



# Contemporary Upper Blepharoplasty: Volumetric Contouring Concept

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## Abstract

Upper blepharoplasty has traditionally involved subtractive approaches with excision of different amounts of skin, muscle, and fat. However, this approach often results in iatrogenic acceleration of the normal volume depletion and bone resorption associated with aging, which leads to deepening of the superior sulcus, A-shape deformity and generalized hollowness. In recent years, the concept of periorbital volume restoration and augmentation has shifted the paradigm toward fat preservation and gland repositioning procedures. Herein, we describe the volumetric contouring concept, a contemporary approach for upper blepharoplasty that includes gland repositioning, suspension of the levator aponeurosis, fat transposition or reposition, and adjunctive filling procedures. This concept seeks for long-term restoration of the eyelid-brow complex by addressing every involuntional aspect of the aging process, while treating and preventing hollow eyes and A-shaped deformity. In our experience, this approach has enabled us to attain optimal and long-lasting aesthetic results.

## Keywords

upper blepharoplasty, volumetric contouring concept, gland prolapse, fat transposition, fat preservation, sunken eyes

## Introduction

Upper blepharoplasty is a well-known and widely performed procedure for periorbital rejuvenation. Several involuntional changes are associated with periorbital aging, including brow ptosis, dermatochalasis, fat prolapse, and true eyelid ptosis.<sup>1</sup>

However, sulcus depression due to fat volume depletion (hollow eyes) as well as lacrimal gland ptosis are common findings that are frequently overlooked and left untreated. Traditionally, upper blepharoplasty has been focused on excision of redundant tissue, including skin, muscle, and fat. This can contribute to aggravate a previous superior sulcus hollowness.<sup>2</sup>

In recent years, the concept of periorbital volume restoration and augmentation has shifted the paradigm toward volume preservation procedures in upper eyelid surgery.<sup>1,3,4</sup> On the other hand, a ptotic lacrimal gland may produce persistent postoperative bulging in the lateral aspect and a poor aesthetic brow-lid transition. This involuntional change can be easily addressed by repositioning the gland in the lacrimal fossa with suspending sutures to the rim's periosteum.<sup>5,6</sup>

Herein, we aim to clarify certain anatomical concepts and to describe our technique for upper blepharoplasty, a

step-by-step approach designed to restore the volumetric contouring of the upper orbital rim. This technique includes preservation of the orbicularis oculi muscle, gland repositioning, suspension of the levator aponeurosis (LA), fat transposition or reposition, and a modified closure technique. In our experience, this approach has enabled us to address every aspect of upper eyelid aging and to attain optimal and long-lasting aesthetic results.

## Anatomical Considerations

Although a deep and thorough discussion of the anatomy of the eyelid is not the aim of this article, certain anatomical concepts need to be addressed to understand the foundations of this technique. The upper eyelid is divided in 2 lamellae: the anterior lamella includes the skin and the orbicularis oculi muscle, while the posterior lamella includes the tarsal plate and the conjunctiva.

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**The orbital septum.** The orbital septum is a multilamellar sheet of dense connective tissue located posterior to the orbicularis muscle that separates the orbit from the eyelid.<sup>7,8</sup> Superiorly it fuses with the superior orbital rim's periosteum and forms the arcus marginalis.<sup>7</sup> Distally, it separates into 2 layers.<sup>9</sup> The anterior layer continues distally and fuses with the posterior layer of the LA constituting the conjoined fascia.<sup>10</sup>

The conjoined fascia sends multiple fibers of fibrous tissue through the orbicularis oculi muscle that anchor to the skin, which contributes to conform the eyelid crease by pulling the skin and limiting the descent of the preseptal fat.<sup>11-13</sup>

