Treatment of Lower Eyelid Malposition with Dermis Fat Grafting

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Purpose: To report a new technique in the repair of lower eyelid malposition using dermis fat as a posterior lamellar spacer graft.

Design: Retrospective, consecutive, nonrandomized interventional case series.

Participants: Eleven patients who underwent surgical correction for symptomatic lower eyelid malposition using dermis fat as a spacer graft.

Methods: Patients with symptomatic lower eyelid malposition after blepharoplasty, trauma, craniofacial syndromes, and human immunodeficiency virus-associated lipodystrophy were treated with midfacial lifting combined with dermis fat posterior lamellar spacer grafting.

Main Outcome Measures: Preoperative and postoperative measurements of eyelid position, margin-to-reflex distance (defined as the distance from the upper eyelid to the central corneal light reflex and the distance from the lower eyelid to the corneal light reflex), lagophthalmos, corneal staining, presence of ocular surface symptoms, and patient satisfaction.

Results: All patients who underwent dermis fat spacer grafting during lower eyelid malposition repair noted improvement in ocular surface symptoms and restoration of normal eyelid position.


Lower eyelid malpositions are vexing conditions facing patients and are among the most challenging conditions facing surgeons. The causes of lower eyelid malposition are varied and include postblepharoplasty eyelid retraction, posttraumatic eyelid retraction, volume loss, and eyelid retraction seen in human immunodeficiency virus (HIV)-associated lipodystrophy and congenital eyelid colobomas.1–3 These malpositions can result in both symptomatic keratopathy and unacceptable cosmetic appearance.

There are multiple mechanisms responsible for eyelid malpositions. In the case of postblepharoplasty eyelid retraction, excess removal of skin (anterior lamella), scarring of the orbital septum (middle lamella), and unrecognized lower eyelid laxity are among the causative factors.4 There are numerous methods of lower eyelid malposition repair. Common to many of these methods is the use of posterior lamellar spacer grafts such as hard palate mucosa, ear cartilage, and acellular dermis in conjunction with midface lifting and lower eyelid tightening.5–7 Each of these spacer grafts has inherent complications with its use.

The use of dermis fat as a composite graft has been well described in anophthalmic orbits.8,9 However, there have been few reports of its use in functional orbits and none as a lower eyelid spacer graft. Several features make autologous dermis fat a suitable spacer graft, including the ability to supply both posterior lamella on the dermis face, volume on the fat side, no risk of a transmissible agent, and low incidence of tissue rejection.

In this study, the efficacy of dermis fat was evaluated as a posterior lamellar spacer graft during the repair of lower eyelid malpositions. Eleven patients with lower eyelid malpositions from various causes were evaluated, treated with dermis fat grafting to the lower eyelid, and followed up clinically.

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Patients and Methods

Patients
This study was approved by the Institutional Human Research Protections Program and conforms to the principles outlined in the Declaration of Helsinki. The medical records of 11 patients with lower eyelid malposition were reviewed retrospectively over a 1-year period, noting age, gender, past medical and surgical history, details from ophthalmic examination, follow-up interval, and external photographs. The ophthalmic data included the presence of ocular symptoms, visual acuity, eyelid position, margin-to-reflex distance (defined as the distance from the upper eyelid to the central corneal light reflex and the distance from the lower eyelid to the corneal light reflex), lagophthalmos, and corneal staining.

Review of Literature
A search of the PubMed database was performed to determine if there were previously published reports using dermis fat as a spacer graft for lower eyelid malposition. The key words used were dermis fat and eyelid. In this manner, 25 publications were identified, most of which detailed its use in the anophthalmic orbit and none describing the use of dermis fat in lower eyelid malposition repair. When the search was refined further to include malposition or retraction, no publications were found.

Lower Eyelid Retraction Repair and Midface Suspension Technique
To facilitate exposure, a lateral canthotomy and inferior cantholysis was performed. A transconjunctival incision then was made beneath the inferior tarsal border. All scar tissue was liberated extensively to the arcus marginalis. The orbitomalar ligament then was released completely with a combination of blunt dissection and electrocautery along the anterior aspect of the inferior orbital rim. If a midface lift was performed, a subperiosteal dissection plane then was created and extended inferiorly to liberate the entire midface. Next, an upper eyelid crease incision was made and blunt dissection was performed inferolaterally along the preperiosteal plane to communicate with the lower eyelid incision. A 5-0 polygalactin suture (Ethicon, Inc., Piscataway, NJ) then was anchored to the suborbicularis oculi fat to achieve an optimal superolateral traction vector. A fine hemostat then was used to direct the suture under the lateral canthal tissues through the upper eyelid crease incision. This suborbicularis oculi fat suture then was secured to the periosteum at the level of the frontozygomatic suture. A slight overcorrection is desirable, allowing for postoperative descent.

