ORIGINAL ARTICLE

Periorbital Fat Grafting and Its Effect on Upper Eyelid Height

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Introduction: *Recently there has been an evolving paradigm shift towards the treatment of facial volume loss either alone or in conjunction with more traditional modalities. Although volume augmentation is commonly used in rejuvenation of the upper orbital sulcus and brow, the effect on the upper eyelid has not yet been documented. This article describes one clinician's experience (A.N.K.) with autologous fat grafting to the upper orbital sulcus and the effect on upper eyelid position.*

Materials and Methods: *After a detailed clinical evaluation of the periorbital region including overall facial aging, brow position, and eyelid laxity, 7 patients underwent autologous fat transfer to the periorbital region. After the procedure, a clear increase in upper eyelid height was observed in comparison of the photos taken before and after the procedure.*

Results: *All 7 patients described in this study demonstrated objective increase in upper lid height after periorbital autologous fat transfer, ranging from 0.41 mm to 2.08 mm, with a mean of 1.00 mm.*

Discussion: *Periocular volume augmentation and its effect on lower eyelid position have been described previously. An attempt to alter upper eyelid height with volume augmentation directly to the upper eyelid has also been described recently. However, to the authors' knowledge, this is the first report of volume augmentation to the periorbital region affecting upper eyelid position in this manner. The clinical application of this observational data is not yet clear. However, the potential exists for extension of this modality to upper eyelid malposition such as ptosis.*

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Periocular facial rejuvenation has long been a focus and challenge for the oculofacial plastic surgeon. Recently, there has been an evolving paradigm shift towards the treatment of facial volume loss either alone or in conjunction with more traditional modalities to achieve the desired youthful appearance of the periocular region.[1–5] There are several modalities available to the clinician to achieve this facial volume augmentation. A variety of filler compounds, including hyaluronic acid, collagen, silicone, and autologous fat, have been promoted for the treatment of facial volume loss. Each compound has its own drawbacks, and the merits of each have been argued previously.[1,6]

As clinicians have gained more experience, volume augmentation of the periocular region has extended beyond facial rejuvenation to include the treatment of eyelid malposition. To date, published reports have been limited to the lower lid.[7–9] Mancini et al[10,11] recently described a technique of hyaluronic acid gel filler directly to the upper eyelid as a nonsurgical modality of lowering the upper eyelid. The success of these interventions speaks to volume loss as a possible contributing factor to the eyelid malposition in these cases.

Although volume augmentation is commonly used in rejuvenation of the upper orbital sulcus and brow, the effect on the upper lid has not yet been documented. This article describes one clinician's experience (A.N.K.) with autologous fat grafting to achieve volume augmentation of the upper orbital sulcus and the effect on upper lid position.

Materials and Methods

This study represents a nonconsecutive, retrospective case series. All patients had received autologous fat

transfer to the superior orbital sulcus. This was performed to improve brow contour and upper sulcus hollowing in an attempt to ameliorate the stigmata of facial aging.

Patients were excluded from the study if facial rejuvenation included other treatment modalities (eg, neuromodulators, synthetic filler, or surgical intervention). Patients were not excluded if they had received autologous fat to other regions of the face. Next, during review of the preoperative and 1-month postoperative photos of qualifying patients by A.N.K. (plastic surgery) and B.J.L. (oculoplastic surgery), patients who had a clear increase in upper lid height were selected. Seven such patients were found to meet inclusion criteria and were included in the study.

Preoperative and 1-month postoperative photos of each of the 7 patients were evaluated as follows. Using standard photographic editing software, the pixel distance from the upper eyelid margin to the pupillary light reflex of each eye was measured. Then, the horizontal corneal diameter of each eye was measured. In order to calibrate each individual image, this measurement of corneal diameter was standardized to 12 mm for each patient as this represents the mean corneal diameter of an adult population. The initial measurement was compared to the corneal diameter to yield an upper lid margin-reflex distance (MRD1) in millimeters. The MRD1 of each preoperative photo was compared to the postoperative photos, and the difference in upper lid position was calculated and recorded.