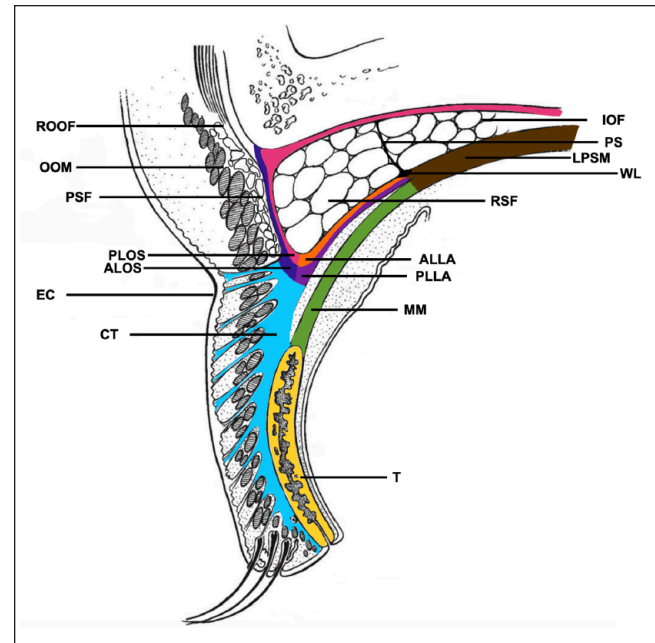
The posterior layer of the orbital septum reflects posteriorly and becomes contiguous with the anterior layer of the LA.<sup>11</sup> Laterally, the septum inserts into the lateral canthal ligament anteriorly and the Whitnall's tubercle posteriorly. Medially, the septum splits and inserts in the posterior and anterior lacrimal crest.<sup>8</sup>

A thin layer of fatty tissue known as "submuscular fibroadipose tissue" (SMFAT), "preseptal fat" or "septal fat pannus" separates the orbital septum from the orbicularis oculi muscle.<sup>7,14,15</sup> The SMFAT is contiguous with the retro-orbicularis oculus fat (ROOF) in the brow.

**The levator palpebrae superioris muscle.** The levator palpebrae superioris muscle (LPS) muscle is the main retractor of the upper eyelid, it is angulated 20° lateral to the sagittal plane. The LPS muscle originates at the superior edge of the annulus of Zinn and courses anteriorly along the orbital roof above the superior aspect of the superior rectus muscle. At the musculotendinous transition, a thickening band of the fascia emerges to form Whitnall's ligament<sup>16,17</sup> (Figure 1).

From there, the LA continues a descending course and divides into 2 layers, anterior and posterior.<sup>11</sup> The anterior layer fuses with the posterior layer of the orbital septum while the posterior layer forms the conjoined fascia and inserts into the anterior aspect of the tarsus.<sup>11</sup> Transversely, LA expands into a medial and a lateral horn.<sup>16-18</sup> The medial horn fuses with the posterior arm of the medial canthal ligament and inserts on the posterior lacrimal crest.<sup>19</sup> The lateral horn divides the lacrimal gland into its orbital and palpebral lobe and attaches onto the lateral orbital tubercle and lateral canthal bands.<sup>16,17,20</sup> Whitnall's ligament inserts on the trochlea medially and into the lateral orbital wall laterally, approximately 10 mm above the lateral orbital tubercle.<sup>16,17,21</sup>

**The upper eyelid fat pads.** It is traditionally described by Castanares that the upper eyelid fat is constituted of 2 components, the central fat pad (also known as preaponeurotic fat) and the nasal (medial) fat pad, separated by the superior oblique muscle tendon and its trochlea.<sup>22</sup> The preaponeurotic fat pad is located between the orbital septum anteriorly and the LA posteriorly.<sup>22</sup> Studies have shown no histologic or biochemical differences between the preaponeurotic fat and the remaining intra-orbital fat.<sup>23,24</sup> However, they are anatomically separated by a short connective tissue septum



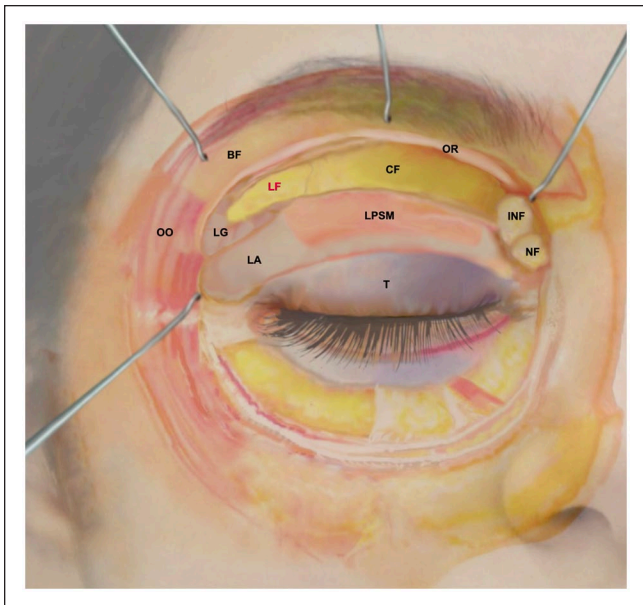
**Figure 1.** Sagittal view of the upper eyelid.

