 5. Mean (n=3 donor skin samples) percent apoptotic cells with respect to locations relative to the wound, WE=wound edge, PW=peri-wound, EZ=extended zone, NPWT delivered for 48 h, Graph show mean plus SEM, *p<0.02.

- The tNPWT+DL† dressing facilitated significantly greater retention of the epidermal structural protein loricrin at the wound edge (WE) and the peri-wound (PW), relative to tNPWT‡ (*p<0.05, **p<0.01) (**Figure 6**).

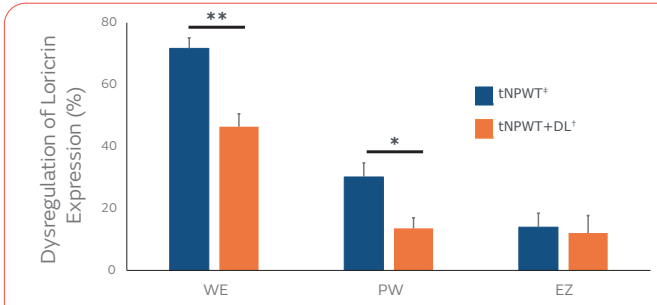


Figure 6. Mean (n=3 donor skin samples) percent dysregulation of loricrin expression at locations relative to the wound, WE=wound edge, PW=peri-wound, EZ=extended zone. NPWT delivered for 48 h. Graph show mean plus SEM, *p<0.05, **p<0.01.

Conclusions

- **Biological impact:** Treatment with the tNPWT+DL† dressing resulted in significantly reduced epidermal-dermal junction disruption and dysregulation of the epidermal structural protein loricrin. Additionally, a significantly greater epidermal cell viability at the wound edge was observed.
- These findings suggest that NPWT systems, such as the tNPWT+DL† dressing, which deliver consistent NWPT across the dressing pad may promote improved cellular responses and potentially accelerate wound healing.

References: 1. Hurd T, *et al*. Adv Wound Care (New Rochelle). 2017 Jan 1;6(1):33-37. **2.** Kirsner R, *et al*. Wound Repair Regen. 2019 Sep;27(5):519-529.

Presented at the Symposium on Advanced Wound Care (SAWC) Spring, April 8-12, 2026, Charlotte, NC, USA

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Evaluating Negative Pressure Distribution and Repositionability of a Novel tNPWT+DL* Dressing: An *In Vitro* Study

Charlotte Skipsey[1], Natalie Bell[1], Billy Hall[1], Runi Brownhill[2], Natasha Middleton[3], and Celia Johnson[1]

[1]Wound Interface Group, [2]Science & Research Group & [3]System Engineering Group, Advanced Wound Management R&D, Smith+Nephew, Hull, UK.

Introduction

Whilst traditional Negative Pressure Wound Therapy (tNPWT) systems have demonstrated efficacy in managing hard-to-heal wounds[1], they are limited by their localized pressure delivery. In contrast, advanced single-use NPWT‡ systems[2] have shown accelerated healing outcomes, attributed to their ability to distribute negative pressure across a wider therapeutic zone. To bridge this gap, a novel tNPWT dressing, enhanced with a distribution layer (tNPWT+DL*) and silicone technology has been developed (**Figure 1**). This dressing can be used with or without a filler and for up to 7-days.

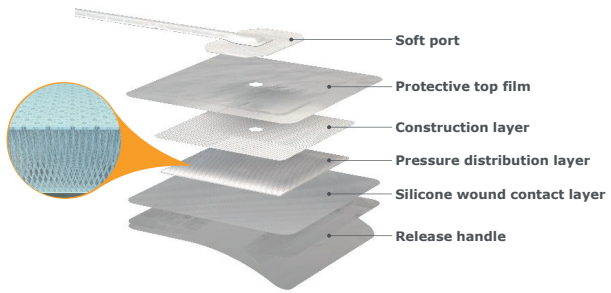


Figure 1. Novel tNPWT+DL* dressing and constituent layers.

Study Aim

To evaluate the *in vitro* performance of traditional Negative Pressure Wound Therapy (tNPWT†) and a novel traditional Negative Pressure Wound Therapy dressing containing a distribution layer (tNPWT+DL*). It focuses on negative pressure delivery to the wound bed and peri-wound as well as the properties of the adhesive wound contact layers and dressing repositionability.

