Dapsone 5% Gel: 
A New Option in Topical Therapy for Acne

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ABSTRACT
Dapsone 5% gel for the topical treatment for acne vulgaris was recently introduced in Canada. It represents the first new anti-acne agent to gain North American regulatory approval in the past decade. Dapsone's utility is attributable to its anti-inflammatory and antimicrobial properties that improve both inflammatory and non-inflammatory acne, with more prominent effects occurring in inflammatory lesions. Short- and long-term safety and efficacy have been demonstrated. Especially for patients exhibiting sensitivities or intolerance to conventional anti-acne agents, topical dapsone is a novel addition to the treatment armamentarium.

Key words: acne vulgaris, dapsone, sulfone

What Is It?
Dapsone, a synthetic sulfone with an amino moiety linking two sulfone rings (4,4'-diaminodiphenyl sulfone; molecular weight 248.30), has had medical applications for more than 7 decades for treating various medical conditions including dermatitis herpetiformis, leprosy, and malaria. It has been used in the past for severe recalcitrant acne in doses ranging from 25-50 mg/day.

The primary metabolites of dapsone are N-acetyl dapsone and dapsone hydroxylamine. The most important adverse events of dapsone result from the hydroxylamine metabolite. This compound increases oxidative stress on erythrocytes with resultant potential for dose-dependent hemolysis and methemoglobinemia. Individuals with glucose-6-phosphate dehydrogenase (G6PD) deficiency are more susceptible, as the absence of functional G6PD increases the risk of hemolysis and denaturation of hemoglobin.

It was hypothesized that a topical formulation of dapsone may be appropriate for treating acne vulgaris while minimizing systemic exposure and hematologic risk. Accordingly, a topical gel formulation of dapsone 5% was developed by Atrix Laboratories almost a decade ago for the treatment of acne vulgaris. While this product was approved by Health Canada in 2006, it has only recently been marketed in Canada.

Mechanism of Action
Dapsone has both anti-inflammatory and antimicrobial properties. A combination of these activities may account for its efficacy in acne. Anti-inflammatory effects include inhibition of neutrophil myeloperoxidase and eosinophil peroxidase activity, suppression of hypochlorous acid production, scavenging of reactive oxygen species, suppression of neutrophil activity, and inhibition of chemoattractant-induced signal transduction. Antimicrobial activity, similar to that of sulfones and sulfonamides, is by inhibition of bacterial dihydropterase synthase in the folic acid metabolic pathway. This mechanism is effective against microorganisms synthesizing their own folic acid. In vitro susceptibility testing has demonstrated some activity for dapsone against Propionibacterium species, including Propionibacterium acnes (P. acnes). In vivo, a 10 week randomized single-blind vehicle-controlled microbiological study demonstrated reduction in Propionibacterium counts for vehicle between 54-78%, and for topical 5% dapsone gel of 63-70% (not significant).1

Evidence for Efficacy
Two identically designed 12 week phase 3 double-blind randomized vehicle-controlled trials in acne (total N=3010) have been performed.2 The objective of these studies was to evaluate the efficacy and safety of twice daily topical dapsone 5% gel in acne vulgaris. Subjects were aged 12 years or older with facial acne, including 20-50 inflammatory lesions and 20-100 non-inflammatory lesions at baseline. The primary efficacy endpoints were global success (achievement of clear or minimal on global assessment) and mean percent reduction from baseline in lesion counts. Baseline characteristics for the vehicle and active treatment groups were similar, with the majority of patients having moderate acne (58%) and a third (33%) having mild...
acne. At end of the study, 41% of the dapsone gel cohort achieved global success, compared with 33% of patients treated with vehicle (P<0.001). Significant reduction in non-inflammatory, inflammatory, and total lesion counts were noted in dapsone gel versus vehicle groups (32% versus 24%, 39% versus 32%, 48% versus 42%, all P<0.001, respectively). The efficacy of dapsone gel 5% in combination with adapalene gel 0.1%, benzoyl peroxide gel 4%, or moisturizer was evaluated in a 12 week double-blind randomized study involving 301 acne subjects. Dapsone gel was applied twice daily and 1 of the 3 additional treatments was applied once daily. Subjects treated with dapsone gel and adapalene showed a significantly greater improvement in non-inflammatory and total lesion count reduction compared to dapsone gel and moisturizer. The dapsone-adapalene treatment group showed a slightly higher incidence of application site burning. Overall, local adverse reactions were minimal and generally mild in severity and improved during treatment. Seven patients in the dapsone gel and benzoyl peroxide group reported temporary tan/brown residue at application sites. However, this discolored residue could be wiped away if observed. The authors suggest that, when used together, the first product should be completely absorbed prior to application of the second, without a visible layer of either product on the skin after application. Alternatively, application of these agents at different times of the day can obviate this discoloration.

