Evolution of the Lateral Canthoplasty: Techniques and Indications


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Received for publication May 16, 1996; revised December 17, 1996.
Abstract

Lateral canthoplasty is a useful method to restore eyelid function and to protect the ocular surfaces. The success of the procedure depends on the proper analysis of periorbital anatomy as it relates to the specific indication for lateral canthoplasty. We report the experience with 1565 lateral canthoplasties with emphasis on the evaluation of newer techniques that better address anatomic and functional requirements. Between 1981 and 1994, 1565 lateral canthoplasties were performed in 684 patients. Of these, 1369 “reconstructive” lateral canthoplasties were performed in 586 patients and 196 “cosmetic” lateral canthoplasties were performed in 98 patients. All operations were performed by a single surgeon (Jelks), and follow-up ranged from 1 to 14 years. The evolution of the operative technique for lateral canthoplasty has been toward an operation that corresponds with the anatomy of the individual. Indications for the procedure include lateral canthal dystopia, horizontal lid laxity, ectropion, entropion, lid margin eversion, lid retraction with or without soft-tissue deficiency, and aesthetic improvement. The types of procedures performed will be reviewed in detail. The evaluation of the newer forms of lateral canthoplasty as unique reconstructive tools and as adjuncts to aesthetic surgery will be discussed.

Lateral canthoplasty is a useful method to restore eyelid function and to correct lower eyelid malposition. Several lateral canthal surgical procedures are available to provide excellent lid function and contour.

Our indications for lateral canthoplasty include: (1) lateral canthal dystopia, (2) horizontal lid laxity, (3) ectropion from cicatrix, atony, or paralysis, (4) lid retraction, and (5) for aesthetic reasons. Many different surgical procedures are available that are related to or affect the position of the lateral canthus, and these include tarsal strip procedures, lateral canthal suspension, transposition of the lateral canthal tendon, and fascial slings to the lower lid. Other procedures influence the lateral eyelid position, such as orbicularis oculi muscle suspension, wedge excision of the lower lid, and cartilage grafts to the lower eyelid.
Anatomically, the lateral canthus is more correctly termed a lateral retinaculum. The retinaculum receives contributions from four anatomic structures, namely the lateral horn of the levator aponeurosis, the lateral extension of the preseptal and pretarsal orbicularis oculi muscle (lateral canthal tendon), the inferior suspensory ligament of the globe or Lockwood's ligament, and the check ligament of the lateral rectus muscle.¹

Careful analysis of individual patients' anatomy and indications for lateral canthoplasty has resulted in a method of determining the optimum type of procedures to perform. The bony orbital anatomy, lower eyelid tarsalligamentous integrity, and prominence of the ocular globe as well as the soft tissue to orbit relationship are key factors in determining the procedure to use.

Much of the early history of lateral canthal procedures is covered in an excellent review by Edgerton and Wolfort.² Early procedures involving the lateral canthal structures were originally described for use in the treatment of ectropion from a variety of causes. Senile ectropion is caused by laxity of the eyelid supportive structures, especially the lid retractors, tarsus, and canthal ligamentous structures. Cicatricial ectropion, in contrast, is caused by a deficiency of eyelid skin or skin and muscle from a variety of causes, including congenital deformities, trauma, burn, inflammation, or irradiation. Paralytic ectropion is due to paresis of the orbicularis oculi muscle with resultant laxity of the ligamentous structures.³

It became apparent, in reviewing the results of many procedures involving the lateral canthus, that it is important to perform fixation of the tarsus to the lateral orbital tissues. Lower lid laxity, therefore, became an indication for lateral canthoplasty. Various methods have been described to attach the tarsus to the lateral orbit.²⁻²¹

Finally, lateral canthoplasty has become an important part of cosmetic blepharoplasty. As the patient ages, a decreasing tonicity of the lower lid structures occurs, especially the lateral canthal tendon.¹⁴ This produces senile lower lid laxity, descent of the lateral canthus, and an inferior migration of the lower eyelid position. Careful analysis of the patients undergoing cosmetic blepharoplasty must be undertaken to determine which patients are predisposed to postoperative eyelid malposition. These patients are good candidates for lateral canthoplasty procedures in conjunction with cosmetic blepharoplasty. This will be discussed in greater detail below.

