Clinical experiences with activated polyacrylate dressings (TenderWet 24®)

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The aim of this study was to report our experience with activated polyacrylate dressing 'TenderWet24®' dressing (Paul Hartmann AG) and to establish the effectiveness of the dressing in preparing the wound bed.

Methods : A prospective case series study was conducted from March to September 2004. Patients with wounds that were assessed as being amenable to the process of autolytic debridement as a method of wound bed preparation were recruited to the study. The wounds were assessed for infection and colonisation by wound fluid cultures and wound biopsy (punch biopsy at wound margin). The arterial blood supply was assessed as needed by clinical examination and with ankle brachial indices. The amount of tissue requiring debridement was assessed and the degree of wound debridement was followed from the first application of TenderWet 24® until the wound did not require further debridement or the treatment was judged to be a failure.

Results : Ten patients were recruited for the study. There were nine males and one female patient with an overall mean age of 62 years (range 33-92 years). Diabetes mellitus was previously diagnosed in three patients. Four wound types were recorded: venous ulcer (n=4); diabetic ulcer (n=3); arterial ulcer (n=5); and wounds due to various aetiologies not included in the other four types (n=1). Biopsy of the wound was performed in six patients.

A microbiological profile was obtained in all patients. In two patients, the dressing did not achieve debridement and an alternative agent was used. We show that the use of TenderWet 24® decreased the mean surface area wounds from 26.4 cm^2 to 21.4 cm^2 over a mean period of 6.5 days.

Conclusion: The results of this study suggest that activated TenderWet 24® therapy is safe and effective for the debridement of all types of wounds. However, to yield statistically significant results, larger studies must be performed.

Keywords: TenderWet 24®, wound bed preparation, leg ulcer, debridement.

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Introduction

Wound bed preparation was first described by Schultz [1] as the management of the wound to accelerate endogenous healing or to facilitate the effectiveness of other therapeutic measures. The two primary elements of wound bed preparation are to remove dead tissue that is forming a barrier to new tissue growth and to reduce the number of bacteria in a wound. As a result, the inflammatory response is down-regulated and the wound moves into the proliferative stage [2,3]. The consequence of not preparing the wound bed adequately is prolonged wound healing [4]. Selective methods of wound bed preparation include: surgical, conservative sharp, enzymatic, mechanical, biological (Larval therapy) and autolytic [5-7]. To achieve a clean wound using some of these traditional methods of debridement may take weeks or even months [1, 8].

The most expedient method of debridement is surgical. The clinical indications for surgical debridement are: superficial septic wounds and widespread infection which involves bone and infected tissue [9, 10]. Many clinicians use enzymatic agents for debridement. Enzyme preparations exert their selective debridement activity by denaturing and digesting proteins. Enzymes may have variable effectiveness based on the pH of the wound and type of necrosis. However, as a practical matter, clinicians do not test wounds for pH and not all enzymes are indicated for infected wounds, as they are not reported to have a direct effect on bacteria. In mechanical debridement, a saline-moistened dressing is allowed to dry overnight and adhere to the dead tissue. When the dressing is removed, the dead tissue is pulled away too. This process is one of the oldest methods of debridement. It can be very painful because the dressing can adhere to living as well as non-living tissue. Because mechanical debridement cannot select between viable and non-viable tissue, it is an unacceptable debridement method for clean wounds where a new layer of healing cells is already developing [11, 12].

There has been a resurgence in biological therapy (larval therapy), particularly in the United Kingdom [13]. Sterile larvae of the *lucilia sericata* fly have been used [13, 14]. They work by breaking down dead tissue by producing enzymes, without harming granulating tissue [15-19]. Autolytic debridement is accomplished by maintaining the wounds as continually moist, allowing the hosts own white blood cells and enzymes to liquefy the necrotic tissue [20]. It involves the process whereby macrophages and endogenous proteolytic enzymes liquefy and spontaneously separate necrotic tissue and eschar from healthy tissue. This occurs to some degree in all wounds. Moist dressing agents such as hydrogels and hydrocolloids promote this process.

