

R E V I E W

Skin aging and the aesthetic medicine management: What is the role of dermocosmetics?

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ABSTRACT

Background: Skin aging is a complex biological process influenced by intrinsic and extrinsic factors. Intrinsic aging is genetically determined and occurs naturally over time, leading to a gradual decline in the skin's structural and functional integrity. Extrinsic aging, also known as photoaging, is primarily caused by environmental factors, such as ultraviolet (UV) radiation, pollution, and lifestyle choices like smoking and diet. The combined effect of these factors results in common signs of skin aging, including wrinkles, loss of elasticity, dryness, and hyperpigmentation.

Aim: To provide an overview of the molecular mechanisms underlying skin aging and highlight the role of dermocosmetics in mitigating visible signs.

Methods: A narrative synthesis of published literature addressing intrinsic and extrinsic drivers of skin aging, as well as evidence-based dermocosmetic interventions.

Results: To combat skin aging, dermocosmetics play a crucial role by offering products that target these visible signs. Key active ingredients in anti-aging dermocosmetics include retinoids, antioxidants, peptides, and hyaluronic acid. Retinoids, such as retinol, are vitamin A derivatives that promote cell turnover and collagen production, reducing wrinkles and improving skin texture. Antioxidants like vitamin C and E neutralize free radicals, which are responsible for oxidative stress and skin damage. Hyaluronic acid hydrates the skin, plumping it and reducing the appearance of fine lines. In addition to these ingredients, sunscreens are essential in preventing further photoaging by protecting the skin from harmful UV rays.



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Conclusions: Regular and combined use of dermocosmetics, together with photoprotection and healthy lifestyle choices, can effectively delay and mitigate visible signs of skin aging, supporting both skin health and quality of life.

Key words: skin aging, photoaging, oxidative stress, dermocosmetics, retinoids, hyaluronic acid

Introduction

As one ages, both intrinsic and extrinsic factors can have an impact on the skin¹. As time goes by, different layers of the skin experience changes that are reflected clinically on different cutaneous signs such as macules, wrinkles and a decrease in skin elasticity². The growing understanding of skin aging has made its management a key focus within aesthetic medicine, and is nowadays acknowledged as an increasingly significant cause for concern³, requiring trained medical doctors (MDs) for a tailored approach.

The aesthetic management of ageing skin by expert MDs should take into consideration the overall needs of each subject, tailoring a personalized program that also includes lifestyle counseling (e.g., diet, smoking cessation) and a referral to specialized healthcare professionals (HCPs) and MDs in case of suspected associated medical conditions.

For ageing skin, an important aspect to consider is the daily skincare routine, as dermocosmetics with different functions (e.g., sunscreen) can help counteract key ageing factors and improve skin appearance³.

This article addresses the skin ageing topic from an Aesthetic Medicine point of view, summarizing and discussing the latest literature with a focus on dermocosmetics.

Methods

The paper is structured as a mini review where the authors have selected relevant topics from literature, which include:

1. pathophysiology of skin ageing, including (intrinsic and extrinsic factors).
2. cleansing and sunprotection for ageing skin
3. Dermocosmetic active ingredients and treatments.
4. Role of dermocosmetics in supporting aesthetic procedures.

Research on the Pubmed database has been carried out to find out articles with the following keywords: “skin ageing” AND “dermocosmetics” AND “cosmetics”. The research included literature from 2018 to current days and articles were excluded if not available in the English language.

Results

The search yielded 52 articles for “skin ageing and dermocosmetics” and 2,185 results for “skin ageing and cosmetics.” The most relevant articles were selected for each topic, providing an overview of current research.

Pathophysiology of skin ageing, intrinsic and extrinsic factors

Skin ageing is driven by a combination of intrinsic and extrinsic molecular processes. Intrinsic ageing involves genetic predispositions, hormonal changes, and accumulation of oxidative damage (reactive oxygen species) that impair DNA repair, reduce cellular replication, and alter metabolic activity^{1,4} (Table 1). Extrinsic ageing mainly results from environmental exposures, especially ultraviolet (UV) radiation, which accelerate any potential damage to skin layers by activating matrix metalloproteinases (MMPs), degrading collagen and elastin, and by causing a structural disorganization of the dermal extracellular matrix⁴. In the last years, the immune aspect has emerged in

Table 1. Comparing photoageing to intrinsic ageing. Adapted from¹.

