

COSMETIC AND COSMECEUTICAL IN SKIN PROBLEM

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Abstract

Cosmetics are defined as an article intended to be applied to the human body for cleansing, beautifying, promoting attractiveness, or altering the appearance without affecting the body's structure or function. Cosmetics are asserted not to have any therapeutic effects. Cosmeceutical is refer to a cosmetic product whose active ingredient is meant to have a beneficial physiologic effect resulting from an enhanced pharmacologic action when compared with an inert cosmetic and generally used to refer to skin care products that are beneficial to improving skin's appearance and promoting healthy skin. Cosmeceuticals contain ingredients that influence the biological function of the skin and improve appearance by delivering nutrients necessary for healthy skin. There are problematic skin conditions that might change the interactive pattern and outcome between cosmeceuticals and skin. Physicians must fully evaluate a patient's skin type, assess the degree of photodamage and take into account any pre-existing skin conditions in order to design an appropriate regimen. The success of both cosmetic and pharmaceutical products depends on an appropriate integration of skin structure and function aspects with the nature of the formulation (cosmeceuticals), its efficacy as defined by the goal of the product (cosmetic or cosmeceutical) and its safety.

INTRODUCTION

Skin is a dynamic organ, meaning that it is always in a state of flux. Skin cells are constantly being exfoliated and replenished and will be replaced by new skin cells. Most of people have some flaws in their complexion which are troublesome to the, whether it be acne, rosacea, or related issues, fine lines and wrinkles, age spots, broken capillaries, facial discoloration including melasma, and dry/oily or scaly skin. Other concerns may include tone, texture and loss of volume as well.

A combination of therapy and procedures is almost always necessary to obtain a satisfactory result. There are some intrinsic factors that can be aggravated or accelerated by extrinsic factors including improper or inadequate skin care, excessive sunlight exposure including artificial tanning, and smoking among other factors.

There are some of common conditions of skin problem that often occur in cosmetic dermatology field such as acne, rosacea, wrinkles, traumatic scars, age spots, melasma, textural problems including dry spots, sun damage, rough and dry skin, and facial redness.

Those conditions listed as many options available to address the issue. It is expected that multiple products and treatment modalities and combinations thereof will need to be used to obtain improvement but none of the treatment stop aging and a maintenance program is necessary to insure continued healthier and more beautiful skin.

In previous decades, skin conditions, such as male-pattern baldness, dandruff, skin aging, and wrinkles, were managed using cosmetics. In general, *cosmetics* are asserted not to have any therapeutic effects and have been defined by the U.S. Federal Food, Drug, and Cosmetic Act (FD&C) as “an article intended to be applied to the human body for cleansing, beautifying, promoting attractiveness, or altering the appearance without affecting the body’s structure or function.” In contrast, a *drug* is defined by FD&C as “an article intended for use in the diagnosis, cure, mitigation, treatment or prevention of disease, (or) intended to affect the structure or any function of the body.”

Cosmetics are “articles intended to be rubbed, poured, sprinkled, or sprayed on, introduced into, or otherwise applied to the human body or any part thereof for cleansing, beautifying, promoting attractiveness, or altering the appearance and articles intended for use as a component of any such article, except that such term shall not include soap.”

Cosmeceuticals are a new breed of skin care products that are a hybrid between cosmetics and pharmaceuticals. The term “cosmeceutical” was coined in 1961 by Raymond Reed, founding member of the U.S. Society of Cosmetic Chemists. He originally conceived the word to describe “active” and science-based cosmetics.

The word and concept were further popularized by Dr Albert Kligman in the late 1970s, with the development of prescription-strength tretinoin for the enhanced appearance of ultraviolet (UV) damaged and wrinkled skin. A *cosmeceutical* is a cosmetic product whose active ingredient is meant to have a beneficial physiologic effect resulting from an enhanced pharmacologic action when compared with an inert cosmetic.

The term cosmeceutical is not recognized by the Food and Drug Administration so there are no specific criteria set up for products to be included in this category. This term is engrained in medical literature, the lay press, and is commonly used by consumers. There is an implied medical nature as a result of “ceutical” and an expectation of medicinal-like properties. Today cosmeceutical is generally used to refer to skin care products that contain active ingredients that are beneficial to improving skin’s appearance and promoting healthy skin.

