

Real-life experiences of a single-use, canister-based NPWT system

This report summarises the proceedings of an industry-sponsored symposium (held during the European Wound Management Association 2023 Conference) at which an international group of clinical specialists shared their experiences of using Avance® Solo (Mölnlycke Health Care, Gothenburg, Sweden) – a single-use, canister-based negative pressure wound therapy (NPWT) system – in the management of both open wounds and closed surgical incision sites.

NPWT is one of a number of advanced interventions that clinicians consider when the use of passive dressings alone is deemed to be insufficient for the topical management of wounds. At the start of her presentation, Rosa Somma described NPWT as the topical application of negative (sub-atmospheric) pressure at the wound-dressing interface. Numerous NPWT systems are described in the literature but they all generally follow the same basic principles, i.e. (i) coverage/filling of a wound with a dressing, (ii) creation of a seal by applying an adhesive dressing or drape, (iii) application of negative pressure via tubes which connect the dressing to a pump and a canister for fluid collection (Norman et al, 2020).

The 'traditional' NPWT systems are reliant on a mains electricity source which, when taken

into consideration alongside their size and weight, has restricted their use to mainly acute care. However, the introduction of portable, single-use negative pressure wound therapy (suNPWT) systems that are typically lighter and smaller in size than their traditional counterparts and are powered mechanically or by batteries, has enabled this much-valued therapy to be accessible to a greater population of patients, such as those in post-acute and community care settings (Orlov and Gefen, 2022). The available suNPWT systems generally fall into one of two categories, i.e. whether they are supplied with a canister or otherwise. Canister-free systems rely solely on the dressings to manage exudate through absorption and evaporation. In contrast, the canister-based (CB) systems, such as Avance® Solo [Figure 1], incorporate a canister in their design, which enables exudate



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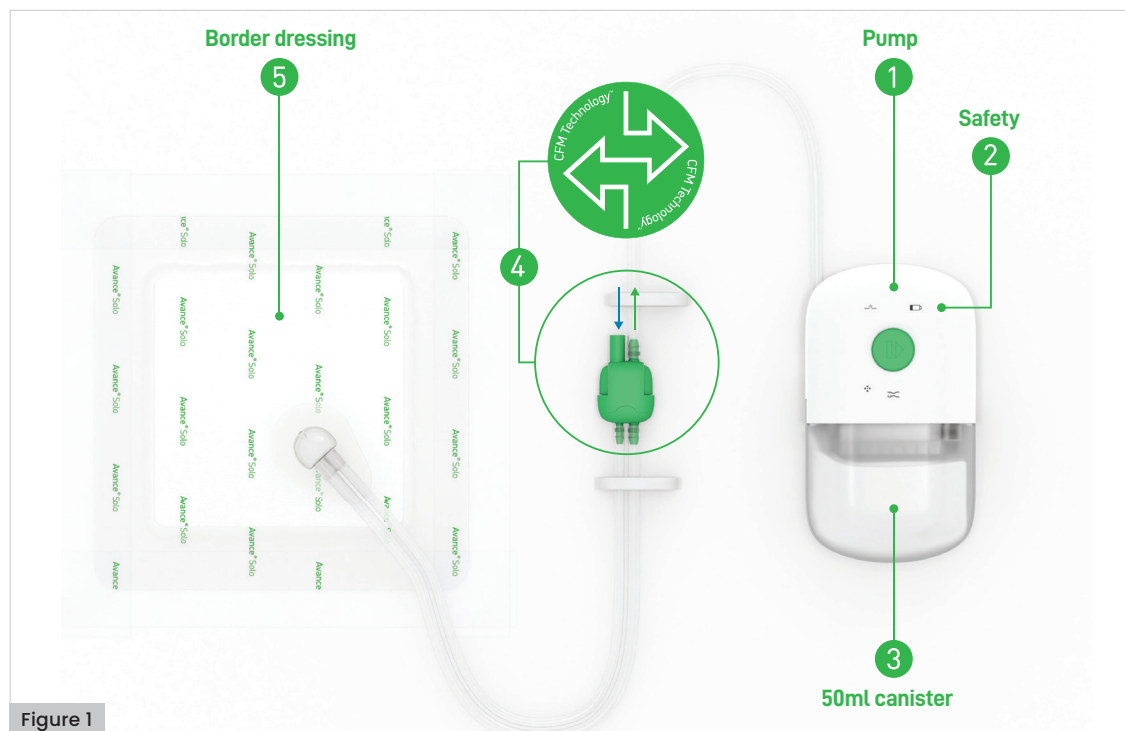


Figure 1. The Avance® Solo NPWT System: (1) pump; (2) audible and visible notifications and alarms; (3) 50 ml canister; (4) 'quick' connector featuring Controlled Fluid Management (CFM) Technology™(5) bordered dressing.

