The Lateral Transorbital Canthopexy for Correction and Prevention of Ectropion

Report of a Procedure, Grading System, and Outcome Study

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Background: There are numerous approaches to correcting laxity of the lateral canthal tendon, each with advantages and drawbacks. Critical evaluation of these techniques is not possible, however, as there is no grading system currently in use to describe this condition or to report outcomes, and prospective trials are lacking.

Objectives: To report and assess a new procedure for repair of the lateral canthus (lateral transorbital canthopexy) and to describe the Ectropion Grading Scale (EGS), with a prospective outcome analysis of their use.

Design: Prospective outcome study of 15 consecutive patients (16 procedures).

Setting: Tertiary referral center in Zurich, Switzerland.

Patients: Consecutive sample of patients referred for treatment of ectropion of various causes.

Interventions: Preoperative and postoperative EGS grades were recorded, a preoperative and postoperative patient-based questionnaire was administered, and lateral transorbital canthopexy was performed.

Main Outcome Measures: Outcome was determined by improvement in EGS grade and results of the patient-based symptom questionnaire.

Results: There were no surgical failures or complications in the study. An average of 83% reduction in patient-reported discomfort was achieved. Two patients with facial paralysis needed medial canthal repositioning. The EGS allowed clear recording of lower eyelid position before and after lateral transorbital canthopexy, and the procedure was uncomplicated to perform.

Conclusions: Lateral transorbital canthopexy is an effective technique for the correction of lower eyelid laxity and appears to allow refined, durable adjustment of the lateral canthus. Self-reported patient satisfaction confirmed the high rate of success of the procedure in this study. The EGS permits critical evaluation and reporting of results and may assist in predicting which patients will need concomitant correction of the medial canthus.

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The lower eyelid acts in conjunction with the upper eyelid as a shield that protects and maintains a balanced moisturization of the eye. It has 2 primary supports: the medial and the lateral canthal tenoligamentous complexes. While both can stretch, the medial canthal tendon is a rather short and stout structure and is less commonly a cause of eyelid dysfunction. The longer lateral canthal tendon (LCT), however, is the weakest portion of the eyelid, and thus is more susceptible to laxity or increased tension. Dysfunction of the LCT has numerous causes, including facial paralysis, aging, iatrogenic insult, trauma, congenital abnormality, or medical illnesses, such as scleroderma and dermatitis. The resulting ptosis can lead to either entropion or, more commonly, ectropion, with medial, anterior, and inferior displacement of the lateral canthus. The ensuing symptoms are varied, depending on the cause and position of the eyelid; epiphora, photophobia, and erythema are common. Symptoms due to conjunctival irritation and corneal exposure may also occur.

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Historically, there have been numerous procedures to correct laxity of the LCT dating back at least to Adams’ resection of a full-thickness eyelid triangle in 1812. Most of these have involved partial eyelid resection, and have shared the complications of unfavorable scarring, phimosis (shortening of the horizontal aperture), trichiasis, and blunting of the lateral canthus. Also, they may further stretch the already lax LCT, leading to recurrence of the problem. A major advance was made in 1977, when Tenzel et al described the lateral sling canthoplasty repair for ectropion, focusing attention on tightening and...
METHODS

PREOPERATIVE EVALUATION

The most critical step in achieving a positive outcome in the treatment of lower eyelid dysfunction is a thorough preoperative evaluation to determine the cause of the problem and to rule out other coincident abnormalities. Assessment begins with observation, comparing the symmetry of the lower eyelid position and the position, width, and angle of the medial and lateral canthi. The vertical traction test is performed, displacing the lower eyelid superiorly over the cornea; this is possible almost to the level of the superior limbus in the normal eyelid and is used to detect craniocaudal retraction. The degree and location of weakness of the eyelid are then ascertained by the eyelid distraction test, in which the eyelid is retracted inferiorly, while the distance from the globe that it travels and the time that it takes to resume its normal position on release are noted. The results are compared with those of the contralateral side. The ability to distract the eyelid more than 10 mm suggests abnormal laxity. A lateral tension test is then performed, in which the eyelid is pulled laterally. If abnormal laxity is present, the eyelid will move up against the eye. We perform this test both medially, placing tension adjacent to the medial canthus, and laterally at the lateral canthus to aid in ascertaining whether the laxity is primarily medial or lateral. In this maneuver, the lacrimal punctum is carefully observed to ascertain its response to tension: in the absence of eyelid retraction, it should rotate superiorly and dorsally to coat the globe. This response will aid in predicting the surgical outcome. If proper positioning of the punctum is not achieved, or if there is excessive vertical widening of the medial canthal angle, consideration must be given to an ancillary procedure to address the positioning of the medial canthus.

