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PRS GLOBAL OPEN

ORIGINAL ARTICLE
Research

Histological Evaluation of Human Skin Biopsies Following Subdermal Helium Plasma Radiofrequency Treatment

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Background: Helium plasma radiofrequency (RF) is an energy-based device that delivers controlled subdermal coagulation and contraction. Although anecdotal reports suggested improvement in the quality of the overlying skin following subdermal treatment, quantifiable data on biological markers remain limited.
Methods: This prospective, single-arm study was conducted at 2 US sites. Seven patients undergoing lower rhytidectomy surgery received adjunctive helium plasma RF treatment to the neck, submentum, and lower face, with untreated mid- and upper-face areas serving as internal controls. Paired 3–5-mm punch biopsies were collected at baseline and at day 180 for histological and immunohistochemical evaluation of collagen, elastin, fibrillin-1, and inflammatory markers. Safety, healing, and aesthetic outcomes were assessed through day 180.
Results: Helium plasma RF–treated tissue demonstrated a 30% increase in elastin fiber density (Van Gieson) and a 34% reduction in inflammation (hematoxylin and eosin). Immunohistochemical revealed a 55% increase in elastin staining intensity and 27% increase in elastin fiber incidence in treated tissue. No significant fibrosis, epithelial disruption, or other adverse microscopic changes were observed. Clinically, all patients showed improvement in both Investigator and Subject Global Aesthetic Improvement Scales scores (100%) at every follow-up. By day 180, participants reported high satisfaction and visible improvements in skin elasticity, youthfulness, and radiance. No serious adverse events occurred.
Conclusions: Helium plasma RF was well tolerated and induced favorable dermal remodeling, characterized by increased elastin and reduced inflammation without significant fibrosis. These findings provide direct human evidence that helium plasma RF initiates a regenerative biological process that enhances skin quality.
(Plast Reconstr Surg Glob Open 2026;14:e8116; doi: 10.1097/GOX.0000000000008116; Published online 25 September 2026.)

INTRODUCTION

Skin quality encompasses characteristics such as elasticity, dermal thickness, and extracellular matrix integrity, which collectively determine the skin's appearance, texture, and resilience.[1] These attributes are influenced by both intrinsic aging, driven by genetic and chronological factors; and extrinsic aging, caused primarily by ultraviolet radiation, cigarette smoking, and environmental pollutants.[2]

The dermis is central to maintaining youthful, healthy skin, as it contains collagen for strength and bulk, elastin for stretch and recoil, and glycosaminoglycans to regulate hydration and maintain moisture balance.[2] With intrinsic aging, collagen synthesis declines and breakdown increases, elastin production steeply decreases after the age of approximately 40–50 years, and glycosaminoglycans degrade, leading to loss of elasticity.[2,3]

Elastin is a particularly critical determinant of skin quality.[2–4] Unlike collagen, which is continuously remodeled, elastin synthesis is largely completed early in life,

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Received for publication November 25, 2025; accepted July 21, 2026.

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DOI: 10.1097/GOX.0000000000008116

Disclosure statements are at the end of this article, following the correspondence information.

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and damaged fibers are replaced slowly, if at all.[2] Loss of elastin correlates strongly with diminished skin elasticity and overall quality, making treatments that preserve or stimulate elastin production central to improving both structure and function of the skin.[3–5]

Various approaches have been explored to restore skin quality by targeting these dermal components.[5] For example, adipose-derived stromal cells have been associated with dermal remodeling and improved skin elasticity following lipografting techniques.[5] Standardized frameworks for assessing biological markers of skin quality have been established. Nakab et al demonstrated the value of objective measures, such as collagen density, elastin, and fibrillin-1, as markers of elasticity. These findings support the use of histological and immunohistochemical (IHC) evaluation to quantify treatment-related changes in skin quality.[1]

Helium plasma radiofrequency (RF) is an energy-based technology that delivers a controlled combination of RF energy and helium plasma to targeted soft tissues, producing predictable thermal effects such as collagen denaturation and contraction.[6] A growing body of clinical research has evaluated helium plasma RF across a range of aesthetic and surgical applications, including both dermal and subdermal treatments, demonstrating favorable safety profiles and improvement in contouring and tissue contraction.[7–27] Although anecdotal reports have suggested improvements in skin quality following subdermal helium plasma RF treatment, no studies to date have directly quantified its effects on biological markers of skin quality.

The present study was designed to directly measure histological changes of human skin treated with helium plasma RF, with a focus on markers of elasticity and tissue restoration, including elastin, fibrillin-1, collagen organization, and inflammatory response. Lower rhytidectomy surgery was used solely to obtain paired biopsies from adjacent treated and untreated areas, enabling precise within-subject comparison of the effects of helium plasma RF on dermal structure and skin quality.