Key words

- Exudate
- Single-use, canister-based NPWT system
- Surgical wound dehiscence

and infectious material to be continually removed from the dressing that is in contact with the wound (Henriksson, 2021).

Rosa went on to describe how NPWT causes two types of tissue deformation – macro-deformation (i.e. visible to the naked eye) and micro-deformation (i.e. at the microscopic level) [Figure 2]. She then focused on the wound-dressing interface, comparing a foam dressing typically used with a traditional NPWT system with the multi-layer dressing supplied with the Avance Solo NPWT system.

Rosa described how, with the traditional NPWT system, the application of pressure causes the dressing to displace into the wound cavity, resulting in a pressure differential between the margins (higher pressure) and centre (lower pressure) of the wound. This higher pressure has the potential to compress capillaries and create hypoperfusion which, in turn, inhibits cellular proliferation [Figure 3a]. In comparison, the structure of the multi-layer dressing supplied with Avance Solo is more resistant to the effects of the applied pressure and, thus, promotes a more even distribution of pressure across the wound without areas of hypoperfusion [Figure 3b]. While positive pressure and mechanical aggravation stimulate the formation of granulation tissue, mechanical traction and hypoperfusion inhibit cell proliferation and wound edge advancement.

Rosa then described her clinical experience using Avance Solo, a single-use NPWT system designed with a canister and featuring Controlled Fluid Management (CFM) Technology™. This technology secures continuous delivery of effective negative pressure therapy of -125 mmHg to the wound site. A controlled inflow of air through a filter placed in the ‘quick’ connector manages transportation of excess exudate from the dressing and it is collected in the canister. With CFM Technology™, the delivery of negative pressure is not compromised by fluid accumulation in the absorptive dressing – a

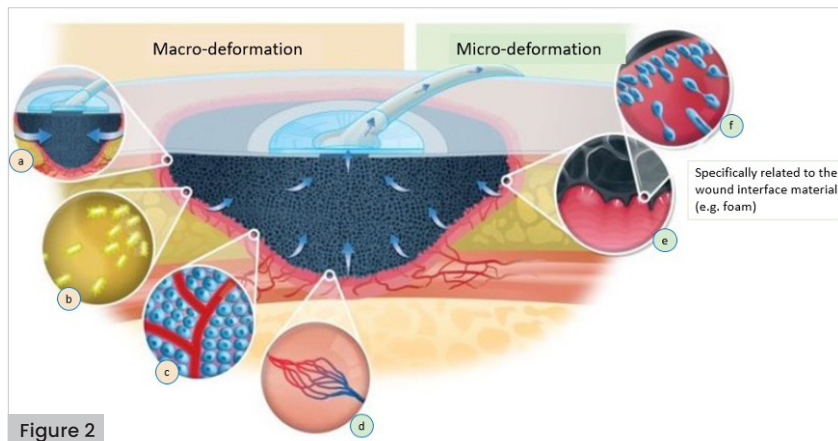


Figure 2

Figure 2. Mode of action of traditional NPWT systems – at the macro-level, draws wound edges together (a), removes infectious material (b) and reduces oedema (c); at the micro-level, promotes angiogenesis (d), tissue micro-deformation (e) and cell stretch (f) (Morykwas et al, 1997; Wackenfors et al, 2004; Chen et al, 2005; Timmers et al, 2005; Torbrand et al, 2017).

shortcoming often associated with canisterless NPWT systems.

With the Avance Solo NPWT system, exudate and infectious material are managed by a combination of absorption in the multi-layer bordered dressing, and transportation of excess fluid to the canister, therefore reducing the risk of the dressing becoming saturated and interrupting the delivery of negative pressure to the wound (Henriksson, 2021; Orlov and Gefen, 2021).

Avance Solo is intended for use on a variety of surgical closed wounds, open wounds, grafts and flaps. The dressing is designed with Safetac® technology in both wound contact layer and borders, and the dressing can be combined with a foam wound filler for cavity wounds.