Common usage has expanded the definition to include “a cosmetic that has or is purported to have medicinal properties.” The cosmetic industry uses the term to indicate

those products that affect the health of skin or that have a sustained effect on the skin's appearance beyond the time of application. These definitions imply a physiologic or pharmacologic action. With the exception of tretinoin and tazarotene the products in this class are sold over-the-counter (OTC) and are regulated as cosmetics, not pharmaceuticals.

Physicians practicing aesthetic medicine have also played a role in expanding the use of cosmeceuticals. Cosmeceuticals are now a regular part of our treatment armamentarium and are used in addition to medications and procedures to improve patient outcomes. Anti-aging cosmeceuticals are among the most frequently recommended by physicians who utilize them as an integral part of a comprehensive skin rejuvenation program. Moisturizers and serums containing ingredients like vitamin C, niacinamide, retinol, peptides, growth factors and botanicals can all be used in this regard.

In addition, patients undergoing cosmetic procedures such as laser resurfacing and chemical peels may be given cosmeceuticals to “prime” the skin for procedures, encourage healing and reduce complications after. Cosmeceuticals are also recommended for patients with acne, rosacea, eczema and other skin conditions where they are commonly used in combination with prescription medications. For example, moisturizers containing anti-inflammatory botanical ingredients may be used in conjunction with prescription medications for treating rosacea. Cosmeceuticals containing soy can be used to provide added skin lightening benefits when paired with hydroquinone. This shift in treatment paradigms has placed the use of cosmeceuticals within the purview of medical practice.

It takes time and skill to develop individualized skin care regimens for patients. Physicians must fully evaluate a patient's skin type, assess the degree of photodamage and take into account any pre-existing skin conditions in order to design an appropriate regimen. It is important to consider if the patient has oily, dry or sensitive skin or if there are any preexisting skin conditions like seborrhea, eczema, acne, and rosacea. Lifestyle considerations such as hobbies, sporting activities and occupation also play a role.

A basic skin care regimen required to maintain skin health and beauty is made up of a cleanser, moisturizer and sunscreen. Toners, astringents and eye creams may also be included although these products are not considered essential. In general, regimens for cosmetic patients should include daytime products that protect the skin and nighttime products that will repair skin damage.

Skin type classification is a good starting point, with dry, oily, normal, or combination of dry and oily, as common types. Complex mechanisms influence the skin type, such as gender, age, hormonal status, and ethnic background. Skin changes over time and elderly

people quite often experience very dry skin conditions. Similarly, hormonal changes, particularly in women during different stages of life, such as menopause, need to be taken into account. Ethnic background is also important, as different skin phototypes show varying sensitivity to UV light, resulting in different degrees of sunburn, tanning or photoaging, which can thus indirectly impact the efficacy of active ingredients. Finally, climate (temperature, humidity, seasonal changes), food and lifestyle have a profound, long-term influence on the skin.

Cosmeceuticals are intended to carry out their functions as protection, whitening, tanning, antiwrinkling, deodorants, antiaging, and nail and hair care. Cosmeceuticals may, however, cause some unwanted problems. The common ones are irritability to the skin, contact dermatitis, photosensitivity, comedogenicity, hair and nail damage, hyper- or hypopigmentation, infectivity, carcinogenicity, and even systemic adverse effects.

The research and development of cosmeceuticals, especially the composite active ingredients, should be based on their clarified sources, structures, interactive mechanisms with the skin, and, most importantly, their efficacy and safety on the targeted components of skin. Here we review some of the cosmeceuticals with different categories of functions, with special focuses on their biologically active ingredients.