Methodology

Negative pressure delivery and exudate management was evaluated through *in vitro* wound model (**Figure 2**) testing (n=3) at -125 mmHg using a foam filler. Testing was conducted using an elliptical cavity wound model plate (1054cm^3 volume, 3 cm deep) and an exudate flow rate of 42.9 ml/hr (75 µl/cm^2/hr) to simulate a challenging clinical scenario.

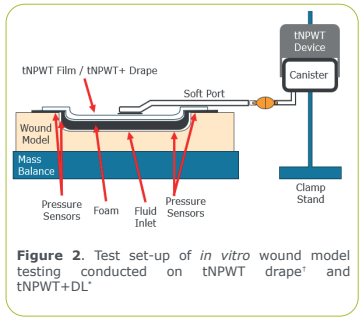


Figure 2. Test set-up of *in vitro* wound model testing conducted on tNPWT drape† and tNPWT+DL*

Methodology cont.

Pressure sensors were located inside the wound cavity, on the cavity wall and on the peri-wound region. Measurements were taken at 5 second intervals.

Using the same test configuration, repositionability of the systems was assessed. The systems were applied to a polyacetal wound model plate; they were then removed and re-applied 4 times at 10-minute intervals to evaluate the system's ability to deliver negative pressure after repeated applications.

To assess the adhesive properties of the system upon system removal, quantitative peel force testing was performed at 135° using a tensile tester and polycarbonate substrate. Testing was conducted after -120 mmHg was applied continuously for a period of 72 hours. A two sample T-test was used to compare the groups.

Results

When evaluated in a simulated wound model, the tNPWT+DL* dressing effectively distributed negative pressure across the wound bed and to the wider zone, with an average pressure of -125 mmHg at both the wound bed and peri-wound sensors (**Figure 3A**). In contrast, the tNPWT drape† delivered negative pressure to the wound bed only, this therapy did not extend past the wound bed (**Figure 3B**).

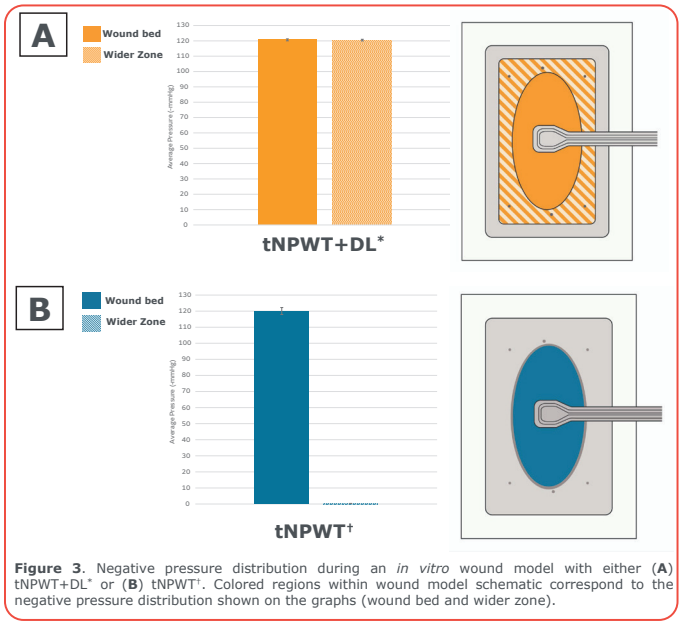


Figure 3. Negative pressure distribution during an *in vitro* wound model with either (**A**) tNPWT+DL* or (**B**) tNPWT†. Colored regions within wound model schematic correspond to the negative pressure distribution shown on the graphs (wound bed and wider zone).

Results cont.

When evaluated for ease of repositioning, the tNPWT drape† failed to maintain therapy delivery after 2 episodes of repositioning. The tNPWT+DL* dressing maintained negative-pressure therapy following all repositioning episodes (**Figures 4A** & **4B**). This demonstrates that the tNPWT+DL* can be easily repositioned if required following initial application.

Peel force testing performed on both dressing systems to assess the gentle interaction with the substrate demonstrated that, following NPWT at -120 mmHg for a period of 72 hours, the force required to remove the tNPWT+DL* dressing was significantly lower (P<0.001) compared to the tNPWT drape† (**Figure 4C**).

