HydroTherapy® poster booklet

Scientific symposium - A New Perspective on Wound Cleansing, Debridement and Healing
Wounds UK 2016
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)

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

SECTION 1
Posters submitted to Scientific symposium
- A New Perspective on Wound Cleansing, Debridement and Healing
HydroClean® plus: A Simple Economic Evaluation of 20 Patients

Pam Spruce - Clinical Director TIVU Consulting, Lindsey Bullough - Clinical Nurse Specialist – Tissue Viability, Wigtion, Wigan and Leigh Foundation Trust Sue Johnson - ClinicalLead Wound Care, Doncaster and Bassetlaw Hospitals, NHS Foundation Trust Debbie O’Brien – Podiatry Clinical Manager (Senior NHS Trust, West)

Introduction

The NHS is under pressure as a result of an aging population and a significant increase in long-term health conditions. 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”.

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. The total cost to the NHS of managing these wounds and associated co-morbidities was estimated to be £6 billion.

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 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 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 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 previous cost of treatment for 1 patient, the cost of treatment was £37.96 more expensive.

Using data from the evaluation, a simple cost benefit analysis 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.

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

53% (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 is marked with an asterisk (*). Wounds treated by this service are complex foot ulcers in diabetic patients or have other conditions which compromise 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 1: Patients healed

<table>
<thead>
<tr>
<th>Cost model 3</th>
<th>80-99% Debridement</th>
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<tbody>
<tr>
<td>Cost components</td>
<td>Standard Care</td>
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<tr>
<td>Wound Cleansing</td>
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<tr>
<td>Primary Dressing</td>
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<tr>
<td>Secondary dressing</td>
<td></td>
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<tr>
<td>Other materials</td>
<td></td>
</tr>
<tr>
<td>Cost per week</td>
<td>£6.09</td>
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<tr>
<td>Weekly cost saving</td>
<td>£293.52</td>
</tr>
</tbody>
</table>

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 |
| Wound Cleansing | | |
| Primary Dressing | | |
| Secondary dressing | | |
| Other materials | | |
| Cost per week | £351 for larvae. This small evaluation suggests that there is potential for HydroClean® plus to contain more cost of debride (100% granulation) for other therapies is 20 days for hydrogels and enzymes and 12 days and speed of debridement is important in containing cost. It has been suggested that the mean time of healing of 7.5 days. The actual total cost savings was £87.78. (Table 2) | £7.94 £10.75 3 £56.07 £67.62 |

Cost model 2: Patient 3 - 100% Debridement

| Cost components | Standard Care | Revised Care |
| Wound Cleansing | | |
| Primary Dressing | | |
| Secondary dressing | | |
| Other materials | | |
| Cost per week | £351 for larvae. This small evaluation suggests that there is potential for HydroClean® plus to contain more | £6.92 £10.75 7 £116.55 £7.75 £10.75 3 £55.50 £61.05 |

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)’ and reported that the total cost of debridement per patient to be £69 – £189 for the monofilament pad, in comparison to £165 – £308 for hydrogel, £180 – £330 for gauze and £306 – £560 for larvae. This small evaluation suggests that there is potential for HydroClean® plus to contain more.
**HydroTac®: Case Studies of Use**

**Pam Spruce - Clinical Director TVRE Consulting.**

**Lindsey Bullough - Clinical Nurse Specialist – Tissue Viability, Wigan and Leigh Foundation Trust**

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**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\(^\circledR\) 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\(^\circledR\) 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 when applied to a dry wound.

The wound had been present for 1 week with no treatment before HydroTac\(^\circledR\) 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.

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**Case Study 2**

The patient was a 72 year old female who presented with a grade 2 pressure ulcer on her right hip. 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\(^\circledR\). 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\(^\circledR\) was reapplied. After 18 days the wound was fully healed.

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**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.

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**Conclusion**

In a small evaluation, the HydroTac\(^\circledR\) 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.

