

## The Effect of Upper Blepharoplasty on Eyelid Position When Performed Concomitantly With Müller Muscle-Conjunctival Resection

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**Purpose:** To determine the effect on eyelid elevation of excising excess skin, orbicularis oculi muscle, and herniated orbital fat and reconstructing the upper eyelid crease (blepharoplasty) concomitant with a Müller muscle-conjunctival resection.

**Methods:** The charts of 202 patients who had undergone Müller muscle-conjunctival resection during an 8-year interval were reviewed. Three hundred forty-five eyelids were divided into two groups. Group 1 (n = 162) underwent a Müller muscle-conjunctival resection only, and group 2 (n = 183) had this procedure combined with excision of skin, orbicularis muscle, and herniated orbital fat with upper eyelid crease reconstruction. Each group was divided into three subgroups based on the amount of Müller muscle-conjunctival resection. Subgroup A had resection less than 7.75 mm; subgroup B, resection of 7.75 to 8.75 mm; and subgroup C, resection greater than 8.75 mm. The change in margin reflex distance-1 (MRD<sub>1</sub>) measurements of the upper eyelid levels (postoperative MRD<sub>1</sub> minus preoperative MRD<sub>1</sub>) were calculated and compared between groups.

**Results:** The mean ( $\pm$  standard deviation) change in MRD<sub>1</sub> was, respectively, 2.3  $\pm$  1.0 mm and 1.9  $\pm$  1.0 mm for groups 1A and 2A; 3.1  $\pm$  1.3 mm and 2.1  $\pm$  1.2 mm for groups 1B and 2B; and 3.4  $\pm$  1.2 mm and 2.8  $\pm$  1.3 for groups 1C and 2C.

**Conclusions:** Blepharoplasty performed concomitant with a Müller muscle-conjunctival resection reduced the anticipated postoperative eyelid elevation by as much as 1 mm. Surgeons who perform these procedures together should be aware that a larger Müller muscle-conjunctival resection may be required to obtain the desired increase in eyelid height postoperatively.

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The Müller muscle-conjunctival resection procedure, first described in 1975 by Putterman and Urist (1), is a technique in which Müller muscle in the upper eyelid is partially resected and advanced. It is used to treat upper eyelid ptosis and may be combined with blepharoplasty (1,2).

The Müller muscle-conjunctival resection procedure is used in the treatment of blepharoptosis in

patients whose upper eyelid elevates to a normal level when 10% phenylephrine drops are applied to the upper conjunctival fornix (the phenylephrine test). Candidates for this procedure usually have minimal congenital ptosis or varying degrees of acquired ptosis. If the eyelid elevates to a normal level with the phenylephrine test, 8.25 mm of Müller muscle and conjunctiva are resected. If the upper eyelid elevates slightly higher, less Müller muscle resection is performed (6.25–8.00 mm), and if the upper eyelid rises slightly less, additional Müller muscle (8.50–9.75 mm) resection is performed. The correlation between the phenylephrine

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test results and the amount of Müller muscle resection was reported by Putterman and Fett (3).

The predictability of the Müller muscle-conjunctival resection has been well determined (3-5). Not yet established, however, is the impact, if any, on postoperative eyelid level (the amount the eyelid elevates as a result of the Müller muscle-conjunctival resection) when the procedure is combined with blepharoplasty.

One way to assess the upper eyelid levels is with the margin reflex distance-1 (MRD<sub>1</sub>) measurement, performed before and during the phenylephrine test as well as postoperatively (1). The MRD<sub>1</sub> is the distance in millimeters from the light reflex on the patient's cornea to the central upper eyelid margin as the patient gazes in the primary position.

The purpose of this study was to determine the change in postoperative upper eyelid position (delta MRD<sub>1</sub>) in patients who underwent either 1) Müller muscle-conjunctival resection alone or 2) Müller muscle-conjunctival resection combined with blepharoplasty.

## METHODS

The records of 202 patients who had undergone Müller muscle-conjunctival resection during the previous 8 years were reviewed. The following preoperative information was recorded by a single observer (A.M.P.): patient's age, sex, date of surgery, preoperative MRD<sub>1</sub>, MRD<sub>1</sub> after instillation of 10% phenylephrine, and the millimeters of conjunctival Müller muscle to be resected; MRD<sub>1</sub> was recorded to the nearest 0.5 mm. Thirty-eight eyelids were excluded from the study because they had undergone concurrent brow surgery (n = 6), had a history of blepharospasm (n = 20), or had anophthalmos (n = 12).

