

Extinguishing the flames – anti-inflammatory active agents

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If we speak of anti-inflammatory active agents in the cosmetic field, we predominantly deal with a prevention of local irritations caused by contact with everyday substances, micro-organisms or by mechanical stress or micro lesions. Accordingly, it is not a matter of a therapeutic use of active agents to treat the neurodermitic skin, serious acne vulgaris or acute psoriasis. Nevertheless, also in cases of a disposition to inflammatory skin reactions it is important to select the adequate skin care.

Most common cause for inflammatory processes is a disturbed and porous skin barrier:

- Foreign substances in workplace and environment easily penetrate into the skin and can trigger irritations and allergies.
- Microorganisms such as bacteria, fungi and viruses find their way into the epidermis and lead to infections.
- Dry skin, low in melanin and with disturbed NMF (Natural Moisturizing Factor) is the perfect condition for sun erythema, even with moderate intensity of radiation.
- Mechanical stress, for instance of hands, will cause cracks in an already disturbed skin barrier. Subsequently, rhagades may develop which then will poorly heal.
- Dry skin frequently is accompanied by itching. The persons affected consequently will start to scratch. Painful open sores will be the consequence.
- Hard water will further damage an already disturbed skin barrier through its hardness minerals (calcium, magnesium).

Inflammatory processes can largely be prevented by following some simple rules and by providing for an adequate care of the skin barrier:

- Use barrier creams with lipids that are related to the natural physiology and physical structure of the skin.
- Support the natural moisturizing factor of a dry skin by applying amino acids, urea and glycerin. Most of the radicals affecting the skin via air and radiation will thus be neutralized. Urea has anti-itching effects.
- Avoid tight and chafing clothes.
- Protect a melanin-low skin by wearing appropriate clothing and sun screens.

- Use skin care creams and wear gloves to minimize skin damages caused by mechanical stress in workplace and during leisure.
- Avoid aggressive tensides for skin and body cleansing. Warm and, if possible, soft water often is sufficient and will spare the skin barrier.
- Carefully check the ingredients of cosmetics (INCI) but also the composition of household products if prone to allergies. House paints and priming materials for instance contain preservatives with a high allergy potential.
- Avoid perfumes containing degradable components which are a common source for allergies. Sometimes the irritating and allergenic substances only develop after their reaction with atmospheric oxygen. Examples here are oxides of abietic acid (colophony) and the oxidized components of tea tree oil.

Apart from that, there are many active agents that can impede or influence inflammatory processes:

Germicides

Antiseptics are topical substances administered in the context of medical treatments. Examples are iodine tinctures and silver compounds. Disinfectants such as chlorine, hydrogen peroxide and high-proof alcohol are used to reduce the germs on surfaces, in water or other materials. Preservatives ensure the product safety of mostly aqueous pharmaceuticals and cosmetics. There also are substances with multiple applications; typical representatives are polyhexanide (PHMB) and triclosan which are used as antiseptics, disinfectants and cosmetic preservatives. With regard to preservatives, the European Union Cosmetics Directive specifies the maximum

permissible dose so that cosmetics equipped with these substances usually have a minor influence on skin infections.

An objectively present effect as in the case of the antimycotic clotrimazole cannot be used for cosmetic sales promotions though. The marketing message in this case is restricted to antidandruff effects although an influence on athlete's foot and vaginal mycosis would be found on condition that adequate formulations and measurements are applied.

Hexamethylentetramine (INCI: Methenamine) has antimicrobial and antiseptic effects due to the formation of formaldehyde in the acidic conditions of the skin.

A substance with strong antiseptic effects is aluminium chloride, the main component of deodorant products. In the cosmetic context only its antiperspirant effect may be emphasized. Zinc compounds (zinc oxide, water-soluble zinc salts) and copper salts also have antimicrobial effects. Zinc salts such as zinc gluconate are ingredients of acne preparations. This also applies for azelaic acid: in cosmetic preparations it is licensed in concentrations of up to 1 % and, liposomally encapsulated it is an excellent skin care substance for the above-mentioned indication. In the case of acne vulgaris, nicotinamide (vitamin B₃) shows anti-inflammatory effects which are comparable to those of clindamycin.^{1 2}

Antimicrobial effects have been ascribed to a multitude of other substances. It should be kept in mind, however, that sometimes the results of in-vitro studies are circulated and that information from folk medicine articles is extrapolated while substantiate measurements still wait to be implemented in this context.