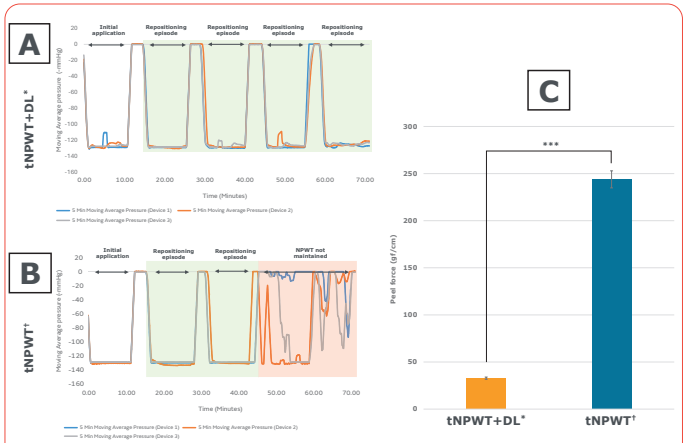


Figure 4. Negative pressure (-mmHg) of drape following repositioning episodes on simulated wound model (**A**) tNPWT+DL* (**B**) tNPWT†. Average peel force (gf/cm) of tNPWT† and tNPWT+DL* drape following NPWT at -120 mmHg for 72 hours (**C**). ***, p<0.001.

Conclusions

When evaluated in a simulated wound model, traditional NPWT drapes deliver NPWT to the wound cavity only whereas, the tNPWT+DL* dressing delivers NPWT to the surrounding peri-wound as well as the wound cavity. Extending therapy to the wider tissue can help modulate tissue biomechanics and support faster wound closure[1,2].

The reduced peel force on removal of the tNPWT+DL* dressing indicates a gentler interaction with the substrate compared with conventional tNPWT drapes†. The silicone layer of the tNPWT+DL* dressing provides repositionability, enhancing ease of use and potentially saving time on application whilst reducing pain on removal.

References: 1. Hurd T, *et al*. Adv Wound Care (New Rochelle). 2017 Jan 1;6(1):33-37. **2.** Kirsner R, *et al*. Wound Repair Regen. 2019 Sep;27(5):519-529.

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*RENASYS◊ WOUND+ Negative Pressure Wound Therapy dressing, Smith & Nephew. †RENASYS◊ Negative Pressure Wound Therapy with drape and foam filler, Smith & Nephew. ‡PICO◊ single-use Negative Pressure Wound Therapy, Smith & Nephew.

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Novel tNPWT+DL† Dressing Delivers Accelerated Healing in an *in vivo* Porcine Model

John Vaughan[1] and Runi Brownhill[1]
[1]Science & Research Group, Advanced Wound Management R&D, Smith+Nephew, Hull, UK

Introduction

Whilst traditional Negative Pressure Wound Therapy (tNPWT) systems have demonstrated efficacy in managing hard-to-heal wounds[1], they are limited by their localized pressure delivery. In contrast, advanced single-use NPWT§ (sNPWT) systems[2] have shown accelerated healing outcomes, attributed to their ability to distribute negative pressure across a wider therapeutic zone. To bridge this gap, a novel cuttable and repositionable tNPWT dressing, enhanced with a distribution layer (tNPWT+DL†) has been developed (**Figure 1**).

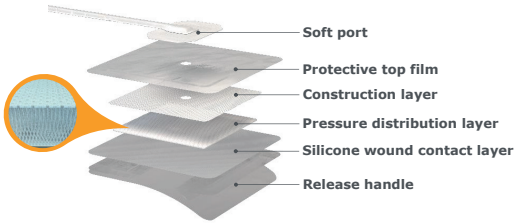


Figure 1. Novel tNPWT+DL* dressing and constituent layers.

Study Aim

To investigate and compare the effect on wound healing of traditional Negative Pressure Wound Therapy (tNPWT) with drape and foam filler‡ and a novel traditional Negative Pressure Wound Therapy dressing containing a distribution layer (tNPTW+DL†), that can be used with or without the use of foam filler (as facilitated by the design of the dressing), in a clinically relevant animal model.

