

# TAKING CARE OF DIABETIC SKIN AND FEET

Supporting Skin Health with  
Viniferamine® Small Molecule Technology

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**VINIFERAMINE®**

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Small Molecule Technology  
Without Scientific Equal™



## INTRODUCTION

According to a recent study, 2 in every 5 American adults are expected to develop diabetes in their lifetime<sup>1</sup>. Overall, worldwide, the number of people with type 2 diabetes is reaching epidemic proportions<sup>2</sup>. Diabetes mellitus is a metabolic disorder associated with chronic inflammation that can lead to various health complications including skin problems and chronic wounds<sup>3</sup>.

Type 2, the most common form of diabetes, involves insulin resistance and decreased insulin production<sup>4</sup>. Increased blood glucose or hyperglycemia is also common in cases of diabetes, and at least 30% of individuals with diabetes have some form of skin problem. Skin dryness, itching (pruritus), skin infection, and impaired wound healing are some of the common problems that can be associated with diabetes. Dry skin is due in part to the fact that individuals with diabetes tend to have reduced skin hydration resulting from decreased skin lipids and a decreased ability to sweat<sup>5</sup>.

Taking care of skin is critical for individuals with diabetes. Compromised vasculature and oxidative stress from hyperglycemia that often accompanies diabetes also result in dry, cracked skin that does not get proper nourishment from blood vessels. Even small cracks in the skin can lead to infected sores and foot ulcers. For those who have neuropathy, it can be even worse because they don't experience the normal warning signs of pain<sup>6</sup>.

Elasticity may also be decreased partially due to reduced collagen in diabetic skin<sup>7</sup>. In addition, reduced collagen makes diabetic skin more susceptible to injury and impairs wound healing. Diabetic foot ulcers are estimated to occur in 15% of all patients with diabetes and are the cause of 84% of all diabetes-related lower-leg amputations<sup>8</sup>.

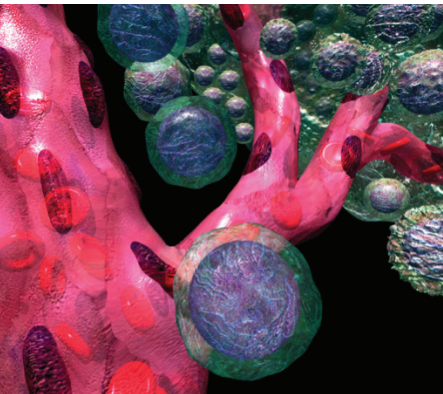


Figure 1: Free radical damage to endothelial cells

## THE EFFECTS OF OXIDATIVE STRESS ON ENDOTHELIAL DYSFUNCTION

Oxidative stress that typically leads to inflammation, results from the inability of cells to eliminate free radicals known as reactive oxygen species (ROS) using the natural defense system that includes defense enzymes such as superoxide dismutase (SOD) (**Figure 1**). Vascular cells and endothelium are major sources of ROS during hyperglycemia even with mild glucose elevations. Oxidative stress induced by hyperglycemia plays an important role in endothelial cell dysfunction and wound healing impairment<sup>9,10</sup>.

During normal healing, microvascular endothelial cells migrate to form new blood vessels (angiogenesis) in response to wounds. However, the metabolic abnormalities of diabetes cause mitochondrial superoxide overproduction in both large and small blood vessels, leading to the dysfunction of vascular cells. It was shown that increased expression of manganese superoxide dismutase (MnSOD) in endothelial progenitor cells improved their angiogenic functions and accelerated wound healing<sup>10</sup>.

## HYPOGLYCEMIA AND WOUND HEALING

Normal wound healing is vital for replacement and repair of tissue and for the restoration of tissue to its functional state. Diabetic foot ulcers and other chronic wounds do not follow the orderly process of normal wound healing that requires a well-orchestrated integration of complex biological events including cell migration, cell proliferation, and extracellular matrix deposition. Collagen, the most abundant protein found in tissues including skin, cartilage and ligaments, is critical for wound healing.

The normal wound repair process is divided into four overlapping phases of coagulation, inflammation, migration-proliferation (including matrix deposition), and remodeling. This complex process involves the interplay of different cell types including keratinocytes, fibroblasts, and endothelial cells. The intrinsic abnormalities associated with diabetes including hypoglycemia, circulatory/vascular deficiencies, and neuropathy all contribute to an abnormal progression of wound repair as well an abnormal wound environment<sup>11</sup>.

