Unilateral Frontalis Sling for the Surgical Correction of Unilateral Poor-Function Ptosis


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Purpose: To evaluate the functional and cosmetic results after frontalis sling repair for unilateral ptosis associated with either poor levator function or synkinesis.

Methods: Preoperative and postoperative photographs and records of 127 patients who underwent unilateral frontalis sling ptosis repair were retrospectively reviewed. An eyelid crease incision was used in all cases, with suturing of the sling material directly to tarsus.

Results: Preoperative diagnosis for all patients was either unilateral poor-function blepharoptosis or ptosis associated with levator synkinesis. Underlying causes included 75 congenital, 13 posttraumatic, 11 congenital “jaw-winking,” 10 cranial nerve III palsies, 9 myasthenia gravis, 5 chronic progressive external ophthalmoplegia, and 4 congenital “double-elevator” palsies. There was a mean follow-up of 11.6 months. Twenty-eight eyelids required reoperation: 11 for undercorrection, 6 for overcorrection with keratopathy, 2 for upper eyelid crease revision, 7 for correction of poor contour, 1 for a broken sling, and 1 for removal of an infected exposed polytetrafluoroethylene sling. Lagophthalmos of greater than 2 mm was noted in 18 patients, 5 of whom had persistent keratopathy requiring reoperation. No other complications were reported, except for 1 suture granuloma. Good to excellent final postoperative eyelid height was achieved in 121 patients (95%) after all surgeries and with conscious recruitment of the frontalis muscle. A large majority of patients and/or parents expressed satisfaction with the final cosmetic result and were not bothered by any asymmetric lagophthalmos in downgaze or lack of a synchronous blink. However, 19 of 25 amblyopic patients were less satisfied with passive eyelid height as they failed to recruit the ipsilateral frontalis muscle to activate the sling during binocular viewing. In 17 of these 19 patients, good to excellent eyelid height could be achieved with conscious active brow elevation.

Conclusions: Unilateral sling provides good to excellent functional and cosmetic results in unilateral poor-function ptosis. However, patients with amblyopia usually require conscious effort to activate the frontalis muscle to achieve satisfactory eyelid height.

The ideal treatment of unilateral blepharoptosis with poor or asynchronous levator muscle function has yet to be established.¹ Although authors agree on the need for frontalis suspension of the affected eyelid, management of the contralateral eyelid remains controversial. Three approaches to the contralateral eyelid have been advocated: to leave it undisturbed,¹ to suspend it from the frontalis muscle without excising the levator muscle,⁷ or to extirpate the levator muscle so as to create a bilateral ptosis that is then corrected through a bilateral frontalis suspension.⁵ Khwarg et al.⁴ favored a bilateral frontalis suspension with contralateral levator weakening as the appropriate alternative for the treatment of Marcus Gunn jaw-winking ptosis. Similarly, in a more recent report, Bowyer and Sullivan⁵ recommended bilateral levator weakening followed by frontalis suspension “to ensure a symmetrical result in primary gaze and down-gaze.” In contrast, our approach has been to initially perform unilateral suspension, with the possibility of subsequent contralateral surgery if the postoperative result is judged unsatisfactory. Herein we report our results after unilateral frontalis suspension for correction of unilateral ptosis.

METHODS

The records of all patients who underwent a unilateral frontalis suspension procedure to treat unilateral ptosis by four of the authors from 1989 to 2001 were retrospectively reviewed. Preoperative and postoperative photographs in primary gaze and downgaze were compared and used in conjunction with the notes in the medical records to rate the final results. The underlying causes of ptosis in our series are listed in the
Underlying causes of ptosis (total n = 127 patients)

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congenital</td>
<td>75</td>
</tr>
<tr>
<td>Third-nerve palsy</td>
<td>10</td>
</tr>
<tr>
<td>Jaw wink</td>
<td>11</td>
</tr>
<tr>
<td>Posttraumatic</td>
<td>13</td>
</tr>
<tr>
<td>Myasthenia gravis</td>
<td>9</td>
</tr>
<tr>
<td>Chronic progressive external ophthalmoplegia</td>
<td>5</td>
</tr>
<tr>
<td>Double elevator palsy</td>
<td>4</td>
</tr>
</tbody>
</table>

Table. In all patients, margin reflex distances (MRD1) in primary gaze with frontalis muscle at rest were less than 1 mm. Levator function measured less than 5 mm in the majority of patients. Levator function was greater than 5 mm in some myasthenic patients (where upper eyelid height and function were variable) and in some patients with jaw-winking synkinesis.

