3M™ Tegaderm™ Matrix

Matrix Dressing

Clinical Summaries

Delayed wound healing: A major clinical problem

Chronic wounds have been defined as those that "fail to progress through a normal, orderly, and timely sequence of repair. Or, wounds that pass through the repair process without restoring anatomic and functional results".[1]

This definition assumes that current best practice, including a "Standard Therapy" are implemented. This has been agreed for venous leg ulcers[2] (VLU) and diabetic foot ulcers.[3] (DLU) Clearly, such wounds will present the practitioner with management problems, increase treatment costs, and, reduce patient Quality of Life if the factors contributing to 'chronicity' are not adequately addressed.

All practitioners involved in the management of such wounds should be aware of the various complicating factors and "chronicity predictors" as outlined by Boyd et al. (2004).[4] Such awareness will aid in the early prediction of wounds that are likely to be 'difficult to heal' or refractory to treatment. This proportion of patients is considerable; for example, approximately 20% of all venous leg ulcers remain unhealed at two years.[5]

My own personal research in the University of Worcester shows that, of an international group of wound care experts treating both VLU and DLU, all recognized that the majority fail to heal with what is currently regarded as "Standard Therapy".

This then requires the clinician to consider the alternatives. Recent research into chronic wounds has revealed that the bioburden and protease enzyme imbalance, in particular differential expression of matrix metalloproteinases (or MMPs) and their inhibitors (TIMPs), are strongly associated with delayed healing in these wound types.[6,7]

The latter have become therapeutic targets which should not be regarded as options after other treatments have failed but rather considered as first-line treatments in wounds at risk of delayed healing. The time has come to incorporate such treatments in everyday chronic wound care.

Richard White Ph.D., M.I.Biol., Professor of Tissue ViabilityInstitute of Health, Social Care and Psychology, University of Worcester, WR2 6AJ.

3M

Clinical focus / Outcomes studied	Wound type	Article title
• MMP-2 expression • Wound healing	Non-healing wounds	MMP-2 assessment as an indicator of wound healing: a feasibility study.
• Healing rate • Reduction in wound size	Complex non-healing wounds	An observational study of the use of a polyhydrated ionogens impregnated dressing *(DerMax®)** in the treatment of wounds.
Under compression / without compression • Healing time	Leg ulcers	Clinical experience of a new wound dressing *(DerMax®* PHI-5)* in the local treatment of chronic leg ulcers.
Standard debridement • Wound closure	Pressure ulcers	A prospective randomized study in recalcitrant pressure ulcers with polyhydrated ionogens is feasible.

* 3M™ Tegaderm™ Matrix, formerly known as DerMax® or Epimax®

Message	Author	Publication
Phase II feasibility study of four patients with non-healing wounds. Wound duration >three months, surface are >1 cm^2. Wounds treated daily with 3M™ Tegaderm™ Matrix were evaluated weekly and biopsied every two weeks until healed. At six weeks, the wounds showed clinically healthy wound beds and reduced inflammation. Histological changes were obvious in all biopsies. Immunohistochemical measurement of MMP-2 expression paralleled clinical characteristics of wound healing. Assessment of fibroblast MMP-2 expression reliably indicates wound healing with Tegaderm™ Matrix treatment.	Karim RB *et al.* 2006	Adv Skin Wound Care, Vol 19, 2006, pp324-327.
Observational study of 23 patients with a variety of complex wounds not healed after more than three months. Following treatment with Tegaderm™ Matrix, overall healing rate at six weeks was 48%. Predicted potential healing rate if used for more than six weeks = 72%. A significant reduction in average wound size was found following treatment with Tegaderm™ Matrix.	Hampton SL *et al.* 2006	EWMA, Prague, Czech Republic, May 2006, poster presentation.
Case studies 1) 81-year-old patient, ulcer *(3.5 cm x 3 cm)* present for four months. Tegaderm™ Matrix and compression therapy, wound dressed at weekly intervals when compression was changed. Healing of previously-unhealed ulcer occurred after 14 weeks of Tegaderm™ Matrix therapy. 2) 69-year-old patient, ulcer present for over two years. Tegaderm™ Matrix and secondary dressing *(patient did not tolerate compression)*, wound dressed at three-day intervals. Healing of previously-unhealed ulcer occurred after 16 weeks of Tegaderm™ Matrix therapy.	Briggs S. 2005	Wounds UK, Harrogate, November 2005, poster presentation.
Prospective, randomized study to determine the potential efficacy of PHI in treating a variety of pressure ulcers. Patients from nursing homes with stage II *(n=1)*, III *(n=10)* and IV *(n=8)* pressure ulcers were treated until full wound closure or for six weeks, if no change was observed. Tegaderm™ Matrix treatment resulted in full closure for 100% of stage II and stage III pressure ulcers with an average healing time of less than six weeks. Healing was reached in only 12.5% of stage IV ulcers *(20% if dropouts are excluded)*. No adverse events or side effects were observed. Visual observations revealed that wounds became covered in a thin layer of transparent wound fluid. These exudates diminished as the wound healed during the course of treatment.	Van Leen MWF *et al.* 2004	WUWHS, Paris, July 2004, poster presentation.

