

Nonsurgical Volumetric Upper Periorbital Rejuvenation: A Plastic Surgeon's Perspective

Steven Liew · D. Q. A. Nguyen

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Abstract In the aging process, upper periorbits can be divided broadly into two groups. Group 1 is characterized primarily by soft tissue ptosis of the upper eyelid, which requires surgical excision. The patients in group 2, show volume depletion of the soft tissue and bony resorption of the orbit, characterized by deflation of the upper eyelid as well as sunken, hollow, and skeletonized orbits. Currently, structural fat grafting is the only means for adding volume the depleted upper periorbit. It is, however, an invasive procedure associated with fairly significant morbidities, long downtime, and hence poor patient acceptance. The advent of safe hyaluronic acid (HA)-based dermal filler has, in the authors' opinion, revolutionized treatment for this group of oculoplastic patients. In the current series, 36 patients with volume depletion of the periorbit were treated with HA dermal fillers to restore the smooth arc of the upper periorbit. The average volume required ranged from 0.2 to 0.6 ml of filler. Despite the relatively small volume required, the upper periorbital aesthetics of the patients were successfully and dramatically transformed. At this writing, the longest follow-up period has been 3.5 years, with the patient still maintaining periorbital volume. No significant morbidities occurred. Given the multiple risks and the resistance of patients to structural fat grafting compared with HA dermal fillers, the authors believe that this nonsurgical technique for adding volume to the

periorbit should become the method of choice for this group of oculoplastic patients.

Keywords Dermal fillers · Hyaluronic acid · Nonsurgical rejuvenation · Structural fat graft · Upper eyelid/eyebrow · Upper periorbital rejuvenation

An aesthetic and youthful upper periorbital subunit is characterized by a well-defined brow of appropriate height and shape, fullness of the upper periorbit, a crisp and well-defined upper eyelid crease, minimal skin excess, and good skin quality [1–3]. This area is one of the first facial regions to show signs of aging, and even minor changes in its structure and volume can distort the perceived emotions and health of patients, possibly diminishing their confidence and well-being.

Traditionally, much of the facial aging focus has been on tissue ptosis as the main etiologic factor, leading to the well-recognized signs of aging on the upper eyelid and eyebrow, with droopy, excessive eyelid skin and lateral hooding. The eyelid crease is no longer visible, and the eyes appear tired and puffy. Accordingly, treatments have been primarily concerned with tissue descent, focusing on excisional and lifting procedures such as blepharoplasties and brow-lifting.

The past decade has seen a growing awareness that depletion of facial soft tissue volume is an important factor. More recently, bony resorption of the facial skeleton has been identified as another factor contributing significantly to facial aging [4, 5]. In turn, modern facial rejuvenation surgery has evolved toward volume restoration in addition to tissue suspension.

Facial aging is a complex and dynamic process. Different people age differently as a result of imbalance,

S. Liew (✉)
Shape Clinic, Suite 109, 19A Boundary Street, Darlinghurst,
NSW 2010, Australia
e-mail: steven@shapeclinic.com.au

D. Q. A. Nguyen
Department of Plastic Surgery, St. Vincent's Hospital,
Darlinghurst, NSW 2010, Australia

disharmony, and disproportion of the aging process between the overlying soft tissue and the underlying bony frameworks [5]. This is seen clearly in the aging process of the periorbit. One group of patients displaying signs of aging due predominantly to soft tissue ptosis of the upper eyelid require surgical excision. At the end of the periorbital aging spectrum is another group of patients who present with volume depletion of the soft tissue and bony resorption of the orbit. Their appearance is characterized by deflation of the upper eyelid as well as hollowing and visibility of the supraorbital bony rim, leading to a sunken, hollow, and skeletonized orbit, which can make the patient appear sickly, anorexic, and old (Fig. 1a, c).

