

Men's Skin Care and Aesthetic Procedures During Ageing and Andropause

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Abstract

Skin ageing is a multifactorial process influenced by intrinsic and extrinsic factors. Both pathways converge at the molecular level through oxidative stress, inflammation, matrix metalloproteinase activation, DNA damage and impaired collagen homeostasis. In men, intrinsic ageing is affected by gradual but pronounced decline in androgens, mainly testosterone, with symptoms that sometimes may be non-specific and overlap with general signs of ageing. Testosterone together with dehydroepiandrosterone and dihydrotestosterone, regulates skin thickness, sebaceous activity, collagen synthesis and hair growth. Its reduction contributes to epidermal thinning, cutaneous atrophy, diminished elasticity and sebum production, increased skin dryness, impaired metabolic and reparative abilities, compromised skin barrier function and alterations in hair follicles. In addition to age-related decline, secular reductions in testosterone linked to lifestyle and environmental stressors further exacerbate male skin ageing. Despite growing interest in this topic, skin and appendages changes in men with androgen deficiency and skin care that should accompany these changes remain an insufficiently studied area. This paper synthesizes the available evidence on the impact of androgen deficiency in skin ageing and andropause on men's skin and highlights the importance of appropriate skin care and aesthetic procedures tailored to the specific needs of males during this stage of life.

Key words: skin ageing, andropause, testosterone, male skin care, aesthetic procedures

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Introduction

Skin ageing is a complex biological process resulting from intrinsic (chronological) and extrinsic (environmental) influences. Intrinsic ageing is characterized by dryness, decreased sebaceous activity, epidermal thinning, reduced elasticity and fine wrinkles, whereas extrinsic ageing, caused by solar radiation, environmental pollution, diet, smoking, lack of sleep and stress is accompanied by deep wrinkles, skin laxity, dullness, roughness, telangiectasias and pigmentation disorders. At the molecular level, both types of ageing share similarities – increased production of reactive oxygen species (ROS), inflammation, activation of matrix metalloproteinases (MMPs), DNA damage and disruption of the balance between collagen synthesis and degradation, ultimately leading to a reduction in dermal collagen and loss of skin firmness and elasticity (1–3).

Intrinsic ageing is strongly influenced by genetic predisposition, metabolic processes and hormonal changes (especially changes in sex hormones). Therefore, understanding sex-specific differences in the physiological properties of the skin is essential when selecting skin care products and aesthetic procedures intended specifically for males during ageing and andropause. Middle-aged and older men experience gradual but pronounced decline in testosterone levels – a phenomenon described in the literature by terms such as male menopause, andropause, androgen decline in the ageing male or late-onset hypogonadism (LOH) (4). Unlike menopause in women, which represents a clearly defined and relatively abrupt hormonal transition, testosterone decline in men occurs gradually, at an average rate of approximately 0.4–2% annually after the age of 30, with symptoms that may be non-specific and overlap with general signs of ageing (4, 5). In addition to changes in body function, decreased physical energy and muscle strength, declining in testosterone levels affect skin health (1, 4). Testosterone plays a pronounced role in the physiology of the skin and its appendages. Together with dehydroepiandrosterone (DHEA) and its active metabolite dihydrotestosterone (DHT), formed through the action of the enzyme 5 α -reductase, testosterone helps maintain skin thickness, influences sebaceous gland activity and sebum production, collagen synthesis in dermal fibroblasts and androgen-pattern hair growth, so its reduction can result in drier skin, diminished elasticity and hair loss (1, 6, 7). Although these effects are not as pronounced as those associated with declining estrogen, they still contribute to the overall ageing process of the skin.

Beside age-related decline, contemporary literature also describes a so-called secular, age-independent decline in testosterone levels within the general male population, which has been linked to obesity, smoking, alcohol use, sedentary lifestyle, chronic stress, sleep disturbances, exposure to environmental endocrine-disrupting chemicals, chronic illness and long-term use of some medications (4, 7). Given that androgen deficiency during andropause leads to reduced testosterone levels and availability, and consequently to diminished stimulation of the skin's collagenous and sebaceous functions, it can be assumed that skin ageing in men during this period of life represents cumulative burden of metabolic, environmental and behavioural stressors (1, 7).

