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Clinical recommendations for the combined use of poly-L-lactic acid (PLLA-SCA) and energy-based devices: expert opinion and literature review

Recomendações clínicas para o uso combinado de ácido poli-L-láctico (PLLA-SCA) e dispositivos baseados em energia: opinião de especialistas e revisão da literatura

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ABSTRACT

The clinical use of combined technologies has been increasing to address the effects of skin aging on the face and other areas of the body. Poly-L-lactic acid is a biocompatible, semipermanent synthetic filler used for volume enhancement through neocollagenesis induction by fibroblast activation. Similarly, energy-based technologies, such as high-intensity focused ultrasound and microneedling radiofrequency devices, promote fat reduction and collagen contraction by heating the deep dermis. This article presents expert panel recommendations and a literature review on the topic.

Keywords: Polylactic Acid-Polyglycolic Acid Copolymer; Radiofrequency Therapy; Collagen Type I; Collagen Type III; Adipose Tissue.

RESUMO

O uso clínico de tecnologias combinadas tem crescido para abordar os efeitos do envelhecimento cutâneo na face e em outras áreas do corpo. O ácido poli-L-láctico é um preenchedor sintético biocompatível, semipermanente, utilizado para aumento de volume por indução de neocolagênese através da ativação de fibroblastos. Da mesma forma, tecnologias baseadas em energia, como ultrassom focado de alta intensidade e dispositivos de radiofrequência microagulhada induzem a redução de tecido adiposo e a contração do colágeno através do aquecimento da derme profunda. Apresentamos as recomendações de um painel de especialistas e revisão da literatura sobre o tema.

Palavras-chave: *Copolímero de Ácido Poliláctico e Ácido Poliglicólico; Terapia por Radiofrequência; Colágeno Tipo I; Colágeno Tipo III; Gordura Subcutânea.*

Review Article

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INTRODUCTION

Aging is a dynamic and complex process influenced by both extrinsic factors and intrinsic changes. As a result, the use of combined therapies has grown significantly to address biometric volume loss and skin alterations.[1,2] In recent decades, rapid technological advancements have driven the widespread adoption of nonsurgical aesthetic procedures.[3] Minimally invasive treatments that integrate multimodal approaches and target various manifestations of aging are not only safe but also often yield superior outcomes compared to single-modality treatments.[1,4]

Despite the increasing body of evidence and the clinical application of combined technologies to enhance aesthetic results,[1,2,4-8] the specific interaction between poly-L-lactic acid (PLLA-SCA) and energy-based devices remains an area requiring further investigation. Strategies to restore lost soft tissue volume include the use of injectable fillers, such as poly-L-lactic acid (Sculptra®, Galderma, Uppsala, Sweden).[9] Sculptra® is a biostimulatory injectable implant containing 150 mg of PLLA--SCA microparticles per vial. Suh microparticles are unique in both shape and have a median particle size of approximately 50 μm, maintained through a rigorous quality control process.[10] PLLA-SCA has been extensively studied for aesthetic applications and functions as an absorbable, α-hydroxy-based synthetic filler that induces neocollagenesis by stimulating fibroblast activity. It is biocompatible and immunologically inert.[2,9,11]

Unlike traditional dermal fillers that primarily provide mechanical volume replacement, PLLA-SCA offers longer-lasting effects, as it stimulates fibroblast activity for up to two years post-injection.[2,12,13] Initially approved for HIV-associated lipoatrophy, PLLA-SCA has also been widely used to correct facial wrinkles and volume loss. More recently, there has been growing interest in the nonfacial applications of PLLA-SCA, including volume augmentation, body contouring, skin laxity improvement, cellulite reduction, scar treatment, and striae distensae correction.[14]

Nonsurgical thermal approaches have been increasingly used to selectively target subcutaneous adipose tissue, including high-intensity focused ultrasound (HIFU) and radiofrequency (RF) energy devices.[15] Both RF and HIFU are noninvasive, energy-based technologies designed for wrinkle reduction, collagen contraction, and skin tightening.[5,16] While RF induces apoptosis in fat cells, HIFU causes coagulative necrosis and cell death.[15]