These unattractive features can appear even more pronounced for patients with deep-set eyes (Fig. 2a). In addition, loss of temporal support for the lateral brow from loss of temple fossa volume coupled with loss of upper lid fullness can create the impression of brow ptosis [5] (Fig. 3a, c).

To date, the only means of effectively adding volume to the depleted upper periorbit has been structural fat grafting [6–8]. Although this technique currently is the gold standard, it is an invasive procedure associated with fairly significant morbidities, including the risk of visible lumpiness, swelling, and bruising that not uncommonly requires a minimum of 1 to 2 weeks to resolve, hence a relatively long downtime. These risk factors have contributed to poor acceptance of this treatment by patients.

The advent of safer and effective hyaluronic acid (HA)-based soft tissue fillers has seen the effective use of



Fig. 1 a, c Volume-depleted upper periorbit with a hollow, aging, and sickly appearance. The volume loss in the superior medial orbit gives rise to an “A-frame” deformity. b, d View 3 months after enhancement with 0.3 ml of Juvederm ultra on each superior orbit. Note the dramatic transformation of the periorbital aesthetics achieved by only a small amount of dermal filler. The youthful full, smooth, and curvy arc of the upper orbital rim is restored. The patient also received some botulinum toxin injections to the forehead, glabella, and crow’s-feet



Fig. 2 a A 40-year-old woman with deep-set eyes, which further exacerbates the hollowing effect of the volume-depleted orbit. The patient appears tired and sad. b View 2 years after enhancement with 0.2 ml of Juvederm ultra on each orbit. The volume-restored orbit has transformed the patient’s appearance, making her appear brighter and refreshed. This patient also was treated with botulinum toxin in the forehead



Fig. 3 a, c A middle-age woman with significant hollowing and skeletonization of the entire superior periorbit, deep-set eyes, and hollowing of the temple. The loss of temporal support and volume of the orbit create the impression of brow descent and loss of lateral brow visibility. b, d View 3½ years after treatment using 0.6 ml of Juvederm ultra to add volume to the entire upper periorbit on each side, giving a softer and fuller upper periorbit and camouflaging of the underlying bony rim. Note that the volume of the temple also was increased with another hyaluronic acid (HA)-based dermal filler, providing support to the lateral brow, as evidenced by the ease of visibility of the tail of the brow in the anterior view. Note, 9 IU of hyaluronidase was placed in the subcutaneous plane at the lateral extent of the upper orbital rim to “spot treat” decreased the perceived excess fullness by the patient week 1 after treatment. No retreatment with HA was required

nonsurgical therapy in periorbital rejuvenation, especially in the tear trough and the subbrow region [2, 9].

A recent three-dimensional computed tomographic study demonstrated that the orbital aperture in the upper periorbital region increases with age. In particular, a significant increase in height of the superior medial orbital rim occurred with both genders, suggesting that the superior orbital rim recedes with age in this region [5].

Our analysis of the upper periorbital region in patients shows that this superior medial bony recession in the aging orbit contributes to the volumetric loss and aged appearance of the upper eyelid (Fig. 1a, 4a, 5a), giving rise to the

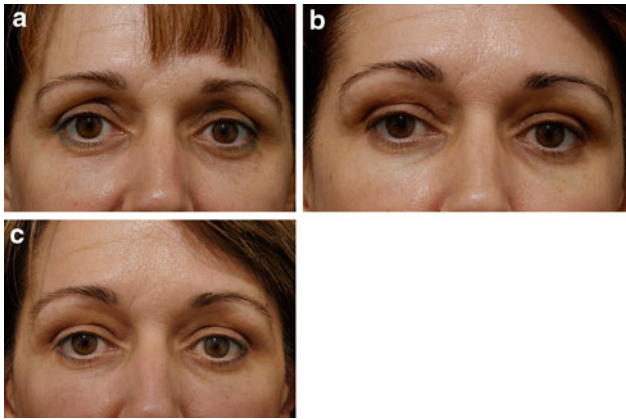


Fig. 4 **a** A-volume depleted upper orbit with “A-frame” deformity. **b** View 1 week after enhancement using 0.2 ml of Juvederm with lidocaine. The fullness of the upper periorbit is restored. Note the minor residual swelling on the right upper eyelid, which resolved spontaneously after a few more days. **c** View 9 months after enhancement, with maintenance of the restored upper eyelid volume. The initial swelling noted at 1 week resolved spontaneously after few days

