Combined Maximum Levator Resection and Septal Sling in Correction of Severe Blepharoptosis with Poor Levator Function: A Novel Surgical Technique

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Abstract

**Purpose:** The aim of this study is to present a novel surgical technique in the management of severe blepharoptosis with poor levator function.

**Methods:** Four patients (five eyes) were included in this study. Mean age of the patients was 15.3 years (range, 3-28 years). Preoperative levator function averaged 3.4±0.9 mm. All of the patients underwent combined maximum levator resection and septal sling in the ptotic eye.

**Results:** The follow-up ranged from 4 to 10 months (mean, 8 months). Preoperative palpebral apertures averaged 4.4±0.7 mm and postoperative apertures averaged 8.5±0.4 mm (P<0.001). There was marked improvement in the aperture (4.1 mm). The mean of margin reflex distance-1 (MRD-1) was increased from 0±1 preoperatively to 4.1±0.4 postoperatively (P<0.001). All the patients demonstrated symmetry of the upper eyelid position (less than 1 mm), good lid crease position, and acceptable cosmetic outcome. All of the patients revealed some degree of lid lag and lagophthalmus. One patient developed exposure keratopathy associated with lagophthalmus which was treated successfully with lubrication.

**Conclusion:** This preliminary study shows that this new technique may be a useful alternative in the management of severe blepharoptosis associated with poor levator function.

**Keywords:** Levator Function, Septal Sling, Ptosis, Surgery
Methods

In this study 5 eyes from 4 consecutive patients (1 male and 3 females) of maximum levator resection and septal sling performed by one surgeon (AA) for correction of severe blepharoptosis with poor levator muscle function. The mean age of all the enrolled patients was 15.3 years (range, 3 to 28 years). Congenital bilateral ptosis was diagnosed in one of four patients, and the other three patients had congenital unilateral ptosis. Written informed consent was obtained from all patients before surgery in accordance with declaration of Helsinki, and was approved by the local ethics committee.

All of the patients gave a thorough medical history and underwent a complete ophthalmologic evaluation, including examination of the anterior segment and fundus. No patient had any associated ocular or systemic disease. In particular, no patient had concomitant vertical strabismus. Having severe preoperative ptosis and levator function measuring at least 2-4 mm were mandatory for patients to be included in the study. The amount of ptosis for unilateral ptosis was defined as the relative difference in the margin reflex distance-1 (MRD-1) values between the eyelids. Bilateral ptosis was defined as the MRD-1 of the ptotic eyelid subtracted from the normal MRD-1 of 4.5 mm. Two patients underwent maximum levator resection with septal sling as the primary ptosis operation and the other two underwent the procedure after failed frontalis suspension.

Postoperatively, we examined patients on days 1, 7, and 30 and then at 2-month intervals to the end of follow-up period. Ocular parameters measured during the preoperative and postoperative evaluations were as follows: (1) vertical palpebral fissure width (distance in mm between the central upper and lower lid margin with the eyes in the primary position of gaze), (2) MRD-1 (distance in mm between a light reflex on the cornea and the upper lid margin in primary gaze; negative numbers indicated the amount of manual upper lid excursion necessary to reveal a corneal light reflex), and (3) Berke levator function (lid excursion from downgaze to upgaze). MRD-1, palpebral fissure and Berke levator function were measured while immobilizing the frontalis muscle. The patients also evaluated for lagophthalmus, corneal staining, lash ptosis, wound integrity, scarring, and formation of lid crease.

Surgical technique

The procedures were performed under general anesthesia. The upper eyelid was infiltrated with lidocaine 2% and 1:100000 epinephrine. An eyelid plate was used to prevent ocular trauma when the needles were passed. A 4-0 silk traction suture was used to prevent ocular trauma when the needles were passed. A 4-0 silk traction suture was placed through the central lid margin and tied inferiorly. A lid crease incision was made at the desired level, usually at the upper border of the tarsal plate (approximately 9 to 10 mm above the lash line). After dissection of orbicularis muscle, the suborbicularis plane was achieved, and then the levator aponeurosis attachments were released from the tarsal plate, and were dissected from the underlying Muller’s muscle. Both the medial and lateral horns of the levator were carefully severed using Westcott scissors, under the preservation of Whitnall ligament. Then the orbital septum dissected from the underlying levator muscle and overlying orbicularis muscle up to the superior rim of the orbit, and then released from the medial and lateral attachments. Maximum levator resection procedure (27 mm) was performed. Three double-armed 6-0 vicryl sutures were placed in a horizontal mattress fashion through a partial thickness tarsus approximately 4-5 mm below the superior tarsal border and through posterior aspect of the levator aponeurosis exiting from the anterior surface of aponeurosis. The levator muscle was clamped with a straight hemostat and excised (Figure 1-A). The orbital septum sutures were tied over the levator aponeurosis to the tarsal plate in a same manner. After evaluation of the lid contour, the sutures were tied down and the extra tissue (between 3-5 mm) was excised (Figure 1-B). The lid crease was reformed with the three 6-0 nylon sutures that internalized from the skin to attach the levator aponeurosis through three small horizontal incisions in the orbital septum and then externalized to attach to the skin (Figure 2). The skin was reapproximated with interrupted 6-0 nylon sutures.
Figure 1. Excision and suturing of levator muscle (A) and orbital septum (B) to the tarsal plate (Asterisk: orbital septum; arrow head: levator aponeurosis)

Figure 2. (A) Horizontal incisions through orbital septum. (B) Forming lid crease with sutures attached to levator aponeurosis through incisions in orbital septum

Results

The follow-up ranged from 4 to 10 months (mean, 8 months). Preoperative levator function averaged 3.4±0.9 mm. Preoperative palpebral apertures averaged 4.4±0.7 mm and postoperative apertures averaged 8.5±0.4 mm (P<0.001). The mean improvement in the aperture was 4.1 mm. The mean MRD-1 was increased from 0±1 preoperatively to 4.1±0.4 postoperatively (P<0.001).

