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Review

Impact of Cosmetics and Cleansers in Atopic Dermatitis—How to Advise Patients

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Abstract

Purpose of Review Atopic dermatitis (AD) or eczema is a frequent chronic inflammatory skin disease. Taking care of the eczematous skin is important to reduce the inflammation and return it to a healthier looking nourished skin. Beyond recommending topical anti-inflammatory drugs and the use of emollients, recommendations on the correct use of other everyday skin products, as cleansers or make-up products, are lacking.
Recent Findings The dry, itchy, and inflamed eczematous skin causes anxiety, poor self-image, low self-esteem, decreased social skills, and an overall decrease in a patients' quality of life. The use of make-up has been shown to ameliorate these impacts. Knowledge on the components of cosmetic products can help suit the products to an eczematous skin. Existing data identifies agents more likely to cause allergic contact dermatitis and shows how to identify cosmetics that follow the principles of "hurdle technology," how rubbing during cleansing is a significant and previously unrecognized exacerbation factor, and how cleansers interact with eczematous skin. An adequate choice of all these products allows a patient to enjoy its benefits, while preserving a healthier skin.
Summary Guiding healthcare professionals on the composition of the cosmetics used, avoiding products with high allergenic properties, identifying products that follow the

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principles of "hurdle technology," and educating patients on the appropriate use of make-up and cleansing products have a positive impact on the care of atopic dermatitis and should be part of a holistic approach to a patient.

Key messages

- Adverse reactions to cosmetics can come from allergic sensitization or irritant stimuli (like the rubbing associated with washing the skin).
- Optimizing the composition of the cosmetics used is essential. Ideally, the patients should distinguish the multiple components of a cosmetic, identifying potential risks.
- Avoid products with high allergenic properties, like fragrances or preservatives. Select products which follow the principles of "hurdle technology": sterile cosmetic technology, good manufacturing practices, appropriate packaging, emulsion form, water activity, and pH control.
- Appropriate use of make-up is important for better care and quality of life of AD patients. Guidance on their use and appropriate cleansing products and techniques are essential to prevent exacerbations.

Introduction: The skin in atopic dermatitis

Atopic dermatitis (AD) is a chronic inflammatory skin disease, characterized by eczematous rashes with age-related morphology and distribution and impairment of the skin barrier function [1]. AD has microscopic changes in the skin, which in turn are responsible for the impairment in skin function and for the hallmark macroscopic manifestations, like the eczematous rashes [2].

The two main functions of a healthy skin are to protect the body from excessive transepidermal water loss (TEWL) as well as to prevent the penetration of compounds into the body [2]. This is achieved by the structure of the stratum corneum (SC), the uppermost layer of the skin's epidermis [2, 3•].

The SC is composed of up to around 25 corneocyte layers in a "brick-and-mortar" structure [2, 3•]. The protein enriched, flattened corneocytes (derived from dead keratinocytes) function as the "bricks," and the lipid-rich matrix is the "mortar" [2, 3•].

The corneocytes are composed of keratin filaments and densely cross-linked proteins—such as filaggrin, loricrin, and involucrin—enveloped by nonpolar lipids, referred to as the lipid envelope [2]. Other components include the natural moisturizing factor (NMF), a metabolite of filaggrin, which also plays an important role in the barrier homeostasis [2].

The intercellular lipid matrix is composed, mainly, by three lipid classes: cholesterol, free fatty acids, and ceramides. They are arranged in a highly ordered, 3-dimensional structure, an orthorhombic crystalline configuration at the top, and a dispersed hexagonal lattice configuration deeper in the epidermis [2, 3•]. This configuration acts as a restrictive barrier to liquid transport, while simultaneously functioning as the main controlled penetration pathway for the diffusion of substances through the skin [2, 3•]. The composition of the SC lipid matrix is dominated by three lipid classes: cholesterol (≈ 25%), free fatty acids (≈ 10–15%), and ceramides (≈ 40–50%) [2, 3•].

These functions and structure are compromised in the skin of AD patients. In AD, we find microscopic changes in the structure of the corneocytes (e.g., filaggrin mutations are found in up to 50% of patients) and in the lipid matrix (Table 1) [2].