All surgeries were performed by A.M.P. The Müller muscle-conjunctival resection was performed in the following fashion. A frontal nerve block (2% xylocaine with 1:100,000 units epinephrine) was used, with additional local anesthesia injected at the central eyelid margin. A 4-0 silk traction suture was placed through skin, orbicularis oculi muscle, and superficial tarsus. A medium-sized Desmarres eyelid retractor (Storz Instrument #E981, Storz Ophthalmics, St. Louis, MO, U.S.A.) was then used to evert the eyelid and expose palpebral conjunctiva. A caliper was set to the size determined preoperatively (6.25-9.75 mm) based on the phenylephrine test and the amount of ptosis.

Quarter-millimeter increments were estimated with the aid of high-powered loupes after calibrating the caliper to a ruler and adjusting the caliper so that the one arm of the caliper was either slightly less or slightly more than halfway between the millimeter increments; thus, in an 8.25-mm Müller muscle-conjunctival resection, the caliper was adjusted so that one arm was slightly more than the 8-mm increment, but less than halfway between the 8- and 9-mm increments on the ruler. This method of measurement was used for all of Müller muscle-conjunctival resections for groups 1 and 2. With one arm of the caliper at the superior tarsal border, a 6-0 black silk suture was passed through the conjunctiva at the desired distance above the superior tarsal border. The marking suture was then placed temporally, centrally, and nasally, with each bite approximately 7 mm apart. Using a toothed forceps, the surgeon grasped conjunctiva and Müller muscle between the superior tarsal border and the marking suture and then separated Müller muscle from levator aponeurosis. A Müller muscle-conjunctival resection ptosis clamp (Karl Ilg & Co., St. Charles, IL, U.S.A.) was placed at the level of the marking suture, and the Desmarres retractor was slowly released. The clamp then was compressed and the handle was locked, incorporating conjunctiva, Müller muscle between the superior tarsal border, and the marking suture. The upper eyelid skin was pulled in one direction while the clamp was pulled simultaneously in the opposite direction, releasing any inadvertently trapped levator aponeurosis from the clamp. A 5-0 double-armed plain catgut mattress suture was passed 1.5 mm distal to the clamp blades. A no. 15 surgical blade was used to excise the tissues held in the clamp. The Desmarres retractor was again used to evert the eyelid, and the nasal end of the suture was run continuously back in a temporal direction through the conjunctival edges. The suture ends were passed through each side of the conjunctiva and the Müller muscle and then were passed through the temporal end of the wound. The arms of the 5-0 plain catgut suture were tied with four or five knots, and the ends were cut close to the knot.

If an upper blepharoplasty was performed along with the Müller muscle-conjunctival resection, the following steps were taken. First, the upper eyelid skin to be removed was marked. After injection of local anesthesia, a scratch incision was made over the lines marked on the upper eyelids. The tech-

nique for a Müller muscle-conjunctival resection was performed through the steps of suture placement, excision of conjunctiva and Müller muscle, and passing of the catgut suture temporally through the conjunctival edges. The suture ends were passed through each side of the conjunctiva and Müller muscle and then through the temporal end of the wound, and were connected with a serrefine clamp. After the outlined area of excess skin and orbicularis muscle was excised, any fat that herniated on gentle pressure to the eye was excised, and hemostasis was obtained. The eyelid was then everted with a Desmarres retractor. The arms of the 5-0 plain catgut suture were tied with four or five knots, and the ends were cut close to the knot. Three 6-0 polyester (Mersilene) sutures were then placed in the eyelid crease (levator aponeurosis to orbicularis muscle in mattress suture fashion). The skin was closed with three or four interrupted 6-0 polyglactin (Vicryl) sutures placed skin to levator aponeurosis to skin, followed by a running 6-0 silk suture placed skin to skin.

