Modified Frontalis Sling Procedure with Lid Crease Formation

Maryam Aletaha, MD; Hossein Salour, MD; Abbas Bagheri, MD
Nasrin Raffati, MD; Ali Masoudi, MD

Ophthalmic Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran

**Purpose:** To report the results of a modified frontalis sling procedure using Mersilene mesh for correction of upper lid ptosis associated with poor levator muscle function.

**Methods:** This interventional case series included 10 patients (15 eyelids) with congenital ptosis and poor levator function. All subjects underwent the upper lid sling procedure with modifications. Main outcomes were lid crease height and position.

**Results:** Overall, 15 eyelids from ten patients including 7 male and 3 female subjects underwent surgery. After a mean period of 10.2±2.8 months, all cases had symmetrical lid crease and contour; upper lid margin to corneal reflex distance and lid fissure were both increased significantly.

**Conclusion:** This modified frontalis sling procedure may be considered as an alternative to conventional surgery; this method provides good cosmesis and is associated with a low rate of reoperations.

**Keywords:** Frontalis Sling; Ptosis; Crease Formation

---

**INTRODUCTION**

Blepharoptosis is drooping of the eyelid which may be congenital or acquired after birth. Correction of blepharoptosis may be considered a challenge to oculoplastic surgeons. Although the functional and visual outcomes of severe blepharoptosis are important, especially in children, acceptable cosmetic results achieved by creating symmetrical upper lid crease, palpebral fissure and lid contour are also important. A variety of procedures have been advocated to improve eyelid appearance and provide acceptable cosmesis. Symmetrical lid fissure height and lid crease are important for facial beauty, especially in female subjects.

Selection of the surgical procedure to correct abnormal lid position should be based on levator muscle function, and other ocular and periocular factors. Frontalis muscle sling with autogenous or exogenous material has been the recommended procedure for correction of lid ptosis associated with poor levator function (less than 4 mm) for many decades. The basic method has remained unchanged since its inception except for the incorporation of new materials.

In this article, we present the results of a modified frontalis sling procedure.

**METHODS**

From September 2009 to September 2010, ten consecutive patients (15 eyelids) with poor levator function ptosis who were referred to the oculoplastic service at Labbafinejad Medical Center were included in this study. Patients...
with unilateral or bilateral congenital ptosis and levator function less than 4 mm were enrolled. Exclusion criteria were previous lid surgery, history of lid laceration, weak Bell’s phenomenon (less than 2+), dry eye and other ocular surface abnormalities, and systemic disorder associated with ptosis, such as myasthenia gravis, myotonic dystrophy, dysthyroid ophthalmopathy, blepharophimosis and chronic progressive extraocular ophthalmoplegia.

Preoperative Evaluation

All patients underwent a complete eye examination in addition to ptosis examination. Ptosis examination included measurement of eyelid crease height, lid fissure height (distance between the center of the upper and lower lid margins) in primary gaze, levator muscle function, upper lid margin-reflex distance (MRD-1, distance between the upper lid margin center and the corneal light reflex), lower lid margin-reflex distance (MRD-2, distance between the lower lid margin center and the corneal light reflex), lagophthalmos, scleral show, and Bell’s phenomenon, ranging from 4+ (implying complete disappearance of the cornea underneath the upper lid) to zero (corresponding to complete absence of Bell’s phenomenon).

MRD-1 and lid fissure height measurements were performed 1, 8, and 24 weeks postoperatively. Photography was performed preoperatively and repeated at 8 weeks and 24 weeks for evaluation of upper lid contour and symmetry. Eyelid crease height was also assessed. Postoperative complications, such as corneal surface disorders, overcorrection, undercorrection and granuloma formation were also evaluated.

Acceptable results consisted of crease and eyelid fissures that were symmetrical (≤1 mm difference) and of appropriate height.

Operative Technique

A 4-0 silk traction suture was placed through the gray line at the center of the upper eyelid. After placing a lidplate for protection of the globe and using a #15 scalpel, two horizontal incisions 2 mm in length were made in the upper lid, 6 mm above the lash line through the skin and pretarsal muscle down to the tarsus. The temporal incision was placed over the 3 o’clock position of the limbus, and the nasal incision was placed over the 9 o’clock position of the limbus.

Three incisions, 2 mm in length were made above the upper border of the eyebrow in the skin and subcutaneous tissues to reach the frontal periosteum. The middle incision was placed 5 mm above the eyebrow but the medial and lateral incisions were placed at the upper border of the eyebrow. The distance between the medial and lateral incisions with the middle incision was equal to the distance between the two upper lid incisions (Fig. 1).

