BioMedical
EMPORIUM

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RETINOL SERUM

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COSMECEUTICAL SIGNIFICANCE

The BioMedical Emporium Retinol Serum is a cutting-edge skincare product designed to rejuvenate and enhance the skin's appearance. Combining the potent effects of retinol, niacinamide, and vitamin E this serum targets multiple signs of ageing, hyperpigmentation, and uneven skin texture. By leveraging scientifically backed ingredients, the BioMedical Emporium Retinol Serum promises to deliver transformative results helping to achieve a healthier and more youthful complexion.

Retinol can be described as a small lipophilic molecule and the main active vitamin A derivative. This molecule acts as a precursor to retinoic acid and can be converted into its active metabolite within human skin. Retinol can penetrate the skin and undergo sequential conversion to retinaldehyde and then to retinoic acid. Topical retinol has a significant advantage over retinoic acid due to its reduced occurrence of side effects, including erythema, scaling, dryness, and itching. In addition, retinol has demonstrated effective promotion of various dermal anti-ageing benefits. It can stimulate collagen synthesis, inhibit MMP activity, reduce oxidative stress, and modulate gene expression. Retinol is also effective in reducing the

appearance of wrinkles, fine lines, and irregular pigmentation which are typical signs of both intrinsic and extrinsic ageing. The mechanisms of retinol action may involve the activation of RARs and RXRs which regulate gene transcription and cell differentiation. Regulation of the activity of growth factors and cytokines involved in ECM turnover and inflammation can also be influenced by retinol.

Niacinamide is a water-soluble form of vitamin B3. Nicotinic acid, also known as niacin, is converted into niacinamide in the body. Although niacin and niacinamide are considered identical in their role as vitamins they have different pharmacological effects. Different body tissues have different thresholds for vitamin B3 deficiency and the skin is particularly susceptible. Studies have shown that niacinamide can significantly reduce dermal pigmentation. It was reported that 44% of niacinamide-treated areas showed good to excellent reduction in pigmentation compared to 55% with hydroquinone treatment. Moreover, side effects such as erythema, pruritis, and burning were less frequent and milder with the application of niacinamide compared to hydroquinone (18% vs. 29%). This is attributed to niacinamide decreasing cutaneous pigmentation by suppressing the transfer of melanosomes from melanocytes to keratinocytes.

Vitamin E is a fat-soluble compound that is naturally found in fruits, vegetables (such as nuts, mangoes, and kiwifruit), and vegetable oils (such as olive oil, avocado oil, and sunflower oil). It is also

present in human skin (dermis and epidermis). For more than 50 years dermatologists have employed vitamin E and its derivatives (vitamin E esters) due to their photoprotective effect on the skin. This compound acts as an antioxidant against free radicals generated by UV radiation. Hence, skin damage such as erythema, edema, and sunburns can be reduced by applying vitamin E topically before UV exposure. This vitamin can help prevent skin cancers and protect against photoageing by reducing wrinkles and improving skin elasticity, structure, and softness. Therefore, the BioMedical Emporium Retinol Serum focuses on restoring skin texture to its youthful state by reducing hyperpigmentation, elevating dermal epithelization, improving the appearance of fine lines and wrinkles, and helping to normalize the physiology of the epidermis by retaining skin moisture.

In conclusion, the BioMedical Emporium Retinol Serum stands out as a comprehensive solution for various skin concerns. By incorporating retinol to stimulate collagen production and reduce oxidative stress, niacinamide to decrease pigmentation and enhance skin barrier function, and vitamin E to provide antioxidant protection and improve skin elasticity, this serum offers a multi-faceted approach to skincare. With regular use the BioMedical Emporium Retinol Serum can help restore skin texture, reduce signs of ageing, and maintain optimal skin health making it an essential addition to any skincare regimen.