Cases using NPWT with and without a canister

Rosa detailed a case where healing of a wound had been delayed by 3 to 4 weeks after the use of a system without a canister. The system was unable to correctly manage the exudate and resulted in maceration of the periwound skin and compromised the healing process.

Figure 3. Impact of NPWT dressing after application of negative pressure. **a.** Traditional NPWT dressing (foam and film). Application of pressure causes dressing to displace into the wound cavity, causing pressure differential. Higher pressure points at wound margin. As the film is drawn over the wound margin into the cavity, blood vessels are compressed, creating zones of hypoperfusion (red circles) at the margin. **b.** Avance Solo multi-layer dressing is less pliable and bulkier than traditional dressing, thus is less displaced in the wound cavity. This results in more uniform pressure distribution and the avoidance of hypoperfusion zones at wound margin (blue circles).

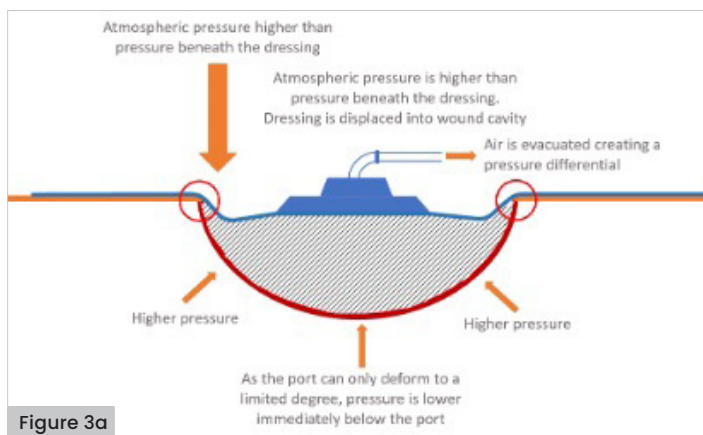


Figure 3a

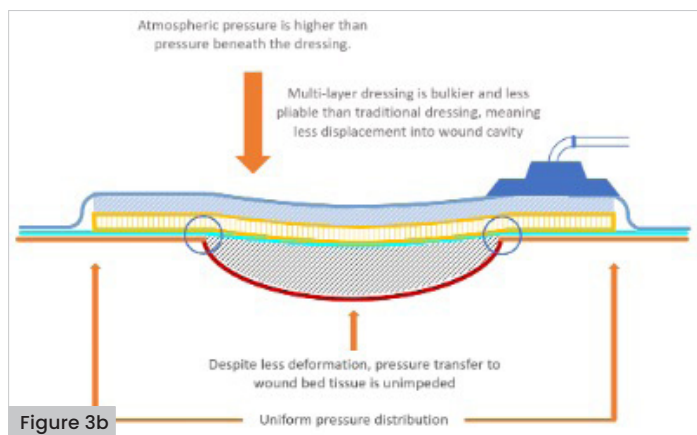


Figure 3b

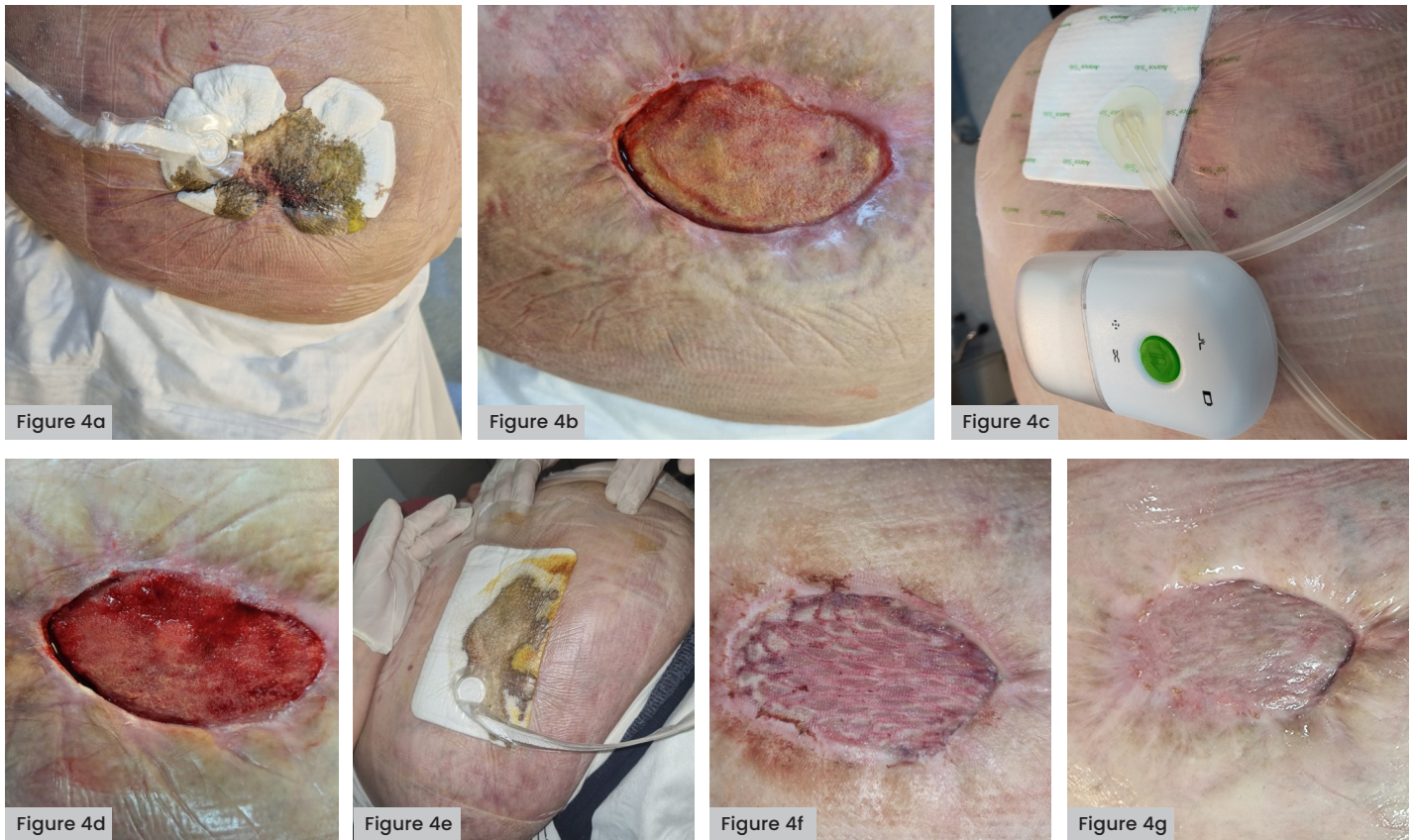


Figure 4. Poorly managed exudation with previously used canister-less suNPWT device, **a**, resulting in periwound maceration and compromised healing, **b**. Following ultrasound debridement, treatment with Avance Solo commenced, **c**, and the periwound problems had resolved within 10 days. The patient then underwent a skin graft procedure before a canister-less suNPWT device was applied, **e**. The skin graft became damaged, requiring intervention (topical haemoglobin spray) to save the graft, before complete healing was achieved.