Hyperglycemia, as well as aging, can also lead to advanced glycation end products (AGEs), which are highly stable cross-linked complexes of protein and glucose. AGEs have been shown to induce collagen crosslinking leading to decreased elasticity in skin and blood vessels<sup>12</sup>. Interactions between AGEs and their receptors are thought to produce oxidative stress<sup>13</sup>.

**“The normal wound repair process is divided into four overlapping phases of coagulation, inflammation, migration-proliferation (including matrix deposition), and remodeling”**

## CHRONIC INFLAMMATION AND DECREASED INSULIN PRODUCTION

Chronic inflammation that can result from oxidative stress and immune dysregulation, which are both typical in diabetes, increases the risk of persistent cell injury and infection and results in decreased skin repair and skin defense functions. Chronic inflammation in individuals with diabetes also contributes to neuropathy and microvascular complications including endothelial dysfunction<sup>14</sup>. Poor circulation decreases oxygen and other vital nutrient flow to skin tissues making individuals with diabetes more susceptible to skin damage, as well as contributing to impaired wound healing<sup>11</sup>. Decreased insulin production also contributes to impaired wound healing in patients with diabetes. In fact, insulin was shown to be a vital growth factor for skin cells (keratinocytes), and is critical for keratinocyte proliferation, migration, and differentiation<sup>5</sup>.

**“Providing important nutrients to skin to help strengthen skin and improve wound healing is critical for individuals with diabetes.”**

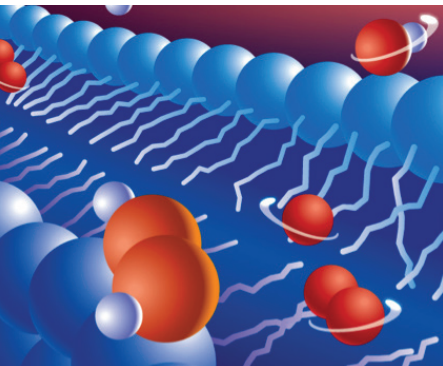
Chronic inflammation and impaired wound healing can result in chronic wounds in individuals with diabetes, including foot ulcers. Due to impaired immune responses and hyperglycemia, the risk of infections is elevated. Providing important nutrients to skin to help strengthen skin and improve wound healing is critical for individuals with diabetes.

## SUPPORTING SKIN HEALTH WITH VINIFERAMINE®

A consistent skin care regimen is essential in the management of skin and wound related issues resulting from diabetes. Viniferamine®, a comprehensive skin and wound care line, contains vital skin nutrients to help normalize barrier function, strengthen skin and promote skin repair. Moreover, the barrier cream and cleansing lotion include a sophisticated silicone complex to protect compromised skin and improve wound healing.

## MORE ABOUT HOW VINIFERAMINE® CAN HELP

The Viniferamine® skin and wound care product small molecule skin nutrients include antioxidants, vitamins and amino acids that combat oxidative stress and inflammation and enhance skin repair (**Figure 2**). Various ingredients moisturize and help keep skin hydrated for individuals with diabetes. Certified organic and pharmaceutical-grade ingredients ensure that pesticides and contaminants are excluded. In fact, Viniferamine® skin and wound care products are non-sensitizing and non-irritating.



**Figure 2:** The small molecules of Viniferamine penetrating skin cells to provide nourishment



## VINIFERAMINE® INGREDIENTS HELP DECREASE INFLAMMATION AND COUNTERACT OXIDATIVE STRESS

Many of the small molecule ingredients found in Viniferamine® skin and wound care products have potent anti-inflammatory activities to decrease skin inflammation commonly found with diabetes, including the polyphenols oleuropein, resveratrol, and epigallocatechin-3-gallate (EGCG) from olives, grapes, and green tea, respectively, as well as the important small molecules, melatonin, and L-glutathione<sup>15-19</sup>. In addition, dipotassium glycyrrhizinate from licorice, avenanthramides in oats, aloe vera and shea butter possess anti-inflammatory activities<sup>20-23</sup>. Various ingredients also counteract oxidative stress typically found with diabetes including oleuropein, resveratrol, and EGCG, as well as melatonin, and L-glutathione<sup>15,17,24-26</sup>. In fact, in a model where MnSOD was deactivated, oleuropein induced MnSOD activity<sup>27</sup>; EGCG has been found to induce MnSOD expression<sup>28</sup>, and resveratrol has been shown to upregulate MnSOD activity<sup>29</sup>.

