

“En-Glove” Lysis of Lower Eyelid Retractors With AlloDerm and Dermis-Fat Grafts in Lower Eyelid Retraction Surgery

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Purpose: To describe a minimally invasive surgical technique using AlloDerm or dermis-fat grafts for lower eyelid retraction.

Methods: A retrospective review of all patients undergoing lower eyelid retraction surgery via a minimal invasive, “en-glove” technique from 2005 through 2009. Charts were reviewed for the type of graft (AlloDerm or dermis-fat) used, the etiology of lower eyelid retraction, and the follow-up time. Outcome measures included lower eyelid height (measured from the corneal light reflex to the lower eyelid margin, or MRD₂), reduction of lagophthalmos, cosmetic appearance, complications, and need for further surgery. Presurgery and postreconstruction photographs were reviewed and graded for functional and cosmetic outcome.

Results: A total of 8 patients underwent successful lower eyelid retraction surgery using this minimally invasive technique. Etiologies included thyroid eye disease and cicatricial paralytic lower eyelid retraction. Mean improvement in MRD₂ was 1.5 mm for the AlloDerm group (4 patients, 7 eyelids) and 1.0 mm for the dermis-fat group (4 patients, 4 eyelids) after a minimum of 3 months’ follow-up. The cosmetic result was satisfactory in all cases.

Conclusions: “En-glove” lower eyelid retraction surgical technique offers a minimally invasive approach for the release of the lower eyelid retractors and allows for volume augmentation using either AlloDerm or dermis-fat spacer graft.

(*Ophthalm Plast Reconstr Surg* 2011;27:137–141)

Lower eyelid retraction, secondary to middle lamellar cicatrix, poses a surgical challenge. Typical etiologies include thyroid eye disease and sequelae of lower eyelid surgery (often blepharoplasty) or trauma. Contracture and scarring of the orbital septum and/or lower eyelid retractors lead to shortening and vertical retraction of the lower eyelid. In postsurgical cases, orbicularis muscle weakness and volume collapse often play a significant role.

To address this challenging problem, several surgical techniques have been developed, some of which use various

graft materials as a “spacer” after elevating the lower eyelid. The spacer is designed to keep the retractors recessed and supports the tarsus, while separating the retractors from the orbital septum and preventing shifting of the overlying lamella.¹ Of note, more recently, nonsurgical elevation and “splinting” of the lower eyelid using hyaluronic acid gel have been used.² However, the latter is temporary and does not directly release extensive cicatrix, which occurs in some cases.

We present a minimally invasive, “en-glove” surgical technique to address lower eyelid retraction, along with volume augmentation/support, using either acellular human dermis (AlloDerm; LifeCell Corporation, Branchburg, NJ, U.S.A.) or autogenous dermis-fat graft.

METHODS

We conducted a retrospective review of all patients undergoing lower eyelid retraction surgery via a minimally invasive “en-glove” technique by 2 surgeons (R.S.D., R.A.G.) at the Jules Stein Eye Institute in Los Angeles, CA, U.S.A., from 2005 to 2009. Charts were reviewed for patient demographics, etiology of lower eyelid retraction, type of graft (AlloDerm or dermis-fat) used, and follow-up time. Patients with less than three months’ follow-up were excluded. Outcome measures included lower eyelid height (measured from the corneal light reflex to the lower eyelid margin, or MRD₂), reduction of lagophthalmos, evaluation of the cosmetic appearance by the surgeon and a blind observer, complications, and need for further surgery.

Preoperative and postoperative photographs were analyzed at the latest follow-up visit and graded for functional and cosmetic outcome in both groups (AlloDerm and dermis-fat). All photographs were obtained with identical lighting at primary gaze. They were analyzed using the TN5 software.^{3,4} The corneal diameter and distance from the center of the pupil to the lower eyelid margin (MRD₂) were measured and standardized to a corneal diameter of 11.5 mm.⁵

Surgical Technique. Surgery is performed under monitored local anesthesia. The dermis-fat graft is harvested from a cosmetically hidden location (e.g., postauricular). The epithelium over the graft is hydrodissected with dilute anesthetic solution, and a thin layer of epithelium is dissected off the underlying dermis with a scalpel (Fig. 1). The dermis itself is then excised, including a thin cuff of subdermal fat, with typical graft size of 8 × 35 mm. (The AlloDerm graft size is similar.)

