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Original Article

Hyperdiluted triamcinolone injection therapy for infraorbital herniated fat pads

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ABSTRACT

Background: Infraorbital herniated fat pads are a frequent aesthetic concern and are commonly corrected surgically. Some patients prefer minimally invasive options, yet robust non-surgical volume-reduction approaches remain limited. Intralesional triamcinolone acetonide (TAC) is widely used in dermatology and other fields, and localized cutaneous/subcutaneous atrophy and lipoatrophy are recognized adverse effects.

Objective: To report outcomes after treating infraorbital herniated fat pads with hyperdiluted TAC prepared at a 1:20 dilution with normal saline and to discuss steroid-related mechanisms affecting adipose tissue.

Materials and methods: We conducted a retrospective case series of nine non–aesthetic-treated patients with infraorbital fat pad protrusion requesting non-surgical management. TAC was hyperdiluted 1:20 with 0.9% normal saline and injected as micro-aliquots into the target fat pad at the lid–cheek junction. Patients received 1–3 sessions at 4-week intervals. Standardized photographs were

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obtained at baseline and follow-up. Two independent physicians graded improvement using the Global Aesthetic Improvement Scale (GAIS), and patients rated satisfaction using a 5-point Likert scale. Adverse events were recorded.

Results: Visible reduction of infraorbital bulging was observed in all patients (9/9). Improvement typically became apparent over several weeks and progressed through follow-up. Mild-to-moderate protrusion generally responded after one or two sessions, whereas more advanced bulging required up to three sessions with partial residual fullness. No serious complications were observed; transient edema, erythema, and tenderness resolved spontaneously.

Conclusion: Hyperdiluted TAC (1:20 with normal saline) may provide a conservative, minimally invasive approach to reduce small-volume infraorbital fat protrusion, plausibly through controlled steroid-associated adipose atrophy. Given the known risk of unwanted atrophy, dyspigmentation, and contour irregularity with corticosteroid injections, this approach should be considered investigational and applied cautiously with appropriate anatomical expertise and follow-up.

Introduction

Infraorbital fat pad protrusion is a common contributor to a "tired" periorbital appearance. Although often described clinically as "under-eye bags," the visible contour can reflect multiple age-related processes, including weakening of eyelid retaining structures and age-associated changes in the bony orbit. Imaging-based work has suggested that orbital rim inclination and inferior rim descent may contribute mechanically to anterior displacement of the lower lid tissues and fat herniation.[1]

Lower blepharoplasty remains the definitive correction for true herniation of orbital fat and for combined excess skin and muscle changes. Surgical techniques continue to evolve, but periocular surgery requires detailed anatomical knowledge and carries a non-trivial complication profile, making some patients reluctant to proceed.[2,3]

Non-surgical strategies are frequently aimed at camouflage rather than reduction of the protruding fat. For example, hyaluronic acid fillers can improve the lid–cheek transition (tear trough deformity) and may reduce the shadowing that exaggerates perceived bulging; however, fillers may be unsuitable when the primary aesthetic concern is a discrete protruding fat pad.[4]

Triamcinolone acetonide (TAC) is an established intralesional corticosteroid used in many dermatologic conditions. Localized dermal atrophy, hypopigmentation, and subcutaneous lipoatrophy are recognized adverse effects and are generally treated as complications rather than therapeutic goals.[5–7]

Periocular tissues may be particularly susceptible to steroid-associated soft-tissue changes. Eyelid fat atrophy and depigmentation have been described after intralesional TAC for chalazion, demonstrating that small volumes of steroid placed near eyelid fat can produce clinically visible volume loss.[8]

In parallel, intralesional TAC has been reported as a minimally invasive alternative to excision for selected subcutaneous lipomas, supporting the concept that local corticosteroid deposition can alter adipose volume and/or architecture in vivo.[9]

Based on these observations, we explored an intentionally conservative approach: hyperdiluting TAC 1:20 with normal saline and delivering micro-aliquots to the infraorbital fat pad with the aim of achieving subtle, controlled volume reduction while minimizing the risk of overt cutaneous atrophy or contour deformity. Here, we report a small case series and discuss steroid-related mechanisms that may underlie the observed changes.