Autologous Fat Transfer Technique

A detailed clinical evaluation of the periorbital region including overall facial aging, brow position, and eyelid laxity was routinely performed. The technique consists of low-pressure hand-held cannula harvesting and roughly 3-minute centrifugation, discarding the supernatant serum and infranatant oils. Injection was performed under general anesthesia via stab incisions at the head of the brow. A 19-gauge blunt tipped single side port cannula (Grams Medical, Costa Mesa, Calif) was used. After successfully reconstituting the supraorbital brow contour, the cannula was advanced inferiorly into the upper eyelid. The orbital rim periosteum is contiguous with the orbital septum, and all injections are superficial to this plane in the preperiosteal and preseptal spaces. The injections proceed to the level of the upper lid crease. The volume of fat administered was determined by the operating surgeon (A.N.K.) and was based on preoperative assessment and intraoperative clinical response in order to achieve the desired esthetic result. Bilateral volume injected was not necessarily symmetric; however, esthetic results were symmetric at the time of injection as deemed by the surgeon.

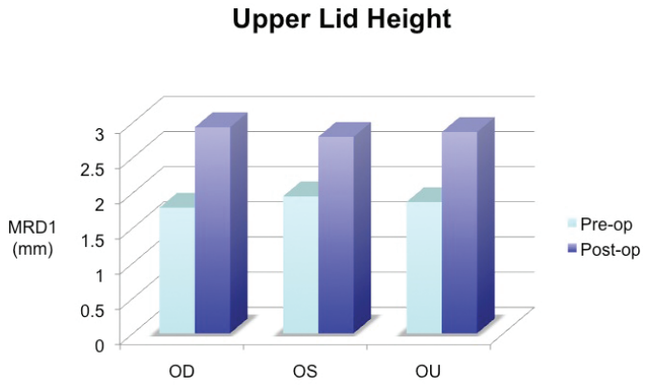

Figure 1. *Summary of the preoperative and postoperative margin-reflex distance (MRD1) for the 7 patients studied.*

Results

Fourteen eyes (7 patients) were included in the study (Figures 1 and 2; Table). Preoperative upper lid height MRD1 ranged from 0.55 mm to 2.97 mm. The elevation of upper lid height ranged from 0.41 mm to 2.08 mm with a mean of 1.00 mm. Preoperative lid height asymmetry ranged from 0 mm to 1.16 mm. Postoperative lid height asymmetry ranged from 0 mm to 1.60 mm. At the time of manuscript submission, long-term follow-up is available for 2 patients (Figure 3). At 2 years, patient RK demonstrated an MRD1 of 2.90 on the right and 2.74 on the left. After 3 years, patient H demonstrated an MRD1 of 2.82 on the right and left.

Complications included posttreatment ecchymosis and edema. One patient reviewed (DK) had an esthetically significant asymmetric result, as the right upper lid elevation far exceeded the left despite symmetric results with regard to volume and contour (Figure 4).

Discussion

Recent trend in periocular rejuvenation has moved towards incorporating treatment and correction of volume loss in addition to or in place of traditional excisional "lifting" treatments.[1,5] The excisional treatments do well in achieving the replacement of facial structures to their former youthful positions, however,