A 1-cm horizontal incision in the skin just below or above the lateral canthal tendon is used to access the lower eyelid retractor plane. Using the Stevens scissors, blunt and sharp dissection creates a pocket to the subconjunctival space. Through the conjunctiva, the surgeon can visualize the en-glove dissection, releasing the retractors from the conjunctiva and inferior tarsus until the conjunctiva is “windowpane” thin (Fig. 1). Next, the scissor re-enters the eyelid in a more anterior plane, adjacent to the arcus marginalis of the orbital rim, which can be

Accepted for publication October 7, 2009.

Presented as video at Fall ASOPRS meeting, November 2008, New Orleans, LA, U.S.A. Presented as lecture at Spring ASOPRS meeting, July 2009, Laguna Niguel, California, U.S.A.

The authors have no proprietary interest to disclose.

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DOI: 10.1097/IOP.0b013e3181c53d38

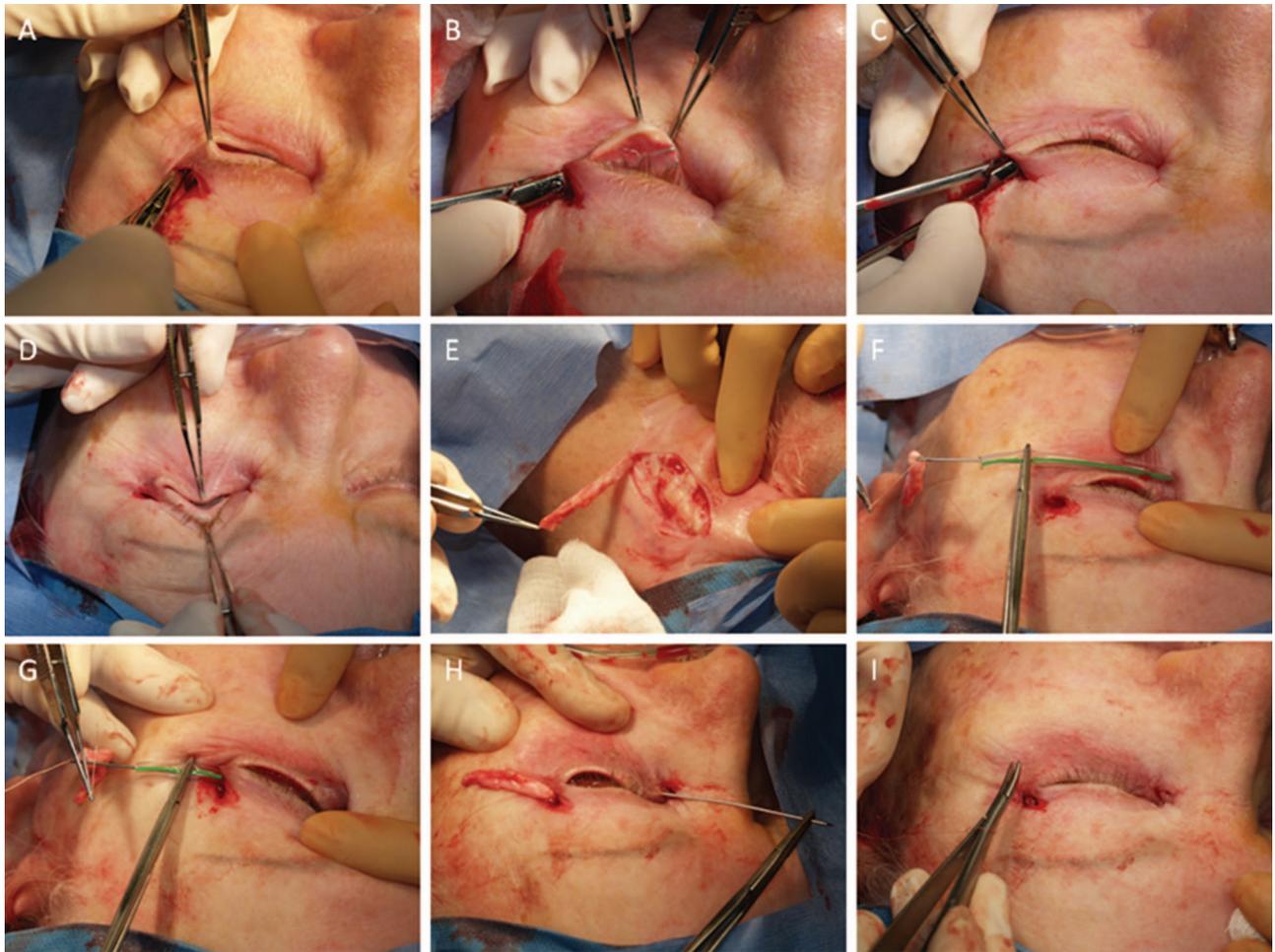


FIG. 1. Intraoperative photographs demonstrating en-glove lysis of lower eyelid retractors and scar with placement of a dermis-fat graft. **A**, Small skin incision above the lateral canthus allows access to the lower eyelid retractors plane. **B**, Lower eyelid retractors and any scar are released using blunt and sharp dissection until the conjunctiva is “windowpane” thin. **C**, The Stevens scissors reenter the lower eyelid in a more anterior plane, adjacent to the arcus marginalis, to release any remaining attachments/scar, aided by stretching the eyelid vertically. **D**, Photograph illustrates appropriate eyelid stretch after release of retractors and scar. **E**, Harvesting of post-auricular dermis-fat graft. The epithelium is dissected *in vivo*, followed by excision of dermis-fat. **F** and **G**, An absorbable suture is attached to one end of the graft. A Keith needle, guarded with intravenous tubing, is passed across the en-glove dissection pocket. **H**, Then, the