



Redefining antiaging in aesthetic plastic surgery: from mechanical correction to biological rejuvenation

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Antiaging aesthetic plastic surgery has long been synonymous with surgical procedures such as forehead lifts, midface lifts, neck lifts, and blepharoplasty. These operations primarily involve the excision of redundant skin and mechanical tightening of soft tissues, including superficial musculoaponeurotic system plication and barbed thread anchoring. Although these techniques significantly improve appearance, they predominantly address only the superficial manifestations of aging.

Traditional surgical procedures are inherently mechanical, targeting mainly visible outcomes. They often fail to address the underlying molecular and cellular changes driving the aging process, such as oxidative stress, telomere shortening, and chronic inflammation. Consequently, while external appearance may temporarily improve, underlying biological aging continues unabated, potentially limiting the durability and effectiveness of surgical outcomes. Moreover, surgical trauma may inadvertently accelerate localized aging through mechanisms such as fibrosis or vascular compromise.

Aging is now recognized as a complex biological process involving cumulative damage at both cellular and molecular levels. Recent decades have revealed fundamental aging mechanisms, including genomic instability, telomere attrition, epigenetic alterations, loss of proteostasis, deregulated nutrient sensing, mitochondrial dysfunction, cellular senescence, stem cell exhaustion, and altered intercellular communication [1]. Advances in proteomics have facilitated the identification of organ-specific aging markers, such as plasma proteomic clocks capable of estimating biological age in the heart, brain, and other organs [2]. These developments offer promising opportunities for early intervention and personal-

ized antiaging approaches.

The integration of regenerative medicine and molecular biology into aesthetic practice has driven the development of non-surgical therapies aimed at addressing the biological basis of aging. For instance, senescent cells accumulate with age and contribute to tissue dysfunction via the senescence-associated secretory phenotype [3]. Senolytic agents, including dasatinib and quercetin, selectively eliminate these cells and reduce inflammation [4]. Similarly, exosome therapy and platelet-rich plasma (PRP) treatments deliver bioactive molecules that stimulate collagen synthesis and promote tissue repair [5]. Metabolic interventions, such as mammalian target of rapamycin (mTOR) inhibitors and nicotinamide adenine dinucleotide (NAD⁺) boosters, have also shown promise for enhancing cellular resilience and delaying systemic aging [6].

Although markers of cellular senescence (e.g., p16 or SA- β -gal) are widely employed in research, reliable biomarkers reflective of organism-level aging remain under development. Some studies indicate that proteomic signatures can more accurately predict organ-specific aging and disease risks compared to chronological age [2,7]. Recently, long telomeric repeat-containing RNA has emerged as a potential hallmark of aging and age-associated diseases, offering promise as a systemic aging marker [8]. However, its clinical applicability within aesthetic medicine is yet to be fully established. The clinical adoption of such biomarkers could enable more precise patient selection, improved risk stratification, and better monitoring of antiaging interventions.

The future of antiaging in aesthetic plastic surgery depends on the integration of biological insights with clinical innovation. As our understanding of aging mechanisms expands, plastic surgeons are uniquely positioned to lead the development of therapies that not only enhance appearance but also promote long-term health and vitality.

The *Archives of Aesthetic Plastic Surgery* welcome original research and perspectives regarding the biology of aging, the development of systemic aging biomarkers, and the clinical application of non-surgical antiaging strategies. Now is a crucial time for plastic surgeons to broaden their focus—from superficial skin enhancements to addressing aging at the cellular core.

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Conflict of interest

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