Following an ultrasound debridement, the use of Avance Solo resolved the damage in 10 days. The patient then underwent a skin graft but, again, a system without a canister damaged the skin graft [Figure 4].

Managing exudate and stimulating perfusion are important and the inclusion of a canister in the Avance Solo system enables exudate and infectious material to be continually removed from the dressing that is in contact with the wound. In the absence of a canister, the dressings used in conjunction with canisterless systems are only able to manage exudate by absorption and evaporation (Henriksson, 2021).

In the final part of her presentation, Rosa described how a small pilot study (5 patients) had been undertaken to evaluate the ability of Avance Solo to manage exudate and stimulate perfusion of wounds of various aetiology. NPWT was used for a 4-week period, with weekly dressing changes. Dressings were weighed before application and after removal in order to measure exudate quantity. Laser photography was used to measure wound size and micro-circulation in the wound bed was assessed by laser doppler imaging. The case presented in Figure 5 is typical of the outcomes observed for all patients.

Dehiscence prevention with NPWT: The reality in cardiothoracic surgery

Viviana Gonçalves outlined the work conducted at her Cardiothoracic Surgery Department, which is the biggest such department in Portugal and carries out approximately 1,600 cardiac surgeries per year. Before each surgery, the patient undergoes a consultation to address modifiable and non-modifiable risk factors for surgical wound complications and dehiscence. Preventative and risk-reduction measures are taken where possible before the surgery.