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Wound Healing and Hyper-Hydration - A Counter Intuitive Model

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Karen Ousey, PhD. - Reader Advancing Clinical Practice, School of Human and Health Sciences, Institute of Skin Integrity and Infection Prevention, University of Huddersfield, Queensgate, Huddersfield, UK

Introduction

The success of Winter’s concept – Most 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, scar 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. Moisture retained over the wound desiccates, promotes expression of cytokines, growth factors and stimulates cell migration.3,4 In addition, a moist environment supports autolytic decrease, 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.4

Hyper-hydration

Hyper-hydration of skin is often associated with prolonged immersion in water and the development of wrinkly skin. This is as result of swelling of the connective tissue in the stratum corneum. However, it is important to note that skin absorption of water is limited by the skin’s physical structure5 and does not necessarily result in sustained damage.6

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.7

Bunyan, a WW2 military surgeon treated servicemen’s burns with an envelope of cool salt 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.8

An animal model the effect of liquid covering on closure of superficial wounds was investigated and compared with wounds exposed to air, and wounds that were covered and kept moist.9 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 burns is carried out 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 / scarring than healing of the air exposed wounds.10

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.1,2 (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.

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

<table>
<thead>
<tr>
<th>Myths</th>
<th>Reality</th>
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</thead>
<tbody>
<tr>
<td>Prolonged contact of the peri-wound skin with isotonically fluid will induce maceration</td>
<td>Prolonged contact of wound bed with isotonically fluid will delay healing</td>
</tr>
<tr>
<td>Prolonged contact of wound bed with isotonically fluid will induce maceration</td>
<td>Prolonged contact of isotonically fluid with the wound bed supports healing in acute and chronic wounds</td>
</tr>
</tbody>
</table>

Table 2 Differences between tissue hydration and maceration

<table>
<thead>
<tr>
<th>References</th>
<th>References</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kruse et al., 201515</td>
<td>Delayed healing</td>
<td>Cutting &amp; White, 200216</td>
</tr>
<tr>
<td>Powers et al., 201313</td>
<td>Increased slough and tissue damage</td>
<td>Mulpuru et al., 201517</td>
</tr>
<tr>
<td>Sarabahi, 201218</td>
<td>Increased tissue necrosis; higher risk of infection</td>
<td>Benbow and Stephens, 201219</td>
</tr>
<tr>
<td>Butcher, 200015</td>
<td>Increased discomfort, infection pain and reduced QoL</td>
<td>Dri et al., 2014</td>
</tr>
<tr>
<td>Bolten et al., 200020</td>
<td>Long term physiological changes in skin with associated tissue degradation</td>
<td>Mulpuru et al., 201517</td>
</tr>
<tr>
<td>Meuleneire, 201421</td>
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</table>

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.3,30

This counter-intuitive approach to healing – hyper-hydration – may initially appear to be very counter-intuitive to enhanced transcutaneous delivery of biomacromolecules. Journal of pharmaceutical sciences 2010;99(2):730-40.

3. Butcher, 2000;28
7. Kruse et al., 2015
12. Morgan, 2000;26
13. Morgan, 2000;26
14. Delays healing, Cutting & White, 2002 |
15. Meuleneire, 201421 |
20. Morgan, 2000;26
22. Butcher, 2000;28
24. Kruse et al., 2015
28. Morgan, 2000;26
29. Morgan, 2000;26
### 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. These wounds can be difficult to heal, and may result in amputation of the affected limb.

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 further surgery would be required.

### 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.

### 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 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.

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>17/03/2015</td>
<td>(Prior to HydroClean® plus)</td>
</tr>
<tr>
<td>20/03/2015</td>
<td>(1st dressing change)</td>
</tr>
<tr>
<td>27/03/2015</td>
<td>(Evidence of epithelial tissue at wound margins)</td>
</tr>
<tr>
<td>19/06/2015</td>
<td>HydroTac® Comfort</td>
</tr>
<tr>
<td>10/07/2015</td>
<td>HydroTac® Comfort</td>
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</table>

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.

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Hydration; Its Role In Wound Healing

**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.

**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. 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.

**Wound healing and hydration**

Optimal wound healing is very dependent upon the appropriate level of tissue hydration and it has been suggested to be the single most important external factor. Skin wound 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.

**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 contradictory. 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 proteolytic enzymes and other tissue-damaging components that are able to damage tissues. 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

**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).

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**Table 1**

<table>
<thead>
<tr>
<th>Enhanced autolytic debridement</th>
<th>Lower infection rates</th>
<th>Reduced scarring</th>
<th>Retention of growth factors to wound site</th>
<th>Promote epithelialisation rate</th>
<th>Faster wound healing</th>
</tr>
</thead>
</table>

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**References**

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

Lindsey Bulloch - Clinical Nurse Specialist – Tissue Viability, Wrexham, Wigan and Leigh Foundation Trust
Sue Johnson - Clinical Lead Wound Care, Dudley and Bassetlaw Hospitals, NHS Foundation Trust
Deb 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 (≥18 years) 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 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 £232.22 overall.