Despite growing interest in andropause, cutaneous and appendages changes in men with androgen deficiency remain insufficiently studied, lagging behind research on the metabolic, cardiovascular and psychological aspects of this syndrome (4).

The aim of this paper was to synthesize the available scientific data regarding the impact of androgen deficiency in skin ageing and andropause on the condition and function of the skin and its appendages and to highlight the importance of appropriate skin care and aesthetic procedures tailored to the specific needs of men during this stage of life.

Methodology

This article included the research that was obtained by comprehensive literature searches in PubMed, Web of Science, Scopus and Google Scholar, using the following search terms: “male AND skin ageing”, “androgen AND skin”, “andropause”, “male AND menopause”, “skin care AND andropause”, “skin care AND male AND menopause”, “cosmetic products AND andropause”, “cosmetic products AND male AND menopause”, “aesthetic AND procedures AND andropause”, “aesthetic AND procedures AND male AND menopause”, “androgen-deficient skin”. The search was conducted by two independent researchers during April and May 2026 and screening was initially performed by searching for the specified terms in: title and abstract (Science Direct and PubMed), in title, abstract and keywords (Scopus) or anywhere in the text (Google Scholar). The search covered publications from the last 25 years. Literature was selected according to thematic relevance and scientific contribution. After removing duplicates, papers were selected according to the following inclusion criteria: texts that examined the connection between male skin, testosterone decline and andropause, published in English with full texts available. Exclusion criteria were: texts that did not examine the aforementioned connection; texts that examined the association between diseases and andropause; studies assessing oral or topical application of androgens; animal studies; and texts not written in English. In addition, the reference list of each selected paper was screened and texts that met the inclusion criteria were incorporated into the article. Ultimately, 30 studies were included, comprising a combination of original research, literature reviews and book chapters.

Discussion

Differences in Skin Structure and Ageing Between Male and Female

During infancy, childhood and early adolescence hydration of the stratum corneum (SC), transepidermal water loss (TEWL), sebum content, and pH value are similar, but over the years, differences in these physiological properties between males and females become more pronounced (5). Until the age of 40, SC hydration is higher in men, but in the fifth decade of life, it progressively decreases, with the decrease being even more pronounced in sun-exposed aged skin (6, 8). On the other hand, SC rehydration capacity in sun-exposed aged men is higher compared with age-matched women. Furthermore,

regardless of age, men have significantly lower TEWL than women. Male skin is characterised by higher sebum and sweat production and larger pore size (8). In men, sebaceous gland activity even increases with age (6). Due to higher testosterone levels, male skin is thicker in areas such as the lower back, abdomen, arms and shoulders and has an increased ratio of muscle to subcutaneous tissue. This increased thickness is predominantly due to a denser dermis (higher concentration of collagen fibres) (9). Men also have more prominent facial musculature and a higher density of hair follicles (10). Skin pH is lower in men and its value increases with age (6, 8).

In addition to anatomical and physiological differences, male and female skin also differ in the ageing process (6). It has been shown that males are more susceptible to the effects of free radicals and experience higher levels of oxidative stress compared with females. The composition of male skin SC sphingolipids (especially ceramides) remains relatively constant during ageing. With age, males experience gradual cutaneous thinning, an age-associated reduction in elasticity similar to women, but more severe rhytides, increased and deeper forehead wrinkles, increased periorcular ageing changes, more pronounced sagging of the lower eyelid compared with women, and they are more prone to hair loss (5, 8, 11, 12). The rate of collagen loss with age is similar to that in females, although the total dermal collagen content is higher in males at all ages. Furthermore, the loss of hypodermal adipose tissue with age leads to deeper expression lines in men. They also experience a decline in peak aerobic capacity and pulmonary function with age which contributes to accelerated cutaneous ageing (5). However, visible signs of ageing often appear later in men (9).