Takeaways

Question: Can subdermal helium plasma radiofrequency (RF) treatment improve intrinsic markers of skin quality?

Findings: In this prospective, single-arm study of 7 patients undergoing lower rhytidectomy, paired biopsies from treated and untreated areas were analyzed at baseline and at day 180. Helium plasma RF–treated tissue showed a 30% increase in elastin fibers, a 55% increase in elastin staining intensity, a 27% increase in elastin expression, and a 34% reduction in inflammation, with no fibrosis or epithelial disruption observed.

Meaning: Helium plasma RF promotes regenerative remodeling that enhances skin quality by increasing elastin and reducing inflammation.

METHODS

This prospective, single-arm, postmarket study (ClinicalTrials.gov ID: NCT06243744) was designed to evaluate the effects of helium plasma RF treatment on histological markers of skin quality. The study was conducted at 2 US investigational centers and approved by the Sterling Institutional Review Board. All participants provided written informed consent before enrollment.

Eligible patients were healthy adults aged 18–75 years who were scheduled to undergo lower rhytidectomy surgery. Key exclusion criteria included a history of previous rhytidectomy or helium plasma RF treatment in the face or neck, autoimmune disorders, known susceptibility to keloid or hypertrophic scarring, and current pregnancy.

During the procedure, helium plasma RF treatment was delivered after flap elevation and applied to the subcutaneous plane between the elevated skin flap and the superficial musculoaponeurotic system in the neck, submentum, and lower facial areas. Treatment parameters were standardized at 80% power with a helium flow rate of 1.5 L per minute, using 4 passes at an activation speed of approximately 1–3 cm per second. The mid- and upper-face were not treated and served as internal untreated control regions. Control biopsies were taken from areas superior to the treatment field and outside the planned lower face/neck dissection and energy delivery zone.

To directly evaluate tissue-level changes, paired 3–5-mm punch biopsies were collected from each patient from the left side of the face. Baseline biopsies, taken from both the treatment and control areas (Fig. 1), were obtained during the initial procedure before helium plasma RF exposure. A second set of biopsies was collected at day 180 near the original sites. This paired sampling design enabled within-subject comparisons of treated versus untreated tissue.

Biopsy specimens were fixed in 10% neutral buffered formalin and processed into formalin-fixed paraffin-embedded blocks. All specimens were submitted to the testing facility with coded identifiers. During histopathological and IHC evaluation, the pathologist and laboratory study director were blinded to treatment status and time point; only the patient ID and antibody information were provided.

Histological and IHC analyses were performed by an independent third-party laboratory (Comparative Biosciences, Inc.). Slides were evaluated through light microscopy by a board-certified pathologist (Farshid Shahriar, DVM, PhD, DACVP) in collaboration with the laboratory study director (Fariba Chalajour, MD, MBA). Histopathological findings (hematoxylin and eosin [H&E], trichrome, and Van Gieson) were graded using a standardized semiquantitative 5-point scoring system (0–4). IHC slides were scored using a standardized intensity and incidence scale (±, 0–4+).

All slides were assessed for adequacy of staining and tissue integrity; slides deemed inadequate were re-stained before analysis. Negative controls were used to rule out nonspecific staining. Digitized slide imaging was performed using an Olympus VS200 scanner. After completion of all scoring and data entry, the study was unblinded solely for data organization and pairing of treated and untreated samples. For histological evaluation, H&E

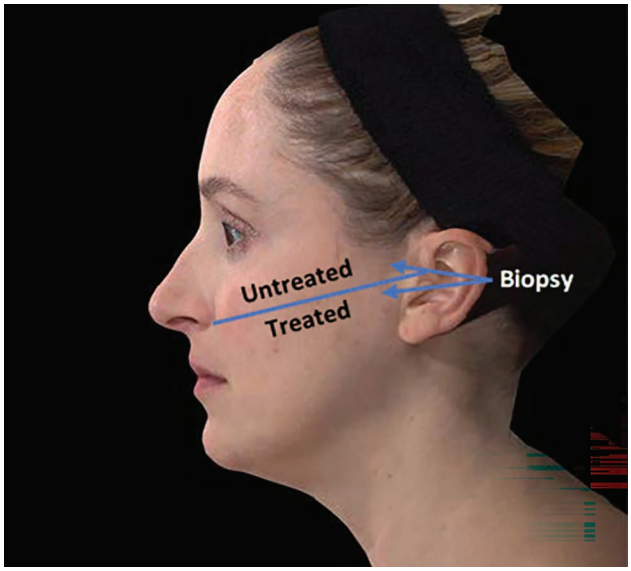


Fig. 1. Treatment and control regions during lower rhytidectomy. Helium plasma RF was applied to the neck, submentum, and lower facial skin flap, whereas untreated mid- and upper-face regions served as internal controls for paired biopsy analysis.

staining was used to assess overall tissue architecture, inflammation, and epithelial integrity, whereas trichrome staining was used to evaluate collagen fiber organization and disruption. Van Gieson staining was additionally performed to visualize elastin fibers. Semiquantitative histological scores were summarized using descriptive statistics. Percent differences derived from mean ordinal scores were calculated to illustrate the relative magnitude and direction of observed changes between treated and untreated tissues. Because these scores represent ordinal semiquantitative assessments, percent differences should not be interpreted as quantitative morphometric measurements or as inferential statistical outcomes.

