HydroTherapy® poster booklet

INTRODUCTION – Professor Karen Ousey

"The adoption of evidence-based medicine by individual healthcare professionals can help ensure the limited resources available are used efficiently, enhancing confidence that additional funds will translate into more people receiving better wound care and having better Health" (Al Benna et al., 2010)[1]

This poster booklet illustrates "Real Life" evidence based medicine in terms of Case Studies which provides information relating to the management of patients with this new treatment programme – HydroTherapy®. As such, this document provides an insight into how the Hydro-Responsive Wound Dressings HydroClean® plus and HydroTac® can be used to overcome specific clinical challenges relating to debridement and aiding healing progression in a variety of acute and chronic wounds.

The examples of Case Studies in this booklet have been provide by clinicians at the forefront of patient treatment and it is true to say that all clinicians that have been involved in clinical evaluations of HydroClean® plus and HydroTac® have been impressed with their results.

To emphasise this point it is worth re-iterating part of a presentation by Leanne Atkin with her first response/ impression of HydroClean® plus and her subsequent enthusiasm for its use.

Initial reactions to HydroTherapy:

"Is that something you have in a spa session?"

No, this is just new terminology to describe a new treatment programme

"Are you sure this is related to wound care?"

Yes, this is innovation in wound care based around optimising hydration of the wound to aid healing

Reactions to dressing performance:

"No way!" - Yes way!

"Too wet" – No provides a 'washing cycle' for the wound

"Too bulky" – No problem with depth of dressing

"Will macerate" – No damage to surrounding skin and positive effect in terms of moist wound edges

Leanne Atkin, Launch Symposium, London 2016

1. Al-Benna S. (2010) *A discourse on the contributions of evidence-based medicine to wound care.* Ostomy Wound Manage 56(6):48-54

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CONTENTS

SECTION 1

Health Economics

HydroClean® plus: A Simple Economic Evaluation of 20 Patients

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Introduction

The NHS is under pressure as a result of an aging population and a significant increase in long-term health conditions.[1] In order to make the best use of limited resources, health care professionals not only have a duty to establish that they are providing good care, but that they are "doing more good than anything else that could be done with the same resources".[2]

Managing patients with wounds contributes significantly to economic burden. In a recent study it was estimated that in 2012/2013 there were approximately 2.2 million people with wounds in the UK, which was equivalent to 4.5% of the adult population.[3] The total cost to the NHS of managing these wounds and associated co-morbidities was estimated to be £6 billion.[3]

HydroClean® plus

A 20 patient evaluation was undertaken where HydroClean® plus was used within "standard" practice. The primary objective was to evaluate the overall performance of the dressing in the management of acute and chronic wounds in facilitating wound bed preparation and wound progression. However, a secondary objective was to undertake a cost benefit analysis in comparison to the previous treatment used.

Results

Using data from the evaluation, a simple cost benefit analysis[4] was used to estimate potential savings where clinically acceptable endpoints were achieved. The cost of care was estimated by using both the cost of dressings and clinician time.

- UK Drug Tariff[5] prices (September 2015) were used for dressings already available in clinical practice.
- The price of HydroClean® plus was the price being proposed for reimbursement.
- The Personal and Social Services Research Unit[6] costs were used to provide the cost of community nursing and podiatry time.

Clinician time for dressing changes was not measured as part of the evaluation, but based on the assumptions used in the NICE (2014), 15 minutes per dressing is used.[7] However, the frequency of dressing change was determined by the clinicians according to clinical need.

The cost of care was estimated for patients in 3 health states.

1. Patients whose wounds had progressed to healing and required no further treatment.

   10% (n=2) of patients reached this health state with a mean time to debride and achieve healing of 7.5 days. The actual total cost savings was £87.78. (Table 1)

2. Patients whose wounds had reached 100% granulation tissue in the wound bed and therefore total debridement of the wound had been achieved. (Table 2)

   10% (n=2) of patients reached this, at a mean time of 5.5 days. However, as there was no previous cost of treatment for 1 patient, the cost of treatment was £37.96 more expensive.

   However, as the patient was previously receiving no treatment, it could be assumed that the wound could deteriorate and require treatment eventually.

Table 1 Patients healed

Standard care – costs of dressings	Clinician cost per dressing change	No of dressing changes per week	Total weekly cost	Revised care- cost of dressings	Clinician cost per dressing change	No of dressing changes per week	Total weekly cost	Actual saving
£0.42	£10.75	7	£78.19	£6.93	£10.75	2	£35.36	£42.83
£1.28	£10.75	7	£84.21	£8.88	£10.75	2	£39.26	£44.95
Total Cost Savings £87.78								

Table 2 100% debridement

Standard care – costs of dressings	Clinician cost per dressing change	No of dressing changes per week	Total weekly cost	Revised care- cost of dressings	Clinician cost per dressing change	No of dressing changes per week	Total weekly cost	Actual saving
£8.30	£10.75	2	£38.10	£7.65	£10.75	2	£36.80	£1.30
No previous treatment costs				£8.88	£10.75	2	£39.26	-£39.26*
Total Cost Increase £-37.96								

* Denotes a higher cost due to no previous treatment for comparison in 1 patient

3. Patients where a high percentage (80-99%) of devitalised tissue was removed by the dressing and assumed to be a successful outcome. (Table 3)

   35 % (n=7) of patients were recorded to have reached this status at the end of the evaluation period at a mean time of 18 days. 3 of the patients in this group were treated within the Podiatry service, which are marked with *. Wounds treated by this service are complex foot ulcers in diabetic patients or have other conditions which compromise healing. As a result, wound healing is slow.

   The actual cost saving compared to standard treatment with this patient group was £293.52 overall, although the cost of revised care was higher for 1 patient. However, as the previous treatment was not achieving the required clinical outcome, it could be assumed that this cost may eventually be higher.

Table 3 80-99% debridement achieved

Standard care – costs of dressings	Clinician cost per dressing change	No of dressing changes per week	Total weekly cost	Revised care- cost of dressings	Clinician cost per dressing change	No of dressing changes per week	Total weekly cost	Actual saving
£3.77	£8*	3	£35.51	£6.61	£8**	2	£29.22	£6.09
£3.20	£8*	2	£22.40	£4.41	£8**	2	£26.02	-£3.62
£5.44	£10.75	7	£113.33	£10.35	£10.75	2	£42.20	£71.13
£9.20	£10.75	7	£139.65	£14.36	£10.75	2	£50.22	£89.43
£5.90	£10.75	7	£116.55	£7.75	£10.75	3	£55.50	£61.05
£6.92	£10.75	7	£123.69	£7.94	£10.75	2	£56.07	£67.62
£6.14	£8*	2	£28.28	£5.23	£8**	2	£26.46	£1.82
Total Cost Saving £293.52								

** Denotes Podiatry rate

An example of the cost models is given for each of the 3 health states.

Cost model 1 Patient 2 - Progressed to Healing

Cost components	Standard Care		Revised Care	
	Product	Cost (£)	Product	Cost (£)
Wound Cleansing	None		None	
Primary Dressing	Non-adherent dressing impregnated with 10% povidone iodine	0.98	HydroClean® plus 10 x10	5.95
Secondary dressing	Dry Pads	0.30	Absorbent, sub bandage wadding. Type 2 light support bandage	1.33
Other materials		0	Protective transparent barrier film	1.60
Cost of Materials		1.28		8.88
Cost of labour -15 mins nurse time		10.75		10.75
Cost Per Dressing Change		12.03		19.63
Frequency of dressing changes	7 x weekly		2 x weekly	
Cost per week		84.21		39.26
Weekly cost saving	**£44.95**			

Cost model 2 Patient 3: 100% Debridement

Cost components	Standard Care		Revised Care	
	Product	Cost (£)	Product	Cost (£)
Wound Cleansing	None		None	
Primary Dressing	Cadexomer dressing with iodine	4.09	HydroClean® plus 4cm round	4.00
Secondary dressing	Adhesive foam dressing with perforated soft gel adhesive wound contact layer and permeable waterproof outer film	2.16	Absorbent, sub bandage wadding. Type 2 light support bandage	2.05
Other materials	Absorbent, sub bandage wadding. Type 2 light support bandage	2.05	Protective transparent barrier film	1.60
Cost of Materials		8.30		7.65
Cost of labour - 15 mins podiatrist time		10.75		10.75
Cost Per Dressing Change		19.05		18.40
Frequency of dressing changes	2 x weekly		2 x weekly	
Cost per week		38.10		36.80
Weekly cost saving	**£1.30**			

Cost model 3 80-99% Debridement

Cost components	Standard Care		Revised Care	
	Product	Cost (£)	Product	Cost (£)
Wound Cleansing	Wound irrigation solution containing PHMB and Betaine	0.60	Wound irrigation solution containing PHMB and Betaine	0.60
Primary Dressing	Hydrofibre non woven pad	1.01	HydroClean® plus 4cm round	4.00
Secondary dressing	Adhesive foam dressing with perforated soft gel adhesive wound contact layer and permeable waterproof outer film	2.16	Gauze	0.41
Other materials		0	Protective transparent barrier film	1.60
Cost of Materials		3.77		6.61
Cost of labour -15 mins nurse time		8.00		8.00
Cost Per Dressing Change		11.77		14.61
Frequency of dressing changes	3 x weekly		2 x weekly	
Cost per week		35.31		29.22
Weekly cost saving	**£6.09**			

Conclusion

Containing costs and effective budget management is an important element of wound care.
The cost of wound debridement was discussed in the Medical Technology Review published by NICE (2014)[7] and reported that the total cost of debridement per patient to be £97 - £189 for the monofilament pad, in comparison to £165 -£308 for hydrogel, £180 - £330 for gauze and £306 - £351 for larvae. This small evaluation suggests that there is potential for HydroClean® plus to contain costs when used for this purpose.

Debriding devitalised tissue from the wound bed has become an essential element of tissue viability, and speed of debridement is important in containing cost. It has been suggested that the mean time to debride (100% granulation) for other therapies is 20 days for hydrogels and enzymes and 12 days for the monofilament pad[7]. Within the evaluation the mean time to debride to the same endpoint for the 4 patients in the study where there was 100% granulation recorded in the wound bed was 6.5 days.

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Enabling Wound Healing and Preventing Limb Amputation: HydroTherapy, A Cost Benefit Case Study

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Aims

To compare the costs of 3 dressing systems: 1) Standard care (previous treatment) versus 2) HydroTherapy (e.g., Hydro-Responsive Wound Dressings, HydroClean® plus and HydroTac® versus 3) potential outcomes (amputation), and also to consider cost minimisation of early intervention, to enable healing progression in the care of a diabetic patient with non-healing wounds.

Introduction

In patients with diabetes, Foot Ulceration (DFU) can deteriorate to such an extent that an amputation is the only clinical alternative. Ulceration and amputation have a significant impact on the patients' mortality and their QoL. Preventing amputation in diabetic patients with any wound is a significant clinical challenge. This Case study exemplifies how a patient with two wounds, a large dorsal non-healing ulcer and a dehisced surgical wound/graft site (that was the result of a popliteal-pedal bypass) was treated successfully with new Hydro-Responsive Wound Dressings (HydroClean® plus and HydroTac®) and ultimately prevented limb amputation..

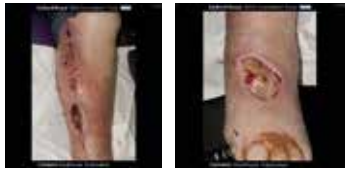
Case study

This case study relates to the treatment of a patient with two wounds (Figure 1): a large dorsal non-healing ulcer and a dehisced surgical wound/graft site that was the result of a popliteal-pedal bypass. Previous treatment over a long period of time had utilised a variety of wound dressing regimens, but with no success and eventual deterioration of wounds such that amputation was considered as an option. The patient was eventually fully healed by use of HRWD (Figure 2)

Conclusion

HRWD treatment was the best clinical and cost option for treatment in this Case Study. Use of HydroTac to aid the healing response at an earlier stage and before tissue breakdown might be an advantageous treatment option.

Figure 1. Wounds before treatment with HRWD

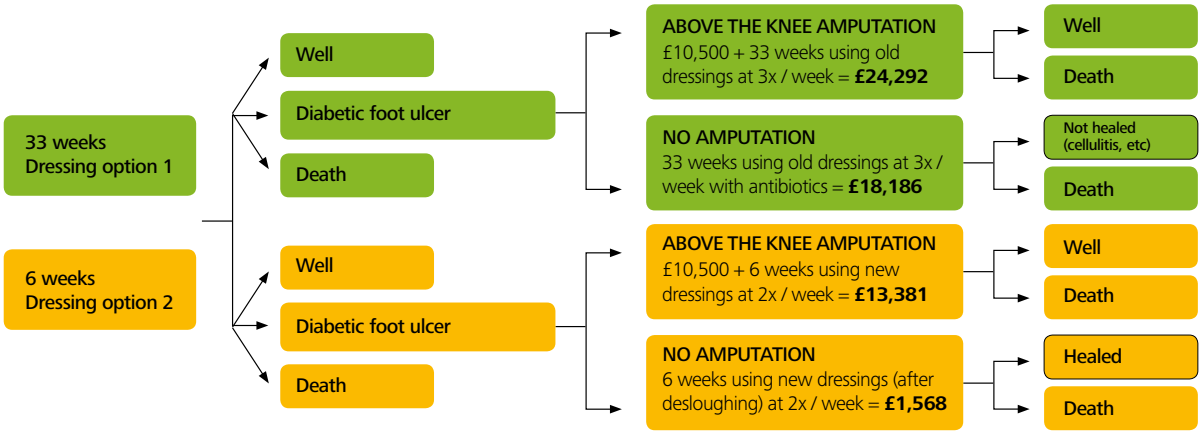


Treatment Options

1. Continue with current treatment
2. Amputation
3. HRWD

Figure 2. Wounds after treatment with HRWD

Probabilities analysis: Conditions, alternatives and expected outcomes from two dressing options



Cost of care

	Option 1: Cost of care with usual dressing (£)	Option 2: Cost of care with new dressing (£)	Cost of above the knee amputation (£)
Total unit / week	534.89	261.38	10,911.55
33 weeks comparison	18,186.26	8,625.54	24,492.70
6 weeks comparison	3,208.14	1,568.28	13,380.85

Effectiveness ratio

Calculation table to illustrate effectiveness cost (EC) ratio	Usual care drawings option 1 at 6 weeks	New dressings option 2 at 6 weeks	Amputation & dressings over 6 weeks
Cost measure (£)	3208.14	1568.28	10500 + dressings x 6 = 13380.85
Effectiveness measure/life saved	1.0	1.0	1.0
CE ratio cost/life	320.80	156.80	1338
EC ratio/life saved	5.67	5.5	8.2

SECTION 2

Clinical Education

Wound Healing and Hyper-Hydration - A Counter Intuitive Model

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Introduction

The success of Winter's concept – Moist Wound Healing (MWH)[1,2] – has heavily influenced clinicians' approach to wound management over the past five decades. This has led to the blinkered view that MWH is the only credible approach to wound management.
This is because

- moist wounds provide an optimal environment for speedy healing and improved cosmesis
- dry wounds lead to: cellular desiccation, prolonged cellular migration, scab formation and poor cosmesis
- wet wounds are considered prone to maceration and delayed healing

Here, we explore the benefits of tissue hydration and hyper-hydration and how these two states should not be confused with the causes and consequences of tissue maceration.

Tissue hydration

Water is essential to maintain homeostasis. Hydration of the dermis is maintained by water inflow from the circulatory system where the fluid is mostly absorbed by connective tissue (glycosaminoglycans (GAGs) and hyaluronan (HA)) within the extracellular matrix.[3] Moisture retained over the wound prevents desiccation, promotes expression of cytokines, growth factors and stimulates cell migration.[4,5,6] In addition, a moist environment supports autolysis, decreases pain and improves cosmesis. Wound granulation tissue maintains a high content of water absorbing GAGs and HA and can retain a large reservoir of absorbed water.[3]

Hyper-hydration

Hyper-hydration of skin is often associated with prolonged immersion in water and the development of wrinkly skin. This is as a result of swelling of the corneocytes in the stratum corneum. However, it is important to note that skin absorption of water is limited by the skin's physical structure[7] and does not necessarily result in sustained damage.[8]
Hyper-hydration of wounds, a counter-intuitive approach in the management of wounds, has an impressive provenance.
Hebra (1861), described how burns patients were immersed in water baths for months or years and that this treatment reduced pain, limited weight loss and ensured patient survival. When the continuous baths were stopped, the patients did not survive.[9]
Bunyan, a WW2 military surgeon treated servicemen's burns with an envelope of coated silk that surrounded the wound and into which a solution of electrolytically produced sodium hypochlorite would dwell for 20 minutes, three times each day. Bunyan stated this method improved healing and cosmesis while avoiding the use of painful dressing changes.[10]
In an animal model the effect of a liquid covering on closure of superficial wounds was investigated and compared with wounds exposed to air, and wounds that were covered and kept moist.[11] The histological results show that the liquid cover enhanced healing. In addition, bacterial contamination and maceration were not complicating factors.
The healing of partial thickness porcine burn wounds in a liquid environment has also been investigated. Continuous treatment with normal saline significantly reduced the early formation of necrosis. In addition, the healing of fluid-treated wounds occurred without tissue maceration and showed less inflammation / scar formation than healing of the air exposed wounds.[12]
In summary, hyper-hydration of the skin is biologically limited and innocuous fluids that remain in contact with the wound bed support healing, and where relevant are tolerated well by patients.

Maceration of the skin

Skin maceration is a common aversion and guidelines advocate prevention. However, skin maceration that results from prolonged contact with water/isotonic fluids is quickly resolved and does not lead to sustained damage.[13] (Table 1).
Where prolonged contact of the wound bed or peri-wound skin with chronic wound exudate occurs, wound enlargement with delayed healing can be expected. Sustained damage to the skin and extracellular matrix occurs as a result of the proteolytic enzyme content of exudate and not just the aqueous content. Table 2 summarises the differences in the clinical consequences of hydration and maceration.

Myths	Reality
Prolonged contact of the peri-wound skin with water/isotonic fluid will induce maceration	Maceration may occur but is transient and quickly reversed
Prolonged contact of wound bed with isotonic fluid will delay healing	Prolonged contact of isotonic fluid with the wound bed supports healing in acute and chronic wounds

Table 1 Myths and reality associated with hyper-hydration of skin/tissue

Epilogue

A dressing that is now available contains a high content of isotonic Ringer's solution and has been shown to be highly successful in the treatment of acute and chronic wounds.[33-36]
This counter-intuitive approach to healing – hyper-hydration – may initially appear divergent to the more familiar moist wound healing orthodoxy. However, use of isotonic fluids in conjunction with soft tissue homeostatic mechanisms provide adequate justification for this novel approach to wound management.

Hydration	References	Maceration	References
Beneficial to healing	Kruse et al., 2015[14]	Delays healing,	Cutting & White, 2002[15,16]
Aids debridement/ cleansing	Powers et al., 2013[17]	Increases slough and tissue damage	Mugita et al., 2015;[18] Ichikawa-Shigeta et al., 2014[19]
Lowers risk of infection	Sarabahi, 2012[20]	Increased tissue necrosis - higher risk of infection	Benbow and Stephens, 2010;[21] Charlesworth et al., 2014[22]
Transient low grade dermatitis	Rietschel & Allen, 1977[23]	High grade dermatitis, wet eczema	Gray and Weir, 2007;[24] Colwell et al., 2011[25]
Less pain	Morgan, 2000;[26] Metzger et al., 2004[27]	Increased discomfort, irritation pain and reduced QoL	Butcher, 2000;[28] Dini et al., 2014[29]
Less scarring	Bolton et al., 2000;[30] Benbow, 2008[31]	Long term physiological changes in skin with associated tissue degradation	Mugita et al., 2015[18]
Lower cost	Kerstein, 1995;[32] Metzger, 2004[27]	Increased cost	Charlesworth et al., 2014[22]

Table 2 Differences between tissue hydration and maceration

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Hydration; Its Role In Wound Healing

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Introduction

All biological processes require water and balancing of moisture levels is key to maintaining the ideal state. There are several mechanisms responsible for maintaining the ideal moisture balance in skin. Wounding disrupts this hydration balance. Evidence suggests that a moist wound environment and maintenance of tissue hydration aids healing. Clinical experience with chronic wounds suggests that excessive wound exudate is damaging to the wound and surrounding skin.

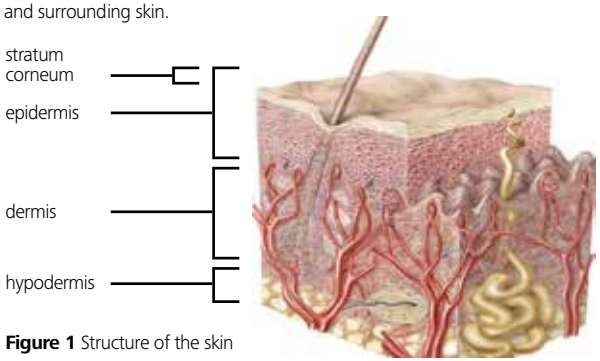

Figure 1 Structure of the skin

Hydration in skin

The outermost layers of the skin, the epidermal stratum corneum, are important for maintenance of skin hydration[1] (Figure 1). Both the physical structure and its chemical composition are key to water retention within the epidermis. Water also plays an important role in the normal functioning of the skin itself. Fluid retention in skin also depends upon the maintenance of an optimal skin hydration level[2]. The dynamic supply (via blood circulation) and removal of fluid (via lymphatic system drainage) from the skin is an ongoing process and any disruption in this fine balance can result in clinical problems. For example, uncontrolled influx or deficient removal of water can lead to tissue oedema. The uncontrolled loss of water as a result of a breach in the skin's integrity (i.e., wounding) can result in tissue dehydration.

Wound healing and hydration

Optimal wound healing is very dependent upon the appropriate level of tissue hydration[2] and it has been suggested to be the single most important external factor[3]. Skin wounding results in an imbalance of the skin's hydration status and exposure of tissues to air leads to tissue drying. The disruption of blood vessels and the increased outflow of fluid in an attempt to maintain moisture balance leads to exudate formation. The initiation of the blood coagulation system quickly "plugs" the open wound to limit fluid loss and to protect tissues from bacterial contamination. Once plugged, wound healing can commence.

Moist wound healing

Skin wounds exposed to air dry out. This drying of the wound and the initiation of the blood coagulation system lead to the formation of a wound scab/eschar. Landmark studies from George Winter in the 1960s showed that wounds exposed to air and allowed to dry, healed poorly when compared to wounds kept moist[4]. Numerous studies performed since Winter's early work have provided evidence of the benefits of a moist wound healing environment (see Table 1). The adoption of the concept of moist wound healing in wound care has led to the development of a number of types of modern wound dressings, all designed to manage various levels of exudate. More recently, some dressings have been developed to help balance and maintain an optimised level of wound hydration (Figure 2). Clinical experience in chronic wound management, however, has suggested that excessive levels of fluid in and around the wound are detrimental to positive clinical outcomes, resulting in tissue maceration, skin reddening and tissue damage.

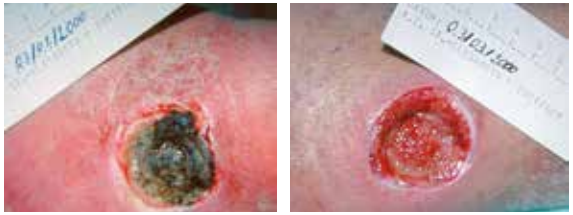

Figure 2 Mechanical debridement in combination with application of wound dressing which optimises wound hydration, resulting in wound cleansing and progression. (Photo courtesy of F. Meuleneire, Belgium)

Wet wound healing

Despite the assumption that excessive hydration of wounds should be avoided, several studies have suggested that wet wound healing, i.e., the presence of free fluid at the wound site, may be beneficial for wound healing. The immersion of wounds with saline or cell culture solutions to create "wet wounds" results in enhanced wound healing, reduced tissue necrosis and scarring compared with dry wounds. Wet wounds show little evidence of tissue maceration.

Wound hydration is good?

Optimising the hydration/moisture balance of the wound optimises healing. Both moist and wet wound healing offers significant healing benefits compared with dry wound healing. The clinical experience of excessive wound hydration being damaging to tissue and the studies suggesting that wet wounds heal with similar benefits previously ascribed to moist healing seem, at first glance, to be contradictive. However, this information, together with the knowledge that chronic wound exudates are fundamentally different from acute wounds, offers an explanation for the apparent contradiction. Chronic wound exudates contain high levels of proteindegrading enzymes and other tissue-damaging components that are able to damage tissues[6]. Acute wounds, however, contain low and controllable levels of these components that are little able to act on tissues. Chronic wound exudates damage tissues because of these components and not as result of exposure to the fluid itself.

Benefits of a moist wound healing environment
Faster wound healing
Promote epithelialisation rate
Promote dermal/wound bed healing responses
Reduced scarring
Retention of growth factors to wound site
Lower infection rates
Reduced pain perception
Enhanced autolytic debridement

Table 1

Conclusion: wound dressings and hydration

Wound hydration levels are important for wound healing. Optimising moisture balance is a key property of modern wound dressings. Recently, wound dressings better able to manage both the fluid levels and the damaging components contained within chronic wound exudate, are better placed to manage these damaging fluids effectively. Hydro-Responsive Wound Dressings are now available that manage both of these characteristics of chronic wound exudate and are now able to donate "fresh" solutions (e.g., Ringer's solution) from the dressings, further optimising hydration levels at the wound site and enhancing the healing benefits of a hydrated wound (Figure 3).

Figure 3 Schematic of Hydro-Responsive Wound Dressing action

1 Madison KC. (2003). Barrier function of the skin: "la raison d'être" of the epidermis. Journal of Investigative Dermatology 121(2): 231-241.
2 Bishop SM, Walker M, Rogers AA, Chen WYJ. (2003). Importance of moisture balance at the wounddressing interface. Journal of Wound Care 12(4): 125-128.
3 Atiyeh BS, Hayek SN. (2005). Intérêt d'un onguent chinois (MEBO) dans le maintient local de l'humidité. Journal des Plaies et Cicatrisation 9: 7-11.
4 Winter GD. (1962). Formation of the scab and the rate of epithelialization of superficial wounds in the skin of the young domestic pig. Nature (London) 193: 293-294.
5 Junker JP, Kamel RA, Caterson EJ, Eriksson E. (2013). Clinical impact upon wound healing and inflammation in moist, wet, and dry environments. Advances In Wound Care 2(7): 348-356.
6 McCarty SM, Percival SL. (2013). Proteases and delayed wound healing. Advances In Wound Care 2(8): 438-447.

