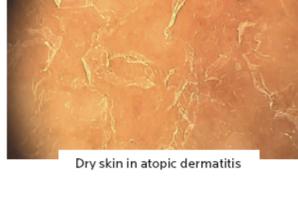


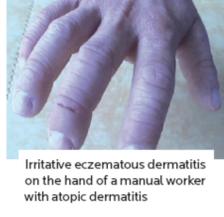
# Dermocosmetics in atopic dermatitis management: hygiene products and emollients

ATOPY FOCUS

Atopic dermatitis is a chronic inflammatory skin disease characterized by a tendency towards dry skin on which eczema patches develop.



Dry skin in atopic dermatitis



Irritative eczematous dermatitis on the hand of a manual worker with atopic dermatitis

It is known that:

- Atopic dermatitis is more prevalent in developed countries than in developing countries
- The prevalence in migrants leaving a developing country (e.g. Africa or the West Indies) to settle in a developed country (e.g. the UK) equals or exceeds that of the indigenous population after a few years
- The prevalence has been steadily increasing for forty years

These observations suggest that several environmental factors are involved in the expression of atopic dermatitis, including microbial factors and factors maintaining or aggravating dry skin.

Management includes two complementary aspects: treatment of eczema flares and dry skin management. Dermocosmetics (hygiene products and emollients) have an essential role because of barrier function anomalies, which appear to be the primum movens of the disease.

## Hygiene products in atopic subjects

Syndet soaps have now surpassed conventional soaps. The chemistry of these products is complex: the washing and cleansing properties are due to the presence of amphiphilic molecules called surfactants<sup>1</sup>. These are formed with a hydrophilic moiety (head) and a hydrophobic apolar moiety (tail). In aqueous media, they form soluble micelles that carry lipid fragments and other debris present on the skin surface.

There are two types of amphiphilic molecules: some are natural (fatty acids of plant origin, such as olive, palm, laurel or coconut oil). These are commonly referred to as soaps. Others are derived from petroleum chemicals (synthetic detergents or syndets). These are long-chain fatty acids with a highly variable composition. They are generally classified according to their polarity.

CLASSIFICATION	
<b>Anionic (negative charge)</b>	Present in soaps in the form of sodium carboxylate (RCOONa) and in most syndets in the form of alkyl sulfates, taurates or sulfosuccinates.  The best known and most widely used are sodium lauryl sulfate (SLS) and its derivative sodium laureth sulfate.  They form the basis of most hygiene products and are characterized by high cleaning efficacy and excellent foaming and wetting properties, but they are irritants.
<b>Cationic (positive charge)</b>	Used more for their antiseptic properties than their detergent properties. The most common are quaternary ammonium salts (cetrimide and benzalkonium chloride). They are especially incorporated into shampoos due to their antistatic and styling powers, and into antiseptics due to their bactericidal properties. They are also irritants.
<b>Amphoteric (positive and negative charge)</b>	Used because of their viscosity-modifying and high foaming properties. The most common are cocamidopropyl betaine, cocoamphoacetate and cocoamphodiacetate. They are mainly incorporated into shampoos and baby-care products. Their widespread use could be explained by their good cleansing and foaming power, moderate antiseptic properties and better tolerance.
<b>Nonionic surfactants (no electric charge)</b>	A heterogeneous class of products: alkyl polyglucosides and sucrose, cocodithanolamide, fatty alcohol esters or sorbitan esters. They are used to increase the viscosity of shampoos and dermocosmetic products. They chelate minerals in water when it is highly calcareous. These products are less irritating for the horny layer, but are also the most expensive.

Most syndets consist of a combination of these different surfactants. They enhance the formulation by providing benefits in terms of texture, foaming power, solubility and rinsing properties. The 'soap-free' label simply means that the product does not contain salts of plant fatty acids (e.g. olive or laurel oil), i.e. only synthetic fatty acids (petroleum extract).

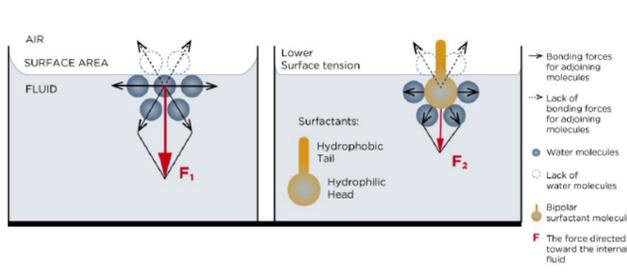
### What about the long-term safety of these products?