IHC analysis was conducted using antibodies against elastin and fibrillin-1, with detection using a DAB/HRP method. Elastin staining was semiquantitatively scored for both intensity and distribution (incidence) to assess treatment-related changes in dermal elastin content, whereas fibrillin-1 expression was qualitatively evaluated to determine localization within the dermis. Elastin distribution in aged/photoaged dermis is inherently heterogeneous; therefore, regional variation in staining intensity is expected. All samples were processed using the same standardized IHC protocol, and interpretation was based on paired within-subject comparisons to control for intrinsic variability.

The primary objective of these analyses was to quantify treatment effects on intrinsic markers of skin quality, focusing on elastin fiber content and distribution, collagen fiber organization, and inflammation and epithelial integrity. Inflammation was assessed on H&E-stained sections using semiquantitative scoring of inflammatory cell infiltrate within the dermis and subcutaneous tissue. Scores reflected the degree of inflammatory infiltrate (eg, lymphocytes/macrophages) and were graded on an ordinal scale (none, minimal, mild, moderate, marked) as defined in the laboratory histopathology scoring criteria. Representative images were selected for figure presentation; minor sectioning artifacts (eg, tissue separation or folding) may be present in individual images and were considered nonpathological when not involving the epidermis or dermal architecture. Safety was concurrently assessed by monitoring all adverse events (AEs) and expected treatment effects (ETEs).

Secondary endpoints included evaluation of the clinical healing profile, bruising, and swelling through day 180, as well as aesthetic outcomes using both the Physician and Subject Global Aesthetic Improvement Scales. Patient-reported outcomes were captured at day 180 through the Patient Satisfaction Questionnaire. This study design allowed for a direct assessment of how helium plasma RF treatment influences intrinsic markers of skin quality by comparing treated and untreated tissue from the same individuals while also capturing clinical outcomes and safety data.

RESULTS

Seven patients were enrolled in this study (6 female patients, 1 male patient; mean age 55.4 ± 6.4 y). Six participants completed the day 180 follow-up visit. Representative before/after images are provided in Figure 2. A total of 15 events were recorded during the study, including 13 ETEs and 2 AEs. The ETEs consisted of 6 cases of mild bruising and 7 cases of mild edema, 2 of which were determined to be treatment related. The AEs included 1 mild seroma and 1 mild focal area of skin breakdown along the posterior cheek flap near the temporal hairline that resolved with routine wound care and without sequelae. Importantly, no serious AEs or unanticipated adverse device effects occurred, and all reported events resolved fully by the final follow-up visit.

Histological Outcomes

Histological and IHC analyses were performed on paired helium plasma RF–treated and untreated tissue samples collected at baseline and day 180 to evaluate the impact of helium plasma RF on skin quality (Table 1) (Figs. 3, 4). Occasional focal discontinuities were observed in select sections and were consistent with routine tissue-processing artifact such as tissue separation during sectioning and mounting, particularly in samples containing adnexal structures and subcutaneous adipose tissue; these did not involve epidermal integrity and were not interpreted as treatment-related tissue disruption. Such artifacts are common in punch biopsy specimens and did not affect the regions used for semiquantitative scoring.

The most notable finding was a 30% increase in elastin fiber density in helium plasma RF–treated tissue compared with controls at day 180, as measured by Van Gieson staining (Fig. 5). IHC analysis confirmed these results, demonstrating a 55% increase in elastin staining intensity (Fig. 6) and a 27% increase in elastin fiber incidence. Staining intensity varied regionally, consistent with expected elastin heterogeneity in mature dermis.



Fig. 2. A 60-year-old woman underwent deep plane face- and neck lift, platysmaplasty, subdermal treatment with Renuvion helium plasma RF of the lower face and neck, shown preoperatively (A) and at day 180 postoperatively (B). Note the improvement in the patient's skin quality postoperatively.

