Implementation of

Total Contact Casting

as Standard of Care for Diabetic Foot Ulcers

A summary of a satellite symposium held at the 17th annual conference of the Canadian Association of Wound Care – November 3, 2011

Diabetic foot ulcers are a common complication of diabetes, and present a complex management issue. Noted Dr. Garceau, "An oversimplified approach to management will surely lead to failure. To be worthwhile, any new therapy must be implemented using a systematic, rigorous and cost-effective approach."

First, a well-trained healthcare team dedicated to the treatment of diabetic foot ulcers is required for optimal management. Second, the principles of pressure relief must be applied. Indeed, a recent meta-analysis noted that, for the management of diabetic foot ulcers, total contact casts are most effective in ulcer healing, while standard therapeutic footwear is less effective.[1]

Pressure offloading options

In patients with diabetic foot ulcers, removable device options for pressure relief include wider footwear, an Arco boot or an air cast. However, these types of removable devices are often ineffective; the literature notes that they are unsuccessful in relieving pressure and resolving wounds in approximately 50% of patients.[1] This is in large part due to the fact that many patients do not adhere to the foot care regimen prescribed. In a study of activity patterns in patients with diabetic foot ulcers, Armstrong and colleagues noted that "subjects with diabetic foot ulcerations appear to wear their offloading devices for only a minority of steps taken each day." The authors concluded that control of this important aspect of care with less easily removable devices may increase the prevalence of healing.[2]

Indeed, a recent study demonstrated that modification of a standard removable cast walker to increase patient adherence to pressure offloading may increase both the proportion of ulcers that heal and the rate of healing of diabetic neuropathic wounds.[3] Thus, noted Dr. Garceau, "if you have patients with removable devices that are not working, you may consider an irremovable device, but be cautioned that they are still not as effective."

When footwear and removable devices are ineffective, noted Dr. Garceau, a viable option for pressure relief is total contact casting.

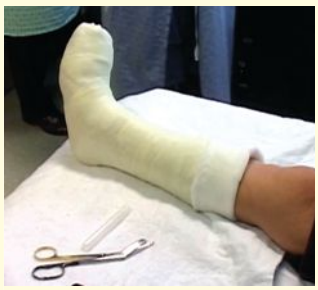

Figure 1. Application of the BSN Medical total contact cast

Caravaggi and colleagues conducted a study of 50 patients with diabetic foot ulcers who were assigned to non-removable fiberglass off-bearing casts or a cloth shoe with a rigid sole.[4] At 30 days, the number of ulcers completely healed was 13 (50%) in the cast group and 5 (20.8%) in the shoe group (p=0.03). The authors concluded that the use of off-bearing casts offers a viable treatment option for diabetic foot ulcers.[4]

Practice Points

- Total contact casting offers a viable option for the treatment of diabetic foot ulcers.
- It is a cost-effective and practical therapy in the wound care clinic setting.

Unfortunately, said Dr. Garceau, total contact casting is rarely used in patients who may benefit from it. "While it is recognized as the gold standard for offloading, it may be considered time-consuming, costly and complex to apply."

However, BSN Medical recently introduced a complete total contact casting kit that can be applied with ease in fewer than 20 minutes by either a trained nurse or assistant (Figure 1). The kit costs $110 and includes all items required to do the casting: cast tape, padding, stockinette, plaster of Paris, adhesive felt and adhesive foam.

While the BSN Medical cast is replaced weekly to allow for proper wound care – vs. traditional total contact casts, which stay in place for weeks – Dr. Garceau indicated that the BSN Medical kit offers an optimal solution for patients who do not adhere to other traditional therapies. With respect to cost-effectiveness, although more cast changes are required, ulcers heal more quickly with the total contact casting kit, resulting in increased financial savings.