All patients were seen postoperatively between days 4 to 7, for examination and for skin suture removal. After Müller muscle-conjunctival resection alone, patients were reexamined 3 to 5 weeks postoperatively, and thereafter until the MRD<sub>1</sub> stabilized. After Müller muscle-conjunctival resection combined with blepharoplasty, patients were examined 3 weeks postoperatively for removal of interrupted 6-0 polyglactin (Vicryl) sutures, and they were followed-up until the MRD<sub>1</sub> stabilized. At each postoperative visit, a single observer (A.M.P.) recorded the following measurements: palpebral fissure width (the distance from the central lower eyelid to the central upper eyelid margins) in the primary position of gaze and on downgaze, amount of lagophthalmos, MRD<sub>1</sub>, margin-to-crease distance, and margin-to-fold distance (the distance from the inferior edge of the eyelid fold to the eyelid margin over the central upper eyelid in primary gaze); MRD<sub>1</sub> was recorded to the nearest 0.5 mm. Follow-up continued until the eyelid level stabilized, which was considered to be the final result. This value, the postoperative MRD<sub>1</sub>, was used for comparisons with the preoperative MRD<sub>1</sub>.

Based on the procedures performed, patients were divided into two groups. Group 1 had a Müller muscle-conjunctival resection, and group 2 had Müller muscle-conjunctival resection combined with blepharoplasty. Each group was further divided into three subgroups based on the amount

TABLE 1. Patient characteristics, preoperative and postoperative MRD<sub>1</sub> and delta MRD<sub>1</sub> (mm)

Feature	Group 1	Group 2	p
	(n = 162)	(n = 183)	
	Mean (SD)	Mean (SD)	
Age (yr)	56.8 (22.6)	60.0 (15.9)	>0.05
Preoperative MRD <sub>1</sub> (mm)	0.5 (1.3)	0.8 (1.1)	<0.01
Postoperative MRD <sub>1</sub>	3.5 (1.1)	3.2 (1.1)	<0.01
Delta MRD <sub>1</sub>	3.0 (1.3)	2.3 (1.2)	<0.01

Group 1 represents patients who underwent only Müller muscle-conjunctival resection; group 2, those who had Müller muscle-conjunctival resection combined with upper blepharoplasty. MRD<sub>1</sub>, margin reflex distance-1; delta MRD<sub>1</sub>, postoperative MRD<sub>1</sub> minus preoperative MRD<sub>1</sub>; SD, standard deviation. *p* values were calculated with a Student *t* test.

of Müller muscle-conjunctival resection. Subgroup A had a Müller muscle-conjunctival resection less than 7.75 mm, subgroup B had a resection of 7.75 mm to 8.75 mm, and subgroup C had a resection greater than 8.75 mm. Finally, the difference between postoperative MRD<sub>1</sub> and preoperative MRD<sub>1</sub> (the delta MRD<sub>1</sub>) was compared between groups 1 and 2 within each of the three subgroups. *P* values were calculated using a Student *t* test.

## RESULTS

A total of 345 eyelids were operated on in 177 patients. Of these, 162 eyelids (74 patients bilateral, 14 unilateral) underwent Müller muscle-conjunctival resection alone (group 1), and 183 (91 bilateral, 1 unilateral) eyelids underwent Müller muscle-conjunctival resection with blepharoplasty (group 2). There was no statistically significant difference in the mean ( $\pm$  standard deviation) age of the patients between the two groups (56.8 [ $\pm$  22.6] years for group 1 versus 60.0 [ $\pm$  15.9] years for group 2). The average length of follow-up was 2.8 months (range, 1-15 months) for patients who underwent Müller muscle-conjunctival resection (group 1) and 3.9 months (range, 2-17 months) for patients who underwent the combined procedures (group 2).

The average preoperative MRD<sub>1</sub> was  $0.8 \pm 1.1$  mm for group 2, patients undergoing Müller muscle-conjunctival resection, and aesthetic upper blepharoplasty with crease reconstruction and  $0.5 \pm 1.3$  mm for group 1, those undergoing isolated ptosis repair (Table 1).

The amount of Müller muscle-conjunctival resection ranged from 6.25 to 9.75 mm in both groups. Table 2 shows the number of eyelids in each subgroup, based on the amount of resection.