Harvest of Dermis Fat Graft
The source of dermis fat for lower eyelid reconstruction was the hip, inferior and posterior to the superior iliac crest. The size of the graft used depended on the degree of lower eyelid retraction as well as the amount of lower eyelid volume loss. In general, an ellipse measuring 25×50 mm was marked on the skin. After marking the ellipse of skin, a diamond burr rotating at 20,000 rpm was used to denude the epithelium with the Stryker Total Performance System hand piece (Stryker, Inc., Kalamazoo, MI). The drill was used to burr down to the level of the deep dermis, and the end point of debridement was a fine, uniform hyperemia of the underlying dermis (Fig 1A). After removal of the epithelium, the graft was removed with sharp dissection and the underlying defect was closed with absorbable sutures (Fig 1B).

Dermis Fat Graft Placement
The dermis fat graft was trimmed down to size and volume after in situ placement. The nasal and lateral edges of the graft were tapered and placed with the dermis side facing the ocular surface and the fat side directed anteriorly. Fig 1C shows the orientation of the graft with respect to the fornix. The graft was anchored deep in the fornix and secured to the cut edges of the conjunctiva with interrupted 6-0 fast-absorbing gut suture (Ethicon, Inc.). If any lower eyelid laxity was present, a lateral tarsal strip procedure was performed. In cases of severe lower eyelid retraction of >3 mm, the lower eyelid was placed on stretch with a Frost suture on foam bolsters and the eye was patched for 1 week (Fig 1D). Because of the necessity of prolonged occlusion from the Frost suture, eyelid malposition repairs were performed one side at a time.

Results
Repair of lower eyelid malpositions using dermis fat as a spacer graft was performed in a total of 11 cases, divided into 4 groups: postblepharoplasty, trauma, congenital eyelid malposition, and HIV-associated lipodystrophy. Each of the groups was treated according to the degree of eyelid retraction and lagophthalmos present. The following patients are representative cases in each group.

The first group consisted of the post-blepharoplasty eyelid retraction. Table 1 (available at http://aaojournal.org) summarizes the clinical findings and treatments for each patient. All patients had blurred vision and foreign body sensation in one or both eyes at presentation. On examination, each patient exhibited inferior scleral show with lower eyelid retraction, lagophthalmos, and punctate keratopathy on the affected side despite aggressive ocular lubrication.

Case 1 had symptomatic exposure keratopathy on the right side after transcutaneous lower eyelid blepharoplasty at presentation. She previously underwent failed lower eyelid retraction repair using mucosal hard palate grafting. Adnexal examination revealed 1 mm of lagophthalmos and inferior scleral show in the right eye. A transconjunctival release of the lower eyelid cicatrix was performed combined with dermis fat spacer grafting and midface suspension on the right eyelid. After surgery, the patient noted complete resolution of her ocular symptoms. Fig 2 shows restoration of the normal lower eyelid position on the right eyelid on frontal view and elevation of the lateral eyelid on side view. The patient remained stable at 1-year follow-up.
Case 2 is an example of severe bilateral exposure keratopathy symptoms after transcutaneous lower eyelid blepharoplasty. On examination, she had 2 mm of lagophthalmos, lower eyelid retraction, and shortage of lower eyelid anterior lamella. Slit-lamp examination revealed marked punctate staining and neovascularization of the inferior cornea. Lower eyelid retraction repair was performed with a large, 12×25-mm dermis fat graft combined with midface lifting. At 9 months of follow-up, the patient remained free of exposure keratopathy symptoms and showed restoration of normal eyelid position and closure (Fig 3).