Informed consent was obtained from all patients or parents before surgery. Patients and/or parents were advised of the various options of repairing unilateral ptosis including unilateral frontalis suspension, bilateral frontalis suspension, or bilateral suspension with contralateral levator extirpation. Unilateral frontalis suspension was recommended, but the option of subsequent suspension of the contralateral eyelid was offered in the event of unsatisfactory postoperative asymmetry.

Surgery was performed under general anesthesia for all children and local anesthesia with sedation in all adults. Five to 6 ml of a 1:1, 2% lidocaine with 1:200,000 epinephrine and 0.5% bupivacaine was injected in surgical sites. The operative steps are outlined in Figure 1. Marks for the suprabrow incisions are made at the superior border of the eyebrow above the medial and lateral canthi, and a third incision site is marked halfway between these two. An eyelid crease incision site is marked in symmetry with the contralateral upper eyelid. Cutaneous incisions are made with a No. 15 blade at the three suprabrow sites, and 6-mm subcutaneous pockets are dissected. The eyelid crease is incised; dissection is carried through the orbicularis muscle and levator aponeurosis to expose the proximal third of the tarsus. The sling material (autogenous fascia lata in 63 cases, exposed polytetrafluoroethylene in 41 cases, silicone rods in 16 cases, and supramid sutures in 7 cases) is sutured directly to the tarsus with two 5–0 Mersilene sutures. Superior traction on the ends of the sling material allows inspection of eyelid contour; the Mersilene sutures are repositioned as needed. The sling material is passed deep into the orbital septum with the aid of a Wright fascia needle and brought through the medial and lateral suprabrow incisions. The ends of the sling are reintroduced through the medial and lateral stab incisions and brought together in the submuscular plane to the central brow incision, creating a pentagonal sling. The eyelid crease incision is closed with absorbable sutures fixed to the superior tarsal border. Careful tensioning of the two ends in the central brow incision allows adjustment of eyelid height. The two ends are tied; the knot and the ends of the sling are tucked deep to frontalis muscle through the central brow incision. The brow incisions are closed with interrupted absorbable sutures.

Postoperative eyelid height and contour, crease symmetry, lagophthalmos, blink, and corneal exposure were assessed in all patients. Based on the criteria recommended by Tarbet et al. (“Frontalis suspension for severe unilateral congenital ptosis with poor levator function,” presented at the ASOPRS Annual Meeting, New Orleans, Louisiana, 1998), eyelid height was judged to be “excellent” if MRD1 measured more than 2 mm or if the difference in MRD1 between the two eyelids (asymmetry) was equal to or less than 1 mm, “good” if MRD1 ranged from 1 to 2 mm or if asymmetry was 1.5 to 2 mm, and “poor” if MRD1 measured less than 1 mm or if asymmetry was greater than 2 mm. Eyelid height was assessed in primary gaze without the patient consciously recruiting the frontalis muscle. In cases with MRD1 less than 2 mm, the patient was asked to voluntarily activate the ipsilateral frontalis muscle to attain maximal eyelid height.

Complications of infection, exposure of sling material, granulomas, undercorrections, overcorrections, exposure keratopathy, or poor cosmesis were noted. At follow-up, all patients or parents were asked if they were satisfied with the surgical outcome and were offered a second surgery on the “normal” side if they judged asymmetric lag in downgaze to be unacceptable.