Patients and Methods

The charts of 684 patients undergoing lateral canthoplasties between 1981 and 1994 were reviewed retrospectively. These patients underwent 1565 lateral canthoplasties in a total of 1018 operations. Bilateral lateral canthoplasties were performed during 547 of the operations, whereas 471 operations were unilateral. Follow-up ranged from 1 to 14 years. The cases were evaluated for the indications for canthoplasty (Table I) and the type(s) of procedure(s) performed (Table II). The number of canthoplasties performed per patient was evaluated (Table III). In addition, the trends over the 14 years of the study were evaluated for type of procedure being performed, the types of patients being operated on(cosmetic versus reconstructive), and the adoption and incorporation of new types of procedures into everyday practice.
Results

The number of canthoplasties performed per year was evaluated (Fig. 1). Between 1981 and 1988, 491 canthoplasties were performed, representing 31.4 percent of the total. The number of procedures during this period ranged from 6 to 129, averaging 61.4 per year. During the period
from 1989 through 1994, 1074 canthoplasties were performed, representing 68.6 percent of the total. The number of canthoplasties ranged from 145 to 196, averaging 179.0 per year.

The lateral canthoplasties were evaluated by indication for the procedure (Table IV). Lateral canthal dystopia (indications 1A, 1B, and 1C = congenital, posttraumatic, and acquired, respectively) was the indication for 420 canthoplasties during 318 operations (84 percent bilateral). This represented 26.8 percent of the total number of canthoplasties. Lid laxity (indication 2) represented the diagnosis for 230 canthoplasties during 119 operations (93 percent bilateral). This represented 14.7 percent of the canthoplasties. Ectropion (indications 3A, 3B, and 3C = senile, cicatricial, and paralytic, respectively) accounted for 507 canthoplasties (32.4 percent of the total) in 306 operations (66 percent bilateral). The senile and cicatricial ectropions (indications 3A and 3B) were bilateral in 70 percent of the cases, whereas the paralytic ectropions (indication 3C) were unilateral in 73 percent. There were 212 lateral canthoplasties performed for lid retraction (indication 4) in 126 operations (68 percent bilateral). This represented 13.5 percent of the cases. Finally, 196 lateral canthoplasties were performed for cosmetic reasons (indication 5) in 98 operations, all bilateral. Cosmetic indications represented 12.5 percent of the total.
inferior retinacular lateral canthoplasties (Table V). The other types of canthoplasties represented only small percentages of the total number of canthoplasties performed.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>HLS® w/medial canthoplasty</td>
<td>29</td>
<td>4.4</td>
</tr>
<tr>
<td>HLS® w/lateral canthoplasty suspension</td>
<td>660</td>
<td>32.1</td>
</tr>
<tr>
<td>Complex lateral canthoplasty</td>
<td>67</td>
<td>3.3</td>
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<tr>
<td>Prosthetic implant</td>
<td>55</td>
<td>2.5</td>
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<tr>
<td>Dermal orbicular pennant lateral</td>
<td>16</td>
<td>0.8</td>
</tr>
<tr>
<td>Dermal orbicular pennant lateral</td>
<td>10</td>
<td>0.5</td>
</tr>
<tr>
<td>Inferior retinacular lateral</td>
<td>167</td>
<td>8.5</td>
</tr>
<tr>
<td>Correct lid retraction w/o graft</td>
<td>105</td>
<td>6.1</td>
</tr>
<tr>
<td>Correct lid retraction w/ graft</td>
<td>81</td>
<td>4.5</td>
</tr>
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TABLE V Lateral Canthoplasty-by Procedure

Each individual type of canthoplasty was evaluated over the 14-year period being investigated. A total of 660 horizontal lid shortening procedures were performed (Fig. 2). This was the predominant procedure performed between 1981 and 1991, with a total of 535 procedures. The horizontal lid shortening was primarily used for cases of paralytic ectropion and horizontal lid laxity. As the advantages of other types of canthoplasty were appreciated, a sharp decline in the number of horizontal lid shortening procedures was seen after 1991.

Fig. 2. Number of horizontal lid shortening procedures performed per year(1981-1994) (n = 660).

A total of 466 dermal orbicular pennant lateral canthoplasties were performed; 269 of these were performed between 1991 and 1994, making it the predominant procedure for this period (Fig. 3). The primary indications for the procedure during this period were cases of soft tissue to bony disparity including lateral canthal dystopia, lid retraction, and cosmetic patients with negative vectors.
Fig. 3. Number of dermal orbicular pennant lateral canthoplasties performed per year (1981-1994). (n = 466).

The inferior retinacular lateral canthoplasty was used a total of 147 times, 137 of them in 1993 and 1994 (Fig. 4), when it became the predominant type of canthoplasty.

Fig. 4. Number of inferior retinacular lateral canthoplasties performed per year (1981-1994) (n = 147).

There were a total of 23 complications, for a rate of 1.7 percent. Complications from the procedures were all minor. There were three lacrimal cysts, three epithelial lined cysts, five suture granulomas, four cartilage granulomas, two minor infections, and six cases of lateral canthal deformity.