Methodology

Full thickness 2.5 cm diameter excisional wounds were created in the flanks of 6 female pigs. Treatments were allocated to each wound with contralateral wounds treated with either tNPWT with drape and foam filler‡ or tNPWT+DL† with or without foam filler (according to manufacturer's guidelines). tNPWT+DL† dressings without foam filler were changed at 7 days while tNPWT‡ and tNPWT+DL† groups with foam filler were changed every 3 days were, in line with product instructions for use.

Observational measurements were taken after days 3, 6, 9 and 12 days for groups used with a foam filler and 7 and 12 days for tNPWT+DL† without foam filler (in line with scheduled dressing changes) to assess various wound healing and surrounding skin outcomes. Histological samples were taken for all groups after 12 days.

The following analyses were undertaken:

- Wounds were digitally photographed with Image Pro™ analysis software (version 4.1.0.0 Media Cybernetics, USA) used to measure closure outcomes.
- Wound depth was measured prior to device application, at each dressing change and at study conclusion to assess degree of filling by granulation tissue.

Methodology cont.

- Tissue samples were taken for histological analysis with haematoxylin and eosin (H&E) staining and assessed for degree of re-epithelization and depth of wound edge epithelium.
- Peri-wound region skin measurements were made using Courage & Khazaka Tewameter™ TM 300 for Trans Epidermal Water Loss (TEWL).
- Wounds were inspected for wound surface damage immediately after removal of dressings or filler (in wounds where the latter is used).
- Where appropriate, when data were found to be normally distributed parametric analysis (Anova – Multivariate Analysis followed by ad hoc two sample student t-test) was performed. For non-normally distributed data non-parametric analysis (Kruskal Wallace – Multivariate Analysis followed by ad hoc two sample Mann Whitney U-test) was used to test the significance of any inter-group differences. Differences were considered statistically significant at $p<0.05$.

Results

- The tNPWT+DL† dressing demonstrated significantly faster wound closure when used without a foam filler, as measured by the percentage of wound area remaining relative to the original wound size, compared to tNPWT‡. By day 12, only 28% of the wound area remained open with tNPWT+DL† versus 60% with tNPWT‡, representing a 1.8-fold (80%) greater area reduction ($P < 0.001$; **Figures 2** and **3**).
- When used with a filler (both groups undergoing 3-day dressing changes), a similar overall healing trajectory to tNPWT‡ was observed. However, significantly faster wound closure (1.1-fold improvement) was evident with tNPWT+DL† after 6 days of treatment ($P < 0.05$).
- The tNPWT+DL† dressing, when used without a foam filler, also enabled 1.7-fold (73%) faster re-epithelialization compared to tNPWT‡ by day 12 ($P < 0.03$; **Figure 4**).
- Furthermore, 90% of wound depth was filled with granulation tissue by day 7 in wounds treated with tNPWT+DL† without a foam filler, whereas this level of granulation was not observed with tNPWT‡ until day 12.

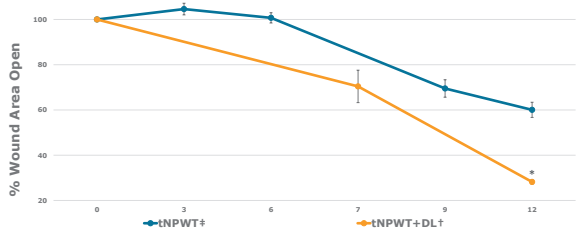


Figure 2. Wound closure (% wound area remaining) over time (n = 3; error bars represent ± SEM) across all groups. *P < 0.05.

- The tNPWT+DL† dressing, when used without a foam filler, resulted in no visible wound surface damage or disruption upon dressing removal at any time point, whereas wound surface disruption was observed in all cases treated with tNPWT‡.

Results cont.

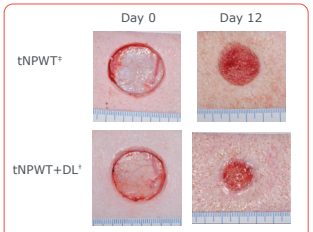


Figure 3. Wound progression over the 12-day study period for wounds treated with tNPWT‡ (with foam filler) and tNPWT+DL† dressing without a foam filler.