Finally, the position and condition of the eyelashes should be noted, and the conjunctiva should be examined for evidence of exposure changes. Abnormalities of the lacrimal system should be ruled out, and an ophthalmology consultation is obtained as indicated.

elevating the slack lateral tendon. This method was modified by Anderson in 1981 into the tarsal strip procedure, which is often used today. A tarsal strip procedure includes a lateral canthotomy and cantholysis; excision of skin and conjunctiva, leaving a free strip of tarsus; fixation of the tarsal strip to the periosteum of the lateral orbital wall; and reconstruction of the lateral canthus to create the appropriate height and tension of the lower eyelid.

There are several problems with the latter procedure, however. Dysfunction of the lower eyelid is typically attributable to malposition rather than to excess tissue, and resection of one or more layers of the eyelid can cause recurrence or exacerbation of the problem. Furthermore, disruption of the lateral canthal angle can lead to dehiscence, overlapping of the eyelids, failure of proper eyelid positioning, trichiasis, alteration of eyelid contour, obstructive scarring, rounding of the canthus, and loss of cilia. Also, excision of tissue is not reversible should overcorrection occur.

These drawbacks prompted the development of the anterior canthopexy (rather than canthoplasty) for tightening of the LCT. In this procedure, through anterior incisions in the upper or lower eyelids, the LCT is fixed to the lateral orbital wall in a somewhat elevated position without resection of the components of the eyelid or canthus. Anterior canthopexy prevents many of the complications that are associated with resection techniques. But the procedure is still suboptimal. If the LCT is simply sutured to the lateral periosteum, there is a risk of recurrent laxity. This problem may be overcome by fixation of the LCT through drill holes in the lateral wall. However, the anterior approach does not allow a proper angle for drilling and can lead to skin damage. If the access is through the upper eyelid, an additional separate subciliary approach is required for releasing the tethering inferior orbital septum. Also, because the lateral horn of the levator aponeurosis is continuous with the LCT, an anterior approach through the upper eyelid has been associated with ptosis resulting from entrapment of the aponeurosis with the canthopexy suture. Finally, an anterior approach mandates the creation of operative trauma and distortion directly in the area that must be meticu-
conjunctiva between the eyelid and the globe and displac-
ing the LCT laterally. The tissue is then palpated through
the incision with another forceps, and the tendon is located
by palpation of its fibrous adhesions with the lateral orbital
wall in the region of the Whitnall tubercle. Once identified,
the LCT is transected at its lateral insertion. It is important
to realize that the lateral insertion of the LCT is approxi-
mately 7 mm in vertical extent, and the conjoined attach-
ment of the lateral aspect of the levator aponeurosis at its
superior border adds approximately 3 mm, for a total width
of 10 mm.10 To prevent problems of eyelid overlapping or
entrapment, we transect the LCT together with the lateral
levator aponeurosis from their lateral attachment, maintain-
ing their integrity as a functional unit. When the complex
has been freed over its full vertical extent, the lateral can-
thus and lower eyelid become freely mobile when manipu-
lated with a forceps (Figure 4, A and B). If an element of teth-
ering remains, the lower lateral orbital septum may be further
incised in a caudal direction. The tendon is separated from
the lateral orbital wall with a craniocaudal vertical incision
(ie, cantholysis), but a horizontal canthotomy is not per-
formed. It is maintained fully intact to avoid disruption of
attachment of the upper and lower eyelids and to preserve
the attachment of the check ligament of the lateral rectus
muscle, which can be confirmed by preservation of lateral
motion of the lateral canthus on extreme lateral gaze. If the
tendon is excessive in its length, a lateral portion may be
trimmed so that its bulk does not prevent adequate tighten-
ing against the orbital wall.