**TABLE 2.** Number of patients as a function of amount of Müller muscle-conjunctival resection

Müller muscle-conjunctival resection (mm)	Group 1 n = 162 (%)	Group 2 n = 183 (%)
<7.75 (subgroup A)	48 (29.6)	53 (29.0)
7.75-8.75 (subgroup B)	39 (24.1)	52 (28.4)
>8.75 (subgroup C)	75 (46.3)	78 (42.6)

The average postoperative MRD<sub>1</sub> was  $3.5 \pm 1.1$  mm for patients who underwent Müller muscle-conjunctival resection alone (group 1), and it was  $3.2 \pm 1.1$  mm for group 2 (Table 1). The average change in eyelid elevation as determined by postoperative MRD<sub>1</sub> minus preoperative MRD<sub>1</sub> (delta MRD<sub>1</sub>) for groups 1 and 2 was  $3.0 \pm 1.3$  mm and  $2.3 \pm 1.2$  mm, respectively (Table 1). The delta MRD<sub>1</sub> was then compared between both groups for each of the three subgroups (Fig. 1). There was a statistically significant difference evident in each of the three subgroups (Table 3; Fig. 1) For group 1A versus group 2A (Müller muscle-conjunctival resection less than 7.75 mm), the delta MRD<sub>1</sub> was  $2.3 \pm 1.0$  mm versus  $1.9 \pm 1.0$  mm, respectively. For group 1B versus group 2B (Müller muscle-conjunctival resection of 7.75 mm to 8.75 mm), the delta MRD<sub>1</sub> was  $3.1 \pm 1.3$  mm versus  $2.1 \pm 1.2$  mm, respectively. For group 1C versus group 2C (Müller muscle-conjunctival resection greater than 8.75 mm), the delta MRD<sub>1</sub> was  $3.4 \pm 1.2$  mm versus  $2.8 \pm 1.3$ , respectively. The Müller muscle-conjunctival resection group (group 1) had a larger delta MRD<sub>1</sub> for a given amount of Müller muscle-conjunctival resection than did the group undergoing combined procedures (group 2).

As shown in Table 4, for resections of less than 7.75 mm, 7.75 to 8.75 mm, and greater than 8.75 mm, the eyelid was less elevated by 0.4 mm, 1.0 mm, and 0.6 mm, respectively, after concomitant blepharoplasty (group 2) than when the same amount of Müller muscle-conjunctival resection was performed alone (group 1).

Figure 2 illustrates preoperative and postoperative photographs of two patients who underwent 9.75-mm Müller muscle-conjunctival resection. The preoperative MRD<sub>1</sub> was 0.0 mm for both patients. The patient who underwent Müller muscle-conjunctival resection alone (group 1) had a postoperative MRD<sub>1</sub> of 4.5 mm (Fig. 2B). However, the patient who underwent Müller muscle-conjunctival resection combined with blepharoplasty (group 2) had a postoperative MRD<sub>1</sub> of 2.5

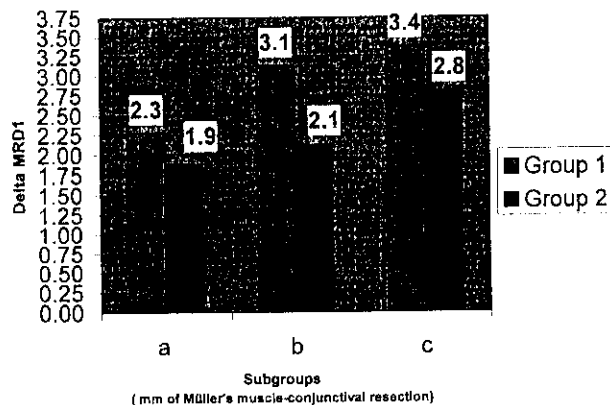
mm (Fig. 2D), despite undergoing the identical amount of Müller muscle-conjunctival resection.

## DISCUSSION

Acquired ptosis of the upper eyelid is a common condition in the elderly population and is often present with dermatochalasis (excess skin). Excision of excess skin, orbicularis muscle, and herniated orbital fat with upper eyelid crease reconstruction of a ptotic eyelid (without the concomitant repair of the ptosis) may actually exaggerate the appearance of a drooping eyelid postoperatively (6,7). Similarly, ptosis repair without concomitant blepharoplasty leads to an exaggerated excess skinfold and asymmetric margin-to-fold distance and may result in skin overhanging the eyelid margin (8,9).

