C

old atmospheric temperatures lead to lower humidity. In such conditions, water is more likely to evaporate from the skin, particularly in individuals with an impaired skin barrier. With the arrival of winter, a discussion of the importance of the skin barrier and how to repair it is appropriate. Notably, cosmeceutical barrier repair products have an important role to play.

The Skin Barrier

Several important functions are served by the skin barrier: preventing transdermal water loss (TEWL), shielding the skin from allergens and irritants, and protecting against infections. This defensive role depends largely on the corneocyte function and the surrounding extracellular matrix (J. Invest. Dermatol. 2005;125:183-200).

The cornified cell envelope that encases the corneocyte is a 10-nm-wide, insoluble layer composed of various highly cross-linked proteins, particularly loricrin, the principal component, and involucrin, desmoplakin, and perilipin (J. Cell Sci. 2001;114:3069-70). The envelope structure is formed via cross-linking by the calcium (Ca2+)—dependent transglutaminase-1 (TG-1) enzyme.

The water barrier function of the skin is largely attributed to the lipids in the extracellular matrix that surrounds the corneocytes (Adv. Lipid Res. 1991;24:1-26). Of note, TEWL is considered insensible water loss (TEWL), which differs from active perspiration. This lipid mixture is composed of approximately 50% ceramides, 25% cholesterol, and 15% free fatty acids (J. Lipid Res. 2007;48:2531-46). Changes in any of these three components of the extracellular matrix can lead to a disruption in skin barrier function.

Ceramides

Ceramides constitute 40% of the lipids in the human stratum corneum (SC) (J. Invest. Dermatol. 1987;88:25-65, but they are not present in significant amounts in the stratum granulosum or basal layer. Consequently, terminal differentiation is likely an important factor in ceramide synthesis. The basic structure of the ceramides consists of a fatty acid covalently bound to a sphingoid base.

In a study conducted by Unilever, ceramide levels were shown to increase in keratinocytes after the exogenous application of sphingoid precursors (specifically teta-acetyl phosphoningo sine or TAPS) (J. Invest. Dermatol. 1996;106:871). In another study by Unilever, TAPS, combined with the fatty acids oleic acid, stearic acid, and stearic/c12:0 stearoyl palmitate, increased ceramide levels (J. Invest. Dermatol. 1996;106:918). In the latter study, researchers found that barrier improvement was improved in patients treated with TAPS, and the improvement was even greater when TAPS was combined with lonicel and juniperic acid. These findings imply that topically applied lipid precursors integrate into ceramide biosynthetic pathways in the epidermis, augmenting SC ceramide levels and thusameliorating barrier integrity. 

Cholesterol

Most cholesterol is synthesized from acetic in cells as the keratinocytes, although basal cells can also absorb cholesterol from the blood. Ceramides are typically metabolized in the epidermis and utilized in the synthesis of ceramides, 25% cholesterol, and 15% fat-soluble substances with high water absorption capacity can attract water from the atmosphere (if atmospheric humidity exceeds 80%) and from the underlying epidermis. Application of a humectant results in a slight swelling of the stratum corneum, yielding the perception of smoother skin with fewer wrinkles. In low-humidity conditions, humectants may actually take water from the deeper epidermis and dermis, resulting in increased skin dryness (J. Biol. Chem. 2002;277:46,616-21), so these ingredients work better when combined with occlusive ingredients.

Glycerin

Glycerin (glycerol) exhibits hygroscopic characteristics closely resembling those of natural moisturizing factor (J. Soc. Cosmet. Chem. 1976;27:65). This allows the stratum corneum to retain high water content even in an arid environment. Glycerol has been shown to play an important role in skin hydration, insofar as glyceroil levels were shown to be associatated with stratum corneum hydration levels (J. Invest. Dermatol. 2005;125:289-93).

Barrier Repair Products

Cosmeceutical ingredients, which are oily compounds often used in cosmetics because of their capacity to dissolve fats, coat the SC and inhibit TEWL. Occlusives also impart an emollient effect.

Petrolatum and mineral oil are two of the best occlusive ingredients available. Used as a skin care product since 1872 and considered one of the optimal moisturizing agents, petrolatum displays a water vapor loss resistance 170 times that of olive oil and is well known for being noncomodegogenic (J. Am. Acad. Dermatol. 1989:20:272-7). By virtue of its long-standing status as the most effective occlusive moisturizing agent, petrolatum is typically thought of as the accepted standard to which other occlusive ingredients are measured (“Dry Skin and Moisturizers,” Boca Raton, Fla.: CRC Press, 2000, p. 251).

Other frequently used occlusive ingredients include beeswax, dimethicone, grapeseed oil, lanolin, paraffin, propylene glycol, soybean oil, and squalene (“Atlas of Cosmetic Dermatology,” New York: Churchill Livingstone, 2003, p. 83). Significantly, occlusives are effective only when they coat the skin; upon removal, TEWL returns to its previous level. Occlusives are typically combined with humectant ingredients in moisturizers.

In 2004, investigators performing a randomized, double-blind, controlled trial observed that mineral oil and extra-virgin coconut oil were as efficacious and safe as aloe vera gel. In such a study, TEWL returns to its level. Occlusives are typically combined with humectant ingredients in moisturizers. Moisturizers,” Baton Roca, Fla.: CRC Press, 2000, p. 217). The high-glycerin products were found to be superior to all the other products tested because they rapidly restored dry skin to normal hydration levels and helped prevent a return to dryness for a longer period than the other formulations, even those containing petrolatum. Of note, glycerin is included in the new Vaseline Intensive Rescue Moisture Locking Lotion and Dove lotion.

Climatic and Endogenous Changes

Cold, low humidity, aging-related changes in hormone levels, and even cholesterol-lowering statin drugs can contribute significantly to dry skin. Therefore, products used last year or even last month might not be ideal today.

When patients plan to travel from a warm-weather climate to colder areas during the winter, I remind them that skin needs 3 days to acclimate and marshal its defensive capacity against cold temperatures. I also suggest that they moisturize on airplanes, where air is very dry, and plan to moisturize more frequently in cold-weather environments.


Regardless of the climatic conditions, for patients with dry skin, I always caution against using foaming cleansers, bubble baths, and bar soap, which denude the epidermis of lipids. Rather, I suggest a cleansing oil such as Shu Uemura or Laura Mercier cleansing oils. CeraVe, Dove, Aveeno, and Cetaphil are appropriate cleansers for moderately dry skin, and cold creams, such as Pond’s and Noxema, are well suited for very dry skin. For non-facial dry and sensitive skin not prone to body acne, a suitable product is Grandma Minnie’s Oil Well Nurturing D0-It-All Oil. Patients with a tendency to get acne should be advised to avoid this product or any other than contains coconut oil.

Finally, I remind patients that the skin and skin barrier can be repaired through diet and dietary supplementation. Specifically, omega-3 fatty acids, borage seed oil, and evening primrose oil may strengthen the skin barrier and ameliorate dryness and itching.

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