THE CLINICAL POTENTIAL OF RETINOL

Reduces hyperpigmentation

Cosmeceutical features: ↑ appearance of pigmented lesions, ↑ overall youthful complexion, ↑ skin texture

Physiology: ↓ tyrosinase, ↓ melanin synthesis, ↑ skin cell turnover, ↑ exfoliation of pigmented cells, ↓ post-inflammatory hyperpigmentation, ↑ collagen

Improves epithelization of the skin

Cosmeceutical features: ↑ epidermal thickness, ↑ skin texture, ↑ overall youthful complexion

Physiology: ↑ epidermal keratinocyte proliferation, ↑ endothelial cell growth, ↑ c-Jun

Improves the appearance of fine lines and wrinkles

Cosmeceutical features: ↑ wrinkle appearance, ↓ fine line formation

Physiology: ↑ Type I collagen, ↑ fibronectin, ↑ tropoelastin, ↑ TGF-β/Smad pathway, ↑ TGF-β1 mRNA expression, ↓ inhibitory Smad7, ↑ CTGF/CCN2, ↑ TGF-β/CTGF pathway, ↓ CCN1 gene expression, ↓ TGF-β/CTGF pathway, ↑ MMP, ↑ ECM production, ↑ epidermal keratinocytes, ↑ c-Jun

Helps to normalize the physiology of the epidermis and retain skin moisture

Cosmeceutical features: ↑ skin nutrient delivery, ↑ skin texture

Physiology: ↑ vascularity (dermis), ↑ microenvironment (dermis + epidermis), ↑ VEGF

THE CLINICAL POTENTIAL OF NIACINAMIDE

Reduces hyperpigmentation

Cosmeceutical features:
↑ lightening of cutaneous pigmentation, ↑ even skin tone

Physiology: ↓ tyrosinase directly, ↓ PAR-2, ↓melanosome transfer from melanocytes to keratinocytes, ↑ expression of differentiated type keratin K1, ↑ antiglycation

Improves epithelization of the skin

Cosmeceutical features:
↑ skin texture, ↑ skin thickness

Physiology: ↑ ceramides, ↑ intercellular lipids, ↑ SPT mRNA

Improves the appearance of fine lines and wrinkles

Cosmeceutical features:
↑ wrinkle appearance, ↓ fine line formation

Physiology: ↓ excess dermal GAGs, ↑ collagen synthesis

Helps to normalize the physiology of the epidermis and retain skin moisture

Cosmeceutical features:
↑ skin moisture, ↓dermal dryness

Physiology: ↑ ceramides, ↓ TEWL, ↑ free fatty acids, ↑ cholesterol

THE CLINICAL POTENTIAL OF TOCOPHEROL ACETATE

Reduces hyperpigmentation

Cosmeceutical features:
↓ pigmentation

Physiology: ↓ UVB-mediated COX-2 induction, ↓ peroxynitrite production, ↓ lipid peroxidation, ↓ ROS

Improves epithelization of the skin

Cosmeceutical features:
↑ skin texture

Physiology: ↑ keratinocyte production, ↑ fibroblast viability

Improves the appearance of fine lines and wrinkles

Cosmeceutical features:
↑ wrinkle appearance, ↓ fine line formation, ↑ skin texture

Physiology: ↓ MMP-1, ↓ collagen degradation

Helps to normalize the physiology of the epidermis and retain skin moisture

Cosmeceutical features:
↓ dermal dryness, ↑ skin texture

Physiology: ↑ protects epidermal cell membranes, ↑ protects lipids from oxidative damage

***Table 1:** Classification and clinical significance of cosmeceutical ingredients included in the BioMedical Emporium Retinol Serum*

INGREDIENT	CLASSIFICATION	REASON FOR INCLUSION
Retinol	Vitamin A derivate	Reduces hyperpigmentation, improves epithelization of the skin, improves the appearance of fine lines and wrinkles, and helps to normalize the physiology of the epidermis and retain skin moisture
Niacinamide	Water-soluble vitamin, antioxidant	Lightening effect, photo-protective and improves the barrier-protective function of the skin
Tocopherol acetate (vitamin E)	Lipid-soluble vitamin, antioxidant	Reduces lipid peroxidation, photoprotective, and improves skin moisturization