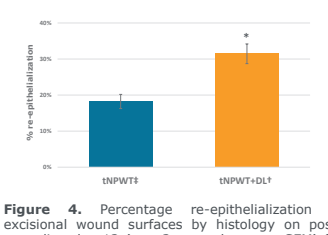


Figure 4. Percentage re-epithelialization of excisional wound surfaces by histology on post-wounding day 12 (n = 3; error bars = ± SEM) for tNPWT‡ (with foam filler) versus tNPWT+DL† dressing (without foam filler).*P < 0.05.

- The tNPWT+DL† dressing, when used without a foam filler, resulted in a >1.9-fold (>48%) reduction in peri-wound epithelial thickness depth compared to tNPWT‡ at day 12 ($P < 0.01$). Reduced peri-wound epithelial thickening may support progression of the advancing wound edge[3,4] (**Figure 5**).
- The peri-wound skin remained unstrained when treated with the tNPWT+DL† dressing (used with or without filler), compared to tNPWT‡, based on TEWL measurements obtained beneath the dressing. TEWL values for tNPWT+DL† remained ≤25 g/h/m² throughout the study (within normal skin conditions[5], 15-25 g/h/m²), whereas with tNPWT‡, values exceeded 25 g/h/m² at days 6, 9, and 12 (**Figure 6**).

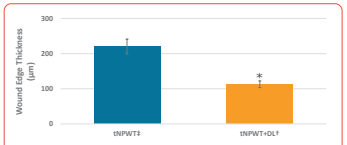


Figure 5. Mean epithelial thickness at the wound edge (peri-wound) by histology (n = 3; error bars = ± SEM) for tNPWT‡ (with foam filler) versus tNPWT+DL† dressing (without foam filler). *P < 0.01

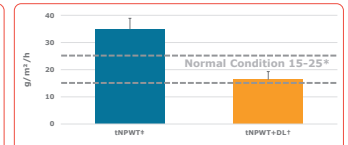


Figure 6. Peri-wound region TEWL on day 12 (n = 3; error bars = ± SEM) for tNPWT‡ (with foam filler) versus tNPWT+DL† dressing (without foam filler).*Threshold based on Matsui *et al*., 2024[3].

Conclusions

- Treatment with tNPWT+DL† dressing resulted significantly faster wound healing (when used with or without a foam filler) and re-epithelialization (when used without a foam filler) than tNPWT‡ with drape and foam filler.
- In addition, when the tNPWT+DL† dressing was used without a foam filler no wound surface disruption was observed upon dressing removal, hyperproliferation of wound edge epithelium was significantly reduced and surrounding skin remained similar to normal skin (TEWL measurements, dressing used with or without a foam filler).
- These findings support that the novel tNPWT+DL† dressing successfully delivered the benefits seen in sNPWT system§ treatment in the traditional NWPT system setting, through its design which delivers negative pressure to the wider zone and allows it to be used without a filler.

References: 1. Hurd T, *et al*. Adv Wound Care (New Rochelle). 2017 Jan 1;6(1):33-37. **2.** Kirsner R, *et al*. Wound Repair Regen. 2019 Sep;27(5):519-529. **. 3.** Fernandes MF, *et al*. Wound Practice and Research. 2025;33(4):186-195 **4.** Melnychuk I and Juriga J. Adv Skin Wound Care. 2023 Sep 1;36(9):495-501. **5.** Matsui, N. *et al*. Electronics 2024, 13, 4779.

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A Model to Evaluate the Biomechanical Strain Modalities Delivered to Tissue by a Novel tNPWT+DL* Dressing

Daniel J. Fitzgerald[1], Louise France[2], Matthew J. Hardman[3], Xuanyuan Zhang[3], and Runi Brownhill[1]

[1]Science & Research Group, Advanced Wound Management R&D, Smith+Nephew, Hull, UK. [2]Faculty of Science and Engineering, University of Hull, Hull, UK, [3]Hull York Medical School, Hull, UK

Introduction

- Whilst traditional Negative Pressure Wound Therapy (tNPWT) systems have demonstrated efficacy in managing hard-to-heal wounds[1], they are limited by their localized pressure delivery. In contrast, advanced single-use NPWT‡ systems[2] have shown accelerated healing outcomes, attributed to their ability to distribute negative pressure across a wider therapeutic zone. To bridge this gap, a novel cuttable and repositionable tNPWT dressing, enhanced with a distribution layer (tNPWT+DL*) has been developed (**Figure 1**).