Evidence for Safety

In the phase 3 studies, few patients withdrew due to side effects (6 dapsone gel, 9 vehicle). The overall incidence of adverse events was similar in both groups. The most common local intolerance events were dryness (20%), erythema (16%), and other reactions (including facial stinging, peeling, sensitivity, flaking, greasiness, photosensitivity, acne breakouts, tingling, and skin tightness). Serious adverse events were observed in 9 subjects, but they were not considered to be related to the treatment (4 dapsone gel, 5 vehicle). No significant changes in hemoglobin or other laboratory values were noted, despite 44 subjects recruited with glucose-6-phosphate dehydrogenase (G6PD) deficiency. Laboratory values were noted, despite 44 subjects recruited (4 dapsone gel, 9 vehicle). Laboratory values were noted, despite 44 subjects recruited (4 dapsone gel, 9 vehicle). Laboratory values were noted, despite 44 subjects recruited (4 dapsone gel, 9 vehicle). Laboratory values were noted, despite 44 subjects recruited (4 dapsone gel, 9 vehicle).

The pharmacokinetic profile of topical dapsone gel was evaluated by reviewing data from three prospective open label studies, two phase 1 pharmacokinetic studies, and a phase 3 long-term safety study. Blood samples were drawn at various times in each trial for assessment of drug and metabolite concentrations. In various settings ranging from 2 weeks to 12 months application of dapsone gel, systemic levels (area under the curve) of dapsone and metabolites were approximately 100-fold less than those after a single dose of oral dapsone. Furthermore, the concentrations of dapsone and its metabolites achieved steady state and did not increase with prolonged treatment with dapsone gel. Further evaluation of hemolysis risk in subjects during dapsone gel use was performed in 64 patients with G6PD deficiency. Subjects were randomized to 12 week treatment periods of either vehicle followed by dapsone gel or dapsone gel followed by vehicle. Chemical and hematological analyses were performed, as well as levels of dapsone and metabolites, along with spontaneous reports of adverse events. Reduction in mean hemoglobin concentration of 0.32 g/dL was observed from baseline to 2 weeks during dapsone gel treatment, unaccompanied by laboratory features of hemolysis. This change was no longer apparent at 12 weeks of treatment. Proportion of subjects with 1 g/dL reduction in hemoglobin was similar between treatment groups at both week 2 and week 12 and no clinical signs or symptoms of hemolytic anemia were observed. Thus, no clinical or laboratory evidence of drug-induced hemolytic anemia in patients with G6PD deficiency was observed during treatment with dapsone gel 5%. The results of this study led to Health Canada and the US FDA removing the G6PD screening and monitoring requirements from the official label for this product.

Although sulfones, such as dapsone, have structural similarities to sulfonamides, the two compounds have distinct chemical properties, e.g., sulfa antibiotics have both anti-inflammatory and antibacterial properties, whereas sulfonamides are antimicrobial agents. Additionally, sulfonamides have been implicated in sulfite sensitivities, but dapsone may be used in sulfonamide-allergic patients.

Conclusion

Dapsone 5% gel is a novel option in Canada for treating acne vulgaris that may be operating via anti-inflammatory mechanisms. Efficacy in acne has been demonstrated in phase 3 and long-term studies. It has undergone rigorous evaluation for safety with no evidence of increased hemolytic risk even in G6PD-deficient patients.