These changes exist even in the nonlesional AD skin but are more pronounced in the lesional skin and are at the core of the problems in AD [2]. In any skin, exogenous stressors can impact the protective properties of the normal skin. Due to its changes, the skin in AD is more fragile and more prone to the effect of the stressors. For example, a reduced ingestion of vegetables rich in the essential unsaturated fatty acid linoleic acid further decreases the production of glycosylated acyl-ceramides.

In this paper, we review the mechanisms by which AD patients can exacerbate their eczema with the use of everyday cosmetic products (e.g., cleansing products and make-up), and how it relates with the microscopic structure of AD skin. Additionally, we provide some specific guidance when using these products, optimizing care and satisfaction of AD patients. This paper will not focus on products which aim to treat or prevent atopic skin disease (e.g., emollients and topical anti-inflammatory drugs).

Table 1. Alterations in the stratum corneum found in atopic dermatitis patients in comparison with normal healthy skin

Stratum corneum's matrix parameter	Alteration in atopic dermatitis skin compared to healthy skin
Fatty acids	Increase in short-chain fatty acids and reduction of long-chain fatty acids
	Increased monosaturated fatty acids and decreased hydroxy fatty acids
Ceramides	Increase in short-chain ceramides and reduction of long chain
	Increase in ceramide subclasses AS, AH, AP, ADS, and NS
	Decrease in ceramide subclasses NP, NH, and acyl-ceramides
3-dimensional structure	Increased level of lipids in a hexagonal lattice configuration
	Reduction of conformational ordering
	Reduction in repeat distance of lamellar phases

Ceramide subclasses result of the combinations between fatty acids and sphingosine chains: AS (α-hydroxy-sphingosine base ceramide), AH (α-hydroxy-6-hydroxy-sphingosine base ceramide), AP (α-hydroxy-phytosphingosine base ceramide), ADS (α-hydroxy-dihydrosphingosine base ceramide), NS (non-hydroxy-sphingosine base ceramide), NP (non-hydroxy-phytosphingosine base ceramide), NH (non-hydroxy-6-hydroxy-sphingosine base ceramide)

The risks of cosmetics: From make-up products to cleansers

The European Union's Cosmetic Products Regulation (EC) No. 1223/2009 (CPR) incorporates the following definition of a cosmetic product: A "cosmetic product" means any substance or mixture intended to be placed in contact with the external parts of the human body (epidermis, hair system, nails, lips, and external genital organs) or with the teeth and the mucous membranes of the oral cavity with a view exclusively or mainly to cleaning them, perfuming them, changing their appearance, protecting them, keeping them in good condition, or correcting body odors [4].

The use of cosmetic products is, therefore, ubiquitous. Patients with AD will use some sort of cosmetic product in their daily life, in addition to specific products prescribed by physicians to treat their AD. This is not risk free. Cosmetics are composed of a broad variety of compounds, mainly foreign to our body, that can elicit an adverse cutaneous skin reaction. The cutaneous adverse reactions due to cosmetic contact can be classified into two different groups: allergic or irritant contact dermatitis.

What do regulations determine?

Cosmetic products are not medical devices used for treatment of diseases, such as AD. The "manual of the working group on cosmetic products (sub-group on borderline products) on the scope of application of the cosmetics regulation (EC) No 1223/2009" version 5.2 states that "products presented as having properties to treat or prevent atopy/atopic skin

cannot be qualified as cosmetic products." Cosmetic products can only be presented as "appropriate for/suitable to skins with atopic tendency/atopic skin" [5].

It is important not to automatically assume that cosmetics are dangerous or that they will cause harm. In the European Union, the Scientific Committee on Consumer Safety (SCCS) provides opinions on questions concerning health and safety risks of non-food consumer products (e.g., cosmetic products and their ingredients) and contains relevant information on the different aspects of testing and safety evaluation of cosmetic substances in Europe [6].