Hormonal changes that occur with age, especially a decrease in testosterone, also have an impact on male skin ageing and exposure to external factors (solar radiation, environmental pollutants and lifestyle) may further accelerate the process (5). In men, hormonal ageing unfolds less as a distinct event and more as the gradual erosion of an established structural advantage (9). Ageing may also cause a loss of sensitivity of target tissues to testosterone or dihydrotestosterone (DHT), which reduces the androgen effect (13).

However, certain studies show that, unlike female menopause, the age-related decline in testosterone in older men is not inevitable and could be modifiable by lifestyle factors (14).

Andropause

As men age, endocrine changes lead to a decline in function and reduced secretion, accompanied by alterations in hormone release. In healthy ageing, in men over 45 years of age, there is a gradual and progressive decline in the secretion rate of testosterone, termed andropause (15). Andropause derives from the Greek words “andras” (man) and “pause” (cessation), a term coined in the 1990s to describe a biochemical clinical syndrome that encompasses various endocrine, somatic and psychological changes that occur as a result of reduced levels of free testosterone, probably due to increased levels of sex hormone-binding globulin (SHBG). Unlike women, men experiencing andropause

do not completely lose reproductive capacity, although fertility declines significantly. According to a systematic review conducted in the Iranian population, andropause is significantly associated with age, lower testosterone levels, smoking, and lower economic and educational status (most likely due to inclination towards unhealthy lifestyle choices and limited engagement in preventive healthcare) (4, 16). The most commonly reported symptoms of andropause are physical (fatigue, decreased muscle mass, flushing, nocturia, hair loss, bone pain), psychological (irritability, depression, memory impairment, lack of concentration) and sexual (reduced sexual activity) (4).

In addition to age-related factors, recent literature also describes a secular, age-independent global decline in testosterone within the general population. Various longitudinal and cross-sectional studies indicate an annual testosterone decline of approximately 0.3–1.8%, independent of age, documented even among adolescent and young adult men. The main causative factors in this phenomenon include obesity and metabolic disorders, exposure to endocrine-disrupting chemicals (phthalates, bisphenol A, per- and polyfluoroalkyl substances (PFAS), micro/nanoplastics, pesticides), sedentary lifestyle, unhealthy dietary patterns (rich in ultra-processed foods, sugar and refined carbohydrates, fried foods and artificial trans fats), sleep deprivation (sleep apnoea, circadian rhythm disruption, poor sleep quality), chronic psychosocial stress, use of certain medications (opioids, statins, glucocorticoids, antidepressants), substance abuse (heavy alcohol consumption, anabolic-androgenic steroids) and exposure to air pollution (7, 17). Because testosterone declines gradually, clinical manifestations often overlap with general signs of ageing, which is why many men with low testosterone levels never develop the full clinical picture of “late-onset hypogonadism” (4).

Effects of Androgens and Their Deficiency on the Male Skin and Appendages During Ageing and Andropause

Androgens are steroid hormones essential for human sexual development and reproduction, regulating various physiological processes and modulating adipose tissue, skin and hair. In adult males, they are synthesised from cholesterol in the testes and adrenal glands and secreted into the circulation to exert their biological effects on target organs through the androgen receptor (AR) (7). Synthesis of the most abundant androgen in men, testosterone, occurs in the Leydig cells of the testes and is regulated by the hypothalamic–pituitary–gonadal (HPG) axis, mainly by luteinising hormone (LH). Approximately 98% of circulating testosterone is bound to proteins (albumin or SHBG), while the remaining 2% is free and considered the metabolically active fraction. Testosterone can be converted into the active metabolite dihydrotestosterone (DHT) through the action of the enzyme 5 α -reductase (7, 18). The level of serum total testosterone declines with ageing by as much as 0.4–2% annually after the age of 30 (5, 14, 19).