The Effect Of Ringer's Solution Within a Dressing to Elicit Pain Relief

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Cliff Richardson - The School of Nursing, Midwifery and Social Work ,The University of Manchester

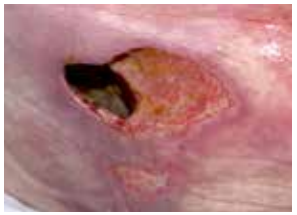
Introduction

Wound-related pain may be persistent, cyclic acute or non-cyclic acute pain resulting from one off procedures. Infection in the wound and cellulitis in the periwound skin may increase pain. The stress and anxiety of wound pain is a particular concern for patients at dressing change.
The analgesic effect of wound dressings by reducing pain can improve the patient's quality of life, reduce the need to provide analgesic drugs and even speed healing. For these reasons pain has become an important consideration in favour of the use of advanced wound dressings along with improved outcomes in patients with chronic wounds.

Hydro-Responsive Wound Dressings (HRWD) containing Ringer's solution - HydroClean® plus (HARTMANN) - provide relief from wound pain: patients treated with these dressings experienced decreased pain after treatment and low levels of pain at dressing change.[1-4] Active cleansing and non-traumatic properties aim to reduce pain at dressing change.

Four mechanisms (protective barrier, exudate dilution, pH and ionic balance, and leukocyte recruitment) are likely to contribute to pain relief when using a dressing with Ringer's solution. Each mechanism overlaps and they all rely on the provision of a controlled moist environment. The importance of each mechanism is dependent upon wound type. In acute wounds the initial protective function and rapid wound healing are likely to be most important. In chronic wounds controlling the detrimental cascade of the inflammatory response is likely to be most important, not just for relief of wound pain, but also for favourable wound healing.

14.05.2015
Grade 4 pressure ulcer that was painful and malodorous



18.05.2015
The patient was painfree and there was no malodour.

1. Kaspar D, et al. Efficacité clinique du pansement irrigo-absorbant HydroClean active contenant du polyacrylate superabsorbent dans le traitement des plaies chroniques – étude observationnelle conduit sur 221 patients. Journal des Plaies et Cicatrisations. 2008; XIII: 63, 21-24
2. Paul Hartmann AG. Effective wound cleansing with TenderWet active – observational study with 403 patients. HARTMANN Marketing Document. 2008.
3. Kaspar, D. TenderWet plus. Therapeutic effectiveness, compatibility and handling in the daily routine of hospitals or physician's practices. HARTMANN Marketing Document 2011.
4. Scholz, S., Rompel, R, Petres, J. A new approach to wet therapy of chronic leg ulcers. ARZT+PRAXIS. 1999; 53: 517-522

Causes of pain

Psychosocial Factors
(e.g. age, gender, culture, education, mental state - anxiety, depression, fear, loss/grief)

OPERATIVE
(cutting of tissue or prolonged manipulation normally requiring anaestetic, e.g. debridement, major burns dressings)

PROCEDURAL
(routine/basic interventions, e.g. dressing removal, wound cleansing, dressing application.)

INCIDENT
(movement-related activities, e.g. friction, dressing slippage, coughing)

BACKGROUND
(persistent underlying pain due to wound aetiology, local wound factors, e.g. ischaemia, infection)

Environmental Factors
(e.g. timing of procedure, setting - level of noise/ positioning of patient, resources)

Modified from: Principles of best practice: Minimising pain at wound dressing-related procedures. A consensus document, London MEP Ltd, 2004

Relief from pain

RINGER'S SOLUTION: REGULATED MOIST HEALING

PROTECTIVE BARRIER
The provision of a moist barrier may have an additional cushioning effect and protect against friction

EXUDATE DILUTION
Dilute prostaglandins, kinins, cytokines and matrix metalloproteases reducing pain and inflammation

PH AND IONIC BALANCE
The pH and ionic balance will influence the action of sodium and calcium channels involved in the pain response

LEUKOCYTE RECRUITMENT
The Ringer's solution's isotonic nature might be expected to recruit leukocytes that release natural painkillers

RELIEF FROM PAIN

From Material Science to Clinical Application – A Novel Foam Dressing for the Treatment of Granulating Wounds

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Petra Zöllner, Joachim Ellermann, Daniela Kaspar - PAUL HARTMANN AG, Heidenheim, Germany

Introduction

Hydro-responsive wound dressings are commonly employed to regulate the fluid balance of wounds after debridement and wound bed preparation[1]. Foam dressings can absorb fluid and through controlled evaporation (MWTR) these dressings are able to handle large amounts of exudate.
One feature which is missing is a hydrogel compartment in contact with the wound surface which is already moisture saturated at the start of the application of the foam dressing.
HARTMANN have developed a novel foam dressing* in which 56% of the surface area is covered with a polyurethane gel containing 40% of water. This polyurethane gel formulation gently sticks and provides initial adhesion of the dressing while the foam component is able to manage exudate in moderately exuding wounds to slightly exuding wounds through vertically stacked foam alveolae.
The novel foam dressing was tested in a prospective, observational study in 270 patients with mostly chronic leg or pressure ulcers.

Material

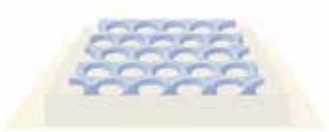

Figure 1 The dressing is made of small sized pore foam reticularly coated with a polyurethane hydrogel matrix.

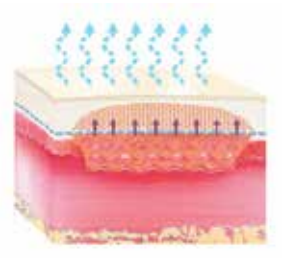

Figure 2 The hydrogel prevents the wound from drying out.
A semi-permeable film which is permeable to water vapour, adjusts the absorption capacity of the dressing to the wound conditions. The film is water and bacteria proof and thus protects against contamination.

Methods

By means of a standardised questionnaire treating persons documented the course of the treatment over three dressing changes

Etiology	No. in %
Venuous leg ulcers	28.5
Traumatic wounds	17.0
Pressure sores	14.8
Mixed leg ulcers	10.7
Pressure sores with diabetes mellitus	7.4
Diabetic foot ulcer	3.7
Arterial leg ulcers	3.3
Burns	1.9
Tumor wounds	0.4
Other etiology	12.2

Table 1 Wound etiology

Results

270 patients with mostly chronic leg ulcers (Table 1) participated in the open-label, multi-centre observational study.
At the beginning, wounds consisted mostly of granulation tissue. During an average of nine days the proportion of epithelialisation tissue increased from 16% to 28% (Figure 3).
Irritation of perilesional skin, particularly maceration, erythema and edema was reduced from 71% to 46% (Figure 4).
With ongoing wound healing the number of patients suffering from pain decreased from 65% to 44% and the number of patients with pain during dressing changes decreased from 56% to 36% (Figure 5).
The removal of HydroTac® and HydroTac® Comfort, respectively, was rated by the attending clinicians as good or very good in 90% and 87% of cases.

Conclusion

HydroTac® and HydroTac® Comfort, are novel foam dressings with AquaClear Technology especially developed for moisture balancing granulating wounds. Both dressing variants effectively protect newly formed tissue and provide a wound milieu which supports epithelialisation.

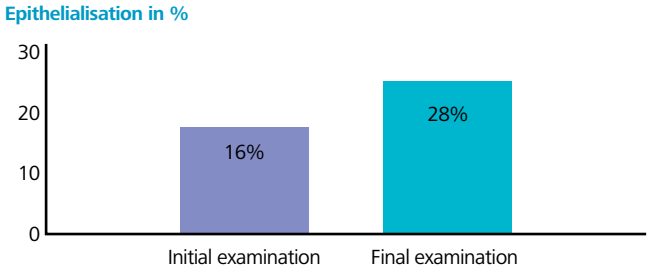

Figure 3 Increase of epithelialisation.

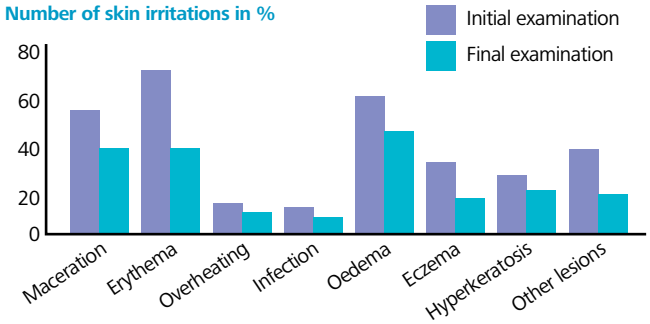

Figure 4 Reduction of irritations of peri-wound skin.

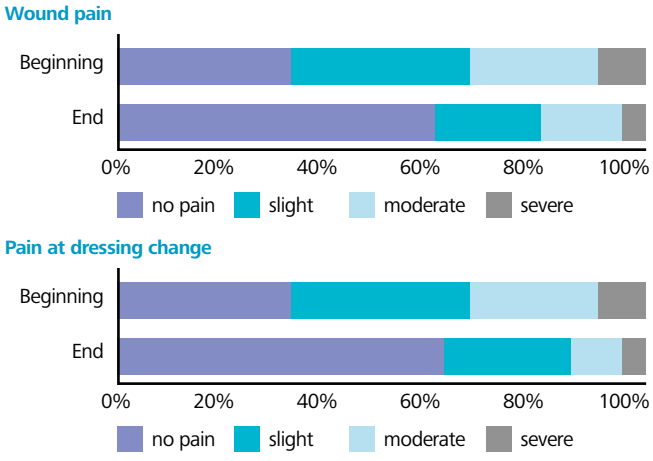

Figure 5 Reduction of wound pain and pain at dressing changes.

* HydroTac

1. Sibbald, R. G. et al. (2000) Ostomy Wound Manage 46, 14 ff.

Hydrated Polyurethane Polymers to Increase Growth Factor Bioavailability in Wound Healing

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Introduction

Soft tissue repair is a highly coordinated cellular process. During inflammation, granulation tissue formation and epithelial wound closure different cell types interact via diffusible growth factors. Exogenous application of growth factors has been explored albeit with limited success. An alternative strategy aims to increase the bioavailability of endogenous growth factors contained in the wound exudate.

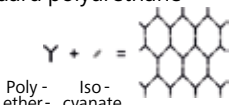
Aim

We analyzed whether hydrated polyurethanes (hPU) could increase the concentration and bioactivity of growth factors contained in the wound exudate.

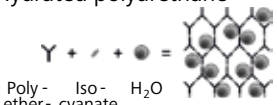
Methods

Hydrated polyurethanes were generated by different combinations of polyetherpolyol (Jeffamine), propylenglycol and isocyanate. These polymers can swell and absorb fluids. We tested the absorption capacity with tissue culture medium containing 5% serum as surrogate for wound fluid. For functional studies Hepatocyte growth factor (HGF) was spiked to the artificial wound fluid.

Standard polyurethane



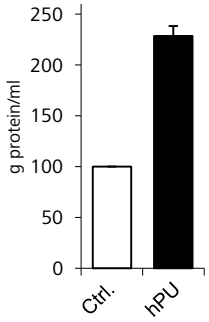
Hydrated polyurethane



Incubation of growth factor-spiked media on the hydrated polyurethanes

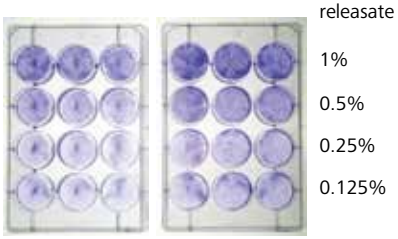
Results

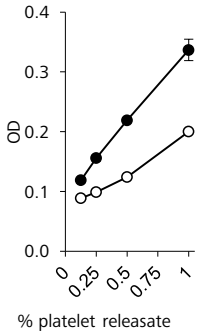
Hydrated polyurethanes concentrate proteins from complex solutions (DMEM + 1% FCS)



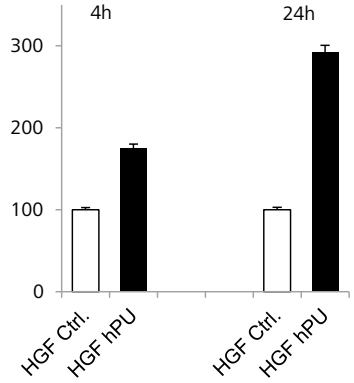
DMEM + 1% FCS incubation on the top of the hPU

Platelet releasate growth factor activity is increased

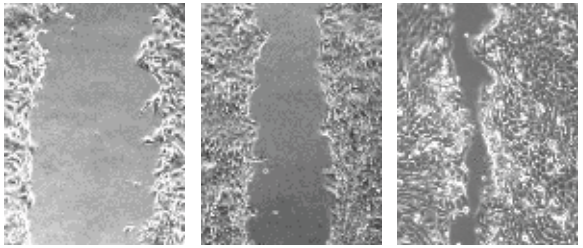




Concentration of HGF (ELISA)



HGF bioactivity in scratch assays with HaCaT keratinocytes



Wound Healing Under Moist / Hydrated and Dry Healing Environments

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Keith F. Cutting, MN., RGN. - Clinical Research Consultant, Hertfordshire, UK
Alan A. Rogers, BSc.(Hons) - Independent Wound Care Consultant, Flintshire, UK
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Institute of Skin Integrity and Infection Prevention, University of Huddersfield, Queensgate, Huddersfield, UK

Introduction

Modern wound dressings promote a moist wound environment. Termed Advanced Wound Dressings, these dressings are designed to maintain an optimal wound healing environment via the maintenance of a balanced hydration level. This optimal environment facilitates wound healing progression. The importance of wound hydration in promoting healing has been documented by many pre-clinical and clinical studies since the original seminal work of George Winter in the early 1960s.[1-3] Preventing wound desiccation and enhancing wound re-epithelialisation, retention of growth-promoting factors at the wound site, decreased pain experienced by patients (wound pain and at dressing changes), reduced scarring and promotion of autolysis (autolytic debridement) are some of the benefits of a moist wound environment.[4] Autolytic debridement and desloughing of a wound to remove the physical barriers to healing is a particularly important clinical benefit. The schematic diagram above summarises the benefits to wound healing in a moist/hydrated environment.

Laboratory and clinical studies have shown that bathing wounds in physiological fluids (termed "hyper-hydration") provides many of the benefits described for a moist healing environment.[5] Although counter-intuitive, these studies show significant benefits for healing wounds. For example, wound dressings that maintain the wound in a fluidic (hyper-hydrated) environment of Ringer's solution have been shown to be very successful in the treatment of both acute and chronic wounds.[6]

1. Winter GD. Formation of the scab and rate of epithelialisation in the skin of the young domestic pig. Nature 1962; 193: 293-5
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3. Winter GD, Scales JT. Effect of air drying and dressings on the surface of the wound. Nature 1963; 197: 91-2
4. Ousey K, Cutting KF, Rogers AA, Rippon MG. The importance of hydration in wound healing: reinvigorating the clinical perspective. J Wound Care 2016 (in press)
5. Junker JPE, Kamel RA, Caterson EJ, et al. Clinical impact upon wound healing and inflammation in moist, wet, and dry environments. Adv Wound Care 2013; 2(7): 348-56
6. Rippon MG, Ousey K, Cutting KF. Wound healing and hyper-hydration – a counter intuitive model.

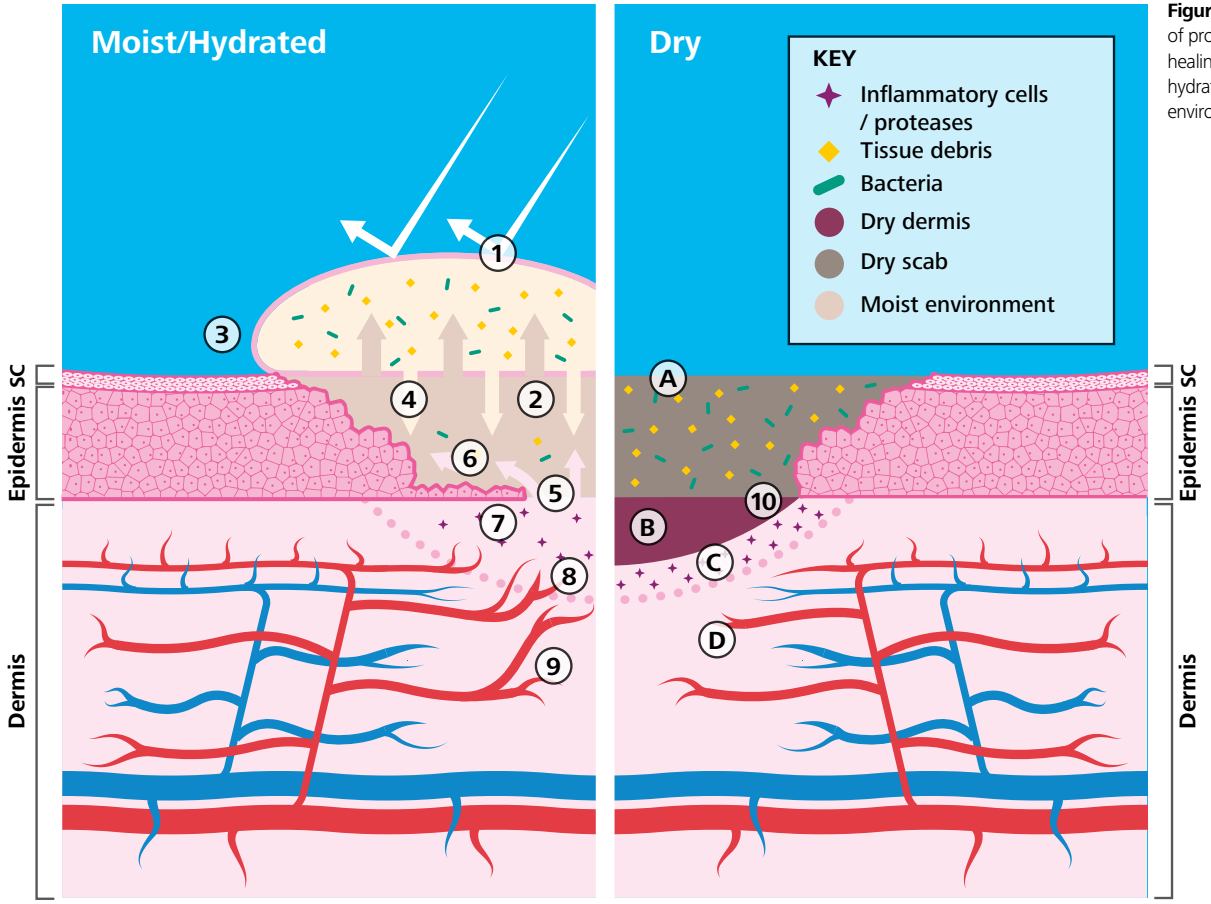

Figure 1 Comparison of processes in wound healing under moist/ hydrated and dry healing environments

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Proposed Mechanism/Evidence Support for Rinsing/Cleansing/Absorbing Action of HydroTherapy®

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Alan A. Rogers, B.Sc(Hons) - Wound Care Consultant, Flintshire, UK

Introduction

Since the first use of superabsorbent polyacrylate polymers (SAP) in wound care, the number of SAP-containing wound dressings has increased significantly[1,2]. The manufacturing process and chemical variability of these SAPs has meant that there is a diversity in the properties of these materials. The fluid handling capabilities are a key property of SAPs and are used to aid in the management of exudate-producing wounds. As well as the properties of the material itself, how it is structured within the dressing and whether or not it is combined with other components will all influence the fluid handling capability of SAP. HydroClean® plus is an innovative wound dressing that uses pre-moistened SAP to provide a rinsing/cleansing/absorbing action when used on wounds[3]. Here we propose a mechanism for the action of this wound dressing (Figure 1) from the evidence available.

Method

The authors reviewed the clinical data on the benefits of HydroClean® plus in the treatment of acute and chronic wounds with regards to the dressing's rinsing, cleansing and absorbing action[1]. The key areas for a proposed mechanism of action were identified and considered in the context of the function and properties of SAP and a proposed mechanism of dressing action was developed.

Figure 1: Proposed mechanism for dressing action[1,3]

Schematic diagram showing the unique rinsing and absorbing action of HydroClean® plus. (A) Continuous release of Ringer's solution (blue) from the superabsorbent polyacrylate core leading to softening of necrotic tissue and fibrin coatings (black) and uptake of bacteria- and protein-laden wound exudate (red); (B) absorption of, necrosis/ fibrinous material, bacteria and exudate into the polyacrylate core; and (C) wound cleansing and generation of optimal wound environment for starting and facilitating the healing process.

Figure 2: Schematic diagram of SAP swelling

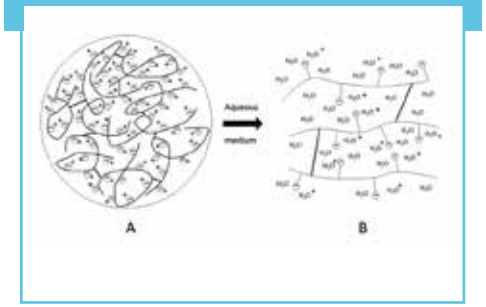
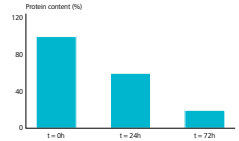


Figure 3: Absorption of bacteria by HRWD dressings[1]

Figure 4: Retention of bacteria[1]

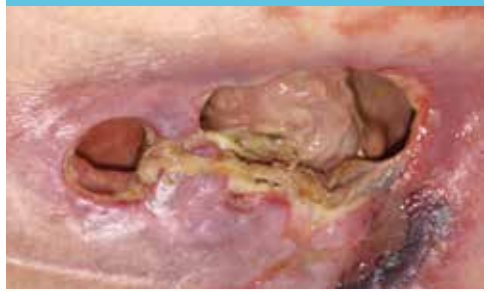
Figure 5: Retention of proteins[1]



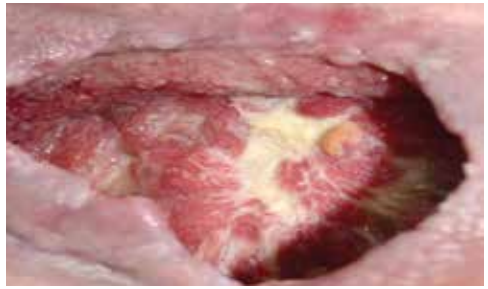
Results and Discussion

Clinical evidence for HydroClean® plus suggests this Hydro-Responsive Wound Dressing (HRWD) cleanses and activates wounds by softening and removing devitalised tissue, absorbing damaging wound exudate and promoting wound bed preparation for subsequent healing[1]. Four key areas of dressing action were identified that are central to dressing action: 1) fluid uptake; 2) protein binding and retention; 3) bacterial retention; and 4) autolysis (Table 1). Together, these aspects form a proposed mechanistic model for the unique rinsing/cleansing/absorbing action of HydroClean® plus to provide rapid and effective wound bed preparation for subsequent healing[3].

Figure 6: Autolytic debridement of a Grade 4 pressure ulcer by HRWD



14 May 2015



23 May 2015

Table 1: Key areas of HRWD action

Fluid uptake	The ionic nature of SAP leads to absorption of significant volume of fluid (exudate) (Figure 2). Active fluid uptake removes damaging exudate components (e.g., proteinases) from wound environment, as well as aqueous fluid.
Protein binding/ retention	The high density of carboxylate groups in SAP provides opportunities for protein absorption and retention to SAP particles via electrostatic interactions (Figure 5).
Bacterial retention	Fluid movement into the wound dressing results in uptake of bacteria into the core of the dressing. Physical entrapment of bacteria takes place within the swelling SAP core and reducing the bacterial bioburden of the wound bed (Figure 3 & 4).
Autolysis promotion	The provision of a moist wound environment promotes the softening of devitalised tissue and aids its removal. The partial hydration of HydroClean® plus with Ringer's solution provides a reservoir of fluid to promote a hydrated wound environment and facilitate autolysis (Figure 6).

Conclusion

Superabsorbent polyacrylate polymers are a diverse group of materials that have been widely used in a number of applications that benefit from the material's high fluid absorption characteristics. Their use in wound dressings has significantly improved the quality of life of patients with chronic wounds, where the management of tissue-damaging wound exudate is required, in order to aid in the healing of these wounds. The specific properties of the SAP used in HydroClean® plus and the way it is incorporated into the wound dressing – for example, pre-moistened with Ringer's solution – offers a novel approach to wound management, and provides an innovative rinsing/cleansing/absorbing action to aid wound healing.

1. Ousey K, Rogers AA, Rippon MG (2016) *HydroClean® plus: a new perspective to wound cleansing and debridement.* Wounds UK 12(1): 94–104 2. Ousey K, Atkin L, White R (2013) *Superabsorbent wound dressings: a literature review.* Wounds UK 9(3): 52–60 3. Rogers AA, Rippon MG *Proposed mechanism/evidence support for rinsing/cleansing/absorbing action of HydroClean® plus wound dressing.* J Funct Biomater (submitted)

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Wound Healing and Hyper-Hydration – A Counter Intuitive Model

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Introduction

Wound hydration has been the basis of modern wound care since Winter in the 1960s showed the benefits of moist wound healing over dry1. Adoption of moist wound healing led to the development of numerous types of modern wound dressings. These wound dressings have been designed to aid moisture balance and optimise tissue hydration levels.