The comparative times to achieve total wound debridement (100% granulation tissue), has been cited as 20 days for hydrogen peroxide and enzymes, and 12 days for the sodium hypochlorite. 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.
A Multi-Centre 15 Patient Evaluation of HydroTac® Comfort Dressing

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Sue Johnson - Clinical Lead Wound Care, Doncaster and Bassetlaw Hospitals. NHS Foundation Trust
Lindsey Bullough - Clinical Nurse Specialist – Tissue Viability. Wrightington, Wigan and Leigh 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 (≥18 years) 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 there 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 strike-through 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 malodorous 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 dressings1 and clinician time2,3.

<table>
<thead>
<tr>
<th>Patient No.</th>
<th>Cost of Treatment Standard Practice (Dressings &amp; Clinical Time)</th>
<th>Cost of Treatment Revised Practice (HydroTac® Comfort Dressings &amp; Clinical Time)</th>
<th>Weekly Saving</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>£19.42</td>
<td>£15.55</td>
<td>£3.87</td>
</tr>
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<td>2</td>
<td>£31.08</td>
<td>£15.25</td>
<td>£15.83</td>
</tr>
<tr>
<td>3</td>
<td>£49.81</td>
<td>£35.53</td>
<td>£14.28</td>
</tr>
<tr>
<td>4</td>
<td>£49.81</td>
<td>£28.08</td>
<td>£21.73</td>
</tr>
<tr>
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<td>£28.96</td>
<td>£28.08</td>
<td>£0.88</td>
</tr>
<tr>
<td>6</td>
<td>£46.17</td>
<td>£36.12</td>
<td>£10.05</td>
</tr>
<tr>
<td>7</td>
<td>No previous treatment</td>
<td>£27.13</td>
<td>£27.13**</td>
</tr>
<tr>
<td>8</td>
<td>£45.32</td>
<td>£29.48</td>
<td>£15.84</td>
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<td>9</td>
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<td>10</td>
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<td>£8.85</td>
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<tr>
<td>11</td>
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<td>£35.53</td>
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<tr>
<td>12</td>
<td>£39.13</td>
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</tr>
<tr>
<td>Total</td>
<td>£552.49</td>
<td>£354.43</td>
<td>£198.02</td>
</tr>
</tbody>
</table>

** 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).

References:
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 metatarsal/ phalanx 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 footwear which was a requirement of his job. He also stopped socialising because he thought the wound was malodorous.

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 (polyhexamethylene 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.

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

Melanie Colegrave - Independent Medical Writer, UK
Mark Rippon - School of Human and Health Sciences, Institute of Skin Integrity and Infection Prevention. University of Huddersfield
CIP 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.

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

Dilate 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

 Causes of pain

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

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

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

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

Causes of pain


Introduction

Hydro-responsive wound dressings are commonly employed to regulate the fluid balance of wounds after debridement and wound bed preparation. Foambased 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

Methods

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

Results

270 patients with mostly chronic leg ulcers (Table 1) participated in the openlabel, 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.
Hydrated polyurethane polymers to increase growth factor bioavailability in wound healing

Hans Smola - University of Cologne, Cologne, Germany, PAUL HARTMANN AG, Heidenheim, Germany
G. Marx, M. Junginger, M. Kettel - PAUL HARTMANN AG, Heidenheim, Germany
S. Smola - Dept. of Virology, Saarland University, Homburg, Germany

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), propyleneglycol and isocyanate. These polymers can swell and absorb fluids. We tested the absorption capacity with tissue culture polyetherpolyol (Jeffamine), propyleneglycol and isocyanate. These polymers can have been explored albeit with limited success. An alternative strategy aims to combine solutions of polyetherpolyol (Jeffamine), propyleneglycol and isocyanate. These polymers can increase the concentration and bioactivity of growth factors contained in the wound exudate.

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

Platelet releasate growth factor activity is increased

Concentration of HGF (ELISA)

HGF bioactivity in scratch assays with HaCaT keratinocytes
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. 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. 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. 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.

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

6. Rippon MG, Ousey K, Cutting KF. Wound healing and hyper-hydration – a counter intuitive model.
A Case Study Series Evaluation of HydroTac®

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 to 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.