A band of Mersilene mesh (Mersilene, Ethicon Inc., Somerville, NJ, USA) measuring 15 cm in length and 5-7 mm in width was inserted in a pentagonal fashion into the upper eyelid using a Wright needle, as shown in figure 1. With the lid plate in place, the Wright needle was inserted into

Figure 1. Schematic view of the surgical technique (ab=cd=de=X).
the medial brow incision down to the periosteum and was passed across the orbital rim without incorporating the periosteum. The needle was directed inferiorly and posteriorly to pass between the orbicularis muscle and levator muscle toward the medial lid incision, anterior to the tarsal plate and subsequently emerged through the incision. The Mersilene mesh band was threaded through the needle. Next, the needle was withdrawn, pulling the band of Mersilene mesh through the medial incision and out the medial brow incision. Thus, the Mersilene mesh passed through the upper lid in a pentagonal fashion.

Both strands of mersilene mesh at the middle brow incision were pulled tightly enough to produce a good lid fold and to elevate the lid margin such that it crossed the upper limbus with the eye in primary position. Next, the free ends were tied and the knots were sutured with 5-0 polypropylene suture material and buried under the frontalis muscle.

The middle brow incision was sutured with 5-0 polypropylene. Other skin incisions were left unsutured due to their small size.

After completion of the procedure, gentamycin ointment was applied, and a Frost suture was placed using 6-0 silk suture material. Mild compressive dressings were applied for corneal protection for one day. Oral cephalaxin (100 mg/kg) was prescribed for five days. The Frost suture was removed if no corneal epithelial defect was present; otherwise removal of the Frost suture was deferred until the corneal epithelial defect had healed completely. For patients with no complications, follow-up visits were performed 1 and 4 weeks, and 3 months after the operation. If necessary, the patients were examined more frequently. Photography was performed at every visit to document the results of the procedure.

RESULTS
A total of 15 eyelids of 10 patients including seven male subjects with mean age of 10.7±10.1 (range, 2 to 28) years underwent the modified sling procedure. All subjects had congenital ptosis associated with poor levator function; five patients (50%) had unilateral while the other five (50%) had bilateral ptosis.

After mean follow-up of 10.2±2.8 (range, 6 to 14) months, satisfactory results in terms of symmetrical lid fissure and lid crease, and less than 1 mm of undercorrection were achieved in all cases (Fig. 2).

Lid fissure height was significantly increased by a mean of 3.49 mm, and MRD1 was increased by a mean of 3.45 mm postoperatively (P=0.001 and P=0.001, Wilcoxon signed-ranks test).

Punctate epithelial erosions were present in 3 cases and were treated without any sequelae. Undercorrection of approximately 1 mm did occur in 5 lids; all of these cases were unilateral.

DISCUSSION
Upper eyelid ptosis is a common problem encountered by oculoplastic surgeons. Unacceptable results and complications such as lagophthalmos or unacceptable lid crease height, are red flags indicating that reoperation is necessary. The frontalis suspension sling is the traditional surgical approach for blepharoptosis with poor levator muscle function, which is primarily encountered in congenital or acquired myogenic and neurogenic ptosis.1-6

Using the conventional approach, eyelid incisions are placed 2 mm above the eyelashes and exogenous material is subsequently inserted within the upper lid between the orbicularis and levator muscles, and above the eyebrow beneath the frontalis muscle without periosteal engagement using a Wright needle.1-6

In this modified technique, we placed the eyelid incisions 6 mm above the lash line, which lies at the lid crease line in children. A higher skin incision results in a much more normal eyelid crease after surgery, especially when the ptosis is unilateral, thereby reducing the need for reoperation for crease formation. Furthermore with this approach, if the eyelid lacks a crease, it can be created. Higher placement of the sling material within eyelid tissues reduces surgery-induced bulkiness of the upper eyelid.

Various suggestions have been made to create a normal lid crease following the sling procedure. One study reported making a crease incision and directly anchoring sling material to the tarsus, then passing it towards the eyebrow.
using a Wright needle similar to the conventional procedure. At the end of the operation, the height of the lid crease is adjusted using incision sutures, which puncture the tissue at sufficient depth to achieve a normal appearance. An extra lid incision results in more tissue damage and a longer healing period. Additionally surgical time is increased compared to the procedure used in the current study.

Another study reports a refined procedure that consists of a circular type of frontalis sling, which is similar to methods previously described.

Other surgeons prefer to reform the eyelid crease in a separate operation a number of months after the sling procedure. Two-stage procedures require more time for hospitalization and incur greater cost than single-stage procedures. Furthermore in younger patients, general anesthesia is required for each procedure.

Figure 2. Photographs of three representative patients with congenital ptosis before surgery (left column) and 24 weeks after the modified sling procedure (right column). The last patient had bilateral ptosis.
We recommend that during passage of the needle between the upper eyelid incision and those placed above the eyebrow, the frontalis muscle should be engaged. We believe that this modification will improve surgical outcomes by enhancing frontalis muscle power available to lift the upper eyelid.

