

Autologous Fat Grafting to the Pre-Levator Muscle Aponeurosis in Patients with Age-Related Enophthalmos

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Background/Purpose:

Age-related enophthalmos results from local eyelid skin sagging, brow drooping, or periorbital fat atrophy. Patients with fat atrophy-related enophthalmos present with increased upper eyelid length, measured from the upper eyelid to the supratarsal crease, contributing to a “sunken” upper eyelid appearance. Sagging of the upper lid can cause ptosis which further exaggerates the sunken appearance. To counteract ptosis, the upper eyelid is actively raised, and the frontalis muscle may be recruited to compensate for visual deficits. This combination of an elevated brow, ptosis, and sunken upper eyelid sulcus characterizes a patient cohort for which blepharoplasty or forehead lift may prove insufficient. Autologous fat grafting (AFG) directly addresses these atrophy-related changes in a way that surgery alone does not and can restore the pre-levator muscle aponeurotic space to effectively reduce upper eyelid length, eliminating the sunken appearance.

Methods/Technique:

Patients treated with AFG to the superior sulcus by a single surgeon were identified between December 2012 and February 2024. Patients who received concomitant upper face lift, forehead lift, brow lift, or blepharoplasty at the time of AFG were excluded. Patient pre-operative photographs were compared to post-operative photographs at the first follow-up visit and measurements were collected through the Mirror Medical Imaging Software. Measurements collected included length of upper lid to orbital rim, palpebral fissure height, and upper and lower margin-reflex distance (MRD). Analysis included descriptive and inferential statistics with significance set at $p < 0.05$.

Fat was harvested from the periumbilical region with a 4mm Mercedes blunt tip cannula at -15 mmHg as measured by the liposuction machine. Harvested fat was subsequently centrifuged at 100g for 30 seconds to separate out the tumescent from the fat. Local anesthetic of 1% xylocaine with epinephrine was injected in the superior tarsal region, and the sub-orbicularis oculi plane was identified. 1cc syringes of fat were injected with a disposable 18-gauge blunt tip single-hole

Tulip cannula in a retrograde manner from superolateral to inferomedial in 10-15 passes until adequate volume was achieved.

Results:

Twenty-four total patients received AFG to 48 eyes during the study period. Of these, 6 (25%) received only AFG at the time of procedure, while 18 (75%) underwent lower face/neck lift at the same time as AFG to the eye. The average follow-up time was 99.5 days for AFG-only patients and 116.2 days for facelift patients. There was no significant difference between the average age of patients undergoing AFG-alone (63.7 years) and facelift (66.1 years), or in the amount of fat injected into each eye (AFG-alone: 1.84 units, facelift: 1.44 units). Of the 6 patients who solely received AFG, significant increases in upper marginal reflex distance (MRD) were noted in both eyes (Average Right eye (OD): 1.35 mm, $p=0.016$, Average Left eye (OS): 1.45 mm, $p=0.022$), with no significant change to lower MRD bilaterally. Similarly, among patients who received AFG alongside facelift, a significant increase in bilateral upper MRD was found post-operatively (OD: .90 mm, $p=0.004$, OS: .96 mm, $p=0.002$) with no significant change to lower MRD bilaterally. Significant reductions in the distance from upper lid to orbital rim were also noted bilaterally for facelift patients (OD: 4.07 mm, $p<0.001$, OS: 4.05 mm, $p<0.001$). There was no difference noted in the palpebral fissure height post-operatively for either AFG-only patients or facelift patients.

Conclusion:

AFG was shown to be successful in restoring volume in patients with enophthalmos due to periorbital fat atrophy, helping to restore a more youthful appearance (Figure 1). By reintroducing volume to the pre-levator muscle aponeurosis, the overlying soft tissue is lifted off the superior tarsal muscle, restoring its natural excursion and function. As a byproduct of this procedure, and by using upper MRD as the principal proxy for upper eyelid ptosis, AFG resulted in a significant reduction in the degree of upper eyelid sagging. While this is by no means an alternative to ptosis correction, it is a noticeable improvement that plays a role in restoring the overall aesthetic appearance of the eye, particularly for sunken eye patients. Qualitative improvements in frontalis wrinkles and tension were observed as a byproduct of this periorbital rejuvenation technique, and quantification of these secondary improvements as well as longevity of these results warrants further investigation. Future analysis with larger cohorts, particularly of AFG-alone patients, may help improve the validity of these results.