Hyper-hydrated vs. dry wounds

Wounds in a hyper-hydrated environment show the following benefits compared with dry wounds[2]

- Up to 50% faster wound healing
- Less scarring and better cosmetic results
- Faster wound contraction
- Enhanced and faster re-epithelialisation
- Generally increased cellular proliferation, including keratinocyte and fibroblast growth
- Prolonged presence of growth factors and cytokines
- Promotion of angiogenesis/ revascularisation
- Greater production and quality of extracellular matrix, including elevated collagen synthesis
- Lower rates of infection
- Wound cleansing and irrigation
- Painless removal of dressings without destroying newly formed tissue

Comparative effects of Hydration vs Maceration[2]

Hydration	References
Beneficial to healing	Kruse et al, 2015
Aids debridement/ cleansing	Powers et al, 2013
Lowers risk of infection	Sarabahi, 2012
Transient low grade dermatitis	Rietschel and Allen, 1977
Less pain	Morgan and Hoelscher, 2000; Metzger, 2004
Less scarring	Bolton et al, 2000; Benbow, 2008
Lower cost	Kerstein, 1995; Metzger, 2004

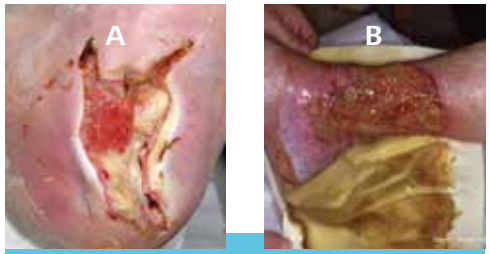
Maceration	References
Delays healing	Cutting and White, 2002
Increases slough and tissue damage	Ichikawa-Shigeta et al, 2014; Mugita et al, 2015
Increased tissue necrosis — higher risk of infection	Benbow and Stephens, 2010; Charlesworth et al, 2014
High grade dermatitis, wet eczema	Gray and Weir, 2007; Colwell et al, 2011
Increased discomfort, irritation pain and reduced QoL	Butcher, 2010; Dini et al, 2014
Long term physiological changes in skin with associated tissue degradation	Mugita et al, 2015
Increased cost	Charlesworth et al, 2014

Hyper-hydration vs. Maceration

Unfortunately, similarities in the presentation of HYPER-HYDRATION vs MACERATION may cause confusion and unwarranted intervention.

This confusion can lead to the wrong treatment pathway being followed and ultimately be detrimental to the patient and the healing outcome of the wound (see Table and Figure).

A clinical distinction must therefore be made between hyper-hydration and maceration and the different CAUSES and EFFECTS taken into consideration.



Clinical presentation of wounds treated under differing hydration conditions
Clinical presentation of a foot ulcer showing hyper-hydration (A) and a leg ulcer showing maceration (B).

Remember - Moist wound healing still remains the single most important component of the healing environment that clinicians can control and use to their advantage

1. Ousey K, Cutting KF, Rogers AA, Rippon MG (2016) *The importance of hydration in wound healing.* J Wound Care 25(3): 122-130 2. Rippon MG, Ousey K, Rogers AA, Atkin L (2016) *Wound hydration versus maceration: understanding the differences.* Wounds UK 12(3): 62-68

Hydration, Its Role In Wound Healing

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Mark G. Rippon, PhD - Visiting Clinical Research Fellow, Institute of Skin Integrity and Infection Prevention, School of Human and Health Sciences, University of Huddersfield, UK

Introduction

Optimal tissue hydration is very important for the normal functioning of the skin and is a key requirement for the progression of the wound healing response. An indication of just how important balanced moisture levels are for healing can be seen in the landmark studies establishing the importance of a moist wound environment for the healing of skin wounds[1,2]. Studies have also suggested that wounds exposed to levels of moisture greater than that achieved during the moist wound healing of non-healing wounds ('hyper-hydration'), offers similar benefits to those seen for wounds healed in a moist environment (Table 1)[3,4].

Table 1: Benefits of moist wound healing

Faster wound healing
Promote epithelialisation rate
Promote dermal/wound bed healing responses
Reduced scarring
Retention of growth factors to wound site
Lower infection rates
Reduced pain perception
Enhanced autolytic debridement

Hydration and wound bed preparation

Wound bed preparation is an essential component of wound management[5] and practical assessment tools such as the T.I.M.E. management framework offer a formalised series of guidelines to aid wound progression[6]. Examining the key components of T.I.M.E., the importance of hydration at all stages of wound healing treatment can be seen (Table 2). Modern, advanced wound dressings designed to manage wound exudate, optimise tissue hydration levels and provide a moist/hyper-hydrated wound environment are key to supporting healing via the principles of T.I.M.E..

Table 2: Summary of T.I.M.E.

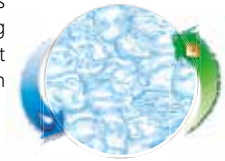
	Clinical requirement	Clinical action
T	Tissue management	WBP removes non-viable tissue and foreign material
I	Control of Infection and inflammation	Removal of infection and minimise inflammation
M	Moisture balance	Establish moist wound environment and optimise hydration
E	Advancement of wound edge epithelium	Provides optimal environment for wound closure

The therapy of hydration

Supporting an optimal level of hydration of a wound at all stages of healing promotes the healing response. The promotion of autolytic debridement and subsequent removal of devitalised tissue and reduction in bacterial bioburden (wound cleansing); the minimising of damaging tissue components in the wound (e.g., proteases) by their removal and dilution, and the establishment of a hydrated environment during the granulation and epithelialisation phases of healing, all promote healing.

The benefits of hydration at all stages of the healing continuum can be illustrated by HydroTherapy®, a sequential wound treatment programme that delivers simple and effective wound care through the use of two innovative and complimentary wound dressings (HydroClean® plus and HydroTac®).

Pre-moistened with Ringer's solution, saline is donated to the wound environment. At the same time, bacteria and tissue debris-laden wound exudate is absorbed and retained by the polyacrylate core (figure 1). This action produces a continuous rinsing and absorbing effect to support effective wound bed preparation and wound progression.



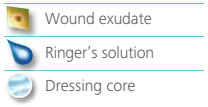
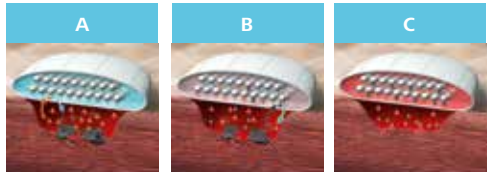


Figure 1

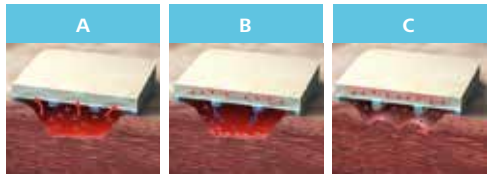
HydroClean® plus

A: The rinsing action of the continuous release of fluid (blue arrow) from thepolyacrylate core results in the softening of necrotic tissue and fibrin coatings (black) and uptake of bacteria- and protein-laden (black/red stars) wound exudate (red arrow) (autolytic debridement).
B: The absorbing action continues the uptake of necrotic tissue, fibrinous material and exudate which are retained within the core of the dressing.
C: The cleansing action leads to a healthy wound bed and the establishment of an optimally-hydrated wound environment for wound progression.



HydroTac®

A: Wound exudate and the damaging exudate components (red stars) are absorbed by the polyacrylate of foam layer (red arrow).
B: The hydrating action of the AquaClearGel Technology releases fluid (blue arrow) to optimise hydration levels within the wound bed.
C: Optimisation of hydration levels andgrowth factor concentrations (blue spheres) promotes new granulation tissue formation and epithelialisation.



Conclusion

Hydration is very important for the progression of the healing response. Advanced, modern wound dressings that promote optimised hydration levels at all stages of wound healing offer the best opportunity to effect optimised healing.

The Therapy of Hydration: Case Study

Background
A 95-year old patient with a pressure ulcer on the left heel which had been present for 2 weeks.
Treatment
HydroClean® plus was applied and secured with a film dressing. Once the wound was cleaned and healthy granulation tissue covered the wound bed, HydroTac® was used to promote the latter stages of wound healing. Dressings were changed every 3-4 days.
Outcomes
Day 4: wound base was largely clear of devitalised tissue
Day 7: new and healthy granulation tissue was visible and normalisation of the wound environment had progressed.
The treatment dressing was changed to HydroTac®.

Figure A: pressure ulcer prior to treatment with HydroClean® plus. The wound showed 100% coverage with necrotic tissue.

Figure B: Treatment Day 4. The second dressing change after the commencement of HydroClean® plus treatment. The wound is largely cleared of devitalised tissue.

Figure C: Treatment Week 8. After the 16th dressing change with HydroClean® plus and HydroTac® treatment, pressure ulcer was almost completely closed.

1. Bishop SM, Walker M, Rogers AA, et al. (2003). *Importance of moisture balance at the wound-dressing interface.* Journal of Wound Care 12(4): 125-128. 2 Ousey K, Cutting KF, Rogers AA, et al. (2016). *The importance of hydration in wound healing: reinvigorating the clinical perspective.* Journal of Wound Care 25(3): 122-130.
3 Rippon MG, Ousey K, Cutting KF. (2016). *Wound healing and hyper-hydration: a counterintuitive model.* Journal of Wound Care 25(2): 68-75. 4 Junker JP, Kamel RA, Caterson EJ, et al. (2013). *Clinical impact upon wound healing and inflammation in moist, wet, and dry environments.* Advances In Wound Care 2(7): 348-356.
5 Schultz G, Sibbald G, Falanga V, et al. (2003). *Wound bed preparation: a systematic approach to wound management.* Wound Repair and Regeneration 11(Suppll. 1): 1-28. 6 Leaper DJ, Schultz G, Carville K, et al. (2012). *Extending the TIME concept: what have we learned in the past 10 years?* International Wounds Journal 9(Supplt. 2): 1-9.

Barriers to Wound Debridement: Results of an Online Survey

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Mark G. Rippon PhD. - Visiting Clinical Research Fellow. School of Human and Health Sciences, University of Huddersfield, Queensgate, West Yorkshire
Dr. John Stephenson - Biomedical Statistician, Institute of Skin Integrity and Infection Prevention, University of Huddersfield, Queensgate, Huddersfield, HD1 3DH

Background

Debridement is the removal of non-viable tissue from the wound bed which assists the conversion of the molecular and cellular environment of chronic wounds to resemble that of acute wounds promoting healing (Schultz et al, 2003). Debridement helps to reduce bacterial burden within the wound, controls on-going inflammation and malodour whilst encouraging formation of granulation tissue thus promoting wound healing (Sieggreen and Maklebust, 1997). This poster presents the results of an online survey which investigated healthcare professionals' knowledge of wound debridement and the techniques used.

Method

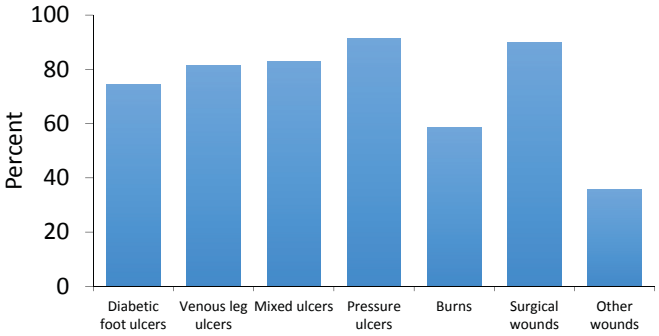
This online survey, using purposive sampling, was distributed to healthcare professionals working within tissue viability services (n=252) via survey monkey across the UK to investigate healthcare professionals' knowledge of wound debridement and the techniques used. Ethical approval to distribute the survey was received from the School of Human and Health Sciences Research and Ethical Panel. A total of 77 responses to the survey were received (31%). All but 5 respondents practiced in England, 3 in Scotland and 2 in Wales

Results

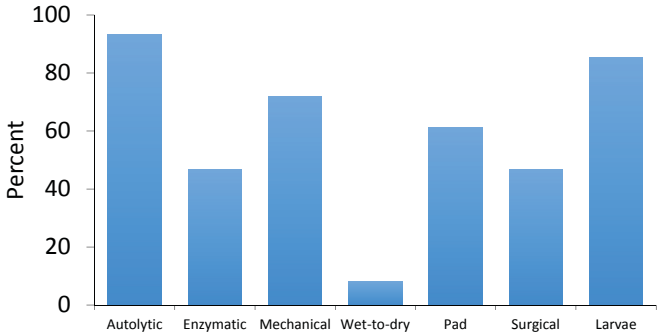
Survey distributed via purposive sampling to healthcare professionals working within tissue viability services across the UK:

- 77 responses received (31% response rate) representing participants practicing in wound care within various healthcare organisations
- 72 respondents (93.5%), when questioned, debrided wounds
- 71 respondents (95.9%), when questioned, were aware of the TIME concept
- An understanding of debridement and desloughing is limited

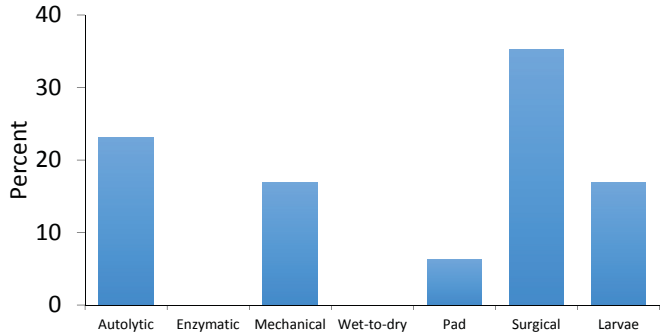
Types of wounds treated (by percentage of respondents)



Types of debridement used (by percentage of respondents who debride wounds)



Preferred means of debridement (by percentage of respondents who debride wounds)



Conclusion

It is evident that respondents were aware of the importance of preparing the wound bed for the healing process with the majority of respondents using the TIME concept to assist in their assessment. Whilst the respondents recognised the importance of removing devitalised tissue, their understanding of debridement and desloughing is limited. Continued education and the development of skills in being able to safely and effectively debride wounds is essential; however funding cuts to education and limited study time make it difficult for practitioners to secure time away from clinical practice.

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Preliminary Studies to Evaluate the Effects of 24 Hour Hyper-Hydration on Skin Barrier Function

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Mark G. Rippon PhD. - Visiting Clinical Research Fellow. School of Human and Health Sciences, University of Huddersfield, Queensgate, West Yorkshire

Introduction

Maintenance of an adequately hydrated wound is seen as paramount, yet many wounds are subjected to excessive hydration through uncontrolled exudate levels, which leads to skin maceration and further potential barrier disruption. In many chronic wounds the presence of excess proteases are present in the exudate, (e.g. elastase) which help to breakdown the peri-wound skin due to the nature of this "corrosive" biological fluid (Chen et al., 2003). In these preliminary studies the effects of 24 hour hyper-hydration of human skin have been evaluated using water, Ringers and an elastase solution.

Method

1cm human epidermal membranes were placed onto Franz diffusion cells placed in a water bath at 32 (± 0.5)°C). Pretreatment of the cells was for 24 hours with the following:
1. Water
2. Ringers
3. Elastase (100ug/ml)
4. Control with no pre-treatment.

200ul of each solution (n=3) was added to the epidermal surface and after 24 hours removed and replaced with
caffeine (1mg/ml) to measure potential barrier disruption.

Each receptor chamber was filled with phosphate buffered saline from which 200ul aliquots were removed (and replaced) at predetermined intervals over a maximum period of 50 hours.

At the end of the 50 hours membranes were carefully removed from the Franz cell and fixed in buffered formalin for H&E examination

Results

Caffeine permeation rates were calculated by plotting the cumulative amount permeated per unit surface area of the membrane (in µg/cm2/hour).
Figure 1 illustrates the cumulative amount of caffeine permeation over 50 hours. No overall barrier disruption was evident following the application of both water and Ringers, when compared with the control, and these data are in good agreement with previous published data (Schreiber et al., 2005; Luo and Lane 2015). Pretreatment with elastase, however, showed a marked increase in cumulative permeation.

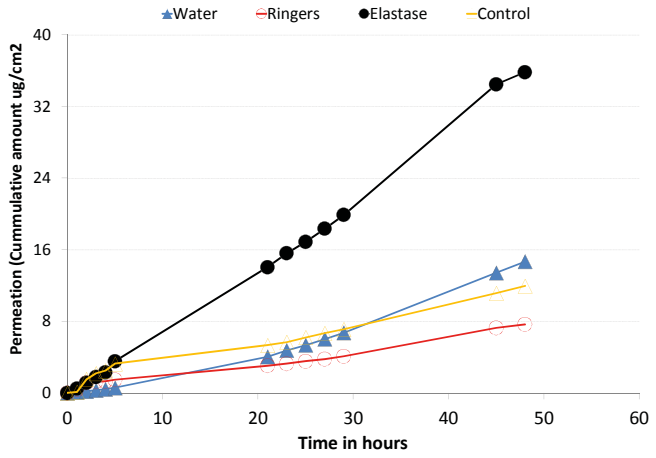


**Figure 1: Cumulative permeation of caffeine across human epidermal membranes.
Following a 24 hour pre-treatment period.**

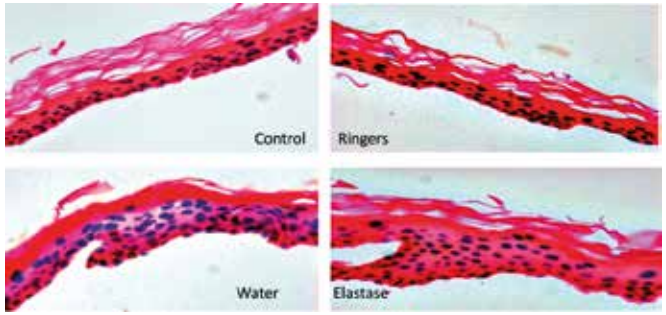


Figure 2: H&E of human epidermal membranes after 50 hours. Note the similarity of the control and ringers versus the more hydrated appearance of the water treated membranes and the observation of gaps appearing in the stratum corneum following elastase pre-treatment (arrowed).

Discussion

Clinically, a major reason for peri-wound skin breakdown is as a result of excessive protease activity present in would fluid (Chen et al., 2003), and previous in vitro skin studies have also observed this (Walker et al.,2008 These in vitro results provide further evidence in support of those original observations. Histological examination of the skin, post applications, also suggests that there may be some breakdown within the stratum corneum structure as indicated by the increased permeation observed. Further studies need to be carried out to confirm these preliminary observations.

Conclusion

These in vitro studies highlight the importance of reducing protease activity in and around the superficial wound areas. This may be helped by the appropriate use of dressings that have a good absorptive capacity to remove excessive proteolytic activity.

1. Chen WYJ, Rogers AA, Walker M, Waring M, et al., 2003. *A rethink of the complexity of chronic wounds – Implications for treatment.* ETRS Bulletin; 10: 65-69 2. Luo L, Lane ME, 2015. *Topical and transdermal delivery of caffeine.* Int J Pharm; 490: 155-164 3. Schreiber S, Mahoud A, Vuia A, et al., 2005. *Reconstructed epidermis versus human and animal skin in skin absorption studies.* Toxicol. In Vitro; 19: 813-822
4. Walker M, Hadgraft J, Lane M, 2008. *Investigation of the permeability characteristics of peri-ulcer and whole ischaemic skin tissue.* Int J Pharm, 357: 1-5

Hydro-Responsive Wound Dressings Simplify T.I.M.E. Wound Management Framework

Karen Ousey, PhD - Professor and Director & Visiting Clinical Research Fellow, Institute of Skin Integrity and Infection Prevention, School of Human and Health Sciences, University of Huddersfield, UK
Alan A. Rogers, BSc.(Hons) - Wound Care Consultant, Flintshire, UK Mark G. Rippon, PhD - Visiting Clinical Research Fellow, Institute of Skin Integrity and Infection Prevention, School of Human and Health Sciences, University of Huddersfield, UK

Introduction

The development of wound management protocols and guidelines such as the T.I.M.E. (Tissue management, control of Infection/inflammation, Moisture balance, advancement of epithelial Edge of the wound) framework are useful tools that aid wound care practitioners to deliver effective wound care[1]. These tools provide a systematic approach for the assessment and management of the majority of acute and chronic wounds. Devitalised tissue in the wound bed, the presence of both an elevated wound bioburden and damaging wound exudate are barriers to wound healing progression that are targeted by T.I.M.E. (Table 1)[1,2]. We briefly summarise the principles of T.I.M.E. and describe an effective and simple two-dressing wound management system[3] that delivers the benefits set out in the T.I.M.E. framework.

Table 1: Summary of T.I.M.E.

	Clinical requirement	Clinical action
T	Tissue management	WBP removes non-viable tissue and foreign material
I	Control of Infection and inflammation	Removal of infection and minimise inflammation
M	Moisture balance	Establish moist wound environment and optimise hydration
E	Advancement of wound edge epithelium	Provides optimal environment for wound closure

Method

The authors examined each of the four aspects of the T.I.M.E. wound management framework in turn, identifying the key features associated with each section. They then reviewed the scientific and clinical evidence in support for Hydro-Responsive Wound Dressings (HRWDs) to assess the dressings' ability to implement all stages of the T.I.M.E. wound management framework.

Results and Discussion

A review of the evidence shows HRWDs (HydroClean® plus and HydroTac®) significantly reduce the levels of necrosis/slough in a number of wounds including ulcers and they reduce wound infections and bioburden, as well as reducing the levels of proteinases (stimulators of tissue inflammation) in wound exudates[3]. HRWDs also show excellent fluid management capabilities leading to reduced peri-wound tissue damage and enhanced epithelialisation (Table 2)[5]. HydroTherapy® is an innovative approach to the treatment of chronic wounds. This therapy involves the use of only two Hydro-Responsive Wound Dressing (HRWD)-centred steps from wound cleansing to wound healing[3-5]. The dressings deliver 1) rapid cleansing, 2) early granulation tissue formation and 3) epithelialisation. These HRWDs establish a balanced hydration level at all phases of healing to support effective healing.

Conclusion

Modern wound care has a myriad of wound dressings (traditional and advanced) that help wound care practitioners deliver effective wound care. The concept of wound bed preparation has become a cornerstone in the efforts to heal chronic wounds and the development of protocols such as T.I.M.E. provide a systematic approach for treating wounds. The appropriate use of wound dressings is key to optimising wound healing treatments. The two-dressing, moisture balance-oriented dressing-based wound management system approach to wound care (HydroTherapy) offers a valuable tool in delivering effective wound management, simplifying which wound dressing to use from the large number of dressings currently available that addresses the requirements set out in T.I.M.E. (Figure 2).

Figure 2: Use of HRWDs with T.I.M.E. framework[4]

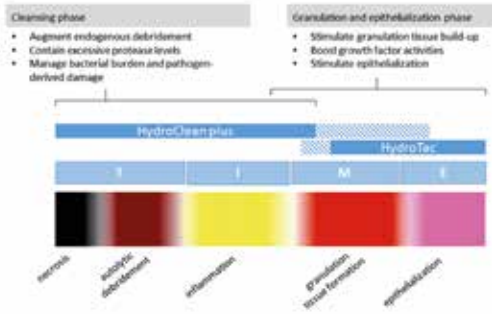
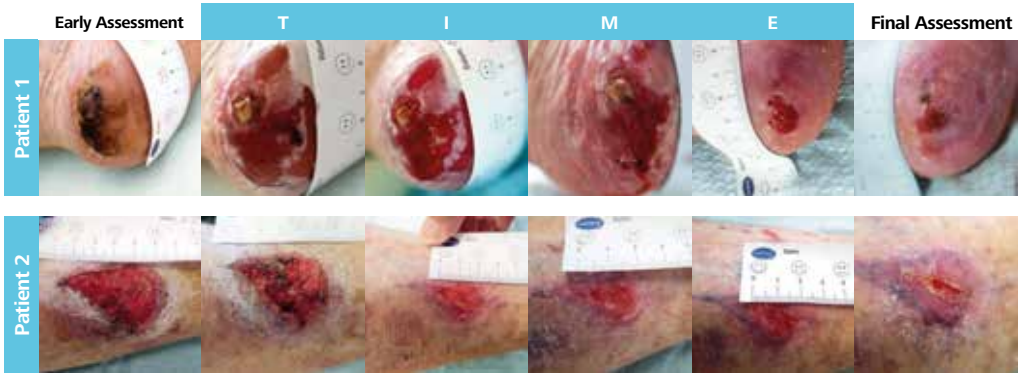


Table 2: Summary of evidence for HRWDs within T.I.M.E.[5]

Clinical observation	Pathology Question	HRWD Clinical Impact	Clinical Effect	Clinical Outcome
Tissue nonviable	Does wound contain nonviable tissue?	Removes devitalised tissue	Reduction in devitalised tissue and promotes viable wound bed	Viable wound bed and wound bed preparation
Infection and/or inflammation	Does wound contain high bioburden and/or prolonged inflammation?	Removed devitalised tissue that provides focus for infection	Reduces bacterial counts and signs of infection/inflammation	Bacterial and inflammatory balance
Moisture balance	Does wound have excessive fluid?	Aids absorption and management of wound exudate	Optimised moisture levels and minimised maceration	Optimised hydration levels and moisture balance
Edge of wound: nonadvancing	Is epidermis non-migratory?	Aids absorption and management of wound exudate	Good periwound skin condition and promotes wound closure	Advancing wound edges and wound closure

Figure 1: Case examples of ulcers treated with HRWDs



Patient 1: 95-year old patient with a pressure ulcer on heel
Patient 2: 83-year old patient with a wound in the region of the knee (tibia right lateral

1. Schultz GS, Sibbald RG, Falanga V et al (2003) *Wound bed preparation: a systematic approach to wound management.* Wound Repair Regen 11(Suppl. 1): S1–28 2. Dowsett C, Newton H (2005) *Wound bed preparation: TIME in practice.* Wounds UK 1(3): 58–70 3. Ousey K, Rogers AA, Rippon MG (2016) *HydroClean plus: a new perspective to wound cleansing and debridement.* Wounds UK 12(1): 94–104
4. Smola H (2016) *Simplified treatment options require high-performance dressings – from molecular mechanisms to intelligent dressing choice.* Presented at the European Wound Management Association (EWMA) Congress, Bremen, Germany, 2016 5. Ousey K, Rogers AA, Rippon MG (2016) *Hydro-Responsive Wound Dressings simplify T.I.M.E. wound management framework.* J Wound Care (submitted)

SECTION 3

Exudate Management

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Wound Healing and Hyper-Hydration – A Counter Intuitive Model

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Mark G. Rippon, PhD - Visiting Clinical Research Fellow, Institute of Skin Integrity and Infection Prevention, School of Human and Health Sciences, University of Huddersfield, UK

Introduction

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Hyper-hydrated vs. dry wounds

Wounds in a hyper-hydrated environment show the following benefits compared with dry wounds[2]

- Up to 50% faster wound healing
- Less scarring and better cosmetic results
- Faster wound contraction
- Enhanced and faster re-epithelialisation
- Generally increased cellular proliferation, including keratinocyte and fibroblast growth
- Prolonged presence of growth factors and cytokines
- Promotion of angiogenesis/ revascularisation
- Greater production and quality of extracellular matrix, including elevated collagen synthesis
- Lower rates of infection
- Wound cleansing and irrigation
- Painless removal of dressings without destroying newly formed tissue

Comparative effects of Hydration vs Maceration[2]

Hydration	References
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Maceration	References
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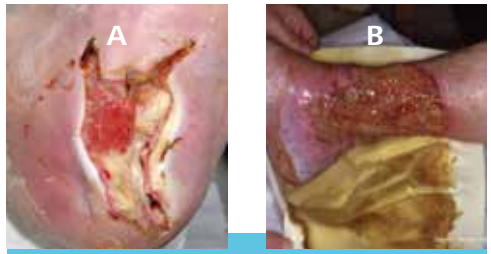
Increased cost	Charlesworth et al, 2014

Hyper-hydration vs. Maceration

Unfortunately, similarities in the presentation of HYPER-HYDRATION vs MACERATION may cause confusion and unwarranted intervention.