In addition to these methods, specific types of polymers – polyacrylates – may enhance selective autolytic debridement. Moisture-activated polyacrylate dressing pads (TenderWet 24®) is a multi-layered wound dressing with a superabsorbent polyacrylate core (SAP). The dressing is prepared with TenderWet Solution, an electrolyte-rich solution containing sodium, chloride, calcium and potassium ions. The SAP core has a high affinity for protein, and therefore acts to absorb wound exudate and bacterial toxins from the wound surface (Figure 1). This process leads to displacement of the TenderWet Solution onto the wound, therefore providing a constant rinsing mechanism that results in a beneficial environment for wound healing (Figure 2). Superficial to the SAP core is a hydrophobic knitted covering layer that conforms to the wound surface, is non-adherent to the wound bed and allows secretions to pass through freely. The action of the dressing lasts for 24 hours (Figure 3), thus requiring daily re-dressing of the wound to occur.

Previous trials involving the use of TenderWet 24® dressings have shown value in the treatment of necrotic tissue via a softening effect, slough reduction, wound granulation via promoting cellular proliferation, and infected wounds via the rinsing effect [21-23]. It is not, however, useful in the epithelialisation phase of wound healing due to the requirement for daily re-dressings. Its use in the treatment of chronic wounds is merited by its properties of wound debridement, removal of toxins and bacteria, and stimulation of cellular proliferation. Adverse effects associated with the use of TenderWet 24® dressings are bleeding, pain and wound adherence to the dressing, although this is usually resolved by moistening the dressing prior to subsequent attempts at removal.

The purpose of this study was to report our experience with the TenderWet 24® dressing (Paul Hartmann AG, distributed by Medline Industries Inc., Mundelein Ill) and to establish the effectiveness of this dressing in chronic wound bed preparation.

Methods

A prospective, non-contrlled study was conducted from March 2004 to September 2004. The inclusion criteria were: patients of any age, patients able to receive or perform daily wound dressings, ulcers of at least 3 months duration, ulcers of arterial, venous or diabetic aetiology and ulcers in necrotic, sloughy, infected or granulation state. The exclusion criteria were: epithelialisation ulcers and stage of healing and wounds of malignant origin or those requiring immediate surgical debridement. A tape measure was used to assess the wound size and amount of necrosis at the beginning and end of application of TenderWet 24® dressing.

The wound was cleaned with Ringers solution and a compress which had been soaked in a defined volume of Ringers solution, based on the size of compress, was applied to the wound. To do this, the compress was first soaked with a defined volume of Ringers solution, depending on its size, and this was then applied to the wound which was first cleaned with Ringers solution. The compress should be in contact with the entire wound bed and should just cover the edges of the wound. Covering the area around the wound with zinc paste was not necessary. Zetuvit™ was applied over the TenderWet 24® dressing as an absorbent dressing pad. Any medication being taken was continued. To monitor progress, the wounds were photographed before and after the treatment, microbial swabs and punch biopsy were taken and the state of the wounds assessed daily.

Wound debridement progress was followed from the first date of treatment with activated polyacrylate dressing until the wound did not require any further debridement: this was assessed by retraction of wound edges with wound decreasing by more than 50% of the initial diameter or removal of more than 50% of the necrotic tissue. The treatment was judged to be a failure if the reduction in wound size and the area of necrosis were less than less than 50 % of the initial parameters

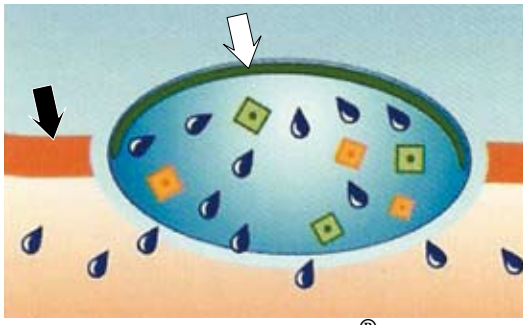


Figure 1: The SAP from TenderWet 24® dressing (white arrow) the absorbs wound exudate (black arrow) containing bacterial toxins, thereby removing all debris from the wound bed surface.

Figure 2: Rinsing of the wound. Delivery of the TenderWet solution (yellow arrow toward the wound). The SAP has a higher affinity for protein (yellow arrow toward the dressing) than for salt solutions. Reproduced with permission (by Paul Hartmann Pty Ltd).