Table 1. Summary of Histological and IHC Outcomes Comparing Treated and Untreated Tissue From Baseline to Day 180

Marker/Histological Feature	Staining Method	Baseline Mean (Control)	Baseline Mean (Treated)	Day 180 Mean (Control)	Day 180 Mean (Treated)	Percent Change Versus Day 180 (Control), %	Percent Change versus Day 180 (Treated), %	Net Difference, %	Interpretation
Elastin fibers	Van Gieson stain	2.2 ± 0.5	2.3 ± 0.5	2.3 ± 0.5	3.0 ± 0.6	0	30	30	Marked increase in elastin content indicating dermal remodeling and improved skin quality
Elastin expression—intensity	IHC (anti-elastin)	3.0 ± 0.6	2.5 ± 0.8	2.3 ± 0.8	3.3 ± 1.2	−22.3	33.2	55	Stronger and more widespread elastin staining confirms biological effect of treatment
Elastin expression—incidence	IHC (anti-elastin)	1.7 ± 0.8	1.8 ± 1.2	1.7 ± 1.2	2.3 ± 1.0	0	27.3	27	Increased distribution of elastin within dermis
Collagen deposition and damage	Trichrome stain	0.5 ± 0.8	1.7 ± 1.5	0.5 ± 1.2	1.5 ± 1.6	−0.5	−12	12	Trend toward structural stabilization; new collagen formation inconclusive
Fibrillin-1 expression	IHC (anti-fibrillin-1)	Minimal	Minimal	Minimal	Minimal	N/A	N/A	N/A	Low staining levels, likely age-related decline and formalin epitope masking
Inflammation	H&E stain	1.8 ± 0.4	2.2 ± 1.0	2.0 ± 0.9	1.7 ± 0.8	11	−23	34	Reduced inflammatory response indicates a proregenerative tissue environment
Fibrosis/abnormal vascularization	H&E stain	None	None	None	None	N/A	N/A	N/A	No adverse microscopic findings observed

Van Gieson and trichrome staining scores are semiquantitative, based on a 0–4 grading scale. Percent change calculated as difference between treated at day 180 versus baseline samples. N/A indicates not applicable or not assessed. Percent differences are descriptive values calculated from mean semiquantitative ordinal scores and are intended to summarize relative direction and magnitude of change; they do not represent quantitative morphometric measurements or inferential statistical comparisons. Inflammation scores reflect semiquantitative grading of inflammatory cell infiltrate on H&E staining (ordinal scale).

Collagen organization also improved. Trichrome staining showed a 12% reduction in total collagen fiber disruption, suggesting a trend toward structural repair. (**See figure, Supplemental Digital Content 1**, which displays comparison of collagen organization at baseline and at day 180. Representative trichrome-stained sections showing collagen fibers [blue stain] in treated and untreated areas. Images are shown at 10× magnification. Above left, baseline control [untreated area]; above right, day 180 control [untreated area]; below left, baseline treatment area

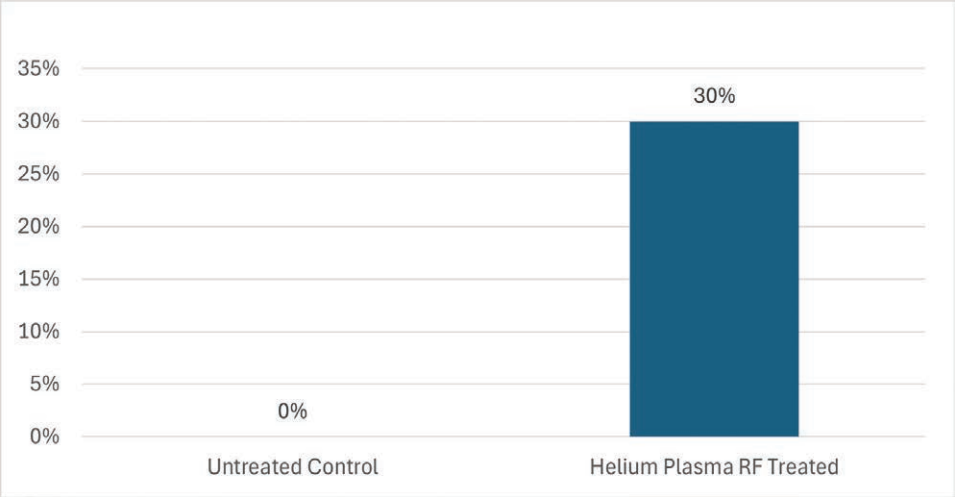


Fig. 3. Difference in elastin density (30%, Van Gieson) between control and treatment groups. Values represent mean semiquantitative ordinal scores from blinded histopathological evaluation. Percent differences are provided solely as descriptive comparisons and should not be interpreted as continuous quantitative measurements.