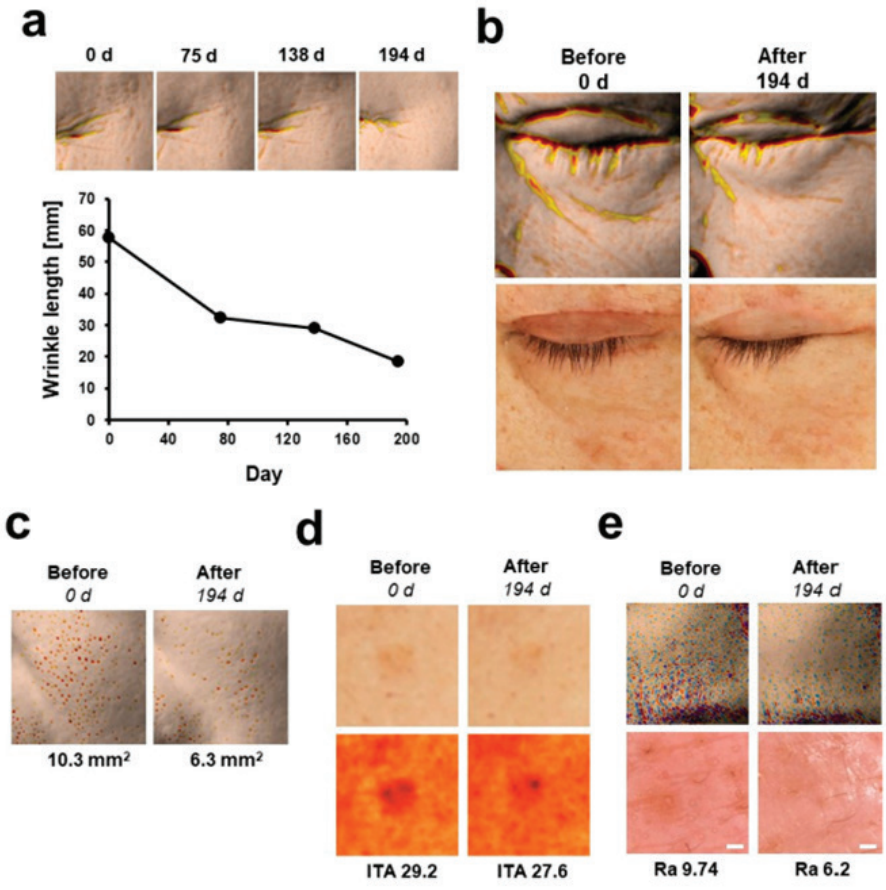

Figure 1. Images revealing the long-term effect of retinol application as seen on day 0 and day 194 **(a)** improved appearance of crow's feet, **(b)** improved appearance of eye wrinkles, **(c)** improved appearance of pores on the cheek, **(d)** improved hyperpigmentation spots, **(e)** improved skin texture (Kang *et al.*, 2022).

