Optimising healing by achieving wound balance: a case-based analysis of Zetuvit® Plus Silicone Border for acute and chronic wound management

This publication is the second of two in a series highlighting the importance of achieving wound balance for chronic and acute wounds. The first publication emphasised the importance of restoring a normal wound healing trajectory to achieve this goal. This second publication explains how, once restored, this trajectory can be maintained. It is crucial that each treatment plan is tailored to patient's goals while maintaining the balance between clinical needs and expected outcomes. Superabsorbent polymer (SAP) dressings can help achieve these goals by steering and maintaining the wound on a healing trajectory while optimising wound balance. The previous publication highlighted how hydro-responsive wound dressings, including HydroClean®/HydroClean®Advance, address signs of chronicity by promoting autolytic debridement, infection control and moisture balance to form a healthy, granulating wound bed. This current publication presents case studies from the Middle East depicting how Zetuvit® Plus Silicone Border, a SAP dressing, optimises the wound microenvironment/biomarkers to promote wound balance and, ultimately, healing.

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Key words
- Chronic and acute wounds
- HydroClean®
- Superabsorbent polymer dressings
- Wound balance
- Zetuvit® Plus Silicone Border

Wounds, whether acute or chronic, can negatively affect a patients' quality of life (QoL) and place a huge burden on clinicians and healthcare systems (Phillips et al, 2018). Within high-income countries, a prevalence of 1-2% has been suggested for chronic wounds, highlighting the importance of timely and optimal interventions to promote clinical outcome improvement (Olsson et al, 2019).

Wound healing occurs through four phases: haemostasis, inflammation, proliferation and remodelling – each stage identified by specific biomarkers, with wounds becoming chronic if these healing phases are impaired (Guo and LaPietro, 2010; Lindley et al, 2016). A large number of complicating factors/comorbidities can contribute toward this chronicity, including systemic disorders (e.g. diabetes and neuropathy), malnutrition or malabsorption of essential nutrients, aging, wound recurrence and certain medications (e.g. immunosuppressants, corticosteroids and anticoagulants, among others; Sibbald et al, 2021). All of these factors inhibit the normal wound healing processes and may be present concomitantly (Sibbald et al, 2021). It is crucial to remember that an apparently acute wound may be complex and at risk of becoming chronic in the presence of comorbidities (Sibbald et al, 2021). In addition to these complicating factors, effective exudate management plays a crucial role in wound healing. Although exudate production is a natural component of healing by maintaining a moist environment (World Union of Wound Healing Societies [WUWHS], 2019; Wounds International, 2023), excessive exudate may increase the risk of infection due to strikethrough, and peri-wound maceration (Fletcher et al, 2020), predisposing surrounding skin to breakdown and excoriation (Voegeli, 2012; WUWHS, 2019). Exudate management is especially important in chronic wounds because this exudate often contains elevated levels of healing inhibitors such as excessive levels of polymorphonuclear elastase and matrix metalloproteinases (MMPs) – specifically MMP-2 and MMP-9 (Mikosinski et al, 2022; Wounds International, 2023). Therefore, dressing choices to manage exudate play a central role in wound management. It is important to remember that, in addition to these physiological factors, other factors can negatively impact the healing journey (e.g. depression, lack of access to care in remote areas or sub-optimal socioeconomic status; Fayne et al, 2020). Due to this multidimensional and complex picture, it is important that diagnosis and intervention occurs as early

Declarations
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as possible and comorbidities are managed (Frykberg and Banks, 2015). Early intervention can help reduce these complicating factors and improve the probability of healing for acute and chronic wounds (Hwang, 2023). Early and timely intervention with clear communication regarding wound management promotes patient engagement, thereby improving outcomes (Fayne et al, 2020; Wounds International, 2023; Blome et al, 2024).

The concept of wound balance provides a multidimensional, comprehensive approach to healing, aiming to simultaneously optimise wound environment management, patient goals, and clinical care (Sen, 2020; Wounds International, 2023; Blome et al, 2024; Trouth, 2024). It embraces the physiological, social and psychological factors that may affect the healing journey in individual clinical settings (Wounds International, 2023); through this multidimensional approach, wound balance is achieved, allowing for healing of complex and/or chronic wounds (Trouth, 2024).

