

THE ROLE OF BIOREVITALIZATION IN ANTI-AGING THERAPIES:
ADVANCES AND PERSPECTIVES

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ABSTRACT: Biorevitalization has emerged as a minimally invasive technique in aesthetic dermatology aimed at restoring skin hydration and promoting dermal regeneration to counteract signs of aging. This review synthesizes current knowledge regarding the mechanisms of action, clinical efficacy, safety profile, and procedural techniques of biorevitalization, with a focus on hyaluronic acid-based formulations enriched with bioactive compounds. Clinical evidence indicates improvements in skin elasticity, texture, and hydration following treatment, though methodological limitations in existing studies necessitate cautious interpretation. Safety data suggest a favorable profile with primarily mild and transient adverse effects. Key challenges include heterogeneity of products, lack of standardized protocols, and insufficient high-quality randomized trials. Future research directions emphasize the development of advanced biomaterials, mechanistic elucidation, and personalized therapeutic approaches to optimize outcomes. Overall, biorevitalization holds promise as a valuable adjunct in anti-aging therapies within cosmetology, warranting further rigorous investigation.

Keywords: Biorevitalization, anti-aging, aesthetic dermatology, skin rejuvenation, hyaluronic acid, mesotherapy

Introduction

The aging process profoundly affects the skin, leading to visible changes such as loss of elasticity, dryness, wrinkles, and thinning. These alterations are driven by both intrinsic factors, such as genetic programming and hormonal changes, and extrinsic influences like ultraviolet (UV) radiation, pollution, and lifestyle habits. As aesthetic medicine evolves, the demand for minimally invasive and effective anti-aging treatments continues to grow.

Biorevitalization has emerged as a promising non-surgical technique designed to restore skin hydration, elasticity, and structure by delivering active substances directly into the dermis. This approach primarily utilizes hyaluronic acid (HA), often combined with vitamins, amino acids, or antioxidants, to stimulate cellular regeneration and improve skin quality from within.

Unlike traditional fillers that aim for volume restoration, biorevitalization focuses on revitalizing the skin tissue itself, enhancing its natural functions. It is increasingly used as both a standalone therapy and in combination with other aesthetic treatments such as botulinum toxin, chemical peels, and laser procedures.

This review aims to explore the current understanding of biorevitalization in the context of anti-aging therapies, highlighting its mechanisms of action, clinical efficacy, safety profile, and future potential in cosmetology.

Mechanism of Action

Biorevitalization works through the intradermal injection of biologically active substances, most notably hyaluronic acid (HA), to restore skin hydration, stimulate collagen production, and enhance dermal cellular activity. HA is a naturally occurring component of the extracellular matrix with a high capacity for water retention, playing a vital role in maintaining skin turgor and elasticity. In aged or photodamaged skin, HA levels decline, leading to dehydration and structural deterioration. The administration of non-crosslinked or lightly crosslinked HA replenishes these levels, improving skin hydration and elasticity while also stimulating fibroblast activity and promoting the synthesis of collagen and elastin. In many formulations, HA is combined with vitamins, amino acids, coenzymes, nucleotides, and peptides, which collectively support antioxidant defense, boost cellular metabolism, and facilitate tissue repair. Additionally, the mechanical effect of microinjections induces a mild wound-healing response, triggering the release of growth factors and enhancing local blood circulation through neovascularization. This combined biochemical and mechanical stimulation contributes to visible improvements in skin texture, tone, and overall rejuvenation (Fig.1).