These regulations provide a framework from which new amendments to the European Cosmetics Regulation arise with the aim to increase the safety of cosmetic products. The evaluation and conclusion that a specific product is safe to use must be detailed in a Cosmetic Product Safety Report. This evaluation takes into consideration not only the active substance of the product but also preservatives, biocides, and fragrances that may also be present in the final product.

Fragrances have specific regulations. Twenty-six potentially sensitizing fragrance substances have been included in the Commission Regulation (EU) 2019/831 amended Annex III to Regulation (EC) No 1223/2009. More specifically, the presence of these substances must be indicated in the list of substances on the label when their concentrations in the final product exceed 0.001% in leave-on products or 0.01% in rinse-off products (2003/15/EC) [6]. This labeling aims to reduce the incidence of contact-allergic reactions in fragrance-sensitive consumers.

Additionally, a model for dermal sensitization quantitative risk assessment (QRA) was developed and implemented by the International Fragrance Association (IFRA). It included a set of safety factors applied for inter-individual differences, for vehicle effects and for use considerations, to determine an "acceptable exposure level" [7]. The aim is to reduce the risk to consumers of the induction of contact allergy presented by fragrance ingredients in cosmetics.

If induction is prevented, elicitation will not occur. This is important as elicitation thresholds (which depend on the intrinsic potency of the sensitizer and the susceptibility of the exposed individual) are likely to be lower compared to induction thresholds [7]. And this can impact the determination of legally acceptable thresholds.

Finally, the way the product is used will also influence the risk of sensitization. The risk in leave-on products is higher than in rinse-off products for the same concentration [8, 9], which means the same substance can have a higher permitted threshold in rinse-off than in leave-on products, as shown in the above example relating to fragrances.

Allergic contact dermatitis

Allergic contact dermatitis (ACD) is a type 4 or delayed-type hypersensitivity reaction of an individual's immune system to a small molecule or hapten, in a sensitized individual. The risk of developing such a reaction to cosmetics

and make-up has long been known, with data ranging from case reports to large cohorts [10–19].

A report from the Netherlands' Food and Consumer Product Safety Authority registered and evaluated reports of undesirable effects of cosmetic products between 2009 and 2011 [18]. In this report, make-up was one of the most frequently reported agents causing ACD. The most frequently identified agents were isothiazolinones (biocides), fragrances, cocamidopropyl betaine, methyldibromo glutaronitrile, and nickel sulfate.

With respect to cocamidopropyl betaine specifically, it is important to point out that recent reports suggest that impurities that arise during the manufacturing process can have sensitizing effects [20, 21].

An Italian study reviewed 283 cosmetics collected from various shops and divided them into three categories: rinse-off, leave-on, and make-up [19]. Of the 68 analyzed make-up products, 26.5% contained fragrances, 32.4 contained preservatives, and 64.7% contained other chemicals of concern.

Different products for different uses have a different list of potential allergens. Cleansers and make-up removers, for example, have three different categories of allergens (Table 2) [22]:

Even though cosmetics are often saturated with well-known allergenic substances, it is important to point out that the composition of these products evolves rapidly, and "old" allergens can be substituted by "new" allergens. Awareness of the risk is essential when evaluating the use of cosmetics in AD. An example of this is with preservatives.

Preservatives are antimicrobial chemicals added to cosmetics to protect them against microbial spoilage and prolong the shelf life of the product [23]. In recent years, there has been a growing consumer concern regarding the presence of preservatives in cosmetics, coupled with a shift in interest in the development of preservative-free cosmetics [23]. In these self-preserving formulations, traditional preservatives have been replaced by other cosmetic

Table 2. Potential allergens that can be found in cleansers and make-up removers

Allergen	Examples
Fragrances	Any fragrance or fragrance-related components
Surfactants	Cocamidopropyl betaine Cocamide diethanolamine Decyl glucoside Dimethylaminopropylamine Oleamidopropyl dimethylamine
Preservatives	Dimethylol-dimethyl (DMDM) hydantoin Diazolidinyl urea Formaldehyde Iodopropynyl butylcarbamate Imidazolidinyl urea Isothiazolinones Quaternium-15

ingredients with antimicrobial properties (as part of a strategy known as "hurdle technology") [23]. Importantly, these ingredients are not listed in Annex VI of the 7th amendment of the Cosmetic Directive and, as such, are not recognized as preservatives by the European Scientific Committee [23].