Integral to achieving wound balance is the choice of an appropriate wound dressing that is easy-to-use and provides atraumatic dressing changes, while managing high levels of exudate and wounds with increased levels of MMPs (Blome et al, 2024). In addition, these dressings should be appropriate for the management of both acute and chronic wounds, able to modulate the wound microenvironment and available across a range of clinical settings (Wounds International, 2023; Blome et al, 2024).

Latest advances in wound dressing technology have shown promising results in microenvironment modulation toward healing in complex and/or chronic wounds, indicated by a rise in biomarkers involved in healing (Barrett et al, 2018; 2020; Mikosinski et al, 2022; Wounds International, 2023). These studies demonstrate that dressings containing superabsorbent polymers (SAPs) effectively stabilise harmful biomarker levels (e.g. excessive MMPs) by sequestering them away from the wound, absorb excess exudate and help achieve atraumatic dressing removal (Barrett et al, 2018; 2020; Mikosinski et al, 2022; Rando, 2024). For instance, Zetuvit® Plus Silicone Border has been shown to effectively manage different levels of exudate (Barrett et al, 2020). This absorption of excessive exudate prevents maceration and peri-wound damage that may otherwise occur (Call et al, 2019; Barrett et al, 2020). It also helps maintain an adequate level of moisture in the wound microclimate ensuring optimal moisture balance (Call et al, 2019; Barrett et al, 2020). It absorbs and sequesters healing inhibitors (e.g. MMPs and microorganisms) which tips the wound microenvironment toward healing

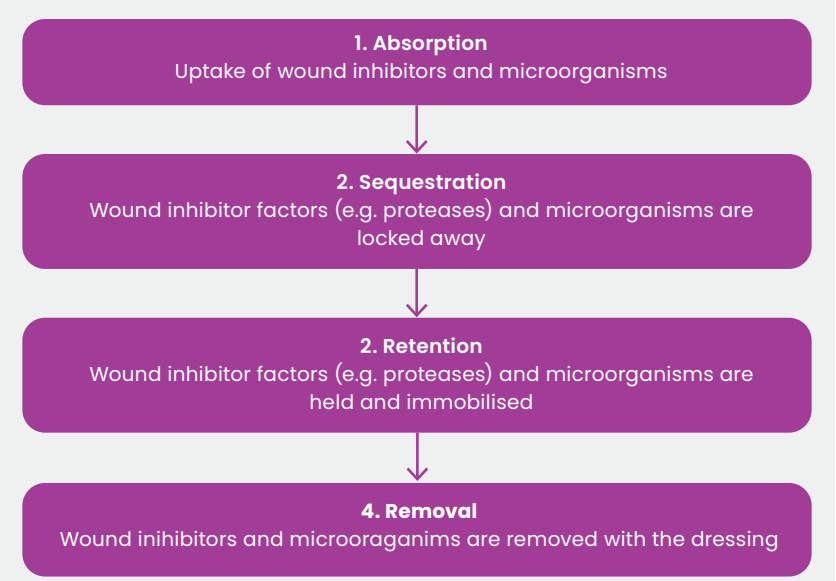

Figure 1

Figure 1. The mechanism of action of Zetuvit® Plus Silicone Border dressing. (Adapted from Wounds International, 2023.)

[Figure 1; Wounds International, 2023]. Through effective exudate management, there is an improvement in a patients' QoL by preventing leakage and related complications (Hiskett, 2020), potentially increasing patient engagement and improving treatment outcomes.

Impact of Zetuvit® Plus Silicone Border – clinical case studies

The following case studies were undertaken to assess the effectiveness of Zetuvit® Plus Silicone Border in facilitating wound closure and improving patients' QoL. Patient consent has been received for publication of all images.

Case studies 1 and 2 are a continuation of cases presented in the first paper, where the mechanism of action of HydroClean®/ HydroClean Advance was discussed in facilitating a shift from a chronic to an acute wound environment.

