

CASE STUDY: REJUVENATING IMPACT OF THE SKIN K PROTOCOL ON FACIAL AGING

Kyze Clauman Goulart¹

Abstract: Facial aging is a multifactorial process associated with structural changes, reduced muscle tone, increased oxidative stress, and the accumulation of cellular metabolic byproducts, such as lipofuscin, impacting skin firmness, uniformity, and luminosity. In 2018, the author developed an original injectable protocol, called Skin K, with a patent application filed, aiming to promote overall improvement in skin quality and facial support through cellular and neuromuscular modulation. Since its implementation in clinical practice, patients undergoing the protocol have been monitored through comparative clinical evaluation and standardized photographic records. Improvements in tissue firmness, greater homogeneity of skin tone, and an overall rejuvenating appearance were observed. The biological mechanisms involved are discussed based on current literature on skin aging. The findings suggest that the protocol may represent a promising approach for improving skin quality and facial support; however, controlled studies are needed for objective validation of the results and in-depth investigation of the mechanisms involved.

Keywords: Skin K, Skin aging, DMAE (dimethylaminoethanol), Lipofuscin, Oxidative stress, Facial skin firmness, Injectable treatments, Cholinergic modulation

¹ A pharmacist graduated from the University of Southern Santa Catarina (UNESC) in 2004, with a specialization in Aesthetic Pharmacy from Nepuga Postgraduate Studies (2019), she is a master's student in Health Sciences at UNESC, where she is developing research on the anti-inflammatory effects of active ingredients applied to facial rejuvenation protocols focusing on cellular and muscular modulation.



INTRODUCTION

Facial aging is a multifactorial biological process characterized by structural and functional changes that include reduced dermal hydration, decreased muscle tone, increased oxidative stress, and progressive accumulation of by-products cellular metabolic drugs, such as lipofuscin. The continuous action of free radicals contributes to cumulative oxidative damage, compromising the integrity of the extracellular matrix, cellular communication, and skin vitality, resulting in clinical manifestations such as sagging, opacity, and uneven skin tone.

In 2018, the author developed an injectable protocol called Skin K, which is continuously applied in clinical practice with the aim of promoting an overall improvement in skin quality and facial support. The protocol includes as one of the active ingredients the use of injectable DMAE, a compound associated with the modulation of peripheral cholinergic activity. The literature describes that acetylcholine plays a central role in muscle contraction and in the regulation of cellular processes, and can influence muscle tone and tissue support.

In addition to neuromuscular modulation, mechanisms related to the reduction of oxidative stress and cellular metabolic dynamics may be associated with improved skin luminosity and uniformity. Lipofuscin, a pigment resulting from lipid peroxidation and cellular aging, is related to the progressive darkening of the dermis. The clinical improvement observed after the application of the protocol is consistent with these mechanisms described in the literature, although no direct biochemical measurements were performed in this report.

The present study describes the clinical findings observed using the protocol developed by the author, discussing its possible biological foundations in the light of current knowledge about skin aging.



**PERFORMANCE OF THE SKIN K PROTOCOL IN CELL REVITALIZATION AND MUS-
CLE LIFTING: PRELIMINARY CLINICAL REPORT**



Image 1





Image 2





Image 3





Image 4

Skin aging is a multifactorial process, in which the accumulation of free radicals and oxidative stress play a central role in cell degradation, compromising the integrity of the dermis and epidermis and contributing to visible skin changes, such as loss of firmness, uniformity, and luminosity (Mustafa, 2024; Ferreira & Matsubara, 1997; Herman, 1992; Braunstein et al., 2025).

A relevant marker of cellular aging is lipofuscin, a residual pigment that accumulates in lysosomes over time, and is associated with cellular senescence, chronic inflammation, and reduced regenerative capacity of the skin (Baldensperger et al., 2024; Dougnon & Matsui, 2025; Moreno-García et al., 2018; Renteln, 2024). The reduction or modulation of this accumulation has been



considered a potential target for interventions aimed at restoring cellular functionality and improving skin appearance.

In addition to cellular effects, muscle tone also plays an important role in supporting the skin. The neurotransmitter acetylcholine, produced in skin and muscle tissues, participates in the regulation of muscle contraction and facial firmness, contributing to the maintenance of the structural architecture of the face (Kurzen, 2007; Kurzen & Schallreuter, 2004; Slominski et al., 2022).

The Skin K protocol uses a proprietary cosmeceutical formulation composed of active ingredients with the potential to modulate pathways related to muscle tone and cell metabolism. Among the compounds described in the literature with this potential, DMAE (dimethylaminoethanol), a substance associated with the production of choline, a precursor of acetylcholine (Blin et al., 2009), stands out.

Based on the clinical results observed in this case, and considering scientific evidence related to the role of DMAE, acetylcholine and lipofuscin in skin aging, it is suggested that the protocol may act, at the cellular level, modulating aspects associated with muscle tone and the accumulation of residual pigments, contributing to skin revitalization.