Clinical focus / Outcomes studied	Wound type	Article title
Wound debridement • Wound closure • Patient satisfaction	Recalcitrant diabetic foot ulcers	Efficacy of polyhydrated ionogens in achieving stable wound closure in recalcitrant diabetic foot ulcers: a multicentre pilot study.
• Wound size reduction • Pain reduction • Granulation and re-epithelialisation • Overall assessment	Chronic leg ulcers	Successful treatment of therapy-refractory non-responding chronic wounds with DerMax®*.
• Action of metal ions • Action of citric acid	Non-healing wounds	A novel formulation of metal ions and citric acid reduces reactive oxygen species *in vitro.*
In vitro* study – Polyhydrated ionogens *(PHI) • Toxicity • Changes in gene expression	Cell culture, dermal fibroblasts	Effect of polyhydrated ionogens *(PHI)* on viability and matrix metalloproteinases levels in cultures of normal and diabetic human dermal fibroblasts.

* 3M™ Tegaderm™ Matrix, formerly known as DerMax® or Epimax®

Message	Author	Publication
Multicentre, pilot study of 20 patients with diabetic foot ulcers >2 cm^2 with a duration of at least three months. Wounds *(Wagner grade or stage I or II)* were debrided and assessed weekly. Serum samples and random punch biopsies were taken on three occasions. Treatment with 3M™ Tegaderm™ Matrix resulted in high patient satisfaction and full closure in 75% of diabetic foot ulcers with an average healing time of 15 weeks. No adverse events or side effects were observed. Dressing changes were standardized. The ulcers were treated daily.	Pirayesh A *et al.* 2004	WUWHS, Paris, July 2004, oral presentation.
A total of five patients with venous leg ulcers were recruited. Tegaderm™ Matrix treatment reduced wound size by 80% within the documented 10-week observation period and pain was reduced from 1.4 to 0.4 *(on a pain scale of 0-5)*. Promotion of both granulation and epithelialization were observed. Final assessment of Tegaderm™ Matrix treatment was rated as 'very good' or 'good'. No side effects were observed.	Körber A *et al.* 2005	European Wound Conference, Stuttgart, September 2005, poster presentation. J Wound Healing, Number 6, 2006, Zeitschrift fur Wundheiling.
In vitro study to investigate the activity of metal ions and citric acid in the reduction of reactive oxygen species. Metal ions inhibited PMNs *(polymorphonuclear neutrophils)* production of reactive oxygen species. Metal ions inhibited the activation of complement via the classical pathway. Citric acid was found to be a scavenger of superoxide anions.	Van den Berg AJJ *et al.* 2003	J Wound Care, Vol 12, Number 10, 2003.
Study examines the cytoxicity of PHI and its effect on gene expression for MMP-2 and TIMPs. No toxicity was shown in dermal fibroblasts from a diabetic foot ulcer with PHI at concentrations of 0.02% to 1.25%. At higher concentrations *(2.5%, 5% and 10%)*, cell numbers were reduced. No toxicity was shown in dermal fibroblasts from a normal volunteer at concentrations of 0.5% or lower. PHI has no toxicity at <0.5% in cultures of fibroblasts from normal or diabetic patients. PHI induced similar changes of gene expression in normal and diabetic fibroblasts. PHI decreased MMP-2, mRNA and increased TIMP mRNA levels, in line with results found in clinical studies. Gene expression patterns are different in fibroblast cultures taken from normal and diabetic patients.	Schultz GS *et al.* 2005	WHS, Chicago, May 2005, poster presentation.

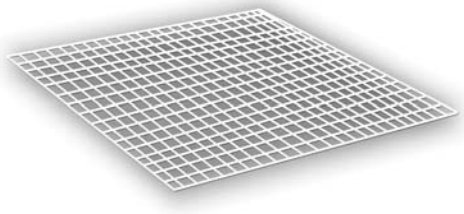
Clinical focus / Outcomes studied	Wound type	Article title
***In vivo* study** • MMP changes • Inflammation • Wound healing	Skin grafting	Wound bed preparation, skin transplantation and matrix metalloproteinases.
Skin transplantation – Polyhydrated ionogens *(PHI)* • MMP expression • ROS production	Experimental wounds	Polyhydrated ionogens regulate matrix metalloproteinases expression and reactive oxygen *(ROS)* species production in recalcitrant wounds.