This publication demonstrates how wound healing was facilitated by the mechanism of action of SAP dressings by leveraging the wound balance concept: the trajectory of wound healing was successfully modulated from chronic to acute via HydroClean®; subsequently, the Zetuvit® Plus Silicone Border helped ensure further control of wound inhibitors.

Case Study 1. Open fracture, with exposed bone

History: A 31-year-old male presented with an open fracture and wounds located at the anterior aspect of the left leg, along with three necrotic areas [Figure 2a]. Treatment commenced with HydroClean® to promote autolytic debridement to form a healthy granulating wound bed, although signs of hyper-granulation tissue were observed, especially

Case Study 1

Figure 2

Figure 2. a) Wound presentation before the first application of HydroClean® (Day 0), b) HydroClean® was stopped and Zetuvit®Plus Silicone Border was initiated as the primary dressing (the picture depicts the status of the wound achieved via HydroClean®; Day 12), c) Wound presentation before the first application of Zetuvit®Plus Silicone Border (Day 25), d) Day 27, e) Day 48, f) Day 102

within the region of bone penetration [Figure 2b]. Possible signs of wound infection were also observed, which were treated with oral antibiotics (Co-Amoxiclav, 1gm twice a day for 2 weeks).

Treatment: Following debridement, granulation was noted and , Zetuvit® Plus Silicone Border was selected as the primary dressing due to its ability to manage exudate levels, and to protect surrounding wound skin and its ability to conform easily to the wound bed. The dressing was stretched to exert mild pressure to manage possible hyper-granulation formation. Hydrocortisone cream was used to treat the three smaller wounds. As signs of infection persisted, a silver wound contact layer dressing (HARTMANN) was applied to manage the infection. Zetuvit® Plus Silicone Border was the dressing of choice, once there were no signs of clinical infection, with the aim to achieve wound healing.

Results: The combined use of the silver and Zetuvit®Plus Silicone Border dressings successfully controlled local infection and bacterial load, managed exudate levels, prevented maceration, and was comfortable for the patient, with wound healing achieved [Figure 2f]. No discomfort was reported during removal. Hyper-granulation in all wounds was successfully resolved by exerting mild pressure via the Zetuvit® Plus Silicone Border dressing. This case study demonstrates how the trajectory of the wound was modulated from chronic to acute with HydroClean®. Zetuvit®Plus Silicone Border was then used to ensure further control of wound healing inhibitors through the wound balance concept.

Case Study 2. Lower limb ischaemic ulcer with an exposed tendon

History: A 68-year-old female presented with a 42-day old ischaemic ulcer on the outer dorsal side of her left foot. It consisted of 100% necrotic tissue, and macerated wound edges. Signs of oedema and infection were present [Figure 3a]. HydroClean® Advance was selected as the primary dressing, and a healthy granulating wound bed was achieved [Figure 3b].

Treatment: From day 140, Zetuvit® Plus Silicone Border was applied as a primary dressing to balance the wound micro environment by managing excess exudate and wound healing inhibitors. The treatment goals included prevention of maceration, dressing conformability and comfort for the patient. Healthy granulation and new epithelisation tissue was achieved while only requiring dressing change once every 5 days.

Results: Zetuvit® Plus Silicone Border successfully managed exudate levels, protected

Case Study 2

Figure 3

Figure 3. a) Wound presentation before the first application of HydroClean® (Day 0), b) Wound presentation before the first application of Zetuvit®Plus Silicone Border (Day 140), c) Day 157, d) Day 187, e) Day 222, f) Day 240, g) Day 281, h) Day 309

the surrounding skin, and prevented maceration. It also conformed to the patient's body contours, providing comfort and coverage. The dressing helped to encourage formation of granulation and epithelialisation tissue by maintaining moisture balance in the wound bed. There was no discomfort reported during dressing wear and removal. Although ischemic cases are very challenging to treat, the combination of HydroClean® Advance and Zetuvit® Plus Silicone Border successfully supported healing throughout the wound trajectory.