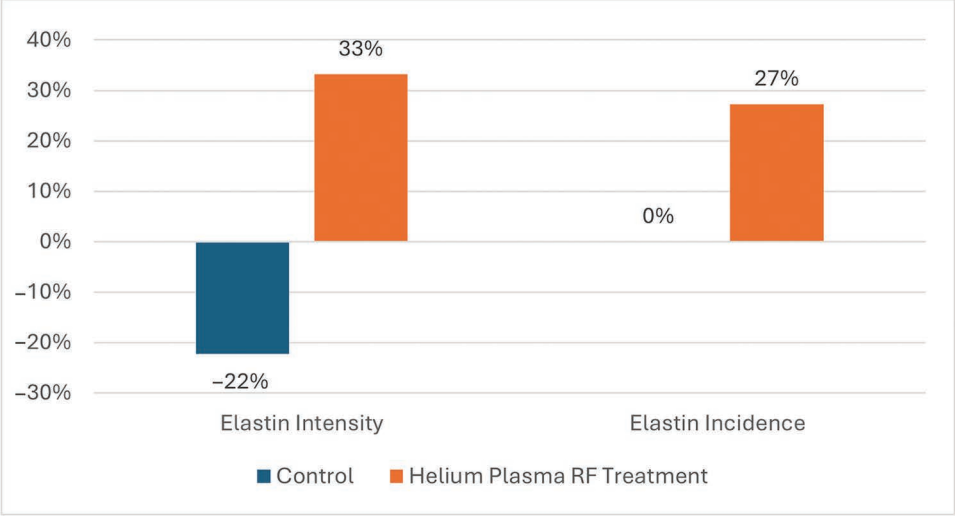


Fig. 4. Difference in elastin expression by IHC: intensity (55%) and incidence (27%). Values represent mean semiquantitative ordinal scores from blinded histopathological evaluation. Percent differences are provided solely as descriptive comparisons and should not be interpreted as continuous quantitative measurements.

[pre-helium plasma RF]; below right, day 180 treatment area [post-helium plasma RF]. Focal discontinuities visible in select sections represent routine sectioning artifacts and do not involve epidermal or dermal architectural disruption, **https://links.lww.com/PRSGO/F284**.) However, the formation of new total collagen fibers remained inconclusive at day 180, likely due to the study's limited sample size and follow-up duration. No significant changes in epidermal thickness were observed between groups.

Fibrillin-1, a microfibrillar glycoprotein involved in elastic fiber assembly, showed minimal staining across all samples (study age range, 46–63 y), likely reflecting a combination of natural age-related decline, formalin-induced epitope masking, and previous tissue interventions. Although included in the study design, these results limited interpretability and were insufficient to support conclusions regarding treatment-related changes.

In addition to these primary markers, H&E staining demonstrated a 34% reduction in inflammation in treated tissue compared with controls. (**See figure, Supplemental Digital Content 2**, which displays H&E-stained sections demonstrating inflammation in untreated control tissue and treated tissue at day 180. No significant fibrosis, abnormal vascularization, or epithelial disruption was observed in treated samples. Images are shown at 10× magnification. Above left, baseline control [untreated area]; above right, day 180 control [untreated area]; below left, baseline treatment area [pre-helium plasma RF]; below right,