The "hurdle technology"—aimed at creating a hostile environment in the cosmetic product which inhibits or kills microbial growth, thus preserving the product—encompasses other principles, which help reduce the need for these agents: good manufacturing practices, appropriate packaging, emulsion form, water activity, and pH control.

Consequently, ingredients such as alcohols, essential oils, extracts, and surfactants—which are used for their other beneficial effects on the skin, but who also have antimicrobial properties—can be used to help preserve the cosmetic formulations and are not listed as preservatives [23]. However, this does not mean they are risk-free when it comes to the risk of sensitization. Table 3 lists some of these agents [23]:

In the event of a suspected allergic reaction, referral for patch testing is important. A correct evaluation of the new preservative-free cosmetics will uncover new allergens and allow for new updates of the European Baseline Series [24•].

Whatever the compounds a cosmetic may have, the risk of developing contact sensitization to these compounds is dependent on how damaged the skin is. In AD's lesional skin, the skin barrier is more profoundly disrupted. This means it can be drier and scaly or with ulcers and exudative. The severe disruption of the skin barrier allows for the unhampered penetration of multiple compounds, increasing the risk of sensitization [25]. This is supported by studies such as the one by Jakasa et al., which looked at the penetration of 1% sodium lauryl sulfate in the skin of 20 patients with AD and 20 healthy controls [26]. The diffusivity of the sodium laurel sulfate was higher in the lesional skin of AD patients than in the nonlesional skin of AD patients. It was also higher in the nonlesional skin of AD patients than in the skin of healthy controls.

In the lesional AD skin, make-up should be avoided due to the aforementioned risk, and also because the lesions make it a poor base on which to apply make-up. In the nonlesional skin, tolerance for make-up is higher. However, the risk of sensitization is still high [26]. And leave-on cosmetics, like make-up, can additionally worsen skin symptoms due to irritant mechanisms [27•].

Irritant contact dermatitis (IDC)

Irritant contact dermatitis (ICD) is a non-immunologic inflammatory reaction caused by direct contact with a wide range of irritants, whether of a physical, chemical, or mechanical nature, resulting in skin damage [28].

In AD patients, the more fragile nonlesional skin and the acutely inflamed lesional skin have a lower threshold for irritancy than the normal skin. The skin becomes sensitive, reactive, and intolerant to abrasive

Table 3. List of cosmetic substances with antimicrobial activity, not classified as preservatives on Annex VI of the 7th amendment of the Cosmetic Directive

Multifunctional antimicrobial ingredients	Examples
Middle chain polar compounds	Caprylyl glycol Ethylhexylglycerin Fatty acids and their monoesters (i.e., heptanoic acid, caprylic acid, capric acid, and lauric acid) Phenethyl alcohol
Chelating agents	EDTA Lactic acid Citric acid Phytic acid
Phenolic antioxidants	Propyl gallate Caffeic acid Coumaric acid Ferulic acid
Plant-derived essential oils and extracts	*Origanum vulgare* *Thymus vulgaris* *Rosmarinus officinalis* *Lavandula officinalis* *Cinnamomum zeylanicum* *Hydrastis canadensis* *Artemisia afra* *Pteronia incana* *Calamintha officinalis* *Lonicera caprifolium* *Lonicera japonica* *Melaleuca alternifólia* Chitosan (extracted from the shells of mollusks) *Inula helenium* Totarol (*Podocarpus nagi*) Usnic acid (extracted from lichen species)
Fragrances	Benzyl acetate Phenethyl alcohol Linalool p-Anisic acid Levulinic acid

physical stimuli, or any chemical with certain physical properties prone to irritate (even if a healthy skin would tolerate it).

The application of make-up and the specificities regarding cleansers are rarely mentioned when treating AD patients. Given the need to clean their skin daily and the importance that make-up can have on their quality of life, knowledge about these factors is important [29].

Make-up and atopic dermatitis: the importance of cosmetic camouflage

Considering the risks of ACD and ICD, why then contemplate the use of make-up in AD, and not ban it outright?

