Transcaruncular Medial Canthal Ligament Plication for Repair of Lower Eyelid Malposition

Victor M. Elner, MD, PhD; Hakan Demirci, MD; Asa D. Morton, MD; Susan G. Elner, MD; Adam S. Hassan, MD

Objective: To evaluate the long-term efficacy of transcaruncular medial canthal ligament (MCL) plication in the treatment of eyelid malposition.

Methods: Transcaruncular MCL plication was performed on 176 eyelids of 125 patients with symptomatic ocular exposure due to lower eyelid malposition in which MCL laxity was an important component. Preoperative and postoperative ocular exposure symptoms, lower eyelid position, lagophthalmos, and keratopathy were compared.

Results: At an average ± SD follow-up time of 25 ± 27 months (range, 1-103 months), 88% of preoperative symptoms resolved or improved. Lower eyelid position (P < .001), lagophthalmos (P < .001), and keratopathy (P < .001) were significantly improved. In 11% of eyelids undergoing MCL plication as the only repair, results were comparable with those in which other repairs were performed concurrently. Complications were suture breakage in 2 cases and pyogenic granuloma in 1 case.

Conclusions: Transcaruncular MCL plication is a safe and effective technique for MCL laxity that contributes to lower eyelid malposition. This minimally invasive technique achieves good functional and cosmetic outcomes by re-establishing the vectoral forces for eyelid support that are normally provided by the tripartite ligament.
lower eyelid margin with the eye in primary gaze and with the coronal plane of the patient's head perpendicular to the floor. Lower eyelid retraction, ectropion, entropion, or punctal ectropion were also documented as present or absent. Medial canthal ligament laxity was assessed by laterally distracting the lower eyelid while observing movement of the punctum as previously described. Lagophthalmos, measured during gentle eyelid closure, was measured in millimeters. Superficial punctate keratopathy was graded from 0 to ++ and the percentage of corneal surface involved with keratopathy was multiplied by the grade to derive the corneal exposure index.

SURGICAL METHOD

After we obtained informed consent, we performed transcaruncular MCL plication entirely from a transconjunctival approach as described by Fante and Elner1 or a recent modification of the method (Figure 1). Anesthesia was accomplished with intravenous sedation and local infiltration with bupivacaine 0.5% mixed in equal parts with lidocaine hydrochloride 1% with epinephrine 1:100 000 or with epinephrine supplementation to 1:50 000 as previously described. Briefly, 2 separate small incisions were made: a 5-mm incision through the inferior palpebral conjunctiva to expose the inferior margin of the tarsus just lateral to the ampulla and a 10-mm medial conjunctival fornix incision made posterior to the junction of the caruncle and plica semilunaris. The medial orbital wall peri-orbita posterior to the posterior lacrimal crest was then exposed by blunt dissection performed via the medial fornix incision through the fascial extensions from the medial rectus muscle sheath (check ligament). This anterior orbitotomy approach provides safe passage by preserving the integrity of the medial rectus muscle, the lacrimal canaliculi and sac, and the deep heads of the orbicularis muscle (Horner muscle) constituting the lacrimal pump.

Medial canthal ligament plication using 4-0 clear polypropylene suture on a semicircular P-2 needle (Ethicon, Somerville, NJ) was performed by initiating the passage of the suture either through the eyelid or medial fornix incision. In earlier cases, the suture was initially passed coronally to engage the full height of the medial inferior tarsus just lateral to the ampulla and tunneled deep to the conjunctiva, but superior to the origin of the inferior oblique muscle to reach the medial forniceal incision. Under direct visualization, the needle was then passed to engage the periosteum at or just superior to the posterior lacrimal crest while the globe was gently retracted laterally with a malleable retractor. The suture was then passed retrograde subconjunctivally from the medial forniceal incision to reach the original subtarsal eyelid incision. The suture was tied while observing the tension of the lower eyelid. The tension was ascertained after securing the initial double throw of a surgeons' knot by distracting the eyelid laterally while examining for punctal position with respect to the superior punctum, the kinking of the canaliculus, and the 3-dimensional contour of the medial lower eyelid as compared with the contralateral side. Once these parameters were achieved, the knot was tied permanently and rotated toward the medial orbital wall. The conjunctival incisions were not sutured. In later cases (Figure 1), suture passage was initiated by first engaging periosteum via conjunctival incision followed by passage to the subtarsal eyelid incision, engagement of the tarsus, and retrograde passage to the medial fornix incision. This positions the knot near the orbital wall without the need for suture rotation.