Note. ROOF = retro-orbicularis oculi fat; OOM = orbicularis oculi muscle; PSF = preseptal fat; PLOS = posterior layer of orbital septum; ALOS = anterior layer of orbital septum; EC = eyelid crease; CT = conjoined tendon; IOF = intra-orbital fat; PS = posterior septum; LPSM = levator palpebrae superioris muscle; WL = Whitnall's ligament; RSF = retro septal fat; ALLA = anterior layer of levator aponeurosis; PLLA = posterior layer of levator aponeurosis; MM = Muller muscle; T = tarsus.

that extends from the LA at the level of Whitnall's ligament to the orbital roof. Although this posterior septum can be clearly identified in magnetic resonance imaging, it is rarely acknowledged in most parasagittal drawing of the orbit, where the preaponeurotic fat is drawn contiguous with the intraorbital fat.<sup>25</sup> The nasal fat pad is located in between the medial horn of the LA, the orbital rim and the superior oblique muscle tendon, and has a distinctive pale or whitish color.<sup>22,26</sup>

However, several anatomical variations in the upper eyelid fat pads have been described in the literature, leading to frequent confusion among readers. In the medial (nasal) compartment, Ullmann et al<sup>27</sup> described that it was actually composed of 2 distinct fat pads, the medial inferior and the medial superior fat pads. Niechajev et al<sup>28</sup> described a third fat pad in 44% of cases, which was anatomically and histologically a medial extension of the central fat pad. He suggested that this one should be considered as the central fat pad.<sup>28</sup> Later on, Persichetti et al<sup>29</sup> described a lateral extension of the preaponeurotic fat pad in 20% of cases, protruding under the inferior border of the lacrimal gland and situated lateral to the 2 classic compartments described by Castanares.

In our experience, complete transection of the orbicularis oculi muscle and delicate dissection of the retroseptal space



**Figure 2.** Eyelid anatomy.

Note. OO = orbicularis oculi muscle; BF = brow fat; OR = orbital rim; LG = lacrimal gland; LF = lateral fat; CF = central fat; INF = internasal fat; NF = nasal fat; LPSM = levator palpebrae superioris muscle; LA = levator aponeurosis; T = tarsus.

has enabled us to identify 4 distinct fat pads, 2 in each compartment (Figure 2). The medial compartment is composed of the nasal fat pad (corresponding to Ullman's medial inferior fat pad) and the internasal fat pad (Ullman's medial superior fat pad), whereas the central compartment (pre-aponeurotic fat pad) is constituted by the central fat extends laterally, referred to as the lateral fat pad, and that there is no anatomical separation between them. The lateral extension (lateral fat pad) is actually an extension of the central fat. However, for the purpose of a more didactic explanation and better understanding of the technique, we will consider them as 2 separate fat pads.

The amount of fatty tissue may vary from patient to patient, especially the lateral fat pad; however, we have found these 4 fat pads to be present almost constantly. We advocate for this nomenclature since we believe this description is more accurate and adopting it may help to clarify concepts from a surgical perspective.

### Preoperative Evaluation

A complete medical and ophthalmologic history must be obtained, including diabetes, hypertension, bleeding disorders and blood thinning therapy, chronic systemic diseases, autoimmune disorders and thyroid disease, history of dry eye symptoms or excessive tearing, as well as prior periorbital or ocular surgery.