Testosterone exerts its physiological effects either directly or after being transformed into different metabolic products, primarily through two distinct signalling pathways that regulate gene expression and cellular activity throughout the body. The

first, genomic pathway begins when testosterone diffuses into the cell and binds to androgen receptors, while the second nongenomic pathway involves the activation of membrane-associated receptors and intracellular signalling cascades. In skin and hair follicles, testosterone is reduced by 5 α -reductase to DHT, a more potent androgen with greater affinity for AR. Finally, testosterone and its metabolites undergo metabolism primarily in the liver and are eliminated through the urine (18).

In terms of its physiological functions relevant to this paper, testosterone is a primary anabolic hormone that increases muscle protein synthesis and muscle strength, promotes lean body mass and reduces visceral fat deposits. Testosterone deficiency results in decreased muscle mass and strength and increased visceral fat content (14, 18). Testosterone also affects skin and hair physiology through conversion to DHT and stimulation of sebaceous glands (18). In men, sebaceous glands produce up to four times more sebum, giving male skin a more oily texture and more pronounced pores. Male skin is also 10–20% thicker than female skin. Testosterone directly stimulates collagen synthesis in dermal fibroblasts and modulates the inhibition and expression of metalloproteinase-2 (TIMP-2) and membrane type-1 metalloproteinase (MT1-MMP), preventing excessive collagen degradation. On the other hand, testosterone inhibits cutaneous wound healing, enhances inflammatory responses and delays tissue repair. Regarding hair, the metabolite DHT binds to androgen receptors in genetically predisposed (DHT-sensitive) hair follicles leading to their miniaturisation and androgenetic alopecia with the characteristic pattern of receding hairlines and crown baldness (18).

The rate of decrease in testosterone levels varies from man to man (4). Decline in androgen levels during ageing results in epidermal thinning and flattening of the dermo-epidermal junctions, cutaneous atrophy, reduced stimulation of collagen synthesis, diminished elasticity and sebum production, increased skin dryness, impaired metabolic and reparative abilities, reduced nutrient transfer, compromised skin barrier function and alterations in hair follicles (10).

Dehydroepiandrosterone (DHEA), an androgen precursor secreted by the adrenal glands, also influences skin ageing and declines with age. DHEA contributes to sebum production, supporting skin hydration and barrier function, so its age-related reduction leads to increased skin dryness, decreased elasticity and reduced protection against UV radiation (1).

Cosmetic Products Intended for Men During Ageing and Andropause

Well-chosen products and a well-planned skin care regimen tailored to all the aforementioned specificities of men's skin that occur with ageing and during andropause can delay the visible signs and improve skin quality. For managing ageing men's skin, the focus should be on consistent, long-term skin maintenance and protection to slow the rate of these gradual but pronounced signs of ageing (9).

Cosmetic products, especially those that reduce oxidative stress, stimulate cellular turnover, improve hydration and epidermal barrier function are the main non-invasive strategies for the treatment of skin ageing.

A well-structured male skin care regimen during ageing and andropause encompasses protection against extrinsic damage, cleansing, moisturising, skin care and treatment of existing age-related changes. Avoidance of solar radiation is a fundamental preventive measure for further skin ageing, so sun avoidance, protective clothing and the use of sunscreen products (broad-spectrum UVA and UVB sunscreens with antioxidants – free radical scavengers that provide enhanced photoprotection against visible light) are recommended (2, 3, 9, 20).

Considering compromised skin barrier function and increased skin dryness as a consequence of testosterone decline, products with mild synthetic detergents (syndets) and a pH adjusted to physiological levels (5–5.5) are recommended for skin cleansing.