## VINIFERAMINE® INGREDIENTS HELP IMPROVE ENDOTHELIAL FUNCTION

Endothelial dysfunction resulting from hyperglycemia contributes to impaired wound healing. Resveratrol and EGCG have been shown to inhibit endothelial dysfunction and enhance wound healing<sup>23,30-32</sup>. Many other beneficial ingredients for individuals with diabetes, found in Viniferamine® skin and wound care products, including oleuropein, L-carnosine, L-glutathione, asiaticoside and aloe vera were also found to improve wound healing<sup>21,23,34-37</sup>. In addition, oleuropein has been shown to restore function in endothelial progenitor cells<sup>38</sup>.

## VINIFERAMINE® INGREDIENTS HELP STIMULATE COLLAGEN SYNTHESIS

**“Improving collagen synthesis is important for individuals with diabetes that frequently have impaired wound healing.”**

Improving collagen synthesis is important for individuals with diabetes that frequently have impaired wound healing. Titrated extract of *Centella asiatica* (TECA) and aloe vera found in Viniferamine® skin and wound care products stimulate collagen synthesis and enhance wound healing<sup>39-41</sup>. Collagen is vital for its structural role in providing tensile strength to wounds. In addition, collagen modulates critical inflammatory and wound healing processes by binding to receptors that activate other molecules involved in tissue remodeling and repair including matrix metalloproteases (MMPs), cytokines and growth factors<sup>42-43</sup>.

## VINIFERAMINE® OFFERS A DIABETES FOOT CARE KIT TO HELP INDIVIDUALS WITH DIABETES TAKE CARE OF THEIR SKIN AND FEET



The Diabetes Foot Care Kit includes 2 highly beneficial products: Silicone Barrier and Clean N Moist, as well as a Foot Care Guide Booklet written by health care professionals to help patients with diabetes take care of their skin and feet. Silicone Barrier is an advanced 34% silicone cream that is non-occlusive, providing a “second skin” for patients that have compromised epidermis. Clean N Moist cleanses, moisturizes, nourishes, provides a protective barrier, and is perfectly pH balanced to ensure the most fragile skin is gently cleansed without causing irritation. Phytonutrients and other vital ingredients provide nourishment and revitalize skin. The advanced silicone complex in both products helps normalize the barrier function, maintain skin hydration and improve healing outcomes (Figure 3).



Figure 3: Viniferamine® skin and wound care products include beneficial nutritive ingredients, supporting multiple facets of wound healing



## SUMMARY

In summary, diabetes frequently involves dry skin, chronic skin inflammation, oxidative stress and wound healing impairment. Viniferamine<sup>®</sup> skin and wound care products include beneficial ingredients that help individuals with diabetes moisturize, strengthen, repair and protect their skin to help them avoid chronic wounds. The Viniferamine<sup>®</sup> Diabetes Foot Care Kit was created for individuals with diabetes to help them take care of their feet and avoid foot ulcers that can ultimately lead to amputations.

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## ABOUT THE AUTHORS

### **D. Elizabeth McCord, Ph.D., FAPWCA**

Dr. McCord is a renowned biochemist that has worked in the field of skin and wound care for over 30 years. She has been awarded six patents and two medical devices in the field. She currently has more than 60 health products marketed around the world and her most current product line is Viniferamine<sup>®</sup>. Previously, Dr. McCord commercialized skin and wound care products under the Remedy<sup>®</sup> Olivamine<sup>®</sup> brand, which has held a dominant position in the medical marketplace for many years. Both product lines are based on proprietary blends of small molecules that provide corneotherapeutic support, with Viniferamine<sup>®</sup> incorporating over 10 years of further scientific advancements and improvements.

### **Nancy B. Ray, Ph.D.**

Dr. Ray is the Science Officer at McCord Research. Dr. Ray currently writes articles and provides presentations concerning diabetes skin care and other health issues for McCord Research to advance skin care and wound healing awareness. She received her PhD in Biochemistry and Biophysics at Oregon State University and was a postdoctoral fellow at NIH, Harvard University and Dana-Farber Cancer Institute, and the University of Iowa. She also earned B.S. degrees in Chemistry and Microbiology from the University of Montana.

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