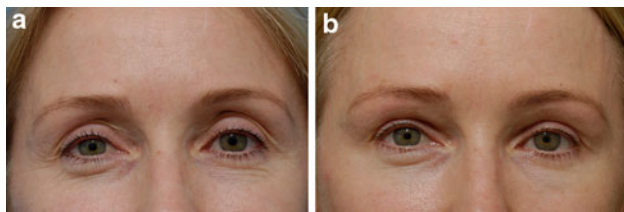


Fig. 5 **a** A middle-age woman with hollowing of the upper orbit and minor tear-trough deformity. **b** View 9 months after the addition of volume to the upper orbit and tear trough. Note the youthful transformation and the recruitment of the loose skin in the upper eyelid after a nonsurgical addition of volume

so-called “A-frame deformity.” This deformity is characterized by a localized wedged-shape recession of the superior medial orbital rim. In severe cases, the volume depletion of the soft tissue and the bony orbit leads to hollowing and skeletonization of the entire upper periorbita (Fig. 6a, c).

This study aimed to investigate the use of a dermal filler as a volume-adding tool to restore the receded superior medial orbital rim in some patients, and in others, to extend the volume restoration to the subbrow region, creating a full, smooth arc to the superior orbital rim, the hallmark of a youthful upper periorbit. The advantages and longevity associated with this approach are discussed and compared with the long-established use of the biologic structural fat graft.

Methods

All patients selected for treatment had volume depletion in the upper periorbit and were potential candidates for

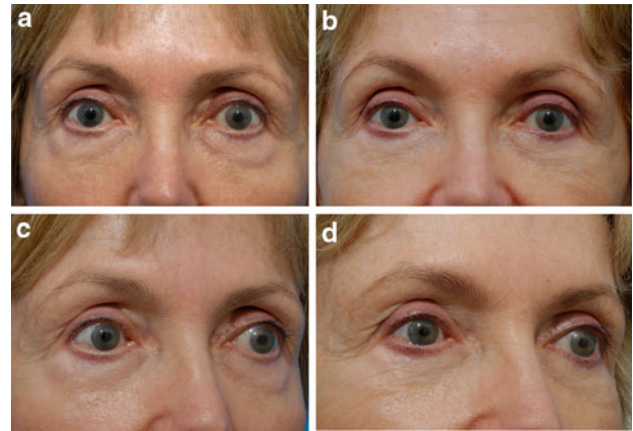


Fig. 6 **a, c** A 58-year-old woman with hollow and sunken upper periorbit, tear-trough deformity, and infraorbital hollowing, making her appear angry and startled. **b, d** View 6 months after the addition of volume with 0.3 ml of Juvederm ultra in each upper orbit and 0.3 ml in the lower eyelid. The periorbital aesthetics are improved, with blending of the lower eyelid junction and reversal of the upper orbit skeletonization

structural fat grafting but refused because of the potential morbidities and downtime. The volumetric upper periorbital rejuvenation was performed initially with Restylane, then with Juvederm ultra from 2006 onward due to its smoothness and ease of injection. Both consist of non-animal-based HA.

Patients were assessed, marked, and treated sitting upright with their eyes in horizontal forward gaze to demonstrate fully the extent of the volume depletion and bony recession (Fig. 7a). Careful analysis followed by palpation was required to mark out the superomedial area of the upper periorbit to be treated. This area is commonly felt as a wedged shape bony irregularity from lateral to medial. The area is located caudal to the palpable external orbital ridge, and in some patients, caudal to the palpable supratrochlear and supraorbital notch (Fig. 7b).