This confusion can lead to the wrong treatment pathway being followed and ultimately be detrimental to the patient and the healing outcome of the wound (see Table and Figure).

A clinical distinction must therefore be made between hyper-hydration and maceration and the different CAUSES and EFFECTS taken into consideration.



Clinical presentation of wounds treated under differing hydration conditions
Clinical presentation of a foot ulcer showing hyper-hydration (A) and a leg ulcer showing maceration (B).

Remember - Moist wound healing still remains the single most important component of the healing environment that clinicians can control and use to their advantage

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SECTION 4

Compression

The Effect of Dressing Type on Pressure Distribution of Compression Bandaging

Isaac Leung, Leigh Fleming, Leanne Atkin, Institute for Skin Integrity and Infection Prevention, The University of Huddersfield

Introduction

Compression therapy is the principal treatment for leg ulcers associated with venous disease. The extent of compression can be estimated from the general Laplace equation relating pressure, bandage tension and leg radius. Multi-component medical compression bandages are widely used to treat venous leg ulcers. However other clinical challenges present themselves when treating these wounds under compression. Such challenges are management of wound exudate, debridement of devitalised tissue, treating infections/cellulitis, management of dry wounds, promotion of healing and management of pain experienced by the patient in relation to the wound and the added discomfort of compression. In order to address at least some of these challenges, wound dressings may be used as part of the overall treatment regimen. If compression is being applied then these wound dressings should not interfere with the graduated pressures applied.

This study was undertaken to demonstrate the effect of introducing HRWD (HydroClean® plus and HydroTac®) dressings under compression bandaging. A pressure mapping study was conducted on two types of wound pads which were HydroTac® and HydroClean® plus. The aim of the study was to investigate the influences of the respective pads to the pressure at compression bandage- leg interface.

Methodology

A volunteer participated in the study to enable compression bandage application to the lower right leg. Three marks were located at the ankle, below the calf, below knee respectively which were the locations where the values of interface pressure were measured by The Teckscan I-scan system. Another mark was located just above the ankle and at the opposite side to the aforementioned mark which was the location were the two wound pads were applied. The dressings and compression bandaging were applied by a trained professional to mimic clinical use of the products. Measurements were taken at all 3 locations a total of 2 times under controlled application, further measurements were taken below the knee using slightly varied compression bandage application, both times were still within the limits of clinical use.

Table 1 Measurement Results

Experiment	Wound Pad	Anatomical Location	Interface Pressure (mmHg)
Original Measurement	HydroTac	Below Knee	52.50
		Below Calf	56.25
		Ankle	58.50
	HydroClean plus	Below Knee	51.43
		Below Calf	55.50
		Ankle	60.00
Repeat Measurement	HydroTac	Below Knee	56.25
		Below Calf	55.72
		Ankle	61.08
	HydroClean plus	Below Knee	54.38
		Below Calf	53.44
		Ankle	59.25
Without Wound Pad (Tighten)		Below Knee	45.00
Without Wound Pad (Loosen)		Below Knee	54.75

Results and Discussion

The values of the measured interface pressure are listed in Table 1.

- The percentage differences between the original and repeat measurement were all less than 6.7%.
- The percentage differences between the use of HydroTac® and HydroClean® plus were all less than 4.1% in both original and repeat measurements.

This indicated that two wound pads had very little influences on the values of interface pressure between the volunteer's leg and the compression bandage. Two extra measurements were conducted without any wound pad. One of these measurements was conducted with slightly increased tightness compression bandage application and the other one was with slightly reduced tightness compression bandage application. The percentage difference between the extra measurements was 17.8%. These results showed that the interface pressure was affected more by the variation in application of the compression bandage rather than the types of dressings used.

Conclusion

Compression bandaging remains the bedrock of venous leg ulcer treatment and without which healing of these wounds is uncertain. Adjuvant therapies (e.g. wound dressings) are also required alongside of compression and may in some cases interfere with optimisation of sub-bandage pressures required for clinical effectiveness. Knowledge (clinical and experimental) of what and how these therapies might interfere and cause an increase or decrease in sub-bandage pressure is required. Thus is in order to enable the clinician to decide how such adjuvant therapies might be used in order to balance positive and negative effects on clinical outcomes. This data enables nurses to choose HRWD combined with compression therapy to treat patients with venous leg ulcers.

Pennine Care NHS
NHS Foundation Trust

A Case Study Series Evaluation of Zetuvit Plus in the Treatment of Moderately to Highly Exuding Wounds under Compression

Kimberley Wilde, Wound Care Pathway Lead Email: kimberley.wilde@nhs.net

Introduction

A venous leg ulcer is defined as an open lesion between the knee and the ankle joint that occurs in the presence of venous disease and takes more than two weeks to heal (NICE, 2013). Guest et al (2015) found that there were at least 730,000 patients with leg ulcers in the UK, which equates to 1.5% of the adult population having a leg ulcer. Venous ulcers can take weeks or months to heal and have a high reoccurrence rate.

Venous ulcers have been found to have a significant impact on a patients' quality of life, with associated personal, social and psychological effects; this also has a considerable financial impact on healthcare providers, as well as a wider social and economic impact (EWMA, 2016).

Zetuvit® Plus

Zetuvit Plus is a highly superabsorbent dressing with a four layer design of skin-friendly materials which gives the dressing a unique softness. Due to its high absorbency rates this leads to fewer dressing changes resulting in time and cost saving.

Method

This project was undertaken over a 6 month period to review the performance of Zetuvit plus under compression bandaging All clinicians involved had attended educational seminars on Zetuvit plus .Patient consent was obtained and ethics approval was not required .The community nursing team assessed ease of application and removal ,comfort exudate management use under compression number of dressing changes and patient satisfaction .

Results

Pennine Care have considered the results to date and find they are extremely promising with the main benefits being improved exudate management reduced dressing change prevention of peri wound damage and patient satisfaction .In this case study series it was found that Zetuvit plus absorbs wound exudate and reliably retains it within the absorbent core without any detrimental effects on levels of compression .

Conclusion

Pennine Care will continue the evaluation of Zetuvit Plus as consideration is now being given for the addition of Zetuvit Plus for forthcoming formulary inclusion

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National Institute for Health and Clinical Excellence (2013) Clinical Knowledge Summaries: Leg Ulcer – venous. Available online at: http://cks.nice.org.uk/leg-ulcer-venous#!topicsummary

Guest JF, Ayoub N, Mcllwraith T et al (2015) Health economic burden that wounds impise on the National Health Service in the UK. BMJ Open 5: e009283. Doi: 10.1136/bmjopen-2015-009283

European Wound Management Association (2016) Management of patients with leg ulcers: Challenges and current best practice. Available at http://www.magonlinelibrary.com/pb-assets/JOWC/EWMA-venous-leg-ulcers.pdf

Case Study

- Female aged 45
- Lymphoedema
- Long standing lower leg ulcer
- Uses compression wrap
- Self manages between appointments
- On commencing Zetuvit Plus over a two-week period there has been a reduction in her wound size from 37x11cm to 27x7cm. Figure 2
- Patient has found the dressing very comfortable and easy to apply and remove
- staff have commented on a better level of exudate management with no maceration of the peri-wound skin

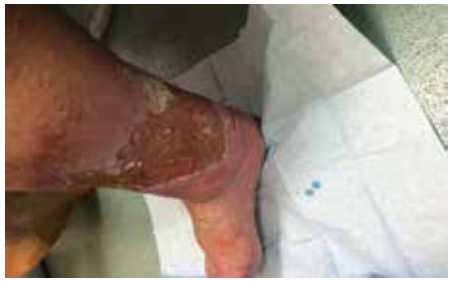


Figure 1

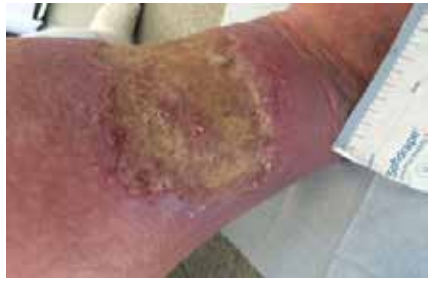


Figure 2. Two weeks later

SECTION 5

Wound Contact Layers

Shropshire Community Health NHS
NHS Trust

Use of a new Wound Contact layer in NPWT

Joy Tickle Tissue Viability Nurse Specialist. Tissue Viability Service Shropshire Community Health NHS Trust Email: joy.tickle@nhs.net

Introduction

Negative pressure wound therapy (NPWT) is a procedure used frequently in the treatment of acute and chronic wounds. One of the challenges when using NPWT is adherence of the primary wound contact layer to the wound bed. This can lead to potential damage to the wound bed tissue, delayed healing time and also lead to increased pain and discomfort for the patient during dressing change. The application of a non-adherent wound dressing between the wound bed and the primary NPWT dressing would assist in preventing these problems.

Methods

Type of Research -Case Study series over 6-month period of 10 patients with unspecified wounds that required treatment with an atraumatic (silicone adhesive) wound contact Layer (Atraumann Silicone) in conjunction with NPWT. This clinical evaluation was conducted to assess the acceptability and effectiveness of a new wound contact layer Atrauman Silicone that can be used in combination with NPWT, in the local management of acute and chronic wounds. Patient consent was gained and ethics approval was not required.

Results

- Atrauman Silicone in conjunction with NPWT was shown to be effective in that:-
- It did not adhere to the wound when being used in conjunction with NPWT in 100% of the Cases.
- Supported a healing response in that the average wound area reduction over the two weeks evaluated was 23%.
- Enabled wound bed preparation with a change from an average baseline level of slough of 63% wound coverage to 91.5% granulation tissue.
- Silicone contact layer protected the granular tissue from damage or potential trauma
- Pain (as measured by VAS) was at the baseline 5.8 (sd 2.9) vs that at the finish of 1.3 (sd 0.8). All patients reported no pain on dressing application and removal.

Reported Outcomes

- No wound adherence from contact layer and or NPWT contact layer.
- No reported pain or agitation on dressing change.
- Granulation tissue protected.
- wound decreasing in size and depth

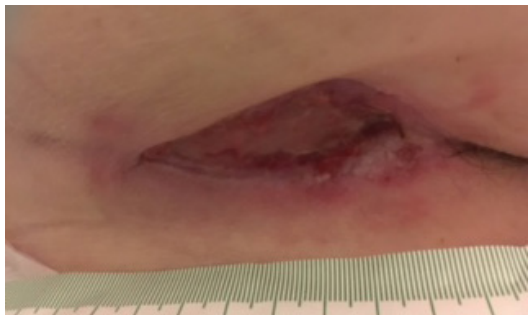
Conclusion

This 10 patient case study series demonstrated that there was no wound bed adherence when using the silicone contact layer alongside the NPWT, an overall wound improvement with increased granulation tissue production, reduction in wound size and depth resulting in increased wound healing. Patients reported decrease in pain levels and increased comfort thus assisting in improving their quality of life when living with a wound. From the results of this clinical evaluation and supporting clinical evidence future management of wounds requiring NPWT will now involve the use of Atrauman Silicone to achieve and improve best practice and patient comfort.

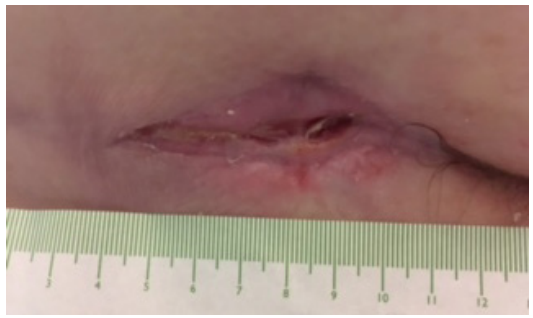
Case Study

Case study 52-year-old gentleman with learning difficulties, he was doubly incontinent (profuse faecal incontinence) with a faecal drainage system in use. Moisture damage and pressure ulceration developed. He had surgical and sharp debridement and NWPT commenced to support healing. The patient was at a high risk of infection/sepsis.

NPWT was extremely painful to patient, he was agitated and his Quality life negatively impacted due to his requiring constant bedside nursing.



As Pu was granulated and exudate levels decreasing the NPWT contact layer was adhering to wound bed. Painful and traumatic to granulation tissue.



Two weeks following the introduction of Atrauman as a primary contact layer, no wound adherence, no reported pain, granulation tissue protected, wound drecreasing in size and depth.

SECTION 6

Multi-centre Studies

A Multi-Centre 15 Patient Evaluation of HydroTac® Comfort Dressing

Lindsey Bullough - Clinical Nurse Specialist – Tissue Viability. Wrightington, Wigan and Leigh Foundation Trust
Sue Johnson - Clinical Lead Wound Care, Doncaster and Bassetlaw Hospitals. NHS Foundation Trust
Debra O'Brien – Podiatry Clinical Manager (Solent NHS Trust, West)

Introduction

An evaluation of HydroTac® Comfort was undertaken to observe its performance when used as a primary dressing, to prepare the wound bed and facilitate wound progression. A cost benefit analysis was also used to identify the potential for cost savings to be made. A multi-centre evaluation was performed, where 15 patients were recruited from the adult (≥18years) populations routinely seen by the evaluating clinicians from three centres, one of which was a community based Podiatry service.

Discussion

HydroTac® Comfort performed extremely well in this small, uncontrolled study. It was used as a primary dressing throughout and no other dressings or extra adhesion was used.
It provided the optimal environment, which facilitated healing in 12 patients with an overall cost saving of £198.06 in comparison to standard practice.
HydroTac® Comfort was easy to apply and remove, and no problems were identified. It was also highly acceptable to patients who reported it to be comfortable during application, wear and removal, and it was associated with a reduction in pain.

Results

9 patients (60%) were male and 6 (40%) female, with ages ranging from 42 to 89 years (mean age of 72 years). Relevant co-morbidities were recorded in 87.1% (n=14) patients.

- The dressing was evaluated on a wide range of wound aetiologies where the duration of the wounds ranged from 1-26 weeks (mean 4.6 weeks)
- 94% (n=14) of patients were experiencing some degree of wound pain (mean pain score 2). Among those, 20% (n=3) patients were taking analgesia for pain
- 13% (n=2) of patients presented with existing wound infections for which they were receiving systemic antibiotic therapy

Dressing performance

Data was collected on 58 dressing changes where the number per patient ranged from 1 to 7 (mean 4), with the evaluation period ranging from 3 days to 28 days (mean 12 days)
Dressing change frequency was recorded:

- 88% (n=50) of dressing changes undertaken every 3 days
- 6% (n=4) of changes undertaken on alternate days. This was related to 1 patient whose dressing was contaminated from incontinence
- 6 % (n=4) of dressing changes performed weekly

Wound progression

- 74% (n=11) of patients progressed to healing. The time to heal ranged from 2 days to 20 days, with a mean time of 10.4 days to achieve total wound closure
- In the remaining 26% (n=4) all wounds improved in size, depth or wound bed status. The overall mean percentage reduction in wound size was 71.77%
- The overall mean percentage reduction of devitalised tissue (slough and necrosis) in the wound bed was 76%

Exudate management

- There was no incidence of wound leakage or strikethrough from the dressing

Periwound skin condition

- 74% (n=11) of patients had damaged skin at baseline, which reduced to zero at the end of the evaluation. The dressing was also easy to remove and no incidence of skin stripping or damage from the adhesive border was reported.

Pain and Odour

- At the end of the evaluation 74% (n=11) were pain free
- No patients developed a malodourous wound

Patient and clinician satisfaction

In 100% (n=58) of responses:

- Dressing application and removal was rated as easy
- Patients reported the dressing as comfortable to wear
- The dressing conformed to the wound and clinicians were satisfied with the dressing's exudate management properties

Cost Benefit Analysis

A simple cost benefit analysis was used to demonstrate potential savings in the 12 patients where healing as an endpoint was achieved. This is demonstrated in the table[1]. The cost of care was estimated by using both the cost of dressings[1] and clinician time[2,3].

Conclusion

The evaluation undertaken on HydroTac® Comfort demonstrated that in this cohort of patients it was effective at improving clinical outcomes, and was highly acceptable to both clinicians and patients. The cost benefit analysis suggests that there may be cost savings associated with using this dressing.

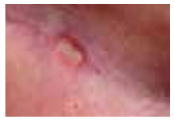
1 Department of Health (2015). UK Drug Tariff. Department of Health. London.
2. Personal Social Services Research Unit. (2014) wwwpsru.ac/uc 2014.
3. NICE medical technology guidance 17. The Debrisoft monofilament debridement pad for use in acute or chronic wounds. March 2014

Patient No.	Cost of Treatment Standard Practice (Dressings & Clinical Time)	Cost of Treatment Revised Practice (HydroTac® Comfort) (Dressings & Clinical Time)	Weekly Saving
1	£29.42	£15.55	£13.87
2	£31.08	£15.25	£15.83
3	£49.81	£35.53	£14.28
4	£49.81	£28.08	£21.73
5	£28.96	£28.08	£0.88
6	£46.17	£36.12	£10.05
7	No previous treatment	£27.13	-£27.13**
8	£45.32	£29.48	£15.84
9	£144.90	£36.93	£107.97
10	£44.38	£35.53	£8.85
11	£43.51	£35.53	£7.98
12	£39.13	£31.22	£7.91
Total	**£552.49**	**£354.43**	**£198.02**

Table 1 Weekly – standard and revised care costs of patients who healed.
** denotes a higher cost due to no previous treatment for comparison.

Case Study

The patient was an 83 year old man who had developed a grade 3 pressure ulcer, which had been present for 2 weeks. He had been acutely ill with severe diarrhoea and vomiting. The wound bed contained 100% sloughy tissue, from which there was a small amount of exudate. However, the wound was painful, which the patient identified to be 3 on a visual analogue score (0 - no hurt, 5 - hurts worst). The previous treatment was an adhesive foam dressing which was changed on alternate days. Pressure relieving devices were also used and wound prior to Hydrotac® Comfort (see right, top).
The sacral shaped HydroTac® Comfort was applied to the wound. It conformed well, and protected the wound from contamination of faeces. It was also easy to apply and remove and was comfortable for the patient.
After 2 dressing changes (5 days) the wound had healed (see right, bottom).



27.03.2015
Wound prior to treatment

30.03.2015
First dressing change

01.04.2015
Final assessment

A Multi-Centre 15 Patient Evaluation of a Hydro-Responsive Wound Dressing (HRWD) – HydroClean® plus

Lindsey Bullough - Clinical Nurse Specialist – Tissue Viability. Wrightington, Wigan and Leigh Foundation Trust
Sue Johnson - Clinical Lead Wound Care, Doncaster and Bassetlaw Hospitals. NHS Foundation Trust
Debra O'Brien – Podiatry Clinical Manager (Solent NHS Trust, West)

Methods

The objectives of this non comparative study were to evaluate the overall performance of HydroClean® plus in facilitating wound bed preparation and wound progression, evaluate the product in use and identify potential cost savings. A multi-centre product evaluation was performed involving 15 patients who were recruited from the adult (≥18years) populations routinely seen in 3 NHS Trusts.

Discussion

Although this was a small, uncontrolled evaluation, the data supports the use of HydroClean® plus on a range of wound types. It provides a safe and acceptable therapy to rapidly reduce devitalised tissue in the wound bed, which provides a suitable environment for wound closure.
It should be noted that the evaluation was limited due to the small numbers of patients involved and the subsequent cost and clinical outcomes were based on a total of 9 patients.
The evaluation demonstrates that the dressing is easy to use and is acceptable to both clinicians and patients. It also improves the quality of life for a high proportion of patients recruited, by reducing odour and pain.

Results

15 patients were recruited of which 80% (n=12) were male and 20% (n=3) female, with ages ranging from 28 to 86 years (mean 65.3 years). Relevant co-morbidities were recorded in 87.1% (n=14) patients.

The dressing was evaluated on a wide range of acute and chronic wounds, which had been present ranging from 0 (not known) to 75 weeks. The mean duration was 11.7 weeks.

- 100% (n=15) of patients were experiencing some degree of wound pain (Mean pain score was 2.5)
- 53% (n=8) of wounds were malodorous

Data was collected on 76 dressing changes over an evaluation period ranging from 4 days to 31 days (mean 16 days).

Wound Progression

9 patients achieved the primary outcome of healing (100% epithelialisation), 100% wound debridement or a measurement of 80% healthy tissue in the wound bed

- 13% (n=2) of patients progressed to healing
- 13% (n=2) of wounds were fully debrided (100% granulation tissue in the wound bed)
- 33% (n=5) of wounds debrided to 80-99% healthy tissue

Pain and Odour

At the end of the evaluations:

- 80% (n=12) of patients were pain free
- No wound malodour was reported

Patients and Clinician Satisfaction

- 95% (n=73) of dressing applications recorded as easy
- In 100% of dressing changes (n=76) the dressing conformed to the wound, was easy and painless to apply and remove
- In 95% (n=73) of changes, clinicians were satisfied with the way HydroClean® plus managed exudate
- Patients reported comfort during wear in 98% (n=74) of assessments

Cost Benefit Analysis

The cost of care was estimated for patients in 3 clinical end points:

- 13% (n=2) of patients progressed to healing with a mean time to debride and achieve healing of 7.5 days. The actual total cost savings was £87.78 over standard practice.
- In 13% (n=2) of patients 100% debridement was achieved at a mean time of 6.5 days.
- In 34 % (n=5) of patients 80-99% of devitalised tissue was removed at a mean time of 18 days. The actual cost saving compared to standard treatment with this patient group was £223.22 overall

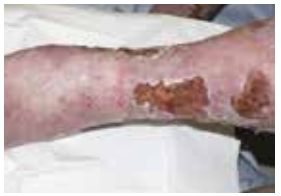
The comparative times to achieve total wound debridement (100% granulation tissue), has been cited as 20 days for hydrogels and enzymes, and 12 days for the monofilament pad[1]. Within the evaluation of HydroClean® plus, the mean time to debride to the same endpoint is a mean time of 7 days.

Conclusion

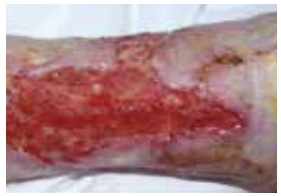
The evaluation undertaken on HydroClean® plus suggests that in this cohort of patients it is effective in improving clinical outcomes, and is highly acceptable to both clinicians and patients. The cost benefit analysis suggests that there are potential cost savings associated with using this dressing, and the time to debride may be reduced for some patients.

Case Study 1. 71 year Old Female - Venous Ulceration

The wound measured 10cm x 4 cm at the start of the evaluation.



18.07.2015
A 10cm x 10cm size HydroClean® plus dressing applied to the wound. An absorbent pad was used as a secondary dressing and a retention bandage was used to secure in place. The patient refused compression therapy at this time. The dressing was changed on alternate days.



25.07.2015
After 7 days, the wound bed was assessed at 90% granulation tissue

Case Study 2. 72 Year Old Male – Grade 4 Pressure Ulcer

The wound measured 8cm x 4cm at the start of the evaluation, and was assessed as a grade 4 pressure ulcer. Wound depth not known due to presence of slough in the wound bed. HydroClean® Plus (10x10) was used over the wound and secured with HydroTac® Comfort.

14.05.2015

18.05.2015
After 4 days (2 dressing changes) the sloughy tissue was removed and allowed for more accurate assessment of wound size.

1 Bahr S, Mustaffi N, Hattig P et al. Clinical efficacy of a new mononofilament fibre- containing wound debridement product. Journal of Wound Care. Vol20. No5. 2010

A Multi-centre, One Hundred Patient Clinical Evaluation of a Hydro-Responsive Wound Dressing: The Glasgow Experience

H. Hodgson,Lead Investigator and Lead Nurse Tissue Viability, D. Davidson,Vascular Nurse, Specialist, A. Duncan, Vascular Nurse Specialist, J. Guthrie,Tissue Viability Specialist Nurse, E. Henderson,Tissue Viability Nurse Specialist, M. MacDiarmid, Tissue Viability Clinical Nurse Specialist, K. McGown, Tissue Viability Nurse, V. Pollard, Tissue Viability Nurse, R. Potter, Tissue Viability Clinical Nurse Specialist, A. Rodgers, Paediatric Tissue Viability Nurse, A. Wilson, Tissue Viability Nurse Specialist, J. Horner Tissue viability Personal assistant, M. Doran Tissue viability Personal assistant, S. Simm Clinical Development Manager, A. Rogers Medical Communications, M.G Rippon Visiting Clinical Research Fellow

Introduction

This poster presents the outcomes of the use of HydroClean® plus, a Hydro-Responsive Wound Dressing (HRWD), in a multi-centre clinical setting. The aims were to assess the effectiveness of HRWD in debridement and wound bed preparation of a variety of acute and chronic wounds that presented with a level of devitalised tissue that needed removing in order that healing may proceed.