References

Introduction

This best practice for the prevention and treatment of pressure ulcers (PrU) has been developed with the expertise of the authors and utilizing:

- The 2009 evidence-based guidelines developed in collaboration between the National Pressure Ulcer Advisory Panel and the European Pressure Ulcer Advisory Panel (NPUAP-EPUAP)\textsuperscript{1,2}
- The Registered Nurses Association of Ontario’s guideline for the prevention and treatment of pressure ulcers\textsuperscript{3,4}
- Canadian Association of Wound Care’s best practices for pressure ulcers\textsuperscript{5}
- Wound Bed Preparation Update 2011\textsuperscript{6}

The best approach to pressure ulcer management includes the patient and their circle of care along with an interprofessional team of health professionals including physicians, nurses, rehabilitation specialists, dietitians, and other allied health specialists.

Prevention

The holistic assessment to identify persons at risk of a pressure ulcer includes:

- Review of comorbidities and historical events (e.g., previous history of a pressure ulcer)
- Assessment of the patient’s skin, particularly over bony prominences
- Medication profile
- Use of a validated risk assessment tool

The routine assessment interval is based on patient acuity (e.g., daily in acute care units to weekly assessments in chronic care for the first 4 weeks and then monthly to quarterly). High risk individuals include those with advanced age, spinal cord injuries or other causes of immobility, and low body mass index (i.e., BMI below 20).

For adult patients there are three validated risk assessment scales: Braden, Waterlow, and Norton:

- Braden scale with 6 subscales (sensory/perception, moisture, activity, mobility, nutrition, and friction/shear) is most commonly used in North America\textsuperscript{7}
- Waterlow scale with 9 subscales: (BMI, continence, skin type, mobility, appetite, tissue malnutrition, neurological deficit, major surgery/trauma, and medications)\textsuperscript{8}
- Norton scale with 5 subscales (physical condition, mental condition, activity, mobility, and incontinence)\textsuperscript{9}

The Braden scale scores between 6 and 23. A score of 18 or lower indicates an increased risk of developing a pressure ulcer. It is important to institute prevention strategies for each low scoring or high risk subscale item and use clinical judgment in addition to any risk assessment tool scores.

Despite optimal care, not all pressure ulcers are preventable as outlined in a recent consensus document (Skin Changes At Life’s End=SCALE).\textsuperscript{10}

Pressure Ulcers

The international NPUAP-EPUAP defines a pressure ulcer as “Localized injury to the skin and/or underlying tissue usually
over a bony prominence as a result of pressure, or pressure in combination with shear.41

Findings from international PrU prevalence audits (447,930 patients) reported incidence rates of 9.2-27.3%.41 Pressure ulcers are a significant financial burden on healthcare systems. Non-healing/chronic wounds are associated with increased length of hospital stay and mortality, and patients are at greater risk for developing complications such as cellulitis, osteomyelitis, and sepsis.

**Determine Heavability**

Categorization of wound healability (i.e., healable, maintenance, or non-healable) is of particular importance. This designation defines for the clinician, patient, and family an expected course of action, plan of care, and predictable healing rate. As a prerequisite to setting realistic treatment objectives, wounds are differentiated as:

- **Healable wound**: the cause is corrected, there is enough blood supply to heal; moist interactive healing
- **Maintenance wound**: the wound could heal, but the cause is not corrected due to patient unwillingness to adhere to treatment or a lack of required system resources
- **Non-healable wound**: the patient is ill or may have negative protein balance or inadequate blood supply that is not bypassable or dilatable

Other cofactors/comorbidities such as systemic disease, nutrition, and medications may also delay or inhibit healing in all of the above groups. For maintenance and non-healable wounds, moisture balance is contra-indicated and antiseptics in all of the above groups. For maintenance and non-healable wounds, moisture balance is contra-indicated and antiseptics should be avoided. Polyhexamethylene biguanide (PHMB) may be prudent choices in a gauze or packing format. Conservative debridement of slough can, however, be undertaken to prevent spread of infection to local or deeper surrounding tissues through moisture and bacterial reduction.

