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.

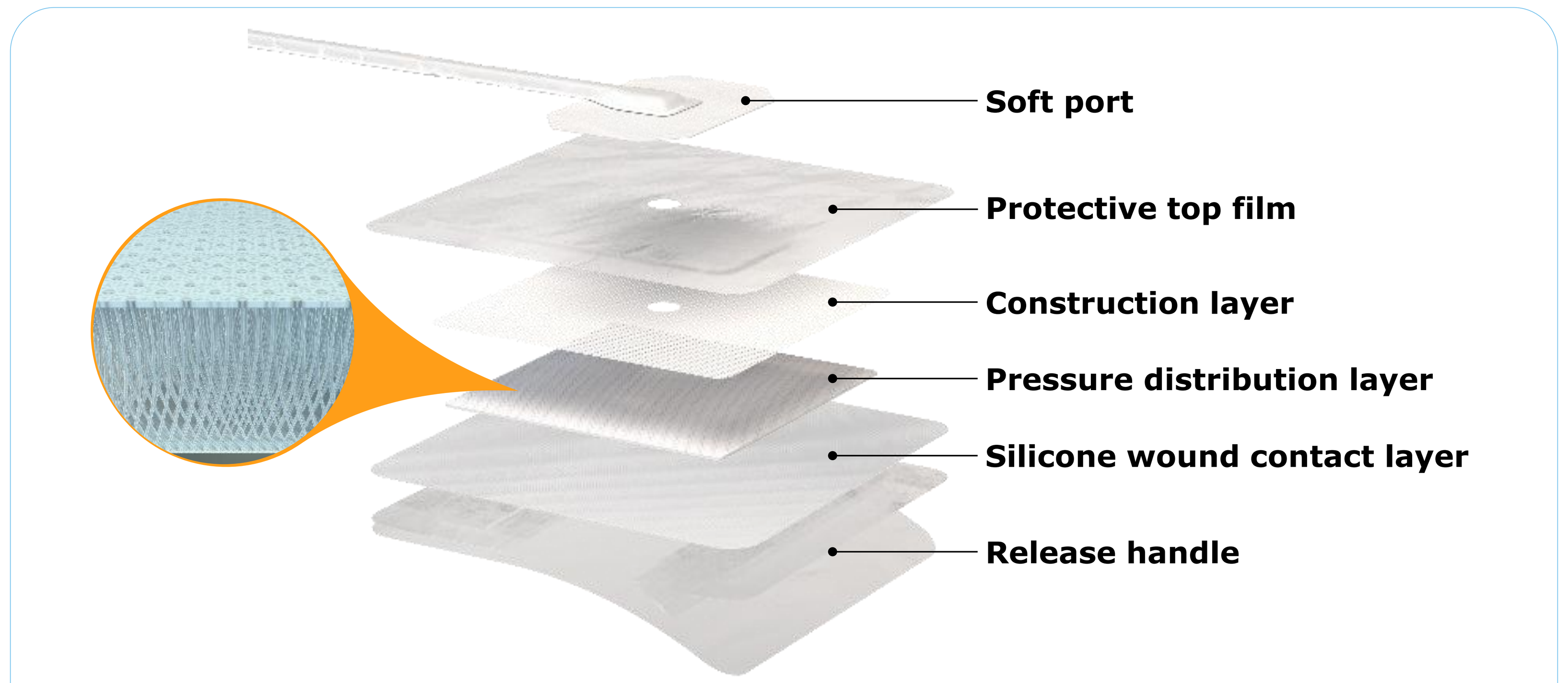

Figure 1. Novel tNPWT+DL* dressing and constituent layers.

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 (1054cm³ volume, 3 cm deep) and an exudate flow rate of 42.9 ml/hr (75 µl/cm²/hr) to simulate a challenging clinical scenario.