intravenous tubing is withdrawn, and the needle is used to pull the suture and attached graft through the lower eyelid. **I**, The suture medially is tied onto itself at skin, while the lateral edge of graft is sutured to the lateral canthal tendon. The small skin incision is closed and frost sutures are placed to stabilize the eyelid, with assistance of pressure dressing.

palpated. In this plane, anterior attachments of the eyelid retractors are released, aided by stretching the eyelid vertically with the other hand and strumming any residual attachments (Fig. 1). Once the anterior and posterior attachments of the eyelid retractors are released, the eyelid should rest in appropriate position above the limbus, and vertical elevation should be limited only by the anterior lamella.

An absorbable suture is attached to one end of the dermis-fat graft (or AlloDerm). A long Keith needle is guarded with a 6-cm segment of intravenous (IV) tubing, clamped down with a hemostat, so that the needle can pass freely across the en-glove dissection pocket (Fig. 1). After pushing the guarded tip of the needle to the medial extent of the dissection pocket, the IV tubing is withdrawn, and then the needle is used to pull the suture and attached dermis-fat graft (or AlloDerm) through the lower eyelid (Fig. 1). If possible, the graft should be fed in the wound, so that it lies flat, with dermis side posterior. The medial end of the suture can be knotted or tied to the skin with a second suture (Fig. 1). The lateral edge of the graft is sutured to the lateral canthal tendon or orbital rim, under gentle tension, creating a horizontal sling effect. The small skin incision is closed.

The eyelid is stabilized to the eyebrow using multiple mattress reverse Frost suture to set the retractors on stretch and immobilize the graft (Fig. 1), with assistance of pressure dressing. The dressing and temporary tarsorrhaphy are removed 5 to 7 days after operation.