**Treat the Cause: Pressure and Shear**

The foundation of the prevention and management of pressure ulcers is to **reduce the forces of pressure and shear** that damage the skin in the deep tissue compartments, particularly subcutaneous fat and muscle. **Pressure** is defined as the “force per unit area exerted perpendicular to the plane of interest.”41 **Shear** is the “force per unit area exerted in parallel to the plane of interest.” Appropriate pressure reduction is outlined in Table 1. To minimize shear (the axial skeleton moves in opposite direction to the skin surface), do not raise the head of the bed more than 30 degrees and avoid slipping or sliding with transfers or in various types of seating.

**Nutrition**

The nutritional assessment should include body mass index (BMI), hemoglobin (Hgb), and serum albumin level. The BMI is normal between 20-25, with levels >30 obese, and >40 morbidly obese. A BMI of <20 poses an increased risk of pressure ulcer development. Investigations of nutritional status should include Hgb (110-120 normal, ≥100 for normal healing, 80-100 for delayed healing, and 60-80 will severely impair the wound healing process). The albumin measures the protein status over the past few months in the peripheral circulation. Normal albumin levels are above 30-33, with delayed healing at levels between 20-30, and at <20 it will be very difficult to heal a wound. Nutritional support should include adequate protein intake of 10-20 g/kg/day. Zinc deficiency is uncommon in adults and its supplementation can interfere with absorption of other nutrients.

<table>
<thead>
<tr>
<th>Surface/Activity</th>
<th>Strategy/Approach</th>
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</thead>
<tbody>
<tr>
<td>Bed</td>
<td>Consider a reactive support surface (one that changes pressure distribution only in response to change in body position) for clients who are at risk or who have pressure ulcers, but are able to reposition themselves. Consider an active support surface (one that changes pressure distribution independent of body position, e.g., alternating air or lateral rotation) for clients who have pressure ulcers, but are unable to reposition themselves.13 If feasible, do not confine the patient to bed, since fostering activity while using appropriate surfaces is the best approach.3</td>
</tr>
<tr>
<td>Chair/Wheelchair</td>
<td>Pressure management cushions have been shown to reduce the incidence and prevalence of pressure ulcers in clients in long-term care settings. For all clients, choose a cushion that prevents shearing and reduces pressure.14 Foster independent repositioning by the client.</td>
</tr>
<tr>
<td>Commodes</td>
<td>Limit the amount of time the client spends on the commode due to the reduced surface area. Consider padding the commode and/or adding a tilt function.</td>
</tr>
<tr>
<td>Car</td>
<td>Consider the addition of a pressure management surface to the car seat, with special consideration of head clearance given the ceiling height of the vehicle, and visual field if the client is driving.</td>
</tr>
<tr>
<td>Tub benches and other equipment</td>
<td>Consider the addition of a pressure management surface, ensuring that the surface does not cause deterioration in the functional abilities or balance of the patient.</td>
</tr>
<tr>
<td>Transfers and transitions to various surfaces</td>
<td>Ensure transfers are smooth, minimizing any potential for pressure, friction, and shear. Work to improve the patient's strength; where possible, improving their transfer techniques. Consider implementing transfer devices (e.g., mechanical or ceiling lifts) and repositioning equipment (e.g., low friction sheets).</td>
</tr>
</tbody>
</table>

**Table 1: Surfaces/Activity with Strategy/Approach (Sibbald RG)
Immobility, Level of Activity and Positioning
Persons with spinal cord injuries (SCI)\(^6\) and neuromuscular degenerative disease are at an increased risk of developing a pressure ulcer. Interprofessional team members can offer patient-specific strategies for safe and optimal activity levels for individuals with a pressure ulcer. These consultations should actively engage input from both the patient and their circle of care with respect to an exercise program (e.g., in bed, movements or positioning during seating, assisted ambulation, and training equipment). Even with therapeutic surfaces, persons with PrU’s require a regular turning program based on their risk level and ability to perform voluntary changes in position.

Moisture and Friction\(^7\)
Excess moisture may be due to sweat but is more often associated with urinary or fecal incontinence. Fecal incontinence is most harmful in the sacral area and a bowel routine or external collection device should be considered, as well as prompt changing of wet underwear or diapers. Urinary incontinence may be controlled with intermittent catheterization, a condom catheter, or an indwelling catheter; however, their use is associated with other complications including infections.