Debridement

Dr. Garceau stressed that debridement is crucial to the optimal care of diabetic foot ulcers: "Clinicians must debride and probe every single wound ... otherwise they might neglect a crucial ulcer component." A landmark study by Piaggesi and colleagues compared usual care with aggressive debridement in patients with diabetes and neuropathic foot ulcers.[5] Surgical treatment of neuropathic foot ulcers in diabetic patients – including surgical excision, eventual debridement or removal of bone segments underlying the lesion and surgical closure – proved to be an effective approach, compared with conventional treatment, with respect to healing time, complications and relapses, and can be safely done in an outpatient setting.[5]

References

1. Cavanagh PR, Bus SA. Off-loading the diabetic foot for ulcer prevention and healing. *J Am Podiatr Med Assoc.* 2010;100:360-368.
2. Armstrong DG, Lavery LA, Kimbriel HR, et al. Activity patterns of patients with diabetic foot ulceration: patients with active ulceration may not adhere to a standard pressure off-loading regimen. *Diabetes Care.* 2003;26:2595-2597.
3. Armstrong DG, Lavery LA, Wu S, et al. Evaluation of removable and irremovable cast walkers in the healing of diabetic foot wounds: a randomized controlled trial. *Diabetes Care.* 2005;28:551-554.
4. Caravaggi C, Faglia E, De Giglio R, et al. Effectiveness and safety of a nonremovable fiberglass off-bearing cast versus a therapeutic shoe in the treatment of neuropathic foot ulcers: a randomized study. *Diabetes Care.* 2000;23:1746-1751.
5. Piaggesi A, Schipani E, Campi F, et al. Conservative surgical approach versus non-surgical management for diabetic neuropathic foot ulcers: a randomized trial. *Diabet Med.* 1998;15:412-417.

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BSN medical

Benefits of the

Antimicrobial Dressing PHMB

A summary of a power breakfast held at the 17th annual conference of the Canadian Association of Wound Care – November 5, 2011

Practice Points

- PHMB antimicrobial dressings are an effective option for various wound types.
- They are cost-effective, easy to use and confer many patient benefits.

What is PHMB?

Polyhexamethylene biguanide (PHMB) is a high-performance biocide with a broad spectrum of activity against a wide range of organisms, particularly gram negative pathogens. It is non-volatile and stable at elevated temperatures, and has broad pH compatibility (i.e. it is effective over a pH range 1.0–9.0). It has no odor and is bio-eliminated by absorption when discharged to effluent.

PHMB should be considered whenever there is a need for the safe and effective treatment of infected or critically colonized wounds, and when chronic wounds have stopped healing or are enlarging. PHMB dressings can be used in slightly or moderately exuding wounds, both in deep and superficial wounds. If combined with an advanced wound healing dressing, PHMB can also manage exudate to optimize the wound healing environment. In some cases, the PHMB molecule has been chemically bound to the base material, providing it with antiseptic/antimicrobial properties when in contact with wound moisture. Therefore, the product protects against the development of wound infection by decreasing the bacterial load in the dressing and bacterial penetration through the dressing. Wound types that can be considered for treatment with PHMB are outlined in Table 1.

In vitro and in vivo studies regarding the effectiveness of PHMB in wound care have demonstrated that it may also have other benefits in wound management. Daeschlein and colleagues reported that the product may reduce pain and malodor, while Mueller and Krebsbach found that its use reduced fibrin slough and prevented the build-up of necrotic tissue and so promoted connective tissue regeneration.[1,2]

Specifically, PHMB should be used to reduce bacterial burden in critically colonized wounds and may be indicated for prophylaxis in immunocompromised individuals. Therapy with PHMB should also be considered as an adjunct to systemic treatment when treating serious wound sepsis.

Table 1

Wound types that can be considered for treatment with PHMB

- Second-degree burns
- Postsurgical wounds
- Traumatic wounds
- Donor/recipient sites
- Leg ulcers
- Pressure ulcers
- Epidermolysis bullosa wounds
- Scleroderma wounds

Benefits of PHMB

PHMB is an effective sanitizer in recreational water, such as swimming pools and hot tubs, and is sold through retail stores to pool and spa owners for this use. It is not affected by sunlight, water temperature or pH fluctuations.

A number of foam, gauze and non-adherent dressings impregnated with 0.2% and 0.5% PHMB are available from Covidien. They remain efficacious on wounds for up to 3 days (gauze products containing 0.2% PHMB) and 7 days (foam products containing 0.5% PHMB), but should always be changed when the dressing has reached its absorbency capacity.

PHMB binds to bacteria's outer membrane. It disrupts this membrane, causing cytoplasm to leak out and the cell's protective layer to disintegrate; cell death then occurs, leaving no bacteria to mutate or replicate. There is no known resistance to PHMB at this time. Further PHMB antimicrobial dressing benefits include:

- Broad-spectrum effectiveness, providing protection against gram negative, gram positive and yeast/fungi microorganisms, including methicillin-resistant staphylococcus aureus, vancomycin-resistant enterococci, pseudomonas and acinetobacter baumannii.
- Resists bacterial colonization within the dressing.
- Reduces bacterial penetration through the dressing.
- Limits cross-contamination to and from patients, clinicians and the environment.
- Lower cost than most antimicrobial treatments and silver dressings.