Message	Author	Publication
Down-regulation of MMP-2 *(gelatinase A)* diminishes breakdown of type IV collagen. MMP-9 appears to be associated with an active epithelialization process. A reduced inflammatory state is observed with reduced production of oxygen radicals by granulocytes with scavenging of oxygen radicals. Transformation of a non-healing wound into a healthy one takes place within two weeks of commencement of treatment with 3M™ Tegaderm™ Matrix.	Hoekstra MJ & Richters N. 2002	11th International Conference on Tissue Banking, EATB Annual Meeting, October 2002, oral presentation.
Dressings were applied daily. Levels of MMP and ROS estimated *in vitro* through histological staining. Within two weeks, MMP-2 expression was down-regulated and re-epithelialization was initiated. Impaired healing in recalcitrant wounds is related to MMP/TIMP imbalance and protracted inflammation. Protracted inflammation is associated with presence of reactive oxygen species *(ROS)*. PHI regulates protease imbalance, down-regulates ROS production and stimulates re-epithelialization.	Hoekstra MJ *et al.* 2003	Abstract from the European Tissue Repair Society Meeting, Amsterdam, September 2003, oral presentation.

3M™ Tegaderm™ Matrix

Matrix Dressing

Supports faster healing in chronic wounds[8]



- Normalizes the wound micro-environment[9-11]
- Regulates MMPs *(matrix metalloproteinases)*[12]
- Facilitates re-epithelialization[9]

Ordering information

Catalogue No.	Size	Dressings/Box	Boxes/Case
90900	2 in x 2 ⅜ in 5 cm x 6 cm	10	24
90901	3⅛ in x 4 in 8 cm x 10 cm	5	24

References:

1. Lazarus GS, Cooper DM, Knighton DR *et al.* (1994). Definitions and guidelines for assessment for wounds and evaluation of healing. Arch Dermatol 130; 489-93.
2. Rudolph D. (2001). Standards of care for venous leg ulcers: compression therapy and moist wound healing. J Vasc Nurs. 19(1); 20-27.
3. Margolis DJ, Kantor J, Berlin JA. (1999). Healing of diabetic neuropathic foot ulcers receiving standard treatment. A meta-analysis. Diabetic Care 22(5); 692-95.
4. Boyd G, Butcher M, Glover D, Kingsley AR. (2004). Prevention of non-healing wounds through the prediction of chronicity. J Wound Care 13(7); 265-66.
5. Rippon M, Davies P, White RJ, Bosanquet N. (2007). The economic impact of hard to heal leg ulcers. Wounds UK Journal June Vol 3; Issue 2: 58-69.
6. Lobmann R, Zemlin C, Motzkau M *et al.* (2006). Expression of matrix metalloproteases and growth factors in diabetic foot wounds. J Diabet Complic 20(5); 329-35.
7. Mwaura B, Mahendran B, Hynes N *et al.* (2006).The impact of differential expression of extracellular matrix metalloproteases on the chronicity of venous leg ulcers. Eur J Vasc Endovasc Surg 31(3); 306-10.
8. Hampton S, Young S, Kerr A, King L. (2006). An observational study of the use of a polyhydrated ionogen impregnated dressing (DerMax) in the treatment of wounds. Poster presentation, EWMA, Prague, Czech Republic. May 2006.
9. Hoekstra M, Pirayesh A. (2003). Poly Hydrated Ionogens regulate Matrix Metalloproteinases Expression and Reactive Oxygen Species in Recalcitrant Wounds European Tissue Repair Society Congress, September 2003.
10. Körber A, Freise J, Rietkötter J, Grabbe S, Dissemond J. (2006). Erfolgreiche Behandlung therapierefraktärer chronischer Wunden mit DerMax (Successful treatment of therapy-refractory chronic wounds with Tegaderm Matrix). Zeitschrift fur Wundheiling 6; 310-314.
11. van den Berg AJJ, Halkes SBA, Quarles van Ufford HC, Hoekstra MJ, Beukelman CJ. (2003). A novel formulation of metal ions and citric acid reduces reactive oxygen species in vitro. J Wound Care 12(10).
12. S Monroe, & G Schultz. (2005). Effect of Polyhydrated Ionogen (PHI) on Viability and Matrix Metalloproteinase Levels in Cultures of Normal and Diabetic Human Dermal Fibroblasts. Poster presentation, WHS, Chicago, May 2005.

PHI: Polyhydrated ionogens

3M Canada
P.O. Box 5757
London, ON N6A 4T1
Canada

1 800 364-3577

www.3M.com/ca/healthcare

3M Medica
D-41453 Neuss
Germany