Standard eyelid measurements should be noted, including vertical palpebral fissure, levator excursion, lid crease



**Figure 3.** Skin marking of inverted canoe and hollow area (#).

height and pretarsal show, and the margin reflex distance (MDR-1) for the assessment of eyelid ptosis. Canthal tilt and the presence of an epicanthal fold are also significant findings that must be noticed. Asymmetries between the eyes are common, but these must be diagnosed and explained to the patients preoperatively.

Visual impairment due to excessive dermatochalasis should be documented. Excess fat and fat bag prolapse is more frequent in the nasal area. Excessive bulging in the lateral third is more likely to correspond to a prolapsed lacrimal gland which can be confirmed preoperatively by applying gentle compression to the globe. Superior sulcus hollowness (hollow eyes) might be masked by dermatochalasis and will worsen after skin resection if not corrected intraoperatively.

Assessment of brow shape, fullness, and position relative to the orbital rim is fundamental. Deep frontal lines due to a hyperactive frontal muscle might be a compensation for excessive dermatochalasis, brow ptosis, or both. In the presence of undiagnosed brow ptosis, upper eyelid surgery alone might result in further lowering of the brow and/or in excessive skin excision.

### Surgical Technique

1. Skin marking: the design of the incision is a modified inverted canoe (Figure 3). The patient is marked in an up-right sitting position. The marking begins with the inferior incision. The brow of the patient is elevated and the tarsal crease is identified by making the patient look up and forward in primary gaze. Dots are placed over the whole tarsal crease from medial to lateral. For the marking of the superior incision, the

non-dominant hand is placed above the brow to annul the action of the frontalis muscle, so that the brow is kept in neutral position preventing its elevation. The patient is asked to look upward and the incision is marked by placing dots at the point where the hooding (excess skin) meets the eyelid margin, from medial to lateral up to the lateral limbus. From this point laterally, the incision is continued parallel to the brow. In the mid-pupil line, the distance from the eyelid margin to the inferior incision and the distance from the superior incision to the lower part of the brow are measured to confirm that at least 20 mm of skin is left between the eyelid margin and the brow. Most frequently, in our Caucasian population, 10 mm are left below the tarsal crease and 10 mm are left above the superior incision to secure proper eyelid closure. In the lateral part, the distance between the lateral canthus and the inferior incision should be of at least 8 mm, whereas the distance from the brow till the upper incision should be kept at 10 mm. Pinch test is performed for double checking of correct eyelid closure, and the points are joined with a fine and clear line. The 2 incisions are joined both medially and laterally, placing the lateral aspect in a crow's feet crease. The areas of hollowing where fat should be transposed are marked in both eyes. Finally, symmetry is assessed and minor corrections to the designs can be made if necessary.

2. Anesthetic infiltration: The eyelids are infiltrated with approximately 3 cc per eye with a premixed anesthetic solution containing lidocaine, epinephrine and tranexamic acid as previously published.<sup>30</sup> Infiltration of this mixture is injected subcutaneously, in the nasal, central, and lateral fat pads and in the periosteum in the lateral aspect.
3. Skin resection: After giving appropriate time for hemostasis and anesthesia to take effect, the skin is resected from lateral to medial using a radiofrequency Colorado tip for better hemostasis intraoperatively and less hematoma postoperatively (Figure 4).
4. Complete opening of the orbicularis oculi muscle and anterior septum: The muscle is completely opened from nasal to temporal without resection, leaving at least 5 mm of muscle cuff in the upper part to allow for proper closure lately (Figure 5).
5. Identification of retroseptal structures: The anterior septum is transected and the nasal, central, and lateral fat pads are identified. The medial compartment is addressed and the nasal and internasal fat pads are identified by blunt dissection introducing the tip of a mosquito forceps while gently pressing the eyeball until it pops out. The nasal fat pad has several sensitive branches from the supratrochlear nerve and is well vascularized. Anesthetic infiltration is recommended before dissection, and careful cauterization