Figure 1. Wound bed preperation

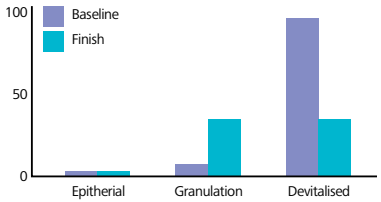


Figure 2. % reduction in wound area

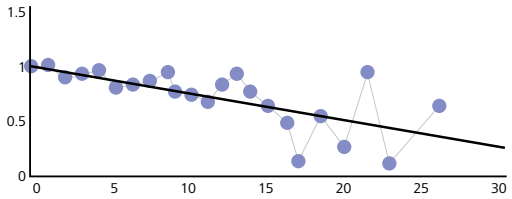


Figure 3. Peri-wound skin changes

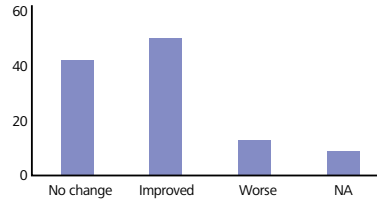
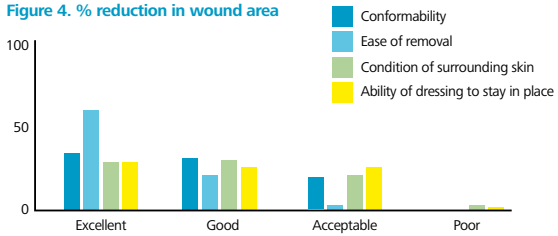


Figure 4. % reduction in wound area



Key results

One hundred patients with a variety of wound types were included in the study.

- The primary objective of removal of devitalised tissue to enable a healing response was achieved in over 90% of patients
- Levels of devitalised tissue (necrosis and slough) reduced from 85.5% to 26.3% and was accompanied by an increase in wound bed granulation from 12.0% to 33.7% (Figure 1.). Correspondingly there was a 40% reduction in wound area - Ninety-three percent of chronic wounds demonstrated wound progression upon treatment with HRWD.
- Peri-wound skin condition showed a tendency towards improvement (Figure 3), this was probably due to the fluid management capabilities of the HRWD that was reported as Good to Excellent in the majority of cases (Figure 4).

Method

This was a non-comparative evaluation, where both acute and chronic wounds were assessed as requiring debridement as part of their normal treatment regimen. Clinicians recorded wound changes including a subjective assessment level of devitalised tissue and wound bed preparation, presence of pain, wound status (e.g., wound size), and peri-wound skin condition. Data was also collected from clinicians and patients to provide information on clinical performance of the dressing.

Clinical Box

Female, 73 years old with a sacral pressure ulcer, with 100% coverage black necrotic tissue and the peri-wound skin showed signs of reddening.

HydroClean® plus was applied and fixed in position using a film dressing, and the dressing was changed every 3 days.

Within 8 days of application of HydroClean® plus, the black necrosis had debrided from the wound leaving a layer of yellow slough visibly detaching from healthy wound margins. Healthy-looking granulation tissue could also be seen.

HydroClean® plus treatment was continued with slough levels decreasing and there being a corresponding increase in granulation tissue until the wound was at a point where sharp debridement was applied to clean the wound of the remaining devitalised tissue.

Cost-effectiveness assessment of the use of HRWD for the treatment of wounds requiring debridement Treatment summary

A	Application of HRWD (HydroClean® plus, £5.95) and secondary film dressing (365 Healthcare, £0.38)	£6.33
B	4-step process using a wound cleanser (Prontosan, £0.59) and gauze swabs (10 pieces, £0.40) to cleanse the wound, followed by application of honey (Activon Tube, £2.05) to the wound bed and covered with a Hydrofiber wound dressing (Aquacel EXTRA, £2.38) and a hydropolymer adhesive dressing (Tielle Plus, £2.63)	£8.05
C	Larval therapy (requiring special order of live larvae) (Larvae Biobag, £306.39)	£306.39
D	Application of a monofilament fibre debridement pad (Debrisoft, £6.45) and secondary dressing (Tielle Plus, £2.63)	£9.08

SECTION 7

Podiatry

The patient experience with a Hydro-Responsive Wound Dressing (HRWD) – HydroClean® plus

Debra O'Brien – Podiatry Clinical Manager (Solent NHS Trust, West)
Zoe Clarke - (Solent NHS Trust, West)

Introduction

The patient was a 51 year old male with progressing HIV, who was being treated with retroviral therapy. He developed a blister on the medial 1st metatarso-phalangeal joint of his right foot, on the 26th December 2014. The wound was treated by the Practice Nurse for 6 weeks, and despite 3 courses of antibiotics for a suspected wound infection, it deteriorated and developed into a chronic wound.

The ulcer profoundly affected the patient's quality of life in that he was unable to work because of the wound pain, and could not wear the protective foot wear which was a requirement of his job. He also stopped socialising because he thought the wound was malodourous.
As the wound deteriorated he was afraid that he would need an amputation.

Method

The wound had been present for 8 weeks when the patient was referred to the complex foot ulcer clinic. The foot was reassessed by the Podiatry Team.

- No underlying problems detected
- Wound measured 1.9cm x 2cm, with a depth of 0.4cm
- Joint capsule visible in the wound bed, which contained 30% slough and 70% granulation tissue
- Exudate level assessed as "moderate", and the peri-wound skin appeared macerated
- Patient's pain was assessed using a visual analogue score ranging from 0 (no hurt) and 5 (hurts worse). Although the wound pain was distressing for the patient, he only scored this as 1
- No infection was present in the wound, although the wound was malodorous

After discussing possible treatment options with the patient, he consented to participating in an ongoing evaluation of HydroClean® plus. The dressing was used within the standard practice delivered by the Podiatry Service. After cleansing with an antimicrobial solution containing PHMB (polyhexamine biguanide), HydroClean® plus 7.5cm x 7.5cm was applied to the wound, with sterile gauze as a secondary dressing and fixed in place using a surgical tape.
The dressing was changed every 3 days by the podiatrists at the clinic, or by the patient undertaking his own care. The patient was unable to tolerate anything pressing on the affected area, so had cut a hole in the side of a canvas training shoe to reduce the pressure. This was replaced by a Darco shoe, which he found comfortable and provided more protection over the wound.

Results

Week 2 (11/03/2015) – the wound had reduced to 1.5cm x 1cm, and there was evidence of epithelialisation. However, there was an increase in soft, sloughy tissue in the wound bed, HydroClean® plus was continued.
Week 4 (26/03/2015) – 50% of the wound was epithelial tissue. Although this was the end of the evaluation period, the dressing was continued at the patient's request.
Week 5 (02/04/2015) – 75% epithelial tissue.
Week 7 (16/04/2015) – the wound was healed although the healthy tissue was covered by a thin membrane which had adhered to the epithelialised wound bed. This was protected using Atrauman® until it could be safely removed.

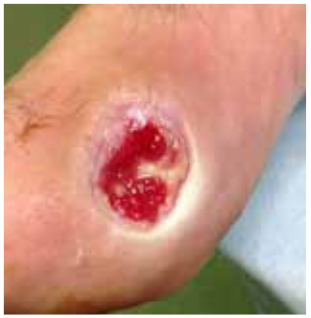
During the evaluation period, the patient was admitted to hospital as his general condition deteriorated as a result of his HIV. However, his retroviral treatment was changed and he was discharged home. During this period, HydroClean® plus was continued. No new wound infections developed and the patient did not require further antibiotic therapy.

Quality of Life

Pain and odour were the two quality of life measures collected in the evaluation. The patient was delighted that wound odour was eliminated after the first dressing change and the pain reduced by the second, commenting that he "could walk much better". However, the notes made by the podiatrists in their case records demonstrate that the patient's quality of life improved considerably as he observed positive changes to his wound at the start of treatment with HydroClean® plus, and the reduction in odour and pain continued. As the dressing was easy to apply and conformed well to the wound, he was able to undertake some of the dressing changes which was important to him to be able to participate in his care. After 7 weeks the wound was healed and the patient was able to return to work and resume his busy social life.

Conclusion

Healing wounds is a positive outcome, but it is equally important that distressing symptoms such as pain and malodour can be addressed effectively. It is also relevant that patients can feel empowered when involved in making decisions about their care, and are able to actively participate[1].
The use of HydroClean® plus within a programme of care rapidly removed some of the more distressing aspects of this patient's wound, and in conjunction with being able to observe a visible improvement at an early stage of treatment, improved his overall well being. The outcome was positive for a patient where the potential for healing was compromised by a concomitant illness.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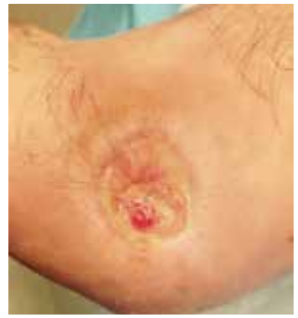
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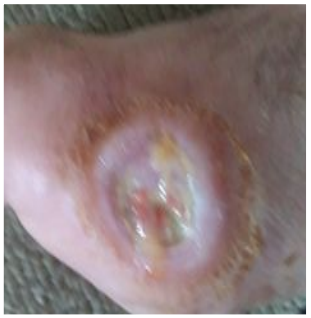
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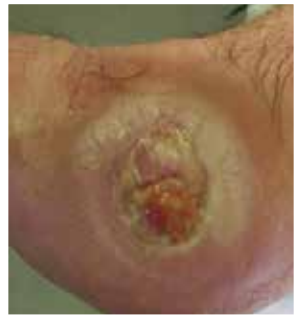
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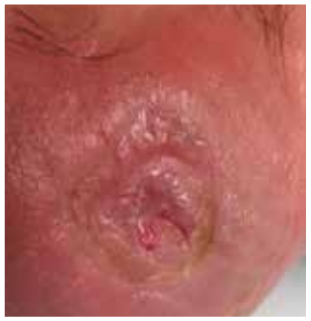
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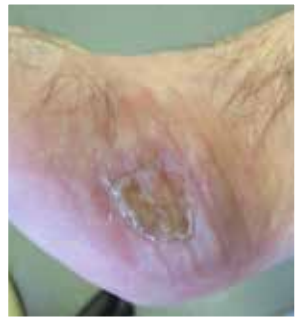
15.04.2015

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Clinical Impact of HydroClean® plus

University of HUDDERSFIELD
Inspiring tomorrow's professionals

Clare Barker - Vascular Specialist Sister, Mid Yorks NHS Trust
Leanne Atkin - Lecturer Practitioner/Vascular Nurse Specialist, Institute of Skin Integrity and Infection Prevention,School of Human and Health Sciences, University of Huddersfield/Mid Yorks

Introduction

HydroTherapy is a sequential wound treatment programme that delivers simple and effective wound care through the use of two innovative and complimentary wound dressings (HydroClean® plus and HydroTac®). The pre-moistened HydroClean® plus cleanses the wound whilst in situ and can remain in place for at least 3 days at a time and avoiding additional dressing changes. These characteristics make HydroTherapy® particularly useful for treating wounds with a high degree of slough and necrotic tissue that would normally require debridement. We present three cases of patients with sloughy and necrotic wounds and the results of their treatment with HydroClean® plus to provide information about the use of HydroTherapy®.

Case Study 1

A post-surgical debridement diabetic foot ulceration that had increased in depth, contained slough and necrosis, with dry/retracting wound edges and a skin flap that remained non-adhered (Fig. 1).
After 6 days of HydroClean® plus treatment the wound was moist, depth was reducing and the flap was adherent (Fig. 2). After 13 days, the skin flap was fully adhered and the wound bed was debrided. The wound edges were hyper-hydrated but not macerated (Fig. 3). Treatment was considered successful and stopped. After an additional 12 days, the wound had reduced, the skin flap was fully adherent and the surrounding skin was normal (Fig. 4).

Fig 1

Fig 2

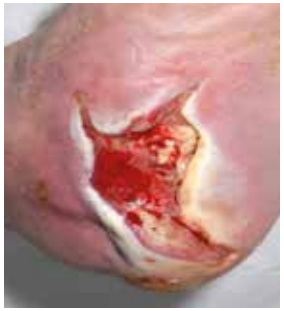

Fig 3

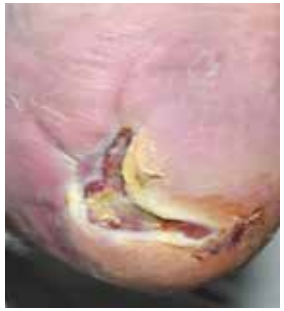

Fig 4

Case Study 2

A patient with an infected ischaemic diabetic foot ulceration who underwent surgical debridement and amputation of 4th and 5th toes. Patient's arterial disease was optimised with distal angioplasty. One week post-op, the wound re-sloughed and was covered with 80% sloughy/necrotic tissue (Fig. 5). After only 2 application of Hydroclean® plus, which was in place for 4 days, the slough started to rehydrate and debride (Fig. 6). After a further week of Hydroclean® plus therapy, the wound continued to be debrided and there was evidence of healthy granulation tissue filling the tissue void (Fig. 7). The exudate was contained within the dressings and there was no evidence of maceration of the surrounding skin.

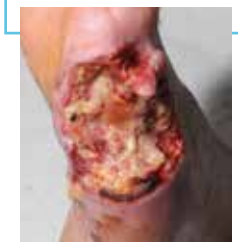

Fig 5

Fig 6

Fig 7

Case Study 3

A 72-year-old lady with Type 2 diabetes and significant PAD had undergone crural percutaneous transluminal angioplasty but with limited success. The wound presented with ischaemia and necrosis. It was surgically debrided but the wound re-sloughed (Fig. 8).

Treatment with HydroClean® plus resulted in some slough removal with hyper-hydration on the surrounding skin. The wound failed to heal due to limb ischaemia and other comorbidities. However, it is noteworthy that the wound infection was contained and, despite poor vascularity, healthy granulation tissue developed within the perimeter of the wound (Figs. 9-11).

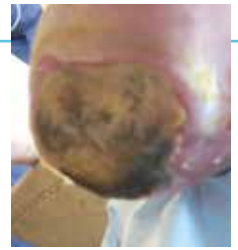

Fig 8

Fig 9

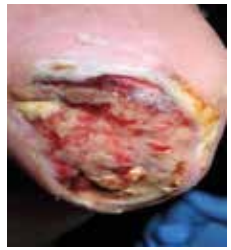

Fig 10

Fig 11

Conclusion: HydroTherapy provides new options to aid limb salvage.

Salford Royal NHS
NHS Foundation Trust

The Use of Hydro-Responsive Wound Dressing For Wound Bed Preparation in Patients with Diabetes

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Samantha Haycocks FFPM RCPS (Glasg) - Advanced Podiatrist Salford Royal (NHS) Foundation Trust, UK

Introduction

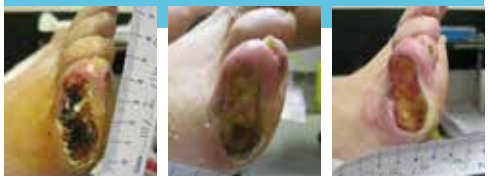
The increasing incidence of diabetic mellitus has given rise to a cascade in the number diabetic foot ulcers (DFU) that challenge wound care clinicians[1]. The pathogenesis of such ulcers are varied and include for example peripheral vascular disease, neuropathy, and infection which may confound treatment[2].

The management strategies for treatment of DFU includes wound bed preparation in terms of the "TIME" framework which encompasses tissue management, inflammation and infection control, moisture balance, and epithelial (edge) advancement[3]. The basic tenant of tissue management is to remove the necrotic tissue burden using various methods of debridement (e.g. surgical, mechanical, autolytic etc.,)[4]. Restoration of bacterial balance (including reduction of bacterial biofilms) (Infection and inflammation in TIME). Achieving a moist wound healing environment results in moisture balance which enables healing. Finally removal of the physical and biochemical barriers for migration of epithelium from wound edges enables healing[5]. The effectiveness of using HydroTherapy as a basis for treatment of DFU within the TIME framework is demonstrated in this case study series.

Methods

A clinical case study series was undertaken on patients with diabetic foot ulcers (DFUs). Patients were chosen according to their DFU having slough or eschar that required removal. Hydro-Responsive Wound Dressing (HydroClean® plus) was used to enable the removal of devitalised tissue. The study was undertaken at Salford Royal Hospital, Podiatry Outpatients. Patients undergoing routine treatment for their wounds, but specifically in need of removal of devitalised tissue (e.g. slough), were entered into the evaluation. Only qualitative evaluation of the impact of HydroClean® plus was undertaken with photographs and notes relative to slough removal, healing progress and patient impact were recorded.

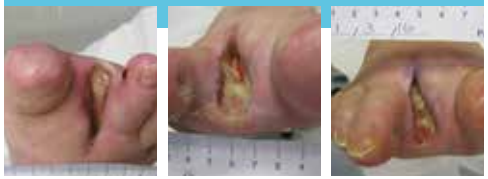
Case Study 1



Start **2 days** **7 days**

A male with type 1 diabetes suboptimal control, asthma and neuropathy. Presented with a necrotic wound caused by a burn which had become infected. The patient was commenced on antibiotics and HydroClean® plus applied to the 100% necrotic wound. By day 2 the wound had been actively debrided with 30% necrotic tissue remaining. At day 7 the wound bed had 50% granulation and slough. HydroClean® plus had very quickly actively debrided the wound.

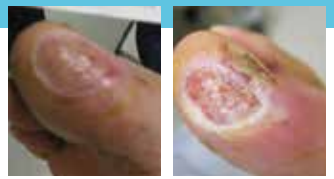
Case Study 2



Start **6 days** **Final**

A male aged 54 years with type I diabetes, retinopathy, neuropathy and hypertension. A toe amputation site had become sloughy. The patient had received antibiotics and had previously been treated with Askina® Calgitrol® paste and KerraMax Care™. The wound showed 90% necrosis and 10% granulation. After four weeks of HydroClean® plus treatment, the size of the wound had decreased and the wound showed 20% granulation tissue and 80% slough. Because of the position and shape of the wound it was at times difficult to dress the wound. Tolerance of the dressing was rated as excellent.

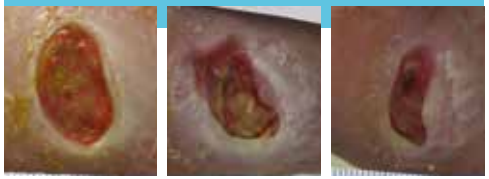
Case Study 3



Start **17 days**

A male patient aged 71 years with type II diabetes, neuropathy and chronic obstructive pulmonary disease. He had developed blisters on the right foot that had previously been dressed with Telfa AMD. HydroClean® plus improved the wound and decreased its size.

Case Study 4



Start **2 weeks** **Final**

A male aged 73 years with peripheral vascular disease, alcoholic neuropathy and deep vein thrombosis history. A blister had ulcerated, become infected and developed osteomyelitis. The patient was treated with antibiotics and had previously been treated with foam dressings. Pressure relief was provided with Softcast. The wound had 40% granulation and 60% slough. After 4 weeks of HydroClean® plus treatment, the wound decreased in size and slough had reduced to 20% with 80% granulation. Tolerance of the dressing was excellent.

Case Study 5

Start **2 weeks** **Final**

A 62 year old male with type II diabetes, retinopathy, neuropathy, obesity and pulmonary embolism. An amputation site had 50% slough 50% granulation. The patient was receiving antibiotics and the wound had been treated with ACTICOAT™ Flex and KerraMax Care . The wound improved during the four weeks of evaluation with HydroClean® plus and decreased in size. The HydroClean® plus dressing performed well to deslough the wound which reduced to 20% with 80% granulation, and was easy to apply. Tolerance of the dressing was excellent.

Conclusions

- **Removal of de-vitalised tissue and wound bed preparation according to TIME is a vital component in the treatment of DFU.**
- **HydroTherapy with HydroClean® plus for the first step of wound bed preparation, involving de-sloughing/debridement, was successful in the first step of treating patients with DFU.**

1. NCD Risk Factor Collaboration (NCD-RisC) (2016) *Worldwide trends in diabetes since 1980: a pooled analysis of 751 population-based studies with 4.4 million participants.* Lancet 387(10027): 1513-30. 2: Papatheodorou K, Banach M, Edmonds M et al (2015) *Complications of Diabetes.* J Diabetes Res 2015: 189525. 3: Dowsett C (2008) *Using the TIME framework in wound bed preparation.* Br J Community Nurs 13(6): S15-6, S18, S20 passim 4: Pilcher M (2016) Wound cleansing: a key player in the implementation of the TIME paradigm. J Wound Care 25(3 Suppl): S7-9. 5: Zhang Z, Lv L, Guan S (2015) Wound bed preparation for ischemic diabetic foot ulcer. Int J Clin Exp Med 8(1):897-903

City Hospitals Sunderland | chs

HydroTac® Evaluation of a Surgically Debrided Wound

Diane Knowles - Special Podiatrist Wound Care & Diabetes, City Hospitals Sunderland
Lisa Wright - Special Podiatrist Wound Care & Diabetes, City Hospitals Sunderland
Elaine Ricci - Clinical Lead Podiatrist Wound Care and Diabetes, City Hospitals Sunderland

Background

A 78 year old male patient with multiple co-morbidities including right below knee amputation, peripheral artery disease, left posterior tibial artery (PTA) and anterior tibial artery (ATA) angioplasty, neuropathy, asthma, liver cirrhosis and gout.

Wound History

This wound occurred as a result of surgical debridement to the left Achilles tendon following extensive abscess and infection. During his in-patient stay he had an angioplasty (PTA and ATA) and numerous dressings were used. After six weeks the patient was discharged from hospital to the specialist podiatry wound care clinic for wound management and access to the multidisciplinary team, if required. The wound (size 9.0 x 9.5 x 0.5 cm) presented with slough and granulation (50% each respectively) and bone was palpable in the wound base. Wound exudate was moderate with no signs of infection present. Peri-wound skin was dry. (Figure 1.).

Treatment with HydroTac®

HydroTac® 15 x 15 cm was applied with Hypafix® to secure a dressing pad as a secondary dressing and a trauma sandal. The first dressing change showed a wound bed improvement to 10% slough and 90% granulation tissue with a reduction in size (7.5 x 4.5 x 0.5 cm) (Figure 2). The second dressing change showed complete de-sloughing with the wound bed presenting with 100% granulation tissue (no change to wound dimensions) (Figure 3). At the third dressing change the wound bed still showed 100% granulation tissue and the wound dimensions had improved (7.5 x 4.3 x 0.2 cm) (Figure 4).

Conclusion

The use of HydroTac® in a surgical wound was found to be beneficial. It was found to significantly aid in de-sloughing this wound. This allowed healthy granulation tissue to form supporting healing. The patient did not report any adverse effects from the dressing and none were observed by the team. No discomfort during or between dressing changes was reported.

Figure 1
26 Jul 2016

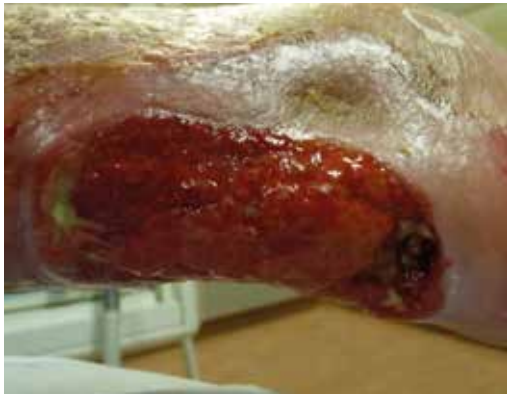


Figure 2
29 Jul 2016

Figure 3
2 Aug 2016

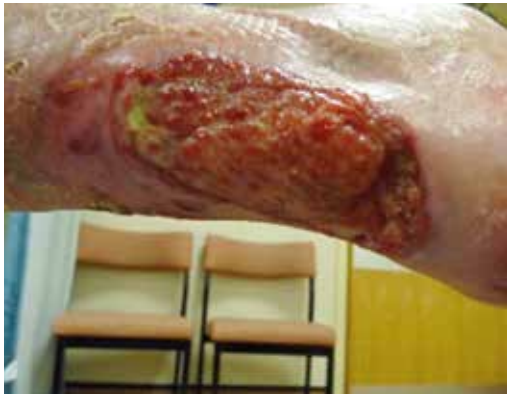


Figure 4
5 Aug 2016

Pennine Care NHS
NHS Foundation Trust

HydroTac® Dressing Assists Wound Healing of a Pressure Ulcer on the Heel

Kimberley Wilde - Highly Specialist Podiatrist/Wound Care Pathway Lead, MSc in Professional Development, BSc(Hons) Podiatry, Pennine Care Foundation Trust

Introduction

Despite guidelines for effective prevention of pressure ulcers, they remain a common problem for nursing staff. Timely and effective management of pressure ulcers can be challenging and, in spite of this, some can become chronic causing a great deal of pain and discomfort to the patient. Effective dressings aid healing in the ulcer bed and protect the condition of peri-ulcer skin. Various different types of dressings are currently used in the treatment of pressure ulcers. HydroTac® (HARTMANN) is a Hydro-Responsive Wound Dressing with AquaClear Gel Technology that keeps wounds in a balanced, moist environment by providing a combination of absorption and moisture donation. This optimizes healing efficiency. A hydrogel contact layer releases moisture to the wound as needed, and prevents the wound drying out. This moist gel layer also prevents the dressing from sticking to the wound and allows for more comfortable removal, which is essential for pain-sensitive patients. A case study of a patient with a pressure ulcer being successfully treated with HydroTac® is presented in this poster.

Wound History

The patient was an eighty-three-year-old female with a pressure ulcer to the right heel. She was treated at the podiatry and wound care service shared care. Her general condition was good but she had rheumatoid arthritis. The ulcer was the result of trauma to the foot and had been present for more than twelve months. At presentation, the ulcer was 16 x 10 mm in size, 2 mm in depth and the wound bed showed 20% slough and 80% granulation tissue (Figure 1). The wound edges were callused and there was moderate blood-stained exudate. The peri-wound skin was intact and healthy. The previous, unsuccessful treatment the patient had received over the twelve-month period involved the use of AQUACEL® Ag, INADINE®, honey and Urgotul® SSD. The treatment was challenging because the patient had reduced mobility due to her rheumatoid arthritis. At the start of this case study, treatment was altered to use HydroTac® as the primary dressing in order to reduce infection, promote granulation and re-epithelialisation of the wound. The aim was to progress this chronic wound towards healing.to protect the surrounding tissue and reduce trauma at dressing change.