Case Study 3. Stevens-Johnson syndrome

History: A 33-year-old female presented to the emergency department with Bullous Systemic Lupus Erythematosus (BSLE) in association with autoimmune haemolytic anaemia. Following treatment with sulphonamide antibiotics, she unfortunately developed widespread blistering across her body, with a notable concentration around the underarms, mouth and neck. The diagnosis was amended to include Steven-Johnson syndrome, primarily attributed to the use of the sulphonamide antibiotic. The patient was subsequently referred to a wound care team (WCT) for specialised management of her lesions.

The WCT identified two wounds within the anterior upper chest region. One was located on the left side of the chest, measuring 4cm (length) x 3.2cm (width), and the other was on the right side of the chest, measuring 3.5cm (length) x 4cm (width) [Figure 4a]. Clusters of smaller, ulcerated areas surrounded both wounds. The surrounding skin was dry, and the patient was experiencing severe wound-related pain. Prompt medical intervention included drainage of accumulated fluid from the lesions.

Treatment: Biosynthetic membrane dressings were initially applied to facilitate healing and minimise complications. The biosynthetic membrane encouraged excessive moisture development and had limited absorbency, with the clinicians reporting that it did not remain *in situ*. Following reassessment, Zetuvit® Plus Silicone Border was chosen to cover the wounds due to its ability to sequester and retain wound exudate, accelerate wound healing and enhance comfort through its cushioning and padding effect. At the first review, all the cluster wounds had fully healed with the condition of the surrounding skin improving and appearing healthy. The patient no longer experienced wound-related pain [Figure 4b]. By the fourth review, the two major chest wounds had completely healed [Figure 4d].

Results: Zetuvit® Plus Silicone Border successfully created a healthy wound environment for healing fragile and painful wounds through its superior absorption

Case Study 3

Figure 4

Figure 4. a) Day 0, b) Day 9, c) Day 28, d) Day 35

capacity, moisture balance properties, gentle adherence and good cushioning/padding effect. The silicone border created an effective, yet gentle, seal to prevent leakage, with the dressing staying in place on the frail peri-wound skin. The dressing protected the fragile granulation tissue, promoted accelerated re-epithelialisation and ensured patient comfort during wear and removal. The reduction in pain and itching improved the patient's QoL.

Case Study 4. Posterior neck carbuncle

History: A 45-year-old female, with a complex history of diabetes mellitus and hyperlipidaemia, presented with an abscess that developed into a carbuncle, requiring surgical excision and suturing. Carbuncles are a type of hair follicle infection caused by certain bacteria (mostly Staphylococcus aureus) and affect multiple adjoining hair follicles, resulting in inflammation, pain, fever and tiredness (National Library of Medicine, 2022). Nine days post-surgery, the patient returned with mild swelling and discomfort. A post-operative film dressing with an absorbent pad was applied; however, 2 days later, she returned with increased swelling, pain and wound discharge, prompting the use of single-use negative pressure wound therapy (sNPWT). Unfortunately, this therapy increased her pain, and the wound remained infected, with high exudate. Traditional NPWT with a canister was then applied. After 9 days, she continued to experience pain; the wound measured 3cm (length) x 1cm (width) x 1.5cm (depth), and contained 70% slough and 30% granulation tissue [Figure 5a]. The wound was highly contaminated, causing moderate wound-related pain.

Treatment: As the wound showed limited healing progress with NPWT, the treatment plan was reviewed and Zetuvit® Plus Silicone Border