Friction is “the resistance to motion in a parallel direction relative to the common boundary of two surfaces.”\(^1\) Moisture and friction are often responsible for the superficial breakdown of the skin in the sacral area, where incontinence associated dermatitis (IAD), a form of contact irritant dermatitis, is often misdiagnosed as a pressure ulcer.

Patient-centered Concerns\(^18\)
Pain is often underestimated by wound care providers. Controlling pain promotes wound healing as well as renders patients more comfortable. Pain can be either nociceptive (gnawing ache, tender, and throbbing) stimulus dependant or neuropathic (burning, stinging, shooting, and stabbing) non-stimulus dependent. The former can be treated with the WHO's pain ladder, starting with acetysalicylic acid and nonsteroidal anti-inflammatory drugs and progressing to weak and stronger narcotic agents. Short acting drugs are used for initial dosing and breakthrough with longer acting agents for sustained and adequate pain control. Neuropathic pain can be spontaneous and is best controlled with tricyclic compounds high in anti-noradrenaline activity (e.g., nortriptyline or desipramine 10-30 mg at night, titrating higher if required) or anti-epileptic agents (e.g., gabapentin, pregabalin, or carbamazepine). Pain can also be minimized at dressing change with modern, easily removable dressings featuring soft silicone rather than traditional adhesive products.

Odor from a wound dressing is often concerning to patients and may indicate the need for treatment against gram-negative or anaerobic bacteria.

Smoking can decrease cutaneous blood flow by as much as 40%, inducing ischemia and impaired healing.\(^19\) Smoking one cigarette creates a vasoconstrictive effect for 90 minutes.\(^20\)

Bed rest resulting in physical and mental deterioration can be one of the most harmful strategies for the treatment of pressure ulcers.\(^21\) The facilitation of daily living activities will help promote a return to normal function.

Classification of Pressure Ulcers\(^5\)
Pressure ulcers previously identified as grades or levels are now known as categories (outlined in Table 2). It is worth noting that the NPUAP considers suspected deep tissue injury (sDTI) and unstageable ulcers as a separate category, whereas the EPUAP designates both conditions as category 4.

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Non-blanchable erythema (over a bony prominence)</td>
</tr>
<tr>
<td>2</td>
<td>Erosion (epidermal base) or superficial ulcer (dermal base)</td>
</tr>
<tr>
<td>3</td>
<td>Ulcer (subcutaneous fat base)</td>
</tr>
<tr>
<td>4</td>
<td>Ulcer (muscle, fascia, bone base)</td>
</tr>
<tr>
<td>4+</td>
<td>sDTI (suspected deep tissue injury)</td>
</tr>
<tr>
<td>4+</td>
<td>Unstageable (slough or eschar in the base obscuring the actual depth)</td>
</tr>
</tbody>
</table>

Table 2: Pressure ulcer categories and descriptions
A sDTI is characterized by a purple or maroon localized area of intact skin that may feature a blood filled blister due to damage of the underlying soft tissue from pressure and/or shear. Not all sDTIs subsequently ulcerate or breakdown, as they can self-resolve.

Location and Size
It is important to document the location and size of the wound. This facilitates objective assessment of progress or deterioration, especially when several care providers are involved with patient care. Wounds should be measured at the longest length and then the widest width at right angles to the measured length. Depth can be measured with a cotton tip applicator or wooden stick, where the deepest depth is measured a notch should be made on the disposable measuring instrument, and then the length should measured.

Arterial Insufficiency
Heel ulcers, although triggered by pressure, may be due in large part to lower limb arterial insufficiency.\(^6\)

Treatment\(^6\)

Local Wound Care
Gently cleanse wounds with low-toxicity solutions, i.e., saline, water, or acetic acid (0.5-1.0%). Wounds should not be irrigated when seepage of the solution is not visible or retrieval (or aspiration) of the irrigation solution is not possible. Under these conditions, use compresses applied with forceps on gauze ribbon as an alternative.