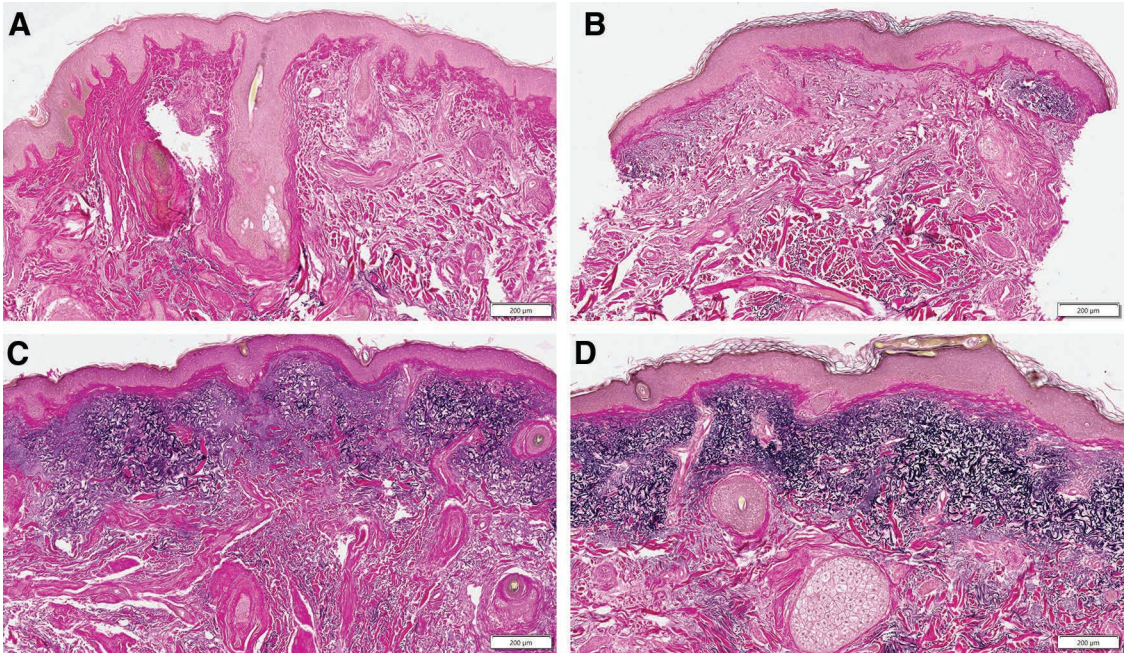


Fig. 5. Representative Van Gieson–stained histology sections demonstrating elastin content at baseline and at day 180 (10× magnification). Elastin fibers appear as darkly stained structures within the dermis; treated areas show increased elastin content compared with untreated control tissue. A, Baseline control (untreated area); B, day 180 control (untreated area); C, baseline treatment area (pre-helium plasma RF); D, day 180 treatment area (post-helium plasma RF).

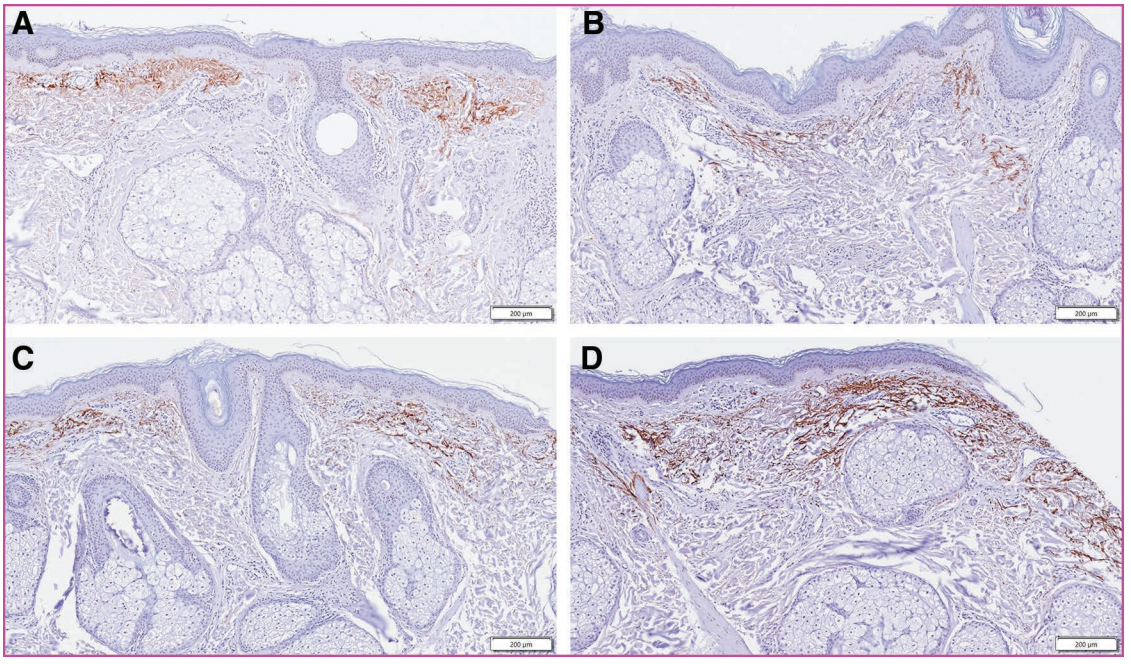


Fig. 6. Representative IHC staining for elastin at baseline and at day 180 (4× magnification). Elastin is visible as brown deposits within the dermis. A, Baseline control (untreated area); B, day 180 control (untreated area); C, baseline treatment area (pre-helium plasma RF); D, day 180 treatment area (post-helium plasma RF). Focal discontinuities represent routine sectioning artifacts and do not reflect tissue disruption.

day 180 treatment area [post-helium plasma RF], **https://links.lww.com/PRSGO/F285**.) Importantly, there was no evidence of significant fibrosis, abnormal vascularization, or epithelial disruption in any treated samples.

Clinical and Patient-reported Outcomes

Clinically, healing progressed steadily with near-complete healing scores achieved by day 180 (Table 2). Bruising (Table 3) and swelling (Table 4) resolved by day

Table 2. Healing Profile

Healing Profile	Day 1 (N = 7)	Day 7 (N = 7)	Day 14 (N = 7)	Day 45 (N = 7)	Day 90 (N = 7)	Day 180 (N = 6)
Average ± SD	17.5 ± 16.6	40.0 ± 28.9	47.5 ± 28.9	70.8 ± 17.4	92.1 ± 6.4	99.8 ± 0.4

Table 3. Bruising Duration

Bruising	Day 1 (N = 7), n (%)	Day 7 (N = 7), n (%)	Day 14 (N = 7), n (%)	Day 45 (N = 7), n (%)	Day 90 (N = 7), n (%)	Day 180 (N = 6), n (%)
Yes	6 (85.71)	5 (71.43)	5 (71.43)	0	0	0
No	1 (14.29)	2 (28.57)	2 (28.57)	7 (100)	7 (100)	6 (100)