Technique

The area to be treated is anesthetized with topical anesthetic cream for about 20 min. After routine skin cleansing with chlorhexidine aqueous solution, a 30-gauge hypodermic needle is used to inject the product at a 30° angle to the skin from lateral to medial, with a small aliquot of not more than 0.1 ml deposited at the supraperiosteal level (Fig. 7b, c). Typically, two to three entry sites are used to ensure even distribution of the products. The injection technique is slow and precise, with the tip of needle constantly moving, albeit to a minute degree.

The product is placed in a linear droplet fashion. The dermal filler then is massaged inferiorly into the desired area, reaching as low as the subbrow eyelid junction.



Fig. 7 **a** The “A-frame” deformity and volume-depleted area of the upper orbit is clearly noted in this woman. **b** Marked area of treatment, with each arrow indicating a point of needle entry. The product is placed in small-threads-of-aliquots fashion at the preperiosteal level. **c** Placement of dermal filler on the supra-orbital level of the orbit identified in shaded area. **d** The smooth curve of the upper periorbital rim is restored, giving a softer, more aesthetically pleasing appearance

The process is repeated until the desired volume has been added. The aim is to restore a visible smooth curve, replicating a youthful upper periorbital rim (Fig. 7d).

For patients with skeletonization of the lateral bony orbital rim, dermal filler is introduced along the lateral orbital rim and lateral subbrow to restore soft tissue loss and provide a youthful and pleasing cushioning effect to camouflage the visible bony prominence (Fig. 3d). This approach also supports the lateral brow, which tends to reverse the illusion of brow descent from the shadow it casts due to the lack of subbrow fullness [7].

Results

Between 2006 to 2010, 36 patients were treated. Four were treated with Restylane, and the remaining patients were treated with Juvederm ultra. Since 2009, all patients have been treated using Juvederm ultra with lidocaine.

The average treatment time was 20 min. All patients tolerated the procedure well with topical anesthesia alone. However, the introduction of Juvederm with lidocaine has improved the comfort level even more.

The follow-up period ranged from 3 months to 3.5 years (Table 1). At this writing, none of the patients have

required any reinjection. The patient followed up the longest (3.5 years) still maintains adequate volume to her upper periorbit. No significant complication has been seen. Minor bruising and edema are the most commonly reported adverse outcomes, which can be camouflaged easily with makeup.

One patient (early in the series) reported a significant change to her appearance despite what the senior author (S.L.) thought was an aesthetically ideal outcome. The excess was dissolved with 9 IU of hyaluronidase. This was placed superficially in the subcutaneous plane, allowing its diffusion to the area of perceived fullness. The aim was to spot-reduce the product and not to dissolve the entire treated area. No further reinjection with HA was required. The patient was extremely pleased with the final outcome, and at this writing 3½ years later, no further retreatment has been required (Fig. 3b, d).

Three patients reported minor lumpiness early in the series and required prolonged massage treatment for up to 3 weeks. This was due to the inadvertent superficial placement of the products. All three patients achieved an optimal result after massage, and none required instillation of hyaluronidase.

Discussion

The surge in popularity of nonsurgical rejuvenation has seen its application extended well beyond the realm of wrinkles and skin folds [9–12]. Increasingly, dermal fillers are being used in lieu of structural fat grafts to add volume to the aging face. Despite the temporary nature of HA-based dermal fillers and the requirement of repeated treatments, it is a treatment that appeals to patients due to its ease of application, efficacy, minimal downtime, and noninvasive nature.

