International Journal of Clinical Dermatology
2026, Vol. 9, No. 2, pp. 145–154
https://doi.org/10.11648/j.ijcd.20260902.16

Case Report

Facial Volumization Using Low-Energy High-Intensity Focused Ultrasound (HIFU): A Case Series

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Abstract

Background: High-intensity focused ultrasound (HIFU) is increasingly applied for facial volume restoration, yet evidence on low-energy protocols for adipose tissue proliferation remains limited. This case series evaluated clinical outcomes and tolerability of low-energy HIFU using the LinearZ device for facial volume loss in patients with Fitzpatrick skin types III and IV. Case Presentation: This retrospective single-clinic case series includes four adults treated for infraorbital hollowness, midface concavity, temporal hollowing, and nasolabial folds. All participants underwent three sessions at two-week intervals using LinearZ Contour (9.0mm) and Core (4.5mm) cartridges in DOT mode at 0.2 J. Standardized protocols delivered 100 shots per side to the under-eye and temple regions and 300 shots per side to the cheeks and nasolabial folds. Outcomes were assessed with standardized photography at baseline, one month, and three months post-treatment. All patients completed treatment without complications. Improvements included smoother lid–cheek junctions, restored midface convexity, increased temporal fullness, and softened nasolabial folds. Clinical changes were apparent after the first session and continued to progress throughout the protocol. Patients reported transient tingling or warmth during treatment that resolved immediately. No bruising, swelling, pigmentary alteration, blistering, or sensory changes occurred. All patients resumed normal activities immediately after the procedure. Conclusions: In this preliminary case series, Low-energy HIFU with the LinearZ device appears safe, well tolerated, and effective for progressively restoring facial volume in Fitzpatrick skin types III and IV. Further controlled studies with larger cohorts are required to establish parameters and long-term outcomes.

Keywords

High-intensity Focused Ultrasound, HIFU, Facial Volumization, Adipose Tissue, LinearZ, Adipogenesis

1. Introduction

Facial volume loss is a hallmark of aging, resulting from soft tissue atrophy, skeletal remodeling, and dermal degradation. These changes affect multiple layers of facial anatomy, from diminished subcutaneous fat compartments to gradual bone resorption, leading to clinical manifestations such as under-eye hollows, midface flattening, temporal concavity, and deepened nasolabial folds [1]. Anatomical research increasingly emphasizes that facial aging is not solely due to gravitational descent; localized volume depletion plays a central role and guides contemporary rejuvenation strategies [2].

Over the past decade, high-intensity focused ultrasound

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Received: 25 October 2026; **Accepted:** 2 November 2026; **Published:** 16 November 2026

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(HIFU) has emerged as a non-invasive technology that delivers targeted thermal energy to specific tissue depths [3, 4]. This controlled energy deposition denatures collagen, stimulates fibroblast activity, and promotes neocollagenesis and neoelastogenesis [5]. Unlike energy-based devices that primarily target the superficial dermis, HIFU can create focal coagulative zones in the deep dermis and superficial musculoaponeurotic system (SMAS), enabling lifting and volumetric remodeling without disrupting the epidermis [6].

Clinical evidence supports using HIFU for skin tightening and lifting in the lower face, jawline, and neck [7, 8]. However, published data on its use in smaller, volume-deficient zones such as the infraorbital hollow, temple, and midface remain limited. Treating these areas requires precise energy delivery to avoid adverse effects in anatomically delicate regions, particularly where the skin is thin and the subcutaneous tissue is minimal [9].

This case series describes our clinical experience with HIFU for targeted volume restoration in aesthetically sensitive areas. We aim to present detailed treatment parameters, photographic outcomes, and safety observations to contribute to the evolving literature on advanced HIFU applications for facial rejuvenation.

2. Case Presentation

This observational case series included patients who underwent high-intensity focused ultrasound (HIFU) treatment using the LinearZ (Jeisys Med Inc., Seoul, Republic of Korea) device for facial fat proliferation. The study population consisted exclusively of individuals with Fitzpatrick skin types III and IV.