Table 4. Swelling Duration

Swelling	Day 1 (N = 7), n (%)	Day 7 (N = 7), n (%)	Day 14 (N = 7), n (%)	Day 45 (N = 7), n (%)	Day 90 (N = 7), n (%)	Day 180 (N = 6), n (%)
Yes	7 (100)	7 (100)	6 (85.71)	0	0	0
No	0	0	1 (14.29)	7 (100)	7 (100%)	6 (100)

Table 5. Subject Global Aesthetic Improvement Scale

Rating	Day 45 (N = 6), n (%)	Day 90 (N = 7), n (%)	Day 180 (N = 6), n (%)
Worse, much worse, very much worse	0	0	0
No change	0	0	0
Improved	0	0	1 (17)
Much improved	2 (33)	4 (57)	2 (33)
Very much improved	4 (67)	3 (43)	3 (50)

45. All patients demonstrated measurable improvement on both the Subject Global Aesthetic Improvement Scale (Table 5) and Physician Global Aesthetic Improvement Scale (Table 6) at days 45, 90, and 180. No participants reported worsening or unchanged appearance.

By day 180, all participants expressed high satisfaction with their treatment outcomes, reporting noticeable improvements in skin elasticity, radiance, and youthfulness (Table 7). All participants indicated that they would recommend the procedure to others, aligning with the histological findings of enhanced elastin content and reduced inflammation.

DISCUSSION

The results of this study demonstrate that treatment with helium plasma RF led to favorable changes in dermal composition, most notably a 30% increase in elastin fiber density, a 55% increase in elastin staining intensity, and a 27% increase in elastin fiber incidence at day 180 compared with untreated control tissue. Elastin is a well-established marker of skin quality, critical for resilience and elasticity[2–4]; its upregulation suggests that helium plasma RF promotes biological dermal remodeling and restoration. The increase in elastin content is particularly significant given that elastin production naturally declines with age,[2,3] and is further compromised by photoaging, where ultraviolet-induced degradation and abnormal elastin deposition (solar elastosis) contribute to loss of elasticity and resilience.[4] These findings align with broader concepts in regenerative aesthetics, in which treatments aim to reverse or slow biological aging at the tissue level, supporting both structural and functional improvements in skin health.[2,28] Collectively, these results provide the first direct, quantifiable evidence in humans that helium plasma RF treatment can positively impact fundamental markers of skin quality.

Importantly, these histological improvements are attributable to helium plasma RF itself and not to the normal healing response that follows rhytidectomy alone. Traditional rhytidectomy procedures primarily stimulate tissue remodeling through surgical wound repair, whereas plasma-based energy interacts with tissue through multiple biologically active pathways. Prior plasma research, including work by Heinlin et al[29,30] and Fitzpatrick et al[31], has demonstrated that plasma-generated reactive species, photons, and thermal effects can activate signaling cascades responsible for tissue regeneration, angiogenesis, and extracellular matrix remodeling. Additional nitrogen and helium plasma skin regeneration studies further support plasma-induced dermal remodeling and accelerated epithelial recovery,[31–35] reinforcing that the changes observed here are attributable to helium plasma RF bioactivation rather than surgical healing alone.

We also observed reduced inflammation without fibrosis or epithelial disruption, indicating a favorable tissue response and absence of adverse wound-healing patterns. This is critical, as fibrosis and epithelial disruption can indicate adverse wound healing or scarring.[36] The combination of reduced inflammation and increased elastin suggests a tissue environment conducive to healthy dermal remodeling, consistent with a proregenerative biological response.

Recent preclinical work supports a similar regenerative response, showing early inflammatory activation followed by rapid transition to tissue remodeling. This mechanism

Table 6. Physician Global Aesthetic Improvement Scale

Rating	Day 45 (N = 7), n (%)	Day 90 (N = 7), n (%)	Day 180 (N = 6), n (%)
Worse, much worse, very much worse	0	0	0
No change	0	0	0
Improved	1 (14)	0	0
Much improved	1 (14)	1 (14)	0
Very much improved	4 (71)	6 (86)	6 (100)

Table 7. Patient Satisfaction

Question	Day 180 (N = 6), n (%)
Do you notice any improvement in the appearance of your lower face?	6 (100)
Characterize satisfaction with procedure	
Satisfied (very, satisfied, or slightly)	6 (100)
Neither satisfied nor dissatisfied	0
Dissatisfied (slightly, dissatisfied, very)	0
Recommend procedure to friends and family members	
Yes	6 (100)
No	0
Improvement noticed	
Improved skin dryness/skin feels more hydrated	1 (16.67)
Improved elasticity/pliability	3 (50)
Skin quality is improved	2 (33.33)
Skin appears more youthful	5 (83.33)
Improved skin radiance/"glow"	3 (50)

aligns with the increased elastin and reduced inflammation observed in this study.[37] These findings suggest that helium plasma RF activates molecular pathways supporting regeneration, which may explain the increased elastin and reduced inflammation observed at day 180.

