

Cosmeceuticals for Men

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The demand for topical products capable of preventing aging or delivering cosmetic improvement to the male skin is growing. Companies are marketing products that are labeled “for men.” Nevertheless, there is no consensus on which properties these products should possess. This article aims to develop a rational approach to men’s cosmeceuticals based on anatomic and physiologic features of the male skin without neglecting behavioral idiosyncrasies when relevant.

A review of the literature for skin gender singularities was used to determine the needs of male skin and subsequently to postulate how cosmeceuticals could fulfill these needs. Cosmeceutical ingredients capable of reversing sun-induced alteration are of particular benefit for men. Adapting cosmetic treatment to male grooming routines increases compliance. Shaving presents an opportunity to deliver cosmeceuticals for men. The marketing of skin care products for men is evolving and becoming seemingly complex; further research is warranted.

The field of male-specific cosmeceuticals is rapidly expanding. Sociodemographic changes in a globalized world have reduced gender gaps in the demand for skin care products. Men are more motivated to use creams, desiring to prevent and hide aging features. However, as observed for more invasive cosmetic procedures, gender differences are still determinant in the pattern of product consumption, even when they are intended to achieve goals similar to those for women.

Aftershaves containing aloe vera or other ingredients intended to decrease inflammation or promote

healing have been on the shelves for a long period of time. Nevertheless, until recently most products directed toward men were perceived as purely cosmetics and were limited to shampoos, creams, lotions, and deodorants containing fragrances, textures, and colors appealing to men or labeled “for men.”

The skin care industry’s initial response to the expanding market was to adapt established products originally sold to women by minimally modifying their texture and fragrance or by changing packaging and advertising so that they would be desired by men. This purely commercial strategy does not adequately fulfill patient needs. A rational approach to men’s cosmeceuticals, based mainly on anatomic, physiologic, and behavioral specificities, seems more medically appropriate. Therefore, we conducted a review of the literature looking for skin gender singularities to determine the needs of male skin and subsequently postulate how cosmeceuticals could fulfill these needs.

MALE SKIN ANATOMY AND PHYSIOLOGY

Most male-specific skin features arise during puberty under the influence of testosterone produced by the testes acting on genetically distinct cells.¹ In postmenopausal

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women, the substantial decrease in estrogens and only mild decrease in androgens may result in virilization of skin features, whereas in elderly men, the declining levels of androgens may have the opposite effect.² Accordingly, at advanced ages, skin sexual dimorphism becomes less evident.

Postpubertal adult male skin differs from female skin in several features, including hormone metabolism, terminal hair pattern, immunologic properties, sweat rate, sebum gland size and production, biofilm, UV radiation

sensitivity, pigmentation, and skin thickness.^{1,3} Table 1 lists putative cosmeceutical ingredients based on the physiologic needs of male skin.

Hormone Metabolism

Testosterone is essential for inducing the male skin phenotype during adolescence. In men with normal gonadal function, less than 5% of testosterone is derived from conversion of adrenal androstenedione; in women the adrenal gland substantially contributes to total

TABLE 1

Putative Cosmeceutical Ingredients and Mechanism of Action for Male Skin Needs

Indication	Mechanism of Action	Possible Ingredients
Androgenic alopecia	5 α -Reductase inhibition	Green tea extract, <i>Serenoa repens</i> , <i>Artocarpus incisus</i> , isoflavonoids, lignans, alizarin, curcumin
	Other	Minoxidil (considered medication, not cosmeceutical, in some countries)
Prevention of photoaging (excluding sunscreens)	Antioxidants	Green tea; isoflavones; lycopene; vitamin C; coenzyme Q10; selenium; resveratrol; ferulic, caffeic, and α -lipoic acids; <i>Polypodium leucotomos</i> ; propolis
	Toll-like receptor agonist	Soybean Kurosengoku
	Retinoid agonist	Vitamin A and related compounds
	Sirtuin induction	Resveratrol
Improvement of epidermal barrier function	Phosphodiesterase inhibition	Caffeine
Oily skin/ increased pores	Decrease in sebum production	Phytoestrogens, lignans, retinol
	Keratolytic	α -Hydroxy acids
Excessive sweat/odor	Odor absorber	Magnesium hydroxide
Wound healing	Transforming growth factor β , fibroblast growth factor induction	Aloe vera
Skin tone	Keratin oxidation	Dihydroxyacetone
Immunologic modulation	Toll-like receptors	Green tea, resveratrol, vitamin D
	Phospholipase A ₂ inhibition	Ginkgetin (<i>Ginkgo biloba</i>)
	Inhibition of retinoic acid-inducible gene 1	Epigallocatechin gallate (green tea)

