Avelle™
Negative pressure, positive power

The *in-vitro* physical performance characteristics of the Avelle™ Negative Pressure Wound Therapy System

Contents

Introduction

Negative pressure wound therapy (NPWT) is used to manage wounds by promoting wound closure through application of mechanical strain to the wound surface, removal of excess fluid and stabilising the wound environment[1].

Since the description of NPWT to aid wound closure in 1997[2], NPWT techniques have been applied in the management of a broad variety of chronic and difficult to treat wounds, including diabetic foot wounds, skin grafts and closed surgical incisions[1,3,4,5]. As the use of NPWT has become more widespread, recent advances in device technology have focussed on enabling greater patient mobility. The original NPWT devices were relatively large and cumbersome, incorporating bulky pumps and canisters for the required level of exudate management. Innovations in NPWT have included the development of more portable and disposable, single patient use devices, which allow treatment to be delivered in an outpatient setting[6].

Tissue ingrowth into the wound contact layer of traditional NPWT systems has been observed, causing pain to the patient during dressing removal and at dressing changes[7]. The wound contact materials used in these systems are generally a porous polymeric structure (usually Polyurethane foam), which due to physical characteristics, allows re-epithelised tissue to grow into and adhere to the material during therapy. Tissue ingrowth has been shown to be negated when gauze (cellulosic, cotton) has been used as the wound contact material during NPWT[7]. The Avelle™ NPWT system is the first disposable, portable, canister-less NPWT device to incorporate the benefits of Hydrofiber® technology.

The Avelle™ NPWT system: an NPWT device incorporating Hydrofiber® technology

The Avelle™ NPWT system includes a disposable, portable battery powered pump unit and absorbent wound dressings, which are connected via an airway and luer-lock fitting (Figure 1). The Avelle™ NPWT dressing is powered by Hydrofiber® technology which helps prevent peri-wound maceration[8], a potential complication associated with NPWT that can lead to delayed healing[9]. Hydrofiber® Technology is ConvaTec's proprietary technology designed to help create a beneficial moist wound environment for healing[10]. The device is indicated for patients with a low to moderately exuding wound that would benefit from NPWT, with such wounds including:

- Chronic wounds
- Acute wounds
- Traumatic wounds
- Subacute and dehisced wounds
- Flaps and grafts
- Surgically closed incisions

The Avelle™ NPWT dressing may be worn for up to 7 days, depending on the level of exudate and per clinical need*. The pump may be used for up to 30 days (batteries may need to be replaced over this period), and can therefore be used for multiple dressing changes within the 30-day period.

** Please refer to package insert for complete instructions for use*

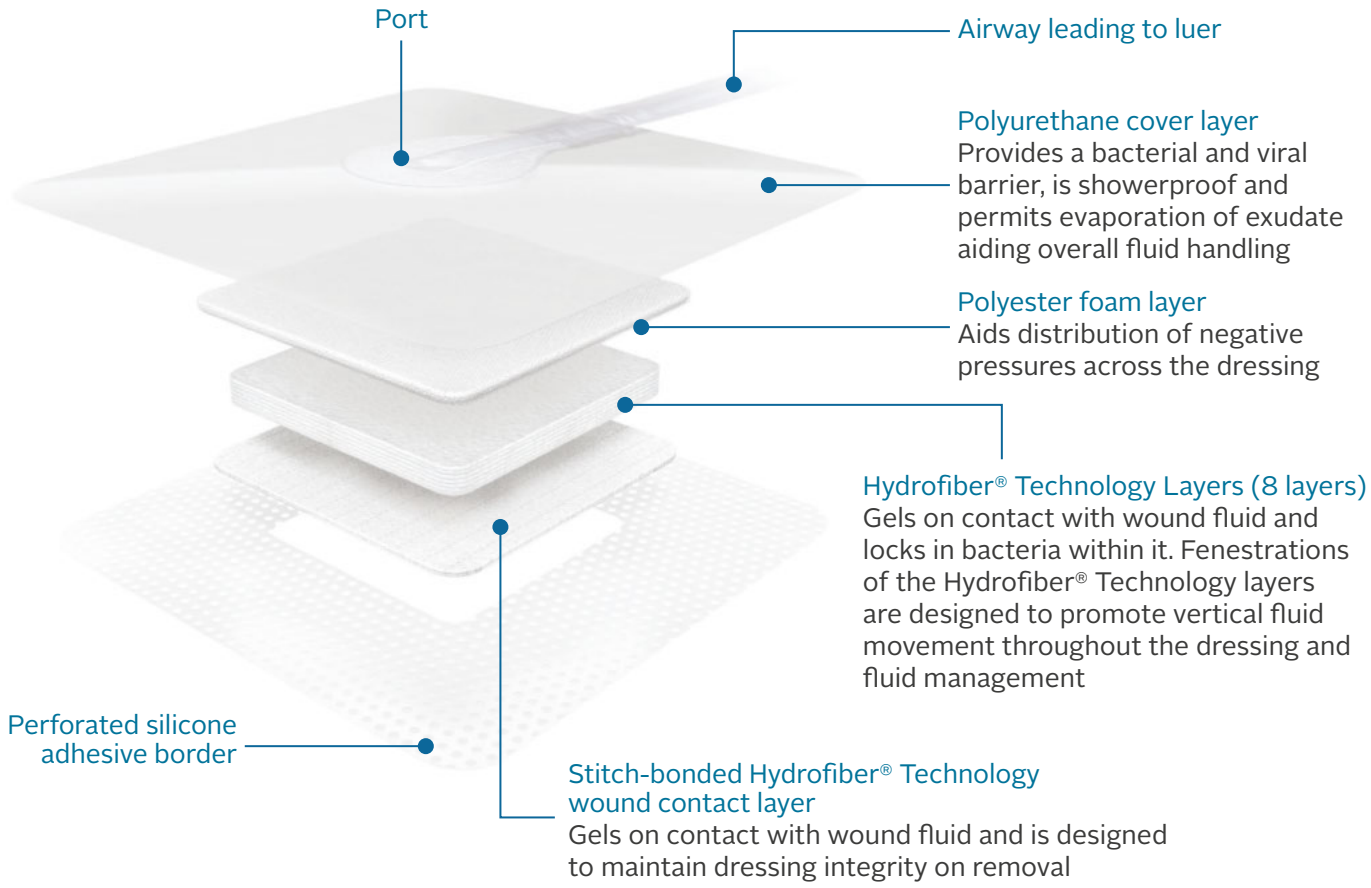
Figure 1: The Avelle™ NPWT System

The Avelle™ NPWT dressing comprises a wound contact layer constructed of strengthened Hydrofiber® Technology, which retains its structural integrity following exudate absorption. An additional eight Hydrofiber® Technology layers above the wound contact layer have been fenestrated to enhance fluid transport capabilities (Figure 2).

The wound contact layer is surrounded by a silicone adhesive border which gently secures the dressing in place to the peri-wound skin. Each of the Hydrofiber® Technology dressing layers gels upon contact with wound exudate as demonstrated *in-vitro*[8]. Benefits of a gelling wound contact layer such as the Avelle™ Hydrofiber® Technology wound contact layer, include a lack of large open pores for the new epithelia to grow upwards into during management and that the wound contact surface remains hydrated, thus providing a moist wound healing environment which is known to promote good healing outcomes[11].

The remaining dressing layer comprise polyester foam, designed to aid distribution of negative pressure across the dressing and a showerproof polyurethane cover layer designed to provide a bacterial and viral barrier, while permitting the evaporation of moisture vapour to aid overall fluid handling.