Putterman and Urist (1,2) described the Müller muscle-conjunctival resection for patients with mild ptosis and good levator function. Candidates for the procedure are patients whose ptotic eyelid elevates to a normal position 2 to 5 minutes after instillation of 10% phenylephrine drops into the upper fornix of their ptotic eye. If the eyelid elevates to a normal position with 10% phenylephrine, 8.25 mm of Müller muscle and conjunctiva are resected.

Numerous authors (3-5,10) have reported on varying the amount of Müller muscle-conjunctival resection from 6.5 to 9.75 mm Müller muscle, based on the degree of ptosis and the response of 10% phenylephrine. Putterman and Fett (3) varied the amount of Müller muscle-conjunctival resection



**FIG. 1.** Change in MRD<sub>1</sub> (mm) as a function of millimeters of Müller muscle-conjunctival resection for group 1 versus group 2. Group 1 represents patients who underwent only Müller muscle-conjunctival resection; group 2, those who had Müller muscle-conjunctival resection combined with excision of skin, orbicularis, and herniated orbital fat with upper eyelid crease reconstruction. MRD<sub>1</sub>, margin reflex distance-1.

**TABLE 3.** Change in MRD<sub>1</sub> (mm) as a function of mm of Müller's muscle-conjunctival resection

Müller's muscle-conjunctival resection (mm)	Group 1	Group 2	<i>p</i>
	(n = 162)	(n = 183)	
	Mean (SD)	Mean (SD)	
<7.75	2.3 (1.0)	1.9 (1.0)	<0.05
7.75-8.75	3.1 (1.3)	2.1 (1.2)	<0.01
>8.75	3.4 (1.2)	2.8 (1.3)	<0.01

MRD<sub>1</sub>, margin reflex distance-1; SD, standard deviation. *p* values were calculated with a Student *t* test.

from 6.5 to 9.5 mm as a function of the eyelid elevation after instillation of 10% phenylephrine (Neo-Synephrine, Sanofi Winthrop Pharmaceuticals, New York, NY). Dresner (4) reported a semilinear formula to excise a specific amount of Müller muscle for varying amounts of ptosis. Weinstein and Buerger (5) reported a linear relationship between the resultant eyelid elevation and the millimeters of Müller muscle-conjunctival resection.

The advantages of the Müller muscle-conjunctival resection over other ptosis procedures include preservation of the tarsus compared with the Fasanella-Servat procedure, which lessens risk of keratopathy (1,11). Another advantage is that the Müller muscle-conjunctival resection provides more predictable results compared with the levator aponeurosis advancement and tuck procedure (12).

Patients with excess upper eyelid skin, herniated orbital fat, or ill-defined eyelid creases are candidates for upper blepharoplasty. Many articles describe the techniques and benefit of concomitant ptosis repair and blepharoplasty, but most use external levator advancement. Moreover, whereas the efficacy of the Müller muscle-conjunctival resection procedure has been well established, the impact, if any, on the eyelid elevation with associated upper eyelid surgery has not been elucidated.

Dresner (4) reported a series of 114 patients who underwent Müller muscle-conjunctival resection. Twenty-one of these patients had associated eyelid surgeries, 11 of whom had an aesthetic upper blepharoplasty. The eyelids were symmetric in 20 of the 21 patients. No analysis of effect was noted for the patients who underwent aesthetic upper blepharoplasty.

In the current study, we found that combining an aesthetic upper blepharoplasty with a Müller muscle-conjunctival resection leads to a diminished elevation of the upper eyelid, compared with performing an isolated Müller muscle-conjunctival

resection. For any given amount of Müller muscle and conjunctiva resected, the amount that the eyelid elevates is smaller if the resection is combined with blepharoplasty.

The difference in preoperative MRD<sub>1</sub> between group 1 and group 2 was slight ( $0.5 \pm 1.3$  mm versus  $0.8 \pm 1.1$  mm) but statistically significant ( $p < 0.01$ ; Table 1). This difference might be a result of patients seeking treatment for dermatochalasis with a small amount of ptosis, whereas patients with ptosis alone are likely to be referred if their ptosis is significant. In addition, the difference between the preoperative MRD<sub>1</sub> values, although statistically significant, may not be clinically significant.