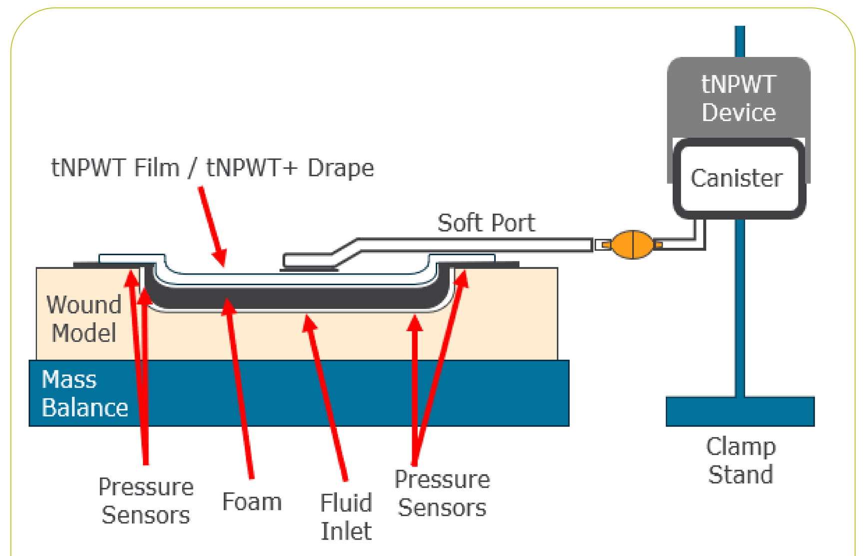

Figure 2. Test set-up of *in vitro* wound model testing conducted on tNPWT drape† and tNPWT+DL*

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**).

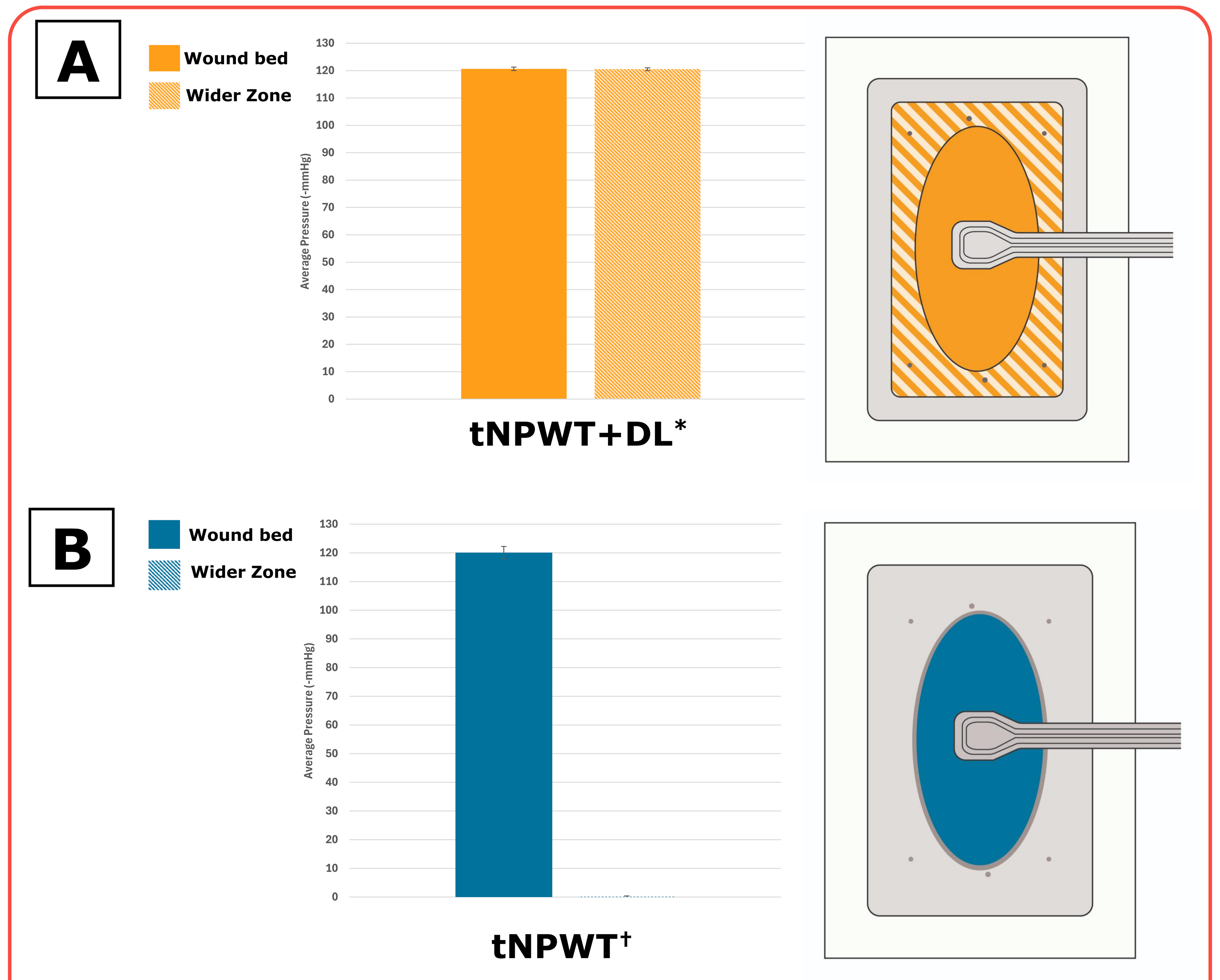

Figure 3. Negative pressure distribution during an *in vitro* wound model with either (**A**) tNPWT+DL* or (**B**) tNPWT†. Colored regions within wound model schematic correspond to the negative pressure distribution shown on the graphs (wound bed and wider zone).