Clearly, to claim that a product is a cosmeceutical, it has to fulfill three important conditions:

1. It has to include scientifically proven active ingredients at concentrations that have physiological effects and make observable improvements of human skin. The effects would be reduction of fine lines and wrinkles, thickening of the epidermis, increased, normal collagen network, improved elastin deposition, restoration of natural moisturizing factors, normalization of skin color and removal of pigmentation blemishes, or normalization of sebum secretion.
2. A cosmeceutical should be formulated to give optimum penetration of the active ingredients. A product with adequate concentrations of effective ingredients will not work as a cosmeceutical if the formula does not ensure good penetration of those ingredients into the area where they are needed. In some cases, transdermal penetration has to be enhanced to position the active molecule where it is most needed.
3. A cosmeceutical should not expose the client to any deleterious consequences, although one has to realize that because effective concentrations of active ingredients are used, the possibility of transient skin reactions does increase. This is in keeping

with the Gauss distribution curve. Inevitably, some people may develop skin irritation, whereas most get good changes or even superb changes to their skin. For that reason, cosmeceuticals should only be administered by trained skin care therapists who can advise clients on the proper way to use them, and ideally cosmeceuticals should not be sold over-the-counter in department stores and others.

Cosmeceutical ingredients should be classified as follows:

- Those that are naturally found in the skin (e.g., chirally correct vitamins)
- Phytonutrients not normally found in skin but have physiological benefits (e.g., green tea polyphenols)
- Designed molecules (e.g., peptides not normally found in nature but that have physiological actions due to their cytokine activity)

The success of both cosmetic and pharmaceutical products depends on an appropriate integration of skin structure and function aspects with the nature of the formulation (pharmaceuticals), its efficacy as defined by the goal of the product (cosmetic or pharmaceutical), and its safety.

Like cosmetics, cosmeceuticals are topically applied, but they contain ingredients that influence the biological function of the skin. Cosmeceuticals improve appearance by delivering nutrients necessary for healthy skin. Cosmeceuticals typically claim to improve skin tone, texture, and radiance, while reducing wrinkling. Cosmeceuticals are the fastest-growing segment of the natural personal care industry. Commonly used substances included in cosmeceutical formulations are described as follows:

Moisturizing Agents

Stratum corneum is the primary barrier of the skin whose one of main purpose is to keep inside in & outside out. This barrier is rich in cholesterol, free fatty acids, and ceramides. Many oily preparations have been used to maintain the fluidity of the skin (Mineral oil, Lanolin, cyclomethicone, etc.). Water from the stratum corneum gets evaporated very quickly leading to dehydration. This dehydration of skin can be averted by using moisturizers which provide flexibility to the skin.

Humectants are cardinal ingredients of the moisturizing formulations. Humectants also help in preventing drying out of the formulations. When moisturizers are applied to the skin, a thin film of humectant is formed which retains moisture and imparts better appearance to the skin. Bio-mimetic lipid containing formulations facilitate in normalizing the damaged skin. Water can cause the excretion of cytokines when applied to the skin for a prolonged

period of time. This may further lead to edema, vasodilatation, and inflammation gets induced.

Moisturizers by hydrating the skin, make the stratum corneum softer & can even alter physiology of skin. Ceramide containing moisturizers are very popular as these contain the same balance of lipids as our skin. There are nine different types of ceramides in the stratum corneum named as ceramide. They constitute 40-50% of the lipids in this outermost layer. It has been proven that these substances help to treat eczema, and can even be used for dry skin.

Fluocinolide containing ceramides formulation has been found to reduce eczema. Besides these, black cohosh, soy extract, and vitamins A and E also help in augmenting the skin's natural moisture balance. Complex mixture of hyaluronic acid and a revival complex containing green tea leaf extract, and glutathione are also promising moisturising agents.

Sunscreen Agents

Use of sunscreen agents and limiting the exposure to sun prevents early wrinkling and skin cancer. Sunscreen agents are used to prevent sunburns. There are two kinds of sunscreen agents: chemical and physical. Chemical sunscreen agents protect the skin from the sun by absorbing the ultraviolet (UV) and visible sun rays, while physical sunscreen agents reflect, scatter, absorb, or block the rays.

Sunscreen agents often may comprise more than one ingredient. For example, products may contain an ingredient that provides protection against the ultraviolet A (UVA) sun rays and another ingredient that protects from the ultraviolet B (UVB) sun rays, which are more likely to cause sunburns than the UVA sun rays. Ideally, coverage should include protection against both UVA and UVB sun rays.