HIFU delivers ultrasound energy to selectively heat dermal and subdermal tissues above 60°C, creating a linear array of tightly focused thermal coagulation points. This process stimulates long-term collagen remodeling, leading to tissue tightening and lifting without damaging the epidermis.[1,17,18] Treatment parameters can be adjusted by modifying energy levels and focal depth. Depending on the device, transducers emit frequencies between 2 and 10 MHz, with focal depths ranging from 1.5 to 13.0 mm, allowing targeted treatment of different facial and body tissues.[15,19,20,21] Multiple studies have demonstrated the clinical efficacy and safety of HIFU for facial, neck, and body rejuvenation.[17,18,22,23]

Most HIFU devices include multiple transducer depths and focal sizes. Macrofocused ultrasound (MaFU) transducers, with larger thermal coagulation points, are typically used for fat reduction, while microfocused ultrasound (MIFU) transducers operate at different frequencies to tighten and lift lax skin.[20]

Similarly, RF technology employs low-frequency waves to generate an electromagnetic field within the skin, producing thermal heating of the dermis. This process promotes neocollagenesis, elastin formation, and angiogenesis during the healing response.[24,25] Microneedle RF (MRF) enhances this effect by combining the mechanical penetration of microneedles with the thermal impact of RF. This combination allows heat to be delivered at variable depths, expanding the range of anatomical locations and tissue types that can be effectively treated.[25,26] The precision of energy delivery optimizes dermal, subdermal, and adipose heating while minimizing epidermal damage, thereby facilitating contraction of dermis, subdermis, and surrounding connective tissue. Additionally, MRF can induce fat coagulation.[27]

MRF is a safe and effective treatment for various dermatologic concerns, including sagging skin, wrinkles, acne vulgaris, photoaging, enlarged pores, skin laxity, and scars.[27-29] MRF is a versatile treatment option for various dermatologic concerns and is safe for patients of all skin types.[25] In this expert opinion article, we present group recommendations for the combined use of PLLA-SCA and energy-based devices, drawing from the best available evidence and extensive long-term private practice experience.

METHODS

Participant Selection and Expert Group Composition

In August 2023, a multidisciplinary panel of eight Brazilian medical experts convened to discuss the combined use of injectable PLLA-SCA and energy-based technologies. The group comprised physicians specializing in dermatology and plastic surgery, each with extensive clinical experience in these treatment modalities. The objective of this collaboration was to provide insights and establish best practices for optimizing treatment outcomes.

Questionnaire Development and Pre-Meeting Inquiry

Prior to the meeting, expert group members were invited to participate in a pre-meeting questionnaire comprising 17 key components related to various aspects of treatment. The questionnaire covered the following topics:

1. Patient selection criteria for therapy combination
2. Clinical indications
3. Contraindications
4. Preoperative preparations

5. PLLA-SCA dilution methods
6. Techniques for PLLA-SCA injection
7. Number of PLLA-SCA sessions
8. Commercially available tested devices (MiFU, MaFU, MRF)
9. Device application techniques
10. Number of sessions for each device
11. Interval between sessions for each device
12. Sequencing in combined therapy
13. Order of technology application
14. Guidelines for intraoperative care
15. Protocols for postoperative care
16. Potential adverse effects
17. Post-treatment follow-up strategies

Meeting Facilitation and Data Collection

During the meeting, a neutral and trained medical facilitator (RT) led the discussions, ensuring an organized and structured exchange of insights. The session was recorded on video to accurately capture the discussions based on the questionnaire responses. The facilitator guided the conversation, summarized key points, and facilitated clarifications to ensure balanced participation from all experts. Discussions centered on comprehensive explanations of different treatment methods, the rationale behind treatment sequencing, safety considerations, and the synergistic effects of combined therapies for aesthetic rejuvenation.

Guideline Formation

Open debates and discussions were conducted to reach a consensus on potentially controversial topics. Participants leveraged available evidence, personal clinical experience, and key concerns to identify the most relevant principles. Such deliberations, supplemented by a review of current literature, served as the foundation for a practical guideline covering facial and body aesthetic rejuvenation treatments.