Syndets have the same chemical structure as natural soaps – they are amphiphilic. They cleanse the skin and so are somewhat aggressive since they alter the barrier function by solubilizing lipids of the horny layer.

Anionic forms have the same characteristics as natural soap. They have a negatively charged head. They are present in most personal care products and act on the skin surface through two properties:

- By reducing the surface tension and energy. As the surfactant lowers them, the cleansing properties increase and it emulsifies fatty acids to a greater extent (by enclosing them in surface debris);

### EFFECT OF SURFACTANTS ON THE SURFACE TENSION



Source: Karin Broil, Johannes Schott (Didactics of Chemistry, Bayreuth University): Funktionsweise von Tensiden (31.03.2014). online article at <http://daten.didacticchemie.uni-bayreuth.de>

- By their ability to spread over the surface (i.e. wettability). As they increase, the contact angle becomes small to nil, while the cleansing properties increase because they spread more. In return, they solubilize a portion of membrane lipids (especially ceramides) and induce corneocyte cytotoxicity. They denature keratin and cell membrane and collagen fibre turgor. Several studies have shown that the tolerance of syndets depends on their composition.

## Emollients in atopic subjects

The purpose of applying emollients in atopic dermatitis is to improve skin dryness, reduce itching and limit flares<sup>2</sup>. This is an essential part of the treatment.

VARIOUS EMOLLIENTS	
<b>Moisturizers</b>	<ul style="list-style-type: none"> <li>• Based on humectant active ingredients</li> <li>• Maintain a certain degree of hydration in the stratum corneum</li> <li>• Can be readily applied and the subject can get dressed soon after the application</li> </ul>
<b>Semi-occlusive creams</b>	<ul style="list-style-type: none"> <li>• Oil-in-water emulsions (cream type) containing cholesterol, ceramides or fatty acids</li> <li>• Restore the intercellular lipid matrix</li> <li>• Designed for application on moderate dry skin and especially in specific areas such as the face, neck and folds</li> </ul>
<b>Occlusive creams</b>	<ul style="list-style-type: none"> <li>• Water-in-oil emulsions (ointment type) with a rich lipid composition</li> <li>• To be applied only to very dry areas during periods of aggravated skin dryness (winter, excessive hygiene, etc.)</li> <li>• Poor cosmetic acceptability because oily and stains clothing</li> </ul>
<b>Creams containing antipruritic substances (plant extracts, etc.)</b>	<ul style="list-style-type: none"> <li>• For use in small pruriginous areas as a follow-up to topical corticosteroid therapy</li> <li>• But no efficacy and few clinical studies</li> </ul>
<b>Emollients containing anti-inflammatory agents (niacinamide, shea butter)</b>	<ul style="list-style-type: none"> <li>• Sustainable improvement to the skin barrier and dryness</li> <li>• May reduce the use of topical corticosteroids</li> </ul>

## Guidelines for emollient application

Proposals have been put forward for the standardization of atopic dermatitis management in France (SFD, 2005) and for the use of emollients in England (BAD, 2013).

It is essential to first explain to the patient and his/her family:

- The common causes of atopic dermatitis and the importance of treating dryness
- The natural history of atopic dermatitis and its various stages
- The difference between eczematous patches (requiring topical corticosteroid or immunosuppressant therapy) and dry skin (requiring emollient application)
- The application of emollients should reduce the number of flares and the need for topical corticosteroid therapy
- The advantages of prescribing two types of emollient to tailor applications to the site (face, folds, limbs), the importance of considering the extent of dry skin, the time of flares and planned activities (difficulty of wearing clothes over areas treated with oily products)
- The importance of using a sufficient quantity of emollients for regular daily massage (to penetrate the products)



Prurigo and scratch lesions on dry skin of an atopic subject

Applications should be tailored to seasonal variations and the severity of the disorder and flares, while considering the cost of the products and especially prescribing high volumes.

Unsuitable cleansing products containing detergents (and sometimes even sodium lauryl sulfate) should be avoided. They could contribute to altering the barrier function and should never be used to excess.

The onset of tingling or burning in areas where emollients have been applied could reflect sensitization to one of the components (e.g. a plant extract) or an underlying eczema exacerbation requiring the discontinuation of emollients and topical corticosteroid applications for a few days.

## Conclusion

- Impaired skin barrier function and severe dryness are major factors in the pathophysiology of atopic dermatitis. Managing these disorders may reduce the intensity and number of flares and enhance patients' quality of life.

- There are two additional gestures: adopt good daily hygiene and regularly apply emollient care formulated for atopic skin.