The histological findings in this study align with this mechanism. By day 180, treated tissue showed restoration without epithelial disruption and with enhanced elastin content. Although fibrosis is recognized as a risk associated with all energy-based technologies,[8,38–42] its absence here may reflect the proregenerative cascade described by Smith et al.[37] This interpretation is supported by Trott[38], who observed supple tissue, minimal scarring, and clean dissection planes free of fibrosis during neck lift surgery performed 4 months after helium plasma RF treatment.

The biological changes observed were consistent with patient-reported outcomes, where participants described enhanced skin elasticity, radiance, and youthfulness. Although these self-reported measures are subjective, their alignment with histological evidence strengthens the clinical relevance of these findings.

The biological response observed in this study may share mechanistic parallels with those described for cold atmospheric plasma, which has been shown to promote tissue repair through plasma-generated reactive oxygen and nitrogen species.[29,30] Reactive oxygen and nitrogen species have been shown to modulate wound-healing pathways, including fibroblast activity, angiogenesis, and proliferation signaling.[43,44] Although cold atmospheric plasma and helium plasma RF differ in energy delivery and depth of tissue interaction, both may converge on similar biological pathways that support regeneration and remodeling rather than scarring.

The proregenerative tissue response observed in this study is also supported by emerging translational evidence from fat grafting research. In a preclinical mouse model, Ruff and Sterodimas[45] demonstrated that pretreatment of the recipient site with helium-based RF energy increased adipocyte viability, enhanced adipose-derived stem cell concentration, and reduced fibrotic remodeling compared with controls. The study found that helium plasma pretreatment promoted active tissue remodeling through colocalization of adipose-derived stem cells and macrophages, suggesting accelerated adipose tissue regeneration within a healthier stromal environment. These findings were extended clinically by Sterodimas[46], who reported an 89% fat graft survival rate at 12 months when helium plasma RF was used for recipient site preparation before stromal-enriched lipograft breast augmentation, compared with 63% without pretreatment. Collectively, these data suggest that helium plasma RF enhances the biological quality of recipient tissue, creating a more supportive microenvironment for regeneration, cellular viability, and long-term remodeling. This mechanism may similarly relate to the improved dermal architecture and reduced inflammation observed in the present study.

Overall, these results suggest that helium plasma RF may both downregulate inflammation and upregulate elastogenesis to enhance intrinsic skin quality. By increasing elastin content and reducing inflammation, helium plasma RF may support long-term improvements in skin resilience, elasticity, and overall health. This mechanism distinguishes it from many existing aesthetic modalities, such as lasers, ultrasound, or bipolar RF, which rely primarily on bulk-heating-induced thermal injury to promote tissue remodeling, without the additional biological effects as conferred by helium plasma.

The primary limitations of this study include its small sample size and descriptive, semiquantitative nature. Future studies using quantitative morphometry and molecular markers may further characterize treatment-related remodeling.

CONCLUSIONS

Histological and IHC analyses demonstrated that treatment with helium plasma RF was well tolerated, with no adverse microscopic findings, including absence of significant fibrosis or abnormal epithelial changes. Treated tissue exhibited a 30% increase in elastin fiber density, reduced inflammation, and enhanced dermal remodeling, indicating a regenerative response. Collectively, these findings suggest a beneficial, proregenerative role for subdermal helium plasma RF treatment.

Because elastin is a key determinant of skin elasticity and overall skin health, these findings provide the first direct, quantifiable human evidence that helium plasma RF can enhance intrinsic markers of skin quality. The observed changes are consistent with recently described

mechanistic preclinical data showing that helium plasma RF initiates a short-lived inflammatory cascade that rapidly transitions into a proregenerative state, supporting elastin deposition and dermal matrix restoration.

Together, these results highlight the potential of subdermal helium plasma RF to deliver meaningful, sustained improvements in skin quality, supported by both objective histological evidence and subjective patient-reported outcomes. Although the small sample size remains a limitation, the consistency of biological and clinical findings supports a favorable safety profile and suggests a unique regenerative remodeling effect that distinguishes helium plasma RF from conventional energy-based modalities.

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DISCLOSURES

Dr. Melinda Lacerna Kimbrell is a consultant, principal investigator, and speaker for Apyx Medical. Dr. Holcomb is a consultant and principal investigator for Apyx Medical.

ACKNOWLEDGEMENT

The authors thank Kari Larson, MBA, Apyx Medical, for providing medical writing assistance under their direction.

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