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Case Study

Case Study on a Multi-Layer Approach to Skin Rejuvenation: Effects of Energy-Based Devices and Injectable Biostimulatory Therapies

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ABSTRACT

Achieving smooth, healthy-looking skin is a common aesthetic goal across all age groups. This study assessed the effectiveness of a novel protocol combining non-crosslinked hyaluronic acid (HA), hydro-exfoliation, infrared technology, and non-ablative fractional 1470 nm laser to enhance skin quality parameters. This case report included participants aged 43 and 58 years, both in good general health but exhibiting signs of skin atrophy or aging in the face or neck area. On Day 0, subjects underwent mesotherapy injections with non-crosslinked HA (18 mg/mL), supplemented with 0.01% calcium hydroxyapatite, glycine, and l-proline, administered at depths of 0.5 to 4 mm. On Day 7, a hydro-exfoliation and infrared treatment were performed, followed by a session with a non-ablative fractional 1470 nm laser. Skin quality improvements were visually assessed through comparative photographic analysis taken before treatment and four weeks post-procedure. The comparison revealed enhancements in wrinkle reduction, pore size, skin texture, and overall firmness. All treatments were well tolerated. In conclusion, the combination of non-crosslinked HA mesotherapy, hydro-exfoliation, infrared technology, and non-ablative fractional laser led to noticeable improvements in multiple skin quality parameters across a broad age range. While the study highlights the cosmetic benefits of this approach, further research is needed to comprehensively evaluate the long-term safety profile of these treatments, as the current methodology was not specifically designed for safety assessment.

INTRODUCTION

Skin quality is a key indicator of both overall well-being and aesthetic appeal, shaping how individuals perceive themselves and others. While much of the current research focuses on age-related skin changes rather than skin quality as an independent parameter, the demand for interventions that improve tone, texture, firmness, and radiance continues to grow across all demographics. This growing interest transcends age, gender, and ethnicity, with both men and women actively seeking solutions to preserve or enhance the appearance of their skin (1, 2).

A core strategy in modern aesthetic medicine is physiological biostimulation, which harnesses the body's natural regenerative processes to improve skin elasticity, structure, and overall quality. While physiological aging occurs gradually, factors such as oxidative stress, inflammation, and metabolic imbalances contribute to pathological aging, accelerating the decline in skin integrity. By stimulating fibroblast activity and remodeling of the extracellular matrix, biostimulation promotes deep skin renewal and supports long-term structural resilience.

The skin's regenerative capacity is closely linked to cellular turnover, which diminishes with age. In younger individuals, a full skin cell cycle typically takes around 20 days, whereas in those over 50, it extends beyond 30 days (3). This decline is further worsened by external factors such as poor diet, environmental exposure, and lifestyle habits. Smoking, excessive alcohol consumption, and sleep deprivation all impair the skin's renewal process, resulting in noticeable deterioration in texture, tone, and elasticity. Additionally, collagen production (crucial for maintaining firmness) declines by approximately 1.0% to 1.5% per year after the age of 25, contributing to the gradual development of fine lines and wrinkles (4).

While traditional topical treatments primarily act on the skin's surface, true skin quality depends on deeper structures. This has led to the development of multilayer treatment approaches, which target both superficial and deep layers of the skin to achieve more effective and long-lasting outcomes (1, 3).

A variety of aesthetic procedures have been shown to stimulate cellular turnover across the epidermis and dermis. These include fractional laser therapy, ultrasound-based treatments, deep chemical peels, mesotherapy, and microneedling (1). Among them, mesotherapy is notable for delivering bioactive substances [such as hyaluronic acid (HA)] directly into the skin, offering hydration, nourishment, and regenerative stimulation. Mesotherapy is often combined with exfoliating agents or ingredients that accelerate cellular renewal, further enhancing rejuvenation and tissue remodeling (1).

A complementary approach, hydro-exfoliation (or water peeling), provides gentle yet effective mechanical exfoliation. Using microscopic water droplets, it enables precise exfoliation, deep cleansing, and hydration in a single step. Compared to more abrasive techniques, hydro-exfoliation is non-invasive and better tolerated, making it ideal for sensitive skin while improving texture and clarity.

Infrared (IR) therapy is also gaining recognition for its ability to improve skin quality by activating dermal fibroblasts and stimulating collagen synthesis (5). Research has shown that IR promotes dermal remodeling and increases the production of collagen types I and III as well as elastin, thereby enhancing firmness, elasticity, and texture—all without damaging the epidermis (5, 6). As a non-invasive and well-tolerated modality, IR therapy is often integrated into aesthetic regimens in combination with other technologies to achieve comprehensive rejuvenation and long-lasting effects (7).