**Figure 4.** Skin excision.

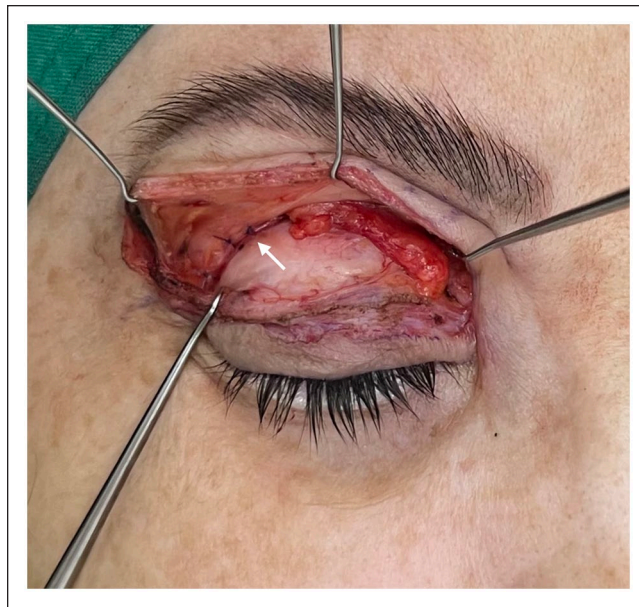


**Figure 5.** Complete orbicularis oculi muscle transection.

is mandatory as intraorbital bleeding can be a serious complication. The temporal aspect should be properly assessed for the presence of a prolapsed lacrimal gland which is a firm, pinkish, lobulated structure, often hidden behind the lateral fat pad. The lateral fat pad should be completely separated from the lacrimal gland. Care must be taken at this step since a prolapsed gland can be easily mistaken with the lateral fat pad and aggressive cauterization or excision of the gland must be avoided by all means (Figure 6).



**Figure 6.** Identification of structures in the retroseptal space. Note. LG = lacrimal gland; LF = lateral fat; CF = central fat; INF = internasal fat; NF = nasal fat.



**Figure 7.** Reposition of the lacrimal gland under the orbital rim.

6. Lacrimal gland repositioning: repositioning of the lacrimal gland is done by suturing the lower tip of the gland or its capsule to the arcus marginalis periosteum, just anterior to the lacrimal fossa with 2 to 3 interrupted 5-0 vicryl sutures (Figure 7). Even in minor displacements, the lacrimal gland needs to be repositioned to prevent future prolapse, as the mechanical support structures will keep involuting as the patient ages.
7. Lateral suspension of LA: The LA is suspended to the orbital rim in the temporal part with one or two 5-0 vicryl sutures; this maneuver allows for better transitioning and can aid to correct minor lateral pseudoptosis (Figure 8). At this point, it is key not to grab the levator muscle with the suspending sutures and check for proper gliding of LA in the upward movement of the eye.
8. Fat transposition: For correct transposition, all fat pads should be pedicled and freed by lysing all connective tissue attachments from the posterior septum, the orbital rim, and the levator complex. A nylon 5-0 double suture is passed through the nasal (and/or internasal) fat pedicles and fixed to the arcus marginalis to the superior medial orbital rim, where hollowness or A-shape deformity is usually found. The lateral fat pad can be resected or transposed. The central fat pad should be repositioned with or without reducing it, but never excised. Finally, the fat from the medial compartment (nasal and internasal fat pads) should be always transposed; mild reduction can be done if needed depending on the amount of



**Figure 8.** Suspension of the levator aponeurosis.

medial hollowness and fat volume. Proper correction of hollowing and fullness can be assessed by gently pressing the eyeball. Finally, a smooth transition in the superior sulcus is achieved by sculpting the transposed fat with conservative bipolar cauterization. Alternatively, the lateral fat pad can also be transposed to the supraorbital area to increase brow fullness and correct bony defects if needed. All sutures for transposition and reposition are done with vicryl 5-0 with exception of the first one, which is done



**Figure 9.** Fat transposition: nasal and internasal fat pads have been transposed to the area of hollowness, the lateral fat has been partially excised and transposed to the hollowness, and central fat has been repositioned toward the hollow area. Note. Note the change in volume and contouring of the orbital rim.



**Figure 10.** Muscle closure.

with nylon 5-0 to guarantee a stable transposition of the nasal and internasal fat pads (Figure 9). Some patients may still have some volume deficiency in the superior medial orbital rim after fat transposition. This can be corrected by adding free fat graft from the excised fat through a small pocket under the orbicularis muscle over the bony rim.