In the periorbital region, dermal fillers have been used successfully to correct tear-trough deformity and the palpebral malar groove [2, 11]. In addition, it has also been used to increase the volume of the lateral sub-brow region to provide support and a temporary browpeky effect [2, 9]. The use of dermal filler as a volume-adding tool to reconstitute the youthful, smooth curve arc of the superior bony orbital rim depleted in volume mainly by bony resorption in the superomedial orbit and by soft tissue atrophy in the remaining upper orbit has never been formally published to the best of the authors’ knowledge.

Structural fat grafts have been the traditional treatment for the volume-depleted orbit. Although its success has been widely reported [6, 13, 14], in the senior author’s (S.L.) opinion, the main plastic surgical fraternities worldwide have had inconsistent results with this technique. Furthermore, the risk of lumpiness, requiring

Table 1 Results: follow-up evaluation and volume of products used

Case	Average volume of products on each side (ml)	Duration at last follow-up (months)	Retreatment with HA
1	0.2	18	No
2	0.3	16	No
3	0.1	6	No
4	0.2	36	No ^a
5	0.2	24	No
6	0.6	42	No
7	0.4	28	No
8	0.1	4	No
9	0.2	3	No
10	0.3	12	No
11	0.25	20	No
12	0.2	38	No
13	0.15	26	No
14	0.4	21	No
15	0.2	16	No
16	0.1	25	No
17	0.3	29	No
18	0.25	23	No
19	0.2	22	No
20	0.15	16	No
21	0.3	15	No
22	0.2	10	No
23	0.1	9	No
24	0.25	25	No
25	0.2	27	No
26	0.1	22	No
27	0.2	31	No
28	0.2	13	No
29	0.4	7	No
30	0.3	11	No
31	0.1	15	No
32	0.25	8	No
33	0.15	18	No
34	0.2	14	No
35	0.1	8	No
36	0.2	16	No

HA hyaluronic acid

^a Only unilateral upper orbit was treated

surgical excision if problematic, is of great concern to both surgeons and patients. This together with the unpredictability of the graft's survival and the relatively long downtime has arguably contributed to its lack of acceptance by most patients.

The use of off-the-shelf HA-based dermal fillers has become the senior author's treatment of choice for this group of oculoplastic patients. We believe this nonsurgical technique has revolutionized the treatment of patients with

a sunken and hollow superior upper periorbit. The safe nature of the product, the short duration of treatment (20 min), the minimal downtime (1 day), the minimal irregularities in this region, and the ability to dissolve the products with hyaluronidase are some of the main positive aspects of this technique compared with the fat graft (Table 2).

The long-lasting nature of the HA dermal fillers in the tear trough has been well observed. The longest follow-up period for our tear-trough patient to date is 4 years, with persistence of its volume. The same longevity of the upper periorbit has been noted in our series. To date, the longest follow-up period of 3.5 years (Fig. 3) has been very encouraging and is another important positive aspect of this technique. None of the patients in our series have required reinjection (Fig. 8a–c).

Currently, we inform our patients that the treatment will remain effective for 2 to 4 years, perhaps longer, to account for any as yet unforeseen individual variation in metabolism (Table 1). We hope to provide more accurate longevity results with further follow-up assessment in the future.

The observed longevity of the HA-based filler in the upper periorbital region is especially interesting and positive given the expected 6 to 12 months longevity for most treatments with HA-based fillers in other facial regions. The reason for this is not clear. The lack of mobility of the overlying muscle and the supraperiosteal placement of the filler may well be the contributing factors for longevity.

It is important to note that only a small volume of Juvederm ultra (0.2–0.6 ml on each orbit) is needed to create the fullness required, and it has dramatically improved the patient's upper face aesthetics in all the cases managed (Fig. 1b, d, 3b, d, 4c). In fact, for novice practitioners, it is better to be conservative and undertreat rather than overtreat in this region due to the significant transformation the treatment can achieve.

