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THE PROTECTIVE AND HYDRATING CAPACITY OF EMOLLIENT AGENTS IN THE ANTI-AGING TREATMENT OF THE SKIN

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Synopsis

The skin is uniquely structured to function as a major barrier to protect the underlying organs against the ravages of the enviroment. With age, the dermal structural fibers change their nature and their organization so that their solubility decreases and various physical properties alter. In Cosmetic Dermatology, moisturizing creams are used to solve the cosmetic problem of dry, dehydrated and aged skin. These creams are made up of a set of lipids, water and different kind of active compounds. The aim of so-called emollients and moisturizers is not only to act as simple lubrificants, but to maintain skin homeostasis.

Riassunto

La pelle è una struttura appositamente organizzata per funzionare come barriera protettiva per gli altri organi nei confronti dell'ambiente. Con l'età, le strutture del derma modificano la loro natura e la loro organizzazione in modo da diventare meno solubili e quindi meno attive. Nella Dermatologia Cosmetologica, si utilizzano le creme idratanti per risolvere il problema cosmetico che si crea come conseguenza della cute secca, disidratata ed invecchiata. Queste creme sono formulate come miscele di lipidi e acqua con diversi e specifici principi attivi. Lo scopo dei cosiddetti "emollienti" ed "idratanti" è quindi di agire non soltanto quali semplici lubrificanti, ma di mantenere l'omeostasi della pelle

The skin as barrier

The skin is uniquely structured to function as a major barrier to protect the underlying organs against the ravages of the enviroment. The epidermis mantains a reserve of germinal cell layers whose proliferation, stratification and differentiation result in production of stratum corneum. The network of elastic fibers in the dermis probably maintains the tonus of the skin, and it is likely that the fibers also provide the small elastic forces which restore the extensibility of slack skin and which allow normal body movements. The horny layer usually contributes the rate-limiting step in the sequence of percutaneous absorption, although the aqueous viable tissues can binder the penetration of very hydrophobic natural or chemical compounds.

With age, the dermal structural fibers change their nature and their organization so that their solubility decreases and various physical properties alter. The skin becomes more rigid, the tensile strenght increases, and the integument wrinkles (1-3).

Furthermore in recently years there has been a growing awareness that many of the so-called attributes of aging skin are, instead, a reflection of environmental assault upon exposed of the body. Of special import are the deterious effects of solar radiation on dermal connective tissue, leading to the visible manifestations of photoaging. The result is a blurred distinction between the characteristics of intrinsic aging and photoaging (4-5).

One of the typical characteristics of aged skin is a partial decrease in the hygroscopic water-soluble components, with a resultant lowered capacity for binding water in the corneum, and hence a dry skin. Moreoever deficiency of the surface lipid is though to be a factor, probably brought about by the lessened contribution of the sebaceous glands in older people, especially in cold weather, and by decreased release of lipids during cornification. Detergents, alternating with water-soaks, may be of particular importance in reducing the elasticity of the keratin. With low relative humidity and cold weather, the stage is set for asteatosis (4).

Stratum Corneum and surface skin lipids

The stratum corneum consists of protein enriched corneocytes embedded in a lipid-enriched intercellular matrix, a continuous lipid phase surrounding a discontinous protein phase. Sebum and sweat flow on the horny layer as heterogeneous mixture of lipids, water and mineral salts, known as the surface lipid film (6).

This mixture enriched with amino-acids, pyrrolidon-carboxylic acid (PCA), sugars and other hygroscopic derivatives from filaggrine catabolism, filters between the corneocytes too from NMF (Natural Moisturizing Factors). NMF is made up of a set of substances acting as skin moisturizers capable of "binding" water from "perspiratio insensibilis" and retaining it (7).

For this purpose, the aim of so-called emollients and moisturizers is not only to act as simple lubrificants, but to maintain skin homeostasis. Well formulated cosmetics delay water evaporation in the "perspiratio insensibilis" , increasing the capacity of the stratum corneum to retain water and restoring the surface lipid film, which is the indispensable regulator of water exchanges (8).

Sebum and Skin Hydration

In Cosmetic Dermatology, moisturizing creams are used to solve the cosmetic problem of dry, dehydrated and aged skin.

