Anatomy, Physiology and Homeostasis of the Skin / The Concept of Nourishment of the Skin to Enhance the Function and Restoration of Damaged, Impaired Skin With Clinical Applications

Jane Fore-Pfliger, MD, CWS, FAPWCA, Lewis-Clark Wound Care Clinic
Lewiston, ID and Clarkston, WA

Introduction
The beginning of a wound is disruption of the stratum corneum of the epidermis; the final healing of a wound is the return of the fully functional stratum corneum. Much has been learned about the development and maintenance of the epidermis in the last several years. Additionally, research is revealing ways to enhance and restore the function of impaired skin. Through the use of nourishing topical agents, such as Olivamine*, the skin can be treated and restored to full function, enabling the skin to be the very effective barrier it is meant to be. A healthy epidermis is flexible yet strong, able to fight off invading organisms and is able to recover and heal after inflammatory and mechanical insults. Endemic nourishment of the skin that is exposed to external factors will help to prevent the development of wounds. Skin that is newly healed is also susceptible to damage and requires treatment and ongoing maintenance to again attain durability. Conditions that lead to impaired skin include photo and chronological aging, eczema and other inflammatory dermatoses, arterial insufficiency, venous stasis, lymphedema, injury to the peri-wound skin, incontinence, fissuring, and cracking.

Epidermis
One purpose of the epidermis is to build a fully functional and capable stratum corneum. These functions include building a strong, flexible, and mature kerneocyte proteins as well as abundant intracellular lipid layers. The skin is the largest organ of the body and is the primary line of defense against chemical, environmental, infectious and mechanical stressors. Orderly maturation of the epidermis is essential for a normal stratum corneum. This visible organ, reflecting the general health of the person, is metabolically very active with biosensors and responds to many stimuli including humidity and chemicals. Average turnover rate for the epidermis is 39 days. A fully functional and mature epithelium is the ultimate defense of our bodies. Compromise to this line of defense is considered significant in ability to cause damage.

*Olivamine™ Containing Products, Remedy™, from Medline Industries, Inc. Mundelein, IL

Presented at the Clinical Symposium on Advances in Skin and Wound Care, Phoenix, AZ, September 30-October 3, 2004
Protective Functions Of The Epidermis

- Metabolic Functions - Barrier and Lipid
- Mechanical Integrity
- Defense - Chemicals, Drugs, Antigens
- Antioxidant Repair
- Cytokine Signaling - Langerhans, Melanocytes, Keratinocytes release signals to defend and repair
- Antimicrobial Defense
- Permeability Barrier Hydration - Limits Transepidermal Water Loss (TEWL) to 2-5 cc/hr/cm²
- Waterproofing/Repellency
- Cohesion/Desquamation

Conditions Associated With Skin Damage

- Flattening and weakening of the dermal – epidermal junction reducing communication, nutrition, and blood supply. Along with this, the main source of skin hydration is significantly reduced. The skin is more fragile and more prone to skin tears.
- Epidermal turnover rate reduction results in slower healing.
- The intracellular layers are reduced leading to dryness and cracking.
- Cholesterol and amino acids are reduced leading to a decreased bacterial defense mechanism.

WHAT FACTORS ARE ESSENTIAL TO HEALTHY SKIN DEVELOPMENT, MAINTENANCE AND REPAIR?

1. Adequate building blocks (nutrients) for production of the skin
2. Optimal conditions for orderly maturation of the epidermis
3. A healthy dermis to support the epidermal function

HOW CAN WE NOURISH, REPAIR AND POTENTIALLY CREATE MORE DURABLE SKIN?

Products that are placed on the skin should have a significant positive impact on the optimal functioning of the epidermis and dermis. The skin needs topical support, at all times, particularly in times of distress.

Topical Ingredients to Optimize Cellular Biosynthesis and Repair

- Antioxidants - Hydroxytyrosol
- Amino Acids - Must be altered to be bioavailable
- Vitamins - niacinamide, lipoic acid, ascorbic acid
- Lipids - mixtures of ceramides, cholesterol, fatty acids
- Lipid precursors - phytosphingosine, tetraacetylphytosphingosine, omega-hydroxyfatty acids, linoleic acid, natural oils (safflower, olive, borage)
- Alpha, beta, & polyhydroxyacids - L-lactic, malic, citric, salicylic, glycolic acid
- Humectants - glycerol, urea
- Protease inhibitors - egg white lysozyme, aminocyclohexanecarboxylic acid
- Minerals - magnesium, calcium
- Histamine receptor antagonists – H1 and H2 receptor antagonists
- Peroxisome proliferator receptor agonists - especially PPAR alpha like linoleic acid, vitamin D, retinoids, some fatty acids, fibric acid derivatives, petroselinic acid, niacinamide
- Triterpenoids - ursolic acid
- GABA agonists - type A agonists - musimol, Isoguvacine
- Purinergic receptor- P2Y antagonists
- Glucocorticoid receptor antagonists

Summary

Traditionally, we use topical skin care products that have a passive function, leaving the patient susceptible to skin injury and poor healing. Recently, in our clinical practice, many patients have benefited from the addition of a skin care regime that included the application of topical nutrients and lipid based products. We have noticed great improvements in general skin conditions such as diffuse rashes, diabetic skin conditions, scarring, perineal breakdown as well as lower extremities with venous dermatitis. Several case studies are represented here. By adding an active product that nourishes and enhances metabolic function to our skin protocols we have seen a dramatic improvement in the overall skin health, strength and durability of the epidermis and demonstrated more resistance to breakdown. Since the fully functioning and mature epithelium is our ultimate defense, we have found a way to help reduce any compromise to this important organ.
Case Study 1
DO has had IDDM for over 34 years and has suffered for many years with fissured, dry, scaly skin over her elbows, fingers, toes and feet and knees. She uses an insulin pump and there are no other reported chronic conditions.

Case Study 2
JS is a 62 year old male with severe venous hypertension, edema, cellulitis and the tendency to dry, scaling skin. He has had ulcers in the inframalleolar area on his left foot for over seven years. He has been using appropriate compression stockings.

Case Study 3
SN is a 52 year old male who has diabetes, severe vasculopathy and significant neuropathy, hypertension and presents with recurrent fissuring and severe dryness on both feet. He has a callous on his right first toe that usually needs shaving at each office visit. The rash on his toes appears to have a fungal component — we started him on an antifungal cream that also contained Olivamine.

Case Study 4
BS is a 57 year old female who survived a traumatic gun shot wound, but suffered a pelvic fracture and was left paralyzed from the waist down several years ago. She has had multiple recurrent ulcers in the right perivaginal perineal area. She is very involved in her care and takes great measures to decrease any further breakdown while transferring. She has used moisturizers for several years and when the need arises, she uses an antifungal treatment.
References:


4. Elias PM, The epidermal permeability barrier: from the early days at Harvard to emerging concepts, J Invest Dermatol 204:233:36-39


