Jump-start the healing process by overcoming the inflammation stage: New technology may hold an answer to non-healing wounds.

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Wounds may resist conventional treatment and become chronic for various reasons that prevent normal healing process from advancing through its main stages: hemostasis, inflammation, proliferation, and remodeling. Chronic wounds are stalled in the inflammation stage mainly due to heavy bioburden, uncontrolled wound drainage, and a presence of non-vital tissues.

Removal of these critical impeding elements is the pivotal step in the treatment of chronic wounds that can help get past the inflammation stage and jump-start the healing process. The new advanced self-adaptive wound dressing (sold under the brand name ENLUXTRA™) was designed and developed with this exact goal in mind and proven to be superior to other products in this respect.

Normal healing process: How it is impeded

Wounds healing normally go through four main stages marked by specific physiological and biochemical processes (Figure 1).

When these processes are impeded, the wound fails to advance to the next healing stage and becomes chronic.

Researchers agree that among other major impeding elements, bacterial burden, necrotic tissue, and loss of moisture balance[1] contribute heavily to slowing down the natural processes that advance the wound to complete healing.

Typically, a wound is stalled in the inflammation stage when bacterial overgrowth and infection are present, necrotic tissue is formed, and moisture levels are uncontrolled (Figure 2).

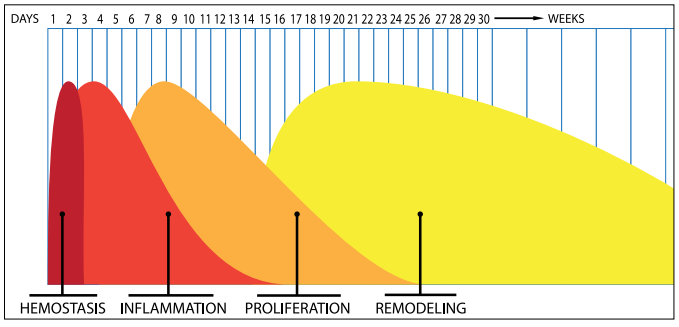

Figure 1. Normal wound healing progress.

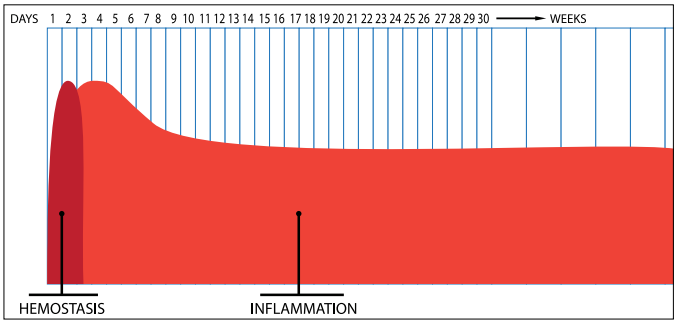

Figure 2. Chronic wound healing progress.

These three elements heavily depend on each other for support and, if left unchecked, engage in a perpetual cycle that leaves the wound unable to move past the inflammation stage.

For instance, bacterial burden tends to increase due to abundant water supply from uncontrolled wound exudate and the presence of non-vital tissues that serve as a medium for bacterial overgrowth. Chronic wound exudate also has abnormally high levels of MMPs — proenzymes that may degrade the extracellular collagen matrix and delay the process of cell proliferation and wound closure.[2]

Treatment options and challenges

Removal of major impeding elements combined with the constant support of the optimal moist healing environment may quickly set the wound on the path to full closure.

The task of wound drainage control has been implemented to a various degree in many wound care products available today. Additionally, antimicrobial and other control measures are introduced in many wound dressings. However, even the most advanced products fail to produce consistent results. A recent retrospective study from the US Wound Registry demonstrated that only about 66% of chronic wounds were healed.[3]

A possible explanation of such large scale treatment failures is that while a dressing may excel at its primary function, e.g. absorption, it inevitably falls short at the other necessary functions, causing wound deterioration.

The fact is, wounds are not uniform and homogenous. Wounds constantly evolve, often quickly and unexpectedly, in response to systemic processes taking place in the body.

Incidentally, various established wound care protocols rely solely on results of wound assessment at each dressing change, i.e. periodical monitoring of the wound conditions and making treatment decisions on the spot. This approach is far from perfect as it fails to consider the immediate changes in wound milieu spontaneously occurring while the dressing is in place.

The unpredictable nature of wound environment dictates the need for a treatment modality that is as variable and changeable as the wound itself. If such treatment is imposed, wound dynamics are followed up properly in real time, all impeding elements are addressed simultaneously, and healing process is supported throughout the entire time the dressing stays on the wound.