All groups of data are expressed as averages plus or minus standard deviations. Statistical significance of differences between preoperative and postoperative groups of measurements was determined using a 2-tailed t test. Differences between groups were considered to be statistically significant at P<.05.

RESULTS

The transcaruncular MCL plication was performed on 176 eyelids of 125 patients with an average±SD follow-up time of 25±27 months (range, 1-103 months). The average±SD patient age was 66±17 years (range, 10-97 years); there were 70 men and 55 women. Six patients (5%) had a previous history of lateral canthal ligament repair, 2 of whom had had concurrent lower eyelid retractors reinsertion (2%). Two patients (2%) had undergone previous lateral tarsorrhaphy.

The most common preoperative symptoms were epiphora, discomfort, and lower eyelid malposition (Table 1). Postoperatively, 81% of patients' initial symptoms resolved (Table 1) while an additional 7% improved. Medial canthal ligament laxity, present in all eyelids preoperatively, was successfully treated by plication in more than 90% of eyelids (Table 2). Preoperative lower eyelid retraction was present in 128 eyelids (73%) (Table 2). Retraction improved in 120 eyelids (94%) with complete resolution in 98 eyelids (77%) (Figure 2 and Figure 3). Preoperatively, the lower eyelid margin averaged 1.3±1.0 mm inferior to the corneoscleral limbus.
in retracted eyelids (Figure 4). This measure was significantly improved to 0.3±0.8 mm superior to the limbus postoperatively (P<.001). Other lower eyelid malpositions included punctal ectropion, entropion, and entropion, which were present in 9%, 18%, and 9% of patients, respectively (Table 2). These eyelid malpositions responded variably to the procedure. Ectropion resolved in 87% of cases in which it was present, and entropion resolved in 56% of cases (Figure 5). As reported previously, punctal entropion was not effectively addressed in most cases, resolving in only 38% of cases when present.

Preoperative lagophthalmos was present in 56 eyes (32%) (Table 2). Of these eyes, 42 improved (75%), including 22 eyes (40%) that showed complete resolution (Figure 6). Lagophthalmos was significantly improved from an average of 2.3±1.9 mm preoperatively to 1.1±1.6 mm postoperatively (P<.001) (Figure 7).

Preoperative superficial punctate keratopathy was present in 155 eyes (88%) (Table 2). Superficial punctate keratopathy improved in 112 eyes (72%) (72%) of which 53 eyes (30%) showed complete resolution. The initial corneal exposure index averaged 0.3±0.4 mm (Table 2). Superficial punctate keratopathy improved in 112 eyes (72%) of which 53 eyes (30%) showed complete resolution. The initial corneal exposure index averaged 0.3±0.4 mm (Table 2). Superficial punctate keratopathy improved in 112 eyes (72%) (P<.001).

In this large series, most patients had other eyelid abnormalities in addition to MCL laxity that required repair. Lateral canthal ligament repair was the most common additional procedure (70%) followed by midfacial lift (30%), repositioning of lower eyelid retractors (29%), hard palate grafting (18%), and lateral tarsorrhaphy (14%). Seven patients (4%) requiring plication of the MCL whose integrity was compromised by malignant tumor resection also underwent additional reconstructions with flaps or grafts.

Nineteen eyelids of 14 patients had transcaruncular MCL plication as their only surgical repair. Resolution or improvement of symptoms occurred in 16 eyes (84%). Medial canthal ligament laxity was eliminated in 17 eyelids (89%). Superficial punctate keratopathy, present in 15 eyes (79%) preoperatively, was only seen in 9 (47%) postoperatively while the preoperative average corneal exposure index of 0.27±0.04 was improved to 0.03±0.03. Lower eyelid retraction, observed in 11 eyelids (38%) preoperatively, improved from an average of 2.3±1.9 mm preoperatively to 1.06±1.4 mm superior to the limbus. Preoperative lagophthalmos, seen in 6 eyes (32%), improved in all eyes (100%) and completely resolved in 5 (83%). Improvement in all of these parameters was similar to the overall patient population when compared statistically.