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

<table>
<thead>
<tr>
<th>Wound Information</th>
<th>Start</th>
<th>End</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area cm²</td>
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<td>0</td>
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<td>Depth cm</td>
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<tr>
<td>Wound bed status</td>
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<tr>
<td>Pain (scale)</td>
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</tr>
<tr>
<td>Malodour</td>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td>Periwound Skin</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>Other products used</td>
<td>Tubisorb</td>
<td></td>
</tr>
</tbody>
</table>

Outcome: Healed

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

<table>
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<th>Wound Information</th>
<th>Start</th>
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</tr>
</thead>
<tbody>
<tr>
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<td>Depth cm</td>
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<tr>
<td>Wound bed status</td>
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</tr>
<tr>
<td>Pain (scale)</td>
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<td>0</td>
</tr>
<tr>
<td>Malodour</td>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td>Periwound Skin</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>Other products used</td>
<td>Tape</td>
<td></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Wound Information</th>
<th>Start</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Area cm²</td>
<td>6</td>
<td>2</td>
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<td>Depth cm</td>
<td>0.25</td>
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<tr>
<td>Wound bed status</td>
<td>Exudate</td>
<td>Moderate</td>
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<td>Pain (scale)</td>
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</tr>
<tr>
<td>Malodour</td>
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<td>No</td>
</tr>
<tr>
<td>Periwound Skin</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>Other products used</td>
<td>Tape</td>
<td>Tape</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Wound Information</th>
<th>Start</th>
<th>End</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area cm²</td>
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<td>Depth cm</td>
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<td>Wound bed status</td>
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<td>Moderate</td>
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<td>Pain (scale)</td>
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<td>1</td>
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<tr>
<td>Malodour</td>
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<td>No</td>
</tr>
<tr>
<td>Periwound Skin</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>Other products used</td>
<td>Viscoplast bandage</td>
<td></td>
</tr>
</tbody>
</table>

Outcome: Lost to follow up

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.

<table>
<thead>
<tr>
<th>Wound Information</th>
<th>Start</th>
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</tr>
</thead>
<tbody>
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<tr>
<td>Depth cm</td>
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<tr>
<td>Wound bed status</td>
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<tr>
<td>Pain (scale)</td>
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<td>0</td>
</tr>
<tr>
<td>Malodour</td>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td>Periwound Skin</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>Other products used</td>
<td>Hypertape</td>
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</tbody>
</table>

Outcome: Continue HydroTac®

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

<table>
<thead>
<tr>
<th>Wound Information</th>
<th>Start</th>
<th>End</th>
</tr>
</thead>
<tbody>
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<tr>
<td>Depth cm</td>
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<tr>
<td>Wound bed status</td>
<td>Exudate</td>
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</tr>
<tr>
<td>Pain (scale)</td>
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<td>0</td>
</tr>
<tr>
<td>Malodour</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Periwound Skin</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>Other products used</td>
<td>Viscoplast bandage</td>
<td></td>
</tr>
</tbody>
</table>

Outcome: Lost to follow up
SECTION 2
Posters submitted to Wounds UK 2016
Proposed mechanism/evidence support for rinsing/cleansing/absorbing action of HydroTherapy®

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
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 significantly1-2. 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 wounds3. 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. 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 wounds3. Here we propose a mechanism for the action of this wound dressing (Figure 1) from the evidence available.

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 healing4. 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 healing4.

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.

Table 1: Key areas of HRWD action

<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluid uptake</td>
<td>The ionogenic nature of SAP leads to absorption of significant volume of fluid (exudate) (Figure 2). Active fluid uptake removes damaging exudate components (e.g., proteases) from wound environment, as well as aqueous fluid.</td>
</tr>
<tr>
<td>Protein binding/retention</td>
<td>The high density of carboxylate groups in SAP provides opportunities for protein absorption and retention to SAP particles via electrostatic interactions (Figure 5).</td>
</tr>
<tr>
<td>Bacterial retention</td>
<td>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 biofilm of the wound bed (Figure 3 &amp; 4).</td>
</tr>
<tr>
<td>Autolysis promotion</td>
<td>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).</td>
</tr>
</tbody>
</table>

Wound healing and hyper-hydration
– a counter intuitive model

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
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

Hyper-hydrated vs. dry wounds
Wounds in a hyper-hydrated environment show the following benefits compared with dry wounds1:
- 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 Maceration2

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

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

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

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.

References
Hydration, Its Role In Wound Healing

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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\(^1\). 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)\(^4\).

