

Repairing the barrier – on active agents and active agent systems to support the skin regeneration

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For a long time, the term skin regeneration has been used with reserve only since it insinuates a healing effect that legally is not allowed for advertising purposes. In the final analysis, the term “regeneration” originates from medicine and resumes, in a nutshell, the regenerating cell biological processes.

Repairing the skin or the support of regenerative processes is as old as cosmetics itself.

- **Decorative cosmetics** show how we visualize a regeneration of the skin.
- **Skin-caring cosmetics** with active agents contribute to the regenerative process.
- **Cosmeceuticals** trigger off physiological-biochemical processes.
- **Instrument-based treatments** such as ultrasound & Co. accelerate the reactions in the epidermis.
- **Aesthetic medical treatments** comprise dermaroller, laser and hormone treatments.

The present survey focuses on skin-caring cosmetics and cosmeceuticals. Instrument-based procedures only are mentioned if useful in the context of cosmetic preparations.

At the outset there is damage...

Regeneration implies damage – such as a sun burn or a prematurely aged skin due to behavioural, environmental or cultural influences. As a matter of fact, prevention would have been the better alternative in all these cases. On closer examination though, it can be stated that a number of preventive measures also are appropriate tools for damage containment.

A further rationale is that the skin more or less acts like a bank account. This means that “minor overdrafts” can be counterbalanced, “larger amounts” have to be dearly paid or even require the “oath of disclosure” – the damages then are irreversible. Now, skin damages will not develop all of a sudden but sneak in their way and subtly accumulate. Best example for such a process is the aging of the skin. It should also be mentioned that the skin will not forget a single thing similar to our memory.

What can be done though? First of all, it is appropriate to consider the skin barrier that protects epidermis and body. Barrier damages frequently are responsible for many subjacent problems.

Barrier disorders

Already dry skin ranks among barrier disorders. The barrier layers consisting of cholesterol, fatty acids and ceramides are porous or incomplete. The Natural Moisturizing Factor (NMF) comprised of salts, urea, glycerin and amino acids, is damaged. Hence, moisture can evaporate in the form of water vapour. Vice versa, occupational or environmental substances as well as microorganisms can penetrate from the outside and trigger various unwanted effects in the epidermis such as e.g. redness, irritations, mycoses and bacterial infections. Professor Albert Kligman could prove how atopic (neurodermitic) skin that is prone to extreme barrier disorders shows a clinically significant improvement after being treated with adequate physiological moisturizing substances that support the NMF. This also applies for lipids that correspond to the natural structure of the skin. He called this particular type of treatment corneotherapy or also “outside-in” strategy.

Other studies could prove that the stratum corneum is the initial point for various signals that control significant functions in the living epidermis. This leads to the conclusion that the particular care of the horny layer indirectly but nonetheless substantially influences the regenerative processes in the deeper skin layers which in turn have an effect on the condition of the stratum corneum.

Peelings & Co

The signals emitted by the stratum corneum can be macroscopically observed on the basis

of two simple examples – even without being scientist.

- Plasters and abundantly applied non-physiological fatty substances (mineral oils, mineral waxes, vaseline) that remain on the skin surface reduce the natural regenerative activities of the skin.
- An abrasion of the superficial epidermis layers by mechanical, enzymatic or chemical peelings, and analogously also herb peelings belong to this group, stimulates the skin to regenerate intensively. Microdermabrasion basically has the same effects. Erbium-YAG and CO₂ lasers use thermal energy for the abrasion.

Frequency, type and intensity of peelings have been discussed over and over. What is sure is that excess treatments are counterproductive since they always induce damages or irritations. Let's just recall the cumulative effect of sun burns although it has a slightly different quality due to the deep-acting effects of UV radiation. With regard to the popular fruit acid treatments, long term effects such as rosacea and perioral dermatitis have become known by now. Short-termed side effects such as dry skin, infections and scar formation (laser) depend on the intensity of the treatments.

Masks & packs

Masks or packs are an integral part of many different treatments. Besides the regeneration of the skin barrier, the focus above all is on intense short term effects of the active agents. They aim at stimulating the collagen formation, reducing wrinkles, improving the hydration of the skin or soothing particular skin problems such as acne, rosacea, and pigment disorders just to mention the most significant conditions. Incidentally, the professional faces the dilemma that the care of the skin barrier and the intended in-depth effects of active agents are contrasting though. The reason is that the skin first has to be opened in order to transport the active agents into the deeper layers of the skin. Conventional treatments use peelings for this purpose. Subsequently the barrier is supported by applying lipid substances.

A simple and physiologically useful alternative can be the variant of Kligman's corneotherapy utilizing liposomal and biodegradable nanodisperse sera made of natural substances of the body. They have a fluidizing effect on the barrier. The stratum corneum allows the active agents of the sera to penetrate. Subsequently the skin is treated with physiological barrier substances and the barrier remains intact. In theory, a peeling is not necessary with this

procedure – unless the horny cells should only be slightly removed from the surface.

In this context also light massages are useful in order to stimulate the dermal circulation and the connective tissue. It also is beneficial to apply the same material as already used in the masks and packs. As a matter of fact, modularly designed preparations are useful in this regard since they allow for an individual adaptation to the particular needs of the skin.

Cosmeceuticals

In the past years up to the present, a whole series of active agents have been developed which are supposed to have traceable biochemical and physiological influences on the regeneration of the skin. The following substance classes are primarily concerned:

- **Antioxidants:** The radical scavengers protect against oxidative stress and cannot be assumed away from the daily practice. Just to mention an example: the multifunctional liposomal sodium ascorbyl phosphate (INCI) additionally supports the collagen formation.
- **Retinoids:** They are enzymatically transformed into vitamin A acid which stimulates the regeneration in the case of cornification disorders.
- **Vitamins** with their already postulated properties.
- **Phytohormones** belong to the polyphenols with various slightly estrogenic effects in-situ.
- **Peptides:** In part they are so-called effect actives with e.g. botox-like effects that temporarily can reduce wrinkles. Others can influence the collagen formation for instance.
- **Growth factors & messenger substances** have also been included into the repertoire of cosmeceuticals. Due to the fact that they mostly are long-chained peptides, their availability out of a cream is rather low which means that they have to be applied in combination with penetration boosters. A more elegant variant consists of activating the already present growth factors in the epidermis by means of externally applied low molecular compounds such as retinoids.
- Extracts or substances from **vegetable stem cells** or **plant cell cultures** also are to be classified as cosmeceuticals with anti-oxidative or other effects; their vegetable stem cell properties cannot be transferred to human skin cells.
- Substances with **inhibiting or stimulating effects on dermal enzymes:** examples

are anti-inflammatory 5-lipoxygenase inhibitors, matrix metalloproteinase inhibitors which impede the collagen degradation or tyrosinase inhibitors against hyperpigmentations.

- Meanwhile, **essential fatty acids** play a vital role as ceramide substrates and local anti-inflammatories in the case of atopic and acne-prone skin.
- **Active pharmaceutical ingredients** permitted in cosmetics: representatives are D-panthenol with cell proliferative and azelaic acid with antimicrobial properties.
- **Trace elements** such as copper, zinc, selenium, manganese and silicon with various regenerative effects in the epidermis.

Frequently, however, we are confronted with biochemical study outcomes based on in-vitro observations on artificial skin, tissue samples or plant cells which then are indiscriminately transferred to actual skin conditions. However, speculations and imagination are rather doubtful advisers when the recovery of the skin is concerned.

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