Case Study 4

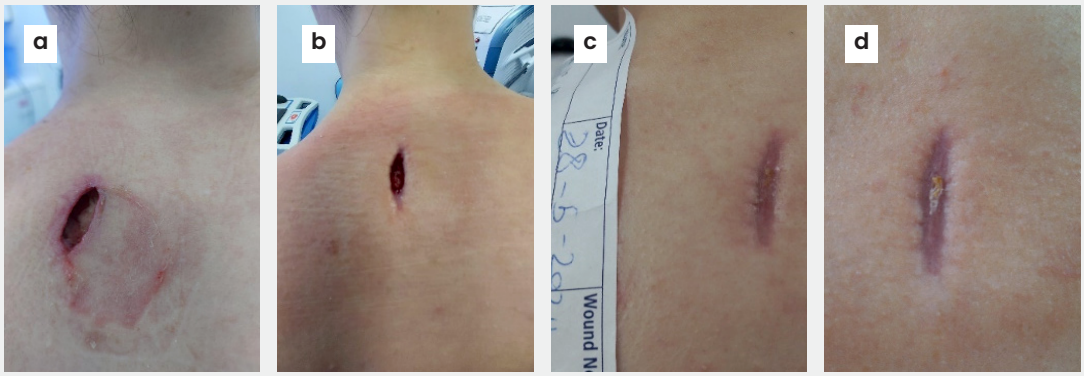

Figure 5

Figure 5. a) Day 0, b) Day 21, c) Day 43, d) Day 45

Case Study 5

Figure 6

Figure 6. a) Day 0, b) Day 10, c) Day 13

chosen for its absorptive qualities and gentle interface. This dressing was used until complete healing.

Results: After 45 days of treatment, the carbuncle healed completely [Figure 5d]. Zetuvit® Plus Silicone Border effectively managed the wound environment and promoted healing. This facilitated faster granulation and epithelisation. It also decreased the risk of hyper-granulation due to the light pressure exerted by the dressing. Zetuvit®Plus Silicone Border was easy to apply and adjust, conformed well to the body's contours, reduced pain and improved QoL. The patient found the dressing comfortable during movement, unlike NPWT. She reported a decrease in her pain upon dressing removal. She had felt itchy when using NPWT but did not experience this with Zetuvit® Plus Silicone Border.

Case Study 5. Paediatric burn – left thigh and genital area

History: A 5-year-old male presented with second-degree burns affecting approximately 4% of his body surface area following an accidental scald injury from boiling water. Using the Abbreviated Burn Severity Index (ABSI; Usmani et al, 2022), a grade 2B burn was identified on the mid-left thigh, and grade 2A burns in the groin region, genitalia (penis and scrotum), and perianal area. The mid-left thigh wound measured 12cm (length) x 11cm (width); the wound bed consisted of 100% necrotic tissue; the surrounding skin was inflamed and red [Figure 6a]. The patient also experienced severe wound-related pain.

Treatment: Zetuvit® Plus Silicone (size 10 x 20 cm) was trimmed to appropriately fit the grade 2B burn on the mid-left thigh. Due to the location of the burn area that surrounded the genitals, the wound management team agreed to leave it open and clean daily as it was difficult to ensure that a dressing would stay in place.

Results: Zetuvit® Plus Silicone Border effectively managed wound exudate, maintaining a moist wound environment conducive to faster healing (healing completed at day 13; Figure 6c). Due to its softness, Zetuvit® Plus Silicone Border significantly improved this patient's QoL by decreasing the wound-related pain and increasing comfort during wear. This was due to the cushioning effect of the dressing and the ease of dressing removal. All of these factors supported patient engagement with treatment. The dressing, being thin and flexible, conformed well to body contours, allowing the patient to feel comfortable throughout, especially during movement.

Zetuvit® Plus Silicone border: Advancing donor site healing

Case Study 6. Donor site, left upper thigh

History: A 47-year-old male was admitted to the orthopaedic department with a deep laceration wound on the left arm, sustained from a machine injury. Following assessment by the plastic surgery team, a split-thickness skin graft procedure under general anaesthesia was performed, using skin from his left upper thigh. A week later, the patient reported pain and discomfort associated with the traditional paraffin gauze dressing that had been applied to the donor site wound. A wound measuring 10cm (length) x 7cm (width) x 0.2cm (depth), and of 7-day duration, was identified. The wound bed comprised of 60% granulation and 40% epithelialisation tissues, respectively [Figure 7a]. There was no infection, but the patient was experiencing mild, wound-related pain and excessive itching.

Treatment: Zetuvit® Plus Silicone Border (16 x 26 cm) was selected for use on the donor site until the wound fully epithelialised.