Debridement
Debridement can be accomplished surgically with scalpel, curette, or scissors. Sharp techniques may help remove bacterial burden on the surface of the wound, particularly when it is arranged in biofilms. Autolytic debridement is often facilitated with dressings (e.g., calcium alginate, hydrogels or hydrocolloids). Enzymatic (e.g., collagenase) or biological debridement with maggots are additional alternatives.
**Moisture Balance**
Achieving optimal moisture balance is essential in wound healing, which promotes new tissue growth by encouraging cellular proliferation and collagen formation. Moisture balance dressings are listed in Table 3 along with their autolytic debridement properties.

<table>
<thead>
<tr>
<th>Dressing Class</th>
<th>Debridement</th>
<th>Infection / Critical Colonization</th>
<th>Moisture Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-adherent</td>
<td>−</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>Films</td>
<td>+</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>Hydrogels</td>
<td>++</td>
<td>−/+</td>
<td>+</td>
</tr>
<tr>
<td>Hydrocolloids</td>
<td>+++</td>
<td>−/+</td>
<td>++</td>
</tr>
<tr>
<td>Acrylics</td>
<td>+</td>
<td>−/+</td>
<td>++</td>
</tr>
<tr>
<td>Calcium Alginate</td>
<td>++</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>Foams</td>
<td>−</td>
<td>−</td>
<td>+++</td>
</tr>
<tr>
<td>Hypertonic Saline</td>
<td>+</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>Hydrophilic Fibres</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Antimicrobial</td>
<td>VAR</td>
<td>+ to +++</td>
<td>VAR</td>
</tr>
</tbody>
</table>

Table 3: Moisture balance dressings (Sibbald RG®)

+ minimal activity; ++ moderate activity; +++ strong activity; − no clinical activity; VAR = variable according to dressing class listed above

**Infection**
Bacteria can critically colonize wounds, leading to stalled healing. Critically colonized wounds can be identified with the presence of any three clinical signs in the mnemonic NERDS (non-healing, exudate increase, red friable or easily bleeding granulation tissue, new slough or debris on the wound surface, and smell). Topical antimicrobials for healable wounds include silver dressings (combined with foams, alginates or hydrogels, as well as grid or cloth-like structures), PHMB foam and gauze, iodine dressings (combined with foams, alginates or hydrogels, as well as grid or cloth-like structures), PHMB foam and gauze, iodine (cadexomer iodine or povidone iodine), and honey (alginate, hydrogel or hydrocolloid).

The mnemonic STONEES (size increase, temperature of the surrounding skin, cellular proliferation and collagen formation) indicate infection that may be superficial, deep, or both, particularly if increased exudate and smell are present. Treatment with systemic antibiotics is required in these situations. The choice of antibiotic should preferably be based on bacterial swab results. Wounds that have been present for >4 weeks or if the patient is immuno-compromised require antimicrobial coverage for gram-positive, gram-negative and anaerobic organisms. Osteomyelitis (OM) must be considered as a complication of pressure ulcers, especially if the ulcer probes to bone or the bone surface is rough, gritty or contains bone fragments. Supporting evidence for OM can be simply achieved by X-ray or MRI in some cases, along with elevated sedimentation rate (>40 mmHg/h) may be helpful in making this determination. Positive parameters should be followed and corrected prior to stopping systemic antibiotics.

**Inflammation**
Persistent inflammation due to excess harmful cytokines (e.g., matrix metalloproteinase 9) can result in delayed wound healing. This can be treated topically with dressings containing silver, collagen, oxidized regenerated cellulose, or ibuprofen.

**Edge Effect**
If the cause of a healable wound has been corrected and patient-centered concerns are addressed (including receiving optimal local wound care), but healing is stalled, advanced therapies can be considered. The edge effect refers to the cliff-like edges of a wound that is often seen with stalled healing, which contrasts the tapered edges and peripheral rim of purple new epithelium of a healing wound. If a wound does not exhibit a 30% reduction by week 4, it is unlikely to heal by week 12.

**Advanced Therapies**
There is RCT evidence of advanced therapies in pressure ulcers, including electrical stimulation and therapeutic ultrasound. Surgery is also considered when deep ulcers have bone, muscle or fascia base, and granulation tissue involvement, or healing cannot be easily stimulated with local measures. Surgery is often a major procedure that is accompanied by a structured rehabilitation program to prevent dehisence. Some patients with heel pressure ulcers and peripheral vascular disease may benefit from hyperbaric oxygen therapy. Additionally, there may be a role for negative pressure wound therapy when a healable wound is stalled with excessive exudate.