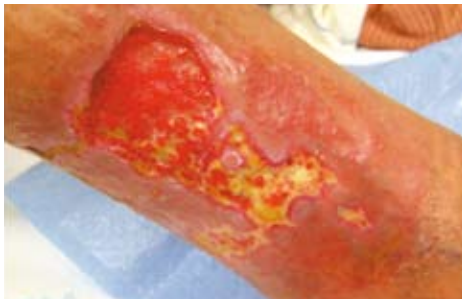
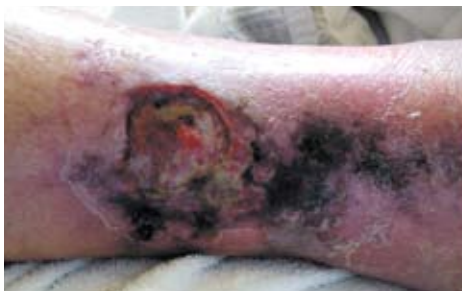


Figure 3(a): 62 year-old patient diagnosed with calciphylaxis with a leg wound that is dry, necrotic and with slough.



(b): the same wound 10 days after application of TenderWet 24®. All necrotic tissue has been autolytically debrided. The wound bed shows evidence of granulation tissue in the upper half of the ulcer whilst the lower part of the ulcer still contains slough with moderate granulation.

of the wound and if there was a reaction to the dressing. At each dressing change, the degree of pain was assessed and the duration in minutes was documented.

The study did not require any ethical approval but patients were clearly informed as to the nature of the TenderWet 24® dressing. Damage to peri-wound skin was also recorded. Systemic antibiotic therapy was used if there was evidence of a systemic inflammatory response (elevation of white cell count or C-reactive protein), the wound microbiological profile indicated therapy (from pus swab or wound biopsy) and there was no improvement in the healing of the wound despite adequate bed preparation. Adjuvant management was used if indicated (elevation of the leg for venous ulcer, arterial revascularisation for arterial ulcer).

Results

Ten patients were included, 9 male and 1 female aged 33-92 years (mean age 62 years) with lower leg ulcers. Diabetes mellitus was present in three patients. The following four wound types were recorded: venous ulcer (n=4); diabetic ulcer (n=3); arterial ulcer (this group comprises some diabetic and venous wounds; n=5); and wounds due to various etiologies not included in the other four types (n=1). Eight of ten wounds contained slough alone or combined with necrotic tissue. The rate of debridement per day was estimated at 6% (Figure 3a, b). The mean surface area of all wounds before and after treatment were respectively 26.4 cm2 and 21.4 cm2 (Figure 4) with a mean treatment time of 6.5 days.

Wound biopsies were performed on 6 patients. In three of the biopsies, the features were suggestive of venous stasis and there was no evidence of malignancy. The remaining three biopsies revealed inflammatory granulation. A microbiological profile was obtained in all patients. In eight patients, *Staphylococcus aureus* and *Pseudomonas aeruginosa* were isolated. These patients received directed antibiotic therapy if the wound was not responding to topical therapy or evidence of systemic infection was present. In two patients, the treatment did not facilitate debridement and alternative agents were used. In three patients, there was desquamation of normal tissue around the wound associated with pain during dressing change.

Discussion

In this study, we show that the use of TenderWet 24® decreased the mean surface area of the wounds examined from 26.4 cm^2 to 21.4 cm^2 over a mean period of 6.5 days. Venous and diabetic ulcers were debrided most expediently. These results are similar to the results of wound healing reported by Paustian and Stegman (2003), who found a debridement rate of 37.7% per week [24-25]. Optimal host inflammatory response is an important factor in the effectiveness of autolytic debridement. It has been found in a previous study that older or frail patients have a limited capability to achieve adequate autolytic debridement and require a more aggressive form of debridement than the autolytic method alone. There are numerous physiological processes responsible for this poorer response in the elderly. Previous publications have found that elderly patients have a lower turnover of keratinocytes [26-27], fewer cells in the dermis [28], reduced production of extra-cellular matrix [29], and flattening of the dermoepidermal junction producing atrophic skin [30]. In our small sample size, the impression was that age did not influence debridement rate.

The results of this study suggest that activated polyacrylate dressing is suitable for cleaning chronic wounds and represents a good alternative if extensive debridement is not necessary or is not feasible in ambulant care. To further investigate the effectiveness of TenderWet 24® dressing as a wound bed preparation agent, a larger sample size is required.