Although in the office our MRD<sub>1</sub> measurements were in 1/2-mm increments, in the operating room we believe we are able to measure the amount of conjunctiva Müller muscle resection in 1/4-mm increments. We used high-powered loupes to calibrate the caliper to a ruler, we then adjusted the caliper so that the one arm of the caliper was either slightly less or slightly more than halfway between the millimeter increments. Thus, in an 8.25-mm Müller muscle-conjunctival resection, the caliper was adjusted so that one arm was slightly more than the 8-mm increment, but less than halfway between the 8- and the 9-mm increments on the ruler.

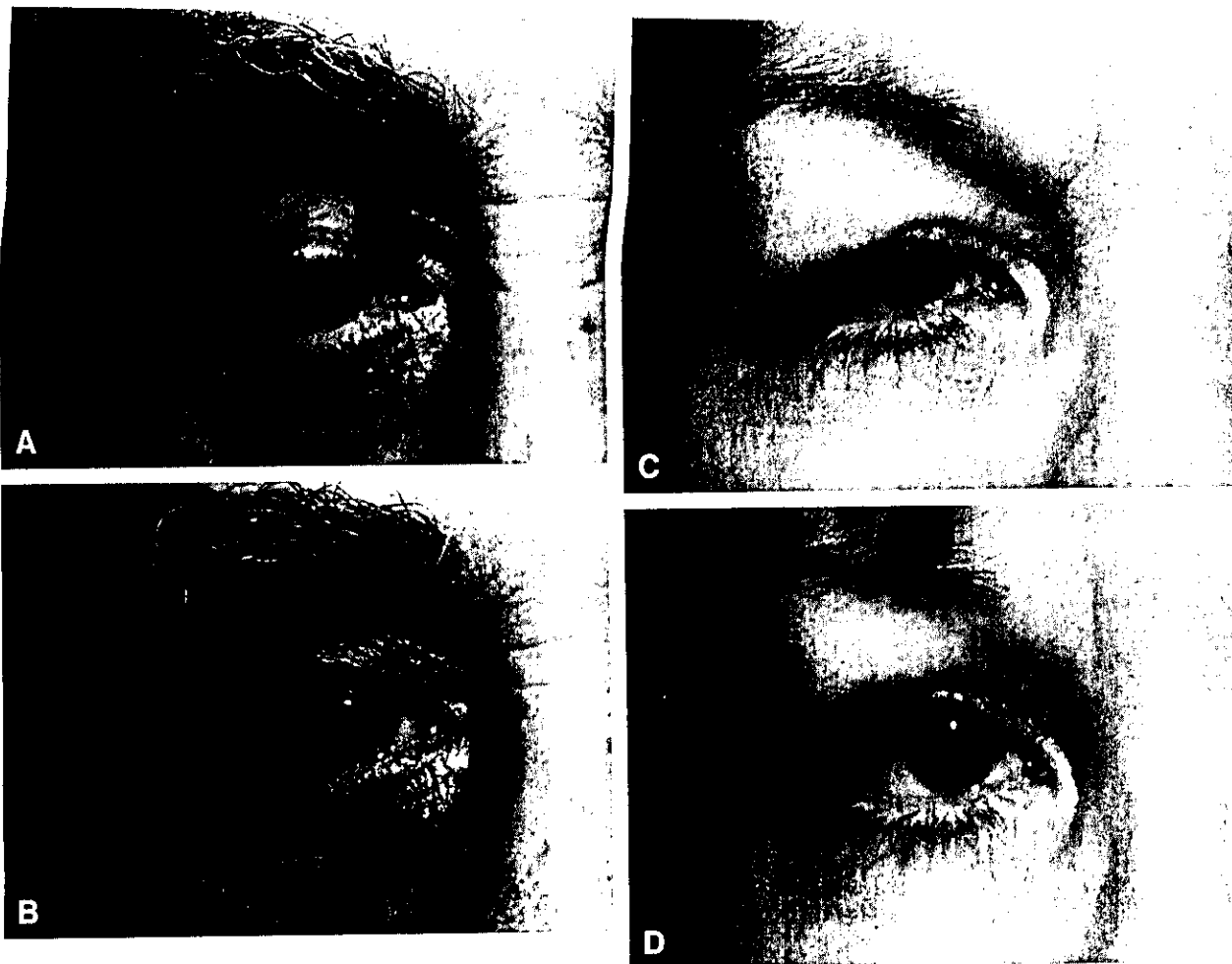
Two possible explanations why the excision of skin, orbicularis, and herniated orbital fat with upper eyelid crease reconstruction may limit the eyelid elevation after Müller muscle-conjunctival resection are as follows:

1. More edema may result from the excision of skin, orbicularis muscle, and herniated orbital fat with upper eyelid crease reconstruction. Müller muscle-conjunctival resection procedure is hypothesized to correct ptosis by advancing the levator aponeurosis and by shortening the posterior lamella (4,13). Additional edema might lead to less advancement of the levator aponeurosis (or additional dehiscence of levator aponeurosis).

**TABLE 4.** Change in MRD<sub>1</sub> (mm) as a function of amount of Müller muscle-conjunctival resection and amount of decreased eyelid elevation (mm) in Group 2

Müller muscle-conjunctival resection (mm)	Decreased elevation (Group 1 MRD <sub>1</sub> minus Group 2 MRD <sub>1</sub> ) (mm)		
	Group 1	Group 2	
<7.75	2.3	1.9	0.4
7.75-8.75	3.3	2.1	1.0
>8.75	3.4	2.8	0.6

MRD<sub>1</sub>, margin reflex distance-1.



**FIG. 2.** Preoperative and postoperative photographs of two patients who underwent 9.75-mm Müller muscle-conjunctival resection. **A.** Preoperative patient from group 1. **B.** Postoperative patient from group 1. **C.** Preoperative patient from group 2. **D.** Postoperative patient from group 2. The preoperative (**A, C**) MRD<sub>1</sub> was 0.0 for both patients. The patient who underwent Müller muscle-conjunctival resection alone (group 1) had a postoperative MRD<sub>1</sub> of 4.5 mm (**B**). However, the patient who underwent Müller muscle-conjunctival resection combined with excision of excess skin, orbicularis muscle, and herniated orbital fat with reconstruction of the upper eyelid crease (group 2) had a postoperative MRD<sub>1</sub> of 2.5 mm (**D**), despite undergoing the identical amount of Müller muscle-conjunctival resection. (Note: The light reflex seen here is not an accurate measure of the patients' MRD<sub>1</sub> because of the position of the flash.) Note the undercorrection of ptosis correction postoperative **D** compared with **B** in the patient who underwent Müller muscle-conjunctival resection combined with excision of skin, orbicularis, and herniated orbital fat with upper eyelid crease reconstruction.

2. Intra-eyelid scarring of the external eyelid tissues (skin, orbicularis, and septum) that commonly follows external blepharoplasty in which skin, orbicularis muscle, and fat are removed and a lid crease is reconstructed by attaching the levator to orbicularis may inhibit upward movement of the eye. This scarring may be noted immediately postoperatively with inhibition in movement of the upper lid from down gaze to up gaze. It may be palpated postoperatively when the patient attempts to look upward or when the examiner tries to push the upper lid upward. There is commonly a resistance, and this is believed to be due to scar tissue. This scar might restrict eyelid elevation and result in a lower postoperative MRD<sub>1</sub>

after a blepharoplasty performed with the internal levator advancement compared with doing the internal levator advancement alone.

We made no intentional compensation in the determination of the amount of Müller muscle to be resected, nor did any patient require revision. However, we believe the diminished elevation is nevertheless clinically significant. For patients with a borderline response to the phenylephrine test (MRD<sub>1</sub> is marginally acceptable), a reduction in the postoperative MRD<sub>1</sub> may yield an unacceptable result.

Surgeons who perform blepharoplasty in conjunction with Müller muscle-conjunctival resection should be

aware that the anticipated postoperative eyelid level is reduced by as much as 1 mm. In our study, the delta MRD<sub>1</sub> increased proportionately to the size of the Müller muscle-conjunctival resection in each of the three subgroups of patients undergoing this resection in conjunction with (group 2). Thus, surgeons may wish to increase the size of the Müller muscle-conjunctival resection to compensate for the diminished eyelid elevation when the surgery is combined with an aesthetic upper blepharoplasty.

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