A current protocol is in place at the Montreal Neurological Hospital for patients with an external ventricular drain. Patients who have an external ventricular drain have an AMD Excilon dressing applied at the drain site. The dressing is treated as a central line, and is changed every 72 hours. Since the start of this protocol, ventricular drain infections or ventriculitis events post drain insertion have been reduced significantly.

A current protocol is in place at the Royal Victoria Hospital in Montreal for patients with a Ventricular Assist Device (mechanical heart). Prior to 2009, a high post-op infection rate was observed. Since 2009, an Excilon dressing is placed around the drive line entry site. While in hospital, the dressing is changed daily; upon discharge home, patients or their caregivers continue daily dressing changes. It has been noted that some patients develop a pocket infection around 8 months post-op; this phenomenon is not as yet explained.

References

1. Daeschlein G, Assadian O, Bruck JC, et al. Feasibility and clinical applicability of polihexanide for treatment of second-degree burn wounds. *Skin Pharmacol Physiol.* 2007;20:292-296.
2. Mueller SW, Krebsbach LE. Impact of an antimicrobial-impregnated gauze dressing on surgical site infections including methicillin-resistant *Staphylococcus aureus* infections. *Am J Infect Control.* 2008;36:651-655.

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Efficacy and Cost Effectiveness of

Collagenase vs. Hydrogel for Chronic Wound Debridement

A summary of a satellite symposium held at the 17th annual conference of the Canadian Association of Wound Care – November 3, 2011

The goal of wound debridement is to remove necrotic tissue. Various methods can be used: surgical excision; sharp debridement; autolytic; mechanical; biologic; enzymatic; and synergistic use of one or more of the above. The method chosen depends on the skill of the clinician, assessment of the wound, time required to achieve debridement, patient comorbidities and available resources (i.e. supplies, staff).

Collagenase is a metalloproteinase made from the bacteria *Clostridium histolyticum*. It cleaves type 1 collagen bonds that anchor eschar in the base of a pressure ulcer.[1,2]

In a systematic review of the literature regarding collagenase, Ramundo and colleagues demonstrated that collagenase is superior to placebo ointment, silver sulfadiazine and wet-to-dry dressings.[3] Mosher and colleagues showed the superiority of collagenase to hydrogel in a computer-based predictive model, with subsequent Delphi consensus.[4]

Hydrogels are hydrophilic polymers with moisture content to facilitate the body's own natural enzymes to selectively degrade denatured protein.[1] They are passive, slow and are also associated with anaerobic bacteria.[5,6]

Head-to-head study: Hydrogel vs. collagenase

Milne and colleagues[7] compared hydrogel and collagenase in initial debridement and promotion of microdebridement in patients with pressure ulcers in a long-term care setting; 27 patients were enrolled (13 patients: collagenase; 14 patients: hydrogel) (Figure 1). There were no statistical differences (p <0.03) between the 2 groups regarding age, gender, age of wound, or percentage of non-viable tissue at time of enrollment. Randomization occurred after consent was given. Patients' wounds were evaluated weekly by 1 investigator; wounds were also evaluated by planimetry by 2 different investigators, who were blinded to treatment regimens. Dressings were applied daily after 4–15 psi non-saline irrigation of the wound. No sharp debridement was allowed during the study. To measure wound healing, both the PUSH Tool Score and the Wound Bed Score were used.[8,9]

A chi-square analysis showed that collagenase (p <0.003) achieved statistical significance in complete debridement by day 42, compared with hydrogel. Complete debridement was achieved in 11/13 (85%) collagenase subjects, vs. 4/14 (29%) hydrogel subjects. Milne noted that this study adds to the evidence base that collagenase enzymatic debridement has greater efficacy in the debridement of non-viable tissue in pressure ulcers, compared with hydrogel: "We now have evidence that collagenase is better for pressure ulcers than hydrogel," she said. "In future, if we apply the drug in concert with sharp debridement, our results should be even better."