The sun protection factor (SPF) that is present on the label of these products reflects the minimum amount of UVB sunlight that is needed with that product to produce redness on sunscreen protected skin as compared with unprotected skin. Sunscreen products with high SPFs provide more protection against the sun. The following sunscreen agents have been recommended by the U.S. Department of Health :

- Cycloform (isobutyl p-amino benzoate)
- Propylene glycol p-amino benzoate
- Monoglyceryl p-amino benzoate
- Digalloyl trioleate
- Benzyl salicylate and benzyl cinnamate (2% each)

Besides these, chemical sunscreens mainly based on para-amino benzoic acid, its derivatives, cinnamates, various salicylates and benzophenones, dibenzoylmethanes, anthraline derivatives, octocrylene and homosalate are frequently employed as sun blocking agents. Direct physical blockers include metal containing compounds such as iron, zinc, titanium, and bismuth.

Zinc oxide and titanium dioxide are highly reflective white powders, but submicron zinc oxide or titaniumdioxide powder particles transmit visible light while retaining their UV blocking properties, thus rendering the sun block invisible on the skin. Other commercially available sunscreens are Benzophenone-8, Neo Heliopan MA and BB, Parsol MCX and HS, Escalol 557, 587, and 59740.

Hydroxy Acids

Hydroxy acids are organic carboxylic acids classified into alpha-hydroxy acids (AHA), beta-hydroxy acids (BHA), poly-hydroxy acids, and bionic acids on the basis of their molecular structure. Hydroxy acids are found in most of the marketed cosmetic preparation but are used in very low concentration. Alpha-hydroxy acids range from simple aliphatic compounds to complex molecules.

Derived product can be either from natural or non-natural origin, product derived from natural origin are known as fruit acid. Hydroxy acids are found to be present in antiaging formulations, moisturizers, and peels, and in treatment products to improve hyperpigmentation and acne. The skin appears to be smoother and more uniform. The likely cause of these changes is the property of AHAs to enhance epidermal shedding. Some claim that AHAs increase the synthesis of glycosaminoglycans (GAGs), improve the quality of elastic fibers, and increase the density of collagen.

Beta-hydroxy acids are aromatic compounds. Salicylic acid is the reference BHA; it has dermatolytic properties and helps in various xerotic and ichthyotic disorders. Other BHAs include 2-hydroxy-5-octanoyl benzoic acid, also known as beta-lipo-hydroxyacid (B-LHA), and tropic acid.

Mechanism of action of hydroxyl acid is unknown however one finding of its biological activities may be attributed to the inherent acid strength of the compounds. Ability of AHAs to increase sensitivity to UV radiation has been proved and thus sunscreen application may be advisable when these products are used. Some AHAs comprise the

following: lactobionic acid, glycolic acid, lactic acid, citric acid, mandelic acid, malic acid, and tartaric acid.

Vitamins

Exposure to the UV radiations accelerates the aging effect of the skin. The progressive telomere shortening and finally its disruption by low-grade oxidative damage are related to the aging. Damage is initiated by the generation of reactive oxygen species (free radicals). It is a progressive process whose consequences are damage to DNA.

The topical treatment of acne vulgaris with vitamin A, is very well supported by evidence. Vitamin B3, commonly known as nicotinamide or niacinamide, is available in cosmetic and cosmeceutical products and can be used as a complementary agent for some types of acne, as well as aging skin.

Activation of toll-like receptors may also be involved in the scarring process by activating the metalloproteinases. The retinoids are vitamin A derivatives constituting the most effective comedolytic agents. They function by normalizing desquamation of the follicular epithelium, preventing the formation of new microcomedo, and minimizing the formation of comedones and inflammatory lesions.

Nicotinamide is useful as a complementary drug because of its mild anti-inflammatory activity and its possible action in the reduction of sebum production and improvement of the skin barrier.

