Editorial

Can we prevent skin aging?

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The desire to look young and in turn vital has been a lure to man since ancient times, though aging as a rule remains a fact of life. The current advances in health sciences have lead to a boost in average life expectancy; hence, aging skin has set to become an issue to the current dermatologists. Increasing awareness regarding skin research has lead dermatologists and common man alike to seek out for answers concerning the complexities of the aging process.

Ayurveda, one of the oldest sciences of India, describes aging as '*Jar*ā ,' defined as that which has become old by the act of wearing out '*jīryati iti jar*ā'. It is synonymed as '*vārdhakya*' meaning increasing age.[1] Biologists define aging as a genetic physiological process associated with morphological and functional changes in cellular and extracellular components aggravated by injury throughout life and resulting in a progressive imbalance of the control regulatory systems of the organism, including hormonal, autocrine, neuroendocrine, and immune homeostatic mechanisms.[2] In short, aging is a process in which both intrinsic and extrinsic determinants lead progressively to a loss of structural integrity and physiological function.[3] The theories of aging are defined as following:

Cross-linking theory of aging

This theory is based on the observation that our proteins, DNA, and structural molecules develop inappropriate cross links to one another and look like older tissue as deduced by researchers on experiments with brain tissue.

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Wear and tear theory of aging

Years of damage to cells, tissues, and organs wear them out, killing them, and then the body. Telomerase the cap of DNA shortens with each cell division and reaches critical short length beyond which cell cannot divide and becomes senescent.

Free radical theory of aging

Free radicals cause DNA damage, cross linking of proteins, and formation of age-pigments, hence irreversible damage.

Somatic mutation theory of aging

The somatic mutations that are not corrected and accumulate will cause cell malfunction and death.

The pacemaker theory of aging

It suggests that the two biological clocks, neuroendocrine system and the immune system are set at birth to run for a specified period.

Genetic theory of aging

According to this theory, life span determining genes are inherited and are called longevity assurance genes, and they determine the process of aging

BIOLOGICAL MARKERS OF AGING

These are measurable indicators of aging and they include in vitro proliferative capacity of fibroblast, glycation of collagen, and DNA unwinding rate.[4]

Chronologically aged skin is thin, relatively flattened, dry and unblemished with some loss of elasticity and age-related loss of architectural regularity. General atrophy of the extracellular matrix is reflected by a decrease in the number of fibroblasts. Reduced levels of collagen and elastin, with impaired organization are primarily because of decreased protein synthesis affecting types I and III collagen in the dermis, with an increased breakdown of extracellular matrix

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proteins.[5] Aging happens due to a variety of reasons.

These are as following:

a) Constant effect of gravity on soft tissue results in their sagging over the facial skeleton.
b) Sun damage to skin.
c) Hormonal changes in women around menopause.
d) Decreased skin blood flow associated with aging.
e) Weight gain due to slow down of metabolism and fat deposition in regions of body called 'depots'.
f) Fascial and ligament laxity.
g) Shrinkage of glandular tissue (Salivary glands).
h) Skeletal resorption.[6]

There are two types of aging, intrinsic aging and extrinsic aging. Intrinsic aging is the slow irreversible degeneration of tissue that affects almost all body organs.[7] Intrinsic or natural aging is cellularly determined as a function of heredity, is inevitable, and results in cutaneous alterations.[8] The rate of aging is significantly different among different populations, as well as, among different anatomical sites even within a single individual. The intrinsic rate of skin aging in any individual can also be dramatically influenced by personal and environmental factors, particularly the amount of exposure to ultraviolet light.[5]

The common signs of intrinsic skin aging are:

- Fine wrinkles
- Thin and transparent skin
- Loss of underlying fat leading to hollowed cheeks and eye sockets with noticeable loss of firmness on the hands and neck
- Bones shrink away from the skin as a result of bone loss, which causes sagging skin
- Dry skin with pruritus
- Inability to sweat sufficiently to cool the skin
- Greying hair eventually turning white[8]

Skin that age intrinsically is smooth and unblemished, and characterized by normal geometric patterns, with some exaggerated expression lines. Histologically, such skin manifests epidermal and dermal atrophy, flattening of the epidermal rete ridges, as well as reduced numbers of fibroblasts and mast cells. In addition, increases are seen in the number of collagen fibrils as well as the ratio of collagen III to collagen I.[9]

INTRINSIC AGING DETERMINANTS

The factors involved in determining intrinsic aging are as follows.

Ethnicity

The greatest effect of ethnicity on aging is primarily related to differences in pigmentation. High levels of pigmentation are protective with regard to the cumulative effects of photoaging, with African-Americans showing little cutaneous difference between exposed and unexposed sites. Basal cell carcinoma and squamous cell carcinoma occur almost exclusively on sun-exposed skin of light-skinned people. African-American skin is more compacted than Caucasian skin, as well as having a higher intercellular lipid content, which may contribute to more resistance to aging.

Anatomic variations

Skin rigidity is much higher at the forehead than at the cheek in post-menopausal women. Also, in areas of the body with high blood flow, for example, lip, finger, nasal tip, and forehead, blood flow decreased with age compared to areas with baseline low blood flow, in which no difference was observed. The decrease in epidermal thickness with aging was found to be smaller at the temple than at the volar forearm, which may be the effect of cumulative photo aging.