These creams are made up of a set of lipids, water and different kind of active compounds.

The water in the emulsion system plays an important role as an emollient, as a vehicle in O/W emulsions, or as the dispersed phase in W/O types. Water delivered by the cosmetic could break the interprotein hydrogen bonds of the keratins and induce a rapid soothing effects.

The selection of lipids and active compounds

together with their physical and chemical features is fundamental for the hydrating capacity of the cosmetic. It is not to be forgotten that lipids, due to their more or less accentuated occlusive power, induce build up of water in the skin vehicle interface and, having an affinity for sebum thus also helping penetration of the moisturizing active compounds. However, the same affinity of both water and lipids is an important factor for their distribution through the skin layers.

Therefore the content in the vehicle of more "porous" and "hydrophilic" unsatured fatty acids, such as linoleic and gamma-linolenic acid is not to be underacted. The topical administration of both linoleic and gamma linolenic acids balances the fluidity and hydrophyly of the cellular membrane, thus helping exchange of hydrosoluble compounds such as NMF and definitely improving hydration of the whole cutaneous ecosystem.

Emollient lipids

It has applied the term emollient to those substances which help to maintain the smooth, soft and pliable texture of the normal skin surface, and in this context it is regarded the cutaneous lipids as naturally occurring emollients (9).

Lipids play two distinct roles in emollients action. One purely physical role of lubrification and protection, and the second in maintaining the correct degree of hydration of the stratum corneum. Emollient preparation usually contain components selected on the basis of compatibility with skin lipids, often trying to simulate the composition of sebum. It is not to be forgotten that skin surface lipids are made up of fatty acids with chain lenghts from C8 to C22, waxes and cholesterol esters with chains between C26 and C42, tryglicerides, squalene and a small amount of paraffins with lengths of C16 to C32, from the external enviroment. Moreoever the 15% of all fatty acids, whether free or not, and of wax-related alcohols are made up of saturated and unsaturated branched chain acids making the surface lipidic film more "porous" and water permeable (10-11).

The presence of saturated and unsaturated fatty acid glycerides in human sebum and in skin surface lipids suggest the use of this type of material as emollients in creams and lotions. This has been achieved by the inclusion of numerous vegetable oils in emulsions, such as peanut, sanflower, olive, borago, avocado, etc..

The major drawback to these emollients is that the polynsaturation render them prone to development of rancidity, which may be retarded by the use of antioxidants. However, there has been an awareness of the essential role played by the polynsaturated fatty acids in skin metabolism and they may be valuable additives for emollient creams. The free fatty acids in human sebum undoubtedly contribute a degree of emollient effect to the skin by virtue of their slip characteristics and mildly occlusive properties. Considerable quantities of stearic and palmitic acid are used in creams, to provide excess fatty acids, to serve as bodying agents, emollients and skin protectants. Another important group of used emollients are the alkyl esters, such as isopropyl myristate and isopropyl palmitate. They are light oily, polar in nature because of an ester group in the molecule. These esters are among the most readily spreading of all emollients when applied to the skin, imparting a smooth, relatively non greasy film.

Their hight solvent power, moreoever, is effective in blending otherwise immiscible oils and waxes, and to plasticize this phase of the emulsion higher melting waxes because the oils impart added slip to the oil-wax phase when applied to the skin.

Natural phospholipids also have been used topically as a moisturizing emollient for many years because of their inherent compatibility with the lipids in the skin. Unfortunately natural phospholipids do not show an high degree of substantivity and their effect, when applied topically, is thus short-lived. Recently it has been

discovered that reversing the placement of the phosphate and cationing grouping in the phospholipid molecule provides phospholipids which interact favorably with the natural lipids in the skin showing a high degree of substantivity and skin affinity (12).
The selective adsorption by keratin or substantivity of emollient lipids to the keratin of the stratum corneum are characteristics that contribute to the total emollient effect. At the end the frictional properties of emollients are another aspect of the complex process of emollient action as they relate to the degree of slip and smoothness.