- It is essential to moderate hygiene habits, i.e. avoiding excessive hygiene which promotes skin dryness, itching and maintains eczema.

- Emollients are necessary. They have been established as essential adjuvants for successful atopic dermatitis management. Detailed instructions on their use are required.

## Appendix

BARRIER FUNCTION	
<b>In normal subjects<sup>3,4</sup></b>	<b>In atopic subjects<sup>4,7</sup></b>

<p><b>Stratum corneum</b> acts as an important barrier, protecting from physical stress, preventing water loss and protecting from microorganisms invasion.</p> <p>Three types of barrier on the skin surface:</p> <ul style="list-style-type: none"> <li>• Physical protection due to the high adhesion between corneocytes, reinforced by corneodesmosomes and transmembrane proteins. Within corneocytes, the protein filaggrin contributes to hydration and water flux through</li> <li>• Biochemical barrier formed via the accumulation of long-chain lipid bilayers, thereby enhancing the impermeability of intercorneocyte spaces</li> <li>• Bacteriological protection due to the surface release of antimicrobial peptides, including defensins and cathelicidins</li> </ul>	<p>The skin barrier function is disrupted; thus are observed a skin roughness, an increased transepidermal water loss (TEWL), and an increased susceptibility to infection (bacteria, fungi, and viruses).</p> <ul style="list-style-type: none"> <li>• Decrease of the physical protection through an accelerated degradation of corneodesmosomes and a defective filaggrin production due to genetic mutations present in some AD patients</li> <li>• Alteration of the biochemical barrier through the decrease of stratum corneum lipid content, notably multiple ceramides subfractions, and an altered ratio of lipid composition of the stratum corneum intercellular lipid membrane</li> <li>• Decrease of bacteriological protection: the deficiency of the physical and chemical skin barriers enables different environmental factors to penetrate the epidermis, including bacteria. In addition, a kind of selective antimicrobial peptide deficiency leads to a loss of microbial diversity with an overabundance of the <i>Staphylococcus</i> bacterial genus</li> <li>• Structure of ceramides, which are long-chain lipids that provide the basic structure of lipid bilayers</li> </ul>
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HYDROLIPIDIC FILM AND SKIN MICROBIOTA	
<b>In normal subjects</b>	<b>In atopic subjects</b>

<p>The hydrolipidic film is composed of:</p> <ul style="list-style-type: none"> <li>• Water derived from insensible water loss and sweat;</li> <li>• Lipids derived from stratum corneum desquamation;</li> <li>• Free fatty acids and sterols derived from sebaceous secretion.</li> </ul> <p>The surface tension of the skin is high, which slows down the spreading of water drops (contributing to its impermeability) and sweat (contributing to thermoregulation).</p> <p>Normal skin microbiota<sup>8</sup> represents a natural system of resistance to external infections. It is highly rich and varies on different parts of the body. It has been shown that there are 1,000,000/cm<sup>2</sup> of bacteria, currently divided into four classes:</p> <ul style="list-style-type: none"> <li>• <i>Actinobacteria</i> (62%), including <i>propionibacteria</i> and <i>corynebacteria</i>;</li> <li>• <i>Firmicutes</i> (26%), including <i>bacilli</i>, (<i>staphylococci</i>) and <i>Clostridia</i> spp.</li> <li>• <i>Bacteroides</i> (1%);</li> <li>• <i>Proteobacteria</i> (4%).</li> </ul> <p><i>Propionibacteria</i> are found in seborrhic areas, while Gram-negative forms are found in dry areas (forearms and legs).</p>	<p>The hydrolipidic film is damaged or not present. Disorders related to lipid synthesis and hygroscopic factors could explain the low levels of free fatty acids, triglycerides and cholesterol in the surface film. In addition, the natural moisturizing factor composition is altered and the TEWL increase.</p> <p>Lipid anomalies (RL) and irregular protein structures (R) revealed by freeze-fracture in atopic skin.</p> <p>The microbiota differs in terms of its content of:</p> <ul style="list-style-type: none"> <li>• Resident bacteria such as Gram-negative forms (<i>Candida albicans</i>) and <i>Staphylococcus epidermidis</i>;</li> <li>• Transient bacteria such as <i>Staphylococcus aureus</i>, whose proportion increases sharply during flares (from 35% to 90% on eczema plaques).</li> </ul> <p>The presence of <i>Staphylococcus epidermidis</i> is linked to its ability to secrete antimicrobial peptides. It will act as a competitor to hamper <i>Staphylococcus aureus</i> colonization.</p>
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