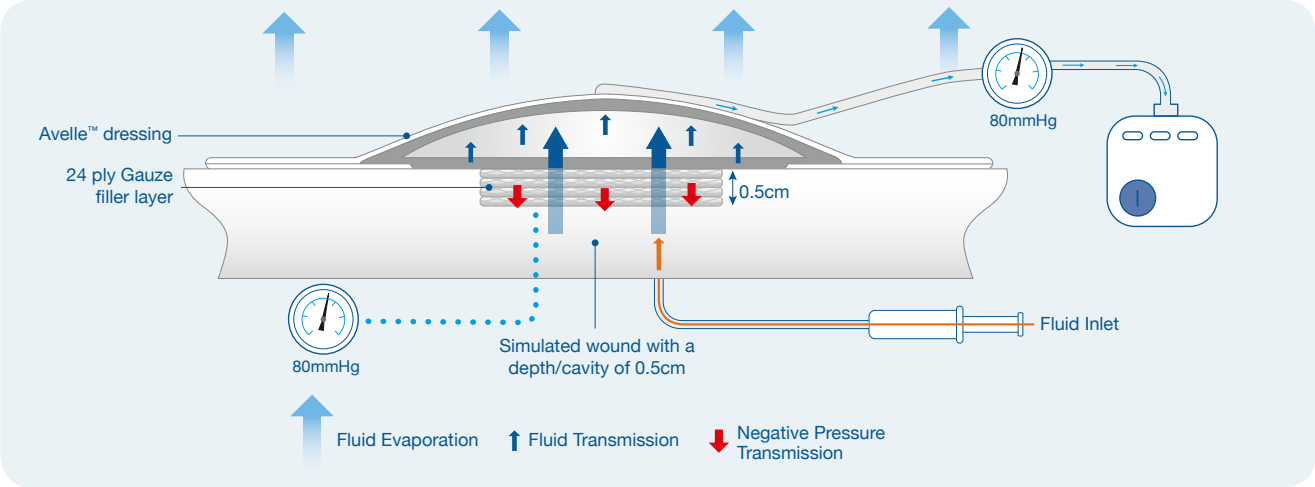
Figure 2: The Avelle™ NPWT Dressing



The Avelle™ NPWT system is designed to manage fluid in low to moderately exuding wounds

Exudate removed from the wound during use is designed to be managed by the dressing via absorption and transpiration of fluid through the absorbent dressing layers and breathable backing layer. The Avelle™ NPWT system therefore does not require the use of a canister system, as seen in traditional portable and static NPWT devices[12]. The fully hydrated dressing maintains its structural integrity without fluid pooling under the dressing.

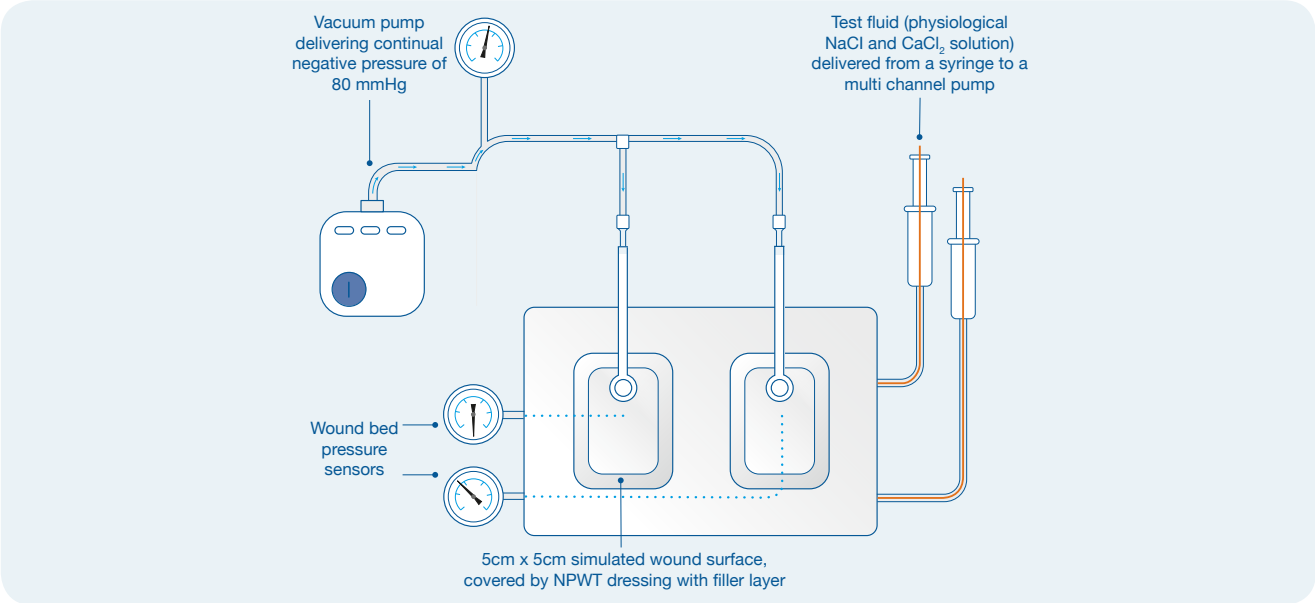
Figure 3



Unlike traditional NPWT systems, the Avelle™ Hydrofiber® Technology wound contact layer forms a gel upon contact with exudate at the wound surface. In wounds where a filler layer is required (e.g. cavity wounds), use of AQUACEL® Extra or AQUACEL® dressing would be appropriate in combination with the Avelle™ NPWT dressing.

Fluid handling of the Avelle™ NPWT system was investigated using an *in-vitro* simulated 5mm shallow depth wound model, delivering simulated exudate at low (108 ± 10 mL fluid over 7 days) or moderate (82 ± 10 mL fluid over 3 days) levels. During design of the Avelle™ NPWT system test model, available literature describing NPWT test models was reviewed, including that reported by Smith and Nephew for testing of the PICO™ NPWT system, which incorporated gauze filler layer during the test.[12] To allow comparison between fluid handling for the two devices, *in-vitro* testing with the Avelle™ NPWT dressing also incorporated a 24-ply gauze filler layer. Figure 4 illustrates the test model employed.

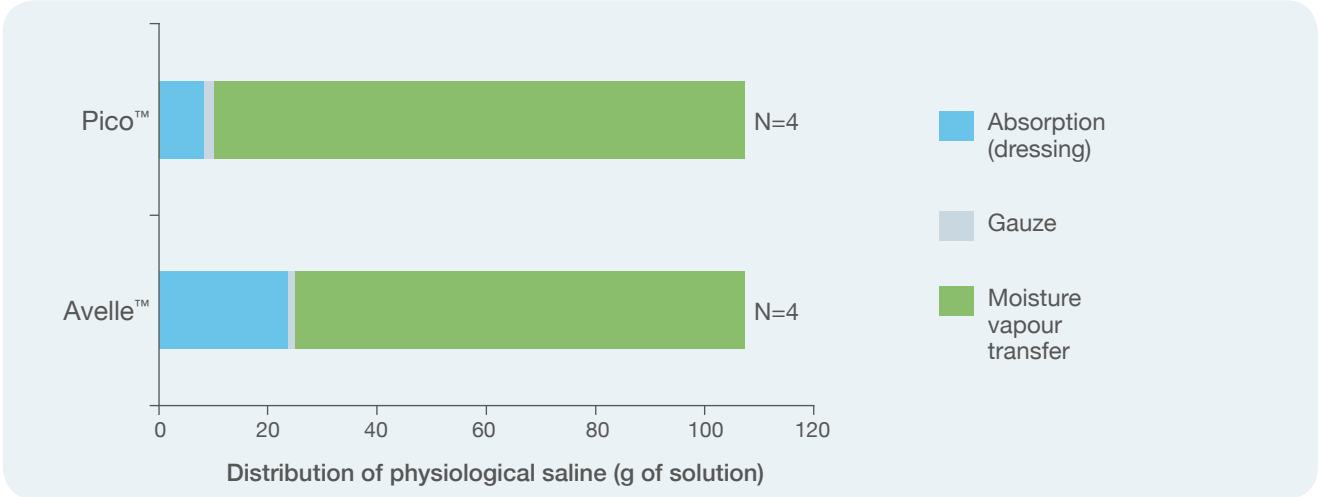
Figure 4



Testing was carried out using a 5cm × 5cm × 5mm wound model with a gauze filler dressing covered by a 16cm × 21cm Avelle™ NPWT dressing. Physiological saline solution was pumped into the simulated wound model at the specified rate and over the specified test period to simulate varying wound exudate levels. The dressing was attached to a vacuum pump set to deliver a nominal negative pressure of 80 mmHg throughout the test period. The dressing and the model were assessed at the end of the test period to calculate the dressing total fluid handling capacity under the simulated conditions and to verify the ability of the Avelle™ NPWT dressing to absorb all fluid delivered during the test. In testing using an *in-vitro* wound model simulating low (108 ± 10 mL fluid over 7 days) or moderate (82 ± 10 mL fluid over 3 days) levels of wound exudate, the Avelle™ NPWT system absorbed all the test fluid under standard operating conditions (nominal negative pressure of 80 mmHg).