**RESULTS**

Forty-nine right upper eyelids and 78 left upper eyelids of 127 patients underwent unilateral frontalis sling procedure for the correction of unilateral ptosis. There were 74 male and 53 female patients, ranging from 3 months to 95 years of age (mean, 25.2 years old). Thirty-two patients had had previous ptosis surgery performed elsewhere. Twenty-three patients had strabismus and 25 had amblyopia on the side of the ptotic eyelid. With a mean follow-up of 11.6 months (range, 1 week to 96 months), final eyelid height was rated good to excellent in 121 of 127 cases (95%) after all surgeries and with the active recruitment of the frontalis muscle (Fig. 2). The contour was found to be excellent in 93% of eyelids. Contour was rated unsatisfactory if it was peaked, asymmetric to the contralateral side, or still showing a substantial degree of lash ptosis. Reoperation was required in 28 eyelids: 17 for undercorrection, 7 for poor contour, 6 for overcorrection with persistent keratopathy, 2 for upper eyelid crease revision, and 1 for broken fascia lata sling that occurred during the immediate postoperative period. The time to reoperation ranged from 1 week to 7 years. After all surgeries, 3 cases were still undercorrected; 2 amblyopic patients showed low upper eyelid height even with active contraction of the frontalis muscle; one patient with congenital ptosis had an MRD1 of 0.5 mm 1 week after surgery and was lost to follow-up. Among the 25 patients from the amblyopic group, 19 patients were undercorrected during binocular viewing. In 17 of the 19, occlusion of the contralateral eye or conscious elevation of the eyebrows resulted in good to excellent eyelid height. The remaining 6 amblyopic patients had excellent eyelid height in repose during binocular viewing. Lagophthalmos exceeded 2 mm in 18 patients after the first surgery. Five patients had severe keratopathy that resolved after reoperation. Seven patients had moderate keratopathy that resolved with medical treatment, and 6 did not exhibit keratopathy despite lagophthalmos. In one patient with a fascia lata sling, a suture granuloma, presumably reactive to a 5–0 Mer-
FIG. 1.  A, Three-month-old child with severe poor-function left upper eyelid ptosis thought to be at risk for amblyopia. B, Preoperative marking of eyelid crease incision and medial, central, and temporal brow incisions. C, Exposure of the tarsal plate through an eyelid crease incision. D, Suturing of Gore-Tex strip directly to tarsal plate with 5–0 Mersilene sutures. E, Use of fascia needle to retrieve strips through brow incisions. F, Upward traction placed on the two strips to assess eyelid contour. G, Strips tied centrally to provide sufficient tension to achieve desired eyelid height. H, Gore-Tex strips are buried centrally and stab incisions are closed. I, Appearance 1 week after surgery. J, Appearance 9 months after surgery (the head is slightly tilted).
sulene tarsal suture, resolved after in-office removal of the suture. There were 2 cases of presumed infection, both in exposed polytetrafluoroethylene cases; one resolved with oral antibiotic therapy, whereas the other required reoperation and sling removal. There were no cases of extrusion or eyebrow reaction. The vast majority of patients or parents were satisfied with the functional and cosmetic result of the unilateral frontalis sling procedure. The 19 patients with amblyopia who did not appear to be recruiting their frontalis muscle during binocular viewing were less satisfied. Asymmetric lag in downgaze was present in all patients but was never the subject of cosmetic complaint. None requested or accepted a second procedure on the contralateral eyelid when this was proposed to improve symmetry in downgaze.

DISCUSSION

Resection of the involved levator muscle or aponeurosis is generally the procedure of choice when attempting surgical correction of unilateral ptosis. This procedure is less successful in patients with reduced levator function. In patients with poor levator function, “supramaximal” resection has shown variable results, and it risks problematic lagophthalmos. Consequently, frontalis suspension surgery is generally the procedure of choice when the levator muscle either has poor function or is aberrantly innervated. A successful frontalis suspension procedure relies on the patient’s spontaneous recruitment of the ipsilateral frontalis muscle to achieve a full binocular visual field.

There is controversy relating surgical options for unilateral ptosis with abnormal levator muscle function. Beard, concerned about asymmetry between the suspended and contralateral eyelids, advocated excision of the normal levator muscle, creating bilateral ptosis, and frontalis suspension of both eyelids. This seems to be the preference of many surgeons. Callahan suggested bilateral slings, but with preservation of the contralateral levator muscle. This produces symmetrical lag in downgaze but allows the functioning levator muscle on the nonptotic side to elevate the eyelid in primary position. The two aforementioned procedures impose dysfunction on a normal eyelid and impart some risk to the underlying normal globe. One of the authors encountered a patient with ulcerated exposure keratopathy and visual loss in the contralateral “good” eye after a bilateral sling procedure for unilateral severe ptosis. This prompted us to contemplate the advantages of unilateral surgery. Some authors advocate bilateral surgery to achieve symmetric lag in downgaze and symmetric asynchronous blink. However, in our experience, results are excellent with unilateral surgery. In nonamblyopic patients, spontaneous unilateral frontalis recruitment in primary gaze is usually present before surgery and is maintained after

surgery, allowing full binocular visual fields. Most patients are not bothered cosmetically by asymmetric eyelid lag in downgaze, learning to mask this by changing their head position. In fact, in this series, no patient or parent was dissatisfied and requested an operative procedure on the "normal" side to achieve better cosmesis.