androgen production.² Testosterone is enzymatically converted in the skin to 5 α -dihydrotestosterone (DHT). These enzymes are not equally distributed among skin cells. Male beard and scalp recession are dependent on 5 α -DHT stimulation.³ Several botanicals can block 5 α -reductase with potential benefits for androgenic alopecia^{4,5}; however, technology for topically exposing hair follicles to high concentrations of these compounds is not yet available. Topical minoxidil is used as a cosmeceutical for the improvement of androgenic alopecia.

Aromatase converts androgens into estrogens. Estrogens may stimulate hair growth in men, possibly by increasing the anagen phase.³ They also may reduce sebaceous gland size and activity. Several cosmeceuticals contain phytoestrogens such as soy isoflavones and lignans as active ingredients.⁶ It is still unclear how high concentrations of topically applied phytoestrogens can alter male skin.

Plasma testosterone decreases by 2% per year after achieving its postpubertal peak,² which does not cause substantial problems, but hormone replacement therapy is an increasing trend among aging men. Androgens frequently are used by young men attempting to enhance athletic performance or increase muscles. These medical and nonmedical uses of androgens may affect the skin. It is unclear if cosmeceuticals could decrease untoward skin effects related to those habits.

Skin Morphology

The overall thickness of the skin (epidermis and dermis) is increased in men when compared to the same anatomic areas in women. The subcutaneous tissue is less prominent in males.¹

Most studies of the epidermal dependence on hormones have been conducted in mice. The male mouse epidermis is thinner,⁷ but in humans it has been reported that the male cellular epidermis is slightly thicker than in women.⁸ Accurately determining the thickness of the epidermis is not easy because it varies according to body site and tissue processing may lead to artifacts. More refined studies using noninvasive techniques, such as *in vivo* confocal microscopy or optical coherence tomography, are necessary to provide reliable data. Gender differences in epidermal thickness are important for cosmeceutical development and use because the actions of almost all of the available topically applied cosmeceuticals are limited to or modulated by the epidermis before acting on the dermis. Products tested in women may act differently on men's skin.

The incidence of melanoma and squamous cell carcinoma is higher in men.⁶ Hydroxy acids and retinoids increase the epidermal thickness, possibly decreasing UVB penetration to the basal epidermis. Dermal thickness

is dependent on androgens. Dehydroepiandrosterone increases procollagen synthesis and inhibits matrix metalloproteinase 1. It also increases tissue inhibitor of metalloproteinase 1 and stromelysin 1; the combined action of these enzymes results in increased collagen deposition.² However, male dermal thickness starts decaying linearly after 20 years of age, whereas in women dermal thickness remains constant up to menopause.¹ It is generally assumed that wrinkles in men appear later, around the fourth decade of life, but are deeper than those in women. Early prevention of dermal thickness decay could benefit male skin.