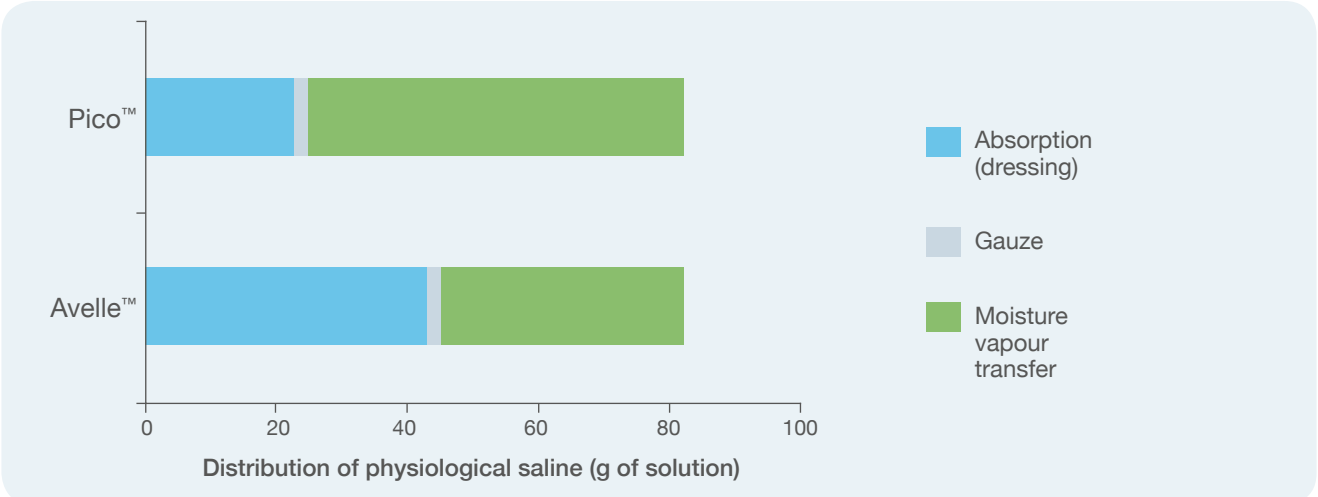
In conditions simulating low levels of wound exudate, 76.71% of the absorbed fluid was transported through the dressing and transpired as water vapour (Figure 5).[12]

Figure 5: Fluid handling (by weight of solution) by the Avelle™ NPWT system and comparator *in-vitro* conditions simulating low exudate flow[12]



In conditions simulating moderate exudate 45.11% of the absorbed fluid transpired through the dressing as water vapour, while the dressing retained 52.56% of the absorbed fluid (Figure 6).

Figure 6: Fluid handling (by weight of solution) by Avelle™ NPWT dressing and comparator dressing *in-vitro* conditions simulating moderate exudate flow[12]



The data for both the low exudate and moderate exudate tests are comparable to those reported with a comparator device, (Smith & Nephew PICO™ NPWT system). The Avelle™ NPWT dressing retained a higher amount of fluid than the comparator product due to its distinctive mode of fluid handling provided by the unique fluid handling properties of the Hydrofiber® Technology layers, which promote wound healing and lock in wound exudate and bacteria: The Hydrofiber® Technology creates a soft gelling wound contact layer (data on file), which is designed to help provide a beneficial moist wound environment for healing;[10] and each of the 8 Hydrofiber® Technology layers locks in wound exudate and bacteria as exudate is transported through the dressing toward the outer polyurethane cover layer, where it is transpired as water vapour.

A separate Total Fluid Handling Capacity (TFHC) and Absorbency (Abs) *in-vitro* study on all of the Avelle™ NPWT system dressing sizes compared to the predicate NPWT device PICO™ (Smith & Nephew). The Abs aspect of this *in-vitro* method was carried out in accordance with BS EN 13726-1:2002[12]. The TFHC *in-vitro* laboratory method was determined by measurement of fluid uptake using the Payne cup method in accordance with BS EN 13726-1:2002[12]. Briefly, this involved cutting a test dressing (55mm diameter) and placing into a Payne/Paddington cup, which was then weighed (W1). A minimum volume of 20 ml of test solution sodium/calcium chloride BP [physiological saline] was added, and the whole cup was then re-weighed (W2). Each cup was placed in a controlled environment incubator (37°C and relative humidity below 20%) for 24 hours, after which the cup was removed and equilibrated to room temperature before re-weighing (W3). Moisture Vapour Loss (MVL) = W3 - W2 (A). The solid plate was then removed from the cup, excess fluid was drained and the cup re-weighed (W4). Fluid Absorption = W4 - W1 (B). Total Fluid Handling Capacity (TFHC) was determined by the addition of A and B.

The testing was completed over 24hrs and when extrapolated from the mean result for TFHC and Abs, the data on the Avelle™ NPWT dressings (Table 1) is comparable to the PICO™ dressings (Table 2).

Table 1: Summary of the Abs and TFHC data for the Avelle™ NPWT dressings

Device	Dressing size (cm)	Pad size (cm)	Area (cm^2)	TFHC (g)*	TFHC (mL)	Abs (g)**	Abs (mL)
	16 x 16	10 x 10	100	203.6	203.6	77.3	77.3
	16 x 21	10 x 15	150	305.4	305.4	116.0	116.0
	12 x 21	6 x 15	90	183.2	183.2	69.6	69.6
	12 x 31	6 x 25	150	305.4	305.4	116.0	116.0
	26 x 26	20 x 20	400	814.4	814.4	309.2	309.2
	21 x 26	15 x 20	300	610.8	610.8	231.9	231.9
	12 x 41	6 x 35	210	427.6	427.6	162.3	162.3

*TFHC mean (20.36g / 10cm2 / 24hr) **Abs mean (7.73g / 10cm2 / 24hr) for Avelle™ NPWT dressings

Table 2: Summary of the Abs and TFHC data for the PICO™ dressings

Device	Dressing size (cm)	Pad size (cm)	Area (cm^2)	TFHC (g)***	TFHC (mL)	Abs (g)****	Abs (mL)
	15 x 15	10 x 10	100	193.4	193.4	64.1	64.1
	15 x 20	10 x 15	150	290.1	290.1	96.2	96.2
	15 x 30	10 x 25	250	483.5	483.5	160.3	160.3
	10 x 20	5.6 x 15	84	162.5	162.5	53.8	53.8
	10 x 30	5.6 x 25	140	270.8	270.8	89.74	89.74
	10 x 40	5.6 x 35	196	379.1	379.1	125.6	125.6
	20 x 20	15 x 15	225	435.15	435.15	144.2	144.2
	25 x 25	20 x 20	400	773.6	773.6	256.4	256.4

***TFHC mean (19.34g / 10cm2 / 24hr) ****Abs mean (6.41g / 10cm2 / 24hr) for Pico™ dressings

The Avelle™ NPWT system is designed to produce a continuous nominal negative pressure of 80 mmHg across the wound surface

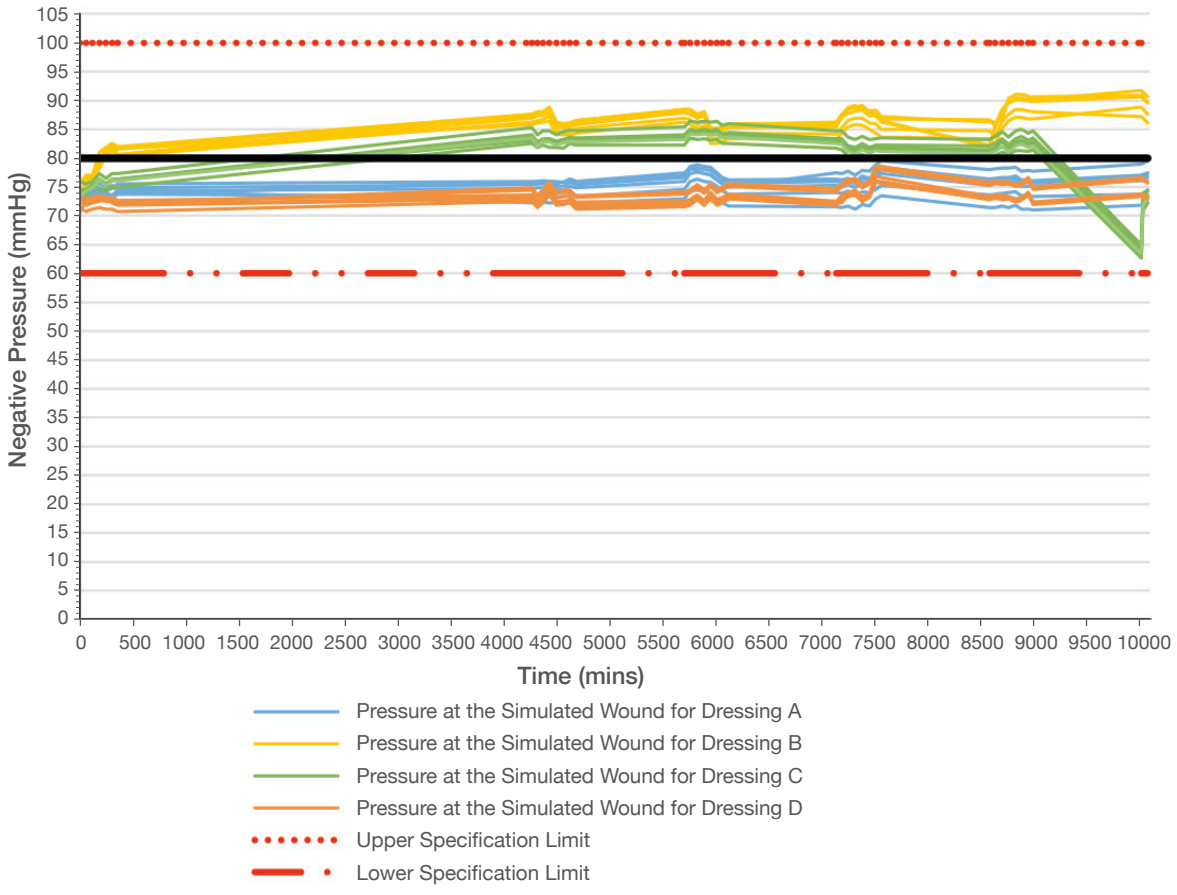
This data summaries the *in-vitro* testing carried out over 3 and 7 days to assess the Avelle™ NPWT system, to support the fluid handling data as discussed above and to demonstrate that the system can manage fluid whilst distributing negative pressure through the dressing to the wound bed. The *in-vitro* test model used has been developed taking into consideration that reported by Smith and Nephew for testing of the PICO® NPWT system[12]. The simulated wound model conditions were modified for this test to more closely mimic the clinical situation. During the testing, the simulated models were incubated at body temperature (37°C) and Simulated Wound Fluid (SWF) was used as test solution.