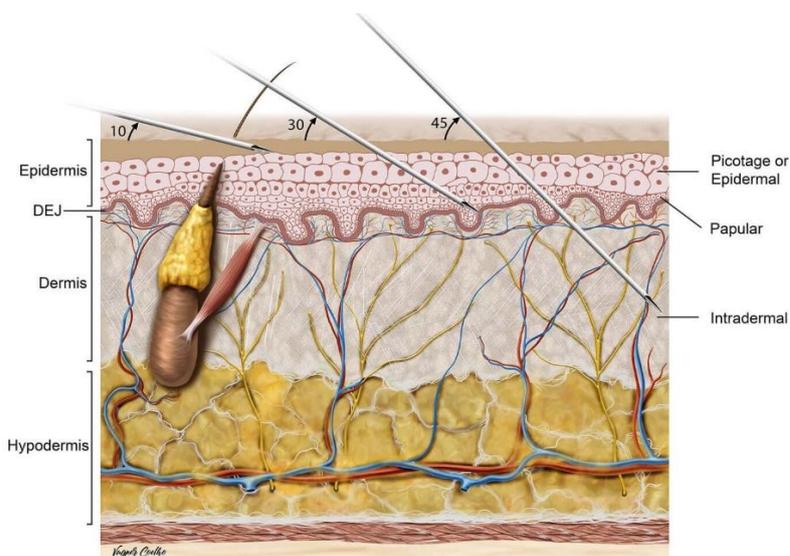


Fig.1. Mechanism of Action Diagram: A schematic showing how hyaluronic acid interacts with dermal components to stimulate collagen production and improve skin quality.

Biorevitalization Agents and Techniques

Biorevitalization protocols employ formulations primarily based on non-crosslinked or lightly stabilized hyaluronic acid, selected for its biocompatibility, biodegradability, and capacity to restore dermal hydration. These formulations are frequently enriched with biologically active additives such as vitamins (notably ascorbic acid and tocopherol), amino acids, antioxidants, coenzymes, nucleotides, and trace elements, each intended to support

fibroblast function, collagen synthesis, and extracellular matrix remodeling. The procedure is performed through intradermal injection using fine-gauge needles or cannulas, with technique selection—such as micro-papular deposition, linear threading, or mesotherapy patterns—dependent on anatomical site, skin condition, and clinical objectives. Depth of injection typically ranges from superficial to mid-dermis to ensure optimal diffusion and cellular interaction. Treatment protocols are usually structured as a series of sessions administered at regular intervals (e.g., every 2–4 weeks), often followed by maintenance phases (Fig.2).



Fig.2. Before and After Treatment Images: Photographs illustrating the effects of biorevitalization on skin hydration and texture.

While biorevitalization is not intended to provide volumetric correction like traditional dermal fillers, it functions as a regenerative intervention aimed at improving dermal quality, elasticity, and tone. Furthermore, it is frequently used in multimodal aesthetic strategies, enhancing the outcomes of other treatments such as botulinum toxin, microneedling, or energy-based devices. The success of biorevitalization is contingent upon proper agent selection, precise injection technique, and individualized treatment planning.

Clinical Evidence and Outcomes

Clinical data on biorevitalization suggest measurable improvements in skin hydration, elasticity, texture, and overall dermal quality, particularly in patients exhibiting early to moderate signs of cutaneous aging. Multiple observational studies and small-scale randomized controlled trials have demonstrated that intradermal administration of hyaluronic acid-based biorevitalizing agents leads to significant enhancement in skin viscoelasticity, as measured by cutometry and corneometry, with improvements often persisting for several weeks to months following a series of treatment sessions. Histological analyses have revealed increased fibroblast density, neocollagenesis, and improved organization of collagen and elastin fibers post-treatment, suggesting that the clinical effects are not solely attributable to hydration but also to dermal remodeling. Moreover, some studies report increased expression of dermal biomarkers such as type I collagen, fibronectin, and hyaluronan synthase following treatment with specific formulations.



Fig.3. Before and After Treatment Images: Photographs illustrating the effects of biorevitalization on skin hydration and texture.

Patient-reported outcomes frequently indicate high satisfaction rates, with improvements in skin brightness, firmness, and tone; however, subjective assessments are often not corroborated by blinded evaluation, highlighting the need for standardized, objective measurement tools (Fig.3). The heterogeneity of available products, variability in injection techniques, and absence of large-scale, double-blind studies limit the generalizability of current evidence. Nonetheless, the existing literature supports the efficacy of biorevitalization as a safe and beneficial adjunctive treatment in aesthetic dermatology, particularly when integrated into individualized anti-aging protocols.