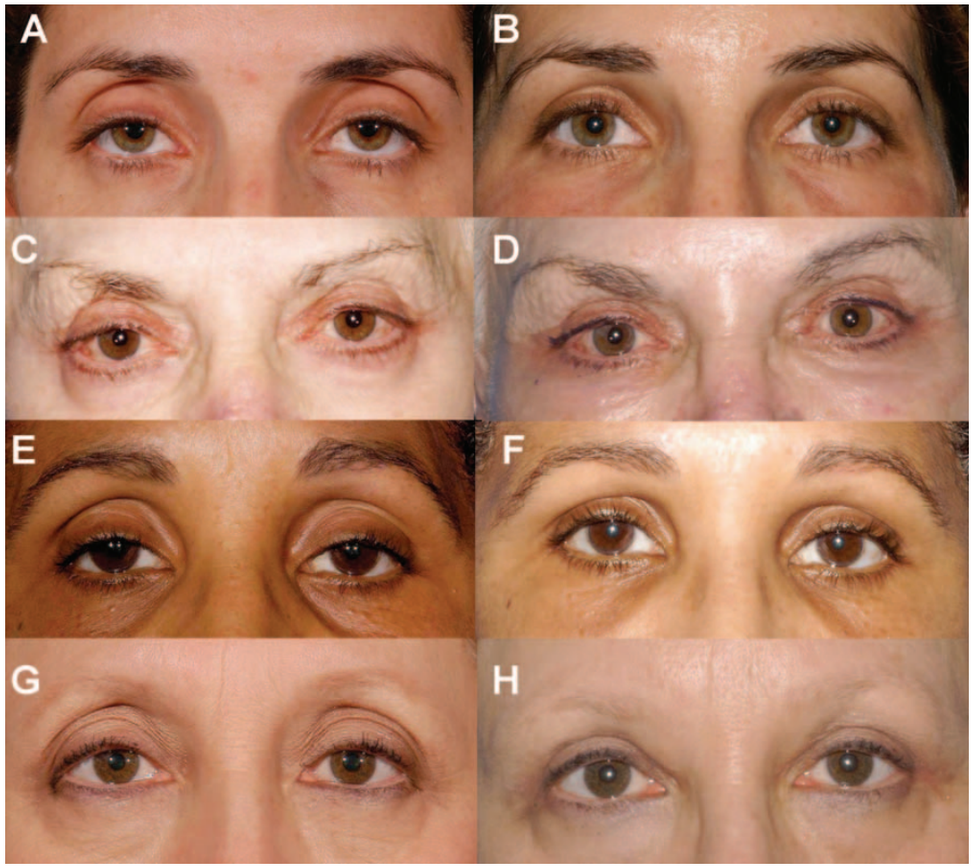

Figure 2. *(A, C, E, G) Four selected patients demonstrating superior sulcus hollowing with volume loss prior to treatment. (B, D, F, H) After treatment and volume augmentation, hollowing is improved and upper lid height is elevated .*

fail to address the 3-dimensional changes of volume loss that occur during aging. There is current debate over the causes of facial descent with aging. Descent due to both gravitational forces over time and deflation secondary to volume loss are currently implicated and each likely plays a contributory role.

As previously discussed, there are several modalities available to treat facial volume loss. Although it is not the goal of this paper to argue the merits of each, it is important to note that the results seen in this study are likely secondary to the volume augmentation of the

The Preoperative and Postoperative Margin-Reflex Distance (MRD1) of Each Patient Reviewed is Listed*

	Preoperative MRD1		Postoperative MRD1	
Patient	OD	OS	OD	OS
CM	2.526	2.684	3.157	3.157
DK	0.837	0.545	2.559	0.957
JS	1.171	1.258	2.319	2.200
MD	1.811	2.971	2.182	3.240
DD	2.328	2.507	3.403	3.761
RK	2.571	2.400	3.550	3.042
H	1.27	1.27	3.35	3.209

*OD indicates right eye; OS, left eye.

Figure 3. *Long-term follow-up at 2 years for patient (A) RK and (B) H. Diminished but lasting effect is demonstrated.*

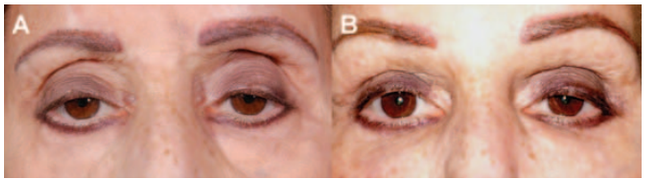

Figure 4. *(A) Pretreatment superior sulcus hollowing with bilateral upper blepharoptosis. (B) After treatment, hollowing is improved bilaterally; however, lid height elevation is asymmetric with right eye greater than the left.*

orbital sulcus. Therefore, the results would likely not be limited to the material used in this study, autologous fat, but could be seen with other materials that adequately restore facial volume.

Involutional blepharoptosis is commonly due to dehiscence of the levator aponeurosis and therefore is also referred to as aponeurotic ptosis. The results of this study beg the question whether the descent of the upper eyelid that is often seen with aging is caused, at least in part, by loss of facial volume in addition to the causative factors already known. This question is one that perhaps will become clearer as clinicians gain experience with facial volume augmentation.

The exact mechanism of altered lid height in these patients cannot be elucidated with any certainty; however, the authors propose a hypothesis. Expansion of the preseptal/postorbicularis soft tissues of the superior orbital sulcus creates several effects on the local anatomy. Increased brow support, with or without brow elevation, can support and lift the upper lid. In addition, expansion of the preseptal space can create tension on and posterior displacement of the orbital septum. These forces are then likely referred to Whitnall's ligament and the levator attachments to the tarsus (Figure 5), effectively elevating tarsal height.