No complications occurred during any of the operations. Postoperative complications were suture breakage in 2 cases and a pyogenic granuloma in 1 case. Early postoperative kinking of the lower eyelid margin, sometimes occurring just lateral to the punctum at the site of tarsal suture anchoring, resolved in the early postoperative period. Postoperative swelling, limited to the caruncle and semilunar fold region, resolved in all cases within 3 weeks. No patient developed wound infection or complained of postoperative ocular surface irritation.

**Table 1. Symptoms Due to Lower Eyelid Malposition at First and Last Visits**

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Preoperative</th>
<th>Postoperative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asymptomatic</td>
<td>3 (2)</td>
<td>102 (82)</td>
</tr>
<tr>
<td>Symptomatic</td>
<td>42 (34)</td>
<td>11 (9)</td>
</tr>
<tr>
<td>Epiphora</td>
<td>24 (19)</td>
<td>9 (7)</td>
</tr>
<tr>
<td>Discomfort</td>
<td>14 (11)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Ectropion</td>
<td>14 (11)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Unable to keep the prosthesis</td>
<td>12 (10)</td>
<td>0</td>
</tr>
<tr>
<td>Dryness</td>
<td>6 (5)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Unable to close the eye</td>
<td>4 (3)</td>
<td>0</td>
</tr>
<tr>
<td>Lower eyelid entropion</td>
<td>6 (5)</td>
<td>NA</td>
</tr>
</tbody>
</table>

**Table 2. Clinical Features of Lower Eyelid Malposition at First and Last Visits**

<table>
<thead>
<tr>
<th>Clinical Feature</th>
<th>Preoperative</th>
<th>Postoperative</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCL laxity</td>
<td>Absent</td>
<td>0</td>
</tr>
<tr>
<td>Absent</td>
<td>120 (68)</td>
<td>142 (81)</td>
</tr>
<tr>
<td>Present</td>
<td>56 (32)</td>
<td>34 (19)</td>
</tr>
<tr>
<td>Punctal entropion</td>
<td>Absent</td>
<td>160 (91)</td>
</tr>
<tr>
<td>Absent</td>
<td>144 (82)</td>
<td>172 (98)</td>
</tr>
<tr>
<td>Present</td>
<td>32 (18)</td>
<td>4 (2)</td>
</tr>
<tr>
<td>Lower eyelid retraction</td>
<td>Absent</td>
<td>155 (88)</td>
</tr>
<tr>
<td>Absent</td>
<td>102 (58)</td>
<td></td>
</tr>
<tr>
<td>Entropion</td>
<td>Absent</td>
<td>160 (91)</td>
</tr>
<tr>
<td>Absent</td>
<td>16 (9)</td>
<td>7 (4)</td>
</tr>
</tbody>
</table>

**Abbreviations:** MCL, medial canthal ligament; NA, not applicable.

**COMMENT**

The MCL comprises 3 limbs that serve to anchor the medial end of the tarsus to the bone of the maxilla anteriorly, the periosseum overlying the lacrimal bone posteriorly, and the dense connective tissue overlying the fundus of the lacrimal sac superiorly.5-8 Together these MCL structures provide for posterior, medial, and superior vectoral support for the lower eyelid. Such support is essential to maintain lower eyelid height and contour, proper apposition of the lower eyelid to the globe, and support for lacrimal pump function. Medial canthal liga-
ment laxity has the potential to compromise each of these functions, particularly when the laxity is not compensated by good orbicularis oculi muscle tone. The patients in this study all exhibited symptoms and signs of MCL functional compromise due to laxity or loss. The most common symptoms were epiphora, discomfort, and visible malposition of the lower eyelid (Table 1) while the predominant signs were lower eyelid retraction, lagophthalmos, and exposure keratopathy (Figures 4, 7, and 8).