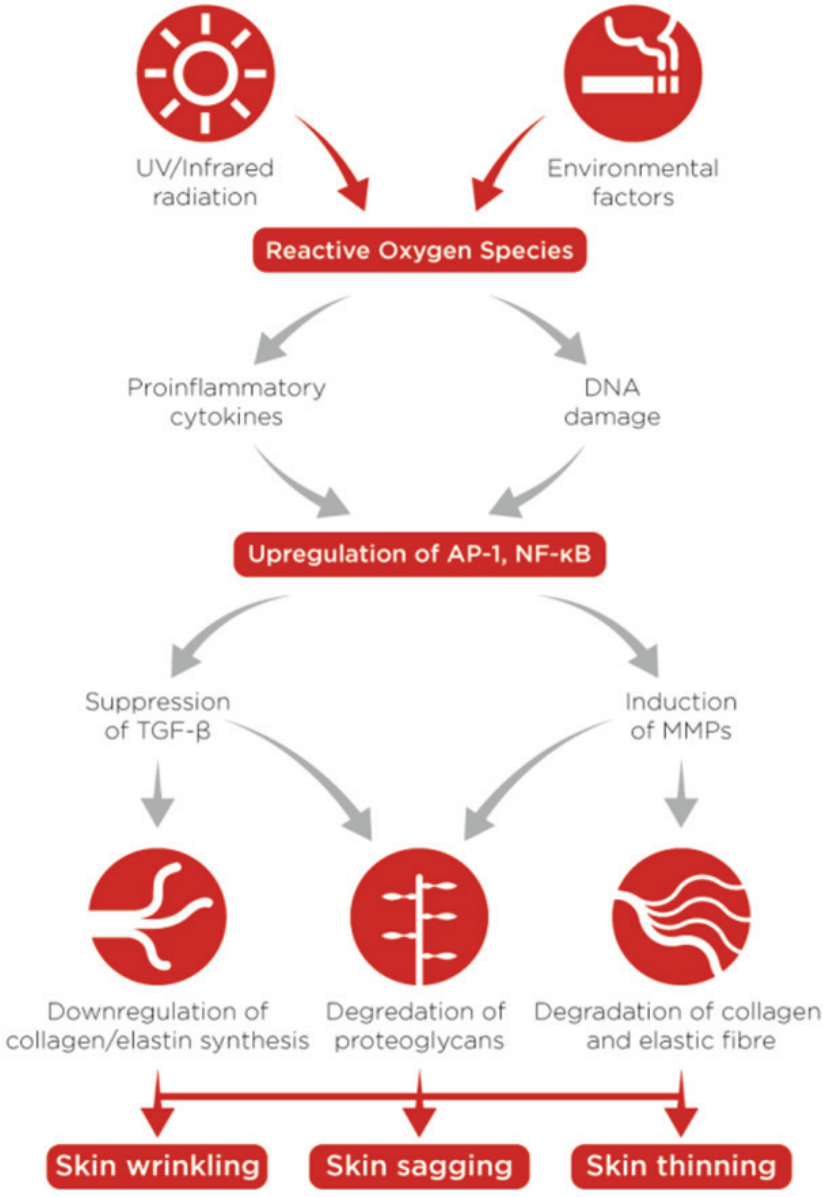

Figure 2. A simplified illustration of the main pathogenetic factors leading to major clinical features of accelerated skin ageing (Wadstein *et al.*, 2022).

ABBREVIATIONS

AP-1:	activator protein 1
CCN1:	cellular communication network factor 1
CCN2:	cellular communication network factor 2
c-Jun:	Jun-Proto-Oncogene
COX-2:	cyclooxygenase-2
CTGF:	connective tissue growth factor
ECM:	extracellular matrix
GAGs:	glycosaminoglycans
MMP:	matrix metalloproteinases
mRNA:	messenger Ribonucleic Acid
PAR-2:	protease-activated receptor 2
RARs:	retinoic acid receptors
ROS:	reactive oxygen species
RXRs:	retinoid X receptors
Smad:	suppressor of mothers against decapentaplegic
Smad7:	suppressor of mothers against decapentaplegic homolog 7
SPT:	single particle tracking
TEWL:	transepidermal water loss
TGF-β:	transforming growth factor
UV:	ultraviolet
UVB:	ultraviolet B radiation
VEGF:	vascular endothelial growth factor

WARNINGS

Inappropriate or excessive use of topical retinol can lead to potential side effects. These generally include skin dryness, redness, and peeling, which can cause discomfort. However, typically these side effects diminish over time as the skin adjusts. Therefore, lower doses of retinol can be applied until the skin's tolerability improves whereafter the concentration of retinol can be increased.
Please note: BioMedical Emporium Retinol Serum contains vitamin A-related compounds, which contribute to the daily intake of vitamin A. Sun alert: Vitamin A-containing products may cause photosensitivity and increase sensitivity to sunburn; ensure to apply adequate sunscreen protection while using BioMedical Emporium Retinol Serum.
Side effects from the topical application of niacinamide are minor and rare. Reported side effects include mild burning, pruritis, and erythema. However, these side effects tend to improve with continued use.
Vitamin E and its derivatives are widely used in many cosmetic and dermatologic products, in general, literature reporting side effects such as allergic or irritant skin reactions are rare.

STORAGE INSTRUCTIONS

Store at or below 25°C.

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