Surgical wound dehiscence is the separation of the margins of a closed surgical incision, with or without exposure or protrusion of underlying tissue, organs or implants (Sandy-Hodgetts, 2018). It tends to be more common in patients classed as high-risk with comorbidities such as diabetes, peripheral vascular disease or obesity, as well as those who have undergone multiple surgeries with time gaps. Female patients are found to be at a higher risk of dehiscence.

NPWT has been shown to lower the incidence of dehiscence and infection in post-surgical wounds (Stannard et al, 2012; Wounds UK, 2013), and it is often used in the management of complex wounds where wound healing is particularly challenging. NPWT at -125mmHg as

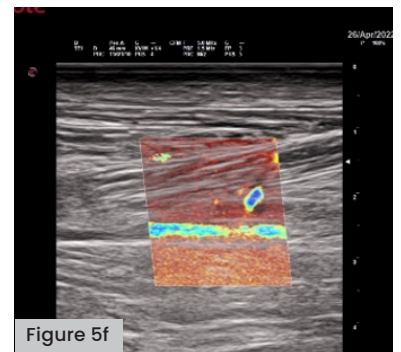
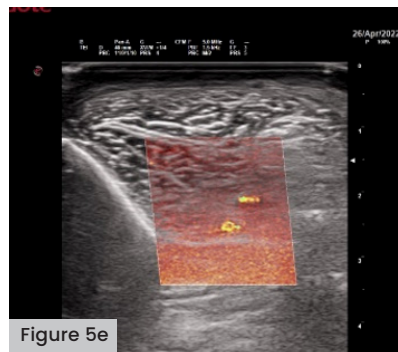
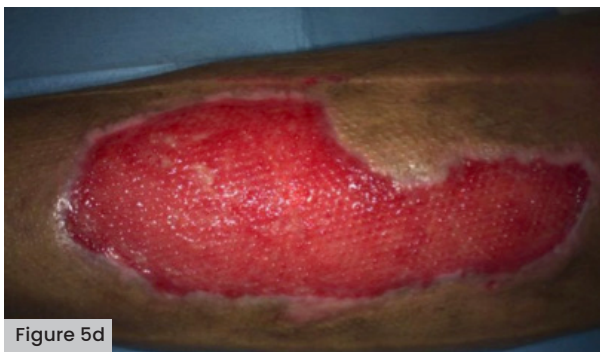
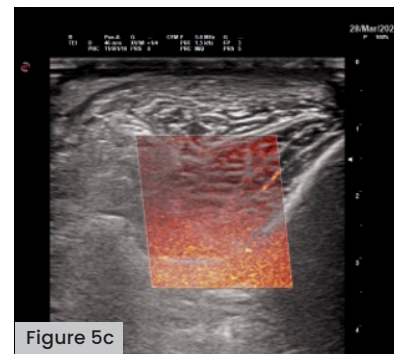
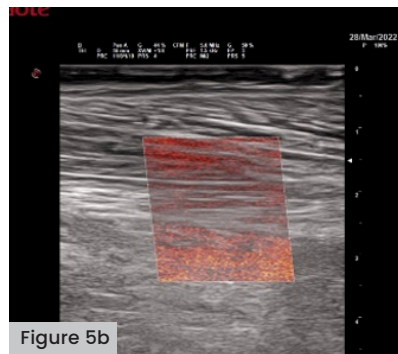


Figure 5. The patient was a 63-year-old female who presented with a 3-month-old traumatic wound, resulting from a motorcycle accident. The moderately exuding wound, located on the right shin, measured 90.7 cm² with a depth of 1.4 cm, **a**. Avance Solo treatment was commenced and, over a period of 28, the wound decreased in size (73.6 cm²) and depth (2 mm) with concomitant reduction in exudate levels, **c**. More striking was the increased perfusion after 4 weeks of NPWT, **e,f**, relative to that at the start of therapy. **b,c**, At this point, the wound was suitable for grafting.

Table 1: Intended uses of the Avance® Solo NPWT system.

<p>Surgically closed incisions</p>	<p>Open wounds:</p> <ul style="list-style-type: none"> • Chronic, acute, traumatic, subacute and dehisced wounds • Ulcers (such as diabetic, venous or pressure) • Flaps, grafts
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a preventative measure has also been found to have a good cost-benefit ratio, as well as better scarring outcomes.