Results: After 14 days of treatment, the wound healed and comprised of 100% epithelialised tissue [Figure 7c]. Zetuvit® Plus

Case Study 6

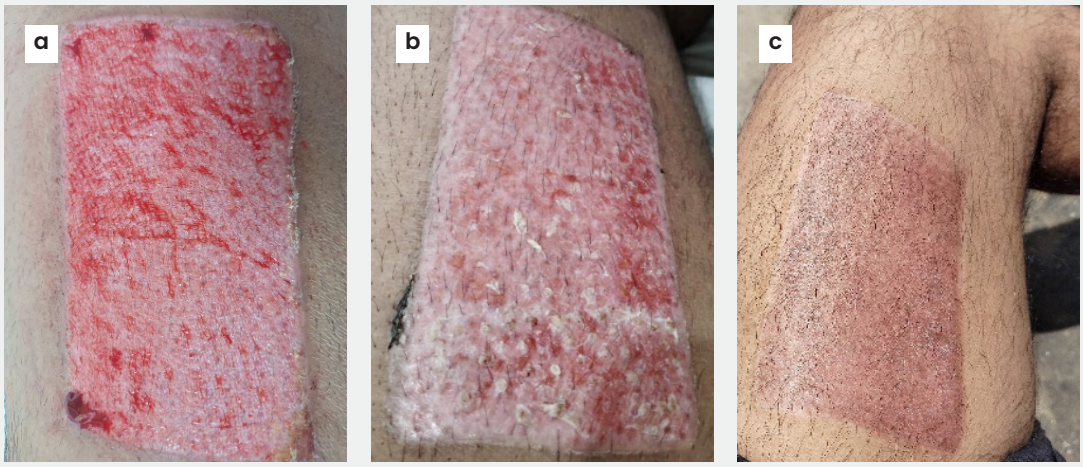

Figure 7

Figure 7. a) Day 0, b) Day 4, c) Day 14

Silicone Border enhanced granulation and epithelial tissue formation. The patient reported the dressing completely removed the itching sensation, was comfortable to wear and reduced pain while in situ and upon removal thereby improving his QoL. In this case, the use of Zetuvit® Plus Silicone Border was described as more effective than traditional paraffin gauze dressings. It was proven to be an effective wound management tool for patients and healthcare professionals to achieve optimal wound healing.

Case Study 7. Donor site, left anterior thigh

History: A 46-year-old female presented to the general surgery department with a soft tissue infection to her left leg. The patient was obese, with a history of diabetes mellitus managed with oral hypoglycaemic medications. Initial management involved three debridement procedures on the left foot, ankle and distal leg. The patient subsequently underwent a split-thickness skin graft procedure, with the donor site located on the left anterior thigh. The wound care team identified a wound measuring 27cm (length) x 25cm (width); the wound bed consisted of 100% granulation tissue [Figure 8a]. No signs of infection were observed, but the patient was experiencing severe wound-related pain and discomfort associated with the traditional paraffin gauze dressing applied following surgery.

Treatment: The treatment plan was reviewed and Zetuvit® Plus Silicone Border (16 x 26cm) was selected for use until the wound bed consisted of 100% epithelialisation tissue [Figure 8c].

Results: Zetuvit® Plus Silicone Border was more effective in wound treatment versus traditional paraffin gauze dressings. Patient feedback was positive: improved QoL was noted with Zetuvit® Plus Silicone Border; the patient was comfortable throughout and during movement, with the dressing staying in place. The patient experienced less pain during wear and upon dressing removal. The itching also reduced.