Efficient skin care should boost regeneration and restoration of the barrier, keep the skin hydrated, elastic and smooth, protect collagen and elastin from degradation and prevent wrinkle formation. To achieve this, cosmetic products for men should contain: retinol, retinyl aldehyde or retinol esters (which stimulate proliferation and differentiation of keratinocytes, increase dermal collagen production and visibly improve wrinkles); alpha- and polyhydroxy acids (which reduce SC thickness, stimulate epidermal renewal, regulate the pH of the surface layers of the skin, have moisturising and antioxidant effects, and inhibit the action of matrix metalloproteinases); hyaluronic acid and its fragments; niacinamide (for the reduction of inflammation and “inflammageing”), antioxidants (e.g. ascorbic acid, tocopherol and their derivatives, lipoic and ferulic acid, ubiquinone, various plant extracts with polyphenols); proteins (collagen, hydrolysed elastin); peptides (mainly signal peptides that stimulate fibroblast activity the synthesis of collagen, elastin and glycosaminoglycans); emollients and barrier-restoring agents (e.g. ceramides, cholesterol, fatty acids) (2, 9, 21–25).

Non-invasive Aesthetic Procedures in the Treatment of Male Skin During Ageing and Andropause

Achieving the desired anti-ageing effect of cosmetic procedures requires a continuous, stepwise protocol that combines biorevitalisation, rejuvenation and layer-specific skin restoration. A slowing of the rate of epidermal renewal, slower wound healing and less efficient desquamation in older skin should be taken into account (3). An accurate assessment of the current skin condition and the severity of the changes characteristic of hormonal ageing is also necessary, i.e. personalisation of treatment. In addition, the expectations of the client/patient are important (for example when it comes to procedures, men tend to focus on three areas of the face: hairline, periorcular area and jawline) (12).

For more pronounced signs of skin ageing in men during andropause, energy-based devices (high-intensity focused ultrasound (HFU), radiofrequency (RF), intense pulsed light (IPL) therapy and lasers) are also available. By delivering thermal energy to the

reticular dermis and subcutaneous tissue, they cause thermolysis, denaturation and shortening of irregular collagen and increase collagen synthesis. After several series, skin elasticity increases, wrinkles are less visible and the facial contour changes (1–3, 20, 26).

Based on aesthetic dermatology literature, non-invasive anti-ageing methods for testosterone-deficient skin could also be electroporation and sonophoresis, which stimulate microcirculation and metabolic processes, increase cellular oxygenation and improve the penetration of cosmetic active substances into the skin (27–30). A common non-invasive method for superficial skin resurfacing is microdermabrasion, a mechanical exfoliation technique that removes the surface layer of the skin and facilitates the penetration of active substances (1, 30). However, additional studies need to be conducted to evaluate the effectiveness of aforementioned procedures, that is responses of testosterone-deficient male skin to various interventions.

Minimally Invasive and Invasive Aesthetic Procedures in the Treatment of Male Skin During Ageing and Andropause

“Resurfacing” the epidermis (removing the damaged epidermis and replacing the tissue with remodelled skin layers as a result of regeneration and repair mechanisms) and improving the condition and appearance of male skin can be achieved by controlled chemical exfoliation and epidermal damage using chemical peels. Superficial chemical peels (glycolic, lactic, mandelic and salicylic acid), as minimally invasive procedures, target the corneosomes, loosening corneocyte adhesions, promoting epidermal renewal and stimulating dermal fibroblasts. As a result, the skin becomes firmer and more hydrated, with less visible wrinkles (1–3, 5, 20, 22).

Microneedling procedures, especially dermapen, are minimally invasive methods used to create controlled microinjuries to the skin that lead to collagen synthesis by initiating the natural cascade of wound healing reactions characterised by the release of growth factors. In addition, these microchannels favour the penetration of active substances into the deeper layers of the skin. Serums used during this procedure are mainly solutions containing hyaluronic acid, multivitamin complexes, L-carnitine, caffeine and plant stem cells and extracts (1, 5, 20).