This retrospective, single-clinic, observational case series included four patients (three female and one male) with a mean age of 47.5 years, Fitzpatrick skin phototypes III to IV, at least one of the following concerns: under-eye hollowness, hollow cheeks, hollow temporal area, or nasolabial folds, and who opted for HIFU treatment for volume restoration at Radiant Clinique, Shah Alam, Malaysia. The clinic's treatment records were used to identify patients for this case series.

2.1. Treatment Protocol

All patients underwent three sessions at two-week intervals using core and contour cartridges in DOT mode (9.0 mm and 4.5 mm) at 0.2 J energy, without anesthetic cream. Table 1 lists the device parameters.

Table 1. *The treatment parameters for each anatomical area were.*

Area	Mode	Depth & Shots (per side)	
		4.5mm (core cartridges)	9mm (contour cartridges)
Under-eye	DOT	50	50
Hollow cheeks	DOT	100	200
Temple	DOT	50	50
Nasolabial folds	DOT	100	200

2.2. Data Collection

Clinical data included demographic variables (mean age and sex distribution), treatment parameters, and photographic documentation obtained at baseline and follow-up visits (1 month and 3 months).

2.3. Follow-up and Outcome Assessment

We followed patients at 1 month and 3 months after the final treatment session. We took standardized before-and-after photographs for each treated area. We evaluated outcomes based on clinical photographs and physician assessment.

3. Results

3.1. Under-eye Repositioning

Standardized photographic assessment demonstrated a visible reduction in hollowness and a smoother lid–cheek junction following treatment. In most cases, improvement was evident after the first session, with further enhancement occurring across subsequent sessions. The effect was symmetrical in bilateral treatments. No adverse events such as swelling, bruising, or pigmentary alteration were observed.



Figure 1. *Patient 1 (male), composite baseline and post-treatment photographs showing right, left, and frontal views.*



Figure 2. *Patient 2 (female), composite baseline and post-treatment photographs showing right, left, and frontal views.*



Figure 3. *Patient 3 (female), composite baseline and post-treatment photographs showing right, left, and frontal views.*



Figure 4. *Patient 4 (female), composite baseline and post-treatment frontal photographs showing open and closed eyes.*

3.2. Hollow Cheeks

Three patients underwent treatment targeting the buccal fat pad to restore midface volume. Each side received 200 shots with the Contour Cartridges (9.0 mm) in DOT mode and 100 shots with the Core Cartridge (4.5 mm) in DOT mode at 0.2 J, for a total of 300 shots per side. All patients completed three treatment sessions at two-week intervals.

Photographic evaluation showed restored cheek fullness and reduced midface concavity. Improvement was evident after the initial session and increased cumulatively through the treatment protocol. The changes were most evident in oblique facial views.



Figure 5. *Patient 1 (male), hollow cheeks: composite baseline and post-treatment photographs showing right, left, and frontal views.*



Figure 6. *Patient 2 (female), composite baseline and post-treatment photographs showing right, left, and frontal views.*



Figure 7. *Patient 3 (female), composite baseline and post-treatment photographs showing right, left, and frontal views.*

3.3. Temple Area

Three patients were treated for temporal hollowing. Each side received 50 shots using the contour cartridge (9.0 mm) in DOT mode and 50 shots using core cartridges (4.5 mm) in DOT mode at 0.2 J, for a total of 100 shots per side. All patients completed three treatment sessions at two-week intervals.

Post-treatment photographs showed progressive restoration of temporal convexity, particularly most notable in lateral and oblique views.