Hormonal influence

Hormonal changes in skin are primarily the effect of changes of oestrogen levels in the skin especially in women. After menopause, the following changes occur: vaginal epithelium atrophies, cervico-vaginal secretions become sparse, vaginal pH rises, atrophic vaginitis becomes more common, collagen and water content decrease, pubic hair grays and becomes sparse, the labia majora loses subcutaneous fat and also the labia (labia minora, vestibule and vaginal mucosa) atrophies. The cumulative effect of oestrogen deficiency contributes to poor wound healing. Skin collagen content and thickness decrease with the hormonal affects of castration. Also dramatic hormonal changes, particularly thyroid, testosterone and oestrogen, alter epidermal lipid synthesis.[3]

EXTRINSIC AGING DETERMINANTS

Extrinsic factors are, to varying degrees, controllable and include exposure to sunlight, pollution or nicotine, repetitive muscle movements like squinting or frowning, and miscellaneous lifestyle components such as diet, sleeping position and overall health.[3]

Sun exposure

When skin is exposed to sunlight, UV radiation

is absorbed by skin molecules that can generate harmful compounds, called reactive oxygen species (ROS), which then cause "oxidative damage" to cellular components like cell walls, lipid membranes, mitochondria, and DNA. These ROS also play an important role in molecular pathways.[10] UV-B is a strong immunosuppressive agent and therefore may have very significant systemic effects related to the release of immunologically active molecules from the skin, such as tumour necrosis factor (TNF)-alpha and cis-urocanic acid, which themselves produce immunosuppressive effects including depression of delayed hypersensitivity, suppression of T-lymphocytes and activation of cutaneous herpes simplex infections.[5]

Photoaged skin is classified according to the Glogau score and the degree of wrinkling observed as:

- Mild (age 28–35 years): Few wrinkles, no keratoses
- Moderate (age 35–50 years): Early wrinkling, sallow complexion with early actinic keratoses
- Advanced (age 50–60 years): Persistent wrinkling, discolouration of the skin with telangiectases and actinic keratoses
- Severe (age 65–70 years): Severe wrinkling, photoaging, gravitational and dynamic forces affecting the skin, actinic keratoses with or without skin cancer.[3]

Life style influence

Skin is affected by ambient conditions such as temperature and humidity. An increase in skin temperature of 7–8°C doubles the evaporative water loss. Low temperature stiffens skin and decreases evaporative water loss even with plenty of humidity in air, as structural proteins and lipids in the skin are critically dependent on temperature for appropriate conformation.[11]

Effects of smoking

Tobacco smoking in addition to seriously affecting the internal organs of the body, affects a person's appearance by altering the skin and body weight and shape. Skin damaged by smoke appears grey and wasted.[5] Cigarette smoking is strongly associated with elastosis in both sexes, and telangiectasia (red spots on skin) in men. Smoking causes skin damage primarily by decreasing capillary blood flow to the skin, which, in turn, creates oxygen and nutrient deprivation in cutaneous tissues. It has been shown that those who smoke have fewer collagen and elastin fibres in the dermis, which causes skin to become slack, hardened and less elastic. It has been suggested that MMP-1 induced by smoking may explain the multiplicative effects of sunlight and smoking.[7]

Effects of pollution

Despite its barrier properties, the skin is also a point of entry for substances capable of causing harm, e.g. exposure to xenobiotics, pesticides, topical drugs and cosmetics

The differences between intrinsic aging and photoaging (extrinsic) aging are stated in Table 1.

PREVENTION OF AGING

Photoprotection

Photoprotection refers to measures that can be taken to protect the skin from UV damage and is achieved by sunscreens, sun-protective clothing, and sun avoidance. Sunscreens are broadly defined as agents that protect against UV damage and protect against sunburn, wrinkles, and pigmentary changes sun-protective behaviour is achieved through patient education. Patients should be discouraged from using sun tanning beds, which accelerate photoaging. Patients should be educated to avoid midday Sun exposure when ultraviolet radiation is most intense, to participate in outdoor activities early or late in the day, to avoid sunbathing (even with sunscreens), and to seek shady, covered areas rather than direct sunlight.[10]

Caloric restriction

Calorie restriction i.e., under nutrition without malnutrition, is known to extend lifespan and slow aging. The possible mechanisms that underlie antiaging action include attenuation of oxidative damage, modulation of glycemia and hormesis.

Hormonal replacement

Growth hormone replacement has resulted in improved muscle/fat ratio, increased lipolysis, bone density changes and improved exercise capacity. Melatonin, an antistream agent has proved to be an effective antiaging strategy. Dehydroepiandrosterone replacement therapy has gained attention over years. Also replacing estradione, testosterone, growth hormone, and reducing cortisol raising stress are strategies employed in maintaining insulin sensitivity.[4]

Table 1: Differences between photoaging and intrinsic aging

Characteristic	Photoaging	Intrinsic aging
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 aging
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 densa
Vitamin A content	Destroyed by sun exposure	Plasma content of retinol increases
Dermis		
Elastin	Marked elastogenesis followed by massive degeneration	Elastogenesis followed by elastolysis – 'moth-eaten fibres'
Elastin matrix	Massive increase in elastic fibres,	Gradual decline in production of dermal matrix
Lysosyme 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
Inflammatory response	Pronounced inflammation, perivenular, histocytic-lymphocytic infiltrate	No inflammatory response observed.[3]

Antiaging supplements

Vitamin A, C, beta- carotene, selenium, coenzyme Q 10, estrogen, testosterone, silymarin, pycnogenol, procyanidins are the major players in antiaging therapies.[4,8] Antioxidants, all of which display various distinguishing characteristics and activities, are believed to be an important focus in prevention of aging, as these free radical scavengers protect the skin via several mechanisms.[8]

To conclude, dictums of good health namely keeping a healthy weight, avoiding smoking, sun protection, proper diet, regular exercises, development of good adjusting, and coping skills, complemented by good social skills, reduced anxiety are in right potions for preventing aging.

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