In the next group of patients, dermis fat grafting was used for posttraumatic lower eyelid retraction. Case 5 was referred for lower eyelid malposition 2 years after a motor vehicle accident. He previously underwent orbital floor fracture repair with a titanium mesh implant. On examination, there was right malar hypoplasia, lower eyelid retraction, hypoglobus, and cicatricial entropion of the lower eyelid. A lateral canthotomy and inferior cantholysis was performed, followed by transconjunctival release. A dense cicatrix in the inferior fornix was present and anchored to the titanium mesh. All scar tissue was liberated from the orbital implant, and a subperiosteal dissection plane was created. The midface was fixated to the frontozygomatic periosteum with 2 separate sutures for added support. Based on the amount of posterior lamella shortening and volume deficit, a large graft, measuring 15×30 mm on the dermis face and 20 mm in thickness of the subcutaneous fat, was secured to the cut edges of the conjunctiva. Overcorrection of both the lower eyelid retraction and volume loss was the goal. At 6 months of follow-up, resolution of the cicatrical entropion, lower eyelid retraction, and volume loss were noted (Fig 4).

The third group of patients consisted of those with lower eyelid malpositions seen in craniofacial syndromes. Case 10 is a typical example of a patient with...
Treacher-Collins syndrome who exhibited lower eyelid retraction and lagophthalmos. Right lower eyelid shortening, midfacial lifting, and dermis fat grafting were performed (Fig 5). After surgery, the patient had marked improvement in her lower eyelid retraction and midfacial hypoplasia that remained stable at the 1-year follow-up. In Fig 5, the fullness of the left lower eyelid in the preoperative photograph is the result of prior injection of...
hyaluronic acid gel, which dissipated on long-term postoperative photographs.

In the fourth group, dermis fat grafting was applied to the lower eyelid retraction and fat atrophy seen in the setting of HIV-associated lipodystrophy. Case 11 had bilateral lower eyelid retraction, lagophthalmos, and deep superior sulcus resulting from atrophy of orbital fat (Fig 6A, C, E). Bilateral lower eyelid dermis fat grafting and canthoplasty without midface lifting was performed. After surgery, the patient had marked improvement in eyelid position. The frontal view in Fig 6 shows improvement in the lower eyelid retraction as well as resolution of lagophthalmos and the superior sulcus deficit (Fig 6B, D, F). The side view demonstrates how the augmentation of dermis fat graft elevates the lower eyelid and restores a more natural appearance. At 9 months of follow-up, the patient remained stable with no further periorcular lipodystrophy despite continued antiretroviral treatment.

For each group, all patients noted improvement in foreign body sensation and blurred vision, if present, and reported less use of topical lubricants. Furthermore, all of the patients reported marked cosmetic improvement and high satisfaction after the reconstructive surgery.

Discussion

To the best of the authors’ knowledge, this is the first report that describes the use of dermis fat as a posterior lamellar graft for the repair of lower eyelid malposition. Although dermis fat has been used successfully for many years in anophthalmic orbits, its application for lower eyelid malpositions has not been well described.

Mucosal hard palate has been used successfully as a lower eyelid spacer since its initial description in 1985. However, there are several complications that can arise from usage of hard palate, principally at the donor site. Oro-nasal fistula formation and donor site candidiasis were noted in 2 cases, whereas others have reported donor site granuloma formation, chronic mucoid discharge, prolonged donor site hemorrhage, and formation of torus palatinus. Additionally, leukoplakic changes and prolonged gingival bleeding were noted in 1 patient who underwent hard palate graft harvesting. Subsequent histopathologic examination of the mucosal graft demonstrated invasive stage I, grade 3 squamous cell carcinoma that was present in the original graft. Ocular complications include graft keratinization causing ocular surface irritation and potential infection from oronasal flora.
Acellular dermis is another widely used spacer graft for lower eyelid retraction repair and is derived from human cadaveric dermis. The primary advantage of acellular dermis is its immediate commercial availability without the need to harvest from a second surgical site. However, acellular dermis has a postoperative contraction rate of 57% and can demonstrate growth of fine hairs. Finally, there is the theoretical risk of transmission of an infectious agent and possible immunogenic rejection despite postharvest testing and processing.