Materials and methods

Study design and setting

This was a retrospective observational case series conducted in an outpatient clinical setting. The study was designed to describe clinical appearance changes after treatment and to capture safety observations. The work was performed in accordance with local regulations and the principles of the Declaration of Helsinki. Written informed consent for treatment and medical photography was obtained from all patients; institutional review board oversight was obtained or waived according to local policy.

Participants

Nine consecutive patients presenting with infraorbital herniated fat pads (under-eye bulging) who requested a non-surgical option were included. All patients were "non–aesthetic-treated," defined as no prior periocular aesthetic procedures (e.g., fillers, lasers, threads, or surgery) in the treatment area. Exclusion criteria included pregnancy or breastfeeding; active infection or inflammatory dermatoses of the periocular skin; history of hypersensitivity to corticosteroids; uncontrolled systemic disease that could impair wound healing; known bleeding diathesis or anticoagulant use that could not be safely managed; and any ocular condition in which periocular injection was deemed unsafe.

Intervention (hyperdiluted TAC)

Triamcinolone acetonide was diluted at a 1:20 ratio (v/v) with sterile 0.9% normal saline immediately before use, yielding a low-concentration, "hyperdiluted" suspension. This dilution was selected to reduce total corticosteroid exposure and minimize the burden of steroid crystals in the superficial tissues, given the association between intralesional corticosteroid deposition and localized atrophy/lipoatrophy.[5,6,10]

Injection technique

After skin cleansing and marking of the most prominent fat bulge, hyperdiluted TAC was delivered as small-volume micro-aliquots into the target fat pad along the lid–cheek junction using a fine-gauge needle. Injections were placed in a deep subcutaneous plane to avoid intradermal deposition. Treatment was performed conservatively and symmetrically with the goal of subtle reduction rather than aggressive deflation. Patients were instructed to avoid manipulation of the area immediately after treatment and were provided routine post-procedure instructions (Figure 1).

Treatment schedule

Patients received between one and three treatment sessions depending on baseline severity and response, with approximately 4 weeks between sessions to allow time for steroid-associated tissue changes to declare and to reduce the risk of cumulative overcorrection.

Outcome assessment

Standardized photographs were acquired at baseline and at each follow-up using consistent lighting, patient positioning, and camera settings. Two independent physicians (not involved in the injection procedure) evaluated paired photographs and graded aesthetic change using the 5-point Global Aesthetic Improvement Scale (GAIS): very much improved, much improved, improved, no change, or worse. Patients rated satisfaction on a 5-point Likert scale (very satisfied to very dissatisfied).

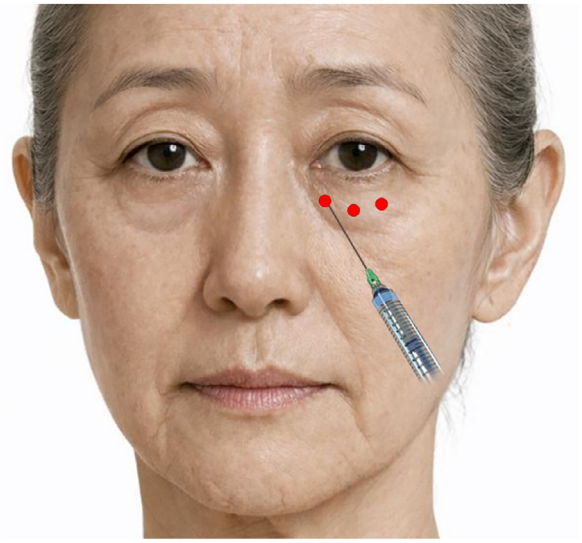

Figure 1. Schematic illustration of the proposed injection pattern for infraorbital herniated fat pads. Three micro–aliquot injection points are marked per side along the lid–cheek junction over the area of maximal protrusion.

Safety assessment

Immediate and delayed adverse events were documented, including pain, bruising, edema, erythema, nodularity, dyspigmentation, visible skin thinning, contour irregularity/overcorrection, and any ocular symptoms. Because periocular steroid injection can, rarely, be associated with unintended cutaneous changes, particular attention was paid to signs of depigmentation and atrophy.[5,6,8]

Statistical analysis

Given the descriptive objective and small sample size, only summary statistics were used.

Results

Nine patients were included (9/9 female). Mean age was 46.7 years (range 27–65). Baseline infraorbital fat pad protrusion was graded clinically as mild-to-moderate in five patients and severe in four patients. The median follow-up after the final treatment session was 12 weeks (range 8–24) (Figures 2 and 3).