Syringes were filled with SWF of known volume and inserted into a syringe pump connected under the simulated wound model. A total of six pressure gauge ports were positioned across the area of the dressing: one located between the simulated wound bed and the airway, four located at each of the dressing pad corners and one located within the simulated wound area. The simulated wound bed selected for testing was 5cm x 5cm with a depth of 0.5cm. The 16cm x 21cm Avelle™ NPWT dressing, with a central 10cm x 15cm absorbent pad area, was placed over the top of the simulated wound, with the port and airway located away from the simulated wound bed. Fixation strips were then applied to help maintain the seal of the dressing. The airway was connected at a one-way valve and attached via luer lock to an Avelle™ NPWT pump, to deliver a nominal negative pressure of 80 mmHg. SWF at a flow rate of 82 ± 10 mL over 3 days (1.139 mL / hour) simulating a moderate exuding wound or 108 ± 10 mL over 7 days (0.643 mL / hour) simulating a low exuding wound, was delivered into the test model at the simulated wound bed. Pressure readings from all pressure gauges were recorded at the start of the test and thereafter every hour (± 10 mins). The test setup was transferred to an oven and the temperature and humidity were recorded daily. At the end of the test the total addition of fluid was recorded.

The *in-vitro* results show that the Avelle™ NPWT dressing can handle simulated wound fluid delivered at both low and moderately exuding rates up to 0.5cm deep. The negative pressure delivered from the pump unit can be transmitted through the Avelle™ NPWT dressing to the simulated wound bed, whilst in a hydrated state. The negative pressure delivered from a pump unit to the simulated wound bed, was within specification of the Avelle™ NPWT system IFU (80 ± 20 mmHg) throughout the test. The wound contact layer gelled and the Avelle™ NPWT dressing could be removed in one piece. All simulated wound exudate was managed by the dressing system, with no fluid leakage or pooling around the simulated wound bed.

Figure 7: Graphical summary of data obtained at simulated wound bed over a 3-day period at multiple pressure points[12]

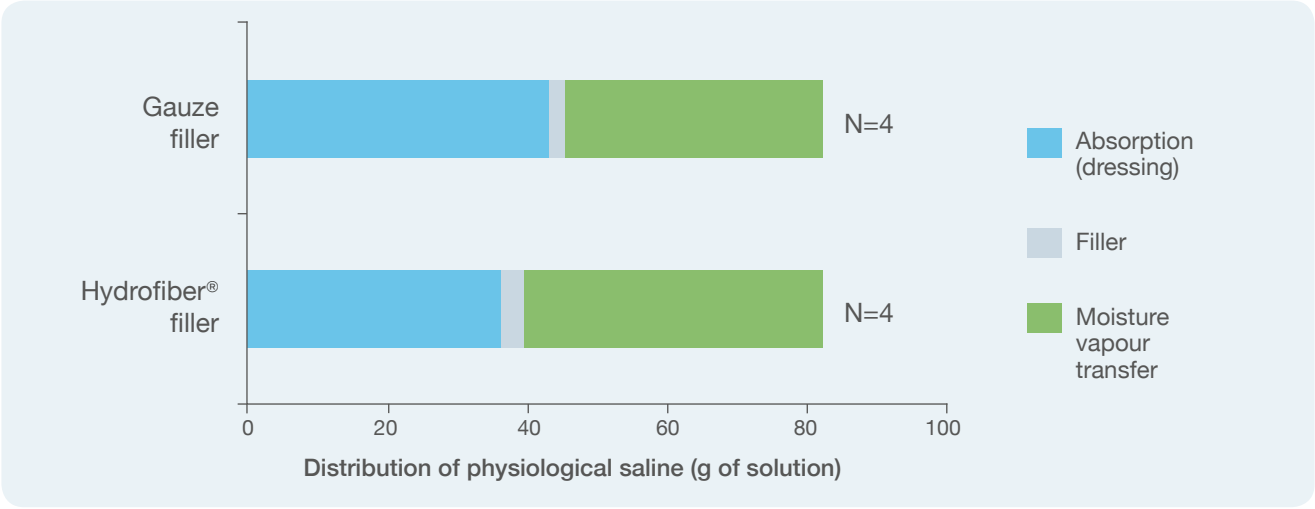
Figure 8: Graphical summary of data obtained at simulated wound bed over a 7-day period at multiple pressure points[12]



The Avelle™ NPWT system is suitable for use with a Hydrofiber® Technology layer as a filler dressing

With many current NPWT systems, the wound contact layer is typically a porous polymeric structure, such as polyurethane foam. With the Avelle™ NPWT system, wounds deeper than 0.5cm up to 2cm can be filled using a Hydrofiber® Technology flat dressing: AQUACEL® Extra or AQUACEL®dressings. Where not available, standard gauze may be used. To investigate the fluid handling capabilities of the Avelle™ NPWT system in combination with a Hydrofiber® Technology dressing filler, the *in-vitro* simulated wound model with moderate levels of exudate were repeated for the Avelle™ NPWT dressing and an AQUACEL® Extra dressing as a filler layer. Importantly, fluid handling was comparable with the Hydrofiber® Technology filler layer and with gauze filler in the *in-vitro* simulated wound model (Figure 9), indicating that the use of a Hydrofiber® Technology filler is not detrimental to the fluid handling or pressure transmission properties of the Avelle™ NPWT dressing.

Figure 9: *In-vitro* fluid handling (by weight of solution) by the Avelle™ NPWT system with Hydrofiber® technology or gauze filler in conditions simulating moderate exudate flow[12]



The movement of fluid through the Avelle™ NPWT system when used with a Hydrofiber® Technology filler layer as the primary wound contact, was demonstrated *in-vitro* in a variety of potential wound conditions, including low or moderate exudate rates, and shallow (0.5 cm deep with one layer of AQUACEL® Extra filler) or deep (2.0cm deep with four layers of AQUACEL® Extra filler) wounds[12]. The simulated wound exudate consisted of sodium chloride and calcium chloride solution containing 142 mmol of sodium ions and 2.5 mmol of calcium ions as the chloride salts. This solution has an ionic composition comparable to human serum or wound exudate. AQUACEL® Extra dressing was chosen as the filler layer. AQUACEL® Extra dressing is one of the more absorbent dressings in the Hydrofiber® Technology product range as it is primarily made up of CMC fibres and contains cellulosic fibres for additional strength.