Clinical effects observed include natural-looking facelifting, improved skin tone uniformity, and increased skin luminosity, conferring a more youthful and revitalized facial appearance, as demonstrated in comparative clinical photographs before and 15 days after treatment (Figures 1–4). It should be noted that these findings are still under investigation, and additional studies are needed for scientific confirmation. The present clinical report represents a preliminary contribution to the understanding of the potential mechanism of action of the Skin K protocol in the context of facial aging.



COMPARISON BETWEEN THE RESULTS OF SKIN K REJUVENATE AND OTHER AVAILABLE REJUVENATION TREATMENTS

The comparison between the results of the Skin K protocol and other treatments used in facial rejuvenation is relevant to contextualize its possible clinical applicability. Currently, several approaches are employed in aesthetic dermatology, including laser technologies, dermal fillers, and botulinum toxin applications, with the aim of reducing wrinkles, improving facial contour, and restoring skin quality.

In general, these treatments act through different mechanisms, such as stimulation of neocollagenesis, volumetric replacement, or modulation of facial muscle activity.

However, in addition to structural changes in the skin, cellular processes associated with aging, such as oxidative stress and accumulation of waste products of cellular metabolism, also play a relevant role in the deterioration of skin function (Harman, 1992; Mustafa, 2024; Ferreira & Matsubara, 1997).

Among these processes, the accumulation of lipofuscin, an intracellular pigment resulting from lipid peroxidation and incomplete degradation of cellular components, stands out. This pigment is associated with cellular aging, oxidative stress, and lysosomal dysfunction, and may contribute to the reduction of the regenerative capacity of tissues (Baldensperger et al., 2024; Moreno-García et al., 2018; Dougnon & Matsui, 2025).

The understanding of these mechanisms has stimulated the development of therapeutic approaches that seek not only to improve the external appearance of the skin, but also to act on cellular pathways related to aging. In this context, the Skin K protocol uses a proprietary cosmeceutical formulation composed of active ingredients with the potential to act on metabolic pathways associated with the cellular physiology of the skin.

Among these pathways, the cutaneous cholinergic system stands out. Evidence shows that human skin has a non-neuronal cholinergic system capable of synthesizing acetylcholine, a molecule



involved in the regulation of cellular functions and communication between skin cells (Kurzen, 2007; Kurzen & Schallreuter, 2004). Acetylcholine also participates in processes related to muscle contraction and the structural organization of tissues, and can influence facial tonicity (Slominski et al., 2022).

Compounds associated with the choline–acetylcholine pathway, such as dimethylaminoethanol (DMAE), have been studied for their role as a choline precursor and for their potential biological effects on different cellular systems (Blin et al., 2009). Thus, approaches that explore these pathways may represent complementary strategies in the management of the signs of skin aging.

Thus, unlike treatments that act predominantly on structural or volumetric correction of the face, the proposed protocol seeks to integrate aspects related to cell function and muscle tone. However, direct comparisons between different therapeutic modalities still require controlled clinical studies for better evaluation of efficacy and safety.

In addition to objective clinical results, patient satisfaction is a relevant parameter in the evaluation of aesthetic treatments. Factors such as the naturalness of the result, the perception of improved skin quality, and the durability of the effects can significantly influence the therapeutic choice.

Thus, the investigation of the Skin K protocol and in the context of facial rejuvenation can contribute to broadening the understanding of approaches that integrate structural, cellular and functional aspects of skin aging. Additional studies will be needed to establish more robust comparisons with other therapeutic modalities used in clinical practice.

SIDE EFFECTS AND CONTRAINDICATIONS OF USING SKIN K REJUVENATES IN DIFFERENT SKIN TYPES.

Research into the side effects and contraindications of using the Skin K protocol on different skin types is essential to ensure the safety and effectiveness of the treatment. While Skin K has shown



promising results in reducing wrinkles and revitalizing the skin, like any aesthetic intervention, it may not be suitable for all individuals. Identifying and classifying contraindications is crucial, especially in populations that are diverse in terms of skin conditions, age groups, and medical history.

Potential side effects can range from mild to moderate, depending on individual skin sensitivity and the specific characteristics of each patient. Among the effects commonly reported in injectable treatments are pain at the site of application, ecchymoses, swelling and transient local reactions. Although serious adverse events are rare, they should be considered in clinical practice. A detailed evaluation before treatment is essential to minimize risks and ensure patient safety.

Pre-existing skin conditions, such as active dermatitis, eczema, inflammatory acne, or open lesions, may contraindicate the application of the protocol, since the introduction of substances into compromised tissue can aggravate the condition. Classic evidence indicates that chronic inflammation can alter the response to cutaneous interventions and increase patient discomfort (Manso, 1992; Harman, 1992). Careful dermatological evaluations and health questionnaires help to identify contraindications and plan safe alternative strategies.

In addition, individual variability, including genetic and environmental factors, may influence treatment response. Each skin type has specific characteristics that can modify both efficacy and tolerance, and it is important to consider aspects such as phototype, dermal density, and history of hyperpigmentation or hypopigmentation.

Given the complexity of skin ageing and the variety of treatments available, it is imperative that the scientific community continues to document and analyze the effects of the Skin K protocol, considering both objective parameters and the subjective perception of the patient. Ongoing training of healthcare professionals and maintaining safe application environments are vital to ensuring that patients receive the best possible care. Continued research on side effects and contraindications will contribute to a more robust understanding of the protocol, supporting the formulation of practical guidelines that protect and inform patients.