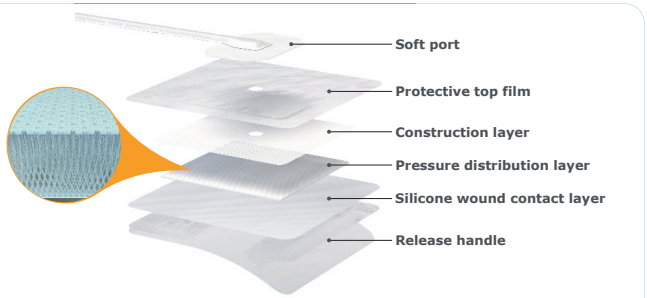


Figure 1. Novel tNPWT+DL* dressing and constituent layers.

Study Aim

- To investigate the biomechanical effects of NPWT *in vitro*. Peri-wound dermal strain range of interest (3.5-6.5%) was assessed for its influence on injured primary human dermal fibroblasts (HDFs) using a bespoke cell culture model.

Methodology

- **Tissue strain measurements:** *In vitro* studies were conducted with porcine tissue substrates (pork belly tissue, n=3).
- Wounds (~3 cm diameter, ~1.5 cm deep) were created prior to application of tNPWT† and tNPWT+DL*.
- Computational Finite Element Analysis (FEA) was used to determine tissue strains calculated from real-time displacement data (measured with metallic markers inserted into the porcine tissue in a grid pattern and imaging with micro-CT concurrently with the application of the NPWT) at depths of 1, 2, and 3 cm from the surface for both tNPWT† and tNPWT+DL*.
- **Effect of strain on injured primary human dermal fibroblasts (HDF):** Strain range of interest (3.5–6.5%) were identified within ~3.5 cm from the wound centre, consistent with the peri-wound region.[3]

Methodology cont.

- A bespoke cell stretching device (CSD) capable of delivering the target strains (3.5–4.5% and 5.5–6.5%) was developed, fabricated & validated. Crucially, this device also delivered cyclic§ strain to maintain strain experienced by the cells (i.e. as the cells migrate & proliferate) over the full duration of the experiment.
- The CSD employed specialized collagen I-coated elastic membranes (StageFlexer™, Flexcell™ International Corp.) to support cell adhesion and facilitate strain application. Strain was delivered biaxially via a vacuum-controlled system, allowing precise modulation of mechanical forces across the cell culture surface.
- Primary HDFs were isolated from five donors (ages 27–55) with full informed consent (NHS REC 17/SC/0220): one male (leg) and four females (abdomen ×3, breast ×1). All cells were used at <14 passages.
- HDFs were cultured on StageFlexer membranes housed within the CSD and maintained at 37 °C, 5% CO_2. At ~90% confluence, a vertical scratch was made, debris removed with PBS and fresh medium added. Mechanical strain cycles were then applied for 24 hours under identical incubation conditions. Post treatment, fixation and staining were performed using 1% crystal violet. Scratch images were captured via Optika™ IM-3LD4D microscope and quantified using ImageJ (v1.54g).

§The application of cyclic strain is intended to more accurately simulate the relative constant strain experienced by cells in the peri-wound tissue during application of NPWT. Importantly, this cyclic strain **does not** represent fluctuations in negative pressure itself.

Results

- The tNPWT+DL* dressing delivers 3.5-6.5% strain to a significantly greater extent in the peri-wound tissue region than tNPWT†, with a 6.3-fold (528%) increase in coverage at 2 cm sub-dermal tissue depth (**Figure 2**).