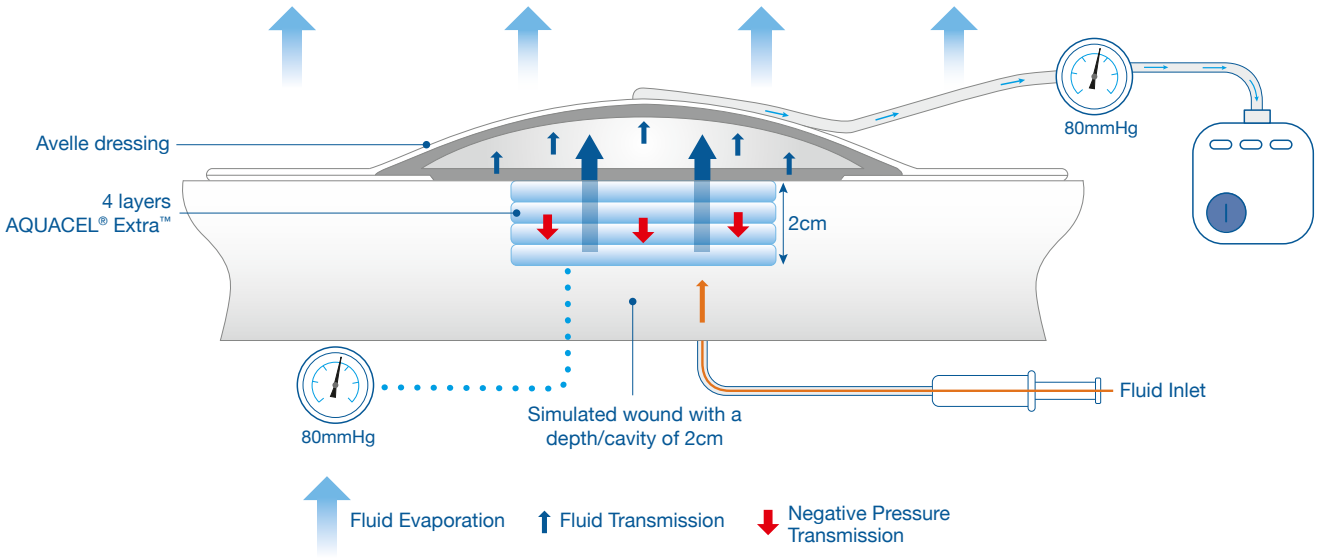
To better characterise the fluid handling properties of the Avelle™ NPWT dressing, *in-vitro* fluid handling tests were repeated to simulate a variety of potential wound conditions (Table 3), to determine how the addition of one or four layers of AQUACEL® Extra filler would affect the negative pressure transmitted to the simulated wound bed.

Table 3: Potential wound conditions tested

Simulated Wound Depth	Test	Duration	Wound contact (filler) material
0.5 cm	Low exudate model (107mL / 7 days)	7 days	1 layer of AQUACEL® Extra
0.5 cm	Moderated exudate model (82mL / 3 days)	3 days	1 layer of AQUACEL® Extra
2.0 cm	Low exudate model (107 mL / 7 days)	7 days	4 layers of AQUACEL® Extra
2.0 cm	Moderated exudate model (82 mL / 3 days)	3 days	4 layers of AQUACEL® Extra

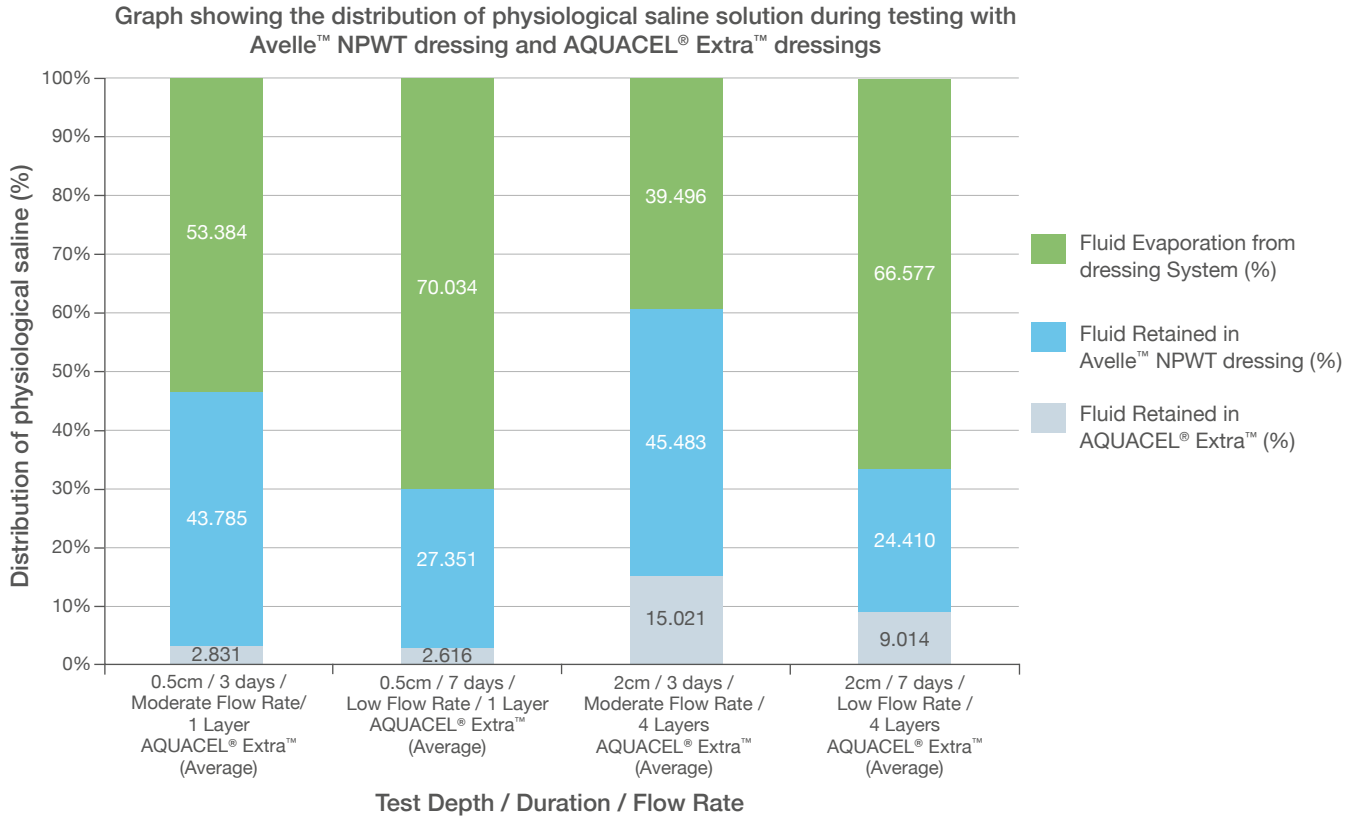
AQUACEL® Extra layers (5cm x 5cm) were placed into a simulated wound bed of depth 0.5cm or 2cm. Initial weights of the Avelle™ NPWT dressing, AQUACEL® Extra layer(s) and release liners were recorded. The 16cm x 21cm Avelle™ NPWT dressing, with a central 10cm x 15cm absorbent pad area, was placed over the top of the simulated wound, with the port and airway located away from the simulated wound bed. Fixation strips were then applied to help maintain the seal of the dressing. The airway parts were connected at a one-way valve and attached via luer lock to a vacuum pump containing a calibrated pressure gauge, and set to deliver a continual nominal negative pressure of 80 mmHg (Figure 10). The dressing was visually assessed to ensure that a negative pressure had been applied across the test area. Simulated wound exudate (physiological saline) at a flow rate of 82 ± 10 mL over 3 days (1.15 mL / hour) simulating a moderate exuding wound and 107 ± 10 mL over 7 days (0.64 mL / hour) simulating a low exuding wound, was delivered into the test model at the simulated wound bed. Pressure readings from all pressure gauges were recorded at the start of the test and thereafter every hour (±10 mins). At the end of the test the gelled AQUACEL® Extra dressing and Avelle™ NPWT dressing were removed in one piece, the total addition of fluid and final weights of the Avelle™ NPWT dressing and AQUACEL® Extra layer(s) were recorded.

Figure 10: *In-vitro* testing with Aquacel filler dressing



The following graph (Figure 11) shows the average fluid handling of the Avelle™ NPWT and AQUACEL® Extra™ (filler) dressings under the different test conditions. The graph shows the distribution of the physiological saline retained within the dressings and evaporated as a percentage of the total dispensed.

Figure 11: *In-vitro* average fluid handling of the Avelle™ NPWT and AQUACEL® Extra™ (filler) dressings under the different test conditions



The fluid evaporation lost from the dressing system was calculated based on the amount of physiological saline delivered during the test period, less the total amount retained by the complete dressing system (Avelle™ NPWT dressing and AQUACEL® Extra™ dressing), with the difference removed by fluid evaporation. The retention of solution by the Avelle™ NPWT dressing is similar at the same flow rates. The fluid evaporation increased over longer test periods, demonstrating how the dressing system transports fluid to the dressing outer surface enabling it to be transpired as moisture vapour i.e. evaporation over time. Additional AQUACEL® Extra™ layers under the Avelle™ NPWT dressing, indicated a reduction in fluid evaporation as fluid is absorbed and retained within the AQUACEL® Extra™ layers. The difference between the number of AQUACEL® Extra™ layers and the overall fluid evaporation of the dressing system is minimal.