The principle concerns with use of dermis fat grafting are surface keratinization and growth of hairs leading to ocular surface complications. Hair follicles exist primarily in the epithelium and, to a smaller degree, in the early dermis. In this series, the authors specifically looked for, but did not note, any ocular surface irritation from dermis fat grafting. This may be technique dependent. The removal of the epidermis traditionally has been performed using mechanical debridement with a blade or a carbon dioxide resurfacing laser. The latter approach may be expected to produce a more uniform removal of the epithelium; however, this would require multiple passes to reach the level of the deep dermis and may be associated with higher risk of thermal injury. The authors performed mechanical debride-

Figure 6. A, Preoperative photograph of case 11 showing lower eyelid retraction, superior sulcus defect, and lagophthalmos. B, Postoperative photograph of case 11 obtained after dermis fat grafting and lateral canthoplasty showing restoration of lower eyelid volume and position. C, E, Preoperative photographs of case 11 showing, on the side views, lower eyelid retraction and volume loss. D, F, Postoperative photographs of case 11 showing the fullness and elevation of the lower eyelids after dermis fat graft placement.
ment of the epithelium using a high-speed diamond tip to burr down to the level of the deep dermis. They believe that this is essential to avoid graft complications. In this manner, they have not observed any postoperative hair growth, surface keratinization, or any major complications. Furthermore, meticulous end-to-end approximation of the dermis side of the graft with the conjunctival edge allows for uniform migration of the conjunctival epithelial cells over the dermal graft surface. Finally, the graft is placed deep in the fornix, where corneal apposition is minimal.

The authors also applied dermis fat grafting to lower eyelid malpositions resulting from rare causes. Long-term treatment of HIV infection with highly active antiretroviral therapy can be associated with lipodystrophy and muscle wasting. In particular, facial lipodystrophy is a well-recognized stigma of chronic HIV infection, and numerous treatments have been reported including recombinant human growth hormone and a variety of filler materials. An often unrecognized complication of HIV-associated lipodystrophy and muscle wasting is orbital fat hollowing and eyelid retraction. None of the prior treatments for facial lipodystrophy has addressed the periocular complications observed with HIV infection. The authors performed dermis fat grafting in a patient (case 11) with severe eyelid retraction and orbital fat atrophy with excellent functional and cosmetic improvement, and at 9 months of follow-up, the dermis fat graft remained stable. Because follow-up was not more than 1 year, the longevity of the dermis fat graft in the setting of continued antiretroviral therapy remains unknown.

In addition to HIV-associated lipodystrophy, dermis fat grafting was applied to the lower eyelid malpositions seen in Treacher-Collins (mandibulofacial dysostosis) syndrome. Lower eyelid colobomas, eyelid retraction, lateral canthal dystopia, and maxillary hypoplasia are some of the periorcular malpositions seen in Treacher-Collins syndrome. A variety of treatments have been described, including autologous bone grafting, alloplastic augmentation of the maxilla and zygoma, subcutaneous dermis grafting, and Z-plasty and musculocutaneous eyelid flaps. Dermis fat grafting to the lower eyelid previously was reported, but often requires repeat grafting owing to graft resorption. The use of dermis fat in this study differs from that of previously reported studies. First, the dermis side was used as a spacer graft in conjunction with lower eyelid retraction repair and midface suspension. Additionally, a large adipose bed was harvested to supply volume in the lower eyelid. In this manner, no significant decrease in volume or return of lid retraction was observed at 1 year of follow-up.

Dermis fat has many advantages over other spacer materials in the repair of lower eyelid retraction. First, no other spacer graft singly can provide both posterior lamellar augmentation as well as volume replacement. Compared with the hard palate, the size of the dermis fat graft is virtually unlimited, and healing of the donor site is more comfortable. Isolated fat pearls or subcutaneous fat injections are susceptible to numerous complications, including graft resorption and an irregular texture. Furthermore, the authors believe that the presence of adipose tissue on the dermis face may play an important role in long-term surgical success partly because of an antifibrotic effect on the middle lamella. In postblepharoplasty eyes and traumatic eyelid malposition, exuberant scarring of the middle lamella of the lower eyelid is a principle driving force for lower eyelid retraction. Complete and meticulous lysis of this middle lamellar cicatrix and prevention of subsequent scarring is essential for a successful outcome. The authors postulate that the presence of adipose tissue on the dermis face may play a role in this long-term success. During the cicatrical phase of wound healing, the fat may serve as an antiinflammatory buffer to prevent subsequent scarring.

This series is limited by its retrospective nature and the small sample size of 11 patients. The follow-up period also is limited, and despite no evidence of surface keratinization or new hair growth, these complications may arise at time points longer than the follow-up period. Furthermore, a head-to-head prospective comparison of dermis fat compared with other spacer materials in fellow eyes to determine which is the superior graft was not performed.