The activated polyacrylate dressing provided an effective rate of debridement. It cleans the wound by continuously rinsing with a balanced electrolyte solution, effectively absorbs exudate, softens and detaches necrotic and sloughy tissue, and prepares the wound bed by the formation of granulation

tissue [21, 23-25]. The dressing can be used for wounds that require active cleansing, including: infected wounds; necrotic, sloughy wounds, chronic wounds such as leg ulcers and pressure ulcers, and wounds associated with diabetes [23-25]. It is also easy for patients and caregivers to use since it reduces the guesswork and complexity involved in using other methods of debridement. The disadvantage of this dressing was pain on removal when applied for a longer period, and this resulted in a reduced tolerance to this form of debridement. This was related to the damaging action of the activated polyacrylate on the surrounding, healthy skin. However, it is possible to avoid this complication by using a dressing equal in size to the wound.

In conclusion, the results of this study suggest that activated Polyacrylate dressing therapy, when applied appropriately to the size and shape of the wound is a safe and effective method of wound debridement for all types of wounds. However, we believe that larger studies must be performed to reach statistically significant results with this type of dressing.

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Table 1: Patient Demographic and Baseline Wound Variables (N=10)

Parameters	Numbers
Sex: (M/F)	9/1
Diabetes	3
Average age (SD)	62
Aetiology of ulcer wound	
Venous ulcer	4
Diabetic ulcer	3
Arterial ulcer*	5
All other wounds	1
Clinical appearance	
Necrotic	2
Sloughy	8
Granulating	1
Epitheliating	1
Exudates Type	
Serous	7
Haemoserous	2
Blood	1
Mean debridement rate	6.5% per day

**This group comprises some diabetic and venous wounds.*

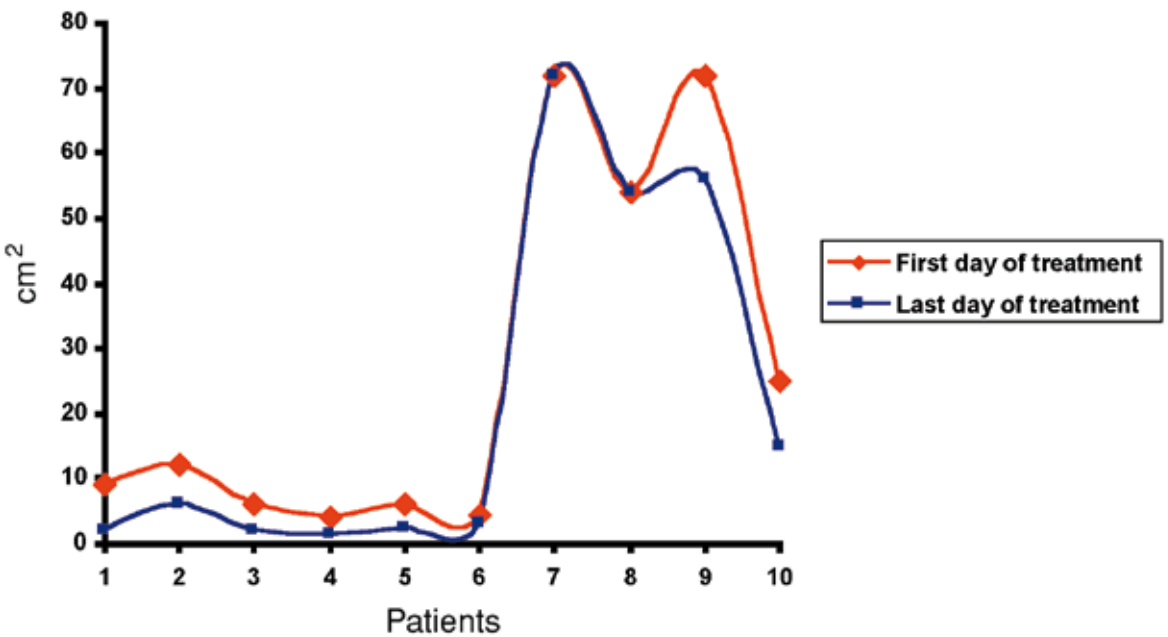

Figure 4: Chart showing the surface of the wound on the first and last day of treatment of all patients. (X) Represent the surface area of wounds in cm2 and (Y) represent all patients.

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