Manuscript Development and Validation

Observations and recommendations from the panel discussions were systematically assessed and compiled into a manuscript. This document underwent multiple iterative revisions, with all authors contributing to its refinement. Through this collaborative process, unanimous agreement was reached on the final version. The recommendations presented in this study reflect the collective expertise of the panel, drawing from extensive clinical experience and supported by previously published data on the integration of PLLA-SCA and energy-based technologies in aesthetic medicine for rejuvenation.

RESULTS AND RECOMMENDATIONS

Composition of the Expert Group

The expert panel had an average age of 48 years and an average of 25 years of medical practice. Their expertise was further strengthened by advanced training through residencies, master's programs, and doctoral degrees in specialized fields such as general surgery, plastic surgery, dermatology, and internal medicine. Following in-depth discussions, the panel formulated expert recommendations based on a combination of scientific evidence and the collective clinical experience of leading dermatologists, plastic surgeons, and researchers.

PLLA-SCA Recommendations

Since PLLA-SCA is the primary technology combined with selected energy-based devices, Table 1 presents detailed expert recommendations on dilution, injection techniques, number of sessions, and treatment intervals, both as a monotherapy and in combination therapy.

After reconstitution, PLLA-SCA can be used immediately or stored for up to 72 hours. Studies indicate immediate injection post-reconstitution is safe, associated with a low rate of adverse events (AEs), and offers practical advantages, such as reduced procedure time and minimized product loss for the injector.[30,31]

Table 1: Preparation and application methods of PLLA-SCA used alone or in combination with other technologies according to expert opinion

	Poly-L-lactic acid (PLLA-SCA)
Dilution method and volume	Reconstitution: immediate or 72 hours before use. Face: 10 mL (8 mL sterile water + 2 mL 2% lidocaine) Non-facial areas: 16 mL (14 mL sterile water + 2 mL 2% lidocaine)
Injection technique	Injection in the superficial subcutaneous plane with 22G x 50 needles or 70mm cannula, according to individual needs, aspirating before injection. Slim face: all previously described techniques (fanning, retrograde linear thread, cross-hatching, depot). Heavy face: frame with retroinjection for a better lifting effect or vector technique. Non-facial areas: application in the superficial subcutaneous plane in the desired area.
Number of Sessions	Depends on individual needs and area size. Face: 1-3 sessions using 1-2 vials per session. Non-facial areas: 1-3 sessions using 1-6 vials per session, according to area size.
Interval between sessions	At least 30 days.

Regarding dilution volume, expert consensus established 10 mL for facial treatments and up to 16 mL for nonfacial applications, both with an additional 2 mL of 2% lidocaine. One expert referenced a prior study supporting the use of 12 mL for body injections.[32] While various studies have explored the safety and efficacy of different dilution volumes for PLLA-SCA, a 2014 consensus by Vleggaar et al.[33] recommended 9 mL for facial treatments and 16 mL for the décolletage, already incorporating anesthetics. Importantly, dilutions below 5 mL should be avoided, as highly concentrated formulations increase the risk of known AEs, including nodules and papules.[34]

The choice of dilution depends on the treatment goals. More concentrated formulations are preferred for volumization, as they require deep dermal or subdermal injections. In contrast, higher dilutions are typically used to improve skin quality or treat cellulite.[3]

PLLA-SCA injection sites yielding the best outcomes are dynamically stable and have sufficient dermal thickness to accommodate proper injection depth.[33] Several injection techniques are reported for facial PLLA-SCA application, including fanning, retrograde linear threading, depot, or vector techniques, depending on the anatomic area and desired effect.[11,33,35]

Special caution is advised when treating patients with a heavier facial structure, thicker skin, and prominent superficial fat compartments. In such cases, the midface is typically avoided, while the upper and lower temples are prioritized, followed by the preauricular area, extending from the zygomatic arch to the mandible.[35]

For nonfacial areas, the choice of injection technique depends on the treatment site. A recent review identified linear threading and fanning as the most used techniques, performed with either a needle or cannula, on the neck, chest, buttocks, abdomen, and thighs.[14] Treating large off-face areas may require up to 20 vials of PLLA-SCA to achieve significant aesthetic enhancement[36]; however, this approach can be costly and time-consuming. To optimize product usage for gluteal augmentation, Sarubi et al.[37] developed a novel injection technique consisting of three distinct approaches, tailored to the primary aesthetic concern: improving skin quality, enhancing contour and lifting, or increasing projection and volume.