Self-adaptive wound dressing

The creators of self-adaptive wound dressing aimed to develop a product that would take into account the non-uniform nature of any given wound, and continuously synchronize its functional response to unpredictable changes taking place in the wound.[4]

The resulting dressing design presents proprietary super-absorbent synthetic polymers immobilized in the 3D-fiber matrix with added hydration functionality achieved by embedding hydrogel into the core of the material. The dressing material composition and structure allow for vertical absorption of significant amounts of exudate (up to 1500% of the dressing weight) without transferring it to non-exuding parts of the wound. This protects both the non-exuding parts and the healthy skin surrounding the wound from the deteriorating effects of free-flowing exudate and prevents the spread of infection.

Additionally — and at the same time — the dressing optimally hydrates non-exuding parts of the wound (dry areas, wound edges, periwound skin) through automatically regulated release of the embedded hydrogel, protecting them from desiccation (Figure 3).

The dressing's mode of action relies on the ability of the polymers to sense and adapt to the changing humidity and fluid content in all areas of the wound simultaneously. Superior absorbency and exudate retention over any exuding area, localized hydration of dry areas, and automatic reversible switching from absorption to hydration enable the mechanism of constant monitoring of wound conditions, and the active synchronized response of the dressing material to changes in and around the wound.

This mechanism is responsible for providing the highly desired ideal moist healing environment, which supports intensive natural autolytic debridement. The porous contact surface of the dressing allows for effective evacuation of liquefied products of this natural process, sequestering the fluids and bacteria in the body of dressing even under compression. Physical removal of the exudate, microorganisms, and disintegrated necrotic tissue results in an imminent reduction of bacterial burden and clears the wound bed (Figure 4).

When the three major impeding elements are removed, the inflammation stage is brought to its completion, and the body can focus on restarting the restorative healing process (Figure 5). The earlier the Enluxtra treatment is started the less likely is the probability of a wound becoming chronic, and the higher are the chances of fast healing.■

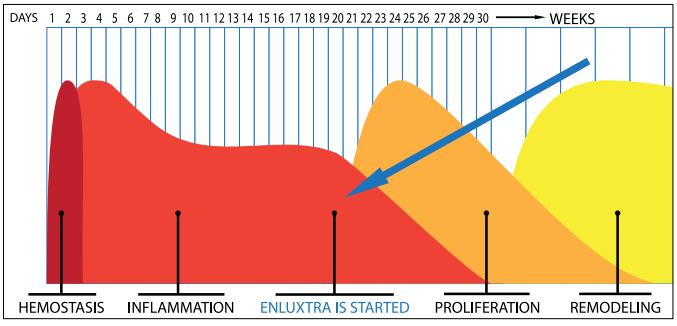

Figure 5. The Enluxtra treatment started on a chronic wound results in successful completion of the inflammatory stage and consequential boost of the restorative healing process.

Figure 3. Effective exudate management with Enluxtra dressing on a heavily exuding wound. All exudate is absorbed into the dressing vertically while the wound edges stay moist and protected from both maceration and desiccation.

Figure 4. A 58-year-old patient with Hepatitis C and drug abuse history has received surgical debridement of the chronic VLU at least 10 times in the 19 months prior to the start of Enluxtra treatment. The figure demonstartes the typical wound clearing progress achieved with Enluxtra dressings that support intensive natural autolytic debridment.

REFERENCES

1. Gist S. et al. Wound care in the geriatric client. *Clin Interv Aging*. 2009; 4: 269–287. Published online 2009 Jun 9.
2. Widgerow AD. Deconstructing the stalled wound. *WOUNDS*. 2012; 24(3):58–66.
3. Fife CE. et al. Wound Care Outcomes and Associated Cost Among Patients Treated in US Outpatient Wound Centers: Data From the US Wound Registry. *WOUNDS*. 2012; 24(1):10-17
4. Wolcott R. et al. Ultimate Standardization of First-Line Wound Dressings to a Single Type. *Today's Wound Clinic*. 2014; 8(3). Published online 2014 Apr 10.
5. Reyzelman A. et al. Evidence of intensive autolytic debridement with the innovative self-adaptive wound dressing. *WOUNDS*. 2015; 27(8):229-235

Figure 6. Left medial.

Figures 6-7. An 87-year-old Korean War veteran, a dibetic with multiple co-morbidities and partial amputations on both feet had suffered from bilateral VLUs for over 10 years. The Enluxtra dressing treatment lasted 9 weeks and resulted in significant progress towards healing of wounds previously unresponsive to other treatments and surgical interventions, including revascularization procedures.

Left medial VLU has been significantly reduced in size and cleared of non-vital tissue. The healing progress is evident as indicated by the presence of granulation tissue and healthy wound edges.

Right leg VLU has completely closed in the course of the treatment.

Figure 7. Right leg.