RESULTS

A total of 8 patients representing 11 eyelids underwent successful lower eyelid retraction surgery using the minimally invasive, “en-glove” technique (Table 1). Mean age was 60 years (range, 34–78 years). Etiologies included thyroid eye disease and paralytic cicatricial lower eyelid ectropion.

All patients showed improvement in the position of the lower eyelid following the operation throughout the follow-up period (minimum 3 months, mean 4.2 months, maximum 9 months), as illustrated in Figure 2 and Table 2. The mean improvement in MRD₂ for the AlloDerm group (4 patients, 7 eyelids) was 1.5 mm at 3-month follow-up, with mean preoperative MRD₂ of 8.2 mm (range, 6.6–9.6 mm). The mean improvement in MRD₂ for the

TABLE 1. Patient demographics

Average age, years (range)	60 (34–78)
Gender (%)	
Male	3 (38)
Female	5 (62)
Etiology of lower eyelid retraction (%)	
Graves orbitopathy	4 (50)
Paralytic cicatricial ectropion	2 (25)
Orbital fracture	1 (12)
Orbital tumor	1 (12)
Graft material used (%)	
AlloDerm	4 (50)
Dermis-fat	4 (50)
Follow-up, months (range)	4.2 (3–9)

dermis-fat group (4 patients, 4 eyelids) was 1.0 mm at 3-month follow-up, with mean preoperative MRD₂ of 7.2 mm (range, 6.5–7.7 mm). The difference between the groups was not statistically significant. The improvement was present at the 6-month follow-up (Fig. 2). The cosmetic result was satisfactory in all cases. Representative cases are presented (Figs. 3 and 4).

DISCUSSION

Lower eyelid retraction, secondary to middle lamella shortage, poses a surgical challenge. The goal of the lower eyelid retraction surgery is to release the cicatrix in the middle lamella that tethers the orbital septum to the inferior orbital rim.⁶ The graft material supports the tarsus of the lower eyelid in an upward position and helps to separate or buffer the lower eyelid retractors from the orbital septum.¹ Several techniques to address lower eyelid retraction have been described. The continued evolution of surgical techniques has been driven by various factors such as the use of smaller incisions, the development of improved graft materials, and unsatisfactory results with current methods.

Several graft materials have been used as “spacer” materials in lower eyelid retraction surgery. These include sclera, ear cartilage, and hard palate, among others. The grafts stiffen the eyelid, providing vertical support, and add some volume to the collapsed eyelid. It is not clear whether a graft controls the position of the lower retractors more predictably than recessing the retractors without a graft.⁷

More recently, AlloDerm has been used as a spacer graft material in lower eyelid retraction surgery. AlloDerm is a dermal matrix processed from human allograft skin graft obtained from cadaveric material that is processed to remove

cellular elements, leaving the dermal matrix immunologically inert.^{8,9} It provides the properties needed for lower eyelid and is similar to hard palate mucosal grafts in its handling.⁸ In addition to providing the needed structural support, it perhaps functions as a substrate for conjunctival neoeptithelialization.⁸ Further advantages include ample amounts of material and the avoidance of a second surgical site. It has been shown to be clinically successful in lower eyelid reconstruction, although it has been noted that AlloDerm tends to contract over time.¹⁰ The tissue used for AlloDerm does carry a theoretical risk of infectious disease, although it is screened and processed to reduce the risk of infectious disease transmission.

Dermis-fat grafts are an option for an autologous graft and are easily harvested with an abundance of potential graft material. The graft provides both flexibility and tensile strength, and dermis seems to vascularize quickly.^{11,12} It has been suggested that dermis-fat grafts offer more structural support than AlloDerm grafts.¹² The dermis-fat graft is especially useful in cases that are characterized by insufficiency of the middle lamella of the eyelid but adequate conjunctiva. Dermis can be harvested from a cosmetically hidden location (e.g., postauricular) with lower donor site morbidity compared with hard palate. The latter would only be needed if the posterior lamella was also insufficient.