Overall, common adverse events, such as localized swelling, tenderness, redness, itching, and bruising, typically resolve within a week.[30] Firmly massaging the treated areas immediately after injection promotes even product distribution and may help reduce the incidence of these side effects.[4]

PLLA-SCA in Combination with Energy-Based Devices

Few studies have explored the combined use of PLLA--SCA with HIFU or MRF devices.[2,4,6,38] As a result, the recommendations presented here are based on the authors' expertise, extrapolating from the available research. When implementing combination therapies, it is essential to consider individual patient needs, treatment goals, and the specific indications of each technology. Tables 2 and 3 outline the authors' recommendations for combining PLLA-SCA with MiFU and MaFU, respectively.

HIFU is used as a monotherapy in only 5–10% of patients, as it is more commonly combined with neuromodulators, fillers, and laser treatments to enhance outcomes.[39] When paired with PLLA-SCA, HIFU simultaneously promotes volume restoration, neocollagenesis, and tissue contraction, offering multilevel cosmetic revitalization.[2]

The primary indications for this combined approach include facial lifting, rejuvenation, and the treatment of mild to moderate skin laxity, particularly in areas with concurrent fat compaction, such as the neck. Azuelos et al.[40] demonstrated a single session of HIFU effectively improves cervical skin laxity, reduces submental fat (double chin), and diminishes neck wrinkles. Additionally, a study by Friedmann et al.[4] confirmed the safety and enhanced efficacy of using MiFU followed by PLLA-SCA for multilayer facial rejuvenation, either in a single session or with a two-week interval to allow swelling to subside.

Coleman & Pozner[38] proposed the use of HIFU followed by PLLA-SCA or HA as a treatment option for laxity and volume loss in the inner thigh and buttocks. However, given the larger treatment area, multiple sessions and vials are typically required. To minimize the risk of nodule formation, a higher PLLA-SCA dilution volume (12–16 mL) is recommended.[32,38]

The decision to administer facial biostimulatory fillers before or after energy-based therapies depends on the type and depth of treatment.[7] Based on research involving other fillers, such as hyaluronic acid (HA) and calcium hydroxyapatite (CaHA), experts generally recommend applying HIFU first, followed by injectable fillers, as a standard approach.[1,5,7,39] If both treatments are performed in the same session, MiFU should be applied first, followed by PLLA-SCA injection, to prevent water displacement from interfering with the targeted tissue depths and to avoid blood contamination of the ultrasound transducers.[2]

Conversely, in patients with a very low body mass index (BMI), skin laxity may result from volume depletion, in which case volume restoration should be prioritized before HIFU treatment.[39] By restoring lost volume and structural support in the cheeks with fillers like PLLA-SCA, followed by MiFU treatment, fat pads are reinflated, and the zygomatic-buccal retaining ligaments are tightened and lifted. This approach often improves the appearance of nasolabial folds and other facial imperfections without the need for additional procedures.[1]

Based on the authors' experience, it is safe to apply line counts approximately 20% above the manufacturer's recommendation to achieve enhanced results; however, this approach may also increase patient discomfort. In a consensus guideline on MiFU applications, experts universally agreed that energy settings should be adjusted to the highest tolerable level, with titration as needed for patient comfort.[41] Further research is warranted to assess the safety and efficacy of this approach.