In many skin diseases, the disfigurement the lesions cause on the skin is a source of psychological stress on patients. In atopic dermatitis, on top of that, the discomfort and messiness caused by eczematous skin lesions worsen the psychological impact. Several studies show how AD causes anxiety, poor self-image, low self-esteem, decreased social skills, and an overall decrease in a patients' quality of life [30–32].

The use of cosmetics and make-up to disguise imperfections and improve good looks is practically ubiquitous in our society. In skin diseases, it has a special relevance in concealing skin lesions and imperfections, a procedure referred to as "skin camouflage" or "cosmetic camouflage" [33, 34].

In AD, the lesions can be quite extensive and the desire to hide them and boost one's self-esteem and self-perception can be great. In AD specifically, a Japanese study evaluated 21 women with AD to whom make-up guidance was given and the psychological effects evaluated [29]. The results are striking. The psychological improvement was noted by several measures: (1) the General Health Questionnaire 30 to assess psychological distress showed a reduction from a mean of 6.52 to 5.32; (2) the State-Trait Anxiety Inventory score showed a reduction of the state anxiety from a mean of 42.1 to 32.7, and of the trait anxiety from a mean of 45.1 to 41.6; (3) the change of the satisfaction for make-up, using a VAS score, showed an increased in cosmetic satisfaction from a mean of 36.8 to 97.1 mm and remained high at 74.5 mm after 6 to 12 weeks.

These results suggest that make-up application can alleviate anxiety and tension and improve the quality of life of female patients with AD [29]. A correct guidance to patients as part of the recommendations given by physicians to these patients can significantly help improve the quality of life.

Rubbing, the hidden exacerbator

Make-up cosmetics are usually difficult to remove with ordinary cleansers because they consist of solid and oily substances that need the physical force of rubbing the skin to disperse/dissolve them and rinse them off. The force used to rub the skin to remove make-up cosmetics is a crucial factor for cleansers [27•].

This rubbing of the skin also causes irritation and barrier distress and worsens skin symptoms (even if patients do not think that the force they use to rub and cleanse their skin is hard enough to do so) [27•]. On a healthy skin, rubbing the skin can cause a mild stimulation with little effect. In AD, that is not the case.

In a study by Hosokawa et al., four different cleansers were tested in AD patients against a control cleanser [27•]. They showed that some cleansers could not adequately remove the make-up. Moreover, those which did required rubbing the skin about 100 times to do so [27•]. This abrasiveness correlated with the presence of pruritus, redness, and skin irritation [27•]. A comparison between cleansers the patients normally used and a test cleanser,

which showed a higher capacity for make-up removal requiring less rubbing force and rubbing times, showed benefit in skin symptoms and reduced the number of skin lesions. Also, when comparing the cleansers the patients normally used with the test cleanser – which showed a higher capacity for make-up removal requiring less rubbing force and rubbing times – The use of the test cleanser had a beneficial effect on skin symptoms and reduced the number of skin lesions. This occurred solely with the change of the cleanser, with no other changes in the use of other skin care products and cosmetics. Accompanying the improvement of skin symptoms, the moisture-retention ability and TEWL values also improved significantly [27•].

Cleansers

When referring to cleansers, the term soap is often used interchangeably. However, this is incorrect as soap refers to an end-product of when a fat interacts with an alkali resulting in a fatty acid salt with detergent properties (an anionic surfactant) [35].

Cleansers are designed to remove unwanted dirt, sweat, sebum, and oils from the skin [3•, 36]. As most of the impurities and contaminants are not water-soluble, using water alone is inadequate, and there is a need for surfactant-containing products [3•]. However, the use of harsh surfactants damages the skin barrier. The extent of the damage depends on the characteristics of the surfactants and the cleansing conditions (water temperature, rubbing force, etc.) [36].

Surfactants can bind to SC proteins, leading to transient swelling and hyper-hydration during the washing period. This is followed by de-swelling while the water evaporates [36]. The resulting enhanced barrier permeability leads to skin dryness, roughness, cracking, and inflammation and causes the skin to reach a state of lower hydration than before the wash [36]. In addition, surfactants lead to a reduction/removal of several important components of the SC, like the natural moisturizing factor (NMF) [36].