Discussion

The lateral canthoplasty has evolved as a reconstructive technique used to correct abnormalities, both acquired and congenital, of lower eyelid malposition. What makes the lower eyelid, and specifically the lateral canthus, so important? Lower eyelid position and tone are secondary to the integrity of the medial and lateral canthal tendons and the intervening fibrous tarsal plate. As the aging process progresses, there is decreasing tonicity of the lower lid, especially the lateral canthal tendon. This produces lower lid laxity, descent of the lateral canthus and an inferior migration of the lower eyelid. In addition, the lateral canthus may be malpositioned and insert too high or too low, or it may be too long. As a result of these changes associated with aging, blepharoplasty has become a popular way of dealing with these physical findings. According to Flowers, canthoplasty and fat removal should be the primary components of lower lid
blepharoplasty. Of utmost importance is that skin on the lower lid be conserved so as not to destroy the long-term benefits of the canthoplasty.

The most common complication of blepharoplasty is an unnatural distortion of the lower eyelid. This malposition results from an interplay of the patient's unique periorbital anatomy with mechanical distraction due to the gravitational and cicatrical forces of the skin, muscle, and septum displacing the lid inferiorly. Canthal and eyelid laxity, edema, hematoma, scarring, and impaired orbicularis oculi muscle function contribute to the disruptive forces. Prevention of this complication requires preoperative evaluation of eyelid and canthal laxity by the distraction or snap test. Patients predisposed to postoperative eyelid malpositions must be identified by careful preoperative analysis of the periorbital anatomy to prevent complications from eyelid surgery. The relationship of the most anterior projection of the globe to the lower eyelid and the malar eminence is assessed by evaluation of the lateral view of the patient. Patients with “negative” vectors require variations in blepharoplasty techniques including conservative skin and muscle resection, lateral canthoplasties, and horizontal lid tightening procedures. Predisposing factors for postblepharoplasty eyelid malposition include hypotonicity/involutional changes, malar hypoplasia, shallow orbit, thyroid ophthalmopathy, unilateral high myopia, and patients undergoing secondary blepharoplasty. Postoperative lower lid malposition is manifested by mild eversion of the temporal lid margin, inferiorly directed lashes, temporal lid bowing, and scleral show or ectropion. Corneal exposure and visual deterioration can occur. Most postblepharoplasty lid malpositions are temporary and resolve within 4 to 6 weeks postoperatively. This resolution can occur more rapidly when edema, inflammation, impaired muscle function, and distracting forces are treated. These treatments may be done nonoperatively in mild cases by using cold compresses, gentle massage, systemic and topical steroids, muscle contraction exercises, and temporary eyelid support sutures. More severe or established eyelid malpositions that do not compromise vision should, ideally, be corrected after observing for 6 to 9 months. This correction should be performed earlier if vision deteriorates.

During the evaluation of the patient with lower eyelid malposition, it is important to determine whether there is any element of midlamellar (tarsus, capsulopalpebral fascia, orbital septum) cicatrical retraction. Midlamellar retraction can be diagnosed by demonstrating a restriction in upward mobility when placing upward traction on the lower lid (usually can be pulled to the midpupil or above). If lid retraction is present, then surgical management consists of lysis of the adhesions. If this creates vertical lid deficiency, an interpositional graft must be placed in the lower lid. These grafts may consist of cartilage, palatal mucosa, or, more elegantly, a flap of deepithelialized lateral canthal dermis.

In contrast, when lower lid malposition is secondary to lower lid laxity, a pentagonal wedge resection may be adequate to manage the deformity. However, it is often beneficial to perform lateral canthal repositioning at the same time.

Several lateral canthal surgical procedures are available to provide excellent lid function and contour. Careful analysis of individual patients' anatomy and indications for lateral canthoplasty has resulted in a method of determining the optimum type of procedures to perform. The evolution of the use of the lateral canthoplasty by the senior author (G. W. J.) provides some
insight into the various techniques available. All of the procedures require a precise knowledge of the anatomy and the desire to preserve the external commissure. We have never relied on simple wedge resections for lower lid support or to preserve the lateral canthal anatomy. The reason is that wedge resection only addresses one aspect of the lower lid malposition, namely excess horizontal length. Optimal correction should address all aspects of the pathology to maximize postoperative success.