Technological advances over the past two decades, particularly in laser-based modalities, have transformed dermatology and expanded treatment options for both cosmetic and medical skin concerns. These innovations have drawn the attention of clinicians and patients alike. One of the most impactful developments has been the advent of non-ablative lasers, which marked a paradigm shift in procedural dermatology.

Over the last decade, non-ablative laser resurfacing has become a preferred treatment for a wide range of aesthetic and therapeutic indications. The introduction of fractional lasers in 2004 revolutionized the field by offering a minimally invasive yet effective method for skin rejuvenation. Fractional lasers operate by creating microscopic thermal zones (MTZs), tiny columns of controlled thermal injury ranging from 100 to 400 μm in width and 300 to 700 μm in depth (8-10). These MTZs are surrounded by intact skin, which facilitates rapid healing and tissue regeneration, significantly reducing recovery time.

Fractional lasers are classified as ablative or non-ablative, depending on their interaction with the stratum corneum. Ablative lasers (2,940-10,600 nm) cause full-thickness skin ablation, whereas non-ablative lasers, operating in the mid-infrared spectrum, selectively target water rather than melanin, making them safer for darker skin types (11, 12). Continued innovation in this field has improved safety, precision, and treatment outcomes, enabling more personalized and effective care across diverse patient populations.

There is no one-size-fits-all approach. Understanding how a patient's skin ages and tailoring treatments accordingly allows clinicians to select optimal combinations of therapies for safe, durable, and natural-looking results.

This case study aims to demonstrate how a combination of complementary technologies and techniques can effectively and safely improve skin quality and whether they offer a viable option for patients seeking subtle, natural-looking enhancements.

MATERIALS AND METHODS

We present the cases of two female patients aged 43 and 58 with skin phototype II-III and diagnosed with skin atrophy or laxity in the treatment area by the investigator, who underwent treatment between October 2024 and January 2025. Both participants provided written informed consent before the initial treatment, including consent for the use of photographic images for analysis, and then followed the outlined protocol.

Treatment Protocol

Both patients attended two visits, one week apart. Treatment areas varied per patient and included the face and neck (first patient: face only; second patient: face and neck). On Day 0, hydro-exfoliation using accelerated microscopic droplets for deep cleansing and hydration was performed first, followed by mesotherapy. The mesotherapy involved injections of 2.5 mL of non-crosslinked hyaluronic acid (HA) (18 mg/mL) combined with 0.01% calcium hydroxyapatite, glycine, and L-proline (Neauvia Hydro Deluxe, Matex Lab, Switzerland). Multiple intradermal or superficial subcutaneous injections (0.5 to 4 mm depth) of small HA volumes were administered using a 32G needle and a pre-filled 2.5 mL syringe. Local topical anaesthesia was available; however, neither patient required it.

On Day 7, both patients received hydro-exfoliation and infrared treatment targeting the entire face (Zaffiro, Berger & Kraft Medical Sp. z o.o., Poland). The hydro-exfoliation phase again employed accelerated microscopic droplets for deep cleansing and hydration. Infrared therapy was delivered via a halogen lamp with an inverted filter, emitting wavelengths between 700 and 1800 nm. Treatment parameters included a constant power output, with the energy density per pulse (J/cm²) set by the operator; the device automatically adjusted pulse duration based on the selected energy density. Patients underwent 2–3 treatment passes (30 minutes total), with an energy level of 40 J/cm², reaching deep dermal temperatures of up to 65°C, depending on individual tolerance and comfort.

Following the IR procedure, both patients underwent treatment with a non-ablative fractional 1470 nm laser (LaserMe, Berger & Kraft Medical Sp. z o.o., Poland), using an energy density of 35 mJ per point and a spot spacing of 1.5 mm. All treatments were painless or nearly painless, required no prior preparation, and did not necessitate local anaesthesia. Additionally, both patients followed a post-treatment protocol using the Instant Recovery Mask and Ceramide Shield cosmeceuticals (Matex Lab, Switzerland).

RESULTS

In this case study, we recruited two subjects, aged 43 and 58, with Fitzpatrick skin types II–III. Both patients underwent all treatments and completed both sessions. A comparison of baseline and post-treatment images revealed improvements in skin tone and overall skin quality. Notable and visible changes in the facial area included reduced wrinkles, refined pores, enhanced skin texture, and increased firmness (Fig. 1a-c, Fig. 2a-d).