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**).

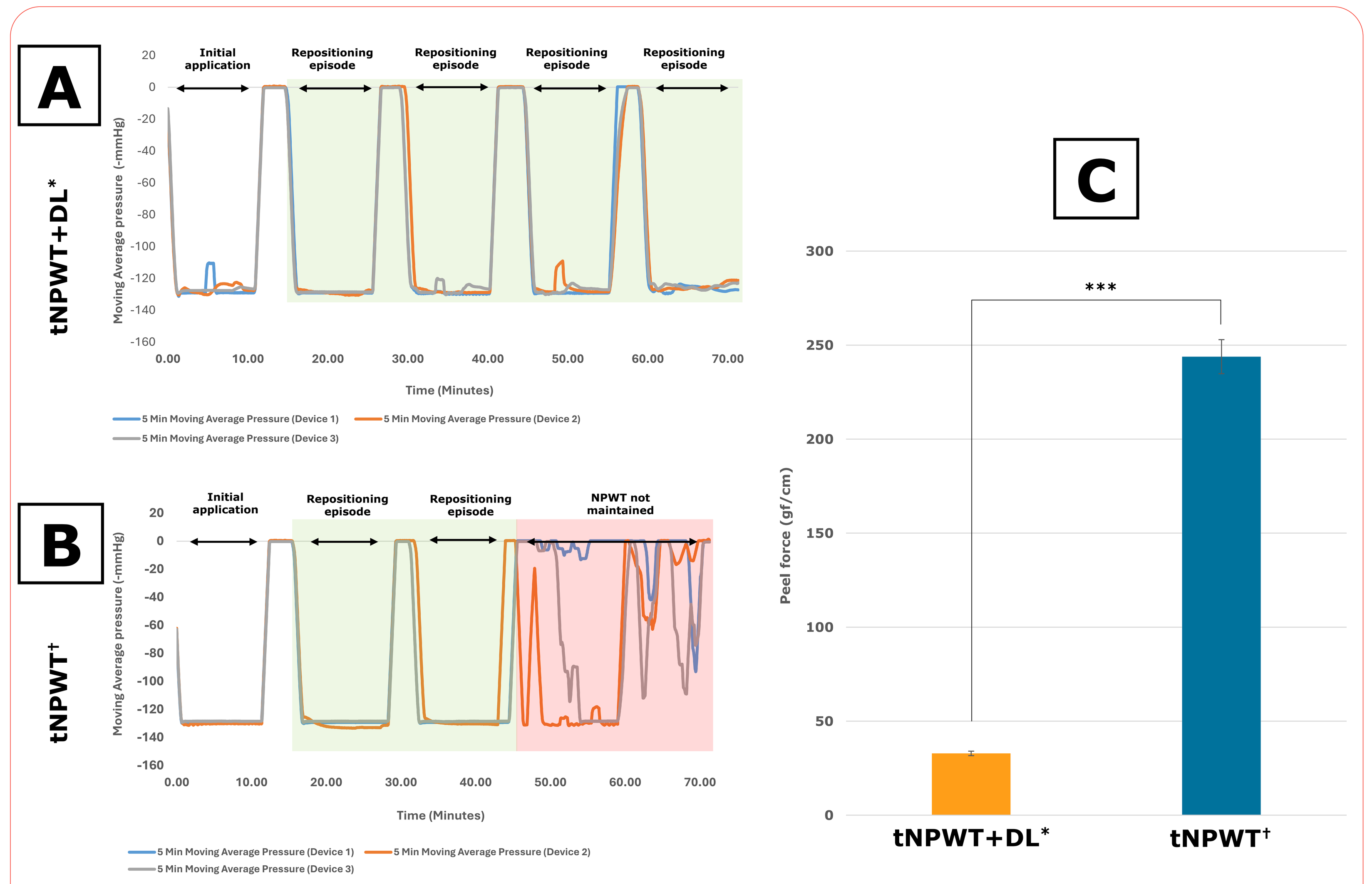

Figure 4. Negative pressure (-mmHg) of drape following repositioning episodes on simulated wound model (**A**) tNPWT+DL* (**B**) tNPWT†. Average peel force (gf/cm) of tNPWT† and tNPWT+DL* drape following NPWT at -120 mmHg for 72 hours (**C**). ***, p<0.001.

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.

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

*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.

Wound Management, Smith & Nephew Medical Ltd, 101 Hessle Road, Hull, HU3 2BN, UK.