The Avelle™ NPWT pump unit was shown to be able to produce a negative pressure of 80 ± 10 mmHg, which was transmitted through the dressing pad and subsequent layers of AQUACEL® Extra™ filler dressings and across an *in-vitro* simulated wound surface[12]. The negative pressure delivered from a pump unit to the simulated wound bed was within specification of the Avelle™ NPWT system IFU (80±20 mmHg) throughout the test. A negative pressure of 80 mmHg has been shown to enhance microvascular blood flow in an *in-vivo* peripheral wound model[13]. The Avelle™ NPWT dressing is connected to the Avelle™ NPWT pump via airway with a luer lock containing a one-way valve, designed to maintain negative pressure should the pump need to be disconnected from the dressing. Laboratory testing has confirmed that the luer connection can maintain negative pressure for at least 60 minutes when disconnected from the pump[12].

The following graphs (Figure 12 to Figure 15) show the pressure at each simulated wound bed. The upper and lower limits of acceptance have been included (red lines) and the pressure delivered by the pump can be seen (black dotted line).

In the *in-vitro* wound model simulating both low and moderate levels of exudate, the Avelle™ NPWT system can maintain a negative pressure of 80 ± 20 mmHg across the simulated wound surface through up to four layers of AQUACEL® Extra™ dressing for the duration of the test period[12].

Figure 12: Simulated wound model 0.5cm deep (moderate flow rate): 83 ± 10 mL over 3 days with 1 layer of AQUACEL® Extra™ dressing

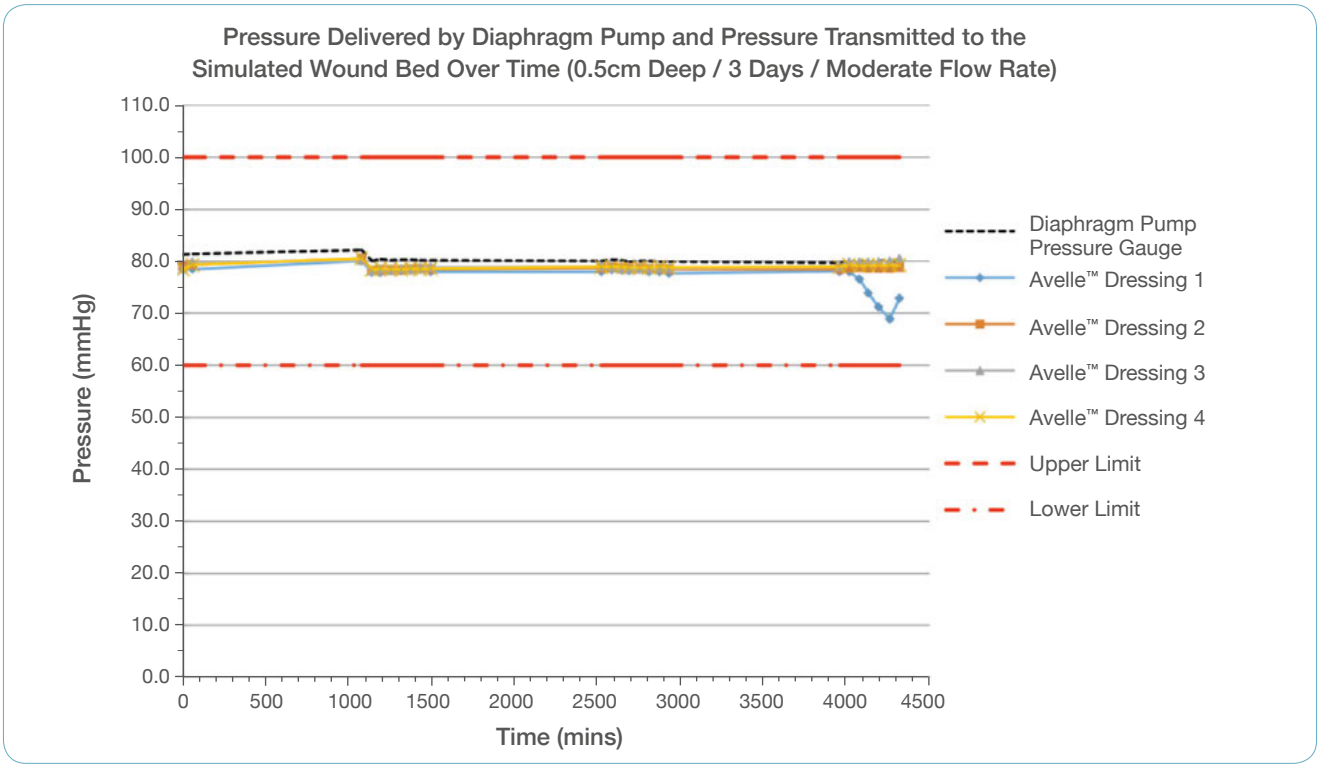


Figure 13: Simulated wound model 0.5cm deep (low flow rate): 108 ± 10 mL over 7 days with 1 layer of AQUACEL® Extra™ dressing

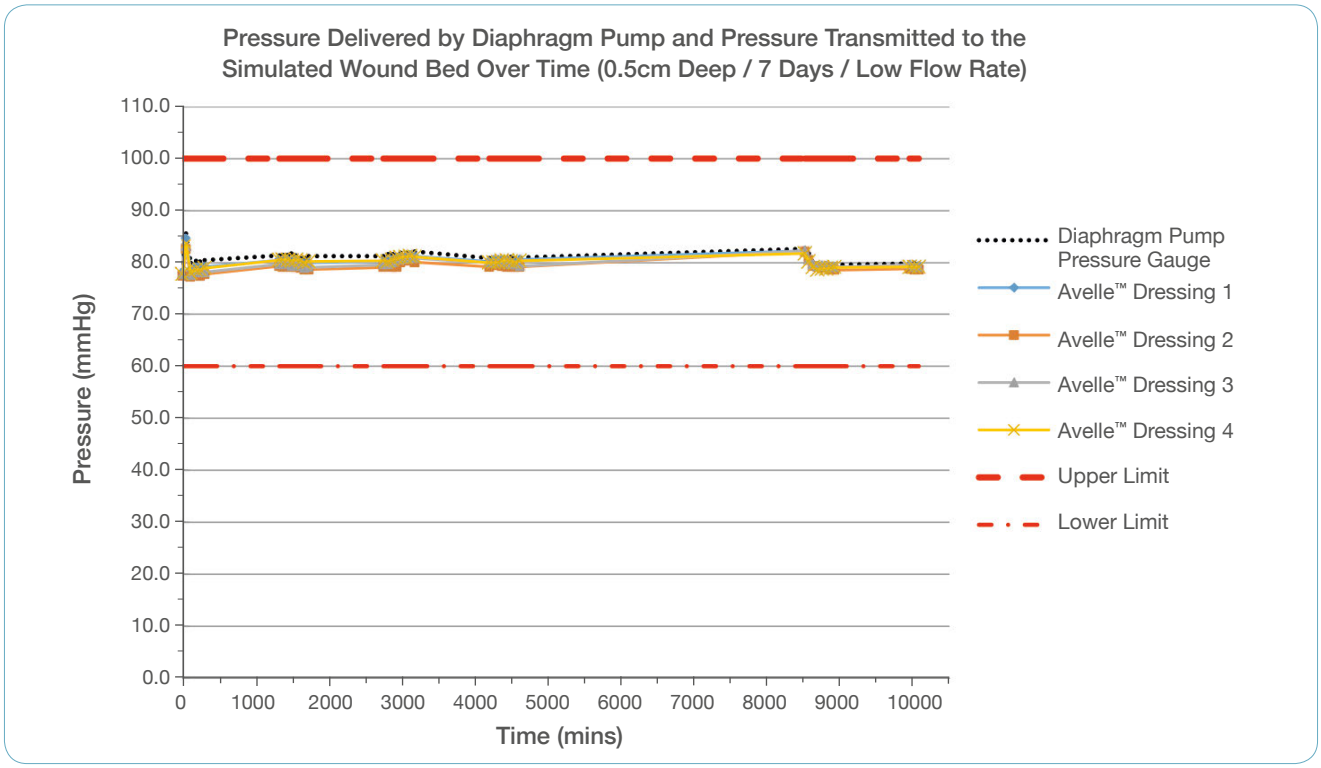


Figure 14: Simulated wound model 2cm deep (moderate flow rate): 83 ± 10 mL over 3 days with 4 layers of AQUACEL® Extra™ dressing