Radical scavengers

Oxygen containing degradation products from essential oils can trigger allergy-related inflammations as already mentioned above. This can be avoided with antioxidants that neutralize the triggering radicals. UV filter already impede the formation of erythema-triggering radicals by transforming the radiation energy of the sun light into heat. An excellent protection against radicals in general is the natural moisturizing factor (NMF) of the skin that can be

supported by a topical application of amino acids and urea. Polyphenols from extracts of green tea, red clover, soy bean or grape seed extract or from other herbal sources also are beneficial in eliminating exogenous and endogenous radicals. Last but not least also classic substances such as vitamin C and vitamin E should be mentioned.

Against the itching

The anti-itching effect of urea (carbonic acid diamide) and allantoin (cyclic amide) can be extrapolated to a multitude of other, above all, organic amides and peptides. Examples in this context are the ceramides that occur in the skin barrier and the fatty acid ethanalamides such as palmitic acid monoethanolamide which belong to the endogenous cannabinoids. These substances indirectly help avoiding inflammatory reactions of the skin by eliminating scratching which certainly causes infections. In the dermatological context, polidocanol (INN) is administered as a local anaesthetic to treat itching and neurodermatitis; it reduces the experience of pain of the skin. The substance belongs to the polyethylene glycols (PEG) and is known under the term laureth-9 (INCI) in the cosmetic field. The German Federal Institute of Risk Assessment (BfR, 2003) however considers skin care preparations with this specific ingredient as hazardous to the health.

Astringents

Astringents are substances that react with proteins and have contracting functions. They frequently have antibacterial and anti-itching effects and hence are beneficial against cracked skin. Gallic acid and its esters as well as the tannins (polyphenolic gallic acid esters) belong to this substance group. Typical representatives are witch hazel and birch and oak bark extracts. Other herbal extracts such as green tea extract (contains epigallocatechin gallate) and sage extract also have astringent effects. They are frequently added to deodorants. This also applies for astringent aluminium salts such as the above-mentioned aluminium chloride.

Influencing the cell metabolism

Boswellia acids gained from frankincense inhibit the 5-lipoxygenase which is responsible for the inflammatory cascade. 5-lipoxygenase is a key enzyme that oxidizes the natural arachidonic acid of the body into 5-hydroperoxyeicosatetraenoic acid (5-HPETE), which subsequently leads to the formation of the pro-in-

¹ Shalita AR, Smith JG, Parish LC, Sofman MS, Chalker DK, Topical nicotinamide compared with clindamycin gel in the treatment of inflammatory acne vulgaris, *Int J Dermatol.* 1995 Jun;34(6):434-7

² Khodaeini E et al., Topical 4% nicotinamide vs. 1% clindamycin in moderate inflammatory acne vulgaris, *Int J. Dermatol* 2013;52:999-1004

flammatory leukotriens LTA₄, LTB₄, LTC₄, LTD₄ and LTE₄. Skin care preparations with boswellia are indicated for persons with a disposition to acne vulgaris, actinic keratosis, psoriasis and neurodermatitis.

The 15-lipoxygenase in the epidermis transforms topically applied omega-3 acids such as e.g. alpha-linolenic acid which occurs in bound form in linseed oil, kiwi oil and rose hip seed oil, and eicosapentaenoic acid (component of fish oil) as well as omega-6 acids such as linoleic acid and gamma linolenic acid into anti-inflammatory acids. Natural oils with a high content of bound essential fatty acids hence are highly beneficial for the skin care. They are applied in the evening due to their sensitivity to light and atmospheric oxygen.

Anti-inflammatory herbal extracts

Besides the defined substances which influence the inflammatory processes in some form or another, there is a multitude of natural extracts with anti-inflammatory effects that are based on the interaction of several different components (synergy effect). Examples in this context are extracts from calendula, ribwort (also called buckhorn, ribgrass etc.), mahonia, chamomile, aloe vera, willow bark, echinacea and arnica (also called leopard's bane, mountain arnica, wolf's bane). By taking the example of arnica, it can be explained that the tolerance to herbal extracts is individually different. Besides the wound-healing effects also adverse effects such as arnica allergy, dermatitis and eczema may appear.

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