Surfactants can damage the skin in a variety of ways. They can cause protein denaturation/damage due to the charge density of protein-bound surfactant aggregates. This explains why the more anionic the surfactant, the higher the lesional potential. The order for the irritation lesional is anionic surfactants > amphoteric surfactants > non-ionic surfactants (Table 4) [36]:

Another factor which relates to protein damage is the surfactant's head-group size, for a given chain length. The larger the head-group size, the lower its tendency to cause protein swelling. Therefore, ethoxylated alkyl sulfates tend to bind less to keratin than the corresponding alkyl sulfates [36].

Surfactants can also cause damage to the intercellular lipid matrix, by solubilizing lipids in surfactant micelles. Lipid damage is also caused by the adsorption and intercalation of surfactants into SC lipid bilayers. Here too, the higher the anionic charge of the surfactant, the higher the lesional potential [36].

Another factor that contributes to skin damage is the cleanser's pH. Soap-based cleansers are alkaline (pH 9–10), while the pH of most syndets (synthetic surfactant-based cleansers) is close to neutral or slightly acidic (pH 5.5–7). SC swelling and lipid damage can exist solely in response to the difference in pH in the absence of surfactants [36].

Table 4. Classification of surfactants

Surfactant type	Examples
Anionic surfactants	Sodium laurate Sodium lauryl sulfate Monoalkyl phosphate Sodium cocoyl isethionate
Amphoteric surfactant	Cocamidopropyl betaine Cocoamphoacetate Cocoamphodiacetate
Non-ionic surfactants or "syndets" (synthetic detergent/surfactant)	Alkyl ether sulfate Alkyl acyl isethionates Alkyl phosphates Alkyl sulfosuccinates Alkyl sulfonates Alkyl taurates Alkyl glutamates (amino acid–based surfactant) Alkyl sarcosinates (amino acid–based surfactant) Alkyl glycinates (amino acid–based surfactant)

In summary, lesional potential can come from inherent structural and charge-density differences the cleansers and the direct effects of pH [36].

The aggressiveness of charged surfactants can be mitigated by reducing the concentration of the surfactant's monomer species, by reducing the anionic charge with the incorporation of various counterions and/or cosurfactants to form mixed micelles, and by introducing ethoxylation. Another way of reducing the deleterious effect of surfactants is the inclusion of emollients in the cleanser. Many liquid cleansers currently available contain vegetable oils such as sunflower or soybean, occlusives such as petrolatum, and humectants such as glycerol [36].

On this basis, many different types of cleansers have been developed, for different skin types and objectives. They are expertly summarized by Zoe Draelos in a table, which we reproduce in Table 5 [35]:

How to best advise patients with AD?

There are no universally safe products. While therapeutic guidelines for the management of atopic dermatitis exist, there is a lack of practical recommendations on the importance of cleansing and use of make-up. Limited patient knowledge of the skin condition, inadequate time for patient education during consultations, and the wide range of over-the-counter skin care products and cosmetic products with different compositions are overwhelming for patients and hinder appropriate product selection [29].

Table 5. Cleanser classification according to mechanism of action and suitability according to skin type and function

Cleanser	Mechanism of action	Skin type suitability	Characteristics
Bar soap	Emulsification	Oily	Excellent sebum and skin soil removal
Syndet bar	Emulsification	Normal to oily	Reduced skin barrier damage
Antibacterial bar	Emulsification	Normal to oily	Decreases colonization of bacteria
Syndet liquid	Emulsification	Normal to dry	Reduced skin barrier damage
Cold cream	Dissolution	Dry	Poor sebum removal, excellent for facial cosmetic removal, leaves behind moisturizing film
Cleansing milk	Dissolution	Normal to dry	Excellent facial cleanser for diseased skin
Cleansing oil	Dissolution	Dry	Poor sebum removal, excellent for very dry skin and excellent for waterproof sunscreen removal
Cleansing balm	Dissolution	Dry	Poor sebum removal, excellent for waterproof cosmetic removal, may need to follow with a liquid syndet cleanser
Micellar water	Emulsification	All	Excellent for facial cosmetic removal
Nonfoaming cleanser	Emulsification	Normal to dry	Useful cleanser in diseased skin
Cleansing scrub	Emulsification and physical skin and dirt removal	Oily	Particulate can produce aggressive pore cleansing and exfoliation
Cleansing cloth	Emulsification and physical skin and dirt removal	All	Cloth weave can vary cleansing characteristics from mild open weave to aggressive closed weave
Medicated cleanser	Dissolution	Oily, acne prone	Drug may contribute to acne treatment