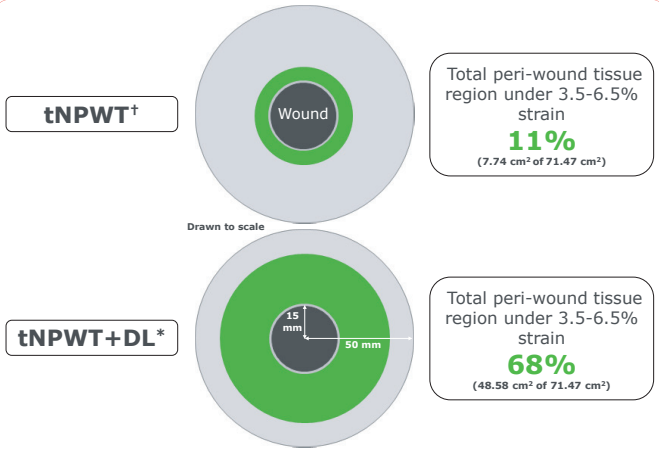


Figure 2. Map of peri-wound strain range of interest. Visual representation of tissue strain distribution in the peri-wound region, 2 cm sub-dermal tissue depth, highlighting: ■ Tissue under 3.5-6.5% strain, ■ Tissue strain outside range of interest.

Results cont.

- The effect of application of the peri-wound region dermal strain of interest (3.5-6.5%) on injured primary human dermal fibroblasts was positive (**Figure 3**).
- For the 3.5–4.5% cyclic strain group, mean scratch closure increased from 71.94% (no strain control) to 79.23%, representing a 7.29% improvement (approximately a 0.1-fold increase), which was statistically significant ($p < 0.0001$).
- Similarly, the 5.5–6.5% cyclic strain group showed an increase in mean scratch closure from 77.10% (no strain control) to 85.07%, a 7.97% improvement (approximately a 0.09-fold increase), also statistically significant ($p < 0.01$).

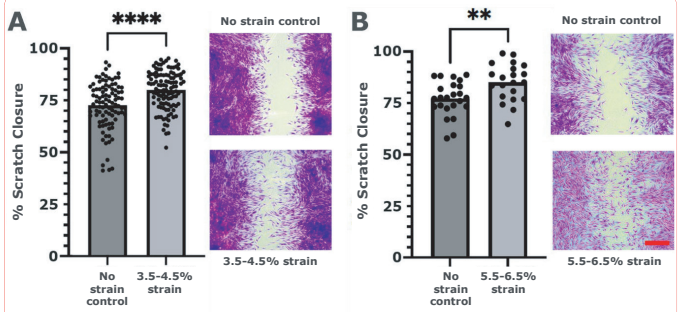


Figure 3. Scratch closure (%) and representative crystal violet-stained images of human dermal fibroblasts under cyclic mechanical strain. Quantification of scratch closure and representative images of human dermal fibroblasts subjected to biaxial cyclic strain between A) between 1.7% strain and 3.5-4.5% therapeutic strain in 30 min intervals for 24 hours compared to no strain controls (n=96-112 across Donors 4 and 5); and B) between 0% strain and 5.5-6.5% strain in 30 min intervals for 24 hours compared to no strain controls (n=21-24 across Donors 1, 2 and 3). Each image was treated as an independent data point, reflecting the heterogeneous microenvironmental strain distribution within the CSD. Statistical analysis was performed using Welch's t-test, **, $p<0.01$, ****, $p<0.0001$; Bar = 500 µm.

Conclusions

- **Strain distribution**: A greater proportion of peri-wound tissue is exposed to beneficial strain range (3.5–6.5%) with tNPWT+DL* (68%) compared to tNPWT† (11%). This represents a 6.3-fold (528%) increase for tNPWT+DL*, relative to tNPWT†.
- **Biological impact**: *In vitro* modelling of strains within this range demonstrated a positive effect on injured primary human dermal fibroblasts, with significantly enhanced cell migration observed in both strain groups compared to no-strain controls.
- These findings indicate that, by delivering beneficial mechanotransductive strains more broadly to the peri-wound region tissue than tNPWT†, the novel tNPWT+DL* dressing may further improve cellular responses and accelerate wound healing.

References: 1. Hurd T, *et al*. Adv Wound Care (New Rochelle). 2017 Jan 1;6(1):33-37. **2.** Kirsner R, *et al*. Wound Repair Regen. 2019 Sep;27(5):519-529. **3.** Dowsett C, *et al*. Wounds International. 2015 6(1):19-23.

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Notes

Accelerates **wound closure**[*1]

+

Supports a return to their everyday lives[2]



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*_In vivo_; wound area measurement in a 12 day porcine wound healing model at day 6; 93% of original wound area remaining with RENASYS WOUND+ with use of a wound filler vs 101% with tNPWT drape and foam filler; p<0.05.

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