Our surgical technique presents a minimally invasive approach to access and release the lower eyelid retractors and allows for the placement of a graft, such as AlloDerm or an autogenous dermis-fat graft, through the same small incision. Traditional surgeries add grafts to the posterior lamella, but may not optimally address volume collapse, and require conjunctival manipulation with an open wound, which may promote secondary intention healing. We prefer the lysis of the lower eyelid retractors “en-glove” through the small skin incision without the need for a separate transconjunctival incision. The placement of a graft provides volume support and creates a buffer between the lower eyelid retractors and the septum/orbicularis complex. The graft is anchored to the lateral canthal tendon or to the orbital rim, creating a sling effect to further support the lower eyelid (Fig. 5). All patients included in this study needed vertical eyelid augmentation through the release of the lower eyelid retractors and scar tissue with the support of a lower eyelid graft, as lower eyelid tightening alone would not have changed the eyelid margin position. All patients showed improvement in lower eyelid position and volume following the operation using either AlloDerm or dermis-fat as the graft material, without any graft complications. The use of AlloDerm or dermis-fat grafts was decided between the surgeon and the patient according to the preference of both the surgeon and the patient and the consideration of possible harvest site morbidity and the risk of transmittable agents. The improvement was maintained over the course of follow-up. Taking the preoperative MRD₂ into account, both groups had approximately 19% improvement in lower eyelid height.

Unlike our technique, Holds et al.⁷ described a lateral canthal incision to access the lower eyelid retractors in a manner similar to the technique we describe here, followed by a modified lateral tarsal strip. The open canthus incision has potential disadvantages, including disarticulation of the upper eyelid/tendon from the lower eyelid/tendon, which can lead to length disparity between the upper and lower tendon, misalignment of the mucosal or cutaneous elements of the canthal junction, and scarring or web formation in the multicontoured mucocutaneous region. Furthermore, the horizontal incision at that location can compromise the lymphatic drainage of the upper and lower eyelids and weaken the orbicularis oculi muscle as it cuts across the circular fibers of the orbicularis.¹³

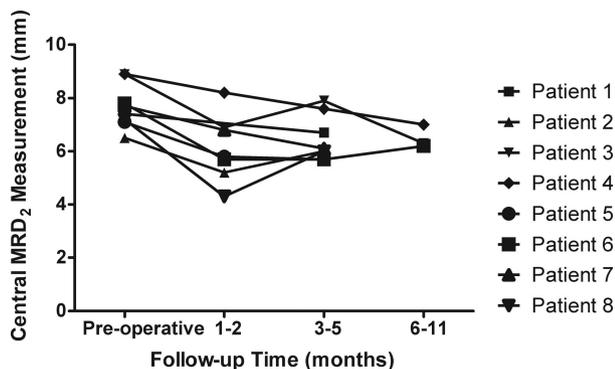


FIG. 2. The position of the lower eyelid before and after en-glove lysis of the lower eyelid retractors and placement of AlloDerm or Dermis-fat graft.

TABLE 2. Central lid dimension measurements

Patient	Age (years)	Diagnosis	Graft material	Preoperative MRD2 (mm)	1–2 Months postoperative MRD2 (mm)	3–5 Months postoperative MRD2 (mm)	6–12 Months postoperative MRD2 (mm)
Patient 1							
Right eyelid	52	Graves orbitopathy	Dermis-fat	7.4	—	6.7	
Patient 2							
Right eyelid	64	Graves orbitopathy	Dermis-fat	6.5	5.2	6.0	
Patient 3							
Right eyelid	77	Graves orbitopathy	AlloDerm	9.6	6.7	7.9	6.3
Left eyelid	77	Graves orbitopathy	AlloDerm	8.1	7.0	—	6.2
Patient 4							
Right eyelid	69	Graves orbitopathy	AlloDerm	8.9	8.5	7.1	6.9
Left eyelid	69	Graves orbitopathy	AlloDerm	8.9	7.9	8.1	7.1
Patient 5							
Right eyelid	78	Paralytic cicatricial ectropion	AlloDerm	7.5	5.9	5.9	
Left eyelid	78	Paralytic cicatricial ectropion	AlloDerm	6.6	5.7	5.4	
Patient 6							
Right eyelid	39	Paralytic cicatricial ectropion	AlloDerm	7.8	5.7	5.7	6.2
Patient 7							
Right eyelid	34	Orbital fracture	Dermis-fat	7.7	6.8	6.1	
Patient 8							
Right eyelid	69	Orbital tumor	Dermis-fat	7.2	4.3	6.0	