To address the functional need to restore posterior and superior support of eyelids with symptomatic medial canthal ligament laxity, we developed and applied a transcaruncular approach for MCL plication. This technique demonstrated promise in our initial study by resolving symptoms in 23 eyelids of 15 patients during a mean follow-up period of 12 months. In this study, we report the results using this method on 176 eyelids of 125 patients followed up for an average of 2 years. Our present results confirm our initial findings and show significant improvement in virtually all symptoms and signs while demonstrating that the benefits remain stable over time. Transcaruncular MCL plication was equally effective whether performed alone or in conjunction with other procedures to repair symptomatic lower eyelid malposition.

Medial canthal ligament plication, as initially described, addressed the anterior limb. Ritleng and Sullivan and Collin first reported methods to provide posterior support as a component of MCL plication to address shortcomings of anterior plication, principally poor eyelid-globe apposition resulting in epiphora and ocular exposure. Both of these techniques involve full-thickness eyelid and canalicular resection to access and shorten the posterior limb, requiring complex repair of the eyelid and lacrimal drainage system. Jordan et al published a simi-
lar method using a medial tarsal strip, which resects a portion of the medial eyelid, sacrificing the punctum and canaliculus. Edelstein and Dryden\textsuperscript{11} described a complex transcutaneous approach to expose the medial orbital periosteum from which a flap is woven through the canicular region to reach the tarsus. Subsequent to our initial report,\textsuperscript{1} Moe and Kao\textsuperscript{17} reported an interesting anatomical approach consisting of a precaruncular technique in the region occupied by the common canaliculus that requires a long incision parallel and adjacent to the canaliculus and an anchoring suture placed to the medial edge of the tarsus where the ampulla is located.

Our method of MCL plication provides support that simulates the normal vectoral forces exerted by the tripartite ligament. It achieves this through passage parallel to the posterior limb while allowing the surgeon to direct the plication superiorly by modifying the location of the periosteal anchoring. This method of MCL plication provides posterior, medial, and superior eyelid support. The transcaruncular technique is rapid and requires no skin incisions or tissue resection. Damage to the lacrimal drainage system is avoided. There are no wounds that require closure. The procedure requires minimal manipulation of medial canthal structures and may be per-

Figure 5. Severe left and mild right ectropion treated with medial canthal ligament plication and lateral canthal repair in an 81-year-old woman. Appearance before (A) and after (B) surgical correction.

Figure 6. Severe paralytic right lower eyelid ectropion and lagophthalmos treated with medial canthal ligament plication and lateral tarsorrhaphy in a 66-year-old man. Appearance before (A) and after (C) surgical correction. Preoperative lagophthalmos (B) was substantially improved following surgical correction (D).
formed using local anesthesia. Our recent modification of the suture passage has eliminated the need for suture rotation, making the procedure easier to perform and less traumatic. Limited dissection and short operative time reduce postoperative morbidity and complications. The method has proven to be safe with few complications or adverse effects. The MCL procedure has resulted in excellent cosmesis and patient acceptance.

This procedure does not supplant transnasal wiring, microplate, and anchor techniques used for MCL avulsions and craniofacial reconstructions and is not consistently effective in treating patients with significant punctal ectropion (Table 2). This inconsistency is caused by the plicating suture’s engagement of the inferior tarsal margin. This results in a vectorial force that itself is unable to rotate the punctum inward. In cases in which the technique is successful in resolving punctal ectropion, plication-dependent improved pretarsal orbicularis oculi muscle position and tone is probably responsible. To directly address punctal ectropion, we described a modification of this technique in which an anterior limb of the plicating suture is added to brace the anterior surface of the tarsus and canaliculus.

The transcaruncular technique for MCL plication targets the functional and cosmetic needs of patients with medial ligament laxity, regardless of severity. Alone, or in conjunction with adjunctive procedures, this technique has demonstrated efficacy and high patient satisfaction.

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Correspondence: Victor M. Elner, MD, PhD, University of Michigan, Kellogg Eye Center, 1000 Wall St, Ann Arbor, MI 48105 (velner@umich.edu).

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REFERENCES