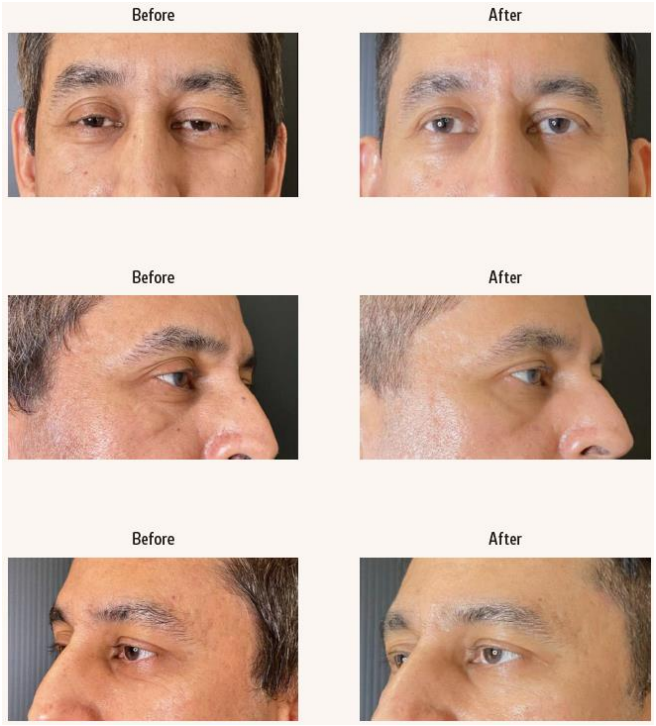


Figure 8. *Patient 1 (male), composite baseline and post-treatment photographs showing right, left, and frontal views.*



Figure 9. *Patient 2 (female), composite baseline and post-treatment photographs showing right, left, and frontal views.*



Figure 10. *(female), composite baseline and post-treatment photographs showing right, left, and frontal views.*

3.4. Nasolabial Folds

Two patients underwent treatment targeting volume loss along the nasolabial folds. Each side received 200 shots with the contour cartridge (9.0 mm) in DOT mode and 100 shots with the core cartridge (4.5 mm) in DOT mode at 0.2 J, for a

total of 300 shots per side. All patients completed three treatment sessions at two-week intervals.

Photographic documentation demonstrated softening of the nasolabial folds and a smoother transition from the cheek to the perioral region. Visible improvement occurred after the first session and was enhanced after completing the protocol.

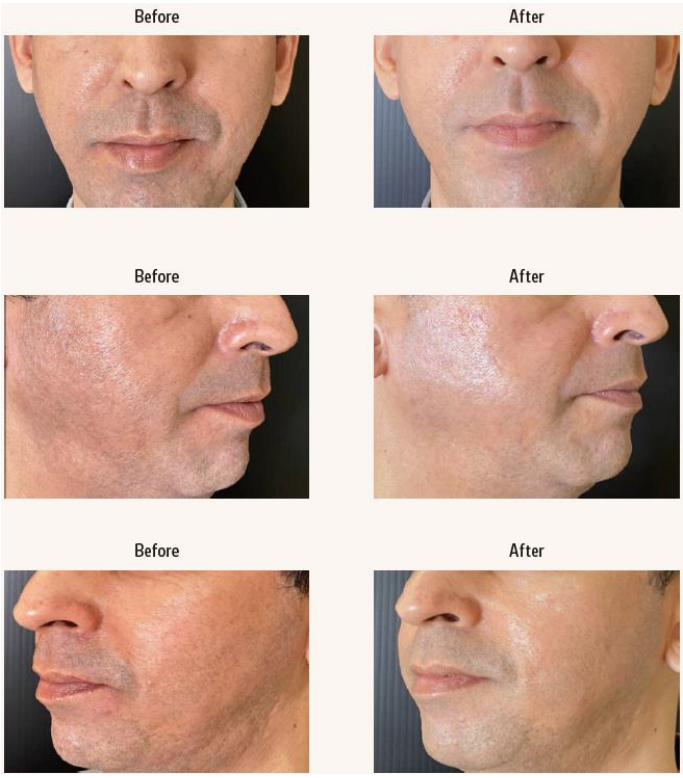


Figure 11. *Patient 1 (male), composite baseline and post-treatment photographs showing right, left, and frontal views.*



Figure 12. *Patient 3 (female), composite baseline and post-treatment photographs showing right, left, and frontal views.*

3.5. Safety and Tolerability

Across all treated areas, procedures were well tolerated, with no complications occurring during or after any session. All patients completed the planned treatment sessions without major discomfort. Some patients reported mild transient sensations, including tingling, warmth, or slight pain, typically lasting only a few seconds during ultrasound energy delivery. These sensations were more noticeable around the eyes and over bony prominences but resolved immediately after treatment. No anesthetic cream was required. All patients resumed normal activities immediately following each session. No adverse events such as bruising, swelling, blistering, post-inflammatory hyperpigmentation, or sensory disturbances were recorded.