Epidermal Barrier Function

Transepidermal water loss gets worse with increased age, photodamage, and androgens. Giving 5 α -DHT to pregnant rats delays the offsprings' barrier development, whereas estrogens accelerate it. The barrier function of castrated mice worsens after testosterone replacement. Topical androgen application delays the recovery of barrier function in mice, which is overcome by the coapplication of 17 β -estradiol. An experiment conducted in a 58-year-old hypogonadal man undergoing testosterone replacement therapy revealed barrier function recovery (by a tape-stripping method) that was consistently delayed during hormonal peak but improved at trough.²

Brandner et al⁹ reported that twice daily topical application of caffeine gel 0.5% for a week improves the recovery of barrier function in men but not in women. High concentrations of caffeine inhibit the phosphodiesterase enzyme, increasing intracellular cyclic adenosine monophosphate. The potent androgen 5 α -DHT has the opposite effect, decreasing intracellular cyclic adenosine monophosphate through adenylyl cyclase inhibition. The short duration of the study did enable the researchers to assess if these changes can be maintained over a long period of time.⁹

Wound Healing

Sex hormones profoundly influence wound healing.¹⁰ 5 α -Dihydrotestosterone inhibits repair, whereas 17 β -estradiol accelerates it. Interestingly, hormonal therapy for a gonadectomized male versus female mice has distinct effects on wound healing when the same hormones are used. Testosterone does not inhibit wound healing in females as it does in males, which may be due to the fact that aromatase substantially converts testosterone to estrogen in females. In contrast, macrophage migration inhibitory factor worsens healing in females but not in males.¹⁰ Observation of wound healing in humans demonstrates that wounds in elderly men heal slower than those in aged-matched women.² It is unclear

if topical preventive application of cosmeceutical phytoestrogens on male skin could decrease the gap.

Immunology

Male skin is more susceptible to viral and bacterial infections than female skin. Squamous cell carcinoma is twice as frequent in men. The melanoma death rates in the United States between 1973 and 1997 were 2-fold higher for men than women.⁷ Gender-related immunologic dimorphism could partially explain those findings.

UV-induced immunosuppression is stronger in males than females.¹ A possible explanation for reduced immunity in males is that some genes important to Langerhans cell function are contained in the X chromosome, including toll-like receptor 7.¹¹ The extract of a Japanese variant of soybean (Kurosengoku) activates type 1 immunity in a toll-like receptor 2- and 4-dependent manner.¹² Interestingly, botanicals with putative cancer prevention actions also may act as immunoregulators with anti-inflammatory potential. Green tea's epigallocatechin gallate suppresses interferon production by the retinoic acid-inducible gene 1 receptor, and resveratrol down-regulates IFN- γ -inducible inflammatory genes in macrophages.¹³ Ginkgetin, a bioflavonoid derived from *Ginkgo biloba*, when topically applied to irritated mouse skin acts as an anti-inflammatory agent inhibiting the activity of phospholipase A₂ and cyclooxygenase-2,¹⁴ properties that could benefit men with pseudofolliculitis barbae. The antioxidant properties of currently used cosmeceuticals may substantially benefit men by reducing the DNA damage induced by UV radiation and by modulating the immune response.

Sweat Glands

Sex hormones are essential for the maturation of apocrine sweat glands but are not required for their maintenance because gonadectomy of adult patients does not affect apocrine production. The odor of apocrine glands is dependent on cutaneous flora and pH. The microflora in men is different from women, which may be due to differences in sebum content and amount of sweat. On average, when subject to physical activity, men sweat 40% more than women.¹ Magnesium hydroxide, a well-tolerated deodorant, alters skin pH, interfering with microflora and odor-producing enzymes.

Sebum Production and Pore Size

Sebaceous glands are responsive to androgen stimulus. Men have increased sebum production and larger pores. White men have an average of 3 $\mu\text{g}/\text{cm}^2$ of sebum, whereas women have 0.7 $\mu\text{g}/\text{cm}^2$.¹ Severe acne is more frequent in males. 5 α -Dihydrotestosterone conversion

and the synthesis of sebaceous lipids in human sebocytes are regulated by the peroxisome proliferator-activated receptor ligand linoleic acid.² It is unclear if topical use or dietary changes of fatty acid can modulate sebum production. Adapting the concentration of sebum-reducing ingredients in male skin care products is beneficial. Products labeled "matifying" can absorb sebum, preventing excessive reflection of light on the skin surface. Matifying ingredients include clay, dimethicone, starch, polyamide 12, potato or cornstarch, cyclodextrin, titanium oxide, and silicone elastomers.¹⁵

Surface pH

Conflicting data have been published about gender-related differences in skin surface pH, but generally skin pH is remarkably lower in men than women.¹ Skin pH is thought to be extremely important to the stratum corneum properties and microflora ecosystem. Creams with different pHs may modify the action of active ingredients on the skin; adapting products to gender differences in pH may provide effective improvement in male skin care.