Post-procedure care is essential to minimize the main

Table 2: Recommendations on the use of PLLA-SCA associated with microfocused ultrasound (MiFU)

	PLLA-SCA combined with MiFU
Clinical Assessment	• Evaluate skin laxity, amount of adipose tissue and the general outline of the area to be treated.
Clinical Indications	• Mild to moderate facial or body laxity. • Fat compaction, even in the presence of saggy skin. • Need for lifting and improvement of facial outline (e.g., jowl, upper eyelids with repositioning of the eyebrow tail, lower eyelids with or without bags) • Slim face: superficial transducers • Heavy face: deeper transducers • Concomitant perioral and periorbital rejuvenation. • Nonfacial areas: sagging skin in regions such as the arms, neck, décolletage, abdomen, buttocks, inner thighs, knees, and around the navel.
Contraindications	• Immune-mediated diseases involving the skin. • Pregnancy. • Local infection. • Presence of permanent fillers at the application site (e.g., PMMA1). • Local metallic prosthesis.
Preoperative care	• Mapping of the treatment area. • Application of topical anesthetic. • Use of anesthetic buttons for cannula insertion. • Asepsis and antisepsis.
Tested MiFU devices	• Ultraformer®, Liftera®, Scanner®, Caneta®, UltracelQ+®, Atria®.
MiFU technique	• Apply a thin layer of gel. • Follow the manufacturer's instructions and adjust the device settings according to the patient's indications.
MiFU sessions	• 1-3 sessions.
Interval between MiFU sessions	• Minimum of 30 days.
Sequencing in the use of both technologies	• MiFU should be performed first, followed by PLLA-SCA, optionally within the same session.
During the procedure	• After MiFU application, allow the patient's skin to cool for approximately 10 minutes to minimize the risk of bruising.
Postoperative care	• Immediate postoperative massage with a degerming agent. • Face: massage for 5 min, five times a day for 5 days. • Nonfacial areas: massage for 5 minutes, twice a day for 7 days. • Painkillers, if necessary. • Avoid corticosteroids post-procedure, based on group experience.
Potential side effects	• Edema and localized pain. • Hematoma, transient nodules, and nerve damage.
Follow-up	• Phone follow-up 24 hours after the procedure. • Follow-up at 3 to 6 months with standardized photographs.

[1]*PMMA: polymethyl methacrylate.*

side effects of both technologies, particularly when used in the same session. A common recommendation for facial treatment is a massage regimen in the treated area for 5 minutes, 5 times a day, for 5 days, which helps prevent nodule and papule formation. Additionally, maintaining a one-month interval between sessions can help avoid overcorrection.[3,4,6,30,42] Similarly, for large non-facial areas, such as the gluteal region, it is recommended to massage the treated area in circular motions for 5 minutes, twice daily, for 5 to 7 days post-procedure to reduce bruising.[37]

Since both PLLA-SCA and energy-based devices stimulate collagen production through a wound-healing response, it is important to systematically evaluate patients for preexisting immune-mediated diseases. Chronic treatment with anti-inflammatory or immunosuppressive medications may impair the body's ability to recover from thermal injury.[39]

Table 4 presents the authors' recommendations for combining MRF with PLLA-SCA. RF therapy targets both the skin and soft tissue, inducing contraction by optimally heating dermal collagen while protecting the epidermis from injury.[25] There are three primary types of RF energy—monopolar, bipolar, and multipolar—which differ in the number of emitting electrodes and depth of energy penetration. Monopolar RF is particularly effective for eyelid skin tightening, as the haptic contact lens protects the globe.[1] RF energy can be delivered as bulk or fractional heating, with fractional modes allowing for interspersed untreated areas, promoting faster healing and reduced downtime.[27] MRF further enhances skin tightening and adipose tissue remodeling by delivering energy through microneedles at a predetermined depth. This approach provides quick recovery, minimal downtime, and a low risk of pigmentation or skin infection.[28]

Table 3: Recommendations for the use of PLLA-SCA in combination with macrofocused ultrasound (MaFU)