Future studies are planned to observe patients for periods of more than 1 year. Long-term surgical correction will be evaluated, and signs of late dermal keratinization, hair growth, and evidence of graft fat atrophy will be monitored. Additional studies will address the efficacy of dermis fat grafting for eyelid retraction secondary to thyroid-related orbitopathy, and a prospective, randomized study will be designed to evaluate the efficacy of dermis fat compared with other grafts. Serial orbital imaging will be performed to determine the rate of resorption of the dermis and fat components. Finally, the authors plan to compare the efficacy of dermis fat harvested from different donor sites.

In summary, dermis fat grafting is an excellent adjunct in lower eyelid malposition repair, restores normal eyelid function, and provides a well-received cosmetic outcome.

References

2. Engerhard P. Correction options for lipoatrophy in HIV-infected patients. AIDS Patient Care STDS 2006;20:151–60.
Table 1. Clinical Findings and Preoperative Symptoms

<table>
<thead>
<tr>
<th>Group</th>
<th>Case No.</th>
<th>Preoperative Margin to Reflex Distance$\text{d}_1$/Margin to Reflex Distance$\text{d}_2$</th>
<th>Preoperative Lagophthalmos Right</th>
<th>Preoperative Lagophthalmos Left</th>
<th>Preoperative Symptoms</th>
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<td>6.0/8.0 6.0/6.5</td>
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<td></td>
<td>2</td>
<td>3.5/8.0 3.5/8.0</td>
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<td>3</td>
<td>1.5/8.5 1.5/8.0</td>
<td>2</td>
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<td>Foreign body sensation, poor cosmesis, and decreased vision</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>4.0/7.5 4.0/7.5</td>
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<td>1</td>
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<td>Posttrauma</td>
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<td>1</td>
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<td>Foreign body sensation, poor cosmesis, and decreased vision</td>
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<tr>
<td></td>
<td>6</td>
<td>3.5/7.0 3.5/4.0</td>
<td>1</td>
<td>0</td>
<td>Poor cosmesis</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>2.5/8.0 2.5/4.5</td>
<td>2</td>
<td>0</td>
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<tr>
<td>Congenital eyelid malposition</td>
<td>8</td>
<td>4.0/7.0 4.0/6.0</td>
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<td>0</td>
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<tr>
<td>(Treacher–Collins)</td>
<td>9</td>
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<td>1</td>
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<td>5.5/7.0 5.5/7.0</td>
<td>2</td>
<td>2</td>
<td>Foreign body sensation and poor cosmesis</td>
</tr>
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HIV = human immunodeficiency virus.
### Treatments for All Patients

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<tr>
<th>Treatment</th>
<th>Postoperative Margin to Reflex Distance&lt;sub&gt;1&lt;/sub&gt;</th>
<th>Postoperative Lagophthalmos</th>
<th>Length of Follow-up</th>
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<td>6.0/6.0</td>
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<td>1 yr</td>
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<td>Bilateral midface lifting and bilateral dermis fat grafting</td>
<td>3.5/5.0</td>
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<td>9 mos</td>
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<td>Bilateral midface lifting, bilateral upper lid ptosis repair, and bilateral lower eyelid dermis fat grafting with lateral canthoplasty</td>
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<td>1 yr</td>
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<td>Bilateral midface lifting, dermis fat grafting, canthoplasty, and cheek implants</td>
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<td>Right midface lifting, lysis of lower eyelid cicatrix, dermis fat grafting, and lower eyelid shortening</td>
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<td>6 mos</td>
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<td>Right midface lifting, lysis of lower eyelid cicatrix, dermis fat grafting, and lateral canthoplasty</td>
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<td>6 mos</td>
</tr>
<tr>
<td>Right midface lifting, dermis fat grafting, and lower eyelid shortening</td>
<td>4.0/6.5</td>
<td>0.5</td>
<td>1 yr</td>
</tr>
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<td>Bilateral midface lifting, bilateral lower eyelid shortening, bilateral lower eyelid dermis fat grafting, and bilateral lateral rim augmentation</td>
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<td>1 yr</td>
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<tr>
<td>Bilateral dermis fat grafting and bilateral canthoplasty</td>
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