Though previous authors have used filler materials to the upper eyelid itself, this technique serves to lower the upper eyelid margin height through its direct effects on the lid and upper lid retractors.[10,11] In reports by Mancini et al,[10,11] the upper eyelid is successfully lowered using hyaluronic acid filler in patients with cicatricial upper lid retraction and paralytic lagophthalmos. The filler material was injected post septal in the levator Muller's muscle plane in the former and to the upper lid pretarsal space in the latter. Although we observe the opposite effect on lid height in our patients, our hypothesis accounts for this. The fact that the filler material is placed only at the sulcus in the preseptal and preperiosteal space and not in the postseptal or pretarsal, allows for secondary force to be applied to the levator and brow. In fact, if one looks closely at the proposed mechanism by Mancini et al[10] for the treatment of upper lid retraction by placement of postseptal filler, one could argue that the opposite effect may be observed because tissue expansion is occurring on the opposite side of the septum.

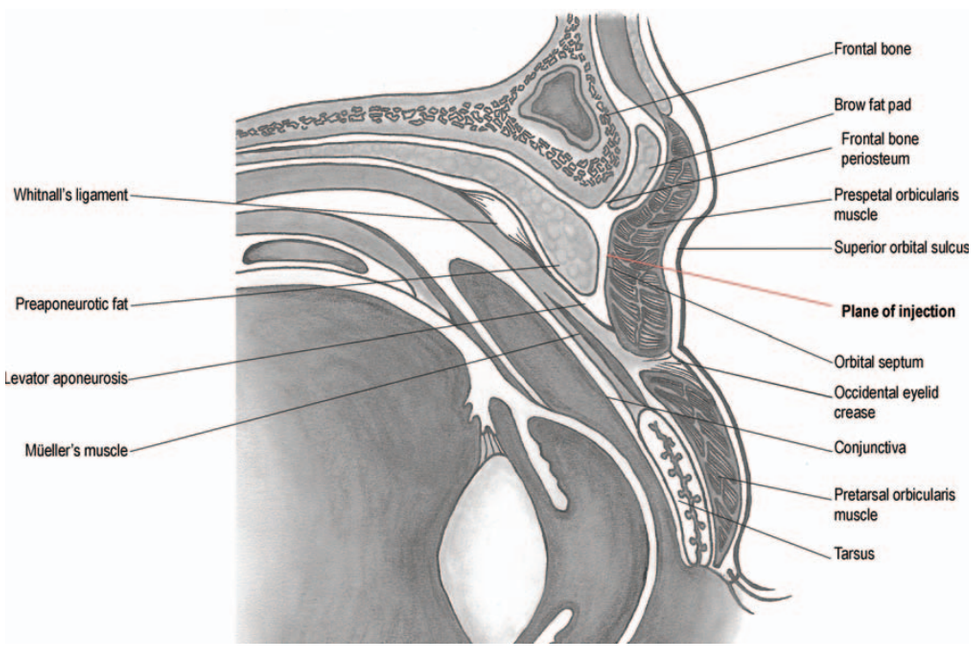

Figure 5. *A schematic diagram demonstrating the plane of fat injection (red arrow) and the surrounding anatomy (illustration by Dr Folgar).*

While long-term follow-up is limited in this study, the 2 patients, RK and H for whom these data are available, further serve to support our hypothesis. When compared to the effect 1 month after the procedure, there is some decrease in MRD1. There remains, however, a clear improvement from preprocedure values. In comparing these patients to their initial and 1-month follow-up photos (H: Figure 2A and B; RK: Figure 2G and H), one can observe a slight decrease in superior orbital sulcus volume when compared to the 1-month follow-up visit, but clear improvement when compared to the preprocedure photo. This decrease likely represents mild atrophy of the grafted fat, a common occurrence, and corresponds to the decrease seen in the upper lid margin height.

It is important to also state the other limitations to this study. First, and most importantly, this is an observational retrospective study. Patients were selected based on the results encountered, and were not randomized, nor were they compared to a control group. This study was nonconsecutive, and patients were selected only after the effect on lid height was observed. Also, a wide variety of preoperative upper lid heights in addition to variable results even in the patients selected further serves to complicate the interpretation of the results.

Conclusion

Periocular volume augmentation is fast becoming a staple of facial rejuvenation in order to address the volume loss that occurs during the aging process. The effect of volume augmentation on lower lid position has been described previously, but the effect on upper lid position has not been described until now. The observation of upper lid elevation after volume augmentation of the superior orbital sulcus is an important byproduct of this esthetic treatment. In addition, this observation may also lead to the use of volume augmentation in conjunction with other modalities for the treatment for upper eyelid malposition.

Acknowledgments

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