	PLLA-SCA combined with MaFU
Clinical Assessment	• Evaluate skin laxity, amount of adipose tissue and the general outline of the area to be treated.
Clinical Indications	• Mild to moderate body laxity associated with localized fat in a small to moderate amount. • Submental laxity associated with localized fat in a small to moderate amount. • Definition of body contour, especially of the buttocks, abdomen, arms, umbilical region, knees, and thighs.
Contraindications	• Immune-mediated diseases with skin involvement. • Pregnancy. • Local infection. • Definitive fillers at the application site (e.g., PMMA). • Metallic prosthesis on the treated area.
Preoperative care	• Mapping of the treatment area. • Use of analgesics and topical anesthetics. • Anesthetic buttons for cannula insertion. • Asepsis and antisepsis.
Tested MaFU devices	• Scanner®, Ultraformer®, Atria®, Liftera®, UltracelQ+®
MaFU technique	• Apply a thin layer of gel. • Follow the manufacturer's instructions and adjust device settings according to the patient's indications. • Select the appropriate transducer and calculate line counts based on the target depth and fat volume. • When treating sagging skin, MaFU can be combined with MiFU transducers to enhance results. • Start with deeper layers and progress to more superficial layers.
MaFU sessions	• 1-3 sessions.
Interval between MaFU sessions	• Minimum of 30 days.
Sequencing of both technologies	• MaFU should be performed first, followed by PLLA-SCA, optionally within the same session. • If the goal is fat tissue compaction, perform two MaFU sessions first, then apply PLLA-SCA immediately after the third MaFU session.
During the procedure	• After MaFU application, allow the patient's skin to cool for approximately 10 min to minimize the risk of bruising.
Postoperative care	• Immediate postoperative massage with a degerming agent. • Face: massage five times a day for 5 days. • Nonfacial areas: massage twice a day for 7 days. • Painkillers, if necessary. • Avoid corticosteroids post-procedure, based on group experience.
Potential side effects	• Edema and localized pain. • Hematoma, transient nodules, and nerve or vascular damage.
Follow-up	• Phone follow-up 24 hours after the procedure. • Follow-up at 3 to 6 months with standardized photographs.

Antiviral therapy may be indicated before microneedling treatment, especially for patients with a history of prior viral infections, in accordance with current surgical guidelines. Additionally, standardized microneedling protocols should be developed, incorporating regulatory guidelines on prophylactic therapy and recommendations for medication suspension in patients on anticoagulants.[43]

Table 4 presents the authors' recommended protocols for combining PLLA-SCA with MRF. According to expert recommendations, the primary indications for this combination include the treatment of mild to severe skin laxity, attenuation of fine lines and ridges, and targeting fat compartments when using multilayer MRF devices.

Carruthers & Carruthers[44] proposed the use of RF and HIFU devices to address skin laxity and submental fat accumulation after first rebuilding the supporting structures around the mouth and jawline using PLLA-SCA.[44] Theoretically, MRF microneedles could enable the physical transdermal delivery of macromolecules with high molecular masses. However, concerns have been raised regarding whether the heat and energy delivered might accelerate filler degradation.[45]

A retrospective study of 28 patients treated with different fillers in combination with MRF found no unexpected filler loss or migration, even in highly expressive facial areas, after three treatment passes.[46] Similarly, animal studies have demonstrated that monopolar RF applied over PLLA-SCA injections signi-

Table 4: Recommendations for the use of PLLA-SCA in combination with microneedle radiofrequency (MRF)