Case Study 8. Donor site, left thigh

History: A 55-year-old male with a history

Case Study 7

Figure 8

Figure 8. a) Day 0, b) Day 6, c) Day 19

Case Study 8

Figure 9

Figure 9.a) Day 0, b) Day 13, c) Day 26, d) Day 33

of poorly controlled diabetes mellitus, hyperglycaemia and hypertension (managed with oral hypoglycaemic medications and Insulin Glargine) was admitted to a general surgical ward. The patient had necrotising fasciitis in the right leg, extending from the distal thigh to behind the knee. He underwent incision, drainage, and surgical debridement under general anaesthesia, followed by multiple postoperative sharp debridements, before receiving a split-thickness skin graft using skin harvested from his left thigh. The patient was referred to the wound care department due to pain and discomfort associated with the traditional paraffin gauze dressing that had been applied following surgery. Two wounds were identified on the left thigh: the left wound measured 15cm (length) x 8cm (width), and the right wound measured 10cm (length) x 7cm (width), with 100% granulation tissue and redness on the surrounding skin **[Figure 9a]**. No infection was present, although he reported moderate pain and itching at rest, and severe pain during dressing changes.

Treatment: Zetuvit® Plus Silicone Border was selected for use due to its absorption capacity, conformability and atraumatic nature, with the aim to optimise wound management and improve patient comfort until complete healing **[Figure 9d]**.

Results: Compared to paraffin gauze dressings, Zetuvit® Plus Silicone Border did not adhere to the wound, resulting in pain-free dressing changes. The dressing was also effective in relieving any itching. Zetuvit® Plus Silicone Border was crucial for supporting wound healing without disturbance. Although the patient suffered from uncontrolled diabetes, which delays wound healing, Zetuvit® Plus Silicone Border was effective in achieving complete healing.

Overall outcomes with Zetuvit® Plus Silicone Border in achieving donor site healing

Zetuvit® Plus Silicone Border has shown superior efficacy in managing donor site wounds compared to traditional dressings. Its ability to effectively modulate a moist wound healing environment that supports wound healing, by promoting granulation and epithelial tissue formation, was crucial to achieving wound healing. The dressing ensured a comfortable healing process by noticeably reducing pain and minimising itching during wear time, enhancing overall patient satisfaction. Moreover, its atraumatic removal properties facilitated pain-free dressing changes. In conclusion, Zetuvit® Plus Silicone Border presented a patient-friendly and effective solution for donor site application.

Conclusion

Zetuvit® Plus Silicone Border is a versatile dressing that can be used for a wide range of chronic and acute wounds. The case studies in this publication demonstrate that this dressing facilitates and promotes the wound healing trajectory through balancing and maintaining a moist microclimate and supporting granulation tissue formation and re-epithelialisation. This is enabled by the dressing's ability to manage exudate and bacterial load through absorption, sequestration, retention and removal of wound exudate. The dressing supported normalisation of wound trajectory, and improved the local wound microenvironment by optimising moisture balance and reducing peri-wound maceration (Wounds International, 2023). The moist environment promotes faster granulation and epithelialisation by enabling diffusion of wound biomarkers across the wound bed; facilitating bacterial clearance and extracellular matrix (ECM) breakdown by MMPs (WUWHS, 2019). Exudate also serves as a medium for the migration of tissue-

repair cells, provides essential nutrients for cellular metabolism, and supports autolytic debridement (WUWHS, 2019; Wounds International, 2023). An additional property of Zetuvit® Plus Silicone Border was observed: if stretched, the dressing exerts a slight pressure on the wound bed to prevent hyper-granulation. In all cases, Zetuvit® Plus Silicone Border protected the wound and its surrounding skin. It conformed well due to its thin and flexible design, allowing patients to feel comfortable, especially during movement, leading to increased patient engagement. Improved QoL was recorded through patient feedback who reported decreased itching compared to previously used dressings, significantly less pain during wear due to the padding and cushioning effect, and atraumatic dressing removal due to gentle adherence. This was especially important with painful and fragile wounds (e.g. in Case Study 3). Additionally, in Case Study 2, it was noted that the simplicity of use for both products (HydroClean® and Zetuvit® Plus Silicone Border) allowed the patient's family to perform dressing changes at home. This supports the concepts of wound balance and supported self-care – factors crucial for people with wounds in resuming their normal life activities. Overall, these clinical outcomes indicate that Zetuvit® Plus Silicone Border can help clinicians and patients achieve wound balance and improve patients' QoL in both acute and chronic wounds. ●

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