Patients who have already undergone multiple eyelid operations are particularly at risk due to their diminished reserve of both orbicularis oculi muscle and lymphatics. In our technique, the placement of the incision is away from the lateral canthus and runs parallel to the orbicularis fibers and lymphatic vessels while still allowing the placement of a spacer graft through the same small incision.

All patients in our study had improvement in the lower eyelid position during the follow-up period. Limitations of our study include its retrospective nature, small sample size, and relatively limited follow-up time. Based on our anecdotal experience, we believe that a minimally invasive “en-glove” scar lysis with closed placement of either AlloDerm or dermis-fat is a useful technique to address the difficult surgical problem of cicatricial lower eyelid retraction due to middle lamella shortage and volume collapse. We have found this procedure useful in patients with all degrees of lower eyelid retraction



FIG. 3. Preoperative (A) and 6-month postoperative (B) photographs of patient 4, a 69-year-old female who underwent bilateral lower eyelid retraction surgery secondary to thyroid orbitopathy via en-glove lysis and placement of AlloDerm graft, performed 2 months after bilateral orbital decompression and upper eyelid blepharoplasty.

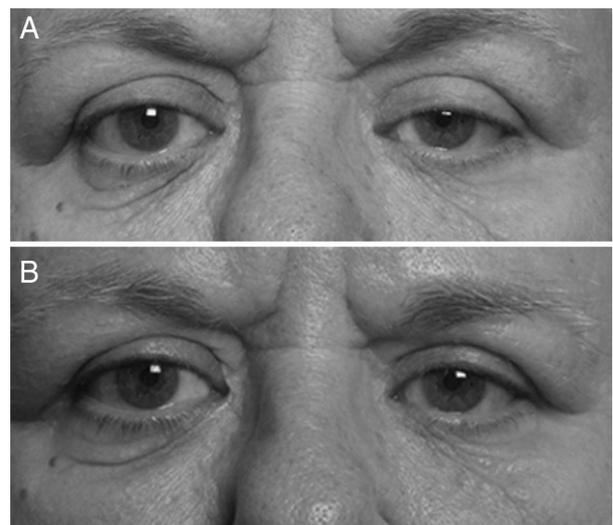


FIG. 4. Preoperative (A) and 3-month postoperative (B) photographs of patient 2, a 64-year-old female who underwent right lower eyelid retraction surgery, secondary to thyroid orbitopathy, via en-glove lysis and placement of dermis-fat graft. She had previously undergone orbital decompression and multiple eyelid surgeries with another physician.