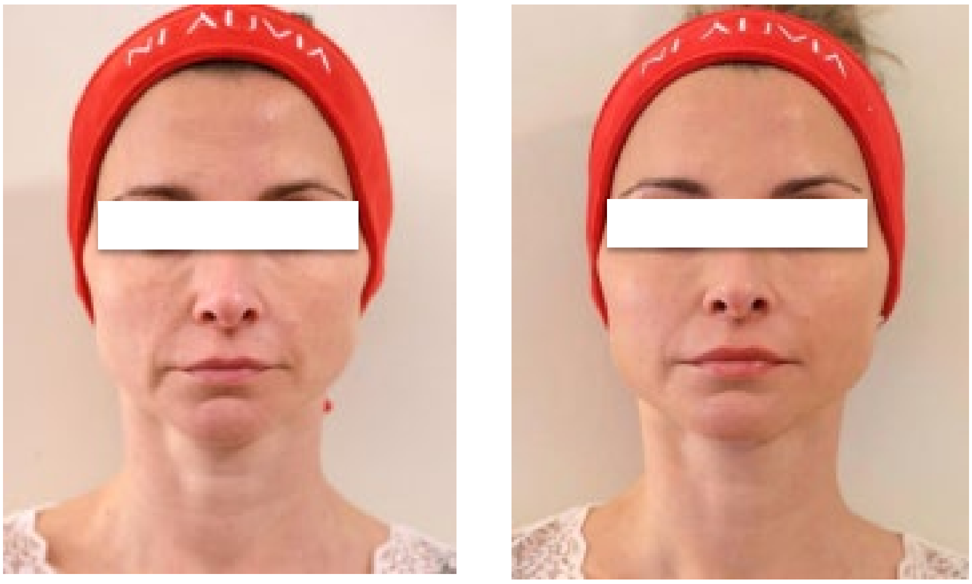

Fig. 1a. *Patient 1 - results at baseline and 4 weeks after the final treatment.*

Fig. 1b. *Patient 1 - results at baseline and 4 weeks after the final treatment.*

Fig. 1c. *Patient 1 - results at baseline and 4 weeks after the final treatment.*

Fig. 2a. *Patient 2 - results at baseline and 6 weeks after the final treatment.*

Fig. 2b. *Patient 2 - results at baseline and 6 weeks after the final treatment.*

Fig. 2c. *Patient 2 - results at baseline and 6 weeks after the final treatment.*

Fig. 2d. *Patient 2 - results at baseline and 6 weeks after the final treatment.*

Both patients reported no adverse effects other than mild redness, which resolved within a few hours. Interestingly, both independently described experiencing the so-called “glow effect” on the day of treatment. In the weeks following the procedure, the patients noted that the most visible improvements were observed in the neck and the central region of the face. Reported effects included a sensation of thicker, firmer, and lifted skin, a reduction in elastosis with a lifting effect, and an overall more radiant and revitalized skin appearance. Unfortunately, due to the limitations of our photographic documentation, we were unable to conduct more detailed or quantifiable assessments. Our focus remained on evaluating the aesthetic outcomes of a combined therapy involving non-crosslinked hyaluronic acid with a low concentration of CaHA, infrared (IR) treatment, and non-ablative fractional laser.

One limitation of this case study (apart from the inherently small sample size) is the absence of a formal assessment of patient satisfaction using validated scales such as the Visual Analogue Scale (VAS) or the Global Aesthetic Improvement Scale (GAIS). In future studies, increasing the number of participants and standardizing evaluation tools, including the use of validated satisfaction scales, would enable a more robust assessment of both subjective perceptions and objective clinical outcomes.

DISCUSSION

In our case study, the proposed treatment protocol, combining mesotherapy with non-crosslinked hyaluronic acid, hydro-exfoliation, infrared thermo-lifting and a non-ablative fractional 1470 nm laser, led to a significant improvement in skin quality. Image analysis and the physician's assessment demonstrated a reduction in fine lines and wrinkles, a decrease in the number and size of enlarged pores, improved skin texture and firmness, and a visible lifting effect, both in the midface and, in one patient, in the neck area. The first stage of the protocol involved mesotherapy using a formulation containing a high concentration of non-crosslinked hyaluronic acid, CaHA, and amino acids. Multiple microinjections were administered into the dermis, ensuring long-lasting hydration and nourishment. The addition of CaHA, even at a very low concentration (0.01%), may stimulate collagen production, contributing to improved skin firmness without a volumizing effect (13-15). The production of extracellular matrix proteins by dermal fibroblasts depends on the availability of key amino acids, particularly glycine and proline, which are primary components of collagen (16, 17). Studies have shown that glycine had the strongest effect on collagen synthesis compared to 20 other amino acids tested on human dermal fibroblasts, while exogenous proline stimulated type I collagen production (16, 17). The use of mesotherapy, consisting of injections of 2.5 mL of non-crosslinked hyaluronic acid (HA) (18 mg/mL) combined with 0.01% calcium hydroxyapatite, was intended to optimize the effects of the therapy preceding the infrared (IR) treatment. This formulation provided deep skin hydration, which was essential for achieving better outcomes during the Zaffiro IR procedure. Water is one of the primary chromophores for IR technology, and well-hydrated skin enables more efficient absorption of light energy, thereby enhancing the efficacy of the procedure (17, 18). A one-week interval between the procedures allowed sufficient time for skin regeneration while ensuring optimal preparation for the next stage of treatment.