Higher placement of sling material with our modified technique may reduce the lifting effect of the sling procedure as compared to lower placed slings, especially in children. The mild undercorrection of approximately 1 mm observed in children in our study may be due to the smaller size and height of the eyelid in children. This level of undercorrection is cosmetically insignificant.

Various methods of constructing the sling are similarly effective, however we prefer to insert material within the eyelid in a pentagonal configuration. With this method, one can more effectively transfer the power of the frontalis muscle to the upper eyelid due to the increased bulk of upper eyelid tissue engaged with the sling material (in comparison with the single-triangle or rhomboid approach) while using only a single needle passage and exogenous material through the eyelid (in comparison with the double-triangle or -rhomboid approach). This approach entails less tissue damage, fewer skin incisions and reduced surgical time as compared to previous methods.

We placed the medial and lateral brow incisions above the eyebrow closer to the middle one which is different from the conventional method in which medial and lateral incisions are made on lines perpendicular to the medial and lateral canthi. This modification reduces eyelid and eyebrow tissue bulk postoperatively; upper lid lifting becomes more effective and eyelid contour achieves a more normal appearance.

In summary, the modified frontalis sling procedure described herein may be considered to be a simple alternative method achieving good cosmetic results for correction of upper lid ptosis associated with poor levator function.

Conflicts of Interest
None.

REFERENCES
1. Della Rocca RC, Bedrossian EH, Arthurs B. Ophthalmic plastic surgery: decision making and techniques. New York: McGraw Hill; 2012.
2. Ellis FD, Ellis FJ. Correction of Blepharoptosis in Children; Duane’s Ophthalmology. 2008 CD-ROM Edition.
3. Deenstra W, Melis P, Kon M, Werker P. Correction of severe blepharoptosis. *Ann Plastic Surg* 1996;36:348-353.
4. Nesy FA. Smith’s ophthalmic plastic and reconstructive surgery, 2nd ed. St. Louis: Mosby; 1998.
5. Della Rocca RC, Bedrossian EH, Arthurs B. Ophthalmic plastic surgery: decision making and techniques. New York: McGraw Hill; 2012.
6. Ellis FD, Ellis FJ. Correction of Blepharoptosis in Children; Duane’s Ophthalmology. 2008 CD-ROM Edition.
7. Deenstra W, Melis P, Kon M, Werker P. Correction of severe blepharoptosis. *Ann Plastic Surg* 1996;36:348-353.
8. Nesy FA. Smith’s ophthalmic plastic and reconstructive surgery, 2nd ed. St. Louis: Mosby; 1998.
9. Allard FD, Durairaj VD. Current techniques in surgical correction of congenital ptosis. *Middle East Afr J Ophthalmol* 2010;17:129-133.
10. Wong VA, Beckingsale PS, Oley CA, Sullivan TJ. Management of myogenic blepharoptosis. *Ophthalmology* 2002;109:1023-1031.
11. Yagci A, Egriilmecz S. Comparison of cosmetic results in frontalis sling operations: the eyelid crease incision versus the supralash stab incision. *J Pediatr Ophthalmol Strabismus* 2003;40:213-216.
12. Chen TH, Yang YJ, Chen YR. Refined frontalis fascial sling with proper lid crease formation for blepharoptosis. *Plast Reconstr Surg* 1997;99:34-40.
13. Goldberger S, Conn H, Lemor M. Double rhomboid silicone rod frontalis suspension. *Ophthal Plastic Reconstr Surg* 1991;7:48-53.
14. Wasserman BN, Sprunger DT, Helveston EM. Comparison of materials used in frontalis suspension. *Arch Ophthalmol* 2001;119:687-691.
15. Clauser L, Tieghi R, Galie M. Palpebral ptosis: clinical classification, differential diagnosis, and surgical guidelines; an overview. *J Craniofac Surg* 2006;17:246-254.
16. Leibovitch I, Leibovitch L, Dray JP. The Long-term results of frontalis suspension using autogenous fascia lata for congenital ptosis in children under 3 years of age. *Am J Ophthalmol* 2003;136:866-871.
17. Philandrianos C, Galinier P, Salazard B, Bardot J, Magalon G. Congenital ptosis: Long-term outcome of frontalis suspension using autogenous temporal fascia or fascia lata in children. *J Plast Reconstr Aesthet Surg* 2010;63:782-786.
18. Ben Simon GJ, Macedo AA, Schwarz RM, Wang DY, McCann JD, Goldberg RA. Frontalis suspension for upper eyelid ptosis: evaluation of different surgical designs and suture material. *Am J Ophthalmol* 2005;140:877-885.