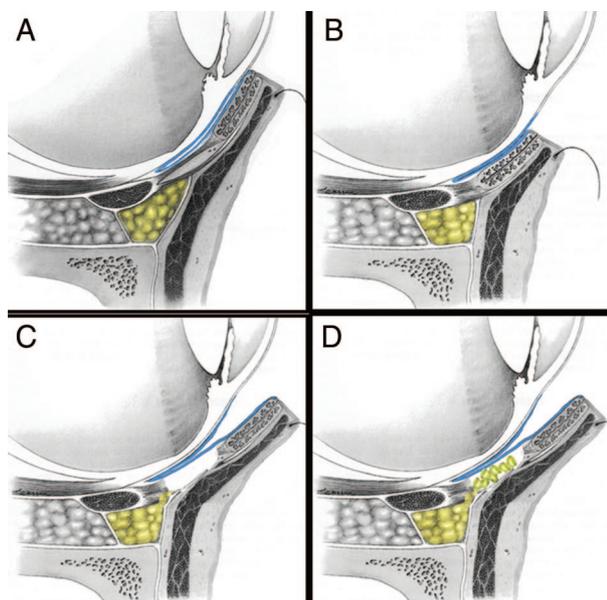


FIG. 5. Schematic diagrams illustrating the concept of lower eyelid volume loss and support, improved by lysis of lower eyelid retractors and placement of a dermis-fat or AlloDerm grafts. **A**, Normal lower eyelid; **B**, retracted lower eyelid; **C**, elevation of lower eyelid after release of lower eyelid retractors and scar; **D**, lower eyelid support with volume replacement.

when there is middle lamellar cicatrix or if there is the need for release of the lower eyelid retractors. The concept of en-glove lysis of middle lamellar scar, and volume replacement, through a small, “closed canthus” incision is applicable to many types of autogenous and alloplastic grafts: any strip of filler, such as AlloDerm or dermis-fat graft, can be used effectively with this method.

REFERENCES

1. Patipa M. The evaluation and management of lower eyelid retraction following cosmetic surgery. *Plast Reconstr Surg* 2000;106:438–53; discussion 454–9.
2. Goldberg RA, Lee S, Jayasundera T, et al. Treatment of lower eyelid retraction by expansion of the lower eyelid with hyaluronic acid gel. *Ophthal Plast Reconstr Surg* 2007;23:343–8.
3. Edwards DT, Bartley GB, Hodge DO, et al. Eyelid position measurement in Graves’ ophthalmopathy: reliability of a photographic technique and comparison with a clinical technique. *Ophthalmology* 2004;111:1029–34.
4. Rasband WS. *Image J*. Bethesda, MD: US National Institutes of Health, 1997–2007. Available at: <http://rsb.infor.nih.gov/ij/>. Accessed 2007.
5. Rüfer F, Schröder A, Erb C. White-to-white corneal diameter: normal values in healthy humans obtained with the Orbscan II topography system. *Cornea* 2005;24:259–61.
6. Taban M, Douglas R, Li T, et al. Efficacy of “thick” acellular human dermis (AlloDerm) for lower eyelid reconstruction: comparison with hard palate and thin AlloDerm grafts. *Arch Facial Plast Surg* 2005;7:38–44.
7. Holds JB, Anderson RL, Thiese SM. Lower eyelid retraction: a minimal incision surgical approach to retractor lysis. *Ophthalmic Surg* 1990;21:767–71.
8. Shorr N, Perry JD, Goldberg RA, et al. The safety and applications of acellular human dermal allograft in ophthalmic plastic and reconstructive surgery: a preliminary report. *Ophthal Plast Reconstr Surg* 2000;16:223–30.
9. Li TG, Shorr N, Goldberg RA. Comparison of the efficacy of hard palate grafts with acellular human dermis grafts in lower eyelid surgery. *Plast Reconstr Surg* 2005;116:873–8; discussion 879–80.
10. Sullivan SA, Dailey RA. Graft contraction: a comparison of acellular dermis versus hard palate mucosa in lower eyelid surgery. *Ophthal Plast Reconstr Surg* 2003;19:14–24.
11. Korn BS, Kikkawa DO, Cohen SR, et al. Treatment of lower eyelid malposition with dermis fat grafting. *Ophthalmology* 2008;115:744–51.e2.
12. Brock WD, Bearden W, Tann T III, Long JA. Autogenous dermis skin grafts in lower eyelid reconstruction. *Ophthal Plast Reconstr Surg* 2003;19:394–7.
13. Taban M, Nakra T, Hwang C, et al. Aesthetic lateral canthoplasty. *Ophthal Plast Reconstr Surg*. In press.