All patients demonstrated symmetry of the upper eyelid position (less than 1 mm), good lid crease position, and acceptable cosmetic outcome (Figure 3). All patients revealed some degree of lid lag and lagophthalmus. One patient developed exposure keratopathy associated with lagophthalmus which was treated successfully with lubrication. Demographic characteristics of the patients and surgical outcomes are summarized in tables 1 and 2 and figure 4.
Figure 3. Pre and postoperative clinical photographs of a patient with excellent functional and aesthetic outcome

Table 1. Characteristics of 4 consecutive patients treated with maximum levator resection and septal sling.

<table>
<thead>
<tr>
<th>Case</th>
<th>Age (year)</th>
<th>Sex</th>
<th>Eye</th>
<th>MRD-1 (mm)</th>
<th>Levator function (mm)</th>
<th>Levator resection (mm)</th>
<th>Septal resection (mm)</th>
<th>Follow-up (months)</th>
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<tr>
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<td>28</td>
<td>F</td>
<td>OD</td>
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<td>6</td>
<td>F</td>
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<tr>
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<tr>
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<td>3</td>
<td>M</td>
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<td>-1</td>
<td>3</td>
<td>27</td>
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</tbody>
</table>

* : Previously underwent frontalis suspension  
F: Female; M: Male; mm: Millimeter; MRD-1: Marginal reflex distance-1; OD: Right eye; OS: Left eye

Table 2. Results of maximum levator resection and septal sling for the 4 patients with severe blepharoptosis and poor levator function.

<table>
<thead>
<tr>
<th>No.</th>
<th>MRD-1 (mm)</th>
<th>Palpebral fissure (mm)</th>
<th>Lid crease</th>
<th>Lag ophthalmus (mm)</th>
<th>Lid lag (mm)</th>
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<td>Post</td>
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<td>Post</td>
<td>Pre</td>
</tr>
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<td>3.5</td>
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<td>1</td>
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<td>4</td>
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<td>4</td>
<td>3.5</td>
<td>8.5</td>
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</tr>
</tbody>
</table>

mm: Millimeter; MRD-1: Marginal Reflex Distance-1; No.: Number; OD: Right eye; OS: Left eye; Post: Postoperative;  
Pre: Preoperative
Discussion

Various techniques for correction of severe blepharoptosis with poor levator muscle function have been described, including bilateral frontalis suspension either with or without extirpation of the contralateral eyelid's normal levator muscle, unilateral frontalis suspension, and various types of augmented levator resection.\textsuperscript{1,3-6} Maximum levator resection, unlike frontalis suspension, does not introduce any exogenous suspension material into the upper eyelid, thereby avoiding the risk of infection, extravasation, and extrusion of the suspension material. It does not require autogenous fascia lata, thereby avoiding the creation of a scar and multiple incision sites, as well as reducing operating time, which is a major concern with young children.\textsuperscript{2,7} In addition, this procedure creates an upper eyelid crease that produces a more normal-appearing upper eyelid compared with that of the frontalis suspension procedure. Furthermore, levator resection does not require surgical manipulation of the contralateral normal eyelid. However, the most frequent complication of levator resection is undercorrection.\textsuperscript{8} Several methods have been developed for augmentation of levator resection, such as super-maximum levator resection and superior tarsectomy, with encouraging results.\textsuperscript{5,6}

A relationship between the eyelid adnexal structures and the upper eyelid function has now been established. Observation of the eyelid structure with magnetic resonance imaging showed that when the eye opens, both the orbital septum and the orbital fat move posteriorly and thicken. When the eye opens, Whitten ligaments also move posteriorly with little change in the acting vector direction of the levator muscle.\textsuperscript{9} Reconstruction of the multiplanar eyelid structure after ptosis surgery would improve levator function via such interactions. Moreover, special attention to suturing of the orbital septum as a separate tissue layer during levator resection for congenital ptosis gives good lid crease definition which may enhance the overall cosmetic outcome.\textsuperscript{10}

Conclusion

Regarding the finding of this study and using a concept based on cadaveric dissections that the orbital septum can suspend the tarsal plate statically, we questioned whether incorporating a septal sling could improve the ptosis corrective ability, reduce the incidence of under correction, and enhance aesthetic results of the maximum levator resection procedure. This procedure will not be suitable for patients with absent levator function. Like other sling procedures of the upper eyelid, lid lag and lagophthalmus are possible complications. Compared to frontalis suspension procedures, another advantage of this procedure is the capability of the septal...
sling to readjust by releasing, recession, and resuturing of the septum to a more superior portion of the tarsus, in the case of severe lagophthalmus or lid retraction.

Although we met encouraging results in these few cases, but the efficacy and safety of the operation should be evaluated in controlled studies.

References