The second stage of therapy involved the use of a device combining hydro-exfoliation and infrared thermo-lifting. Hydro-exfoliation prepared the skin for subsequent procedures by enhancing hydration and removing dead epidermal cells. Infrared thermo-lifting followed, inducing immediate contraction of collagen fibres to their original length, leading to skin tightening and wrinkle reduction. The mechanical strength of collagen is attributed to the presence of covalent cross-links between its fibres (5, 18, 19). Under high temperatures, collagen undergoes denaturation, leading to the breakdown of hydrogen bonds and the unwinding of collagen helices. This process stimulates fibroblasts to intensively produce new collagen and elastin, gradually improving skin firmness and elasticity. The final treatment effects become fully visible within weeks or months. Due to the use of contact cooling, the epidermis remains intact, and the procedure is comfortable for the patient; only transient sensations of warmth and cooling are perceived. Previous studies on infrared technology have demonstrated that it gradually improves skin structure, reduces roughness, diminishes wrinkles, and evens out skin tone. Additionally, it has been documented to stimulate fibroblasts to increase collagen and elastin synthesis, as confirmed by histopathological studies (5, 7, 19). The final stage of therapy involved the use of a non-ablative fractional 1470 nm laser on both patients. This technology is employed for skin tightening, pore size reduction, scar treatment (including acne scars and stretch marks), and the management of pigmentation disorders such as age spots, sun-induced hyperpigmentation, and melasma. Clinical studies have shown that the skin healing process following treatment with this laser is predictable and consistent. The fractional laser creates microscopic thermal injury columns in the dermis while leaving the epidermis intact, minimizing downtime (11, 12). The device demonstrated a high safety profile, and the observed regenerative mechanisms suggest its potential for treating scars, hyperpigmentation, stretch marks, and skin laxity. The proposed treatment protocol proved effective in improving the appearance and quality of facial and neck skin. In addition to wrinkle reduction and texture refinement, a significant improvement in pigmentation irregularities was observed. Although this effect was clearly perceived by both the physician and the patients, it was not quantified within the scope of this case study. The integration of different technologies allowed the simultaneous targeting of various skin layers and addressing the key factors contributing to skin deterioration, whether caused by aging, environmental factors, stress, or inadequate skincare. This approach aimed to achieve biostimulation by activating the body's natural regenerative mechanisms to enhance skin quality, elasticity, and firmness while restoring a youthful appearance (20, 21). In aesthetic medicine, combining multiple technologies is increasingly used to effectively address the multifactorial causes of skin aging. This strategy enables better and longer-lasting therapeutic outcomes (7, 12, 13). However, our study had certain limitations.

A key limitation in the objective evaluation of the results is the absence of standardized assessment tools such as VAS or GAIS. Instead, the case report relies on subjective patient feedback and visual analysis, which reduces its clinical value. It should be emphasized that this is a preliminary report intended to support the concept of combining different technologies. Therefore, larger studies using objective evaluation methods are needed to more accurately assess the efficacy of this therapeutic approach. The 4 to 6-week observation period proved insufficient, especially in skin rejuvenation treatments where long-term outcomes are crucial. Although the initial results appear promising for both physicians and patients, a reliable assessment of long-term efficacy requires extended follow-up. Future studies should include longer observation periods and larger, more diverse patient populations. This would enable a more comprehensive evaluation of treatment durability and help identify potential risks or benefits. The primary limitations of the current report include the small sample size and the short follow-up period, which hinder a full evaluation of lasting effects. While the results are encouraging, further research involving control groups and independent assessment of each treatment component is necessary to validate findings and enhance their scientific and clinical relevance.

CONCLUSION

The combination of non-crosslinked HA with a low concentration of CaHA, along with hydro exfoliation, infrared energy, and a non-ablative fractional 1470 nm laser, led to significant visible improvements in skin quality, including reduced lines and wrinkles, smaller pores, and improved skin texture (22-23). These changes were observed in patients with varying skin types, severity levels, and age groups. All treatments were well tolerated and can be safely combined to enhance facial rejuvenation outcomes.

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