The Alpha-Hydroxy Acids

Another category of cosmetic compounds known to influence the qualitative character of the stratum corneum are alpha-hydroxy acids (AHAs). AHAs appropriate for cosmetic use include a number of acid compounds that occur naturally in foods: glycolic (sugar cane), citric (citrus fruits), lactic, (sour milk), malic (apples), tartaric (fruits and grape wine) and other of similar distinction (13).
They seems to determine the quality of the stratum corneum at its formation, promoting normal cohesion among the newly formed cells.
The efficacy of the AHAs on dry and aged skin is readily demonstrated in extreme cases where the stratum corneum is visibly thickned. In such cases the return to normal appearance of the skin occurs within a span of few days and remain so for several days following discontinuance of topical applications. It should be emphasized that the alpha-hydroxy acids primarily are not moisturizers, although because of their normalizing effects on stratum corneum formation, they may obviate the need for horny layer but reduce abnormal cell cohesion at the level where the stratum corneum is laid down.
AHAs seem to exert their influence on corneocyte cohesiveness by interference with formation of ionic bonds.
This action seems to be mediated by interference with the functions of enzymes that form O-S and O-P linkages of sulfate and phosphate bonds (14).

Topical tretinoin and photoaging

Topical tretinoin has been shown to improve photoaged skin. When sun is avoid for a number of years, a layer of new collagen slowly appears in the papillary dermis of photoaged human skin.
The same regenerative process has been observed in hailess mice when exposure to UV radiaton is stopped or when sunscreen protection is provided.
Topical tretinoin greatly accelerates the formation of this new subepidermal collagen zone during the postirradiation period.
The newly formed collagen is normal in appearance, both histochemically and ultrastructurally. Fibrobalst are more numerous and more metabolically active, producing increased amounts of dermal matrix components.
Besides stimulating new collagen formation, tretinoin may enhance dermal repair by inhibiting collagenase.
With the promotion of new collagen formation in the papillary dermis, fine delicate wrinkles of photoaging are effaced.
Topical tretinoin also stimulates the formation of new dermal blood vessels.
With increased cutaneous blood flow, photoaged skin has increased turgor and a rosy-pink glow.
Topical tretinoin stimulates increased epidermal cell turnover, resulting in greater epidermal thickness.
Rough, sun-damaged skin becomes smoother and has a more healthy youth full look (15-18).

Identification of the cutaneous biotype

It is difficult to correctly evaluate dehydrated, alipidic, and oily skin. Current efforts to acourately classify skin types are based upon naked-eye and magnifying-glass examinations and palpation. Further obsevation employ simple instruments, such as a spatula, vitropreasure slides, Wood's lamp, ect.

A new technology the 3C SYSTEM Dermotech has changed all this. This computerized system allows a thorough cutaneous check-up. It permits a simple and quick determination of the quantity of lipids at the surface of the skin, a reading of the water content linked to NMFs, and pH of the skin. All of this is done while ambient environmental conditions are automatically standardized.

Measurements of moisture content provide an index for hydration or dehydration. Measurements of lipid content provide a soothing index. These accurate mathematical values are available on a computer screen and can be printed out, as desired (19-20).

This remarkable new technology provides information necessary for the selection of products correctly formulated to rebalance the hydration and surface lipidic film. Differeting skin types classified according to numeric references similar to those now used for sun protection, may be matched to specific cosmetic lines, based upon a factual reading of the patient's cutaneous ecosystem. The printer, which is an integral part of this advanced system, provides a permanent record of whatever data the clinician may require. The stored medical history, prior visit information, and all other previously entered data are available. The patient can be provided with a printed description of the measurements taken at each encounter, as well as the products which are recommended for the continuation of the treatment program.

This precise identy card, the "Skin Beauty card", includes the treatments provided at each visit to the medical office and an outline of all products which the person is supposed to be using at home. The "Skin Beauty Card" may become a part of the individual's permanent clinical record.

Conclusion

Relationships between cosmetic and skin hydration, cosmetic and keratinogenesis, cosmetic and aged skin in general are going to be deepened in the future. Neverthless, if it is true that cosmetic treatments help to improve both the external aspects and function of the skin, they are not in themselves enough for restoring an altered or aged skin. Therefore, it is still necessary to have sufficient sleep and to avoide smoking and excessive alcohol that have been proved to increase skin ageing. Finally, a natural, rich and balanced diet is fundamental to achieve a better quality of life.

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