Regarding invasive anti-ageing methods, men are excellent candidates for autologous platelet-rich plasma (PRP), botulinum toxin injections, mesotherapy, dermal fillers, fractional ablative lasers (leading to the vaporisation of epidermal and dermal structures and inducing robust collagen remodelling), non-ablative lasers (causing dermal coagulation without disrupting the epidermis) and adipose tissue reduction (1, 5, 22).

Other Methods of Improvement of Androgen Deficiency Symptoms During Ageing and Andropause

Men skin care during ageing and andropause requires a holistic approach. In addition to cosmetic products and aesthetic procedures, various interventions are being proposed to increase testosterone synthesis and mitigate negative effects of its decline. First line treatment is a non-pharmacological approach: physical activity, weight loss, dietary

changes, reducing alcohol intake, quitting smoking, minimising exposure to endocrine-disrupting chemicals, sleep interventions, stress management and nutritional supplements (vitamin D, ashwagandha, fenugreek seed extracts) (7, 18). Pharmacological interventions, such as testosterone replacement therapy (TRT), are indicated only when necessary – for men with clinically confirmed hypogonadism, concomitant symptoms and/or signs of low testosterone and no contraindication to testosterone treatment (4, 18, 19).

Conclusion

Skin ageing in men is inevitable, but measures can be taken to reduce the changes that are caused by declining testosterone levels and environmental factors. Well-chosen products and a well-planned skin care regimen tailored to all the aforementioned specificities of men's skin that occur with ageing and during andropause can delay the visible signs of ageing and improve skin quality. The aforementioned skin care regimen encompasses protection against extrinsic damage, cleansing, moisturising, and treatment of existing age-related changes. Cosmetic ingredients such as retinol and its derivatives, alpha- and polyhydroxy acids, hyaluronic acid and its fragments, niacinamide, antioxidants, proteins and peptides, emollients, and barrier-restoring agents remain central to maintaining epidermal homeostasis. Non-invasive and invasive aesthetic procedures, as well as lifestyle modifications, offer additional and synergistic treatment options.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Author contributions

M.F.: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft; **S.D.:** Data curation, Writing – original draft; **J.B.:** Writing – original draft; **M.L.:** Supervision, Writing – review & editing.

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Nege kože muškaraca i estetske procedure tokom starenja i andropauze

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Kratak sadržaj

Starenje kože je multifaktorski proces na koji utiču unutrašnji i spoljašnji faktori. Oba puta se konvergiraju na molekularnom nivou kroz oksidativni stres, upalu, aktivaciju matriks metaloproteinaze, oštećenje DNK i poremećenu homeostazu kolagena. Kod muškaraca, unutrašnje starenje je pogođeno postepenim, ali izraženim padom androgena, uglavnom testosterona, sa simptomima koji ponekad mogu biti nespecifični i preklapati se sa opštim znacima starenja. Testosteron, zajedno sa dehidroepiandrosteronom i dihidrotestosteronom, reguliše debljinu kože, aktivnost lojnih žlezda, sintezu kolagena i rast dlake. Njegovo smanjenje doprinosi epidermalnom stanjivanju, atrofiji kože, smanjenoj elastičnosti i proizvodnji sebuma, povećanoj suvoći kože, oštećenim metaboličkim i reparativnim sposobnostima, ugroženoj funkciji kožne barijere i promenama u folikulima dlake. Pored pada povezanog sa starenjem, sekularna smanjenja testosterona povezana sa načinom života i stresorima iz okoline dodatno pogoršavaju starenje muške kože. Uprkos rastućem interesovanju za ovu temu, promene na koži i njenim dodacima kod muškaraca sa nedostatkom androgena i nega kože koja bi trebalo da prati ove promene ostaju nedovoljno proučeno područje. Ovaj rad sumira raspoložive dokaze o uticaju nedostatka androgena tokom starenje kože i andropauze na mušku kožu i ističe važnost odgovarajuće nege kože i estetskih procedura prilagođenih specifičnim potrebama muškaraca tokom ove životne faze.

Ključne reči: starenje kože, andropauza, testosteron, nega muške kože, estetske procedure