Characteristic		Photoageing	Intrinsic Ageing
Overall	Metabolic processes	Pronounced increase	Slow down
	Clinical appearance	Nodular, leathery, blotchy Coarse wrinkles, furrows	Smooth, unblemished Loss of elasticity, fine wrinkles
	Skin color	Irregular pigmentation	Pigment diminishes to pallor
	Skin surface marking	Markedly altered, often effaced	Maintains youthful geometric patterns
	Onset	As early as late teens	Typically 50s–60s (women earlier than men)
	Severity	Strongly associated to degree of pigmentation	Only slightly associated to degree of pigmentation
Epidermis	Thickness	Acanthropic in early stages Atrophy in end stages	Thins with ageing
	Proliferative rate	Higher than normal	Lower than normal
	Keratinocytes	Atopic and polarity loss numerous dyskeratoses	Modest cellular irregularity
	Dermo–epidermal junction	Extensive reduplication of lamina dense	Modest reduplication of lamina dense
	Vitamin A content	Destroyed by sun exposure	Plasma content of retinol increases
	Elastin	Marked elastogenesis followed by massive degeneration, dense accumulations on fibres	Elastogenesis followed by elastolysis – ‘moth-eaten fibres’
Dermis	Elastin matrix	Massive increase in elastic fibres, replacing the collagenated dermal matrix	Gradual decline in production of dermal matrix, only modest increase in the number and thickness of elastic fibres in the reticular dermis
	Lysozyme deposition on elastic fibres	Increased	Modest
	Collagen production	Decrease in amounts of mature collagen	Mature collagen more stable in degradation
	Grenz zone	Prominent	Absent
	Microvasculature	Abnormal deposition of basement membrane-like material	Normal
	Microcirculation	Vessels become dilated, deranged	Microvessels decrease, remaining vessels do not change
	Inflammatory response	Pronounced inflammation, perivascular, histocytic-lymphocytic infiltrate	No inflammatory response observed

research as a relevant player among the various pathophysiological mechanisms⁵. In fact, the skin protects us from the external environment, becoming susceptible to changes, activating an inflammatory response, and generating the so-called “SASP” (senescence-associated secretory phenotype)⁵.

These combined molecular and cellular alterations can clinically result in wrinkles, a loss in skin elasticity and laxity, and a rough-textured appearance⁶.

Cleansing and sunprotection for ageing skin

Dermocosmetics are applied according to their functions, including cleansing and photoprotection.

The potential role of cleansing in aging skin has been poorly documented and investigated. No studies focusing solely on cleansing were identified by the working group.

It is widely known that solar exposure can have damaging effects on the skin and different solar radiations act on various mechanisms: DNA damage, oxidative stress and pigmentation⁷. On the other hand, applying sunscreens is a fundamental step in daily skin-care for preventing photoageing⁸, and has been recently confirmed by an international consensus as the “base of pyramid”⁹. The pyramid concept is a hierarchical framework for anti-ageing dermocosmetic products, starting with foundational sunscreens and antioxidants for protection and repair, followed by moisturizers and exfoliants for skin renewal, and topped with peptides, growth factors, and regenerative agents for activation and regeneration. Recent evidence suggests a role of visible light as well, and this wavelength range should be considered in the sunscreen choice⁸. In addition to filters, other active substances can be considered such as antioxidants⁸.

Dermocosmetic active ingredients and treatment

In the recent years there has been a growing interest in evaluating different dermocosmetic formulations to contrast skin ageing, and “a myriad” of active ingredients can commonly be found¹⁰. However, many of these ingredients lack scientific validation. Some active ingredients, however, have strong supporting evidence and are discussed below. (Table 2).

One of the main categories is represented by topical vitamins¹¹. Natural and synthetic derivatives of vitamin A (usually defined by the term “retinoid”) have been used in topical skin formulations and, according to their chemical structure and properties, can be incorporated into either cosmetic or pharmaceutical products for managing skin ageing¹². Vitamin A and its derivatives are considered as one of the most effective active ingredients for skin ageing with anti-wrinkle properties¹³. Moreover, other topical vitamins have been applied for skin ageing thanks to their antioxidant activity, such as vitamin C, vitamin B3 and vitamin E¹¹. Several derivatives of vitamin C have been studied and developed to improve its active stability and its function in topical formulations¹⁴. Thus, it is important to have a clear view of the differences between the various derivatives, the overall efficacy of the dermocosmetic formulas along with the type of conducted studies (e.g., settings)¹⁴. The cosmeceutical use of vitamin B3 and its anti-ageing properties have been developed and studied not only alone, but also in association with other active components¹⁵. For example, formulas with 5% nicotinamide have shown to reduce skin ageing progression and hyperpigmentation¹⁵.

Hyaluronic acid (HA) represents another main molecule found in the development of cosmetic formulas thanks to different properties covering hygroscopic, rheological, and viscoelastic aspects¹⁶. HA can be used alone or in combination with other active ingredients and its molecular weight is critical for its permeability¹⁶. High-molecular-weight HA (HMW-HA) has limited skin penetration, primarily remaining on the surface to form a hydrating layer. In contrast, low-molecular-weight HA (LMW-HA) can penetrate deeper into the skin layers, including the stratum corneum and epidermis, facilitating enhanced hydration and potentially offering additional anti-ageing benefits¹⁶.

Cosmetic active ingredients targeting skin ageing include many categories, including natural derivatives, peptides, and polyphenols¹¹.