Viviana talked through some patient case studies, which showed some positive results using NPWT after heart surgeries (see Box 1 for summarised case studies).

Case study evaluations of NPWT on open wounds

The Avance Solo system can be used in a variety of wound types, as seen in Table 1. Arja Korhonen introduced some recent case studies where NPWT was used with positive results on some complex open wounds (see Box 2 for summarised case studies).

Finally, Tiina Pöllänen presented two case studies in which the Avance Solo System was associated with successful management of both open surgical wounds and closed surgical incision sites [Box 3].

Conclusions

The application of NPWT has emerged as an effective means of reducing the risk of

generally avoidable complications. The case studies shared in this symposium demonstrated its efficacy and safety in a wide range of clinical settings.

Historically, the use of NPWT was generally confined to acute care, mainly due to the size and weight of the systems and their dependence on a mains electricity source. The recent introduction of portable, single-use systems has now opened up NPWT to hospital outpatients and those being cared for in the community, including ambulatory patients.

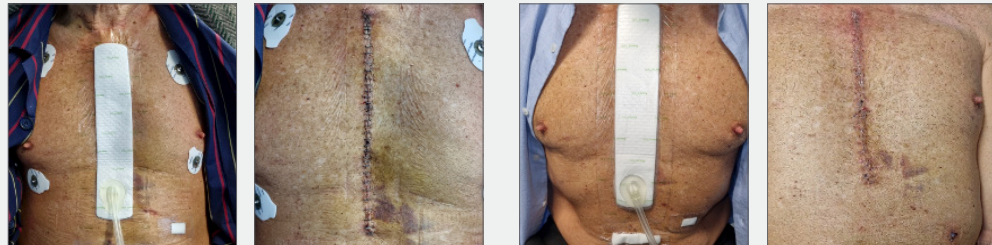
With the Avance Solo NPWT system, exudate and infectious material are managed by a combination of absorption in the multi-layer bordered dressing and transportation of excess fluid to the canister, therefore reducing the risk of the dressing becoming saturated and interrupting the delivery of negative pressure to the wound (Davies, 2022).

The cases presented by the speakers on the use of Avance Solo in practice demonstrated accelerated and effective healing in a variety of wound types. ●

Box 1. Case studies presented by Viviana Gonçalves.

• **Case 1**

The patient was a 62-year-old male who underwent his third heart surgery – he had his first and second surgery when he was 50 and 58 years of age, respectively. The patient had a history of smoking and diabetes. NPWT with Avance Solo was commenced and, 14 days after the surgery, all the suture materials were removed without any complications. A good quality, functional scar remained without keloids. Dehiscence was prevented and the patient reported no side effects of the surrounding skin.



After 7 days with Avance Solo

After 14 days with Avance Solo

• **Case 2**

The patient was a 19-year-old male who underwent his second heart surgery. He underwent his first heart surgery when he was 17 years old, involving the correction of a congenital defect. The patient had an allergy to acrylic dressings and suture material. NPWT with Avance Solo was commenced and, 14 days after the surgery, the sutures were removed without complications. A good quality, functional scar remained without keloids. Dehiscence was prevented, and the patient reported no side effects of the surrounding skin and no allergies to the dressing.

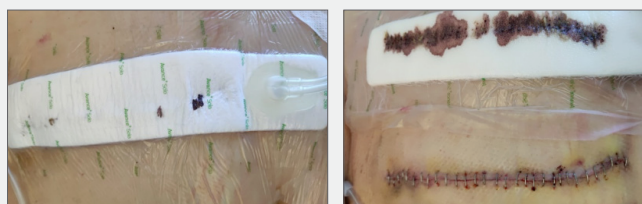


After 7 days with Avance Solo

After 14 days with Avance Solo

• **Case 3**

The patient was a 67-year-old female who underwent her first heart surgery. She had multiple comorbidities including diabetes, obesity, chronic kidney disease and peripheral vascular disease. NPWT with Avance Solo was commenced and, 14 days after the surgery, all the suture materials were removed without any complications.



After 14 days with Avance Solo

• **Case 4**

The patient was a 58-year-old male who was a heavy smoker. He underwent his first heart surgery, which involved a mitral valve replacement and a sternotomy. NPWT with Avance Solo was commenced and, 14 days after the surgery, all the suture materials were removed without any complications, no keloids and a good quality, functional scar. Dehiscence was prevented and the patient reported no side effects of the surrounding skin.