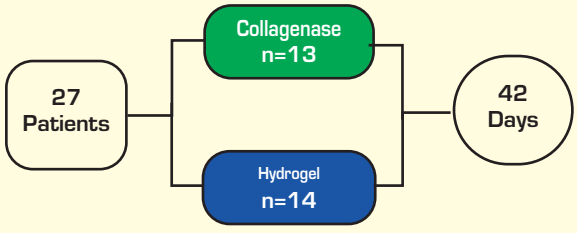

Figure 1. Study design: Collagenase vs. hydrogel

Practice Points

- Collagenase resulted in a larger proportion of patients achieving a debrided, viable wound bed at 42 days, compared with hydrogel.
- Although collagenase acquisition costs were 18% higher compared with hydrogel, collagenase's rapid debridement rate offset the cost difference over the 42-day episode of care.
- Moreover, the cost per unit of clinical benefit for collagenase was one-third that of hydrogel ($37 vs. $111 per granulation day).

Cost-effectiveness analysis

Curtis Waycaster described a cost-effectiveness analysis that was conducted using data from the study described above.[7] The objective was to determine the cost-effectiveness of collagenase enzymatic debridement relative to autolytic debridement with a hydrogel for the treatment of pressure ulcers in a long-term care setting.

The health economic design was a 2-state Markov decision process model, which evaluated the cohort transitions from a necrotic non-viable wound bed to viable granulated bed using data from the study.[7] This model estimated the expected cost per patient and number of granulated wound bed days across 42 days of pressure ulcer care.

Although collagenase treatment costs were approximately18% higher than hydrogel, collagenase demonstrated a significant clinical benefit vs. autolytic debridement with a hydrogel. Indeed, more patients in the collagenase group achieved a debrided, viable wound bed compared to the hydrogel group. Furthermore, the increased cost of collagenase was offset by its greater effectiveness (the estimated cost per granulation day [debrided, viable wound bed day] was 3 times higher for hydrogel than for collagenase [$111 vs. $37, respectively]).

References

1. Shi L, et al. *J Wound Ostomy Continence Nurs.* 2009; 36(Suppl 1):S12-S16.
2. Ayello EA, et al. *Adv Skin Wound Care.* 2004;17:66-75.
3. Ramundo J, et al. *J Wound Ostomy Continence Nurs.* 2009;36(Suppl 1):S4-S11.
4. Mosher BA, et al. *Adv Skin Wound Care.* 1999;12:81-88.
5. Dolynchuk KN. Debridement. In: Krasner DL, et al (eds). *Chronic Wound Care: A Clinical Source Book for Healthcare Professionals.* 3rd ed. Wayne, PA: HMP Communications; 2007:385-390.
6. Eisenbud D, et al. *Ostomy Wound Manage.* 2003;49:52-57.
7. Milne CT, et al. *Wounds*. 2010;22:270-274.
8. National Pressure Ulcer Advisory Panel. *Pressure Ulcer Scale for Healing: PUSH Tool 3.0.* Available at: www.npuap.org/PDF/push3.pdf. Accessed November 10, 2011.
9. Falanga V, et al. *Dermatol Ther.* 2006;19:383-390.

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Is the Evidence Really What it Seems?

A summary of a learning lunch held at the 17th annual conference of the Canadian Association of Wound Care – November 5, 2011

Woo and Woodbury began by noting that: "Evidence-based medicine is the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients … which implies integrating individual clinical expertise with the best available external clinical evidence from systematic research."[1] Patient values and circumstances are also considered and are central to care planning.

Study designs can be either descriptive or analytic,[2] and the appropriate design depends on the research question being asked. In quantitative research, the goal is to avoid bias, while in qualitative research the goal is to add meaning.

Woo asked, Why do healthcare professionals require evidence to inform their decision-making in clinical practice? He noted that evidence-based practice should always be the gold standard for providing the best patient care. While expert opinion is useful, it may be biased. Similarly, product information may be biased toward a manufacturer; thus, potential conflict of interest must always be considered.

Bias can also be present in clinical trials. Potential sources of bias in clinical trials include: patient selection, method of assignment to treatment groups, unaccounted for study dropouts, lack of blinding, lack of group equivalent at baseline, study groups treated unequally and investigator conflict of interest. For evaluating therapeutic interventions, the study design most likely to *minimize* bias is a randomized controlled trial (RCT) (Figure 1). Indeed, the highest level of evidence is found in systematic reviews of RCTs. However, RCTs can be both time-consuming and costly.