The lateral orbital periosteum is raised with a septal
elevator to expose the bone in the region where the can-
thus is to be reattached. Two permanent 4-0 sutures are
placed through the medial aspect of the LCT at the can-
thal angle and adjacent to or through the lateral inferior
tarsal plate (Figure 4, B, black dots adjacent to the lateral
canthus). The ends are left 10 cm long and are clamped
with a small hemostat, and the needle is removed. Two
1-mm-diameter holes are bored in the lateral orbital wall 1
to 2 mm posterior and superior to the Whitnall tubercle in
the region of the frontozygomatic suture, angled dorsally
and superiorly, while the globe is protected with a periosteal
elevator (Figure 5, A through C). The position of these holes
is planned preoperatively and depends on the underlying ab-
normality and the degree to which the eyelid must be ele-
evated and tightened. Placing the holes more superiorly will
raise the eyelid as needed to aid in tear conduction in facial
paralysis, while a more posterior direction will augment the
tightening of the eyelid that is needed to correct senile ptos-
is. Loops of suture are then passed like a noose laterally to
medially through these holes, and the sutures attached to the
lateral canthus and tarsal plate are placed through the nooses,
which are then retracted, externalizing the sutures with them
through the orbital wall. (Figure 5, D, and Figure 6, A). The
sutures are then tightened laterally while the canthal angle
is observed from a frontal perspective, with the eye both open
and closed. With the appropriate tension, the eyelid is seen
to coapt with the globe, and the lacrimal punctum rotates su-
periorly to appose the lacrimal lake. Proper tension and po-
positioning may be confirmed by bringing the patient into a sit-
ting attitude. With the lateral canthus thus in its desired
position, the sutures are tied together (Figure 6, B). Approxi-
mately 1 to 2 mm of overcorrection is desirable so that the
eyelid overlaps the inferior limbus by 1 to 2 mm with the pa-
tient in the upright position (approximately 1-2 mm of eye-
lid relaxation occurs in the first 2-3 weeks after surgery). In
cases of bilateral repositioning, great care should be taken to
assure symmetry of the reconstruction. The patient is then
asked to open and close the eye to confirm normal eyelid mo-
tility. The wound is closed in 2 layers, with 4-0 absorbable
suture through periosteum and muscle to cover the ends of
the canthopyexy sutures and 6-0 interrupted cutaneous su-
tures. The cutaneous sutures are removed on the 5th post-
operative day. A cold pack is applied to the area for several
hours after surgery. Postoperatively, the lateral canthus may
appear to be excessively elevated, with overlapping of the lat-
eral brow tissue over the incision. This soon flattens, how-
ever, and symmetry of the tissue is regained. An axial sche-
matic of the repositioned LCT is depicted in Figure 6, C, and
the immediate postoperative appearance in the sitting posi-
tion is shown in Figure 7.

To avoid these problems, we developed a posterolat-
eral approach, the transorbital canthopyексy (LTC), which
has numerous advantages. As the operative field is moved
laterally and centered over the lateral orbital rim, the struc-
tures that must be analyzed in detail and repositioned are
not incised or transected, and remain clearly in view, with-
out edema. The levator aponeurosis is not functionally com-
promised; the globe is at minimal risk of injury; and a pos-
terolateral approach allows safe drilling of holes for tran-
sorbital fixation of the canthus. Although easily per-
formed in conjunction with upper or lower blepharopla-
sty, these procedures are not required for access. Cen-
tering the approach laterally (the scar is easily hidden in a
skin crease) creates the most direct approach to the area
where the reconstruction takes place. Separation of the ten-
don from the lateral orbital wall is performed without can-
thotomy, so the LCT complex (including the check liga-
ment of the lateral canthus) remains intact. The tendon is
then fixed at its medial border to diminish the chance of
stretching postoperatively, using transosseus suture fixa-
tion to prevent dehiscence. Finally, the procedure is rapid;
it can be performed under local anesthesia without need
for sedation; and, because there is minimal disturbance of
the eyelid itself, and there is no incision through the conjunc-
tiva, there is little postoperative discomfort, edema, or che-
mosis.

A grading system was needed to enable an accurate
description of the type and severity of entropion. On re-
view of the literature, we found no suitable scale, so we de-
developed the Ectropion Grading Scale (EGS) (Table 1).
To add greater detail if desired, documentation can be added
to the distance between the eyelid margin and the central
corneal reflex or on the distance between the ciliary mar-
gin and the globe.