Treatment with HydroTac® (Figures 1-3)

The patient was treated with Prontosan® cleanser, HydroTac® as the primary dressing and Blueline bandages, with an offloading cast. The dressings were changed twice weekly. After use of HydroTac® for two weeks, the wound had reduced in size to 14 mm x 7 mm, 1 mm in depth and the wound bed was now 100% granulation tissue (Figure 3).

Conclusion

HydroTac® dressing assisted with progression towards healing of a pressure ulcer to the heel.

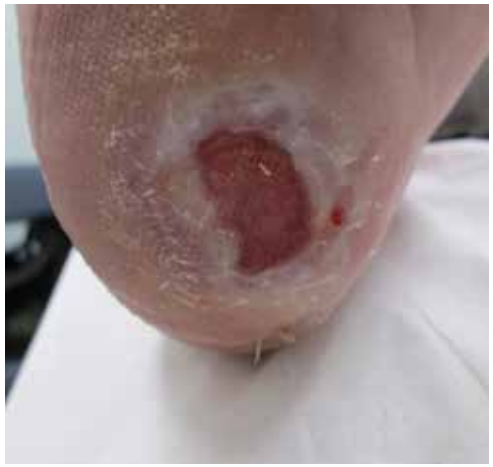


Figure 1
28 Jul 2016

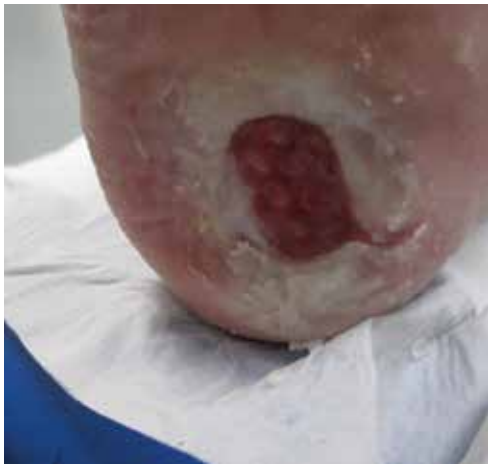


Figure 2
04 Aug 2016

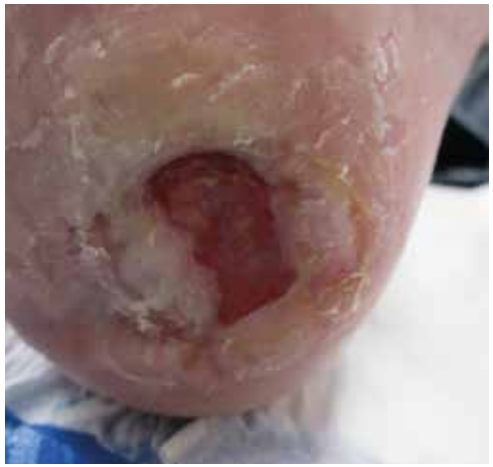


Figure 3
11 Aug 2016

The Use of HydroTherapy® to Heal a Complex Foot Ulcer in a Diabetic Patient

Pam Spruce - Clinical Director TVRE Consulting
Debra O'Brien – Podiatry Clinical Manager
Zoe Clarke - Advanced Practitioner Podiatrist (Solent NHS Trust, West)

Introduction

Foot ulceration in diabetic patients is relatively common, with an estimated 5-7% of the diabetes population thought to have a wound at any one time[1,2]. These wounds can be difficult to heal, and may result in amputation of the affected limb[3].

This case study describes the treatment delivered to a patient with diabetes, who was managed within a complex foot ulcer clinic by a Multi-Disciplinary Team. He had a history of previous amputation, and the failure of his wound to heal was causing concern in that he was at high risk of infection and potentially further surgery would be required.

Background

The patient was a 48 year old male, who had been diagnosed with type 2 diabetes in 2008, and was treated with oral hypoglycaemic medication. He had suffered recurrent foot ulceration on his right foot, which had resulted in amputation of a toe, after which the wound had taken almost a year to heal. The risk factors for further ulceration were high, as he was obese with a BMI of 38.72, he was also alcoholic and had neuropathy starting to develop in his feet. He was also not fully compliant with treatment.

A further ulcer developed on the left foot in 2014, which resulted again in amputation in December . The wound dehisced, and was treated in the complex foot ulcer clinic with regular sharp debridement, offloading of the foot to relieve pressure and topical treatment with a hydrofibre dressing.

Wound Assessment

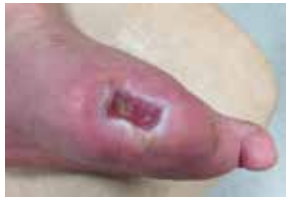
After 14 weeks post amputation, the wound was not progressing. There was no infection present, and although the patient had reduced sensation in the foot, pedal pulses were present. Using the Texas Classification system it was recorded to be a stage A1 ulcer.
The wound measured 2cm x 1cm and was 0.7cm deep, with approximately 40% slough and 60% granulation tissue present on the wound bed. There was a moderate amount of exudate from the wound, but there was no malodour and the periwound skin was healthy. However, the patient reported the wound to be slightly painful. (1 on the visual analogue scale where 0 is no pain and 5 hurts worst).

Treatment with HydroTherapy®

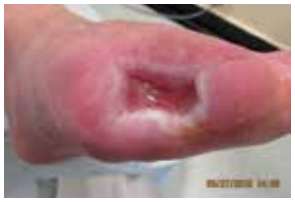
The patient's wound was initially treated with HydroClean® plus on the 17 March, 2015 where a 4cm dressing was applied to the wound after cleansing and sharp debridement was undertaken. A secondary dressing of sterile gauze was used, followed by the use of an aircast boot to offload the wound. The dressing was continued within the standard best practice recommended for diabetic foot ulceration[3] and changed every 3 days.

- At the first dressing change 20/03/2015, there was a reduction in slough and evidence of granulation in the wound bed which was now measured as 0.4cm deep. The wound was also pain free.
- After 10 days of treatment epithelial tissue was observed at the wound margins.

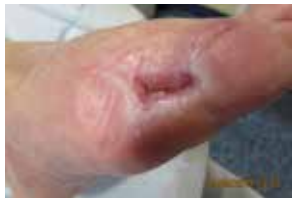
17/03/2015
(Prior to HydroClean® plus)



20/03/2015
(1st dressing change)

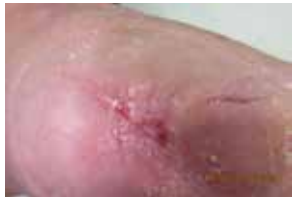


27/03/2015
(Evidence of epithelial tissue at wound margins)



05/05/2015

19/06/2015
HydroTac® Comfort



10/07/2015
HydroTac® Comfort

The wound continued to progress slowly, with the only changes to treatment being the use of Zetuvit® as a secondary dressing, and the intermittent application of a skin protectant. By the 15/05/2015 the wound was superficial measuring 0.7cm x 0.1 cm with minimal depth, and a low level of exudate. At this point HydroClean® plus was discontinued and Hydrotac® Comfort was applied to the wound. This was changed weekly until the wound healed at 07/08/2015

Conclusion

The initial use of HydroClean® plus to debride, then HydroTac® Comfort to protect the wound and support the progression to healing was used successfully in a diabetic patient with a challenging wound. It was used by podiatrists within a complex foot ulcer clinic, within standard best practice of regular sharp debridement and offloading.

Although the wound took almost 6 months to heal, the clinicians were confident in the dressings as improvement was maintained and no infections were reported. They commented on the healthy state of the wound bed, the ease of use of the dressings, and that this therapy had "changed a static wound into a healing wound".

The patient having experienced 12 months to close his previous amputation site on the other foot, had expected that this wound would take a similar time to heal. However, his expectations were outweighed with the use of these two dressings, where he experienced faster wound progression, and as a result he was highly delighted.

1. Diabetes UK. Putting feet first: national minimum skills framework. Joint initiative from the Diabetes UK, Foot in Diabetes UK, NHS Diabetes, the Association of British Clinical Diabetologists, the Primary Care Diabetes Society, the Society of Chiropodists and Podiatrists. London: Diabetes UK, 2011. Available at: http://diabetes.org.uk/putting-feet- first. Accessed March 2013.
2. Kerr M. Foot care for people with diabetes: the economic case for change. NHS Diabetes, Newcastle-upon-Tyne, 2012. Available at: http://bit.ly/ xjY7FS. Accessed March 2013.
3. International Best Practice Guidelines: Wound Management in Diabetic Foot Ulcers. Wounds International, 2013. www. woundsinternational.com

City Hospitals Sunderland | chs

HydroTherapy® Wound Healing of a Category 2 Pressure Ulcer to the Heel

Diane Knowles - Special Podiatrist Wound Care & Diabetes, City Hospitals Sunderland
Lisa Wright - Special Podiatrist Wound Care & Diabetes, City Hospitals Sunderland
Elaine Ricci - Clinical Lead Podiatrist Wound Care and Diabetes, City Hospitals Sunderland

Introduction

HydroTherapy consists of Hydro-Responsive Wound Dressings HydroClean® plus and HydroTac®. HydroClean® plus is based upon a chemically inert superabsorbent polyacrylate material which is "activated" with Ringer's solution. The Ringer's solution is made available to the wound bed and fibrinous slough coatings and necrotic tissue are softened and detached. Simultaneously, the wound dressing pad absorbs bacteria- and proteinase-laden wound exudate into its absorbent core and binds it away from the wound surface. HydroTac® is a Hydro-Responsive Wound Dressing that in conjunction with AquaClear Gel Technology which provides a combination of absorption and moisture donation to help keep wounds in a balanced, moist environment to optimize healing efficiency.

Wound History

This case study relates to a 60 year old man with type 2 diabetes and neuropathy who underwent a recent amputation of the left 1st and 2nd digits. A category 2 pressure ulcer developed as a result of incorrectly applied aircast used as a part of the treatment regimen. The wound (2.5 x 2.5 cm) (Figure 1), positioned on the left retro-calcaneal originally presented with 100% slough, low exudate levels and macerated peri-wound, a pain scale 0 with no signs or symptoms of clinical infection. The wound was treated with both HydroClean® plus to debride and de-slough and HydroTac® to facilitate healing progression.

Treatment with HydroTherapy®

HydroClean® plus was applied with Hypafix® to secure and a secondary dressing pad as a secondary dressing (on 22.6.16), and the wound was offloaded with a trauma sandal and wheelchair with leg elevator. From the initial visit the wound reduced rapidly in size to 1.0 x 1.0 cm (on 13.7.16) (Figure 2). At this point the dressing regimen was changed to HydroTac® (10 x 10 cm) which resulted in an increase in epithelialisation of up to 50% of the wound area and a reduction in wound size to 0.5 x 0.5 cm. (Figure 3) The wound healing was accomplished on 26.7.16 (Figure 4). There was low exudate levels, healthy surrounding tissue and the patient was pain free.

Conclusion

The combination of using both HydroClean® plus and HydroTac® (HydroTherapy) was useful to debride the wound and promote healing for this pressure ulcer. The patient, his family and clinical team were happy at the progress of healing (the wound had healed at 35 days).

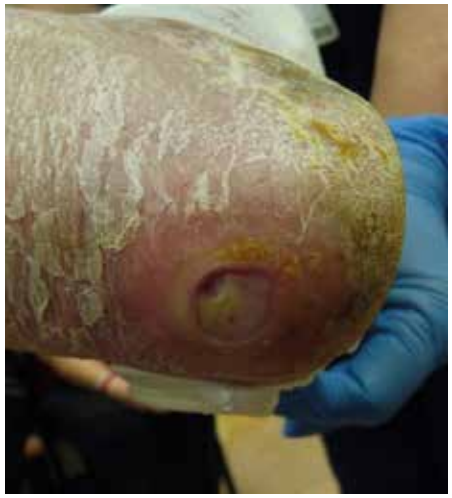


Figure 1
22 Jun 2016

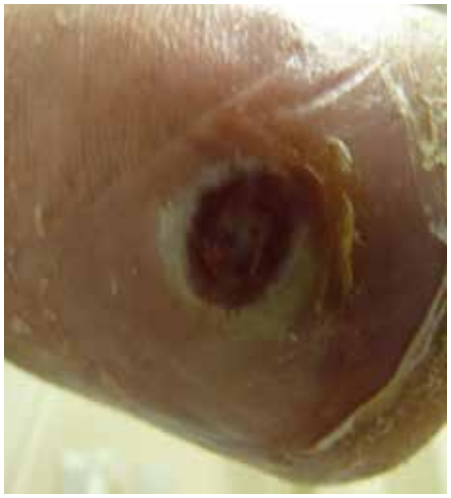


Figure 2
13 Jul 2016

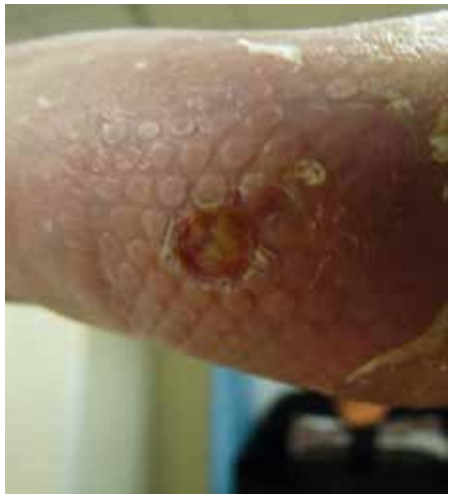


Figure 3
15 Jul 2016

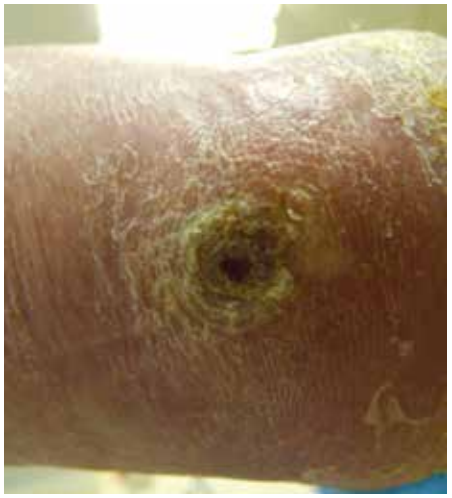


Figure 4
26 Jul 2016

City Hospitals Sunderland chs

HydroTherapy® Wound Healing of a Category 4 Pressure Ulcer to the Heel

Diane Knowles - Special Podiatrist Wound Care & Diabetes, City Hospitals Sunderland
Lisa Wright - Special Podiatrist Wound Care & Diabetes, City Hospitals Sunderland
Elaine Ricci - Clinical Lead Podiatrist Wound Care and Diabetes, City Hospitals Sunderland

Background

A 73 year old female patient and type 2 diabetes and multiple co-morbidities including neuropathy, chronic kidney disease stage 3, chronic obstructive pulmonary disease, and treated osteomyelitis to the right calcaneus.

Wound History

The wound presented as a non-infected chronic long-standing category 4 pressure ulcer (present for several months before her referral to podiatry) positioned over the right calcaneus. There was exposed, damaged bone from a previously-treated osteomyelitis in the wound bed. The wound (6.8 x 5.0 x 1.0 cm) was covered with an area of approximately 90% dense slough with the remaining 10% being bony tissue (Figure 1). Wound exudate level was moderate and there was macerated peri-wound skin. There was no clinical signs or symptoms of infection. The wound had previously been treated by with a succession of different debridement methods including autolytic and larvae therapy.

Treatment with HydroTherapy®

HydroClean® plus 4 x 4 cm was applied and secured with Hypafix® and a dressing pad as a secondary dressing. Pressure relief was maximised with an IPOS heel-relieving sandal and a wheelchair. To offload the heel wound in bed an inflatable wedge was used. The wound was dressed sequentially with HydroClean® plus with the aim of de-slough aiding wound bed preparation (Figures 2 and 3). Following a short period of time in hospital due pneumonia, the wound was deemed suitable for treatment with HydroTac® Concave with the aim of stimulating granulation tissue formation (Figure 4).

Conclusion

This wound presented with adherent slough that had been present for several months. HydroClean® plus was used to de-slough, remove devitalised tissue and aid in the preparation of a clean wound bed. HydroTac® was then used to aid in epithelialisation and promotion of healing.

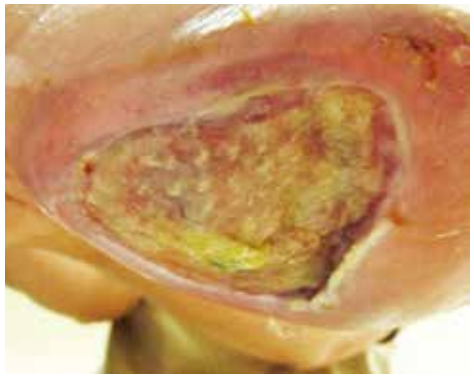


Figure 1
21 Jun 2016

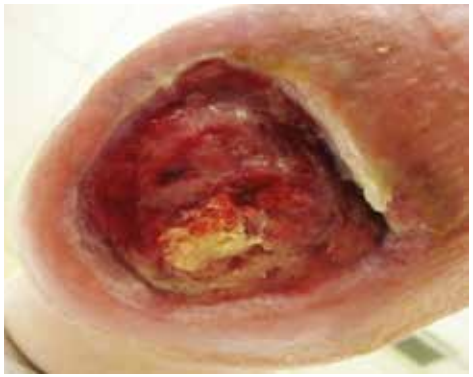


Figure 2
5 Jul 2016

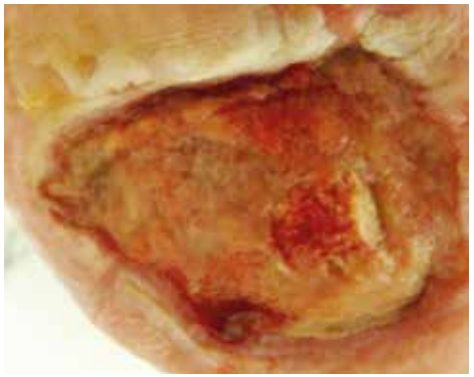


Figure 3
26 Jul 2016

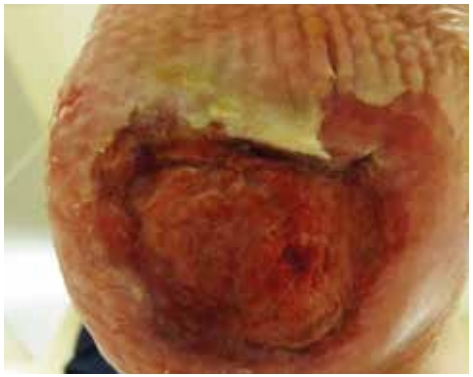


Figure 4
5 Aug 2016

City Hospitals Sunderland chs

HydroTherapy® Wound Healing of a Post Amputation Site

Diane Knowles - Special Podiatrist Wound Care & Diabetes, City Hospitals Sunderland
Lisa Wright - Special Podiatrist Wound Care & Diabetes, City Hospitals Sunderland
Elaine Ricci - Clinical Lead Podiatrist Wound Care and Diabetes, City Hospitals Sunderland

Background

A 61 year old male patient with type 2 diabetes and multiple co-morbidities including peripheral arterial disease, neuropathy, retinopathy and maculopathy, chronic obstructive pulmonary disease, ischaemic heart disease, coronary artery bypass grafting and stroke.

Wound History

The patient had a necrotic infected blister, present for two months. As a consequence, the patient underwent an amputation of the 5th digit and metatarsal which required extensive surgical debridement. The patient was discharged into the multidisciplinary team diabetic foot clinic for wound care and diabetes management. This wound (8.0 x 9.0 cm) initially presented with 90% slough, 10% granulation tissue but with minimal tissue covering the bone below (Figure 1). The wound was offloaded using a trauma sandal. A number of different dressings had been used to debride without success therefore HydroTherapy was used in attempt to initiate healing.

Treatment with HydroTherapy®

The wound was treated primarily with HydroClean® plus, 10 x 10 cm. This was secured with Hypafix® and a dressing pad with a trauma sandal. Following the initial treatment period, it was observed that visible slough reduced and granulation tissue increased (Figure 2). There was concomitant changes to wound dimensions (7.0 x 8.0 cm) over a period of one week (Figure 3), reducing considerably (5.5 x 2.5 x 0.3 cm) over the treatment period (Figures 4 and 5). The high pain levels suffered initially by this patient (VAS 5.0) reduced significantly over the period of treatment such that the patient no longer required opiate pain control.

Conclusion

HydroClean® plus used to debride and de-slough and aid in wound bed preparation, followed by HydroTac® which maintained an optimum environment and promoted reepithelialisation, was beneficial to the healing progress of this wound. It is also noteworthy that HydroTherapy® appeared to significantly reduced the level of pain suffered by this patient. This was demonstrated by the reduced need for opiate pain control.

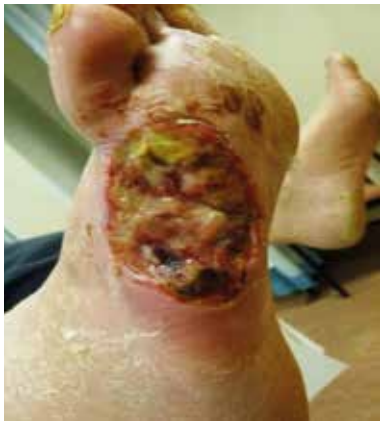


Figure 1
21 Jul 2016

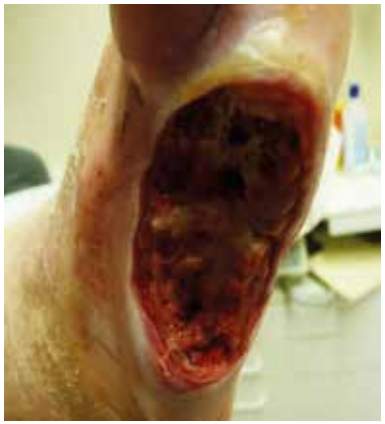


Figure 2
25 Jul 2016

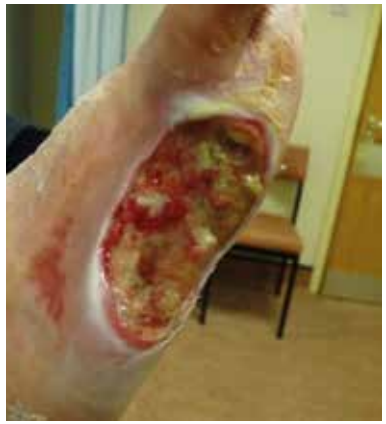


Figure 3
28 Jul 2016

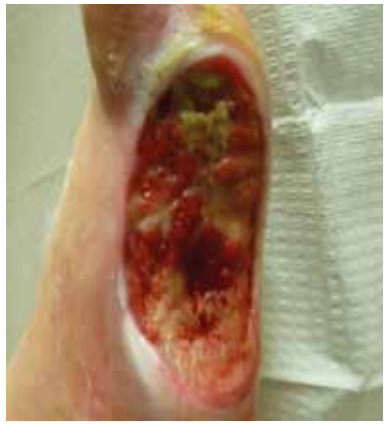


Figure 4
1 Aug 2016

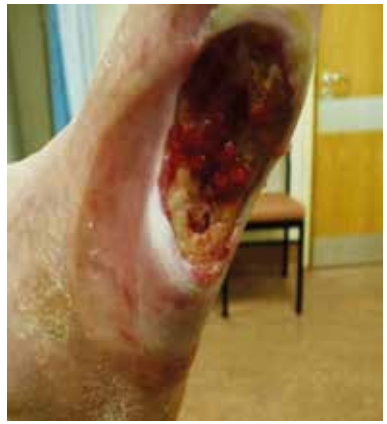


Figure 5
8 Aug 2016

Salford Royal NHS
NHS Foundation Trust

Hydrotherapy: A New Approach to the Treatment of Diabetic Foot Ulcers

Dr Paul Chadwick FFPM RCPS (Glasg) , Consultant Podiatrist and Samantha Haycocks FFPM RCPS (Glasg) Advanced Podiatrist Salford Royal (NHS) Foundation Trust, UK

Introduction

Hydration has been recognised since the early 60's as an important component of the wound healing process.

Debridement is now accepted for removal of devitalised tissue and as the basis of wound bed preparation in TIME management.

Autolysis is the body's own mechanism for removing devitalised tissue and facilitating healing.

Hydrotherapy (Hydroclean® plus and HydroTac®) combines these important components to enable wound healing to progress.

Conclusion

These Case Studies highlight the importance of rapid removal of de-vitalised tissue to optimise wound bed preparation which is a vital component in the treatment of DFU.

These studies also show the HydroTherapy concept using HydroClean® plus and HydroTac® that was highly effective in removing devitalised tissue and promoting healing in potentially limb threatening cases.

Case Study 1

A patient with Type 2 Diabetes (HbA1c 51), Neuropathy, PVD, CKD 5. Previous amputation of right 5th toe (2010) and left hallux (2014). A subsequent popliteal–pedal bypass to the right leg (2015) that was successful. In July 2016 he had a non healing ulcer to left 3rd and 5th met heads with osteomyelitis and a left popliteal-pedal bypass which occluded. He presented with open wounds to the medial leg due to surgical wounds dehiscing (Figure 1a) and a large dorsal wound (Figure 1b). After debriding both wounds with Hydroclean® plus (Figures 2a/b) and using HydroTac® to subsequently support healing, both wounds healed (Figures 3a/b) and an amputation was prevented.

Figure 1a (above) and 1b (below) presentation of wounds

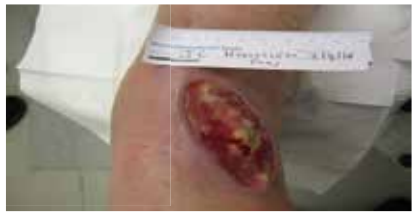


Figure 2a (above) after 4 weeks and 2b (below) after 5 weeks Debrided with Hydroclean® plus

Figure 3a/b treated and healed with HydroTac® after 3 months.