Safety and Side Effects

Biorevitalization is generally regarded as a safe and well-tolerated procedure when performed by trained professionals using sterile technique and appropriate formulations. The most frequently reported adverse effects are mild, transient, and localized, including erythema, edema, bruising, tenderness at the injection site, and, occasionally, pruritus or papule formation, all of which typically resolve within a few days without intervention. These effects are largely attributable to the mechanical disruption of tissue during intradermal injection rather than the pharmacological action of the agents themselves. Rare complications such as delayed inflammatory reactions, granuloma formation, or hypersensitivity responses have been described in isolated case reports but are generally associated with improper technique, use of impure or unregulated products, or patient-specific immunological predispositions. Importantly, the non-crosslinked nature of the hyaluronic acid used in most biorevitalization products contributes to their favorable safety profile, as the rapid biodegradability of these molecules reduces the risk of long-term adverse tissue reactions. Nonetheless, contraindications must be observed, including active skin infections, autoimmune diseases, known hypersensitivity to product components, pregnancy, and anticoagulant therapy. The risk of complications can be further minimized through rigorous patient selection, adherence to aseptic technique, and post-procedure care protocols. While the safety profile of biorevitalization compares favorably with other injectable aesthetic treatments, ongoing pharmacovigilance and standardization of product composition and injection protocols are essential to maintaining clinical safety and ensuring reproducible outcomes.

Current Challenges and Future Directions

Despite the growing popularity and clinical use of biorevitalization in aesthetic dermatology, several challenges hinder the full integration of this technique into evidence-based practice. One of the primary limitations is the heterogeneity of available products, which vary widely in their composition, concentration of hyaluronic acid, molecular weight, presence of adjunctive bioactive compounds, and rheological properties. This lack of standardization complicates both clinical decision-making and comparative analysis across studies. Furthermore, the current body of evidence is largely composed of small-scale trials, observational studies, and case series with limited methodological rigor, often lacking control groups, blinding, or objective endpoints. There is a pressing need for high-quality, multicenter, randomized controlled trials that employ validated assessment tools and long-term follow-up to better define efficacy, optimal treatment protocols, and duration of effect. From a mechanistic standpoint, while the biostimulatory effects of hyaluronic acid are increasingly recognized, the molecular pathways underlying its interaction with fibroblasts, immune cells, and extracellular matrix components remain incompletely understood. Future research should also explore novel biomimetic formulations that incorporate growth factors, stem cell-derived exosomes, or gene-activated matrices to enhance regenerative outcomes. Additionally, as demand increases, there is a critical need for standardized training, regulatory oversight, and clinical guidelines to ensure both safety and consistency in outcomes. Advances in imaging, molecular diagnostics, and personalized dermatology may further refine patient selection and treatment customization, enabling biorevitalization to evolve from a largely empirical technique to a scientifically grounded therapeutic modality.

Conclusion. Biorevitalization represents a promising and minimally invasive approach within the spectrum of anti-aging therapies, leveraging the hydrating and biostimulatory properties of hyaluronic acid and complementary bioactive compounds to enhance skin quality and stimulate dermal regeneration. Current clinical evidence, though limited by methodological constraints, supports its efficacy in improving skin hydration, elasticity, and texture with a favorable safety profile. Nonetheless, significant challenges remain, including the need for standardized product formulations, optimized treatment protocols, and robust clinical trials to validate long-term benefits and elucidate underlying mechanisms. Future advancements in biomaterials and personalized treatment strategies hold potential to further enhance the therapeutic outcomes of biorevitalization, consolidating its role as an integral component of comprehensive aesthetic dermatology. Continued interdisciplinary research and clinical vigilance are essential to fully realize and safely implement the potential of this regenerative modality.

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