A cohort study can also help identify uncommon or adverse effects of treatments, or assess approaches or changes to service delivery, although the lack of random allocation is a drawback. However, cohort studies are useful in situations where an RCT would be unethical, i.e. withholding treatment from one study arm, while providing it to another.

Case control studies are those in which 2 groups of people – those with the condition under study and a very similar group of people who do not have the condition – are observed. Potential biases include subject selection and data quality; however, such studies are useful as a measure of retrospectively determining a presumed beneficial treatment.

A case series can be retrospective or prospective, and tracks patients with a known exposure who are given similar treatment, or examines their medical records for exposure and outcome. Because there is no control or comparison group, an association, but not a causal relationship, between the treatment exposure and outcome can be detected.

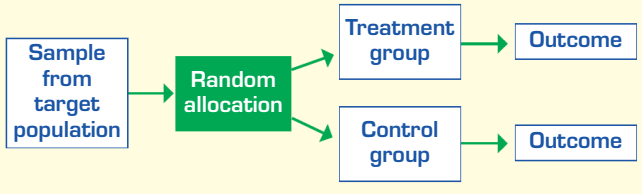

Figure 1. Randomized controlled trial study design

Practice Points

- Clinicians should learn to review research papers critically to determine their validity and to determine whether there are biases.
- Every research study has the potential for bias.
- Randomized controlled trials are the gold standard for evidence about therapy, but other types of trials (e.g. *in vitro* studies, case series) have merit in the research milieu to answer different types of questions.

Putting the evidence into perspective

Although bias may be present in all studies – whatever the design – there is generally less bias with a higher level of evidence, i.e. an RCT vs. a case series. The Centre for Evidence-based Medicine, in Oxford, UK, provides a web-based tool that allows users to critically appraise data from published studies to determine bias.[3] Questions that can be asked to determine internal and external validity using the tool include: Was the study valid? What were the study results (i.e. treatment effect)? Will the study results help me in caring for my patents?[3] Using the CEBM tool, Woodbury analyzed a number of RCTs, and noted some questions regarding methodological issues that the tool can answer:

- Was the randomization process adequate?
- Were the blinding measures sufficient?
- Was the sample size adequate?
- Were the results objective, not subjective?
- Were data points and measures presented uniformly in the paper?

Woo noted that *in vitro* and *in vivo* studies can also provide valuable information to wound care clinicians regarding the proof of concepts or theories, testing of dressings or biomaterials, or the identification of underlying physiological mechanisms in how a dressing/device functions. It was noted, however, that one must ensure that the study design will demonstrate outcomes which have validity in actual clinical practice. He discussed several pitfalls in studies that evaluated antimicrobial dressing materials:

- The products tested are not always comparable: categories of dressing (alginate vs. foam), vapour transmission rate (high vapour transmission may create a hostile environment for bacterial growth but is not ideal for wound healing), conformability of the dressing, release of active ingredients (not all dressings have the ability to release active agents into wounds) and mechanism to activate antimicrobial agents (usually moisture is needed).
- Wound models do not emulate an actual wound environment. Artificial wounds using agar plates do not produce exudate, protein that can inactivate active antimicrobial agents and other inflammatory mediators.

References

1. Sackett DL, et al. *BMJ*. 1996;312:71-72.
2. Koepsell TD, et al. Overview of study designs. In: *Epidemiologic Methods: Studying the Occurrence of Illness.* New York, NY: Oxford University Press; 2003:93-115.
3. Centre for Evidence-based Medicine website. *Levels of Evidence.* Oxford, UK: Centre for Evidence-based Medicine, Oxford University. Available at: http://www.cebm.net/index.aspx?o=5653. Accessed November 23, 2011.