	PLLA-SCA combined with MRF
Clinical Assessment	• Evaluate skin laxity, adipose tissue volume, and overall contour of the treatment area. • Assess the presence of skin texture changes, including dermal atrophy, photodamage, scars, wrinkles, and stretch marks.
Clinical Indications	• Mild to severe skin laxity. • Overall skin improvement, including reduction of fine lines and ridges. • Simultaneous fat compartment reduction when using multilayer MRF devices.
Contraindications	• Immune-mediated diseases involving the skin. • Pregnancy. • Local infection. • Presence of permanent fillers at the application site (e.g., PMMA) • Recent facial filler injection (less than 6 months), if using multilayer MRF devices. • Use of a pacemaker. • Metallic prosthesis in the treatment area. • Presence of tattoos or micropigmentation in the treatment area. • Avoid treatment on tanned skin.
Preoperative care	• Topical anesthetic, possibly combined with anesthetic block or infiltration. • Herpetic infection prophylaxis for facial treatments. • Anticoagulant regimen: assess whether suspension is possible on the day of the procedure and the day after. • Potential use of anesthetic sedation, particularly with multilayer devices. • Asepsis and antisepsis.
Tested MRF devices	• Traditional MRF devices (Endymed®, Agnis®, Eletroderme®) • Multilayer devices (Morpheus®, MegaDerma®)
MRF technique	• Follow manufacturer's instructions and adjust device settings based on the patient's indications. • Depth, intensity, and duration vary according to patient assessment. • Inducing pinpoint bleeding is not necessary, though it may occur after the MRF session.
MRF sessions	• 1-3 sessions.
Interval between MRF sessions	• Minimum of 30 days.
Sequencing in the use of technologies	• MRF should be performed first, followed by PLLA-SCA, optionally within the same session. • According to one research author's experience, the order can be reversed (PLLA-SCA first, then MRF) when using traditional, nonmultilayer devices.
During the procedure	• Adjust flow according to the treatment area. • Perform an immediate massage using sterile or drug-delivery products.
Postoperative care	• LED light application (in office, for recovery). • If large areas were treated, avoid wetting the skin on the day of the procedure. • Hydration with soothing and healing, repairing creams. • Intensive photoprotection and avoid sports for 24 hours. • Avoid sun exposure until the skin is fully recovered. • Painkillers, when necessary.
Potential side effects	• Pain and local swelling. • Post-inflammatory hyperchromia and hypochromia
Follow-up	• Phone follow-up 24 hours after the procedure. • Follow-up at 3 to 6 months with standardized photographs.

ficantly enhances the inflammatory, foreign body, and fibrotic responses, which are essential for the clinical improvements observed. Additionally, RF treatment over filler-injected skin did not reduce the residence time of PLLA-SCA but instead enhanced collagen deposition within and around the treated areas.[47,48]

Beyond its applications in volume restoration, biostimulatory fillers such as PLLA-SCA have been used to mitigate acne scars, particularly where volume loss and tissue redistribution exacerbate scarring. A randomized controlled study reported that combining topical polylactic acid (PLA) injection before MRF significantly improved acne scars compared to MRF monotherapy. After three sessions at 4–6-week intervals, patient satisfaction scores and acne scar assessments were statistically superior with the combination approach.[45]

The interaction between RF and dermal fillers varies based on several factors, including RF type, energy level, filler type, depth of injection, and the interval between treatments.[49] While some researchers suggest that fillers can be combined with RF devices on the same day without an increase in adverse effects or a decrease in efficacy,[50] other studies have documented HA degradation when RF is applied immediately after filler injection[49]. An ex vivo study demonstrated that MRF applied over recently injected filler could damage HA due to its deeper dermal penetration.[51] Conversely, a case study found that MRF performed

one week after HA injection showed no evidence of HA degradation after 8 weeks, with no breakdown or extravasation into the epidermis.[52] These findings suggest that treatment order and session intervals are crucial for optimal treatment outcomes and filler longevity.

While the recommendations presented in this study are based on several years of the authors' multicenter clinical experience and currently available literature, certain limitations must be acknowledged. The primary limitation is the level of evidence, as these guidelines rely on expert opinion rather than large-scale clinical trials. Further clinical and histological studies in large patient cohorts are needed to develop robust, evidence--based guidelines for combined aesthetic technologies in skin rejuvenation.

CONCLUSIONS

The combination of energy-based devices and fillers has become an integral part of clinical practice for patients seeking minimally invasive treatments to address multiple aspects of skin aging and achieve enhanced results. However, there remains a gap in the literature regarding the integration of PLLA-SCA with energy-based technologies, particularly concerning treatment sequencing, session intervals, device selection, injection methods, and application techniques. Based on the available evidence and the authors' clinical experience, this combination has been shown to be both safe and effective for improving skin quality in facial and non-facial areas. By targeting multiple skin layers and tissue types in a single session, this approach enhances treatment outcomes, reduces recovery time, and provides long--lasting aesthetic benefits for patients.

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