<table>
<thead>
<tr>
<th>Clinical requirement</th>
<th>Clinical action</th>
</tr>
</thead>
<tbody>
<tr>
<td>T Tissue management</td>
<td>WBP removes non-violable tissue and foreign material</td>
</tr>
<tr>
<td>I Control of infection and inflammation</td>
<td>Removal of infection and minimise inflammation</td>
</tr>
<tr>
<td>M Moisture balance</td>
<td>Establish moist wound environment and optimise hydration</td>
</tr>
<tr>
<td>E Advancement of wound edge epithelium</td>
<td>Provides optimal environment for wound closure</td>
</tr>
</tbody>
</table>

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

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\(^3\) and practical assessment tools such as the T.I.M.E. management framework offer a formalised series of guidelines to aid wound progression\(^4\). 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.

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\(^5\), a sequential wound treatment programme that delivers simple and effective wound care through the use of two innovative and complimentary wound dressings (HydroClean\(^6\) plus and HydroTac\(^7\)).

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\(^6\) plus was applied and secured with a film dressing. Once the wound was cleaned and healthy granulation tissue covered the wound bed, HydroTac\(^7\) 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\(^7\).

**Figure A:** Pressure ulcer prior to treatment with HydroClean\(^6\) plus. The wound showed 100% coverage with necrotic tissue.

**Figure B:** Treatment Day 4. The second dressing change after the commencement of HydroClean\(^6\) plus treatment. The wound was largely cleared of devitalised tissue.

**Figure C:** Treatment Week 8. After the 16th dressing change with HydroClean\(^6\) plus and HydroTac\(^7\) treatment, pressure ulcer was almost completely closed.

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 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, 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.

HydroClean plus

A: The rinsing action of the continuous release of fluid (blue arrow) from the polyacrylate core results in the softening of necrotic tissue and fibrin coatings (black) and uptake of bacteria- and protein-laden (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 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 and growth factor concentrations (blue spheres) promotes new granulation tissue formation and epithelialisation.

Figure 1

**Figure 1**

Wound exudate
Ringer’s solution
Dressing core

Figure 2

A: The Therapy of Hydration: Case Study

B: Treatment Day 4.

C: Treatment Week 8.

After the 16th dressing change with HydroClean plus and HydroTac treatment, pressure ulcer was almost completely closed.
Clinical impact of HydroClean® plus

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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 hyperhydrated 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).

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.

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 hyperhydration 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).

Conclusion: HydroTherapy provides new options to aid limb salvage.
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. The pathogenesis of such ulcers are varied and include for example peripheral vascular disease, neuropathy, and infection which may confound treatment. 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. The basic tenant of tissue management is to remove the necrotic tissue burden using various methods of debridement (e.g. surgical, mechanical, autolytic etc.). Restoration of bacterial balance (including reduction of bacterial biofilms) is another component in the treatment of DFU. The pathogenesis of such ulcers are varied and include for example peripheral vascular disease, neuropathy, and infection which may confound treatment.

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
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 had 50% granulation and slough. HydroClean® plus had very quickly actively debrided the wound.

Case Study 2
A male aged 54 years with type 1 diabetes, retinopathy, neuropathy and hypertension. A toe amputation site had become sloughy. The patient had received antibiotics and had previously been treated with Askina® Calgitro® 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
A male 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
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
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.

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

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.
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

1 cm 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)

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.

Discussion

Clinically, a major reason for peri-wound skin breakdown is as a result of excessive protease activity present in wound 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.
**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

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**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.
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. These tools provide a systematic approach for the assessment and management of the majority of acute and chronic wounds. Dextralised 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). We briefly summarise the principles of T.I.M.E. and describe an effective and simple two-dressing wound management system that delivers the benefits set out in the T.I.M.E. 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 proteases (stimulators of tissue inflammation) in wound exudates. HRWDs also show excellent fluid management capabilities leading to reduced peri-wound tissue damage and enhanced epithelialisation (Table 2). 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. 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.

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

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</tr>
<tr>
<td>E</td>
<td>Provides optimal environment for wound closure</td>
</tr>
</tbody>
</table>

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).

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.

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

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

Figure 1: Case examples of ulcers treated with HRWDs

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


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.
HydroTherapy® wound healing of a category 2 pressure ulcer to the heel
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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 fibrous 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

HydroTac® evaluation of a surgically debrided wound
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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
HydroTherapy® wound healing of a category 2 pressure ulcer to the heel

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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 fibrous 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).
HydroTherapy® wound healing of a category 4 pressure ulcer to the heel

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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 larval 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.
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.
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.