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Today and Tomorrow:

Proteases & Wounds

A summary of a learning lunch held at the 17th annual conference of the Canadian Association of Wound Care – November 4, 2011

Breda Cullen PhD and R. Gary Sibbald MD noted that proteases are protein-degrading enzymes, which fall into two categories: 1) serine proteases e.g. elastase; and 2) matrix metalloproteases (MMPs). They each function optimally under physiological conditions, and are required for wound healing. Collectively, they can degrade all soft tissue components of the extracellular matrix, and are normally controlled at the tissue level by natural inhibitors. However, when tissue or blood cells are compromised, protease levels can become elevated. **Protease activity is an essential part of wound healing; however, if left unchecked, elevated protease activity may cause sufficient damage to impair healing and destroy normal tissue.**[1]

Protease activity could therefore be a predictive marker in wound healing: **In chronic wounds with elevated protease activity (EPA), there is a 90% chance that the wound will not heal.**[2] Numerous clinical trials have demonstrated that protease-modulating therapies can reduce protease activity, and thus promote wound healing. The protease-modulating dressing collagen/ORC (+silver) rebalances the chronic wound environment and helps wounds heal by: binding and inactivating proteases (both MMPs and elastase); protecting growth factors from proteolytic degradation; stimulating cell growth (i.e. fibroblasts, endothelial cells and keratinocytes); and controlling bacterial bioburden.

In a retrospective study of 974 patients regarding the cost benefits of collagen/ORC and collagen/ORC/silver dressings used sequentially vs. standard care, more wounds (95% vs. 7.2%) reached complete healing and the total cost of therapy was reduced.[3]

Recently, an interdisciplinary group of Canadian wound care clinicians developed a Canadian evidence-informed consensus on use of a protease activity point-of-care diagnostic test. These experts agreed that as clinical expertise alone is unable to visually identify protease activity levels, an objective test is needed.[1] Therefore, a protease point-of-care test would guide clinicians to an appropriate, targeted therapeutic pathway. They further agreed that protease activity testing should be used as part of the assessment of complex, stalled, healable wounds. Protease activity testing results can then be integrated into optimal local and systemic management of wounds (Figure 1).[1]

Improving clinical efficacy

The current understanding of proteases as predictive markers is as follows:

- Protease activity at appropriate levels is important for wound healing, and protease activities are reduced when wounds are in a healing trajectory.
- Most wounds with elevated protease activity (EPA) are non-healing and require intervention.
- Protease-modulating therapies can help to rebalance high protease activities.

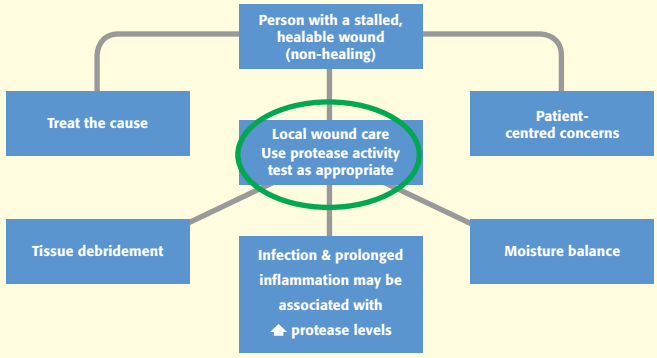
Practice Points

- Awareness of wound microenvironment is crucial to support earlier appropriate intervention, faster healing times and more cost-effective treatment.
- The availability of a protease activity test could facilitate early selection of targeted therapies and revolutionize the current management of stalled, complex wounds.

The following wounds could benefit from testing for EPA:

- Wounds in patients with underlying comorbidities such as diabetes, peripheral arterial disease, or venous stasis.
- A stalled wound, after the cause of the wound has been addressed.
- Dehisced surgical wounds, to prevent complications that may result in readmission.
- Pressure ulcers in at-risk patient populations, such as the elderly or patients with diabetes.
- Wounds in which skin grafting, tissue-engineered products, or scaffolds will be used, as matrix degradation is likely to occur in an environment with high protease activity.
- Wounds in which negative pressure wound therapy will be initiated.

Figure 1. Wound bed preparation paradigm for holistic patient care: The role of protease activity testing



Integrate protease activity testing results into local & systemic treatment

The Protease Status Test, developed by Systagenix, will be the world's first point of care wound diagnostic, and will identify which chronic wounds have EPA.

References

1. Sibbald RG, et al. *The Role of a Point-of-Care Protease Activity Diagnostic Test in Canadian Clinical Practice.* Markham, ON: Systagenix; 2011.
2. Serena T, et al. Protease activity levels associated with healing status of chronic wounds. Poster, Wounds UK, 2011.
3. Snyder R, et al. A retrospective study of sequential therapy with advanced wound care products versus saline gauze dressings: Comparing healing and cost. *Ostomy Wound Manage.* 2010(Suppl A):9-15.

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