Dermocosmetic support in case of aesthetic procedures

Aesthetic procedures such as chemical peels, microneedling, injectables (e.g., botulinum toxin

Table 2. Dermocosmetics for skin ageing.

Action/individual need	Dermocosmetics	Formulation
Anti-wrinkle activity	Natural and synthetic derivatives of Vitamin A ¹¹⁻¹³ A-lipoic acid ¹¹ Idebenone or Synthetic analogue of enzyme Q ₁₀ 17-β-estradiol (1.01%) Progesteron 2% Hyaluronic acid ¹⁶	Topical formulations
	Hormones ¹¹	Systemic hormone substitution ¹¹
Anti-oxidant activity	Vitamin C ¹¹ Niacinamide (Vitamin B3) ^{14,15} Vitamin E ¹¹ Isoflavones ¹¹	Topical formulation ¹⁴
Hydrating activity	Hyaluronic acid ¹⁶	Topical HA (with low molecular weight: 20-300 kDa) ¹⁶ Epidermic filler ¹⁶
Photoprotection ⁽⁷⁻⁹⁾	Sunscreens with inorganic and organic UV filters (with good absorbance in the spectral range_ 290 to 400 nm) ¹¹ Polyphenol reduces DNA damages ¹¹	Topical formulations

and hyaluronic acid fillers), and energy-based devices (e.g., radiofrequency, lasers, and ultrasound) have demonstrated efficacy in mitigating signs of skin ageing by targeting multiple mechanisms, including collagen degradation, elastin fragmentation, and the accumulation of senescent cells¹⁷. In some cases, this strategy can be achieved with various modalities that can include dermocosmetics such as moisturizers and sunscreen (e.g., prevention and maintenance)¹⁷.

In aesthetic management, it is essential to follow the recommendations and protocols established for each individual procedure.

Discussion

Skin ageing can be one of the concerns for which subjects consult MDs, dermatologists and aesthetic doctors. This process should be considered in all its aspects, evaluating potentially damaging external factors and other possible associated conditions. In fact, the medical consultation for skin ageing can represent an important step in the subject's journey, as a complete anamnestic, clinical, and instrumental evaluation could

highlight critical healthcare aspects. Thus, the need of an expert management is required.

Aesthetic Medicine doctors can benefit from a protocol described more than 50 years ago by Carlo Alberto Bartoletti and Gaston Ramette^{18,19}. The so-called Mediskin® check-up protocol defines a punctual methodology where anamnesis, clinical and instrumental evaluations support physician in detecting the skin status ("biotype") and subjects' needs to design a tailored Aesthetic Medicine Program^{18,19}. This program includes counseling on a healthy lifestyle and curated dermocosmetic products^{18,19}. If needed, aesthetic procedures are integrated^{18,19}.

Dermocosmetics can have a role in contrasting skin ageing: the major one is photoprotection and the appropriate use of sunscreens⁷⁻⁹. In fact, multiple ranges of solar radiation wavelengths, specifically UVB, UVA and high energy visible (HEV) light, can have harmful effects on the skin, exacerbating certain features of photoaging⁷⁻⁹. More damaging effects on photoaging by visible light have been found for shorter wavelengths²⁰. Specifically, blue light can exert effects similar to UV radiation, including the formation of reactive oxygen species (ROS) and alterations in the extracellular matrix (ECM)²⁰⁻²³. However, to date, no

significant evidence has been reported regarding the effects of cleansing in counteracting skin aging. Another major component of skincare is the daily topical application of dermocosmetic treatments, which help maintain the skin in good condition through the activity of various ingredients, including antioxidants, humectants, moisturizers, and anti-aging agents¹¹⁻¹⁶.

Thus, dermocosmetics can represent an important tool for everyday skin care, and aesthetic MDs can help individuals in the management of skin ageing, starting with a complete evaluation of anamnesis and skin biotype (normal skin; skin with increased content of superficial lipid [up to seborrhea]; dry skin). This assessment allows the design of a personalized therapeutic journey that includes lifestyle counseling, a tailored skin care routine, aesthetic procedures if needed, and a referral to other MDs in case any underlying or associated pathologies are suspected.

The choice of dermocosmetics should be guided by the individual's skin status and clinical features to recommend the most suitable formulations, always including specific advice on photoprotection. For example, a subject with dry skin and fine wrinkles could benefit from rich-textured products and dermocosmetics that enhance skin hydration (e.g., HA), whereas a subject with normal skin and a dull complexion might require lighter formulas (e.g., serum) with antioxidants such as vitamin C or B3.

Conclusions

Skin ageing can be a concern for many individuals, and its management should be addressed by trained, expert aesthetic MDs through an individualized program. Defined protocols (e.g., Mediskin® check-up protocol) represent an important expert tool, enabling the assessment of the skin status ("biotype") and the subjects' needs, which in turn allow for the prescription of a personalized dermocosmetic skin care regimen.

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