Based on the outcomes observed during follow-up, the short-term prognosis for maintenance of volumization results was considered favorable, with no indication of regression within the three-month observation period.

4. Discussion

This case series suggests that low-energy LinearZ HIFU delivered in DOT mode can produce visible volume enhancement in targeted facial areas, particularly the infraorbital region, midface, temples, and nasolabial folds [10, 11]. Improvements appeared after the first session and continued throughout the three-session protocol. These findings support the proposed mechanism whereby low-energy HIFU promotes adipogenesis by modulating subcutaneous adipose-derived stem cells (ASCs)[12].

Preclinical evidence suggests that low-energy HIFU upregulates heat shock protein 70 (HSP70) expression, which subsequently reduces NF-κB, IL-6, and TNF-α activation in subcutaneous white adipose tissue (sWAT) [10-12]. This downregulation of inflammatory mediators restores primary cilia function in ASCs, attenuates Wnt5/β-catenin signaling, and enhances transcription of peroxisome proliferator-activated receptor gamma (PPARγ) and CCAAT/enhancer-binding protein alpha (CEBPα) [13]. Upregulation of these adipogenic transcription factors promotes differentiation of preadipocytes into mature adipocytes, thereby increasing sWAT thickness [14, 15]. Clinically, this translates into localized restoration of soft tissue volume and improved contour irregularities.

The absence of significant adverse effects in this series aligns with the established safety profile of HIFU in dermatologic applications [12]. Some patients reported transient tingling, warmth, or discomfort during energy delivery, particularly over bony areas, but these sensations were short-lived and did not necessitate analgesia. No bruising, swelling, blistering, post-inflammatory hyperpigmentation, or sensory deficits were observed. The absence of downtime and minimal discomfort further supports the feasibility of using LinearZ for fat proliferation, offering a non-invasive alternative to injectable fillers.

These findings also highlight an emerging clinical application of HIFU: fat control, encompassing both adipose tissue reduction and proliferation depending on treatment parameters. Whereas high-energy HIFU has traditionally been used to induce lipolysis and skin tightening (5–7), the low-energy protocols used in this series may represent a novel therapeutic pathway for patients with facial volume loss (3). This approach could be particularly beneficial for individuals in whom dermal fillers are contraindicated, such as those with a history of vascular occlusion, filler-related granulomas, or certain autoimmune conditions.

However, this series is limited by the absence of quantitative volumetric measurements and long-term follow-up beyond the treatment period. While photographic documentation supports the findings, adding objective assessment tools, such as three-dimensional imaging or ultrasound-based measurements of fat layer thickness, would strengthen the robustness of the results.

Future studies should incorporate standardized outcome measures, larger patient cohorts, and controlled comparisons with established volumization techniques such as dermal fillers or autologous fat grafting. Long-term follow-up will be required to determine the durability of the adipogenic effect and assess whether repeated maintenance sessions are needed to sustain results.

In summary, this preliminary case series supports the concept that low-energy HIFU in DOT mode can achieve localized facial volumization without significant adverse events. When applied within an evidence-based framework, this technology may broaden therapeutic options for non-invasive facial rejuvenation.

5. Conclusion

This retrospective case series indicates that low-energy HIFU delivered with the LinearZ device with DOT mode can achieve visible volumization in targeted facial regions, including the infraorbital area, cheeks, temples, and nasolabial folds. Improvements were evident after the first treatment session and progressed across the three-session protocol, with no significant adverse events or downtime observed.

The outcomes align with proposed biological mechanisms, in which low-energy HIFU promotes adipogenesis by modulating inflammatory signaling pathways and upregulating adipogenic transcription factors. These findings suggest that HIFU may have a therapeutic role beyond skin tightening and lifting, including controlled fat proliferation in patients with facial volume loss.

Abbreviations

HIFU	High Intensity Functional Ultrasound
J	Joule
HSP	Heat Shock Protein
sWAT	Subcutaneous White Adipose Tissue
PPARγ	Peroxisome Proliferator-activated Receptor Gamma

Author Contributions

Rasool Shaik Bin Sehu Mohamed: Data curation, Formal Analysis, Investigation, Writing – original draft, Writing – review & editing

Conflicts of Interest

The author declares no conflicts of interest.

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