After 7 days with Avance Solo

After 14 days with Avance Solo

Box 2. Case studies presented by Arja Korhonen.

• Case 1

The patient was a 46-year-old female who suffered a wound to the back of her calf after a length of plywood dropped onto her leg. The wound extended to the surface of the Achilles fascia and was about 10cm from the heel nodule upwards. Almost 2 weeks after experiencing the wound, the patient was treated with honey, gelling fibre dressings and polyurethane foam dressings. Compression therapy was also initiated with a support sock. At the wound base, the Achilles tendon was visible.

Approximately 3 weeks had passed since the wound occurred to when treatment with Avance Solo commenced and at the fourth dressing change, the surgeon assessed the situation and decided to instigate a skin graft. NPWT continued after skin grafting with a gelling fibre dressing used under the Avance Solo dressing. Approximately 2 weeks after the skin graft, NPWT was discontinued as the wound was healing well.



Treatment commenced with honey, gelling fibre dressings and polyurethane foam dressings



First dressing change after 10 days. Therapy with Avance Solo commenced



First dressing change since skin graft surgery. Exufiber (gelling fibre dressing) used under Avance Solo dressing on skin graft



Scar control 3 weeks after the skin graft and 11 days after discontinuing NPWT

• Case 2

The patient was a 67-year-old female who had prosthetics of the aortic valve installed due to aortic stenosis. She sustained a wound of the right lower limb, which had opened up due to oozing tissue fluid. The wound on the right lower limb had to be opened up at hospital due to excess tissue fluid. Nine days after the patient had prosthetics of the aortic valve installed, NPWT with Avance Solo was commenced.

After 8 days of treatment and according to the surgeon's instructions, NPWT was discontinued a week later due to bleeding, which was related to warfarin anticoagulant administration. A week later, Avance Solo treatment was commenced and soon after, the patient was discharged and the dressings were changed twice a week by home nurses. Despite haematoma on the wound, the wound base was healing well. NPWT with Avance Solo was discontinued 3 weeks later and the wound continued to heal.



Nine days after the application of the prosthetics of the aortic valve. Therapy with Avance Solo commenced



Eight days later, NPWT with Avance Solo was stopped due to bleeding. Therapy with Avance Solo was commenced 4 days later



After a week of treatment, the patient was discharged home and home nurses changed dressings twice a week



After a month of treatment, therapy with Avance Solo was discontinued

Box 3. Case studies presented by Tiina Pöllänen.

• **Case 1**

The patient was an obese 61-year-old female with rheumatoid arthritis and had back problems. She had been diagnosed with an endometrial carcinoma and ovarian tumour and had undergone a laparotomy. Approximately 1 month after the surgery, the lower part of the incision site had re-opened. NPWT with Avance Solo was applied to the 10cm deep cavity wound. The patient was also provided with information and advice about the importance of adequate nutrition for wound healing, as she reported having no appetite and needing support.

Dressings were changed twice a week and the patient said that she was eating better and feeling better. The cavity wound began to heal and reduced in depth (to 1.5cm) within 3 weeks of commencing therapy with Avance Solo. After a further week of NPWT, the wound was observed to be superficial and the patient was ready to commence chemotherapy.



Cavity wound (10 cm depth) re-opened at bottom of incision site. Therapy with Avance Solo commenced



After 3 days of therapy with Avance Solo



After 3 weeks of therapy with Avance Solo. Wound depth reduced to 1.5 cm



After 4 weeks of therapy with Avance Solo. Superficial wound.

• **Case 2**

The patient was an 83-year-old male with a number of comorbidities including type 2 diabetes, gout, hypercholesterolemia and hypertension. He had developed gouty nodules on his left elbow, which progressed to exuding cavities. The wounds failed to respond to local treatments, which resulted in surgical revision of the elbow.

Following surgery, the wound was left open and NPWT with Avance Solo was commenced. Within two days of commencing NPWT, the condition of the wound had improved. Dressings were changed twice a week and the wound was surgically closed 12 days later. Avance Solo was continued and, 1 month later, the cavity had healed. Only a small wound remained.



Exuding cavity wound. Therapy with Avance Solo commenced



Wound condition improved. Surgically closed 12 days later



Avance Solo continued on closed surgical incision



Cavity healed after 1 month. Small wound remained

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