Clinical improvement was observed in all cases (9/9). Patients and physicians generally noted that contour change was gradual: subtle improvement was often appreciated at the 4-week visit, with progressive reduction in bulging over subsequent weeks. Mild-to-moderate protrusion commonly achieved near-complete blending of the lid–cheek junction after one or two sessions, while more advanced protrusion required up to three sessions and tended to retain a small degree of residual fullness.

On physician-rated GAIS at the last follow-up, six patients were graded as very much improved and three as much improved. Patient-reported satisfaction was high: six patients reported being very satisfied and three reported being satisfied.

Transient edema, erythema, and mild tenderness were common and self-limited (9/9). Two patients experienced mild ecchymosis. No patient developed ulceration, infection, persistent dyspigmentation, clinically evident dermal thinning, or a contour defect suggestive of overcorrection during the observed follow-up period (Tables 1 and 2).

Figure 2. Representative patient example. (A) Baseline photograph demonstrating infraorbital fat pad protrusion. (B) Post–treatment photograph demonstrating visible reduction in bulging and a smoother lid–cheek transition.

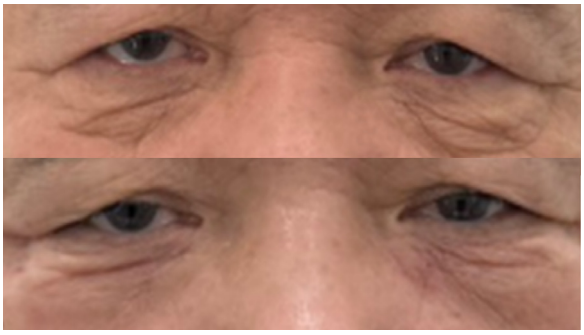

Figure 3. Early post–procedure appearance in one patient. (A) Baseline appearance (manual upper–lid elevation shown). (B) Approximately 3 weeks after injection.

Table 1
Baseline characteristics and treatment parameters ($n = 9$).

Variable	Value
Number of patients	9
Sex	Female: 9 (100%)
Age (years)	Mean 46.7 (range 27–65)
Baseline protrusion severity	Mild-to-moderate: 5; Severe: 4
Injection material	Triamcinolone acetonide hyperdiluted 1:20 with 0.9% normal saline
Number of sessions	1–3 (median 2)
Interval between sessions	Approximately 4 weeks
Follow-up after final session	Median 12 weeks (range 8–24)

Table 2
Physician-rated outcomes, patient satisfaction, and adverse events.

Domain	Category	*n* (%)
GAIS (physician-rated)	Very much improved	6 (66.7)
GAIS (physician-rated)	Much improved	3 (33.3)
Patient satisfaction	Very satisfied	6 (66.7)
Patient satisfaction	Satisfied	3 (33.3)
Adverse events	Transient edema/erythema/tenderness	9 (100)
Adverse events	Mild ecchymosis	2 (22.2)
Adverse events	Serious complications (ulceration/infection/overcorrection/ocular symptoms)	0 (0)

Discussion

This case series suggests that hyperdiluted TAC delivered as micro-aliquots to the infraorbital fat pad can reduce the clinical appearance of under-eye bulging in selected patients. Unlike filler-based approaches that primarily camouflage the lid–cheek junction, the current intervention was intended to modify the volume of the protruding fat itself. In our patients, contour change was gradual and generally unfolded over several weeks, consistent with the time course of steroid-associated soft-tissue remodeling reported in other anatomical sites.[4,6]

A plausible biological explanation is controlled, localized adipose atrophy triggered by corticosteroid deposition. Soft-tissue atrophy after corticosteroid injection has been described across multiple clinical disciplines and is thought to involve a reduction in adipocyte size and number, suppression of collagen synthesis, and broader effects on dermal and subdermal cellular activity. Triamcinolone's relatively low solubility and particulate nature may prolong local exposure, which may increase the likelihood of atrophy when steroid is deposited in or near subcutaneous fat.[6,10]

The periorbital region provides indirect clinical evidence of this phenomenon. Eyelid fat atrophy has been reported after periocular TAC injections for chalazion, emphasizing that small steroid volumes can produce noticeable volume loss in eyelid fat compartments. Although those reports describe an adverse outcome, they also support the core concept that steroid-associated adipose change can be clinically meaningful in the eyelid and lid–cheek transition.[8]