Case Study 2

A patient with Type 2 Diabetes (HbA1c 57) on haemodialysis 3x weekly. He also had previous colon cancer and was referred via another Trust due to severe, rapid deterioration of neuroischaemic wounds potentially limb threatening. He was seen in our MDT referred for amputation of the toes and revascularisation surgery.

Figure 1a/b wound at presentation

Figure 2a/b Wound after two weeks treatment with Hydroclean® plus

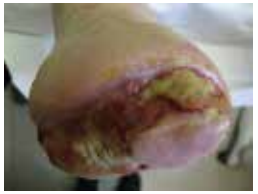


Figure 3a/b fully cleaned wound good healing progression after 8 weeks

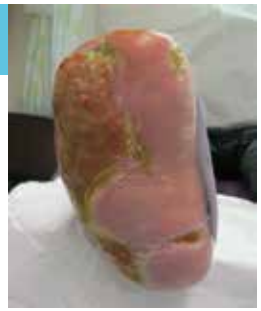


Figure 4 the wound is well on the way to healing after 16 weeks of treatment

SECTION 8

Speciality Areas

Cumbria Partnership NHS
NHS Foundation Trust

University Hospitals of Morecambe Bay NHS
NHS Foundation Trust

HydroClean® plus Assists Healing of Leg Ulcers for a Patient with Systemic Lupus Erythematosus

Tracey Jones - Tissue Viability Nurse, Barrow-in-Furness, Cumbria Partnership NHS Foundation Trust
Kieron McCracken - Tissue Viability Nurse, University Hospitals of Morecambe Bay NHS Foundation Trust

Introduction

Systemic lupus erythematosus (SLE) is a potentially severe autoimmune disease that mainly affects women of child-bearing age. Leg ulcers can occur in SLE because of vasculitis and/or antiphospholipid antibodies. When leg ulcers occur they can cause a great deal of pain and discomfort to the patient, and their effective treatment can be challenging. HydroClean® plus (HARTMANN) is a Hydro-Responsive Wound Dressing that cleanses, debrides, desloughs and absorbs. The dressing contains Ringer's solution which provides a controlled moist environment and optimal wound healing conditions. Here we present a case study of a patient with SLE who had developed bilateral leg ulcers and the result of their treatment with HydroClean® plus.

Clinical History

A female patient (44 years old) with SLE, a previous deep vein thrombosis (DVT) and bilateral leg ulcers, presented with sepsis of bilateral circumferential leg ulcers to the gaiter region in both legs. Compression was tolerated for several months, but this then became problematic. She had a history of chronic cellulitis for over 18 months. Both ulcers were treated and the wound on the right leg was assessed for this study. This wound had 100% necrotic tissue (22 x 33 cm), low exudate and high pain. The peri-wound area was inflamed with no maceration (Figure 1). The patient was not able to tolerate many dressings due to the pain. Many ulcer treatment options had already been tried for this patient, but due to non-compliance the previous treatments were stopped. HydroClean® plus was used on this wound with dressing changes every three days.

Results

The wound evaluation after 14 days of treatment (Figure 2) showed 30% necrotic tissue, 60% soft yellow slough, 10% granulation, moderate exudate and no maceration. This demonstrated a 70% reduction of necrotic tissue and the remaining necrotic tissue was significantly softened. At the final wound evaluation (Figure 3), the wound showed 20% granulation, 80% soft yellow slough, moderate exudate and no maceration. This demonstrated 100% removal of necrotic tissue. The patient reported reduced pain and was fully compliant with the treatment.

Conclusion

HydroClean® plus is a simple and effective way of managing the debridement of necrotic tissue from leg ulcers in a patient with SLE who found all other methods intolerable. We suggest that HydroClean® plus should be considered as an effective treatment for chronic leg ulcers with a large degree of necrotic tissue.

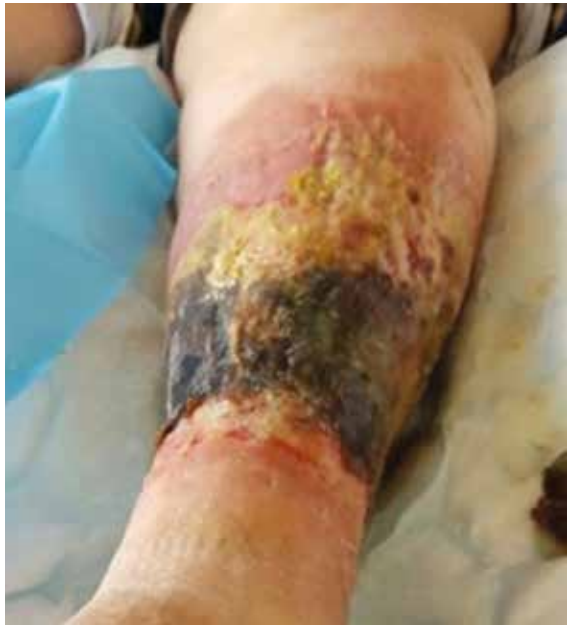


Figure 1

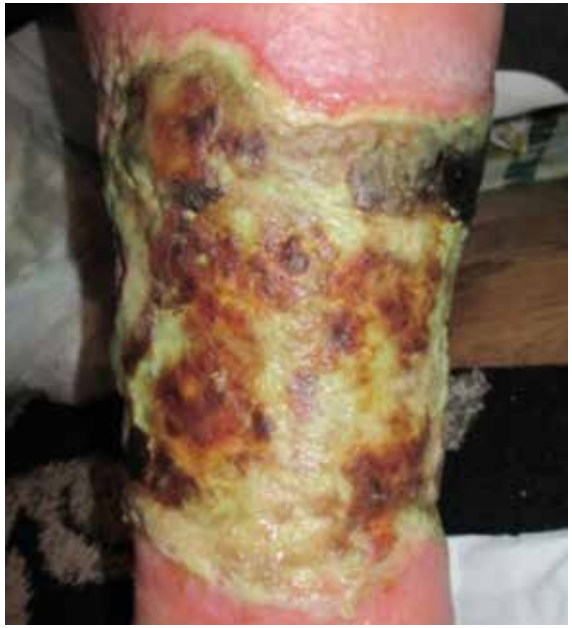


Figure 2

Figure 3

Cumbria Partnership NHS
NHS Foundation Trust

Using HydroTac® to Treat an Elderly Patient With a Leg Ulcer That Had Exposed Tendon

Tracey Jones - Tissue Viability Nurse (Furness), Barrow-in-Furness, Cumbria Partnership NHS Foundation Trust
Phil Hunter - Tissue Viability Nurse (Furness), Barrow-in-Furness, Cumbria Partnership NHS Foundation Trust

Introduction

Leg ulcers cause a great deal of pain and discomfort to patients. Leg ulcers are also challenging wounds to treat effectively, in particular when the wound has exposed the tendon and when the patient has other underlying diseases. HydroTac® (HARTMANN) is a dressing that provides a combination of absorption and moisture donation to help keep wounds in a balanced, moist environment to optimize healing efficiency. Here we present a case study of a 91 year old lady with a leg ulcer exposed to the tendon and the result of her treatment with HydroTac®.

Clinical History

The patient was admitted November 2015 with a leg ulcer present for less than 6 months. The cause of the ulcer was vascular insufficiency and she also had comorbidities of heart failure, chronic kidney disease (Stage 3) and thyroid disease. The ulcer presented as 11.5 cm x 10.5 cm with 30% slough, 70% granulation and was too painful to tolerate the previous compression therapy (pain relief was via Oramorph, codeine and paracetamol). The exudate level was moderate and the peri-wound skin was fragile and dry. The aim of the treatment was exudate management, protection of the peri-wound area, promotion of granulation, promotion of epithelialisation, prevention of infection and reduction of trauma/pain at dressing change.

Treatment History

AQUACEL® and Zetuvit® plus, PROFORE 1 and PROFORE 2 toe to knee were initially used to manage exudate. Barrier cream was applied to the peri-wound area. Honey dressings were used to deslough and promote granulation and prevent infection (although an infection was later treated with intravenous antibiotics). Debrisoft® was used to deslough but this was too painful for patient to tolerate.
Due to poor healing HydroTac® was introduced into the treatment strategy alongside Zetuvit® plus, peri-wound protection with Sorbaderm™ barrier cream and PROFORE 1 and PROFORE 2 toe to knee bandages with Comfifast™ yellowline toe to knee. The dressings were changed every 2 days.

Results

The wound evaluation after 7 days of treatment with HydroTac® showed a reduction in size and an improvement was noted in wound bed appearance. After 14 days there was a reduction in amount of tendon exposure and evidence that granulation tissue was beginning to cover the wound. After 21 days of the treatment schedule there was a minimal amount of tendon exposed and a healthy wound bed.

Figure 1
5 Feb 2016

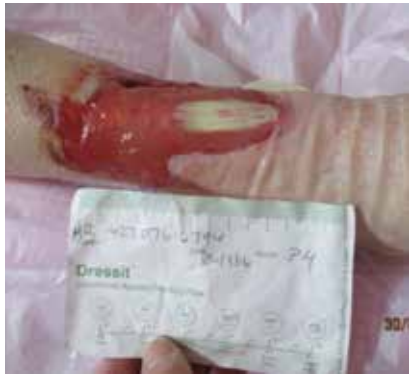


Figure 2
30 Mar 2016

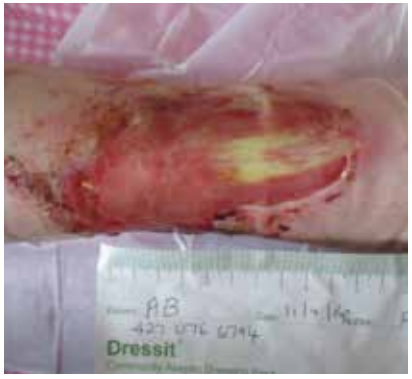


Figure 3
11 Apr 2016

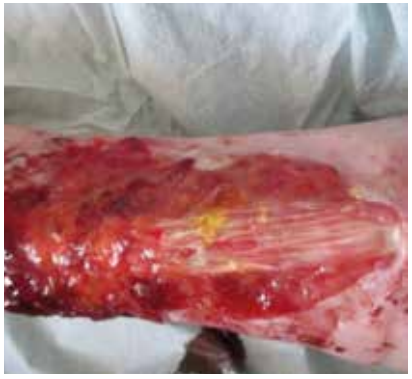


Figure 4
6 May 2016

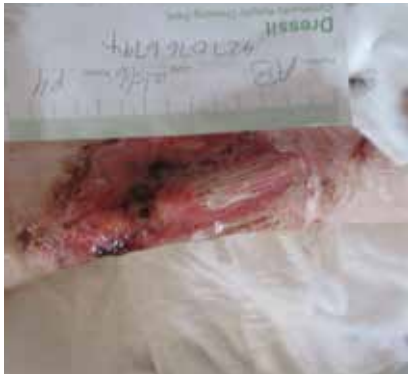


Figure 5
12 May 2016

Clinical Challenges of Treating an Exposed Tendon to the Forefoot: HydroTac® a New Dressing Approach

Sharron Cole, Vascular Clinical Nurse Specialist, Black Country Vascular Centre, Russells Hall Hospital, The Dudley Group NHS Foundation Trust

Aim

To demonstrate the successful treatment of a tendon exposed lower extremity chronic wound in a severely compromised patient (with numerous comorbidities) with a new dressing HydroTac®

Introduction

Open wounds with an exposed tendon situated on the lower leg, present a significant challenge to the clinician in order that they may treat and obtain a positive healing outcome. The location of the wound is of great importance, as it is likely to impede mobility of the tendon and may well lead to chronic inflammation that in turn hinders wound closure. Tendons are structures that are composed of parallel bundles of collagen that connect bone to muscle, they are nourished by blood vessels and diffusion of nutrients from synovial fluid. Exposure of the tendon to air will cause desiccation and subsequent tissue necrosis and infection (Geiger et al., 2016). Existing co-morbidities and patient related factors will also influence the healing process leading to severely delayed healing. As a consequence of this exposure, wound care must be provided to prevent loss of tendon viability. These types of wounds therefore require a treatment regimen that will promote the development of granulation tissue and ultimately enable re-epithelialisation and coverage of the exposed tendon as rapidly as possible.

There are a number of methods to treat chronic wounds with exposed tendons, that have shown various levels of success, these include the use of NPWT (Bukovcan et al., 2016), allografts (Wilson et al., 2016), surgical management (Johnston and Kwan, 2013) or a variety of advanced wound dressings such as Polyheal (Guest et al., 2015). However a recent wound dressing HydroTac® (HARTMANN) has been developed to provide a combination of absorption and moisture donation, that enables wounds to be maintained in a balanced, moist environment in order to optimize healing efficiency.

This article presents a case study of the treatment of a 69-year-old gentleman who presented with a an extensive chronic wound to the left forefoot (post-surgical debridement) with tendons exposed and subsequently successfully treated with HydroTac®

Clinical History: the patient was a 69-year-old male (smoking 10 – 12 cigarettes a day) with rheumatoid arthritis who presented with destructive arthopathy of the metatarsophalangeal and metacarpophalangeal joints. Mobilisation was impaired due to co-morbidities of peripheral vascular disease, symptoms included intermittent claudication and rest pain.

The wound: presented as a large tendon exposed lower extremity chronic wound see Figure 1.

Clinical Challenges: Wound exudate was moderate to high but the primary clinical challenge was to prevent dessication and further damage to the tendon, whilst maintaining an optimum moisture balance that would enable granulation tissue formation and re-epithelialisation as a precursor to healing. Additionally, pain at dressing change (caused by sensitive peri-wound skin, exacerbated by adhesive dressings causing further trauma) and between dressing changes (caused by the underlying pathology of the chronic wound) impacted to the detriment of the patients Quality of Life – hence atraumatic removal was of high importance to the patient.

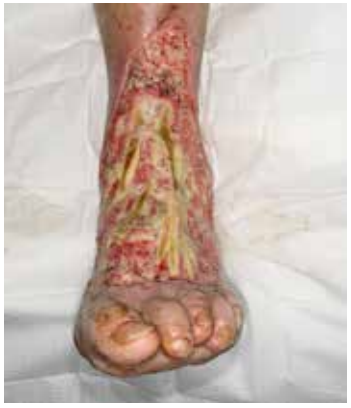
Results: After just 3 days of treatment with HydroTac® the wound showed an improvement in the appearance of the tendons and wound bed. Subsequent dressing changes (over the next few months) demonstrated an improvement in the tendons and importantly a significant amount of granulation tissue was formed resulting on the tendons being partially re-covered with healthy wound tissue. (Figures 2). Healing was achieved in conjunction with other therapies; including NPWT. Overall the patient reported much less pain & discomfort which in turn aided compliance & confidence with medical intervention and staff. On the 12.5.17 a final picture was taken & the wound redressed with HydroTac as shown in Figure 3.

Patient Perspective: The patient found the HydroTac® dressing to be soothing and tolerated the dressing very well, reporting dressing changes to be less painful. This low pain enhanced patient compliance to treatment.

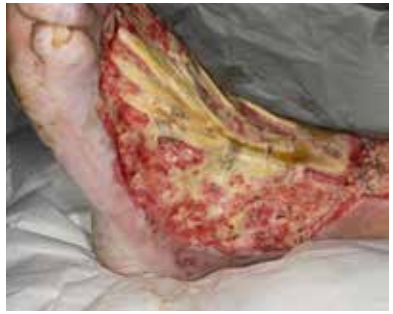
Clinician Perspective: clinicians reported the dressing as easy to apply and highly conformable to the wound bed. As a consequence of the low pain levels experienced at dressing changes, the patient did not require opiate analgesia. Exudate management was good and the dressing was able to be left in-situ for 2- 3 days.

Conclusions: The HydroTac® dressing provided a combination of absorption and moisture donation, thus dessication and necrosis damage to tendons was prevented. Moreover, the wound bed was kept in a balanced, moist environment that enabled optimisation of healing efficiency. Furthermore, HydroTac® proved to be soothing & comforting reducing the need for opiate analgesia. This in turn greatly improved patient confidence in the nursing staff aiding in compliance with medical intervention.

HydroTac®: HydroTac® is a Hydro-Responsive Wound Dressing with AquaClear Technology. The dressing face in contact with the wound is impregnated with a hydrogel contact layer, which is attached to a polyurethane foam layer with a thin polyurethane backing. HydroTac® Comfort has an adhesive border which is permeable to air, waterproof and bacteria resistant. HydroTac® can absorb wound exudate and release moisture (even when applied to dry wounds) which has a stimulating effect on wound healing. The gel on the side of the wound- contact layer prevents the dressing from sticking to the wound. It can be removed almost painlessly without leaving any residue. HydroTac® is suitable for the treatment of light to moderately exuding wounds, during the granulation and epithelialisation phases.



21st June (Figure 1)



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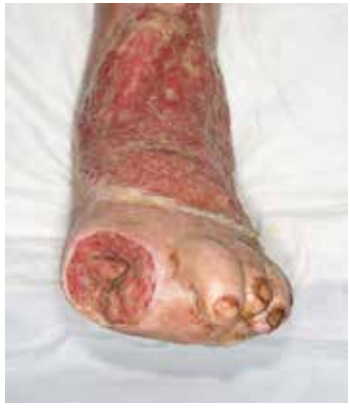
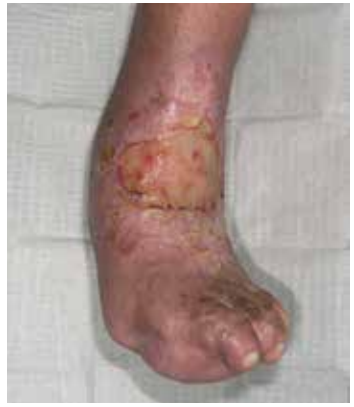


18th August (Figure 2)



12th May 2017 (Figure 3)

NHS
The Dudley Group
NHS Foundation Trust

Clinical Impact of a Hydro-Responsive Wound Dressing in the Treatment of a Neuropathic Diabetic Foot Burn Wound

Lynda Bloomer, Helen Horrobin, Wendy Walker Podiatrist Diabetes, Diabetes & Endocrine Centre, Russells Hall Hospital, Dudley, West Midlands

Introduction: HydroTac is a Hydro-Responsive Wound Dressing featuring AquaClear gel technology which provides a combination of fluid absorption (for exudate management) and fluid donation (for moisture balance) that works to establish and maintain an optimised moist wound environment that promotes healing. Its moist gel layer prevents HydroTac from sticking to the wound resulting in a more comfortable dressing removal experience.

Patient history: This case study relates to a 58 year old man with type 2 diabetes and neuropathy who was generally healthy but had recently undergone T & O surgery on a fractured metatarsal in the left (non ulcerated) foot and had suffered a burn to the dorsum of his right foot and toes from a hot water bottle. He attended the emergency department where Inadine was applied and was then referred to the acute diabetic foot clinic. The wound (75 x 50 mm) presented with dry crusty black eschar and a granulation/slough mix (60% and 40%, respectively), high exudate levels, peri-wound redness and swelling at the wound margins (Figure 1). The Inadine dressing was not able to manage the high exudate levels, which was leaking from the edges of the hard eschar. There was also evidence of local soft tissue infection.

Treatment with HydroTac: HydroTac was applied and retained with a tubular top layer. Pressure on the wound was reduced with a Darco all-purpose shoe. HydroTac was applied initially three times weekly for the first two weeks, reducing to twice weekly thereafter. The patient attended clinic weekly for review and local debridement of the wound bed. From the initial visit the eschar and slough started to lift (Figures 2 and 3) and subsequent de-sloughing was achieved with the wound bed finally presenting with 100% granulation tissue (Figure 4). The wound reduced rapidly in size (Figure 5) and wound closure with minimal scarring was achieved (Figure 6). The total treatment time was 14 weeks. Exudate was managed effectively and the patient found HydroTac to be comfortable and easy to change himself between assessment appointments.

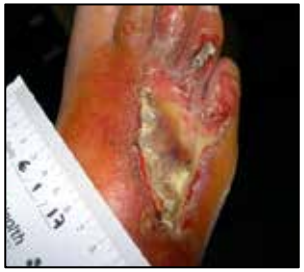


Figure 1: 6-Jan-17

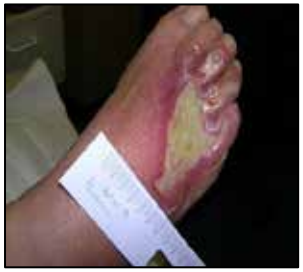


Figure 2: 20-Jan-17

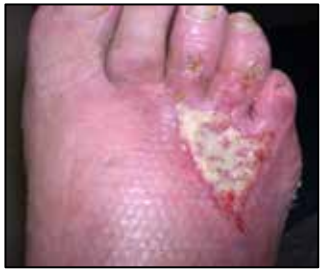


Figure 3: 23-Feb-17

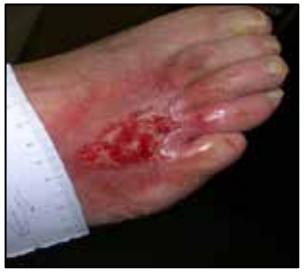


Figure 4: 7-Mar-17

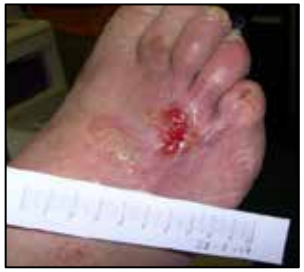


Figure 5: 28-Mar-17

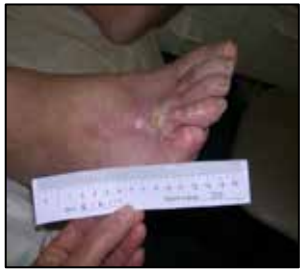


Figure 5: 6-Jun-17

Conclusion: The use of HydroTac resulted in the successful treatment of the wound and the wound healed with minimal scarring and tissue contracture. HydroTac aided wound debridement and wound progression leading to both patient and clinician objectives being met. The patient reported an instant decrease in discomfort upon first application of HydroTac and, overall, the dressing was comfortable, effective and easy to use. This was particularly important as some of the dressing changes were done by the patient at home. The performance of HydroTac exceeded the clinical team's expectations. The dressing was quick and easy to use, with the latter property meaning the patient was allowed to be more involved with his own care which was beneficial both in terms of treatment costs and patient compliance.

The Impact of Hydro Responsive wound dressings in the treatment of Myxofibrosarcoma

Sharon Gardner, Tissue Viability Nurse, The Christie NHS Foundation Trust, Manchester

The Christie
NHS Foundation Trust

Introduction

This poster presents the outcome of the use of Hydroclean plus and HydroTac wound dressings in the management of a 75yr female patient diagnosed with Myxofibrosarcoma in the right popliteal fossa.

Background

Myxofibrosarcoma is one of the most common sarcomas in the extremities of the adult. Wide surgical excision of the primary lesion is the treatment of choice for most patients and radiotherapy may be added in cases of microscopic or gross residual disease, recurrent disease, and in high-grade lesions and advanced-stage disease. Follow-up is necessary to detect local recurrence early and to avoid gradual tumour progression to a higher-grade sarcoma that may then spread. (Pathology International 1997).

Method

A case study 75yr old Female patient diagnosed with myxofibrosarcoma in the right popliteal fossa over a 6 month period following a holistic review by both Tissue viability nurse specialist and the consultant oncologist. Patient consent was obtained and ethics approval was not required. The Treatment goal was to promote granulation of a static wound known to have challenges regarding healing via the use of Hydro responsive wound dressings and if the dressing regime could also have an impact on the reduction in the high levels of pain especially at dressing changes that the patient was experiencing.

Case Study

History

June 2016 10 x 3-4cm elongated superficial defect healing by secondary intention. Pain levels 8 (VAS scale) at rest.

April 2017 Deep tissue swab was taken together with some gentle sharp debridement but wound bed remained static with no obvious vascular supply. PICO commenced Swab results confirmed pseudomonas and the patient was treated with appropriate antibiotics and topical antimicrobial dressings but the wound continued to make slow progress to heal despite the use of PICO.

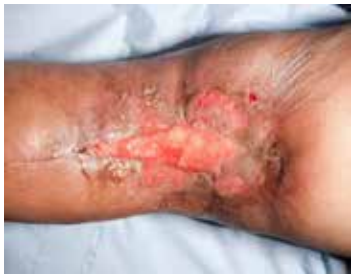
July 2017 Oncology MDT review patient and offered and declined further surgery. PICO discontinued as patient developed a reaction to the PICO film. Hydro Clean Plus commenced due to its ability to cleanse debride absorb and deslough whilst maintaining a balanced moist wound environment. Treatment goal was to promote granulation of a static wound known to have challenges regarding healing together with the removal of the significant build-up of slough. Dressings twice a week

Results

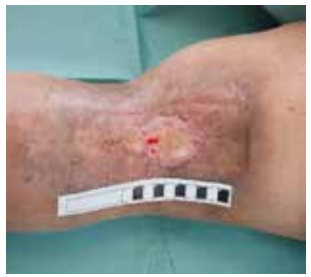
Surgical Debridement by the patient's consultant has been avoided due to progress in wound healing and removal of slough together with reduction in wound size. At a recent multidisciplinary team meeting it was agreed that treatment outcomes have been remarkable considering the length of time the wound had been problematic. Wound pain has subsided considerably measuring at 4 now on the vas scale.
Discussion Wound continues to improve the patient is extremely happy to continue with the treatment regime feels her quality of life has improved significantly due mainly to reduction in pain levels and no pain at dressing changes.

Conclusion

Case study demonstrates a pain free, safe and effective treatment plan which has improved concordance and quality of life for our patient. Combined with the results of this case study so far as a team we have identified further patients whom we believe will most certainly benefit from the treatment regime and as a result we are giving consideration for the Hydrotherapy product portfolio to be added to our formulary.



29th Jan 2017



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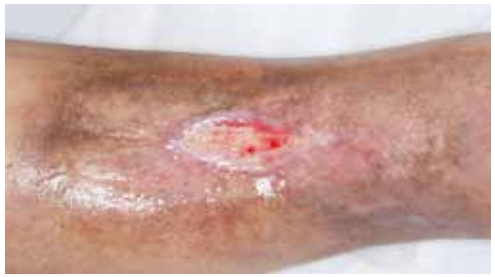


19th Sept 2017

SECTION 9

Mixed Wound Aetiology

HydroTac®: Case Studies of Use

Pam Spruce - Clinical Director TVRE Consulting.
Lindsey Bullough - Clinical Nurse Specialist – Tissue Viability. Wrightington, Wigan and Leigh Foundation Trust

Introduction

Foam dressings are now reported to be the most commonly used product in wound management[1,2]. Non adhesive foam dressings are used less frequently than those with an adhesive border[3], however there is still an indication for use where the patient may have a preference or a clinical indication (e.g vulnerable peri-wound skin) for this type of product.