RESULTS

Fifteen consecutive patients undergoing 16 procedures (patient 15 underwent simultaneous bilateral repair) were
evaluated prospectively with photographic documenta-

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tion and preoperative and postoperative questionnaires evaluating and rating their symptoms (Table 2). Their age, underlying diagnosis, and grade of ectropion before and after surgery are shown in Table 3. Five patients were not available for the 6-month postoperative follow-up visit.

The average patient age was 68 years (age range, 55-88 years). The usual time to complete the procedure was 30 minutes, depending on the severity of the underlying process. There were no surgical complications and no instances of infection, problems in wound healing, unfavorable scarring, or instances of eyelid malfunction. The patients experienced minimal postoperative pain, and the mild postoperative edema resolved within 1 week. No patients required reoperation of the lateral canthus. One patient (EGS grade IV LM) underwent placement of a lacrimal stent for persistent epiphora due to stenosis of the lacrimal duct, and another patient (EGS grade, III LMr) required a medial blepharorrhaphy to reposition the punctum. No patient who was available for follow-up of 6 months or more had a recurrence of symptoms (although 1 patient developed gustatory lacrimation that was unrelated to the procedure), and there was no evidence on physical examination of dehiscence or weakening of the repair.

Of the 10 patients who were available for at least 6 months of follow-up, the average improvement in the subjective severity of the main symptom was 2.5 out of a possible 3 points (diminution from severity 3 to 0 representing a 3-point improvement), or an 83% reduction in discomfort. It must be noted, however, that many patients had multiple symptoms, and this analysis was based on their most severe symptom only. Furthermore, a patient with facial paralysis should not expect complete resolution of symptoms, as the active function of the lacrimal system does not return.

The symptoms caused by dysfunction of the LCT can be extremely annoying to a patient, ranging from continuous epiphora to an exposed, irritated eye with damage of the cornea. The causes of epiphora are numerous, including reflex hypersecretion; punctal stenosis from conjunctival irritation; diminished

![Figure 1](image1.png)

**Figure 1.** Preoperative lateral photograph of grade III L ectropion, right eye, with patient sitting.

![Figure 2](image2.png)

**Figure 2.** A, Patient in supine position, from surgeon’s view, incision marked. B, Normal anatomy from an intraoperative perspective. C, Axial plane viewed from below.

![Figure 3](image3.png)

**Figure 3.** A and B, Exposure of orbital rim; stay sutures on wound edges. C, Orbital septum is transected, and lateral canthal tendon is exposed.
medially directed tear conduction due to caudal displacement of the lateral canthus from its normal position approximately 2 mm cranial to the medial canthus (normal values vary individually and by ethnic origin), loss of apposition of the eyelid margin to the globe, and vertical shortening of the inferior fornix, or an adynamic lacrimal pump due to laxity and temporal sagging of the eyelid. Repositioning of the LCT complex is an effective means of correcting these underlying causes of eyelid malfunction. This abnor-
maleness is not rare; indeed, eyelid retraction and ectropion are the most common complications of lower eyelid blepharoplasty, and those who treat disorders involving the facial nerve are quite familiar with the manifestations. Earlier attempts to correct lower eyelid malfunction, based on excising a perceived overabundance of tissue, were fraught with difficulties that were partly overcome by the development of canthopexy and then anterior canthopexy.

We believe that this has now been further improved and simplified by the development of the LTC, which maintains the anatomical and functional integrity of the LCT, including the ability of the lateral check ligament of the lateral rectus muscle to abduct the canthal angle on lateral gaze. By not detaching the lateral horn of the levator aponeurosis from the LCT when it is repositioned, normal functional relationships are maintained and postoperative eyelid malfunction is eliminated.

Subjectively, the patients in this study were satisfied with the procedure postoperatively, obtaining on average an 83% reduction in the severity of their symptom score. Objective analysis of preoperative and postoperative ptosis/ectropion grading demonstrated an improvement in grade in every case. There were no complications, problems with wound healing, or failures to properly reposition the canthus.