Skin Tone/Appearance

Within the same ethnic groups, men have a darker and less reflective complexion than women. Men tend to produce more intense pigmentation after UV radiation and retain color for a longer period. These changes arise during puberty, suggesting hormonal dependence.¹ The thickness of male facial hair also influences the perception of complexion in men. A properly formulated vehicle is critical to deliver active cosmeceutical ingredients in a most effective manner. Adapting cosmeceutical vehicles to a socially acceptable and desirable perception of male skin is an important and challenging feature of developing products for men.

DELIVERING ACTIVE INGREDIENTS TO MALE SKIN

Many ingredients are marketed as cosmeceuticals based on claims that they topically modulate skin biology to produce a better-looking, healthier, and more pleasant complexion. Except for tretinoin and tazarotene, all products are sold over-the-counter and regulated as cosmetics, not pharmaceuticals. Manufacturers are not required to release gender specificities or information acquired from efficacy tests conducted on those products.

The new field of cosmeceuticals must take into account the special needs and preferences of men. Almost every man shaves daily. Adapting products to short application during shaving is the best approach to achieve male compliance. Therefore, it is of utmost importance for these cosmeceuticals to be truly effective. Table 2 summarizes

shaving routines for different male skin conditions. Using the correct techniques and products can improve and rejuvenate the appearance of aging skin with just 4 steps: (1) cleansing, (2) shaving, (3) protecting, and (4) treating.

Cleansing

Because men have increased sebum production and the skin reacts to environmental pollutants by secreting even more protective natural endogenous oils, cleansers for men should clean and treat the large pores and prevent acne as they improve the appearance of aging skin. Men routinely wash their faces; therefore, it is not an additional cosmetic step. Cleansers containing α - or β -hydroxy acids and those with benzoyl peroxide have been proven to be highly effective for rapid improvement in the appearance of the surface and the large pore size of aging skin.^{16,17}

Shaving

Shaving products have evolved in form, appearance, and composition, but their goals remain the same; they need to be effective but gentle and cannot be associated with side effects. Table 3 lists the major properties of popular shaving vehicles.

Designed to minimize razor burn, aftershaves usually are fragranced colognes. Men with large pores or a tendency to get acne should use a cosmeceutical astringent containing an α - or β -hydroxy acid instead of a mere cosmetic fragranced aftershave to make pores smaller and prevent pimples and pustules while rejuvenating the skin.¹⁸ Men should apply sunscreen immediately after shaving.

Protecting

The single most effective therapy for aging skin is sun protection.¹⁹ Because men are even more susceptible to skin cancer than women, sunscreen is the most important cosmeceutical to prevent the appearance of aging skin. Men with oily complexions or acne should use nongreasy sunscreens. For men with dry skin, cream or lotion sunscreens moisturize the skin but wash off more easily and must be applied vigilantly. Educating men about the facial areas that they tend to forget when applying sunscreen is helpful and can be used to introduce the benefits of using cosmeceuticals to treat the skin because even optimal UVA and UVB sunscreens reduce free radical damage by only 55%.²⁰

Treating

There are several well-proven medical and cosmeceutical treatments that should be included in the daily regimen to maintain not only a younger appearance but also healthier skin. The gold standard for prevention and reversal of photoaging with topical treatment is tretinoin.²¹ It also is well documented that antiaging is achieved with hydroxy acids and certain topical antioxidants.²² Many new products are advertised, but they often have not been proven to be effective by rigorous placebo-controlled, double-blind clinical trials.