9. Modified closure technique: The orbicularis oculi muscle is closed from lateral to medial with simple buried sutures of vicryl 5/0 while the assistant stretches the brow laterally and superiorly (Figure 10). Conservative bipolar cauterization of the muscle is performed after suturing; this will produce contraction in the wound and enhance fullness and brow-eyelid transition. Subcutaneous buried 6/0 vicryl sutures are placed in the lateral part to reduce and relieve wound tension as previously published by Fakh-Gomez et al<sup>31</sup> (Figure 11). Skin is closed from lateral to medial with simple interrupted nylon 6/0 sutures and dressings are placed (Figure 12).
10. Final orbital rim volume contour: In some cases, additional volume may be required to achieve proper contour of the upper eyelid sulcus and orbital rim. For minor corrections, the authors use hyaluronic acid fillers, whereas for extensive volume corrections microfat grafting is preferred.

Removal of sutures is at 7 days. This surgical approach is effective as it is complex, so recovery takes longer than traditional blepharoplasty. Patients are informed that surgical



**Figure 11.** Modified suturing technique.

recovery takes around 2 weeks; however, complete recovery can take up to 3 months.

### Patients Results

So far, 103 patients have undergone this technique, 10 men and 93 women, from July 2019 to September 2022. The mean age was 41.5 years (range, 18-65 years). A total of 36 patients (34.9%) required additional volume correction: intraoperative fat grafting in 6 patients (5.8%), intraoperative filler injection in 15 patients (14.5%), and postoperative



**Figure 12.** Skin closure.

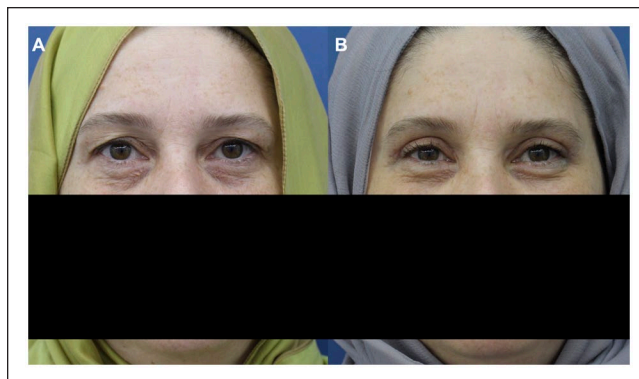
filler injection in 16 patients (15.5%). Filler correction was performed with Belotero Balance (Merz Aesthetic) by injection with a 38 mm 25G cannula in the retroseptal space and in the central/medial ROOF. Surgical recovery was achieved in a mean of 15 days (range, 12-18 days) while complete recovery took a mean of 2.8 months (range, 2.4-3.2 months). No serious complications including infection, dry eyes, or wound dehiscence were found. A total of 35 patients (33.9%) underwent laser treatment with ND-YAG 1064 nm 650 microseconds (Aerolase Neo Elite) for persistent redness in the scar. Mean follow-up time was 27 months (range, 12-42 months). No unaesthetic scarring was found after 3 months, and overall patient satisfaction was excellent. Stable volume correction, with no hollowness nor contour irregularities, was found in all patients at the last follow-up visit (Figures 13-16).

## Discussion

Aging process in the eyelids and periorbital area have distinct features, manifesting as true or apparent tissue excess, herniation/pseudoherniation of fat, tissue laxity, and contour irregularities and depressions.<sup>32,33</sup>

Upper blepharoplasty has traditionally involved subtractive approaches with excision of different amounts of skin, muscle, and fat. However, this approach often results in iatrogenic acceleration of the normal volume depletion and bone resorption associated with aging, which leads to deepening of the superior sulcus, A-shape deformity and generalized hollowness.<sup>34,35</sup>

The consequence is the aggravation of aging rather than the restoration of youth. In recent years, there has been a paradigm shift in upper eyelid surgery toward volume preservation.<sup>4,36</sup>



**Figure 13.** A 50-year-old female patient with excess skin masking a hollow eye deformity with slight lacrimal gland ptosis (A). Result of upper blepharoplasty with volumetric contouring at 6 months (B).