Early in our experience, the procedure of choice was the tarsal strip with horizontal lid shortening, especially in patients with paralytic ectropion and horizontal lid laxity (Fig. 5, above, left). Because this technique violates the external commissure, problems arose with the procedure, mostly aesthetic in nature (Fig. 5, above, center and right). There was a shortening of the lid and a rounding of the external commissure, which led to patient dissatisfaction (Fig. 5, below). These problems could be eliminated by using the dermal orbicular pennant lateral canthoplasty. This procedure used an extension of the lower lid in the form of a deepithelialized pennant of skin and muscle (Fig. 6, above, left). This method maintained the external commissure while allowing tightening of the lower lid as well as lateral suspension. It is most useful in patients with disparity between the lateral orbital rim and the external commissure of greater than 1 cm (Fig. 6, above, right and below, left and right). The persistent edema between the upper and lower lids that occurs laterally with this technique led to the desire to eliminate the dermal orbicular pennant lateral canthoplasty for cosmetic cases and for selective reconstructions (Fig. 7).
Fig. 5. The tarsal strip with horizontal lid shortening procedure. (Above, left) Preoperative view of a 62-year-old man with horizontal lid laxity and scleral show. (Above, center) Line drawing demonstrating the tarsal strip with horizontal lid shortening technique. (Above, right) Intraoperative photograph demonstrating the development of a tarsal strip. Note the violation of the lateral commissure. (Below) One-year postoperative view after the tarsal strip procedure. There is resolution of the lower lid laxity and scleral show, but note the shortening of the lid and rounding of the lateral commissure.
As the number of cosmetic cases increased, the pitfalls of the horizontal lid shortening and dermal orbicular pennant lateral canthoplasty techniques were realized, leading to the development of a technique that did not have these aesthetic problems. As a result, the inferior retinacular lateral canthoplasty arose from the dermal orbicular pennant lateral canthoplasty, and it was applied for some reconstructive cases but primarily for the cosmetic blepharoplasty patient. The inferior retinacular lateral canthoplasty was created based on a thorough knowledge of anatomy and with a specific purpose, namely the need to avoid aesthetic problems at the lateral canthus. It is most indicated in the cosmetic blepharoplasty patient with a negative vector analysis on lateral view but with a favorable bone to soft-tissue relationship (less than 1 cm discrepancy) (Fig. 8). The inferior retinacular lateral canthoplasty has been described in a separate publication. In brief, the procedure is performed through an upper lid blepharoplasty incision. The lower lid component of the lateral retinaculum is selectively lysed, freeing the lower lid completely from all lateral attachments and allowing for free movement of the lid. The inferior retinaculum is sutured inside the lateral orbital rim to complete the procedure (Fig. 9, above, left). The aesthetic problems seen with the tarsal strip with horizontal lid shortening or the
The dermal orbicular pennant lateral canthoplasty are eliminated with the inferior retinacular lateral canthoplasty, making it ideal for use in the cosmetic surgery patient (Fig. 9, above, right and below, left and right).

Fig. 8. Inferior retinacular lateral canthoplasty. (Above) Preoperative full-face view of a 47-year-old woman before undergoing cosmetic blepharoplasty. (Below, left and right) Preoperative lateral view of the same patient. Note that the disparity between the lateral orbital rim and lateral commissure is less than the 1 cm seen in Figure 6. Also note the negative vector.

Fig. 9. (Above, left) Line drawing demonstrating the inferior retinacular lateral canthoplasty technique. (Above, right) Nine-month postoperative full-face view after cosmetic blepharoplasty and inferior retinacular lateral canthoplasty for lower lid support. Note the good lower lid position. (Below, left and right) Nine-month postoperative lateral views of the same patient. Note the absence of any cosmetic deformities in the lateral canthal region.

As a result of this experience in over 1500 lateral canthoplasties, several conclusions were made. In a patient with a diagnosis of lateral canthal dystopia, the dermal orbicular pennant lateral canthoplasty has become the procedure of choice. These patients are characterized by a bony (lateral orbital rim) to soft-tissue (external commissure) distance of 1 cm or greater. This distance is termed bony to soft-tissue discrepancy. The dermal orbicular pennant lateral canthoplasty allows for correction of the lateral canthal angle while preserving the external commissure.13
When lid laxity or ectropion is the indication for canthoplasty, we still prefer some form of horizontal lid shortening, usually with a tarsal strip. This allows correction of the laxity while allowing canthal resuspension.

In cases of lid retraction, a dermal orbicular pennant lateral canthoplasty may be sufficient to correct the problem if there is associated soft-tissue to bony disparity. If midlamellar (orbital septum, lid retractors) release of the cicatrix causing the lid retraction produces a vertical deficiency, we recommend the use of autogenous auricular cartilage as a spacer graft. Also, palatal mucosal grafts are used when release of the posterior lamella (conjunctiva) produces a vertical deficit.

Finally, for the cosmetic blepharoplasty patient with negative vectors and favorable bony to soft-tissue relationships (less than 1 cm), we recommend the inferior retinacular lateral canthoplasty. This procedure avoids the pitfalls of the horizontal lid shortening and dermal orbicular pennant lateral canthoplasty, making it ideal for the cosmetic surgery situation. The procedure can be performed through an upper lid incision without any incision in the lower lid.

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REFERENCES