Hydroxy acids act rapidly (within 2 weeks) to smooth the skin surface by reducing epidermal corneocyte adhesion.²³ Salicylic acid is unique among the hydroxy acids in that it is lipophilic and is particularly attracted to sebaceous orifices, thereby exhibiting its keratolytic properties

TABLE 2			
Summary of Shaving Routine Suggestions for Distinct Male Skin Conditions			
	Sensitive Skin	Acne	Wrinkles
Wash	Sensitive skin cleanser	Salicylic acid, sulfur, benzoyl peroxide	Salicylic acid
Shave	Mild shaving cream	Benzoyl peroxide shaving cream	
Protect	Moisturizing sunscreen	Noncomedogenic sunscreen	Zinc oxide sunscreen, titanium dioxide sunscreen
Treat	Retinol, antioxidants, polyhydroxy acids, caffeine	Retinoids, antioxidants, α -hydroxy acids	Retinoids, antioxidants, tensoactive agents

TABLE 3

Major Properties of Commercially Available Vehicles Used in Shaving Products

Shaving Vehicle	Properties
Foam (aerosol)	Foam produced at the outlet of the valve (does not need brush), most-sold product, mild soap (pH 8.0)
Gel	Requires massage to produce foam, easy to use, bulky, contains effective moisturizer
Cream	Requires brush (less and less used), very alkaline (pH 10)
Oil	Greasiness generally not appreciated, no need to add preservatives

not only to smooth surface wrinkles but also to decrease pore size and prevent acne; however, irritation may limit its use. Polyhydroxy acids are larger molecules that penetrate the skin gradually and are therefore less irritating.¹⁵

There are many over-the-counter cosmeceutical retinoids, including retinol, retinaldehyde, and retinyl esters, that are all less irritating than prescription retinoids, but they also are less effective.²⁴ Therefore, whenever tolerated, men should be advised to use a prescription retinoid.

Topical antioxidant formulations are commonly applied as cosmeceuticals. The challenge is to achieve effective formulations that are stable and absorbed transcutaneously to deliver high concentrations of the active antioxidant to the dermis and epidermis. The best-studied antioxidants that are available in effective formulations are vitamin C and natural vitamin E. Others include selenium, ubiquinone (coenzyme Q10), α -lipoic acid, vitamin B₃ (niacinamide), kinetin, silymarin, pycnogenol, pomegranate polyphenols, and genistein. Some cosmeceuticals, such as soy derivatives, act as a weak phytoestrogen; however, epidemiologic studies have concluded that men who ingested higher dietary soy had less cardiovascular disease, with no mention of any feminizing side effects

resulting from soy consumption by men.²⁵ Nevertheless, studies specifically on men should be conducted if a phytoestrogen cosmeceutical is created for the male market.

PACKAGING AND MARKETING STRATEGIES FOR MALE COSMECEUTICALS

Although exploring gender differences in skin structure, biochemistry, and functionality is essential, men choose a cosmeceutical based on advertising and marketing. Understanding male demand and consumption behavior is important.

Socially perceived benefits are probably the best explanation for the increased demand of cosmeceuticals by younger men. A joint survey conducted by *GQ* and *Allure* magazines in June 2010 among 1000 men and 1000 women revealed that men only spend 7 minutes less than women getting ready in the bathroom. In addition, 72% of men indicated they "feel under more pressure to care about their appearance."²⁶ Marketing strategies targeted to specific niches need to consider their idiosyncrasies to successfully communicate with customers.²⁷

CONCLUSION

Men's interest in cosmetic products is growing, with male patients requesting cosmeceuticals that are designed for their skin properties. Focusing on biologic and physiologic needs of male skin offers extraordinary potential for the development of cosmeceutical products that are truly gender specific. Taking advantage of shaving habits is an opportunity to deliver cosmeceuticals for men. Special attention should be given to men's increased susceptibility to photodamage, fragility of the epidermis, and androgenic-induced changes of the pilosebaceous unit. Better-looking skin has become essential for both women and men.

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