Vitamin A

The human epidermis contains significant amounts of vitamin A (all-trans-retinol). It has been observed that both UVB and UVA can damage the metabolism and transport of vitamin A. This may lead to vitamin A deficiency in the skin. Small amounts of retinol in the body gets converted to all-trans retinoic acid also called tretinoin (active form) and rest of the retinol is converted into retinyl ester (storage form).

Topical retinoids have successfully been used to treat acne. The efficacy of topical tretinoin in the treatment of photoaged and intrinsically aged skin is sufficiently established. The effects are believed to be mediated through its binding to the nuclear retinoid acid receptors. It induces type I and type III pro-collagen gene expression in human skin, resulting in increased deposition of collagen fibrils in the dermis. The effects result in an improvement in the clinical and histologic skin appearance.

Tretinoin cream in the appropriated concentrations of 0.025%, 0.05%, and 0.1%, as well as 0.1% isotretinoin and 0.1% tazarotene, frequently produce moderate to severe skin irritation. Retinaldehyde (0.05%) is another useful topical agent for the treatment of photoaged skin. It has a lower frequency of irritation but less efficacy than tretinoin.

Photosensitivity is another problem to be dealt in case of tretinoin. The useful concentration of topical retinol ranges from 0.3% to 1%. Most of the over-the-counter products available usually contain lower levels of retinol (about 0.08% or less), compared with the concentration used in the few clinical studies available.

Vitamin A exists in three isomeric forms among which beta form found to be more active than alpha & gamma isomer. Its deficiency may lead to dry rough skin. The advent of synthetic analogs of vitamin A in the 1970s brought new interest into their biological activity, especially on the skin. Since then, vitamin A and its derivatives have been useful in the treatment of many skin disorders, including ichthyosis, acne, and psoriasis. A great amount of research has concentrated on its use as an antiaging compound as well as its use for other cutaneous disorders.

As antioxidants, vitamin A protects cells from oxidative damage by 3 different mechanisms: scavenging peroxy radicals, quenching singlet oxygen, and triplet-state sensitizers. Vitamin A and its derivatives have 2 main functions: they act as antioxidants, and they activate specific genes and proteins. Vitamin A also exerts a hormone like effect on the skin, activating specific genes through nuclear receptors.

Vitamin E

The physiological function of vitamin E, if applied dermally is to contribute to the antioxidant defense of the skin, because of its tendency to absorb UV light in the solar spectrum region that is responsible for most of the harmful biologic effects of the sun. Vitamin E blocks lipid peroxidation in cells & tissues & it is a good antioxidant. It helps to enhance the performance of UV filters, softens skin & moisturizes within.

Vitamin E is the body's major lipid-soluble antioxidant, if oxidized, vitamin E can be regenerated back to its reduced form by L-ascorbic acid. Vitamin E as alpha-tocopherol or tocopherol acetate is used in topical OTC (over-the counter) products in concentration (1% - 5%). Alpha-tocopherol has been found to be beneficial in reducing minimal erythema and the number of epidermal sunburn cells, which marks skin damage related to oxidative stress caused by UVB.

The effect of vitamin E after sun exposure seems to have no benefit. Vitamin E can reduce UV-induced erythema and edema when it is applied before UV exposure. Topical application of vitamin E may increase stratum corneum hydration and enhance water-binding capacity. Alpha-tocopherol also shows synergistic effect with vitamins A (retinol) and C (ascorbic acid) in combined products, providing an appreciable photo protection and antioxidant action that suggests a potential effect in the protection against photo aging and skin cancer.

Vitamin B3 (niacinamide or nicotinamide)

Nicotinamide is a part of the coenzymes nicotinamide adenine dinucleotide (NAD), NAD phosphate (NADP), and its reduced forms are NADH and NADPH. These molecules are important in many cellular metabolic enzyme reactions. The reduced forms mainly act as antioxidants.

Nicotinamide is one of the newly discovered vitamin-based components of cosmeceutical products. It is found to possess antiinflammatory and anti acne actions. Its anti-inflammatory effect may improve skin appearance by reducing leucocyte peroxidase systems that may lead to localized tissue damage as well as improve the stratum corneum barrier. In a study, the anti-inflammatory effect of 4% nicotinamide gel in the treatment of acne vulgaris was comparable as the benefits of 1% clindamycin gel. This effect also shows significance to reduce cutaneous erythema in various disorders.