Less successful results in unilateral frontalis sling surgery can result from eye dominance, amblyopia, and failure to recruit the ipsilateral frontalis muscle; from the cause of the ptosis; or from the patient's and/or parents' expectations. In fact, a majority of our amblyopic patients failed to recruit the frontalis muscle to lift the suspended eyelid because of a fixation preference for the contralateral eye. For these patients, it is not clear that extirpating the "good" levator will result in better frontalis recruitment on the opposite side. Our experience in observing unilateral ptosis is that frontalis recruitment is unilateral and limited to the ptotic side. We have also found that asymmetric frontalis recruitment can occur in patients who have undergone bilateral suspension for bilateral ptosis if one eye is amblyopic.

REFERENCES


COMMENTARY ON UNILATERAL FRONTALIS SLING FOR THE SURGICAL CORRECTION OF UNILATERAL POOR-FUNCTION PTOSIS

To the uninitiated, repair of blepharoptosis seems straightforward. Unfortunately, the ophthalmic facial plastic surgeon realizes that these cases are, in fact, quite challenging. The most difficult cases include unilateral ptosis with poor levator function. This situation may arise from congenital myogenic ptosis, IIIrd-nerve palsies, Marcus Gunn jaw-wink ptosis, trauma, and variations of progressive external ophthalmoplegia and myasthenia gravis.

Given the poor levator function (≤4 mm) in these cases, maximal levator resection tends to undercorrect patients in primary position, and asymmetry persists between the eyelids in upgaze and downgaze. Therefore, frontalis slings are often preferred, as they at least typically achieve symmetry in primary position, although upgaze and downgaze asymmetries continue.

Technically, the problem with the unilateral sling is that the good eye can be opened without frontalis muscle use; thus there is little incentive for the patient to use the frontalis to elevate the ptotic eyelid. By addressing this issue, good symmetry can usually be obtained in primary position by placing the ptotic eyelid at the desired "open" position without frontalis action. The orbicularis oculi muscle can be forcefully used to help close the eye. The simplest frontalis suspension approach includes a unilateral silicone sling of the affected side. The beauty of this material is that it can be tightened, loosened, or removed years later through a small frontal incision. Other materials may be preferable on a case-by-case basis. There is increasing agreement that early placement in young children appears to yield the best results, as suggested by Kersten et al.

Alternatively, Beard described the weakening of the normal levator muscle, thus creating bilateral severe ptosis. This can be treated with bilateral frontalis slings, and good upper eyelid symmetry can be achieved in all positions of gaze, although there will be equal lagophthalmos in downgaze. The biggest problem with this approach is that most patients, or families of patients, are reluctant to destroy a normal levator for the sake of cosmesis. Therefore, many surgeons prefer to leave the normal levator alone, yet place bilateral "tight" slings at the desired "open" level with the frontalis relaxed ("Chicken" Beard procedure). In this way, symmetry is achieved in primary position and downgaze (the normal eyelid movement is restricted by the sling in these positions, just as the abnormal side). However, there is still asymmetry in upgaze.

Kersten et al. present an interesting series reporting excellent success with unilateral slings. Although I agree that unilateral slings can be useful, it is unclear that this work validates this point. The paper is retrospective and measures success on the basis of patient photos and chart notes, with comments such as "the patients and/or parents expressed satisfaction with the cosmetic result . . ." Further, the follow-up is limited in many of the cases (mean, less than 1 year). These issues raise concern as to the value of their "success" scoring.

The authors also included cases in this series in which the ptosis had various causes, including congenital ptosis, trauma, jaw-wink, IIIrd-nerve palsies, myasthenia gravis, chronic progressive external ophthalmoplegia, and "double elevator" palsies. These all have unique characteristics that predispose to various postoperative
complications, and different types of ptosis may be better handled by one suspension material or another. Patients with IIIrd-nerve palsies, myasthenia gravis, and chronic progressive external ophthalmoplegia typically have limited ocular motility, particularly in upgaze. This places these patients at increased risk of postoperative corneal exposure due to a poor Bell’s phenomenon. Thus, these patients should have slings placed that can be adjusted if necessary, and it is well known that reoperations may be more successful with some sling materials than with others. For example, it is difficult to adjust fascia lata slings but relatively simple to revise silicone. The wide range of patient ages at the time of sling placement may also play a role in the success or failure of the procedure. There is growing anecdotal evidence that patients with unilateral slings placed early (younger than age 2 years) have a greater ability to open the affected eyelid with the frontalis muscle and better symmetry. There is no attempt in this report to account for these confounders to the analysis.

The authors do make the important point that unilateral slings can be useful in the management of severe unilateral ptosis with poor levator function. There is little doubt about this. However, the reader should be aware that severe unilateral ptosis can have different causes, and each of these may be expected to respond differently to specific sling materials over time. This kind of subset analysis might provide additional useful information to the reader.

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REFERENCES