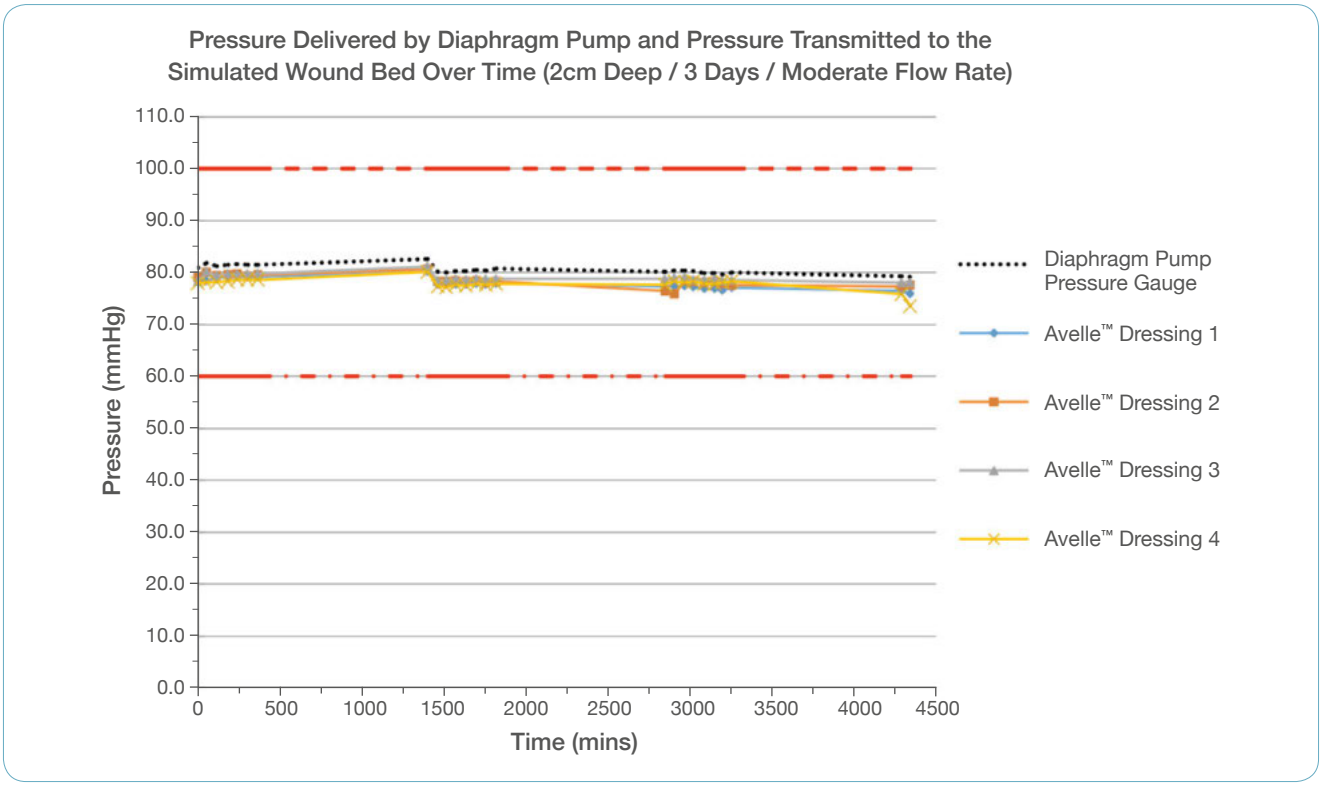
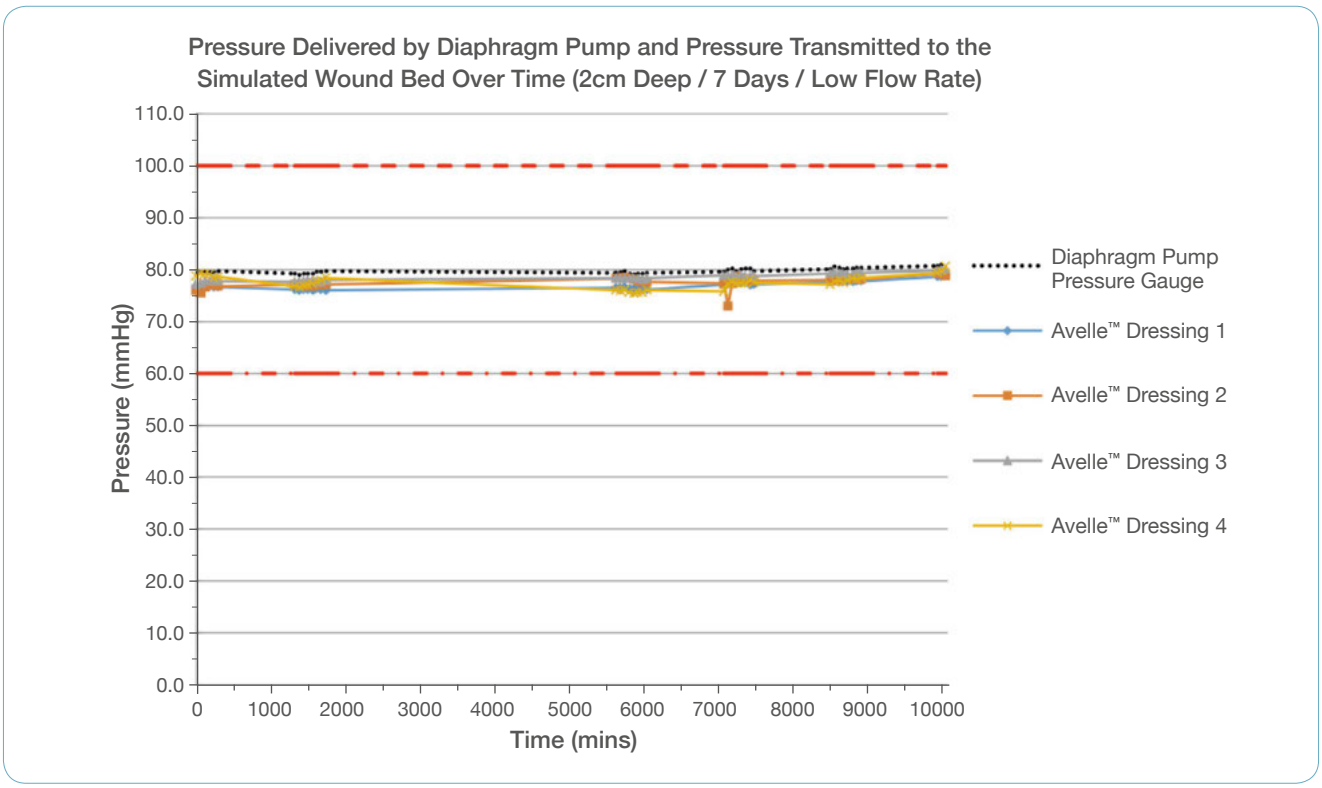


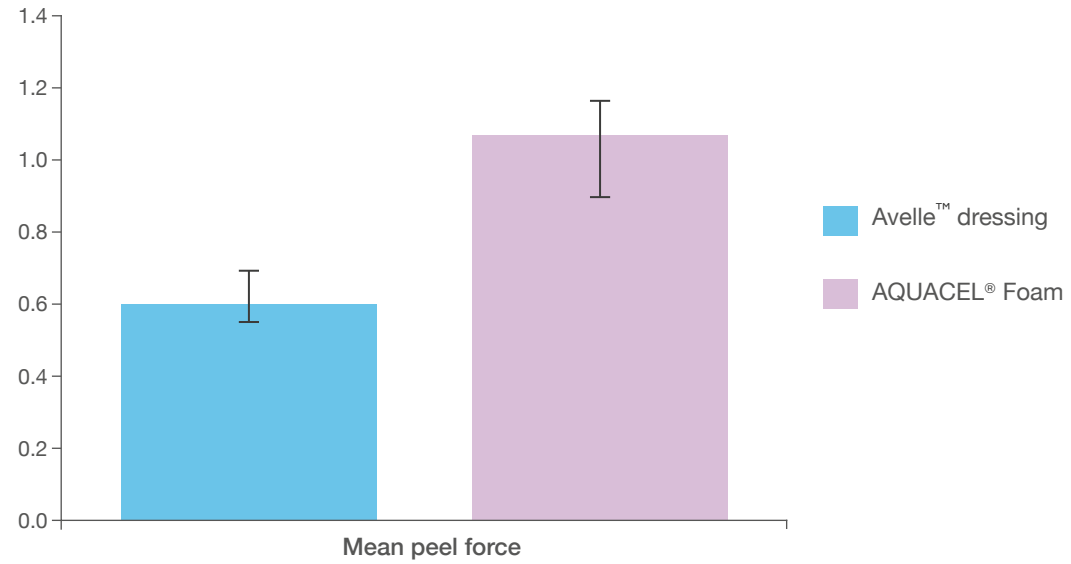
Figure 15: Simulated wound model 2cm deep (low flow rate): 108 ± 10 mL over 7 days with 4 layers of AQUACEL® Extra™ dressing



