

Inflammaging – the role of adequate skin care

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Various causes are responsible for the human skin aging process. Research still remains to be done in order to clarify all the mechanisms involved in the highly complex interactions. A very recent research approach focuses on the so-called inflammaging or in other words the age-related inflammation of the skin.

The demographic development of the age structure of our society shows that the human life expectancy has been increasing over time while the mortality risk decreases. [1] With reference to evolution it is not so long ago that humans started to live longer than 40 years. By improving the health care system, nutrition and hygiene, life expectancy has continuously increased during the past 100 years. [2]

Immune system

An intact immune system is of vital importance for human health and longevity. The immune system comprises various organs, types of cells and also proteins and is a highly complex mechanism. It is differentiated between primary (central) and secondary (peripheral) lymphatic organs. In the first mentioned with the bone marrow and the thymus gland, the B- and T lymphocytes come to maturity and differentiation. In the latter mentioned with the lymphatic nodes as their most popular representatives, the immunological reaction and proliferation of defence cells occurs.

The immune system is divided into innate (unspecific) and acquired (specific) immune responses. The innate immune response is the first defence reaction to the penetration of harmful substances such as pathogenic germs, exogenous proteins and inert substances (antigens). Via macrophage migration and the formation of cytokines they are inactivated on the cellular and humoral level.

The acquired immune response is a learned reaction and only directed against specific pathogens. Mainly responsible for this process are T- and B lymphocytes. Also macrophages participate in this activity just as in the unspecific immune response. [3] In the skin, the Langerhans cells are responsible for the presentation of penetrated antigens to the T lymphocytes. The Langerhans cells reside in the stratum spinosum and migrate into the lymph nodes where they trigger the immune response. [4]

Contribution of the thymus

As the primary lymphatic organ the thymus gland differentiates the T lymphocytes. It can be called the “school” of immune cells. Here the binding affinity is trained with which the T cells dock onto the surface proteins of cells. [5] That way it is impeded that the own cells of the body are attacked and autoimmune diseases develop. [6] Thymus starts its activity already in the prenatal stage and reaches its maximum weight during puberty. After puberty the thymus gland reduces in size and at the age of 50 only a small remnant of the organ is traceable in the form of a fat body with low residual activity. [7]

Immune aging

Along with the reduced activity of the thymus gland the immune aging process (immuno-senescence) starts in the body. Consequences are a gradual impairment of the immune system with alterations in the cytokine release as well as quantitative and qualitative changes of different immune cells. Cytokines are proteins with messenger functions. They control the immune reactions and significantly participate in their success or failure. The release of cytokines is increased in aged (senescent) cells. [2, 8]

Inflammaging

The term inflammaging is coined from the two words inflammation and aging. Inflammaging is the underlying cause for an age-related higher incidence of human diseases such as osteoporosis, arteriosclerosis, arthritis, as well as a concomitant susceptibility to infections. [8] Consequences may vary and depend on the individual person.

The down regulation of the immune system has an impact on the skin cells. The number of aged skin cells increases. Due to the augmented production of pro-inflammatory substances a low-level inflammation of the skin appears which is accompanied by increased oxidative stress in the epidermal structures.

Oxidative stress means that excess ROS (reactive oxygen species) are present. Radicals of the ROS trigger lipid peroxidation. Thus skin-irritating chain reactions are induced. Collagen and elastin are enzymatically hydrolysed through matrix metalloproteinases (MMP). The expression in the skin is increased due to radical- and cytokine formation. [9, 10, 11].

The related aging processes in the skin can be appropriately treated with skin care preparations based on a modular concept that allows individually adapted formulations consisting of base components (creams, gels, lotions) and active agent concentrates (sera).

Skin care

Above all the preparations based on physiological phospholipids are successful skin care formulations. **Hydrogenated phosphatidylcholine** forms lamellar structures in analogy to the lipids of the skin and hence is applied in the case of skin barrier disorders. Lamellar creams can be individually adapted with active agent concentrates.

To protect the skin against harmful oxidative influences liposomally encapsulated sodium ascorbyl phosphate (INCI) has proved as a successful remedy. In the skin the vitamin C derivative is enzymatically hydrolysed and thus transferred into its active form. **Vitamin C** participates in the collagen synthesis and serves as a powerful antioxidant. [12]

Another barrier-protective agent is **epigallocatechin gallate (EGCG)** which occurs in green tea. It also has antioxidative and anti-inflammatory effects. EGCG controls the proteinkinase inhibitor p57 that is responsible for the formation of keratin and filaggrin. With increasing filaggrin level also the skin thickness increases. [13] **Boswellic acids** gained from frankincense inhibit the expression of the above mentioned metalloproteinases. It is advantageous when the acids are encapsulated. Dispersions based on native phosphatidylcholine provide for high bioavailability. [14]

Essential fatty acids can be administered for anti-inflammatory effects. The epidermal lipoxygenase (15-LOX) to some extent induces the oxidation of ω -3- and ω -6 fatty acids such as α -linolenic acid, linoleic acid and γ -linolenic acid into unsaturated hydroxy fatty acids that also have anti-inflammatory effects. [14, 15] **Kiwi seed oil** is particularly rich in unsaturated ω -3 fatty acids. **Evening primrose oil** has a high content of γ -linolenic acid. Both oils are administered in the case of irritated skin.

Phosphatidylserine activates the immune system and induces anti-inflammatory processes. In lipid formulations the phospholipid

integrates into the skin without leaving an unpleasant oily film. [15]

Supportive measures

Studies prove that moderate and regular endurance training strengthens the immune system. [16] In combination with a balanced and varied nutrition it can help prevent inflammaging processes.

Conclusion

Preventing the inflammaging symptoms is a significant element in the antiaging skin care. The use of modular skin care systems can be a significant tool in the individual treatment of inflammaging symptoms of the skin. Lamellar preparations enriched with vesicular active agent concentrates are state-of the art formulations in dermatological cosmetics.

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