We found that the EGS was simple to use and that there was excellent interobserver agreement in patient grading. Furthermore, the system aided in preoperative planning, in that for patients with grade I through III ectropion, no further procedures other than LTC were required; however, in patients with grade III Mr, IV M, or V M ectropion, a procedure directed at the medial canthus, such as medial blepharorrhaphy, should strongly be considered. It should be noted that not all patients attained a postoperative EGS grade of 0. This is because grade 0 means that the patient has had complete resolution of symptoms. In a patient with facial paralysis where the orbicularis muscle is nonfunctional and the lacrimal system functions only passively, the patient cannot be expected to be completely symptom free. In these cases, the goal is EGS grade I.

We believe that the use of a grading system is essential both to enable the surgeon to thoroughly evaluate his or her results and to allow accurate reporting of outcomes and comparisons of various surgical techniques. Because eyelid retraction and ectropion are frequent complications of lower blepharoplasty, attention should be directed toward preventing this problem. While it has been suggested that lower eyelid tightening be performed routinely with or as a substitute for blepharoplasty, it seems reasonable that predisposition to this problem should be sought through the tests discussed above before blepharoplasty is performed; then, LTC may be performed as indicated. We have performed LTC at the same time as blepharoplasty through an extension of either the upper or lower eyelid incision, without difficulty or increased tissue trauma.

Thorough preoperative patient evaluation is necessary to establish the cause of the ptosis and to rule out additional underlying conditions that may require treatment, as well as to plan proper eyelid positioning. Furthermore, patients with long-standing ectropion of advanced grade IV or V may also require adjustment of the medial canthus for full restoration of eyelid contour.

Table 1. Ectropion Grading Scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
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<tbody>
<tr>
<td>0</td>
<td>Normal eyelid appearance and function</td>
</tr>
<tr>
<td>I</td>
<td>Normal appearance but symptomatic; eyelid laxity present on examination</td>
</tr>
<tr>
<td>II</td>
<td>Scleral show without eversion of lower eyelid</td>
</tr>
<tr>
<td>III</td>
<td>Ectropion without eversion of lacrimal punctum</td>
</tr>
<tr>
<td>IV</td>
<td>Advanced ectropion with eversion of lacrimal punctum from lacrimal lake</td>
</tr>
<tr>
<td>V</td>
<td>Ectropion with complication (eg, conjunctival metaplasia, retraction of anterior lamella, or stenosis of lacrimal system)</td>
</tr>
<tr>
<td>L</td>
<td>Predominantly lateral</td>
</tr>
<tr>
<td>M</td>
<td>Predominantly medial</td>
</tr>
<tr>
<td>LM</td>
<td>Combined medial and lateral</td>
</tr>
<tr>
<td>r</td>
<td>Previous revision</td>
</tr>
</tbody>
</table>

* The number of previous revisions can be indicated by the addition of a number after the r, eg, II LMr2.

Table 2. Ectropion Symptom Questionnaire

<table>
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<th>Duration of symptoms</th>
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<tr>
<td>Presence of related illness</td>
</tr>
<tr>
<td>Main symptom</td>
</tr>
<tr>
<td>Other symptoms</td>
</tr>
<tr>
<td>Other ophthalmologic problems</td>
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Rate the following symptoms according to severity:
0, not a problem; 1, mild; 2, moderate; and 3, severe
- Excessive tearing
- Poor vision in involved eye
- Burning sensation
- Itching
- Dry eye sensation
- Excessive redness
- Secretions, matting of eyelashes
- Unusually sensitive to bright light
- Unusually sensitive to wind
- Other complaints

*Patients rated these symptoms before surgery and again at each follow-up visit.
We describe a new method for repositioning the lateral canthus and a grading system for evaluating the type and severity of ectropion. The posterolateral surgical approach may allow more surgical precision and refinement than did previous procedures, while preserving the anatomical relationships and function of the LCT and minimizing postoperative discomfort. Also, increased durability of the repair can be expected, as direct fixation of the lateral canthus through bone virtually eliminates dependence on the LCT, the weakest portion of the eyelid. Prospective analysis has confirmed the effectiveness of the procedure through marked subjective relief in the patient-based symptom severity analysis, as well as through objective improvement in the EG5 grade.

It is our hope that use of the EGS will aid in personal evaluation and reporting of results and encourage objective comparison and prospective study of future improvements in technique.

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This project is dedicated to the memory and inspiration of John R. Moe.

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**REFERENCES**