**Conclusion**
Most pressure ulcers can be prevented, but not all can be avoided. A comprehensive assessment and treatment of PrUs can be completed with the wound bed preparation paradigm (Figure 1) outlined in this article. These assessments and interprofessional collaboration are important for the early identification and optimal PrU treatment. Local ischemia or incontinence associated dermatitis are often misdiagnosed as PrUs. Coordinated PrU treatment needs to combine an awareness of appropriate surfaces, turning schedules, correction of shear, and implement strategies for adequate protein intake/correction of nutritional deficiencies, enhanced mobility, manageable pain levels, and improved activities of everyday living. Empowering patients and their circle of care are key factors to treatment adherence and successful program outcomes.

**References**
Figure 1: Wound bed preparation paradigm for the prevention and treatment of pressure ulcers


Emtricitabine + tenofovir disoproxil fumarate

**Truvada®**
Gilead Sciences, Inc.

In July 2012, the FDA approved once-daily oral emtricitabine and tenofovir disoproxil fumarate, in combination with safer sex practices, to reduce the risk of sexually acquired HIV-1 infection in adults at high risk. It is the first agent to be approved for HIV prevention in uninfected adults, a strategy known as pre-exposure prophylaxis (PrEP).

Collagenase clostridium histolyticum

**XIAFLEX®**
Actelion Pharmaceuticals

Health Canada approved this novel, first-in-class biologic in July 2012 for the injectable treatment for Dupuytren's contracture in adults with a palpable cord. The injected enzymes dissolve and weaken the contracted collagen cord. This is the only nonsurgical option for Dupuytren's disease.

**Computer-assisted system for hair follicle harvesting**

**ARTAS™ System**
Restoration Robotics, Inc.

The European Commission granted CE Mark of approval in July 2012 to the first physician-controlled, computer-assisted technology that harvests individual follicular units directly from the scalp of men diagnosed with androgenetic alopecia with black or brown straight hair. It combines several features including an image-guided robotic arm, imaging technologies (e.g., digital mapping), small dermal punches, and a computer interface. The system identifies and harvests individual follicular units to implement the follicular unit extraction technique during hair restoration procedures.

**OTC HIV test**

**OraQuick®**
In-Home HIV Test
OraSure Technologies, Inc.

The FDA has granted marketing clearance in July 2012 to this first and only rapid OTC human immunodeficiency virus test that can detect antibodies to both HIV-1 and HIV-2 with an oral swab and provide results in 20-40 minutes. Based on a US phase 3 study, sensitivity was 93% and specificity was 99.98% using saliva. The FDA advises consumers that positive test results using this kit must be confirmed by follow-up laboratory-based testing. Also, the test can produce false negative results for reasons that include the occurrence of HIV infection within 3 months before testing.

**Herpes simplex virus test**

**IMIdx HSV-1/2 for Abbott m2000**
IntelligentMDx

The European Commission granted marketing clearance in July 2012 to this high-throughput molecular test designed and developed for the Abbott m2000 System. This automated molecular test detects herpes simplex virus (HSV) viral DNA and determines whether it is HSV-1 or HSV-2 in male and female genital or oral lesions and cerebral spinal fluid.

**Device News**

**Drug News**

According to a systematic review and meta-analysis presented at the Annual Congress of the European League Against Rheumatism (EULAR) in Berlin Germany, June 6-9, 2012, patients with inflammatory rheumatic diseases treated with anti-tumor necrosis factor (anti-TNF) agents (e.g., adalimumab, etanercept, and infliximab) have a 75% greater risk of developing herpes zoster (shingles), when compared with patients who received therapy with disease modifying anti-rheumatic drugs (DMARDs). The study authors conducted an extensive literature search, which included a total follow up of 124,966 patient years (PY) (74,198 PY in the biologics group and 50,768 PY in the DMARD group). Based on their findings, the investigators raise questions about timing of prophylactic vaccine administration for at risk patients and urge vigilance in monitoring for early signs and symptoms of herpes zoster during treatment with anti-TNFs drugs.