FINAL CONSIDERATIONS

The present study describes the development of the injectable Skin K protocol, with the aim of restoring skin vitality, using active ingredients selected based on their ability to modulate core processes of skin aging, including oxidative stress, lipofuscin accumulation, and regulation of the cholinergic pathway.

The preliminary clinical application of the Skin K protocol demonstrated improvement in luminosity, skin tone uniformity and facial tone, corroborating the hypothesis that the approach based on the action of these active ingredients can influence the cellular mechanisms underlying skin aging. These findings are in agreement with evidence previously described in the literature on the biological effects of DMAE and other compounds involved in modulating acetylcholine and maintaining cellular integrity (Blin et al., 2009; Baldensperger et al., 2024; Kurzen, 2007; Slominski et al., 2022).

The observed clinical results suggest that the Skin K protocol is aligned with the most relevant biological processes for visible skin aging, providing empirical support for future controlled investigations. Additional studies will be needed to rigorously quantify the effects, confirm the molecular mechanisms involved, and establish therapeutic recommendations based on robust scientific evidence.

Thus, this preliminary report contributes to the understanding of the application of biological actives in injectable protocols aimed at skin revitalization, offering a solid basis for future research that integrates clinical observations and cellular mechanisms associated with skin aging.

BIBLIOGRAPHIC REFERENCES

Manso C. Aging and free radicals. *Acta Médica Portuguesa*. 1992;5:87-90. Available from: <https://www.actamedicaportuguesa.com/revista/index.php/amp/article/download/3197/2536>

Braunstein I, Motohashi H, Dallenga T, Schaible UE, Benhar M. Redox signaling in innate immunity



and inflammation: focus on macrophages and neutrophils. *Free Radic Biol Med*. 2025 Sep ; 237:427-454. doi:10.1016/j.freeradbiomed.2025.06.006. :contentReference[oaicite:1]{index=1}

Ferreira ALA, Matsubara LS. Free radicals: concepts, associated diseases, defense system and oxidative stress. *Rev Assoc Med Bras*. 1997 Jan– Mar;43(1):61– 68. doi:10.1590/ S0104-42301997000100014. PMID: 9224995.

Mustafa YF. Harmful free radicals in aging: a narrative review of their detrimental effects on health. *Indian J Clin Biochem*. 2024 Apr;39(2):154–167. doi:10.1007/s12291-023-01147-y. PMID: 38577147. :contentReference[oaicite:1]{index=1}

Renteln M. Toward systemic lipofuscin removal. *Rejuvenation Res*. 2024 Oct;27(5):171-179. doi:10.1089/rej.2024.0034. PMID: 39041624. :contentReference[oaicite:1]{index=1}

Moreno-García A, Kun A, Calero O, Medina M, Calero M. An overview of the role of lipofuscin in age-related neurodegeneration. *Front Neurosci*. 2018 Jul 5;12:464. doi:10.3389/ fnins.2018.00464. PMID: 30026686. :contentReference[oaicite:1]{index=1}

Slominski AT, Slominski RM, Raman C, Chen JY, Athar M, Elmets C. Neuroendocrine signaling in the skin with a special focus on the epidermal neuropeptides. *Am J Physiol Cell Physiol*. 2022 Dec 1;323(6):C1757– C1776. doi:10.1152/ ajpcell.00147.2022. PMID:36317800. :contentReference[oaicite:1]{index=1}

Kurzen H, Schallreuter KU. Novel aspects in cutaneous biology of acetylcholine synthesis and acetylcholine receptors. *Exp Dermatol*. 2004;13 Suppl 4:27– 30. doi:10.1111/j.1600-0625.2004.00258.x. PMID: 15507109.

Kurzen H. The non-neuronal cholinergic system of human skin. *Skin Physiol*. 2007;55(5):453–459. doi:10.1007/s00105-004-0724-5. PMID: 17326008.

Dougnon G, Matsui H. Lipofuscin accumulation in aging and neurodegeneration: a potential “timebomb” overlooked in Alzheimer’s disease. *Transl Neurodegener*. 2025;14(1):67. doi:10.1186/s40035-025-00529-x. PMID: 41387918.

Baldensperger T, Jung T, Heinze T, Schwerdtle T, Höhn A, Grune T. The age pigment lipofuscin



causes oxidative stress, lysosomal dysfunction, and pyroptotic cell death. *Free Radic Biol Med.* 2024;225:871– 880. doi:10.1016/j.freeradbiomed.2024.10.311. PMID: 39486751.

Blin O, Audebert C, Pitel S, Kaladjian A, Casse-Perrot C, Zaim M, et al. Effects of dimethylaminoethanol pyroglutamate (DMAE p-Glu) against memory deficits induced by scopolamine: evidence from preclinical and clinical studies. *Psychopharmacology (Berl).* 2009 Dec;207(2):201-212. doi:10.1007/s00213-009-1648-7. PMID:19756528. :contentReference[oaicite:2]{index=2}