The amelioration of facial depigmentation is mediated by the suppression of melanosome transfer from melanocytes to keratinocytes. In fibroblast culture nicotinamide increases collagen production and this effect may lead for the improvement of skin elasticity and reduction of fine wrinkles.

Vitamin C

The increase of vitamin C in skin concentration is limited even with huge oral supplementation. Vitamin C has become a popular topically applied cosmeceutical because topical application of L-ascorbic acid is the only way to further increase skin concentration. Free radical scavengers have grabbed the attention of researchers on vitamin C.

L-ascorbic acid is the active form of vitamin-C, which was first used as cosmeceutical creams. Despite these controversies, all the researchers agree that topically applied vitamin C has many benefits, such as lightening hyperpigmentation, promoting collagen synthesis,

antiinflammatory and photoprotective properties. Vitamin C and its derivatives are believed to show reducing effects on melanin intermediates. They inhibit the oxidative chain reaction from tyrosine/dihydroxyphenylalanine (DOPA) to melanin. It is required for the hydroxylation of procollagen, proline, and lysine. Its deficiency can cause keratotic follicles, purpura and bleeding gums. It is an important regulator of collagen expression stimulating its synthesis, a water-soluble antioxidant that clenches free radicals and regenerates vitamin E.

Vitamin C levels on the skin are severely depleted after UV irradiation and it improves and normalizes the changes caused by light damage.

Skin Lightening Agents

Hyperpigmentation is the changing of colour intensity of the skin to darker hue, which is due to an increased amount of melanin in the epidermis, the dermis, or both. This change can be due to 2 pathophysiologic processes: melanocytosis (increased number of melanocytes) and melanosis (increased amount of melanin).

Skin lightening agents work best when melanosis or melanocytosis is confined to the epidermis. Patients with Fitzpatrick skin types I-III have advantage over type IV such as type I-III benefit from local pigment lightening for the treatment of hormonally induced melasma and postinflammatory hyperpigmentation caused by acne and trauma, whereas those with Fitzpatrick skin types IV and darker may also seek therapy for pigmentary changes that occur around the eyes, in the intertriginous areas, following dermatitis, or with acne and trauma.

Standard dermatologic agent for skin lightening is hydroquinone but its safety is questionable, leading to the use of alternative agents such as retinoids, mequinol, azelaic acid, arbutin, kojic acid, aleosin, licorice extract, ascorbic acid, soy proteins, and *N*-acetyl glucosamine.

Chemical Peeling Agents

Alpha-hydroxy acids have been shown to lighten melasma, solar lentigines, and post-inflammatory hyper pigmentation. Glycolic acid is derived from sugar cane and is used as an ingredient in skinlightening products in low concentrations. It may also be used as a peeling agent in concentrations of 30-70% to increase the efficacy of other lightening agents such as hydroquinone by removal of the dead skin, thus enhancing the penetration of hydroquinone.

Repeated peels every 2-3 weeks are necessary to attain significant lightening. Other chemical peels include 50% trichloroacetic acid (TCA) peels and 20-30% salicylic acid peels used for various pigmentary disorders, including melasma, on darker skin types.

Conclusion

The interactions between cosmeceuticals and skin are complex, depending on the specific composites in cosmeceuticals products, condition of the skin or general health status of a subject, and also the environment where the action occurs. Hundreds of substances have been screened, synthesized, and tested and many have been included in commercially available products. In addition, the desired functions of a cosmeceuticals might require a coordinating action of multiple ingredients. Moreover, there are problematic skin conditions that might change the interactive pattern and outcome between cosmeceuticals and skin. Cosmeceuticals like vitamins, sunscreens, hydroxy acids & many more have proved their efficacy in treating skin diseases thus enhancing the skin texture. Clinical trials of cosmeceuticals are important to know the interaction between skin and cosmeceuticals which could even be influenced by environmental fact. Scientific clinical evaluation is a must for research, development, and application of cosmeceuticals.

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