Adapted from Draelos ZD. The science behind skin care: Cleansers. J Cosmet Dermatol. 2018 Feb;17(1):8–14, courtesy of John Wiley & Sons, Inc. [ref. 35]

Ideally, patients should leave their physician able to distinguish the multiple components of a cosmetic and identifying potential risks. This is not easy.

Recently, an expert panel developed consensus statements on holistic skin care, including atopic skin, with the following consensus recommendations on cleansing [37]:

- Cleansers should effectively and gently remove the dirt and excessive lipids; should not irritate, or dry the skin; and should help to absorb topical medications.
- Once to twice daily, short lukewarm water baths, followed by immediate application of moisturizes are recommended for AD patients.
- Cleansers with neutral to acidic pH, compatible with normal skin, are recommended in atopic dermatitis.
- Synthetic detergents, which have less than 10% soap, are less irritating and drying to the skin and are suitable for patients with sensitive skin.
- Cleansers should be non-comedogenic, non-acnegenic, non-allergenic, non-irritating, and compatible with patients' skin type.

To these recommendations, we can add the following:

- Avoid products with high allergenic properties, like fragrances or preservatives e.g., thiazolinones. Choosing products with sterile cosmetic technology (one of the principles of the "hurdle technology") is ideal to avoid the presence of preservatives. And a correct packaging avoids product contamination [23].

As for the use of make-up specifically, we can make the following recommendations:

- Clean the skin and apply the emollient. Use moisturizers with hyaluronic acid, which hold moisture against the skin without being irritating.
- Avoid applying make-up in areas with active lesions, especially if there are open wounds or exudative lesions.
- Use a fluid foundation corrector.
- Try color-correcting concealer. Green is opposite to red on the color wheel, which means that they are complementary colors. Essentially complementary colors cancel each other out, so in make-up terms, green will be able to help conceal red.
- To set your make-up and mattify the skin, use a translucent mosaic powder. In case of severe eczema, skip the powder as it may dry out the skin and thus increase itching.
- For the eyelids, use a serum or cream suitable for sensitive eyes and skin. Avoid products with vitamin K for its risk of sensitization.
- To enhance the mouth, in case of dry lips, apply lip balm as a base, and for a more natural look, apply a lip cream instead of a gloss.
- To remove the make-up, use an appropriate cleanser. Cleansers are basically water-in-oil (W/O) or oil-in-water (O/W) emulsions. O/W emulsions are less viscous compared to W/O emulsions, which have an oil content between 15 and 30% [14]. A higher oil content increases the greasiness of the cleanser but retains more moisture in the skin and is more effective in removing the solid and oily components of the make-up [14]. Therefore, in patients with eczema and make-up, the use of a make-up remover with high oil content is beneficial. Only if needed, a second mild cleanser can be used to help remove the excess oil left by the first one.

- Even if the label states that it is a "no-rinse," the product should be rinsed off with water. Use your fingers to remove make-up. This is less irritating on the skin than rubbing it with a cotton pad.
- Always reapply moisturizer after cleaning the skin.

Conclusion

AD is a burdensome disease. It can impose several limitations to patients' daily life and impact on patients' quality of life. A complete ban of cosmetics for all AD patients is not feasible, and the use of some products, as make-up, can have beneficial effects on psychological aspects of the disease.

A good understanding of cosmetic chemistry and guidance in the use of cosmetics is an important part of the treatment of AD patients and allows for a better care and satisfaction of AD patients.

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