Shaped foam dressings are also frequently used to improve conformability on areas of the body, which may be difficult to dress.

HydroTac®

HydroTac® is a NEW, unique foam dressing with AquaClear Technology that provides a combination of absorption and moisture donation. It provides a moist wound environment, by absorbing exudate but can release moisture when applied to a dry wound.

The interface of the dressing is impregnated with a hydrogel (AquaClear Technology) which prevents it from adhering to the wound bed, and facilitates painfree dressing removal.

In a recent evaluation undertaken on 20 patients by both nurses and podiatrists, HydroTac® was used on a range of acute and chronic wounds where a non-adhesive or shaped dressing was required. In 85% (n=17) of the patients, the wounds progressed with 20% (n=4) healing within the four–week evaluation period.

The results also indicated that:-

- In 100% of dressing changes (n=93) the dressing was easy to apply and remove.
- In 100% of applications (n=93) the dressing conformed well to the wound.
- In 100% of responses (n=93) the patients reported that the dressing was comfortable during wear and painless on removal.

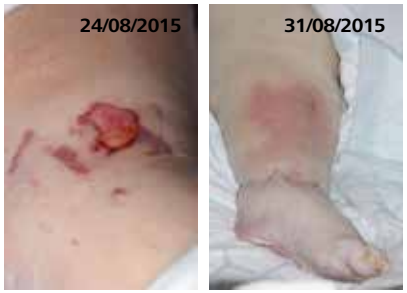
HydroTac® was reported to manage exudate effectively, with dressing changes being undertaken every 3 days in 57% (n=47) of procedures, alternate days in 29% (n=27) and 5-7days in 20% (n=19). The peri-wound skin condition also improved in 55% of patients (n=11) where the tissue was damaged at baseline.

Case Study 1

The patient was a 46 year old female, who had a medical history of ischaemic heart disease and heart failure with uncontrolled oedema in her legs. A blistered area appeared on the gaiter area of her left leg which measured 9cm^2 , from which there was a small amount of exudate.

Because of the friable skin condition, a non adhesive foam dressing was indicated to provide a moist wound environment, absorb the excess exudate and protect from further contamination and the patient also complained that the wound was painful

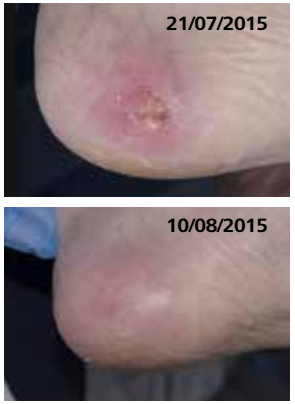
The wound had been present for 1 week with no treatment before HydroTac® was applied, with a tubular cotton bandage to secure in place. After 3 dressing changes (7 days) the blistered area was fully epithelialised with no trauma to the surrounding skin.



Case Study 2

The patient was a 72 year old female who presented with a grade 2 pressure ulcer on her left heel. Although the wound area was small measuring 1.5cm^2, the wound bed contained both slough and granulation tissue and the peri-wound skin was macerated.

After a full assessment of the patient, a programme of care was implemented which included pressure relief and local wound management using HydroTac®. The concave shape dressing was used to ensure that the dressing interface was in contact with the wound bed, and was held in situ with a retention bandage.

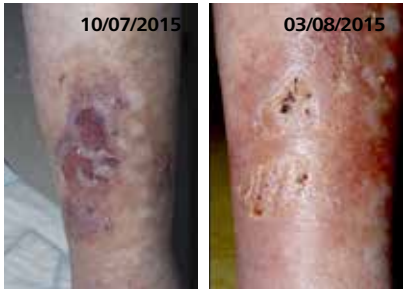


The wound was re-assessed every 3 days, and HydroTac® was reapplied. After 18 days the wound was fully healed.

Case Study 3

The patient was a 52 year old female who was admitted to hospital with a fractured neck of femur on the left leg. On examination, it was observed that she had a venous ulcer present, which measured 40cm^2. Although the wound bed was clean and granulating, there was a moderate amount of exudate and the peri-wound skin was macerated. The patient also complained of pain in the wound.

Because of the peri-wound skin condition, HydroTac was used on the ulcer, with a wool/retention bandage to secure in place. The wound was reassessed every 3-4 days, and HydroTac was re-applied. The patient became pain free and the skin condition returned to normal as the wound progressed. After 22 days of treatment the wound was reported to be healed.



Conclusion

In a small evaluation, the HydroTac® dressing was observed to be effective in managing patients with a range of acute and chronic wounds, which required either a non adhesive, or shaped dressing. The outcome of the evaluation demonstrated that the dressing facilitated wound progression in a high number of patients, was easy to use and highly acceptable to both patients and clinicians. It was comfortable during wear and removal, and an improvement in peri-wound skin condition was observed.

1. Bianchi J, Gray D, Timmons J, Meaume S Do all foam dressings have the same efficacy in the treatment of chronic wounds? Wounds UK (2011) 7(1): 62–67
2. Carter K. Hydropolymer dressings in the management of wound exudate. Br J Community Nurs (2003) 8: suppl 10–6
3. Peach V. Evaluating adhesive foam wound care dressings in clinical practice. Wounds UK 2012, Vol 8, No 3 53-54.

A Case Study Series Evaluation of HydroTac®

Pam Spruce - Clinical Director TVRE Consulting.
Lindsey Bullough - Clinical Nurse Specialist – Tissue Viability. Wrightington, Wigan and Leigh Foundation Trust
Debra O'Brien – Podiatry Clinical Manager (Solent NHS Trust, West)

Introduction

Dressings that create and maintain a moist environment are now considered to provide the optimal conditions for wound healing. Such moisture increases the rate of epithelialisation and promotes the inflammatory phase therefore aiding the healing process (Harding et al., 2006). One such dressing that has been developed with this in mind is HydroTac®.

HydroTac® is a foam dressing with an air permeable, waterproof and bacterial resistant outer layer made of polyurethane. The dressing face in contact with the wound is impregnated with a hydrogel. HydroTac® can absorb wound exudate and release moisture (even when applied to dry wounds) which has a stimulating effect on wound healing. The gel on the side of the wound-contact layer prevents the dressing from adhering to the wound. It can be removed almost painlessly without leaving any residue. HydroTac® is suitable for the treatment of light to moderate exuding wounds, during the granulating and epithelialisation phases. A variety of Case Studies are presented which exemplify the use of HydroTac® in the management of a range of different wound types in a variety of community settings, including specialist wound clinics, community hospitals and community care.

Methods

Case studies were selected from a multi-centre clinical evaluation in which patients were recruited from two centres:

1. which provided specialist tissue viability support into the community setting
2. a community based podiatry service which treats "at risk" feet and regularly manages foot ulcers in diabetic and other compromised patients.

HydroTac® was used as per intended for use until the wound healed. The maximum study length was set at 4 weeks, although the dressing could be discontinued prior this if the wound required an alternative therapy or was requested by the patient.

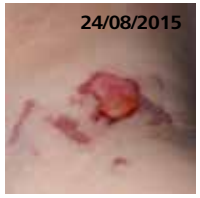
Conclusion

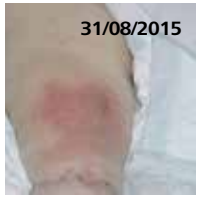
HydroTac® is a Hydro Responsive Wound Dressing that uses AquaClear Technology, a gel that provides a combination of absorption and moisture donation to help keep wounds in a balanced, moist environment to optimise healing efficiency. A net-shaped hydrogel applied to the wound-contact side releases moisture to the wound as needed - counteracting the incidence of a wound drying out. This moist gel layer also prevents the dressing from adhering to the wound and allows for more comfortable removal - ideal for pain-sensitive patients. In this series of case studies, the photographs show the healing benefits of HydroTac® in a variety of different wound challenges. The clinicians that used this product were very satisfied with its physical handling characteristics and superior qualities in relation to aiding wound healing. Patients reported this dressing as pain free, comfortable to use and chose to retain it as their dressing of choice after the study had been completed.

Results

Case Study 1 Female patient aged 46 years old with Ischaemic heart disease/heart failure. The wound was a large blister.

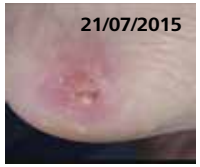
Wound Information	Start				End			
Area cm²	9				0			
Depth cm	0				0			
Wound bed status	Necrotic	Slough	Gran	Epith	Necrotic	Slough	Gran	Epith
	0	100	0	0	0	0	0	100
Exudate	Low				None			
Pain (scale)	3				0			
Malodour	No				No			
Periwound Skin	Normal				Normal			
Other products used	Tubifast				-			
Outcome	**Healed**							

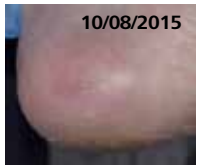




Case Study 2 Female patient aged 72 years old, with a Grade 2 pressure ulcer on the heel.

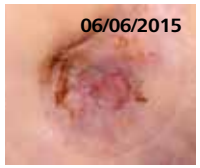
Wound Information	Start				End			
Area cm²	1.5				0			
Depth cm	0				0			
Wound bed status	Necrotic	Slough	Gran	Epith	Necrotic	Slough	Gran	Epith
	0	10	90	0	0	0	0	100
Exudate	Low				None			
Pain (scale)	1				0			
Malodour	No				No			
Periwound Skin	Macerated				Normal			
Other products used	Tape				Tape			
Outcome	**Healed**							

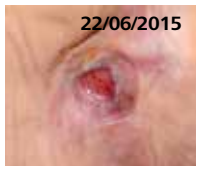




Case Study 3 Female patient aged 63 years old with diabetes and chronic renal failure. The wound was a Grade 3 sacral pressure ulcer of greater than 50 weeks duration.

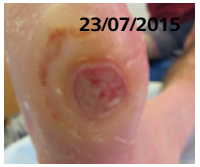
Wound Information	Start				End			
Area cm²	6				2			
Depth cm	0.25				0.25			
Wound bed status	Necrotic	Slough	Gran	Epith	Necrotic	Slough	Gran	Epith
	0	70	30	0	0	0	100	0
Exudate	Moderate				Low			
Pain (scale)	3				0			
Malodour	No				No			
Periwound Skin	Normal				Normal			
Other products used	Tape				Tape			
Outcome	**Discharged**							

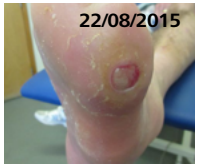




Case Study 4 Male patient with diabetes aged 61 years old, the wound was a neuropathic ulcer located on the plantar region and of 18 weeks duration.

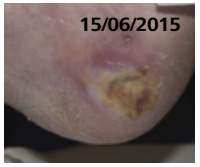
Wound Information	Start				End			
Area cm²	1.96				0.64			
Depth cm	0.1				0.1			
Wound bed status	Necrotic	Slough	Gran	Epith	Necrotic	Slough	Gran	Epith
	0	80	20	0	0	80	20	0
Exudate	Moderate				Moderate			
Pain (scale)	0				0			
Malodour	No				No			
Periwound Skin	Callus				Callus			
Other products used	Hyperfix Tape				Hyperfix Tape			
Outcome	**Continue HydroTac®**							

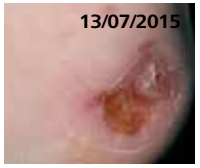




Case Study 5 Female patient 46 years of age with diabetes and immobile. The wound is a neuropathic diabetic ulcer located on the heel its duration is unknown.

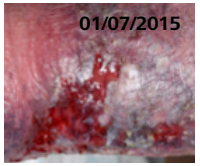
Wound Information	Start				End			
Area cm²	4				2.5			
Depth cm	0				0			
Wound bed status	Necrotic	Slough	Gran	Epith	Necrotic	Slough	Gran	Epith
	0	100	0	0	0	0	100	0
Exudate	Moderate				Low			
Pain (scale)	0				0			
Malodour	Yes				No			
Periwound Skin	Macerated				Normal			
Other products used	-				-			
Outcome	**Lost to follow up**							

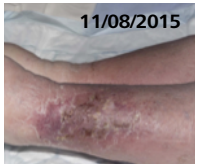




Case Study 6 Female patient aged 73 years old with a haematoma on the shin that had been in place for two weeks

Wound Information	Start				End			
Area cm²	54				54			
Depth cm	0				0			
Wound bed status	Necrotic	Slough	Gran	Epith	Necrotic	Slough	Gran	Epith
	0	0	100	0	0	0	40	60
Exudate	Moderate				Low			
Pain (scale)	1				1			
Malodour	No				No			
Periwound Skin	Inflamed				Normal			
Other products used	Wool/retention bandage				Wool/retention bandage			
Outcome	**Lost to follow up**							





SECTION 10

Scientific

Odour Sequestration Properties of Superabsorbent Dressings

Davies, L O, Rippon M G and Westgate S J.

Introduction

Malodour on humans can be brought about by the bacterial biotransformation of malodour precursors that are present in naturally released exudates. Human malodour studies have shown *Corynebacterium striatum* to be able to transform the malodour precursor, *S*-Benzyl-l-Cys-Gly to the malodorous thiol benzyl mercaptan (Bawdon *et al*. 2015). Samples taken from venous leg ulcers and pressure ulcers have previously identified *C. striatum* as a member of the bacterial consortium (Dowd *et al*. 2008), and it could be involved in the production of wound malodour. Sequestration of known odour causing bacteria and thiols could result in the reduction of wound malodour.

Aim

To determine whether Zetuvit® plus and Zetuvit® Silicone have the potential to sequester malodour thiols.

Method

- The ability Zetuvit® plus and Zetuvit® Silicone to sequester thiols was tested by incubating sections of test dressing with 0.5 mM benzyl mercaptan, a model malodour thiol.
- Thiols have been shown to be perceptible by the human nose at concentrations as low as 1–3 pg L–1 air (Natsch *et al*. 2004; Troccaz *et al.* 2004, 2009), which is orders of magnitude lower than the final concentration of thiol used in this study.
- Samples were incubated with benzyl mercaptan at 20°C for 1 hour and the remaining concentration was determined using optical density measurements.
- The sequestration of the known odour causing bacterium, *C. striatum* by test dressings following 24 hours incubation at 37°C was also investigated.

Results

Significantly less *C. striatum* was recovered from Zetuvit® plus and Zetuvit® Silicone, with a 2.06 ± 0.70 and 3.91 ± 1.70 $Log_{10}cfuml^{-1}$ increase in the sequestration of bacteria compared to the negative control following 24 hours (a gauze product), respectively ($p<0.001$) (Table 1).

Significant sequestration of benzyl mercaptan was observed, with 18.09% ± 9.96% and 21.79% ± 3.51% reduction in benzyl mercaptan following inoculation of Zetuvit® plus ($p<0.05$) and Zetuvit® Silicone ($p<0.001$) compared to the negative control, respectively (Table 2).

Sampling Time	Product	Bacterial sequestration ($Log_{10}cfuml^{-1}$)	SD	T-test
1 hour	Gauze control	0.00	0.00	NA
	Zetuvit® plus	0.96	0.54	<0.001
	Zetuvit® Silicone	1.65	0.28	<0.001
4 hours	Gauze control	NA	NA	NA
	Zetuvit® plus	1.27	0.41	<0.001
	Zetuvit® Silicone	1.73	0.28	<0.001
24 hours	Gauze control	NA	NA	NA
	Zetuvit® plus	2.06	0.70	<0.001
	Zetuvit® Silicone	3.91	1.70	<0.001

Table 2. The average sequestration of *Corynebacterium striatum* NCTC 764 compared to the gauze control. NA = not applicable.

Product	Benzyl mercaptan sequestration (%)	SD	T-test
Gauze control	0.00	0.00	NA
Zetuvit plus	18.09	9.96	<0.05
Zetuvit Silicone	21.79	3.51	<0.001

Table 1. Percentage sequestration of the thiol benzyl mercaptan by test dressings compared to the gauze control.

Discussion

Bacterial transformation of malodour precursors to thiols contributes to malodour. The study showed that concentrations of thiol that are orders of magnitude above those perceptible by the human nose can be sequestered by Zetuvit® plus and Zetuvit® Silicone.

Zetuvit® plus and Zetuvit® Silicone sequestered known odour causing bacteria. The complementary assessment of bacterial and thiol sequestration is important. This combined method addresses the problem of malodour production from two aspects. Bacterial sequestration is important since bacteria that remain within the wound can potentially produce thiols (in addition to degrading the wound) whilst thiol sequestration is important as this involves 'mopping up' the chemicals responsible for malodour. This data suggests that Zetuvit® plus and Zetuvit® Silicone. could reduce malodour in wounds. Clinical studies are required to confirm these observations.

Conclusions

It was concluded that Zetuvit® plus and Zetuvit® Silicone were able to sequester known odour causing bacteria, and malodorous thiols.

This project was carried out by Perfectus Biomed Ltd and funded by Paul Hartmann Limited

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An Assessment of Biofilm Disruption and Bacteriostatic Capabilities of an Autolytic Debridement Dressing

Davies L O, Sellars L E, Rippon M G and Westgate S J.

Introduction

Microorganisms contained within biofilms often have altered phenotypes compared to their equivalents in planktonic culture and are usually more difficult to eradicate. It is thought that biofilm material is present in the majority of chronic wounds and is a factor in preventing these wounds from healing. Treatments that disrupt biofilms may aid healing in previously non-healing wounds.

In order to assess biofilm disruption highly reproducible biofilms need to be established in order to compare biofilm treatments. The CDC reactor model has been accredited by UKAS as being suitable for the growth of highly reproducible biofilms.

Aim

To assess the biofilm disruption properties of hydro-responsive wound dressings, using a CDC reactor biofilm model.

Method

- An inoculum of *S. aureus* was prepared to 1 x 10^7 $cfuml^{-1}$ and added to a CDC reactor containing polycarbonate and glass coupons.
- The reactor was incubated at 37°C and 50 rpm for 24 hours.
- After incubation, coupons were removed from the reactor and washed three times in PBS to remove planktonic cells.
- Coupons were treated by sandwiching each coupon between two sections of HydroClean® or HydroClean® plus. Controls were submerged in 2 ml PBS + 1% TSB. All samples were incubated at 37°C for 24 hours.
- Samples were taken from each dressing core for the enumeration of viable organisms present within the dressing core.
- Samples were taken from HydroClean HydroClean plus and also NA Gauze each dressing and scanning electron microscopy was used to visualise organisms within the dressing core.

Results

- Control biofilms equated to 6 log of viable biofilm material. Following treatment, an average of 4.69 ± 0.28 log and 3.75 ± 0.69 log bacteria were recovered from the inner core of HydroClean® and HydroClean® plus respectively (Figure 1), demonstrating the ability of the dressing to sequester biofilm encased bacteria.
- The neat (pre dilution of the inner core sample) resulted in significantly reduced bacterial recovery compared to the diluted samples, suggesting a bacteriostatic effect of the dressing gel.
- Scanning electron micrographs of NA gauze show a significant bacterial burden on the gauze fibres. The inner core of HydroClean® and HydroClean® plus presented with bacteria within the core of the dressings. Bacteria were visible on the dressing fibres but no organisms were visible on the gel structures. Again this suggests that the majority of the bacterial load was held within the gelling fibres (Figure 2).

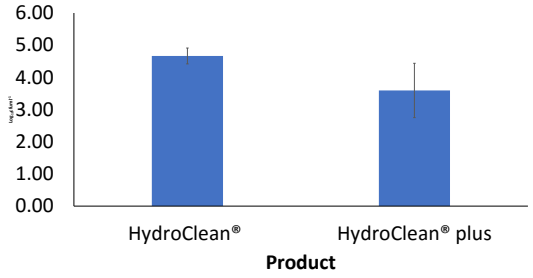

Figure 1. Quantity of viable organisms recovered from the inner core of dressings following treatment.

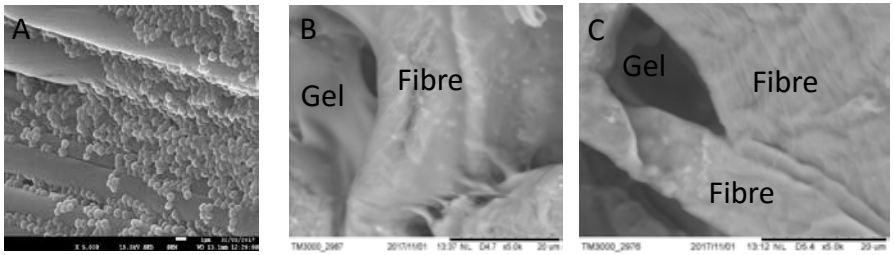

Figure 2. Scanning electron micrographs of NA Gauze (A), HydroClean (B) and HydroClean plus (C) exposed to a *Staphylococcus aureus* inoculum for 24 hours.

Discussion

Biofilm material within chronic wounds can result in difficult to treat infections and non-healing wounds.

Viable material was recovered from the inner core of the dressing but minimal organisms were visible using SEM microscopy. This suggests that the bulk of the sequestered bacteria were contained within the gelling agents of the dressing.

Treatments that sequester bacteria within the dressing present a reduced risk of wound bed recontamination resulting from the dressing core. Treatments capable of disrupting biofilms may improve healing by reducing triggers for persistent inflammation and thus supporting the wound to continue on the healing trajectory.

Conclusions

HydroClean® and HydroClean® plus disrupted pre-formed *S. aureus* biofilms and sequestered bacteria within the dressing core.

This project was carried out by Perfectus Biomed Ltd. and funded by Paul Hartmann Limited

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An Assessment of Debridement Tools to Disrupt Biofilms and the Ability of an Autolytic Debridement Dressing to Minimise Spreading of Bacteria Across the Wound

Sellars L E, Rippon M G and Westgate S J.

Introduction

Debridement tools allow healthcare practitioners to carry out mechanical debridement. Although this method may be efficient at disrupting wound biofilms there is potential for bacteria to be transferred around the wound bed by mechanical debridement tools. Autolytic debridement dressings that promote the body's natural process of enzymatic debridement aim to reduce necrotic tissue and biofilm material without the risk of spreading bacteria across the wound.

Aim

To compare a mechanical debridement tool with an autolytic debridement wound dressing, and assess whether the debridement products transfer bacteria between surfaces, following disruption of a bacterial biofilm.

Method

- *Ex-vivo* porcine skin explants were inoculated with a bacterial suspension of *P. aeruginosa* and incubated at 37°C for 4 hours to encourage bacterial growth.
- Explants were washed 3 times with PBS to mimic wound irrigation prior to debridement.
- Pre-formed biofilms were covered with HydroClean® plus and incubated for 24 hours at 37°C or mechanically debrided with Product D.
- Following treatment debridement samples were transferred to three sterile porcine skin explants.
- Viable microorganisms were recovered from all 3 porcine explants in order to quantify bacteria recovered from inoculated and initially sterile porcine explants.
- HydroClean® plus Dressings and debridement tools were also imaged post inoculation using scanning electron microscopy.

Results

- Samples of HydroClean® plus, used to treat *P. aeruginosa* biofilms, resulted in less visual bacterial transfer after 24 hours than Product D (Figure 1).
- HydroClean® plus significantly reduced the quantity of *P. aeruginosa* transferred from the initial inoculated explant to subsequent explants (Figure 2).
- The quantity of bacteria transferred from treated explants to sterile explants remained >6.83 log when the mechanical debridement tool, Product D was used (Figure 2).
- Following exposure to *P. aeruginosa* inoculum individual bacterial colonies were present on the fibres of the inner core of HydroClean® plus. Bacterial colonies covered a significant proportion of the fibres of the mechanical debridement tool (Figure 3).

Figure 1. TSA plates exposed to A = Negative control, B = HydroClean® plus or C = Product D, after 24 hours incubation with porcine explants, inoculated with 100 µl 1 x 10^3 cfuml^{-1} *Pseudomonas aeruginosa* and incubated for 4 hours at 37°C.

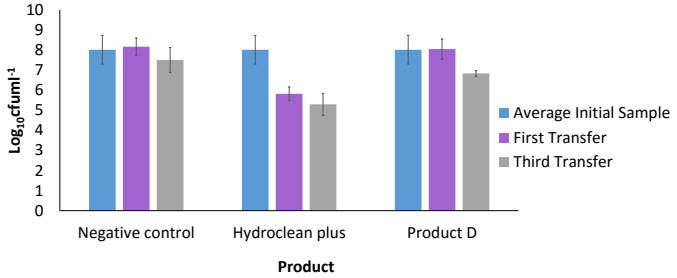

Figure 2. Quantity of viable *Pseudomonas aeruginosa* recovered from inoculated porcine explants treated with a debridement product (Initial Sample) and quantity transferred to fresh porcine explants.

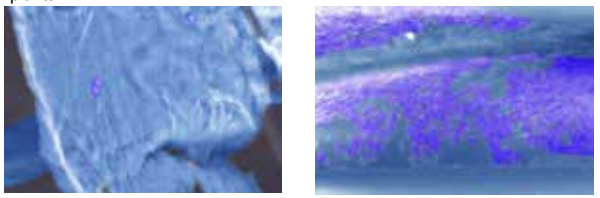

Figure 3. Scanning electron micrographs of HydroClean® plus (A) and Product D (B) after 24 hours exposure to a *Pseudomonas aeruginosa* inoculum (Purple = *Pseudomonas aeruginosa*).

Discussion & Conclusions

Product D resulted in the transfer of *P. aeruginosa* from an inoculated porcine explant to un-inoculated explants. Treatment with HydroClean® plus significantly reduced this transfer. The risk of recontamination of the wound bed was reduced when autolytic debridement was used in place of mechanical debridement. SEM evidence suggested that the autolytic debridement dressing sequestered and retained the bacteria within the dressing core.

This project was carried out by Perfectus Biomed Ltd. and funded by Paul Hartmann Limited

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Product D - Debrisoft® Debridement Pad

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