Reports of intralesional TAC for subcutaneous lipomas provide additional support that local corticosteroid deposition can influence adipose lesions and, in some settings, reduce volume or symptoms. The mechanism in lipomas is not fully established and may include anti-inflammatory effects, changes in local extracellular matrix, or direct effects on adipocytes and adipose progenitors. At the cellular level, glucocorticoid signaling is tightly coupled to adipocyte biology, influencing differentiation programs and lipid metabolism; however, the translation of systemic glucocorticoid biology to focal, particulate intralesional exposure is complex.[9,11]

From a technique perspective, the use of a hyperdiluted (1:20) preparation was intended to reduce the risk of unwanted dermal atrophy, dyspigmentation, and contour irregularity—complications that are well-described after intralesional TAC. In a retrospective series describing steroid-induced atrophy/lipoatrophy, lesions frequently presented as depigmented atrophic plaques and histology may demonstrate diminished subcutaneous fat lobules. These observations highlight why any attempt to harness steroid-associated adipose change must be conservative and anatomically precise, particularly in a cosmetically sensitive area.[5]

Even with conservative dosing, the possibility of overcorrection or unintended cutaneous atrophy cannot be eliminated. The broader corticosteroid-injection literature suggests that soft-tissue atrophy and hypopigmentation often manifest weeks to months after injection and may improve spontaneously over time, although persistence is reported. If steroid-induced atrophy occurs and is unacceptable, management options described in the literature include serial normal saline infiltration to disperse residual steroid crystals and promote recovery, as well as other approaches such as topical calcineurin inhibitors, platelet-rich plasma, or structural correction with fillers or fat grafting depending on severity.[5,6,12]

The role of surgery remains central. Blepharoplasty provides direct correction for true herniated fat and can address concomitant skin and muscle laxity, but requires operative downtime and carries procedure-specific risks. Accordingly, an injectable approach aimed at subtle volume reduction should be viewed as complementary rather than competitive, potentially serving selected patients with localized, mild-to-moderate protrusion who decline surgery.[2,3]

This study has important limitations. The sample was small and retrospective, without a control group or objective volumetric measurement. Outcomes relied primarily on standardized photography and global aesthetic ratings. Follow-up was limited to the short-to-intermediate term; longer observation is needed to determine durability, delayed complications, and the frequency of spontaneous tissue recovery. Finally, periocular use of intralesional corticosteroids for aesthetic volume modulation is off-label, and the safety profile in this context is not established.

Conclusion

In this nine-patient series, hyperdiluted TAC (1:20 with normal saline) delivered as micro-aliquots to infraorbital fat pads was associated with visible improvement in under-eye bulging and a favorable short-term safety profile. The most plausible explanation is controlled steroid-associated adipose atrophy and soft-tissue remodeling. Given the well-documented risk of localized lipoatrophy and dyspigmentation after intralesional corticosteroids, further studies with objective measurements, longer follow-up, and standardized dosing are required before this approach can be recommended beyond carefully selected investigational use.[5,6,13]

Ethics approval and consent to participate

Institutional review board approval was obtained or waived according to local policy for this retrospective case series. All patients provided informed consent for treatment and for the use of clinical photographs for research/publication.

Consent for publication

Obtained from all patients.

Availability of data and materials

De-identified data are available from the corresponding author on reasonable request, subject to local regulations.

Financial disclosure

There is no financial disclosure to report.

Informed consent

Informed consent was obtained from all participants, with full disclosure of the study's purpose, risks, and confidentiality.

Author contributions

All authors have reviewed and approved the article for submission.

Conceptualization, Kyu-Ho Yi, Writing—Original Draft Preparation, Kyu-Ho Yi; Belinda Layrenshia Writing—Review & Editing, Kyu-Ho Yi; Jessie Lim Jia Min, Mariya Sobchyshyn Visualization, Kyu-Ho Yi; Tamara Semenovych , Jin-Hyun Kim Supervision, Kyu-Ho Yi; Isabella Rosellini.

Declaration of competing interest

The authors declare no competing interests.

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This study was conducted in compliance with the principles set forth in the Declaration of Helsinki.

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