We acknowledge the inherent risks involved with the use of a sharp needle in the upper periorbital region including intravascular injections, nerve injuries, and risk for embolization of products. We believe that by using a slow resistance-free injection technique, constantly moving the needle and injecting as the needle is withdrawn reduces these risks significantly. To avoid the potential for supra-trochlear and supraorbital nerve injuries, deep palpation and surface landmarks of the nerves are noted, and the product is placed around its vicinity then massaged into the area.

We believe that this technique of nonsurgically adding volume to the upper periorbit should be reserved for physicians with in-depth anatomic knowledge of this region and experienced injectors who have vast experience in treating tear-trough deformities.

Table 2 Comparison of the structural fat graft and hyaluronic acid (HA) dermal fillers

	Structural fat graft	HA dermal filler
Nature	Biologic/permanent once vascularized	Synthetic/nonpermanent
Technique	Specialized and steep learning curve	Shorter learning curve
Type of anesthesia	Local anesthesia with sedation/general anesthesia	Topical anesthesia
Procedure time (min)	~ 60	~ 20
Risk of lumpiness	Variable and operator dependent. If present, may require surgical excision	Minimal, if present, can be molded or removed with hyaluronidase.
Downtime	1–2 weeks	24 h
Longevity	Permanent once vascularized.	2–4 years or longer.
Other risks	Volume may increase with weight gain.	Displacement and potential Tindal effect



Fig. 8 **a** A middle-age woman with “A-frame deformity” of the upper orbit, worse on her left than on her right orbit. She elected to have only the left upper orbit treated (the same patient as in Fig. 7). **b** Improvement of the left upper eyelid appearance 3 months after the use of 0.2 ml of Juvederm ultra. **c** Persistence of the product is evidenced 3 years after the initial treatment. The left upper orbit remains aesthetically youthful, with maintenance of volume and minimal excess eyelid skin. The untreated right upper eyelid shows progressive aging changes with more eyelid skin excess

Although this is a nonsurgical technique, it requires a steep learning curve compared with nonsurgical injection of other facial regions, including the tear-trough deformities. Treatment of the upper periorbit has its minimal margin of error. The depth of placement and the amount of product used has to be precise, as evidenced by the three cases of lumpiness managed early in the series by the senior author, who has had 8 years of injecting experience, including structural fat grafting.

The author currently is trialing the use of 25-gauge blunt-tip disposable cannulas, which no doubt will further reduce the aforementioned potential risks. The preliminary experience has been positive, and we hope to report this in a future publication.

Juvederm ultra is our preferred choice for the upper periorbital region due to its smoothness, softness, and consequent ease of molding into the more caudal region up to the subbrow/lid-skin junction. Furthermore, its greater cohesiveness may theoretically impart a reduced risk of embolization and migration of products.

The use of Juvederm ultra with lidocaine has introduced an additional comfort factor for patients. We currently treat patients without any topical anesthesia cream in addition to the initial topical ice application, which further reduces our treatment time.

Conclusion

We believe the use of off-the-shelf HA-based dermal fillers has revolutionized the treatment of patients with volume-depleted upper periorbits. The pre- and posttreatment results demonstrate the aesthetic importance of the upper periorbital area, in which a minor addition of volume can significantly transform a hollow and sickly appearance to that of a more youthful, healthy, and aesthetically pleasing face.

We also believe HA-based dermal fillers are the treatment of choice for this area. Although structural fat grafting still has a role due to its presumed stem cell-associated improvement of skin qualities, its use in our practice is reserved for patients allergic to fillers and those who object to the use of any nonbiologic products.

Conflict of interest The authors do not have any financial interests in any of the products mentioned in the article. No financial or material support of any kind was provided in preparation of the article or to any subjects mentioned in the article. Dr Steven Liew is a consultant for Allergan Australia, Allergan USA, Allergan Asia. He is a member of the Advisory board for Allergan Australia and Q-MED Australia. He has received honoraria from Allergan (Australia, USA, Asia) and QMED (Australia, Europe and Asia) for meetings and presentations.

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