**Figure 14.** A 48-year-old female patient with excess skin masking a hollow eye deformity with moderate lacrimal gland ptosis (A). Result of upper blepharoplasty with volumetric contouring at 6 months (B).



**Figure 15.** A 46-year-old female patient with subtle excess skin, slight lacrimal gland ptosis in right eye and extreme hollow eye deformity due to minimal fat and orbital bony rim deficiency (A). Result of upper blepharoplasty with volumetric contouring and filler with hyaluronic acid (belotero balance: 0.8 cc in right eye and 0.6 cc in left eye) at 12 months (B).



**Figure 16.** A 52-year-old female patient with subtle excess skin, slight lacrimal gland ptosis in right eye and hollow eye deformity due to minimal fat and orbital bony rim (A). Result of upper blepharoplasty with volumetric contouring and filler with hyaluronic acid (belotero balance: 0.4 cc in right eye and 0.6 cc in left eye) at 6 months (B).

Massry described the transposition of the nasal fat pad centrally for the prevention of superior sulcus deformity.<sup>34</sup> Fezza suggested the use of a free fat graft from the nasal fat pad to the lateral sub-brow region to enhance a youthful sigmoid shape to the eyelid-eyebrow complex.<sup>37</sup> Sozer et al<sup>36</sup> published results on repositioning central upper eyelid fat as a pedicle to the temporal space to create lateral fullness.

In recent years, periorbital fat grafting has become a powerful and extended adjunctive procedure to eyelid surgery.<sup>38,39</sup> On the other hand, the use of dermal fillers to correct superior sulcus hollowness provides a strategic alternative to autologous fat grafting.<sup>3,40</sup>

Lacrimal gland prolapse has been reported to be clinically present in 15% of patients desiring blepharoplasty.<sup>1,41,42</sup> However, Massry found a prevalence of 60% intraoperatively in the population over 60 years old.<sup>43</sup> The amount of prolapse is usually measured as anterior displacement of the tip of the gland from the orbital rim periosteum. However, there is no standardized grading system nor consensus regarding its management. Resuspension of the gland was first described by Smith and Petrelli in 1978.<sup>5</sup> Beer and Kompatscher described lacrimal gland resuspension by suturing Whitnall's ligament over the gland to the superior orbital rim periosteum.<sup>42</sup> Georgescu et al<sup>1</sup> have also advocated suture suspension, but only through the gland capsule to avoid damage to the gland secretory tissue. Resection of the prolapsed portion of the gland has also been described.<sup>41</sup> Massry described cauterization to be a safe and successful treatment for mild degrees of prolapse.<sup>43</sup>

As we routinely assess for lacrimal gland prolapse preoperatively and systematically open the temporal septum, we have found certain amount of lacrimal gland prolapse to be quite frequent. Moreover, since the mechanical support structures of the lacrimal gland will undergo the same involutional process as the rest of the periorbital structures, repositioning of the gland and suspension of the lateral LA will not only treat but also prevent future prolapse.

As described by Mendelson et al,<sup>35</sup> bone resorption associated with aging in the upper orbital rim affects mainly the medial upper rim leading to lack of support and contributing to hollow eye deformity. The philosophy behind volumetric contouring is to restore the fullness and smoothness to the upper eyelid sulcus by means of redistributing the fat and repositioning the gland. The fat of the brow also plays an important role in achieving a correct contour, especially in the lateral aspect. Defatting may be necessary in some patients with excess fat in the lateral brow. On the other hand, patients with excessive volume depletion, hollowness, and lack of sufficient fat to transpose may require additional volume correction either intra or postoperatively at 3 months. As a matter of fact, the authors rely on volume augmentation procedures on a regular basis to achieve optimal results.

## Conclusion

Volumetric contouring concept represents a new philosophy in upper blepharoplasty that conceives the eyelid-brow complex as a unit. This technique allows to treat and prevent hollow eyes and A-shaped deformity in the superior sulcus by means of fat transposition with or without adjunctive volume augmentation procedures. At the same time, it allows correction of unwanted bulginess in the lateral area through the transposition of the lateral fat pad and the reposition of the lacrimal gland. This concept seeks for long-term restoration of the eyelid-brow complex by addressing every involutional aspect of the aging process.

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