The Avelle™ NPWT dressing contains a gentle silicone adhesive border

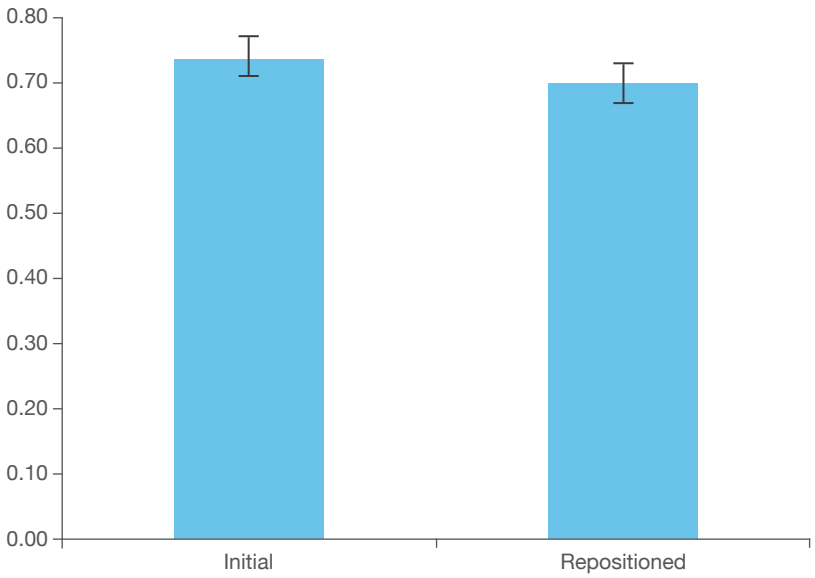
The silicone border of the Avelle™ NPWT dressing is designed to have gentle adhesive properties and can be repositioned. The ability to reposition the dressing increases the ease of dressing application, as it allows the final position of the dressing to be adjusted before it is secured with the fixation strips. The Avelle™ NPWT dressing also includes a strengthened Hydrofiber® Technology wound contact layer designed to maintain dressing integrity on removal[12]. Peel forces were investigated using a reproducible *in-vitro* test reporting the force required to remove the secured adhesive border from a standard frosted polycarbonate sheet surface[12]. Investigations using this *in-vitro* peel test indicate the silicone adhesive border of the Avelle™ NPWT dressing leads to reduced peel forces compared to that of AQUACEL® foam dressings (Figure 16)[12]. In addition, peel forces are comparable after additional application and repositioning (Figure 17).

Figure 16: Mean peel force (N/cm) comparison of Avelle™ NPWT dressing versus AQUACEL® Foam dressing[12]



(Note: Error Bars represent minimum and maximum peel force values determined)

Figure 17: Mean peel force (N/cm) for Avelle™ NPWT dressing after initial application

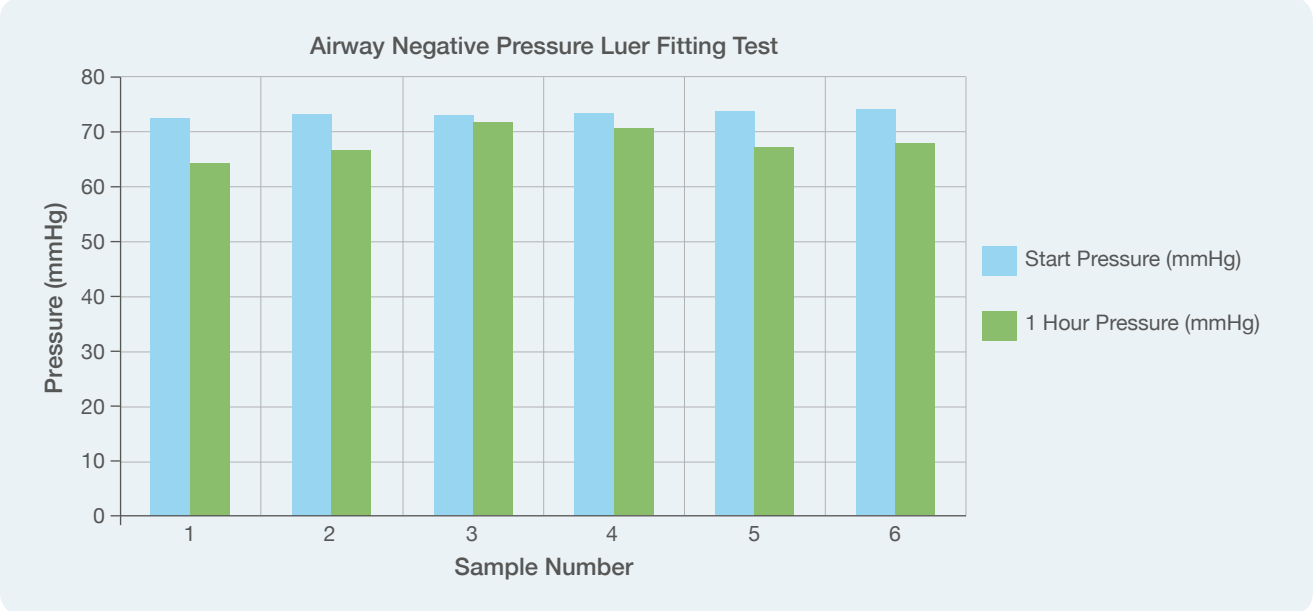


The Avelle™ NPWT dressing is designed to be an effective showerproof barrier and an effective bacterial and viral barrier

While the outer polyurethane layer allows moisture vapour transmission to facilitate exudate handling, it is also designed to be showerproof and protect the wound bed from contamination. Waterproofness of the dressing was investigated using an *in-vitro* testing method described in the British Pharmacopeia (BP). Briefly, a hydrostatic head of 500mm water was applied to the non-adhesive side of the dressing, while filter paper was applied to the adhesive side. The Avelle™ NPWT dressing was shown to provide a shower resistant barrier in in-vitro waterproof testing for up to 24 hours. In addition, the luer lock airway connector containing the one-way valve was shown to prevent water ingress to the Avelle™ NPWT dressing for up to 60 minutes of immersion. *In-vitro* bacterial testing found no bacterial penetration through the dressing after 8 days of incubation with a challenge suspension of Pseudomonas aeruginosa; a small, motile, Gram-negative wound pathogen; and *in-vitro* viral barrier testing indicated no evidence of viral penetration.

Prior to showering, the pump is turned off and separated from the dressing by disconnecting the luer lock airway connector from the pump tubing. The one-way valve within the luer lock connector enables the dressing to maintain negative pressure for approximately 60 minutes of light showering upon disconnection from the pump (Figure 18). The following graph demonstrates the airway luer fitting, connecting the dressing to the pump, can keep the dressing at pressure after removing the pump after 1 hour ± 10 mmHg[12].

Figure 18: Airway luer lock connector demonstrates maintaining pressure after removing the pump from the dressing after 1 Hour ± 10 mmHg[12]



Conclusions

Negative pressure of 80 mmHg has been shown to increase local blood flow in nonclinical models, and may reduce the risk of pain and ischaemia that patients receiving NPWT at greater negative pressure can experience[13]. The Avelle™ NPWT system is a novel, disposable, portable device incorporating Hydrofiber® Technology. The disposable, portable vacuum pump delivers a continuous nominal pressure of 80 mmHg ± 20 mmHg across the wound contact layer, even when the dressing is fully hydrated, and when used in combination with multiple Hydrofiber® Technology filler layers[12].

The *in-vitro* fluid handling capacity of the Avelle™ NPWT system is appropriate for use in the management of moderate or low exuding wounds, and comparable with a comparator system[12]. Fluid handing properties are maintained when used in conjunction with a Hydrofiber® Technology filler, thus the benefits of a Hydrofiber® Technology wound contact layer are preserved with use of a filler without impeding the capacity of the dressing to manage wound exudate as demonstrated in-vitro[12].

The fluid handling capacity of the Avelle™ NPWT dressing is facilitated by a showerproof outer polyurethane layer, which allows fluid transpiration, while also providing an effective bacterial and viral barrier as demonstrated in-vitro[12].

The showerproof outer polyurethane layer, which prevents water ingress, in addition to the luer lock airway connector between the dressing and the portable pump, allows the pump to be disconnected from the wound contact layer without significant loss of negative pressure over 1 hour as demonstrated *in-vitro*[12]. Thus, the dressing can be detached from the pump for short periods of time during routine use, greatly increasing convenience to the patient.

The Avelle™ NPWT system therefore represents a convenient and effective way of incorporating Hydrofiber® Technology into a portable NPWT device, thereby allowing patients to experience the combined benefits of negative pressure therapy and Hydrofiber® Technology.

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